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MICROECONOMICS

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Enjoy & Master Advanced Economics

Topical Questions and Answers: Microeconomics

Ngaiza Series of Advanced Economics

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First Edition, 2026

ISBN 978-9976-5530-7-9

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Published by

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Every effort has been made to ensure the accuracy of the content in this book. The publisher welcomes corrections and suggestions for future editions.

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PREFACE

This book was written because you deserve better.

Advanced Level Economics rewards reasoning, yet many students arrive at the paper having learned to recite definitions they cannot use and to copy diagrams they cannot read. The subject feels familiar, because buying, selling and bargaining are things you have done since childhood, so it is easy to believe you understand a market when you have only shopped in one. Students memorise lists, sit examinations that ask them to define, to explain, to draw and to judge, and leave believing that Economics is a matter of opinions confidently expressed. That is not Economics. That is common sense in a borrowed gown.

Economics is the study of how people and nations choose, when wants run on without end and the means of meeting them always fall short. It is your own country made intelligible: why the price of a crate of tomatoes in Kariakoo wobbles all morning and settles by ten without anyone deciding it, why a supplier of electricity can name a price where a Kariakoo trader with a hundred rivals cannot, and why land at Kilombero carries cane in one season and paddy in the next. It is exact, rooted in real places, and far more logical than its reputation suggests. But mastering it under examination conditions takes more than a book to read. It takes practice: attempting real questions, defining, reasoning, drawing and judging, and learning, answer by answer, how to turn understanding into marks. That is what this book sets out to give you.

Why a book of questions and answers?

You do not learn to reason by reading someone else's reasoning, and you do not learn to draw a market by admiring a finished diagram. You learn by attempting a question, getting it wrong, finding out exactly why, and trying again. This book is built entirely around that truth. Every idea in Microeconomics is turned into questions you must answer yourself, each followed at once by a full model answer that shows not only the right conclusion but the definition, the chain of reasoning, the diagram and the judgement that earn examination marks. Used honestly, with the model covered until you have written your own, it trains the four things the examination really tests: defining with precision, reasoning from cause to effect, drawing what you have argued, and judging how far a claim will hold.

How this book is organised

The book covers the whole of Microeconomics in six chapters: the concept and scope of economics, economic systems, price theory, elasticity, the theory of production and cost, and the market. Each rests on the one before, and the whole of it rests on the first, on scarcity, choice and opportunity cost.

Every question is followed at once by its model answer, so that you can attempt it and check yourself immediately. Within each chapter the questions rise through three tiers.

BINDER questions anchor the core. They fix the definition, the mechanism and the diagram that must be right before anything else can be, and even here they ask you to reason rather than merely to name. If you can answer these, you own the idea.

REAL questions carry that core into the country itself, from a maize market in Iringa to the cane fields of Kilombero and a bus fare in Dar es Salaam, where the subject actually lives. Many of them hand you another candidate's working and ask you to find the error in it, which is the fastest way to stop making it yourself.

HOT questions push you to examination standard and beyond, drawing several ideas together and demanding genuine judgement rather than routine.

Every chapter closes with a clinic: the traps students fall into, the distinctions they confuse, and a capstone question that spans the whole chapter. Worked in one sitting against the clock, with the answers covered, it will show you exactly what you own and what you only recognise. Every answer in the book ends with a Master Key, a single sentence built to be carried into the hall.

Before the questions begin, a short Student Survival Guide shows you how to work this book, and how to beat the two habits that quietly cost good students their marks: the everyday word used loosely where the subject demands precision, and the list offered where an argument was wanted. Read it first. It is the shortest and most important part of the book. At the back, a full index takes you from any term to the pages where it is defined, drawn or applied.

The team behind this book

Enjoy and Master Advanced Economics is the work of the Ngaiza Education Hub, built by a team of experienced economics educators who share one conviction: that Tanzanian students deserve world-class materials written for their context, their course, and their aspirations.

Writers: Mr. Alexander Green, Mr. Yared Osten and Mr. Jovine Kyaruzi.

Editor: Dr. Luxford Brown.

Designer: Mr. Frank Mwita.

I am grateful to every member of this team for their dedication, their expertise, and their refusal to settle for "good enough." I thank too the students whose hard questions and honest struggles shaped every answer in this book. They reminded us, again and again, that a question a student cannot learn from has failed, no matter how correct its economics may be.

To every student of Advanced Economics opening this book for the first time: the subject is not as hard as its reputation, and it is not as easy as it first feels. It is as exact as the definitions you will learn to trust, and as satisfying as an argument that comes out whole. Give it your honest effort, with the model answer covered and your pencil moving, and this book will give you its honest best in return.

Ngaiza Lusima
Series Creator and Director

STUDENT SURVIVAL GUIDE

How to turn what you know into marks.

Why Economics Feels Like Common Sense, and Why That Costs Marks

Economics is the subject every candidate believes they already know. You have haggled for a shirt at Kariakoo, watched the price of rice climb in the weeks before the rains, seen a shopkeeper in Mbeya cut his price to clear a shelf. The subject arrives wearing the clothes of ordinary life, and that familiarity is exactly the trap, because the paper does not pay for what you think about prices. It pays for a theory, stated exactly, applied in order, drawn on a labelled diagram and carried through to a conclusion.

The first trap is the everyday word. Economics borrows the words of the market and gives them harder meanings. Demand is not wanting; it is wanting backed by the ability and the willingness to pay, at a stated price and in a stated period. Distribution is not lorries carrying crates; it is the sharing out of income among the factors that produced it. Cost is not what left your pocket; it is the best alternative you gave up. A candidate who uses the everyday sense loses the definition mark, then loses every mark built on top of it, because the rest of the answer stands on ground the examiner has already crossed out.

The second trap is listing where you were asked to reason. Ask for the determinants of demand and most scripts give a clean list of five: income, taste, the price of related goods, population, expectations. The list is correct and it earns a fraction of the marks, because the question wanted the chain: income rises, so households can afford more at every price, so the whole demand curve shifts to the right, so at the old price there is excess demand and price is bid up. Economics pays for the because. A statement without one is a fact; a statement with one is an argument, and only arguments score at this level.

The third trap is treating the diagram as decoration. At this level the diagram is not an illustration of the answer; it is part of the answer, and it carries marks of its own. Drawn without labelled axes, without named curves and without a marked equilibrium it earns nothing at all, however handsome it looks. Where a question says with the aid of a diagram, an answer without one is capped no matter how well it is written.

The same question, answered by two candidates.

The question. The maize harvest in Iringa is a bumper one. Explain the effect on the price of maize and on the incomes of the farmers who grew it.

The answer that fails. When there is a lot of maize in the market the price goes down, because there is plenty of it and people cannot buy it all. The farmers then earn less money. (True, and almost unmarked: it names no curve, gives no mechanism and never reaches an equilibrium.)

The answer that scores. A bumper harvest is a favourable change in a condition of supply, so the whole supply curve shifts to the right from S to S1 while demand stands still. At the old price there is now excess supply, so sellers compete and price falls until the market clears at a new equilibrium, with a lower price P1 and a higher quantity Q1, as the diagram shows. Because maize is a staple, its demand is price inelastic, so the proportionate fall in price exceeds the proportionate rise in quantity and total revenue to Iringa farmers falls. That is the paradox of plenty: every farmer prospers in the field and they crowd one another out of profit in the market.

Both candidates knew the price would fall. Only the second earned the marks, and the difference is not knowledge but discipline: name the curve, move it, reach the new equilibrium, and say what follows. That gap, repeated across a three-hour paper, is the distance between a pass and a distinction, and this book is built to close it.

How to Use This Book

This is not a book to read. It is a book to work, with a pencil in your hand and paper beside you. A model answer you have only read feels learned and is gone by morning; one you have struggled toward, and then checked against your own, is learned for good. Work every question in four steps.

Cover the model answer. Read the question, then write your full answer on paper, diagram and all, exactly as you would in the hall, before you look at anything.

Uncover and compare. Read the model twice, once for the economics and once for the way it is set down: its opening definition, its chain of reasoning, its diagram and its labels. Did you reach the same conclusion, and did you reach it the same way?

Mark yourself honestly. Award a mark only where your answer truly earned it. A missing definition, an unlabelled axis or a shift drawn as a movement is a lost mark, not a near one.

Fix one thing, then move on. Correct your single biggest error in your own hand, and carry that lesson into the next question.

Climb the ladder, and do not skip the bottom rung. Every chapter rises through three tiers. BINDER fixes the core: the definition, the diagram and the mechanism that must be right before anything else can be. REAL carries that core into named Tanzanian settings, a sugar mill at Kilombero, a bus fare in Dar es Salaam, a maize market in Iringa, and often asks you to find the error in someone else's working. HOT asks for judgement: to weigh, to compare, and to decide how far a claim holds. The tiers are cumulative, and a candidate who jumps to HOT because it looks like the real examination will find the ground missing beneath.

Work the chapters in order. The six chapters run from the ground up: the concept and scope of economics, economic systems, price theory, elasticity, the theory of production and cost, and the market. Each rests on the one before, and the whole subject rests on the first, on scarcity, choice and opportunity cost. Nothing later will hold without them.

Treat each chapter clinic as an examination. The last section of every chapter gathers the traps, the distinctions students confuse and a capstone question that spans the whole chapter. Work those in one sitting, against the clock, with the answers covered, then mark yourself. It is the closest rehearsal for the real day this book can give you.

Read the Master Key last, never first. Each answer closes with one sentence built to be carried into the hall. It is a summary, not a shortcut, and it is worth nothing to a student who has not first done the work it sums up.

How to Write Economics for Marks

Marks in this subject are won in sentences, and a small number of habits win most of them.

Define before you argue. Open by defining every technical term the question names, in one clean sentence each. The definition earns its own mark, it fixes the meaning you will use, and it keeps the everyday sense from creeping back in later.

Lead with the point, then explain it. State the conclusion the question asks for in your first sentence, then give the reasoning behind it. The examiner is trained to find the point, tick it and read on. Bury it at the end of a long paragraph and a tired examiner must hunt for it, and a point that cannot be found cannot be marked.

Join your ideas with the words that carry cause and effect. because, so, as a result, which in turn, therefore. An economic explanation is a chain from a change, through a mechanism, to an outcome, and these words are the links.

Take the chain to its end. Do not stop at the first effect. A tax raises the price paid by buyers, so quantity demanded falls, so the seller's revenue falls, so output and employment in that industry fall. The last link is usually where the last mark is.

Anchor every answer in a real, named place. The Rufiji, Mbeya, Kilombero, Kariakoo, a bodaboda rider in Iringa. A theory tied to a real Tanzanian example is worth more than the same theory floating free, and it is the difference between a good answer and one the examiner remembers.

Give both sides wherever judgement is asked for. Argue the case, then the case against, then decide and say why. An answer that argues only one side has answered a different question.

Scale your answer to the marks. A definition worth two marks wants two sentences, not a page; an essay worth twenty wants a plan, an introduction that defines the terms, one developed point to a paragraph, and a conclusion that answers the question actually asked.

The Words That Cost Marks

Economics is written in ordinary words used with extraordinary precision, and more marks are lost here than anywhere else in the subject. Learn the right-hand column to the letter.

Word	In everyday speech	In economics
Demand	Wanting something	Want backed by the ability and the willingness to pay, at a given price and in a given period
Supply	The stock sitting in the shop	The quantity sellers are willing and able to offer for sale, at a given price and in a given period
Distribution	Carrying goods to market	The sharing out of income among the factors that produced it: rent, wages, interest and profit
Cost	The money that left your pocket	The next best alternative given up; to a firm, its explicit payments plus the implicit cost of its own resources
Capital	Money in the bank	Man-made resources used to produce further goods: machines, buildings, tools and stocks
Wealth	Being rich	The stock of assets owned at a point in time, as against income, which is a flow earned over time
Normal profit	A fair return	The minimum return that keeps the entrepreneur in the industry, and therefore counted as a cost
Efficiency	Working hard and wasting nothing	Producing at least cost, which is productive efficiency, and producing the mix society values most, which is allocative efficiency

How to Draw an Economics Diagram for Marks

A diagram is a second answer, marked on its own. Give every one of them the same furniture, in the same order, and the marks follow.

Label both axes, with the variable and the unit. Price in shillings on the vertical axis, quantity per period on the horizontal. An unlabelled axis cannot be marked, and half the diagrams in a typical script carry one.

Name every curve where it ends. D, S, D1, S1, MC, ATC, AVC, AR, MR. A curve without a name is only a line.

Mark the equilibrium and read it off. Drop a dotted line to each axis and label them Pe and Qe. The examiner is looking for the point, not for the picture.

Show a change with a new curve, never by bending the old one. Draw the second curve, label it D1 or S1, and put an arrow to show the direction of the shift.

Keep the movement and the shift apart. A change in the good's own price moves you along the curve; a change in anything else shifts the whole curve. This one confusion costs more diagram marks than every other error together, and it is the first thing an examiner checks.

Shade and name any area you argue from. Consumer surplus, producer surplus, the profit rectangle, the deadweight welfare loss. An area you talk about in words but never mark on the diagram earns nothing.

Draw it large, in pencil, with a ruler. A diagram squeezed into a corner cannot be read and so cannot be marked. Half a page is the right size.

Refer to the diagram in your prose. as the diagram shows, at the new equilibrium E1. A diagram never speaks for itself; the marks are given for your reading of it.

The same diagram, drawn by two candidates.

The question. With the aid of a diagram, explain the effect of a rise in the price of cooking oil on the market for fish.

The diagram that fails. Two crossed lines, no axis labels, one arrow, and the words fish goes down written beside them. (The candidate knows the answer and has given the examiner nothing to mark.)

The diagram that scores. Price of fish in shillings on the vertical axis, quantity of fish per week on the horizontal; D and S drawn and named; the first equilibrium marked E, with Pe and Qe dotted off the two axes. Then demand drawn again to the left as D1, an arrow on the shift, the new equilibrium marked E1 and P1 and Q1 dotted off. The prose beside it reads: fish and cooking oil are complements, jointly demanded and used together in the pan, so a rise in the price of cooking oil reduces the quantity of oil bought and with it the demand for fish at every price; the demand curve therefore shifts left from D to D1, and both the equilibrium price and the equilibrium quantity of fish fall.

Notice that the failing candidate had the economics right. The marks turned on the labels, the shift and the reading, not on the knowledge, and that is true across the whole paper.

How to Handle the Numbers

The arithmetic of this subject is small, but it is marked strictly, and the marks live in the working rather than in the answer. Six habits protect them.

State the formula before the figures. Elasticity as the proportionate change in quantity over the proportionate change in price, total revenue as price times quantity, marginal cost as the change in total cost over the change in output. A stated formula earns its own mark and steadies everything that follows.

Substitute, then show every line. Put the figures in and work down the page. The examiner marks the method even when the final figure slips, but only if the method is on the paper.

Carry the sign, and mean it. The sign of a cross elasticity is the whole answer: positive for substitutes, negative for complements. Drop it and the coefficient says nothing.

Carry the unit, and convert on purpose. Shillings, units per week, tonnes per season. Most wrong answers are right numbers wearing the wrong unit.

Interpret the number in a sentence. A coefficient of 2.5 is not an answer. Demand is elastic, so a cut in price raises total revenue, is the answer, and the interpretation usually carries more marks than the arithmetic that produced it.

Check the size before you write it down. A total cost that falls as output rises, an elasticity of four hundred, a firm choosing to produce where marginal cost is still falling: each is a signal to go back and look again.

How to Fail Productively

You will get questions wrong. Every strong candidate does. What decides your grade is the five minutes afterwards.

The unproductive response is to rub out your attempt, read the model, nod, and move on. Your page looks tidy and your hand has learned nothing, because you have only watched someone else think.

The productive response is to stop, and not to erase. Set your answer beside the model, find the exact line where the two part company, and name the fault. Was it the definition, because you used the everyday word? The theory, because you reached for the wrong model? The reasoning, because you listed where you should have chained? The diagram, because it was missing, unlabelled, or drawn as a movement when a shift was needed? Or the command word, because you explained where you were asked to judge? Five faults need five different cures, and naming yours is half of the cure. A wrong answer you have diagnosed is worth more than a right one you copied.

How to Revise on Your Own

Most revision feels productive and is not. Re-reading model answers and copying them out neatly let your eyes move while your memory rests. These methods work instead.

Rebuild every diagram from a blank page. Not traced and not copied, but drawn from nothing, with both axes labelled, every curve named and the equilibrium marked, until your hand does it without prompting.

Say the chain aloud. Take a change, any change, a tax on sugar, a drought in Dodoma, a new road to Mbeya, and speak the consequences in order, linking each to the next with because and so. Where you can name but cannot link is exactly what you have not yet understood.

Learn the opening sentence of each model answer. It is written to be learned: one sentence, the whole definition, nothing wasted. Learn ten a week and the definition marks stop escaping.

Work the chapter clinics and capstones under the clock. Timed, in silence, with the answers covered, and then marked honestly against the model.

Test yourself on the words that cost marks. Cover the right-hand column of the table above and define each term in full until the economic meaning arrives before the everyday one.

Revise your weakest chapter first, not your favourite. The topic you enjoy is the one you already own; the one you avoid is the one the paper will find.

How to Face the Examination

The paper does not test how clever you are. It tests whether you can define, explain, draw and judge, by the rules and against the clock. Those are skills, and skills can be practised.

Read every question twice before you write. The second reading catches the command word, the number of points asked for, and the phrase with the aid of a diagram that the first reading skimmed.

Obey the command word. Each asks for a particular kind of answer, and giving the wrong kind loses marks even when the economics is sound. The table below sets out what each demands.

Plan every essay before you write it. Three minutes with a pencil, listing the points and the diagram in order, buys more marks than three minutes of extra writing at the end.

Spend your time by the marks. A question worth twenty deserves roughly twice the minutes of one worth ten, whatever your instinct says while you are enjoying a topic.

Answer the question asked, not the one you revised. A prepared answer poured into a question that did not ask for it scores what it deserves, which is very little.

Leave nothing blank. A definition, a labelled diagram, even one correct sentence earns marks that an empty space cannot. Reach every question you are required to answer.

Command word	What it asks for
Define; State	Give the exact meaning in one sentence. No explanation is wanted and none is paid for.
Explain; Account for; Why	Give the reason and the mechanism behind it. Every such answer needs a because.
Describe; Outline	Give an orderly account of what happens, without having to justify it.
Distinguish; Differentiate	Set the two side by side and give the differences directly. Two separate descriptions do not count.
With the aid of a diagram; Illustrate	A labelled diagram is compulsory and carries its own marks. An answer without one is capped.
Discuss; Examine	Argue the case, then the case against, then reach a reasoned position.
Assess; Evaluate; To what extent	Weigh both sides and commit to a judgement, saying how far the claim holds and why.
Calculate; Compute; Determine	Work the figure in full, formula first and every line shown, and state the answer with its unit.
Comment on; Interpret	Say what the figure, table or diagram means, not merely what it shows.

You now carry what the strongest candidates bring into the hall and most never receive: the discipline to define before you argue, the habit of chaining cause to effect until the argument ends, a diagram that earns its own marks, an honest way of being wrong, and a clear plan for the day itself. The economics in this book is Tanzania's own, in its markets, its farms and its firms, and the first question is waiting a page away. Prepare your pen and pencil, cover the first model answer, and begin.

Chapter One

CONCEPT AND SCOPE OF ECONOMICS

Economics opens not with money or markets but with a problem that every person and every nation must face: wants without end, and the means to meet them always in short supply. This chapter builds the whole subject from that single problem. It fixes first the language economists use, then the definitions of the subject, its two great branches and its method, and finally the chain of reasoning that runs from scarcity to choice, to opportunity cost, and to the production possibilities curve. Work it in order, because everything that follows in the course is built on the ground laid here.

What Economics Is: Scope, Activities and the Economist's Vocabulary

Economics begins with a single, stubborn fact: *human wants are unlimited, while the means of satisfying them are scarce.* This section fixes what economics studies, the four activities through which any economy works, and the exact words (good, utility, wealth, resource) on which every later answer will stand. Learn the vocabulary here to the letter, and the rest of the course has firm ground beneath it.

BINDER Question 1

A Dodoma family with one income must choose between school fees and a new roof; a nation with one budget must choose between a road and a hospital. The same tension runs through both.

Define economics, and explain what is meant by the scope of economics.

Model Answer

Economics is a social science that studies how individuals and societies allocate scarce resources among their unlimited and competing wants.

At its centre is the problem of scarcity: because human wants $>$ available resources at every moment, choices must be made, and economics studies how those choices are made and with what results.

The scope of economics, meaning its subject matter and its boundaries, covers four things:

The allocation of scarce resources: how land, labour, capital and enterprise are shared among competing uses.

The behaviour of economic agents: the choices of individuals, firms, the government and the nation as each pursues its goals under scarcity.

The four economic activities: production, distribution, exchange and consumption, the processes by which resources become satisfied wants.

The character of the subject: whether economics is a science or an art, and whether a statement is positive (what is) or normative (what ought to be).

The Master Key: every definition of economics returns to the same two ideas, scarce resources and unlimited wants. Anchor your answer there, and the scope follows on its own.

BINDER Question 2

Follow a sack of maize from a Mbeya field to a plate in Dar es Salaam, and you pass through every activity an economy performs.

With the aid of a diagram, explain the four economic activities and show how they are linked.

Model Answer

An economy works through four linked activities, production, distribution, exchange and consumption, each flowing into the next, as the diagram shows.

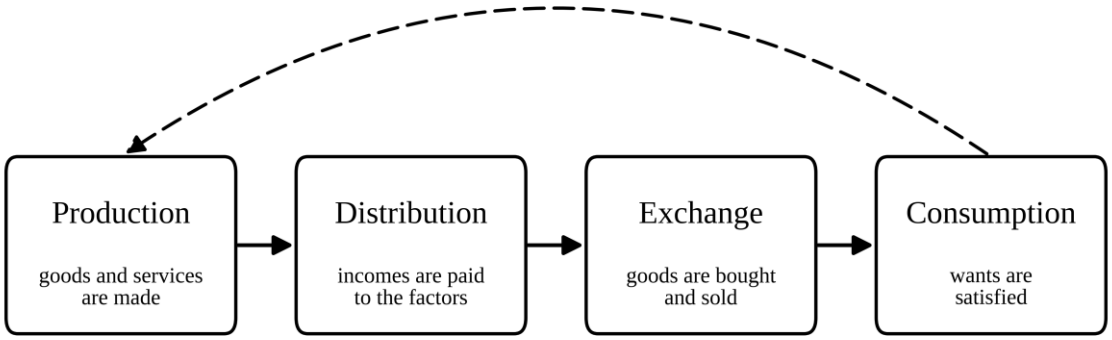


Figure 1.1: The chain of economic activity

Production creates goods and services from the factors of production; the maize is grown on the Mbeya farm.

Distribution, in economics, means the rewarding of the factors of production: rent to land, wages to labour, interest to capital and profit to enterprise, so that incomes are earned in the very act of producing.

Exchange is the buying and selling of what has been produced, with money as the medium; the maize passes from farmer to trader to shopkeeper.

Consumption is the using up of goods and services to satisfy wants; the maize is finally eaten in Dar es Salaam.

Consumption is not the end of the story, because using the maize creates fresh hunger and fresh wants, and those wants send the farmer back to the field; so the four activities form a continuous cycle, not a straight line.

The Master Key: name the four activities in order, and give distribution its economic meaning, the reward of the factors, not merely the delivery of goods, because that is the meaning the examiner tests.

BINDER Question 3

A lorry driver says he works "in distribution", moving crates between towns. An economist means something quite different by the word.

Distinguish the meaning of "distribution" in economics from its everyday meaning, and state the reward earned by each factor of production.

Model Answer

In everyday speech, distribution means the physical movement of goods from producer to seller; in economics, it means the sharing out of the national income among the factors that helped to produce it.

The everyday sense is about transport; the economic sense is about reward. Each factor of production earns its own reward:

- **Land** earns rent.
- **Labour** earns wages (or salaries).
- **Capital** earns interest.
- **Entrepreneurship** earns profit.

So when an economist asks how output is distributed, the answer is given in rent, wages, interest and profit, not in lorries and warehouses, because distribution studies who receives the income, not how the crates travel.

The Master Key: the driver moves goods; the economist shares out income. Give the four factor-and-reward pairs exactly, since a single wrong pairing, such as "wages to land", loses the mark.

BINDER Question 4

A thirsty traveller in the midday sun values a bottle of water more than a bar of gold. The reason is one of the oldest ideas in economics.

Define a want and a need, and explain the meaning of utility.

Model Answer

A want is a desire for a good or service that gives satisfaction, while a need is a want so basic that survival depends on it.

All needs are wants, but not all wants are needs.

Want: a desire that a good or service can satisfy, such as a radio, a soda or a newer phone. Wants are unlimited in number.

Need: a want that is essential for survival, such as food, water, shelter and clothing. Needs must be met first.

Utility: the satisfaction, or usefulness, a person gets from consuming a good or service. It is the reason goods are wanted at all. Utility is subjective and changes with circumstance, which is why the same bottle of water gives great utility to the thirsty traveller and very little to a person seated beside a well.

The Master Key: keep the three ideas apart: a want is desired, a need is essential, and utility is the satisfaction the good delivers.

BINDER Question 5

Two traders own shops of the same size. One owns his outright; the other still owes the bank for his. They are not equally wealthy.

Define wealth, outline its main forms, and show how an individual's net wealth is found.

Model Answer

Wealth is the stock of valuable assets that a person, firm or nation owns at a point in time.

It is a stock, measured at a single moment, not a flow earned over time. Wealth takes several forms:

1. **Individual (private) wealth:** the assets owned by a person, such as land, buildings, money and shares.
2. **Social (collective) wealth:** assets owned by the community, such as public roads, schools and hospitals.
3. **National wealth:** the total private and social wealth of a country, less what it owes abroad.
4. **Financial wealth:** paper claims such as money, shares and bonds.

An individual's net wealth is found by subtracting what is owed from what is owned:

$$\text{Net wealth} = \text{Assets} - \text{Liabilities}$$

So of the two traders, the one who owns his shop outright holds the greater net wealth, because the other's debt to the bank must first be subtracted from his assets.

The Master Key: wealth is a stock of assets, and net wealth is assets less liabilities. Do not confuse wealth, a stock that is owned, with income, a flow that is earned.

REAL Question 6

Read this account of one morning at a Kariakoo market stall, then answer from the passage alone.

> *At dawn, Mama Zawadi arranges the tomatoes her cousin grew on a farm at Kilosa. A wholesaler has already been paid for carrying them to the city, and the farm labourers received their wages last week. By nine o'clock a customer buys two kilogrammes for eight thousand shillings and carries them home for the family's lunch.*

From the passage, identify one example each of production, distribution, exchange and consumption, and name the utility the tomatoes finally give.

Model Answer

Each of the four economic activities appears in Mama Zawadi's morning, and the tomatoes end by giving satisfaction in consumption.

- **Production:** the cousin growing the tomatoes on the Kilosa farm.
- **Distribution:** the wages paid to the farm labourers, a reward to the factor labour.
- **Exchange:** the customer buying two kilogrammes for eight thousand shillings.
- **Consumption:** the family eating the tomatoes at lunch.
- **Utility:** the satisfaction the family gains from eating them, their want for food now met.

The wholesaler's payment is the trap here, because carrying goods to the city is distribution only in the everyday sense; the economic example of distribution is the wages, since that is a factor being rewarded.

The Master Key: read for the economic meaning, not the everyday one; the wages, not the delivery, are the distribution the examiner is paying for.

REAL Question 7

Neema runs a tailoring shop in Morogoro and wants to know what she is truly worth.

> Neema's assets: shop building and machines worth 8,000,000 shillings; cloth in stock worth 1,500,000 shillings; cash of 500,000 shillings.
>
> Her debts: a bank loan of 3,000,000 shillings, and 1,000,000 shillings owed to a cloth supplier.

Calculate Neema's net wealth, and state whether she is wealthier than a neighbour whose net wealth is 5,500,000 shillings.

Model Answer

Neema's net wealth is found by adding everything she owns, adding everything she owes, and subtracting the second total from the first.

First, add her assets (in shillings):

$$8{,}000{,}000 + 1{,}500{,}000 + 500{,}000 = 10{,}000{,}000$$

Next, add her debts (in shillings):

$$3{,}000{,}000 + 1{,}000{,}000 = 4{,}000{,}000$$

Then subtract the debts from the assets:

$$\text{Net wealth} = 10{,}000{,}000 - 4{,}000{,}000 = 6{,}000{,}000$$

Neema's net wealth is 6,000,000 shillings, which is more than her neighbour's 5,500,000 shillings, so she is the wealthier of the two, by 500,000 shillings. Notice that we are told nothing about their incomes: wealth is a matter of what is owned, not of what is earned.

The Master Key: add every asset and every debt before you subtract, and keep the shilling on every line; a total that drops one item, or that subtracts the wrong way round, is the commonest way to lose this mark.

HOT Question 8

A Form Five student tells his friend that economics is simply the study of how to make money. His friend is not so sure.

To what extent is it true to say that economics is about making money?

Model Answer

It is only partly true: money is one concern of economics, but the subject is far wider, because it studies choice under scarcity whether or not money is involved.

There is truth in it: money matters in economics, because much of the sharing out of scarce resources happens through prices, incomes and markets, so earning and spending money are part of what economists study.

But the subject is wider than money: a subsistence farmer dividing his land between maize and beans, or a government choosing between a road and a clinic, is doing economics though little money changes hands, because each is allocating scarce resources among competing wants.

And its aim is welfare, not cash: economics asks how scarce resources can satisfy the greatest wants, so money is only a means to that end, never the end itself.

So the statement captures a part and misses the whole. Economics uses money as a tool, but its true subject is the choices that scarcity forces upon us, which is why even a village where no money changes hands still faces an economic problem.

The Master Key: answer "to what extent" with a verdict, not a list. Concede the true part (money matters), show the larger truth (choice under scarcity), and end by weighing the one against the other.

HOT Question 9

Imagine a world where every want could be met at once, with nothing left to wish for. Ask what would remain for an economist to study.

"Without scarcity there would be no economics." How true is this statement?

Model Answer

The statement is very largely true, because scarcity is the root of the economic problem, and without it the central questions of economics would simply disappear.

Scarcity forces choice: because wants $>$ resources, no society can have everything it wants, so it must choose, and the study of that choice is economics.

Remove scarcity and choice vanishes: in a world of unlimited resources nothing would carry a price or an opportunity cost, and there would be no need to decide what to produce, how, or for whom, so the very questions economics exists to answer would not arise.

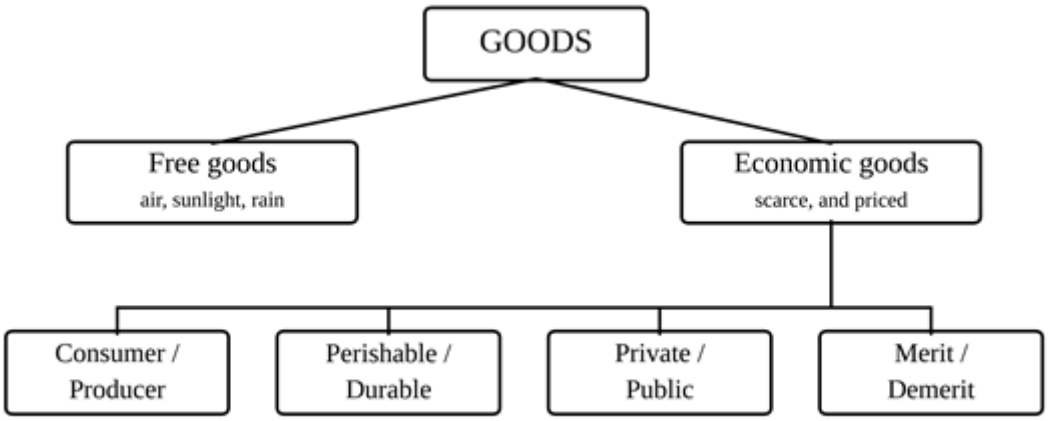
One qualification remains: even with unlimited goods, time is still limited and human wants may still compete, so a little allocation might survive; yet the great body of economics, its prices, production, costs and markets, rests squarely on scarcity.

So the claim holds in its essentials: scarcity is not merely one topic within economics but the reason the subject exists at all, which is why every branch of it can be traced back to the gap between unlimited wants and limited means.

The Master Key: to judge "how true", grant the strong core (no scarcity, no economic problem) and add one honest qualification (time may still be scarce); a judgement that sees both sides scores more than flat agreement.

The Material of Choice: Classifying Goods and the Factors that Make Them

Every economic question is, at heart, a question about goods: which to make, who receives them, and at what cost. Before any of that, a student must be able to name a good for what it is, because the class a good belongs to decides the rule that applies to it. This section sorts goods along the lines examiners test, sets out the wants they satisfy, and names the four factors of production that make every good possible, together with the reward each one earns.



Economic goods are classified by use, by durability, by ownership and by social value.

Figure 1.2: The family of goods, and the ways economic goods are classified.

BINDER Question 10

The rain that fills a farmer's pond in Mbeya costs him nothing; the water a Dodoma household buys by the bucket costs a great deal. The same substance, yet the economist treats the two differently.

Distinguish between economic goods and free goods, and explain why a free good has no opportunity cost.

Model Answer

An economic good is one that is scarce, commands a price and must be paid for, while a free good is so abundant that it carries no price at all.

Economic goods: scarce relative to wants, so they command a price; they give utility, can be owned and exchanged, and are the product of economic resources. Maize, a bicycle and a lesson are examples.

Free goods: so abundant that supply exceeds every want at a price of zero, so they carry no exchange value. Air, sunlight and rainfall in a wet season are examples.

A free good has no opportunity cost because using it sacrifices nothing: there is so much of it that one person's use leaves no less for anyone else, so nothing is given up to enjoy it. An economic good, being scarce, is different: using it here means it cannot be used there, and that sacrifice is its opportunity cost.

The Master Key: the test is scarcity, not usefulness. Air is useful yet free; keep "scarce and priced" for economic goods and "abundant and unpriced" for free goods.

BINDER Question 11

A bag of sugar on a kitchen shelf and the same bag in a bakery's store are counted differently by the economist, though nothing about the sugar has changed.

Distinguish between consumer goods and producer goods, and explain how the same good may be either.

Model Answer

A consumer good is one bought for final use, to satisfy a want directly, while a producer good is one bought to help produce other goods and services.

Consumer goods: satisfy wants directly and are used up in consumption, such as bread, a shirt or a bus ride. They may be perishable, like milk, or durable, like a radio.

Producer goods: also called capital goods, are used to make other goods, such as a tractor, an oven or a delivery van. They are wanted not for themselves but for what they help to produce.

The same good may be either, depending on its use and not its nature. Sugar bought by a family to sweeten tea is a consumer good; the very same sugar bought by a bakery to make cakes for sale is a producer good, because there it is a means to further production.

The Master Key: classify by purpose, not appearance. Ask what the good is for: direct satisfaction makes it a consumer good, further production makes it a producer good.

BINDER Question 12

A crate of tomatoes and a steel hoe leave the same Iringa market, but one must be sold by evening and the other may serve for ten years.

Distinguish between perishable goods and durable goods, and give the economic importance of the difference.

Model Answer

A perishable good loses its usefulness quickly and cannot be stored for long, while a durable good lasts and gives service over a long period.

Perishable goods: decay or lose value fast, such as milk, fish, vegetables and bread. They must be sold and used quickly, so their supply cannot easily be held back.

Durable goods: survive repeated use over months or years, such as furniture, vehicles, tools and buildings. They can be stored, and their purchase can be delayed.

The difference matters because it shapes how goods are traded. A trader in perishables must sell before spoilage, which weakens his bargaining power and can force the price down; a trader in durables can wait for a better price, because holding the stock costs him little.

The Master Key: perishable goods spoil and force a quick sale; durable goods store, so the seller can wait. The real difference is the power to hold stock.

BINDER Question 13

One family cannot keep the light of a street lamp to itself, yet it can easily keep its own torch. That simple contrast defines two kinds of good.

Distinguish between public goods and private goods, and explain the free-rider problem.

Model Answer

A private good is rival and excludable, so that one person's use prevents another's, while a public good is non-rival and non-excludable, so that all may enjoy it together and none can be shut out.

Private goods: are rival, since if I eat the loaf you cannot, and excludable, since the seller can refuse anyone who will not pay. Food, clothing and a seat on a bus are private goods.

Public goods: are non-rival, since my use does not reduce yours, and non-excludable, since no one can be prevented from benefiting. National defence, street lighting and a public road are examples.

The free-rider problem follows from non-excludability: because no one can be shut out of a public good, each person is tempted to enjoy it without paying, hoping others will pay instead. If all reason this way, too little is provided, which is why public goods are usually supplied by the government out of taxes rather than sold in a market.

The Master Key: the two tests are rivalry and excludability; a public good fails both. The free-rider problem is why the market under-provides it and the state steps in.

BINDER Question 14

The government builds clinics and taxes cigarettes. Behind both actions lies a single idea about the goods themselves.

Distinguish between merit goods and demerit goods, and explain why the government intervenes in each case.

Model Answer

A merit good brings greater benefit to society than the individual realises, while a demerit good brings greater harm to society than the individual admits.

Merit goods: yield benefits beyond the buyer, such as education, health care and vaccination. Left to themselves, people consume too little of them, so the government encourages consumption by providing or subsidising them.

Demerit goods: impose costs beyond the buyer, such as cigarettes, alcohol and harmful drugs. Left to themselves, people consume too much, so the government discourages consumption by taxing, regulating or banning them.

The government intervenes because the individual, judging only private benefit or pleasure, ignores the wider effect on society; so it acts to raise the consumption of merit goods, which are under-valued, and to curb the consumption of demerit goods, which are over-valued.

The Master Key: merit goods are under-consumed and encouraged; demerit goods are over-consumed and discouraged. The reason is always the gap between private judgement and the social interest.

BINDER Question 15

Behind every good on a Kariakoo shelf stand four contributors, each of whom must be paid before the good can exist.

Explain the four factors of production, and state the reward earned by each.

Model Answer

The factors of production are the four resources used to make goods and services, namely land, labour, capital and entrepreneurship, and each earns a distinct reward.

Land: all the free gifts of nature used in production, such as soil, minerals, water and forests. Its reward is rent.

Labour: all human effort, of hand or of mind, applied to production, such as the work of a farmer, a teacher or an engineer. Its reward is wages, or salaries.

Capital: all man-made aids to production, such as tools, machines, buildings and funds set aside for investment. Its reward is interest.

Entrepreneurship: the work of the organiser who brings the other three together, takes the risk and makes the decisions. Its reward is profit.

The four are combined in every act of production, and none can produce alone: land lies idle without labour, labour is weak without capital, and all three are wasted without an entrepreneur to organise them and bear the risk of failure.

The Master Key: land-rent, labour-wages, capital-interest, entrepreneurship-profit. Learn the four pairs as one block; the reward of enterprise is profit, which is what remains after the other three are paid.

BINDER Question 16

A family first wants food, then a comfortable chair, then a television it could easily live without. Wants arrange themselves in an order, and they share certain features.

Distinguish between a necessity, a comfort and a luxury, and outline the main characteristics of human wants.

Model Answer

Wants rise in a ladder from necessities, through comforts, to luxuries; and, however they differ, all human wants share the same handful of characteristics.

Necessities: goods essential for survival and basic efficiency, such as food, water, shelter and simple clothing. They must be satisfied first.

Comforts: goods that make life easier and more pleasant without being essential, such as a cushioned chair, tea with sugar, or a fan.

Luxuries: goods that are costly and go beyond comfort, giving prestige or great pleasure, such as a large car or jewellery.

Whatever their place on the ladder, human wants share these characteristics:

- **Unlimited** in number, for as one is satisfied another appears.
- **Varied,** differing from person to person, and from one place and time to another.
- **Of unequal intensity,** some urgent and some faint.
- **Recurrent,** returning again and again, as hunger does.
- **Competitive,** since limited means force one want to be met at the expense of another.
- **Complementary,** some being wanted together, as a car is wanted with fuel.
- **Subjective,** felt differently by each person.

The Master Key: the ladder runs necessity, comfort, luxury, rising in cost and falling in urgency; the characteristics all trace back to one root, that wants are unlimited while the means are scarce.

REAL Question 17

A trader's delivery note lists the day's goods. Sort each one as the economist would.

> The delivery note: (1) a sack of maize flour for a family; (2) a diesel generator for a welding workshop; (3) fresh milk; (4) a metal water tank; (5) bottled water for sale; (6) a packet of cigarettes; (7) rain water collected in the yard.

For each item, state whether it is an economic good or a free good; then, for the economic goods, give one further correct classification (consumer or producer, perishable or durable, or merit or demerit) with a reason.

Model Answer

Every item but one is an economic good, and each can be placed in a further class by its use, its life or its social value.

Maize flour for a family: an economic good, and a consumer good, because it is bought for final use.

Diesel generator for a workshop: an economic good, and a producer good, because it helps to produce other goods.

Fresh milk: an economic good, and a perishable good, because it spoils quickly.

Metal water tank: an economic good, and a durable good, because it lasts for years.

Bottled water for sale: an economic good, and a consumer good, because it is priced and bought for use.

Cigarettes: an economic good, and a demerit good, because they harm society beyond the smoker.

Rain water collected in the yard: a free good, because it is abundant and carries no price.

The Master Key: settle the economic-or-free question first, for only the rain water is free, then choose the further class that the item's use, life or value makes clearest.

REAL Question 18

Read this account of a fish-processing firm on the shore of Lake Victoria at Mwanza, then answer from the passage.

> *Uzima Fisheries rents a stretch of the lakeshore, where twenty workers clean and pack the day's catch. The packing is done with two freezing machines bought on a bank loan. Mwajuma, who started the firm, decides what to buy, hires and pays the staff, and keeps whatever is left after every cost is met.*

From the passage, identify each of the four factors of production at work, and name the reward that each receives.

Model Answer

All four factors appear in Uzima Fisheries, and each earns its own reward.

Land: the stretch of lakeshore the firm rents; its reward is rent.

Labour: the twenty workers who clean and pack the fish; their reward is wages.

Capital: the two freezing machines bought with the loan; their reward is interest, paid to the bank that supplied the funds.

Entrepreneurship: Mwajuma, who organises the firm, hires the staff and bears the risk; her reward is profit, what remains after every cost is met.

The Master Key: match each named thing in the passage to its factor, then give that factor's reward; the organiser who keeps "what is left" is always the entrepreneur, and what is left is profit.

REAL Question 19

A student has written five statements about goods and factors. Some contain an error. Find each error and correct it.

> (1) A free good is one that is very cheap. (2) A tractor bought by a farmer to plough his fields is a consumer good. (3) Street lighting is a private good. (4) Labour earns interest. (5) Cigarettes are a demerit good.

State whether each numbered statement is correct or wrong. For every wrong statement, give the correction.

Model Answer

Statements 1, 2, 3 and 4 are wrong; statement 5 is correct.

Statement 1 is wrong: a free good is not merely cheap but carries no price at all, because it is abundant, not scarce. A cheap good is still an economic good.

Statement 2 is wrong: a tractor used to plough fields is a producer good, because it helps to produce other goods; it would be a consumer good only if bought for direct final use.

Statement 3 is wrong: street lighting is a public good, because it is non-rival and non-excludable; no one can be shut out of its light.

Statement 4 is wrong: labour earns wages, not interest; interest is the reward of capital.

Statement 5 is correct: cigarettes are a demerit good, because they impose costs on society beyond the smoker.

The Master Key: the four traps here are the commonest in the topic: cheap is not free, use decides consumer-or-producer, light cannot be fenced, and each factor keeps its own reward.

HOT Question 20

A minister calls government schooling "a public good". An economist listening is not sure the term is right.

Is education best described as a public good or a merit good? Justify your answer.

Model Answer

Education is best described as a merit good rather than a true public good, because it fails the strict tests of a public good while fitting the definition of a merit good exactly.

It is not truly non-rival: a place filled by one pupil in a classroom is a place another cannot have, so its consumption is, in part, rival.

It is not truly non-excludable: a school can charge fees and turn away those who do not pay, so users can be excluded.

But it is plainly a merit good: its benefits reach far beyond the pupil, since an educated population is healthier, more productive and better governed, benefits the individual does not fully count, so education is under-consumed if left to the market.

So the minister's phrase is loose. Education can be provided publicly, and often is, but that is a choice of policy, not a feature of the good itself; strictly, education is a merit good that the government supplies because society values it more highly than the individual does.

The Master Key: test a good against rivalry and excludability before calling it public. Much of what the state provides, such as education and health, is a merit good, not a public good; never confuse "provided by government" with "public good".

HOT Question 21

The air on a mountain is free, yet a diver pays for the air in his tank. Ask what has changed.

"A free good can become an economic good." Discuss this statement.

Model Answer

The statement is largely true, because a good is free only while it is abundant, and once scarcity or effort enters, the same good acquires a price and becomes economic.

Scarcity can convert it: water is a free good in a flowing river, but where it is scarce, in a dry Dodoma season or in a crowded city, it must be pumped, treated and carried, so it becomes an economic good with a price.

Effort can convert it: air is free to breathe, yet compressed into a diver's tank or a hospital cylinder it has taken labour and capital, so it is now paid for.

Place and time decide: the same good may be free in one place or season and economic in another, because what matters is not the substance but whether it is abundant or scarce here and now.

So few goods are free by nature for ever; most are free only under particular conditions, and as population grows and resources are pressed, goods once free, such as clean water and even clean air, are steadily becoming economic. The line between the two is drawn by scarcity, and scarcity can move.

The Master Key: a good is free or economic not by its substance but by its scarcity in a given place and time; prove the conversion with a clear case, river water to piped water, and note that scarcity is spreading, not shrinking.

HOT Question 22

Each year the government raises the tax on beer and cigarettes, and each year some argue it should go further, and others that it has already gone too far.

To what extent should the government control the consumption of demerit goods such as alcohol and tobacco?

Model Answer

The government has good reason to control demerit goods, but only up to the point where the cost of control begins to outweigh the harm it prevents; so firm control is justified, while outright prohibition often is not.

There is a strong case for control: demerit goods harm society beyond the user, through ill health, lost work and burdened clinics, and because users under-value this harm, taxes, warnings and age limits rightly raise the price and reduce consumption.

But control has limits and costs: a tax that is too heavy, or an outright ban, can drive the trade underground, where goods are untaxed, unregulated and often more dangerous, so the harm returns in a worse form and the government loses the revenue.

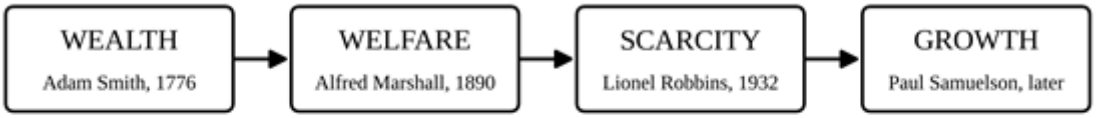
And freedom counts: adults have some right to choose for themselves, so the state must weigh the harm it prevents against the liberty it restricts, rather than banning whatever it judges unwise.

So the sensible course is firm control short of prohibition: tax and regulate demerit goods heavily enough to reflect the harm they do and to help fund its treatment, while stopping short of a ban that would breed a black market. The right amount of control is the amount at which the last shilling of harm prevented still exceeds the cost of preventing it.

The Master Key: answer "to what extent" by finding the limit, not by taking a side. Concede the case for control, external harm, show where it fails, the black market and lost revenue and liberty, then locate the balance between them.

Defining the Discipline: From Wealth to Welfare to Scarcity

Economists have never quite agreed on how to define their own subject, and the definition has shifted with the questions each age thought most pressing. That history is not idle: examiners test it directly, and the strengths and weaknesses of each definition reveal what economics is and is not. This section follows the definition from Adam Smith's wealth, through Alfred Marshall's welfare, to Lionel Robbins' scarcity, and asks how far the subject has grown since.



The subject widened from things, to people, to all scarcity, to the future.

Figure 1.3: How the definition of economics has widened over time.

BINDER Question 23

The first great book of economics, written in 1776, put one word at its centre: wealth.

Explain the wealth (classical) definition of economics associated with Adam Smith, and give two criticisms of it.

Model Answer

Adam Smith and the classical economists defined economics as the study of wealth, that is, of how a nation produces, accumulates and increases its material riches.

What it says: economics inquires into the nature and causes of the wealth of nations, so its task is to explain how wealth is created and made to grow.

Its strength: it rightly placed production and material progress at the heart of the subject, which matters greatly to a poor nation.

Criticisms:

Too narrow: by fixing on wealth alone it ignored human welfare, treating riches as an end in themselves rather than a means to well-being.

The "economic man": it assumed people act only from self-interest and the love of money, which is not how people really behave.

The Master Key: the classical definition is the wealth definition; praise its focus on production, then fault it for making wealth an end in itself and for the selfish "economic man".

BINDER Question 24

A century after Smith, Alfred Marshall shifted the subject's centre from wealth to the people who use it.

Explain the welfare (neo-classical) definition of economics associated with Alfred Marshall, and give two criticisms of it.

Model Answer

Alfred Marshall defined economics as the study of mankind in the ordinary business of life, examining how people earn and use income to promote their material welfare.

What it says: economics studies wealth on one side and, more importantly, human beings on the other, treating wealth as only a means to welfare, not an end.

Its strength: it made human well-being the purpose of the subject, a clear advance on the pure pursuit of riches.

Criticisms:

Only material welfare: by counting only material things it excludes services and satisfactions that are not material, though these too concern economics.

Welfare cannot be measured: welfare is subjective and differs from person to person, so it gives economics no firm, measurable footing.

The Master Key: Marshall's is the welfare definition, wealth as a means to well-being; credit it for centring people, then fault it for the narrow word "material" and for welfare being immeasurable.

BINDER Question 25

In 1932 Lionel Robbins gave economics the definition most examiners still expect, built on a single fact: scarcity.

State Robbins' scarcity definition of economics, and explain the three pillars on which it rests.

Model Answer

Lionel Robbins defined economics as the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses.

The definition rests on three pillars:

Unlimited ends (wants): human wants are without number, so they can never all be satisfied.

Scarce means: the resources for satisfying wants are limited, so they fall short of the wants.

Alternative uses: the scarce means can be put to more than one use, so using them for one end denies them to another.

Because wants are unlimited while means are scarce and can be used in different ways, people must choose; and Robbins made that act of choosing, forced by scarcity, the whole subject matter of economics.

The Master Key: give Robbins' sentence exactly, then the three pillars, unlimited ends, scarce means, alternative uses; together they make choice unavoidable, and choice is what economics studies.

BINDER Question 26

Robbins' definition was powerful, but it too drew objections, chiefly that it left something important out.

Give the main criticisms of Robbins' scarcity definition of economics.

Model Answer

Robbins' definition, though widely accepted, is criticised for being too abstract and for leaving out growth, welfare and the making of judgements.

It ignores economic growth: it treats resources as fixed and asks only how to allocate them, saying nothing about how a nation increases its resources over time, which is the central question for a developing country.

It leaves out welfare: by claiming to be neutral it drops Marshall's concern with human well-being, though improving welfare is why the subject matters.

It avoids value judgements: it presents economics as purely positive, yet real questions, such as how to share a nation's income, cannot be answered without judgements of what is fair.

It is too abstract: reducing all economic life to "ends and scarce means" is technically true but cold, and far from the ordinary business of life.

The Master Key: the strongest criticism for our context is that Robbins ignores growth; add that it drops welfare and value judgements, the very things a developing economy cannot do without.

BINDER Question 27

Later economists, chief among them Paul Samuelson, widened the subject once more to take in time and growth.

Explain the growth-oriented (modern) definition of economics associated with Paul Samuelson.

Model Answer

Paul Samuelson defined economics as the study of how people and society choose to employ scarce resources, which could have alternative uses, to produce goods and services and distribute them for consumption, now and in the future.

It keeps scarcity and choice: like Robbins, it begins with scarce resources that have alternative uses, so choice remains central.

It adds production and distribution: it names producing goods and services and sharing them out, returning Marshall's concern with people to the definition.

It adds time and growth: the words "now and in the future" bring in economic growth, asking not only how to allocate today's resources but how to enlarge tomorrow's.

The Master Key: Samuelson's is the growth definition; it joins Robbins' scarcity to Marshall's welfare and adds the future, which is why it suits a developing economy best.

REAL Question 28

Four statements describe the same Tanzanian sugar cooperative, each in the spirit of a different definition. Match each to the view it reflects.

> (1) "The cooperative exists to increase the region's wealth by producing more sugar." (2) "What matters is whether the workers' material welfare improves." (3) "The land could grow either sugar or maize; choosing sugar means giving up maize." (4) "The real question is how the cooperative can grow its output year after year."

Match each numbered statement to the definition it reflects, wealth (Smith), welfare (Marshall), scarcity (Robbins) or growth (Samuelson), and give a reason for each.

Model Answer

Each statement reflects one tradition, in the order in which the definitions appeared in history.

Statement 1, the wealth definition (Smith): because it makes increasing the region's wealth the purpose.

Statement 2, the welfare definition (Marshall): because it judges the cooperative by the workers' material well-being.

Statement 3, the scarcity definition (Robbins): because it turns on a choice between alternative uses of scarce land.

Statement 4, the growth definition (Samuelson): because it asks how output can be enlarged over time.

The Master Key: read for the key word, wealth, welfare, choice, or growth over time, and it points straight to the definition and the economist behind it.

REAL Question 29

A student's revision notes on the definitions contain some errors. Find and correct them.

(1) Adam Smith defined economics as the study of scarcity. (2) Marshall treated wealth as an end in itself. (3) Robbins' definition rests on unlimited wants, scarce means and alternative uses. (4) Robbins' definition is praised for explaining economic growth.

State whether each note is correct or wrong, and correct every wrong one.

Model Answer

Notes 1, 2 and 4 are wrong; note 3 is correct.

Note 1 is wrong: Smith defined economics as the study of wealth, not scarcity; the scarcity definition is Robbins'.

Note 2 is wrong: Marshall treated wealth as a means to welfare, not an end in itself; it was the classical economists who were charged with making wealth an end.

Note 3 is correct: Robbins' three pillars are unlimited wants (ends), scarce means, and alternative uses.

Note 4 is wrong: Robbins' definition is criticised for ignoring economic growth, not praised for explaining it; it is Samuelson's definition that brings in growth.

The Master Key: keep the four names in their lanes, Smith-wealth, Marshall-welfare, Robbins-scarcity, Samuelson-growth; most errors come from swapping one for another.

HOT Question 30

A textbook calls Robbins' definition "the only true definition of economics". **Weigh the claim.**

Model Answer

The claim is too strong: Robbins' definition is the most widely accepted and the most rigorous, but it is not the only acceptable one, because it leaves out matters that other definitions capture.

Its strengths support the claim: it is scientific and general, it applies to every economic problem, rich or poor, individual or national, and it correctly makes scarcity and choice the core of the subject.

But it is incomplete: it says nothing about economic growth, drops the concern with welfare, and claims to avoid the value judgements that real policy requires.

And the others still add something: Smith keeps production in view, Marshall keeps human welfare in view, and Samuelson adds the future, so each captures a truth Robbins omits.

So Robbins' definition is the best single starting point, and rightly the one to state first, but not the whole truth. A complete view takes Robbins' scarcity and choice and adds Marshall's welfare and Samuelson's growth; the definitions are stages in one deepening account, not rivals of which only one can be right.

The Master Key: answer the word "only" directly. Grant that Robbins' is the best and most general definition, then show what it omits, growth, welfare, judgement, and conclude that the definitions complete rather than cancel one another.

HOT Question 31

Marshall's welfare definition was written to improve on Smith's wealth definition. **Judge whether it succeeded.**

Model Answer

The welfare definition is superior in its purpose but not free of fault, because it corrects the chief error of the wealth definition while introducing a weakness of its own.

Where welfare is superior: it treats wealth as a means to human well-being rather than an end, so it restores people to the centre of the subject and answers the charge that economics worships riches.

Where it improves the method: it studies people in the ordinary business of life, a truer picture than the cold "economic man" of the classical school.

But it has its own weakness: by limiting itself to material welfare it excludes non-material satisfactions, and welfare, being subjective, cannot be measured, which is exactly the firmness Robbins later sought.

So the welfare definition is a real advance on the wealth definition, because a means-to-welfare view is wiser than a wealth-as-an-end view; but its superiority is over Smith, not over all comers, since its vagueness left room for Robbins to improve on it in turn.

The Master Key: judge "superior" on a stated test, here purpose and realism. Welfare beats wealth on both, but concede its vagueness, so the verdict is "superior to Smith, yet not the last word".

HOT Question 32

From Smith in 1776 to Samuelson in the twentieth century, the definition changed four times.

To what extent has the scope of economics widened from Smith to Samuelson?

Model Answer

The scope has genuinely widened, because each definition kept what was sound in the last and added something new, so the subject grew richer rather than merely changing its mind.

Smith to Marshall, from things to people: the subject moved from the wealth of nations to the welfare of the people who create and use that wealth.

Marshall to Robbins, from material to all scarcity: Robbins dropped the limiting word "material" and made the definition cover every scarce means with alternative uses, so it fitted all economic problems, not only material ones.

Robbins to Samuelson, across time: Samuelson added production, distribution and, above all, the future, so the subject took in economic growth as well as allocation.

So the widening is real and cumulative: each economist answered the objection to the one before, and the modern subject holds all four contributions at once, scarcity and choice, welfare, and growth over time. The one qualification is that the core, choice under scarcity, has stayed constant throughout, so the scope has deepened around a fixed centre rather than wandered.

The Master Key: show the widening as a chain, things to people to all-scarcity to the future, and note the constant centre, choice under scarcity; growth around a fixed core is the full answer to "to what extent".

HOT Question 33

A Tanzanian student must choose which definition best describes the economic life of her own country. It is not an idle choice.

Which definition of economics best captures the economic life of a developing country like Tanzania? Justify your answer.

Model Answer

For a developing country like Tanzania, Samuelson's growth definition fits best, because it joins the scarcity every poor economy faces to the growth every poor economy seeks.

Scarcity is real and central: Tanzania's resources fall far short of its people's wants, so Robbins' scarcity and choice describe daily economic life exactly, and any good definition must keep them.

But allocation alone is not enough: a poor country's deepest question is not only how to share today's small output but how to enlarge it, and Robbins' definition, treating resources as fixed, is silent on this.

Samuelson supplies what is missing: by adding production, distribution and the future, his definition asks how Tanzania can grow its resources and raise welfare over time, which is precisely the national task.

So while Robbins' scarcity definition describes the condition of the Tanzanian economy, Samuelson's growth definition describes its ambition, and for a developing country the ambition is the point. The best definition keeps scarcity and choice but sets them in time, so that development, not mere allocation, becomes the subject of economics.

The Master Key: tie the definition to the country's real problem. Scarcity describes Tanzania's condition, but growth is its goal, so the growth definition, scarcity set in time, fits a developing economy best.

Two Lenses: Microeconomics and Macroeconomics

Economics looks at the world through two lenses. Through the first it studies the single unit, one consumer, one firm, one market, and asks how each decides. Through the second it stands back and studies the whole economy at once, its total output, its jobs, its general level of prices. This section fixes both branches, sets out what each is for, and draws the line between them, a line examiners ask students to draw again and again.

BINDER Question 34

When an economist asks why the price of a kilo of rice rose in one Iringa market, she is using the first lens.

Define microeconomics, and state the main issues it studies.

Model Answer

Microeconomics is the branch of economics that studies the behaviour of individual economic units, such as a single consumer, a single firm or a single market, and how each makes its choices under scarcity.

The consumer: how a household decides what to buy with a limited income, seeking the most satisfaction.

The firm: how a business decides what and how much to produce, and at what price, seeking the most profit.

The market: how the price and quantity of a single good, such as maize or fish, are settled by demand and supply.

In every case microeconomics looks closely at the parts, the individual buyer, seller and product, rather than the whole, which is why it is also called price theory: its central task is to explain how the prices of particular goods and factors are determined.

The Master Key: microeconomics is the economics of the single unit, consumer, firm, market; its heart is how the price of a particular good is set, so it is also called price theory.

BINDER Question 35

When the same economist asks why prices across the whole country are rising, she has changed lenses.

Define macroeconomics, and state the main issues it studies.

Model Answer

Macroeconomics is the branch of economics that studies the economy as a whole, dealing with aggregates such as total output, total employment and the general level of prices.

National income and output: how much the whole economy produces in a year, and what makes that total rise or fall.

Employment and unemployment: what determines how many people in the whole economy have work.

The general price level: what causes inflation, a sustained rise in prices across the economy.

Macroeconomics does not ask about the price of one good but about the average of all prices; not about one firm's output but about the nation's; which is why it is also called the theory of income and employment: its central task is to explain what determines national income and the level of jobs.

The Master Key: macroeconomics is the economics of the whole economy and its totals, output, employment and the general price level; its heart is what determines national income, so it is also called the theory of income and employment.

BINDER Question 36

The two branches are best told apart side by side, point against point.

Distinguish between microeconomics and macroeconomics.

Model Answer

Microeconomics and macroeconomics differ in the unit they study, the method they use and the central question they answer, as the table sets out.

Basis	Microeconomics	Macroeconomics
Unit studied	a single consumer, firm or market	the whole economy at once
Method of analysis	partial equilibrium: one market at a time	general equilibrium: all markets together
Central theory	the theory of price and output	the theory of income and employment
Main question	how are a good's price and quantity set?	what determines total output, jobs and prices?
A Tanzanian example	the price of maize in Iringa	the rate of inflation across Tanzania

The two are lenses on one economy, not separate subjects: what happens to the whole is built from what happens in the parts, so a full understanding needs both.

The Master Key: contrast them on unit, method and central theory; the one-line test is single unit (micro) against whole economy (macro), or price theory against income theory.

BINDER Question 37

Microeconomics is not curiosity for its own sake; it aims at three goals that judge whether an economy is doing well.

Explain the three goals of microeconomics: efficiency, equity and optimality.

Model Answer

Microeconomics pursues three goals in the use of scarce resources: efficiency, equity and optimality.

Efficiency: using scarce resources so that no waste occurs and the greatest output is drawn from them; an economy is efficient when it cannot make more of one good without making less of another.

Equity: fairness in how goods and incomes are shared among people, so that the distribution is just and not merely large.

Optimality: the best overall use of resources, the point at which no one can be made better off without making someone else worse off, so that welfare is as high as it can be.

Efficiency asks whether the cake is as large as possible, equity asks whether it is fairly shared, and optimality asks whether, on both counts together, the economy has done as well as it can; a good economy pursues all three.

The Master Key: efficiency (no waste), equity (fair shares), optimality (the best overall balance); hold them as size, fairness, and the best of both.

REAL Question 38

Read these four questions asked in a Tanzanian newspaper, and decide which lens each one needs.

(1) How much income should a Morogoro farmer save from this year's harvest? (2) Why did the general price level in the country rise last year? (3) How many workers should a Mwanza factory lay off to cut its costs? (4) What made Tanzania reach middle-income status?

State whether each question belongs to microeconomics or macroeconomics, and give a reason.

Model Answer

Questions 1 and 3 are microeconomic; questions 2 and 4 are macroeconomic.

Question 1 is microeconomic: it concerns a single household's decision about its own income.

Question 2 is macroeconomic: it concerns the general price level of the whole economy, that is, inflation.

Question 3 is microeconomic: it concerns one firm's decision about its own workforce.

Question 4 is macroeconomic: it concerns the growth of the whole national economy.

The Master Key: ask whether the question is about one unit (micro) or the whole economy (macro); "general price level" and "the country" point to macro, "a farmer" or "a factory" to micro.

REAL Question 39

A district officer lists the economic worries of her area. Sort each by lens.

> *The officer notes: the falling price of tomatoes at the town market; the profit of a single sawmill; the country's total number of unemployed; and the rising cost of living felt across the whole nation.*

Classify each of the four concerns as microeconomic or macroeconomic, with a reason.

Model Answer

Two concerns use the micro lens and two use the macro lens.

The falling tomato price: microeconomic, for it is the price of a single good in a single market.

The profit of a single sawmill: microeconomic, for it is the outcome for one firm.

The country's total unemployed: macroeconomic, for it is an aggregate for the whole economy.

The nationwide rising cost of living: macroeconomic, for it is the general price level, that is, inflation.

The Master Key: a single good or a single firm is micro; a national total, such as total unemployment or the general price level, is macro.

REAL Question 40

A student has labelled four topics micro or macro. Two labels are wrong.

> (1) Inflation: macro. (2) The price of sugar in one shop: macro. (3) A firm's output decision: micro. (4) National income: micro.

State whether each label is correct or wrong, and correct the wrong ones.

Model Answer

Labels 1 and 3 are correct; labels 2 and 4 are wrong.

Label 1 is correct: inflation is a rise in the general price level, a macroeconomic matter.

Label 2 is wrong: the price of sugar in one shop is microeconomic, the price of a single good, not macro.

Label 3 is correct: a single firm's output decision is microeconomic.

Label 4 is wrong: national income is the total output of the whole economy, so it is macroeconomic, not micro.

The Master Key: the two traps are a single price mislabelled macro and a national total mislabelled micro; a single good is always micro, a national aggregate always macro.

HOT Question 41

A student argues that microeconomics is the more important branch, because the whole is only its parts. **Test the claim.**

Model Answer

Neither branch is superior: microeconomics and macroeconomics answer different questions, and each is needed for problems the other cannot reach, so the claim mistakes difference for rank.

The case for micro: it is true that the whole economy is built from individual units, so macroeconomics rests on microeconomic foundations, and understanding the parts is essential.

But micro cannot answer macro questions: no study of single markets can explain why prices across the whole economy rise together, or why national unemployment climbs; these are aggregate problems that need the macro lens.

And they depend on each other: a government fighting inflation must know how firms and consumers will respond, while a firm setting its price is affected by the state of the national economy.

So neither branch outranks the other; they are two lenses on one economy, and a problem is solved only by choosing the lens that fits it. To call microeconomics superior is like calling the study of a single tree superior to the study of the forest: each is right for its own question and wrong for the other's.

The Master Key: refuse the ranking. Concede that macro rests on micro foundations, then show that macro questions need the macro lens, and conclude that the two are complementary, not ranked.

HOT Question 42

The two branches are often taught apart, yet an economy is one thing

"Microeconomics and macroeconomics are complementary, not rivals." Discuss.

Model Answer

The statement is true: the two branches study the same economy at different levels, and each completes the other, so they work together rather than compete.

Macro is built from micro: national output is the sum of what all firms produce, and the general price level is an average of individual prices, so the aggregates of macroeconomics are made from the units of microeconomics.

Micro is shaped by macro: a single firm's sales and costs depend on the state of the whole economy, on national income, interest rates and inflation, so the parts move with the whole.

Each answers what the other cannot: micro explains the price of one good, macro explains the price level of all goods; neither question can be answered with the other's tools.

So the two are complementary in the strict sense: each supplies what the other lacks, and a complete economics uses both at once, the micro lens for the single market and the macro lens for the whole economy. They are not rivals contesting one ground but partners dividing it.

The Master Key: show the two-way link, macro built from micro and micro shaped by macro, and that each answers questions the other cannot; that mutual dependence is exactly what "complementary" means.

HOT Question 43

The government wants to bring down the rising cost of living. A student asks whether this is a job for microeconomics or macroeconomics.

The government wishes to reduce inflation. Explain which branch of economics it must chiefly use, and why the other cannot be ignored.

Model Answer

Reducing inflation is chiefly a task for macroeconomics, because inflation is a rise in the general price level of the whole economy; but the government cannot ignore microeconomics, because its policies act through individual firms and consumers.

It is chiefly macroeconomic: inflation is an aggregate, the average of all prices, and its main causes, too much money or too little output in the whole economy, are macroeconomic, so the tools against it, such as controlling the money supply, are macroeconomic.

But micro cannot be ignored: a macro policy works only through the micro units it acts on, so the government must know how a rise in interest rates will change the spending of individual households and the pricing of individual firms.

The two must be joined: if a policy aimed at the whole ignores how the parts will react it can fail or do harm, as a tax meant to curb spending may instead raise the price of a necessity the poor cannot do without.

So the government reaches for the macro lens to see the problem, since inflation is a whole-economy fact, but keeps the micro lens close, since every macro policy is felt one firm and one household at a time. The right approach uses macroeconomics to set the goal and microeconomics to foresee the effect.

The Master Key: name inflation as a macro problem needing macro tools, then show those tools act through micro units, so both lenses are needed, macro to see the problem, micro to foresee the response.

How Economists Speak: Positive and Normative, Science and Art

An economist must watch not only what is said but how it is said, because a statement of fact and a statement of opinion call for very different treatment. This section draws the line between positive economics, which reports what is, and normative economics, which urges what ought to be; it then asks whether economics is a science, an art, or both, why we study it at all, and how it leans on its neighbouring subjects.

BINDER Question 44

One statement can be checked against the facts; the other cannot, because it says what ought to be. Telling them apart is a basic skill of the economist.

Distinguish between positive and normative economics, giving an example of each.

Model Answer

Positive economics deals with what is, statements of fact that can be tested against evidence, while normative economics deals with what ought to be, statements of opinion that rest on value judgements.

Positive economics: describes and explains, and its claims can be shown true or false by the facts. Example: “a rise in the price of sugar reduces the quantity of sugar demanded.”

Normative economics: prescribes and recommends, and its claims can be neither proved nor disproved, only agreed or disagreed with. Example: “the government ought to make sugar cheaper for the poor.”

The test is whether the statement can, in principle, be checked against the facts: if it can, it is positive; if it turns on “ought” or “should”, or on a judgement of what is good or fair, it is normative.

The Master Key: positive is what is (testable fact); normative is what ought to be (value judgement). Watch for “should”, “ought”, “fair” and “too high”, which mark the normative.

BINDER Question 45

Economics observes, measures, forms theories and tests them against the world, much as a chemist does. In that sense it earns the name science.

Explain why economics is regarded as a science.

Model Answer

Economics is regarded as a science because it studies its subject by the methods of science: it observes facts, forms theories to explain them, and tests those theories against evidence.

It observes and measures: economics gathers data on prices, incomes, output and employment, as a science gathers its observations.

It builds theories and laws: from the facts it forms general statements, such as the law of demand, that explain and predict behaviour.

It reasons systematically: it uses the deductive method, reasoning from general principles to particular cases, and the inductive method, reasoning from particular facts to general principles, the same tools as the natural sciences.

For these reasons economics is called a social science, and Samuelson called it the queen of the social sciences; but a social science it remains, because its subject is human behaviour, which is less regular and less controllable than matter in a laboratory.

The Master Key: economics is a science because it observes, theorises and tests, and uses deduction and induction; call it a social science, since its material is unpredictable human behaviour, not matter.

BINDER Question 46

Knowing the laws of economics is one thing; using them to solve a real problem is another. The second is an art.

Explain the sense in which economics is an art, and hence why it is said to be both a science and an art.

Model Answer

Economics is an art because it does not only explain the world but is used to act on it, applying its knowledge to practical ends, such as reducing poverty or controlling inflation.

A science explains, an art applies: the science of economics tells us how the economy works; the art of economics uses that knowledge to solve problems and guide policy.

It calls for judgement and skill: applying a principle to a particular country at a particular time needs skill and judgement, as any art does, because no two situations are alike.

An example that splits the two: understanding why inflation occurs is the science; designing and timing a policy to bring it down for Tanzania is the art.

So economics is both: a science in its search for laws that explain the economy, and an art in its use of those laws to improve welfare. The two sides are joined, because sound action, the art, must rest on true understanding, the science.

The Master Key: science explains, art applies; economics is both because it discovers the laws of the economy and then uses them to act. Give one example that splits the two, the cause of inflation against the cure for it.

BINDER Question 47

A student may ask what economics is for. The answer reaches from her own household to the whole nation.

Explain why we study economics.

Model Answer

We study economics because it helps individuals, firms, governments and nations to make better use of scarce resources, and to understand the economic world they live in.

For the individual: it helps a person budget a limited income wisely, choosing among competing wants to gain the most satisfaction.

For the firm: it helps a business decide what to produce, how, and at what price, so as to use its resources well and earn a profit.

For the government: it helps the state frame sound policy on taxation, spending, employment and prices, for the good of the whole economy.

For understanding: it explains the economic events that shape daily life, such as why prices rise, why jobs are scarce, or why some nations are rich and others poor.

In short, because scarcity forces everyone to choose, economics is studied by everyone who must make those choices well, from a single household to a whole nation.

The Master Key: economics is studied because it improves the choices of the individual, the firm, the government and the nation under scarcity, and because it explains the economic world; give one use at each level.

REAL Question 48

Read these five statements from a budget debate, and sort each as positive or normative.

> (1) Raising the fuel tax will increase the price of transport. (2) The government should spend more on rural clinics. (3) Last year the economy grew by five per cent. (4) It is unfair that the rich pay the same fare as the poor. (5) A fall in interest rates tends to raise borrowing.

State whether each statement is positive or normative, and give a brief reason.

Model Answer

Statements 1, 3 and 5 are positive; statements 2 and 4 are normative.

- **Statement 1 is positive:** it predicts an effect that can be checked against the facts.
- **Statement 2 is normative:** "should" makes it a recommendation resting on a value judgement.
- **Statement 3 is positive:** it states a measured fact that can be verified.
- **Statement 4 is normative:** "unfair" is a judgement of value, not a fact.
- **Statement 5 is positive:** it states a tendency that evidence can confirm or deny.

The Master Key: test each statement by asking whether the facts could settle it; the words "should", "unfair" and "ought" betray the normative, while a measurable claim is positive.

REAL Question 49

A student's notes on method contain some errors. Find and correct them.

> (1) A normative statement can be proved true or false by the facts. (2) "Inflation rose last year" is a normative statement. (3) Economics is only a science, never an art. (4) The deductive method reasons from general principles to particular cases.

State whether each note is correct or wrong, and correct the wrong ones.

Model Answer

Notes 1, 2 and 3 are wrong; note 4 is correct.

Note 1 is wrong: a normative statement cannot be proved true or false, because it rests on a value judgement; it is a positive statement that can be tested against the facts.

Note 2 is wrong: "inflation rose last year" is a positive statement, a fact that can be checked, not a normative one.

Note 3 is wrong: economics is both a science and an art; it explains the economy, which is the science, and applies that knowledge to act on it, which is the art.

Note 4 is correct: the deductive method does reason from general principles to particular cases.

The Master Key: the traps are treating a value judgement as testable, calling a plain fact normative, and denying that economics is also an art; keep positive-testable and normative-judgement clearly apart.

REAL Question 50

In a single week a Tanzanian economist draws on several other subjects. Match each task to the subject it needs.

The economist must: (1) calculate the growth rate of national income; (2) explain how climate affects the maize harvest; (3) trace how past policies shaped today's economy; (4) draft a contract for a supplier.

Match each task to the subject it draws on, from mathematics and statistics, geography, history, and business studies, and say why.

Model Answer

Each task leans on a different neighbouring subject.

Calculating the growth rate: mathematics and statistics, which supply the tools to measure and compute economic data.

Explaining how climate affects the harvest: geography, which studies the physical environment in which production takes place.

Tracing how past policies shaped the economy: history, which records the events and decisions that made the present economy.

Drafting a supplier's contract: business studies, which deals with the practical conduct of trade and firms.

Economics does not stand alone; it borrows the measuring tools of mathematics, the environmental knowledge of geography, the record of history and the practical methods of business studies, because economic life touches all of them.

The Master Key: match the task to the subject by its content, numbers to mathematics, environment to geography, the past to history, trade practice to business studies; economics draws on all of them.

HOT Question 51

Because economists cannot run controlled experiments as chemists do, some deny that economics is truly a science.

To what extent is economics a science?

Model Answer

Economics is a science in its method but an imperfect one in its subject, so it is best called a social science: it reasons scientifically, yet the human behaviour it studies limits how exact it can be.

It is scientific in method: it observes facts, forms theories and laws, and tests them against evidence, exactly as the natural sciences do, so in method it qualifies as a science.

But its subject resists control: people are not matter; their behaviour shifts with expectations and circumstances, and an economist cannot hold "other things equal" in a real economy, so predictions are tendencies, not certainties.

And it cannot fully escape values: many economic questions touch on what is fair, which no experiment can settle, so pure objectivity is harder than in the natural sciences.

So economics is a science, but a social science: rigorous in method, yet held back by the unpredictability of its human subject. It is more scientific than history and less exact than physics, which is why the honest description is neither "pure science" nor "not a science", but a science of human behaviour.

The Master Key: answer "to what extent" by splitting method from subject. Grant the scientific method, then show the limits set by human behaviour and value judgements, and settle on "social science".

HOT Question 52

A policymaker says only positive economics matters, because facts, not opinions, should guide a country.

"Positive economics is more useful than normative economics." Discuss.

Model Answer

Neither is simply more useful: positive economics tells us what will happen, and normative economics tells us what we should aim for, so good policy needs both, and each is weak without the other.

The case for positive economics: it gives testable, agreed knowledge of cause and effect, so it warns a government of the real consequences of its actions and keeps policy grounded in fact.

But positive economics cannot choose goals: it can say that a tax will raise prices, but not whether the tax is worth imposing; choosing the aim needs a value judgement, which is normative.

So the two work together: positive economics maps the roads, normative economics chooses the destination; a government that knows only the facts does not know what to do with them, and one that knows only its values does not know how to reach them.

So the claim is half right: positive economics is indispensable, but not more useful, because usefulness depends on the task. To predict effects, use positive economics; to decide what is worth doing, normative economics is unavoidable. Sound policy is positive analysis in the service of a normative goal.

The Master Key: reject the ranking. Positive economics supplies facts, normative economics supplies goals; show that policy needs both, facts to see consequences, values to choose aims.

HOT Question 53

Robbins wished economics to be purely positive, free of value judgements.

Can economics be entirely free of value judgements? Discuss.

Model Answer

Economics cannot be entirely free of value judgements, because although its analysis can be positive, the questions it chooses and the policies it recommends rest on values.

The analysis can be positive: the cause-and-effect part of economics, such as the law of demand, can be stated as fact and tested, so this core is genuinely value-free.

But the choice of questions is not: which problems an economist studies, poverty, growth or inequality, already reflects a judgement about what matters, so values enter before the analysis begins.

And policy advice cannot be: to recommend a policy is to say the country ought to do it, which is a normative claim; the moment economics advises, it leaves pure fact behind.

So economics has a positive core that can be value-free, but as a practical subject that chooses problems and advises governments it cannot escape value judgements. The honest position is not to claim a false neutrality but to keep the positive analysis and the normative judgement clearly apart, so a reader can see where the facts end and the values begin.

The Master Key: separate the positive core (value-free) from the choice of questions and the giving of advice (value-laden). Economics cannot be wholly value-free; the discipline is to separate fact from judgement, not to deny the judgement.

The Central Problem: Scarcity and the Three Questions

Everything in this book grows from one problem, the problem this section sets out plainly. Wants outrun means; means must be chosen among wants; and every society, from a village cooperative to a nation, must therefore answer the same three questions. Here the chain from scarcity, through choice and the scale of preference, to the three fundamental questions is drawn out and put to work.

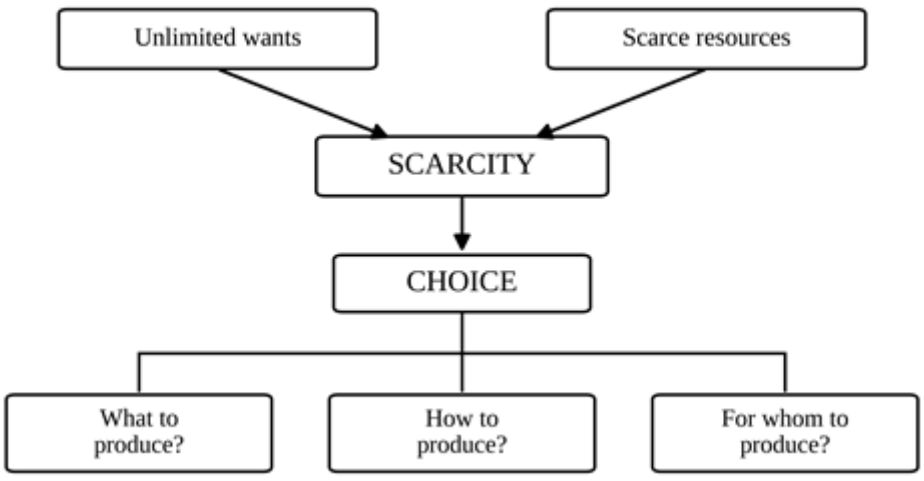


Figure 1.4: From scarcity to choice to the three fundamental questions.

BINDER Question 54

Strip every economic question to its root and the same fact remains: there is never enough to go round.

Explain why scarcity is regarded as the central problem of economics.

Model Answer

Scarcity is the central problem of economics because human wants are unlimited while the resources to satisfy them are limited, so no society can have everything it wants, and every economic question grows from this gap.

Wants are unlimited: as fast as one want is met, another appears, so human wants never end.

Resources are limited: the land, labour, capital and enterprise available to satisfy wants are finite and fall short of them.

Hence scarcity: because limited means cannot meet unlimited wants, goods are scarce, and scarcity is felt by the poorest household and the richest nation alike.

From this single problem the whole of economics follows, because scarcity forces every society to choose what to produce, how, and for whom; remove scarcity, and there would be nothing for economics to study.

The Master Key: scarcity is the gap between unlimited wants and limited means; it is central because every other economic question, choice, opportunity cost and the three questions, grows out of it.

BINDER Question 55

Because it cannot make everything, every society, from a village to a nation, must answer the same three questions.

Explain the three fundamental questions that every economy must answer.

Model Answer

Because resources are scarce, every economy must decide what to produce, how to produce, and for whom to produce.

What to produce: which goods and services, and in what quantities, since producing more of one means producing less of another.

How to produce: by which method and combination of resources, for example whether to farm with many workers or with machines.

For whom to produce: how the goods produced are to be shared among the people, that is, who receives them and in what amounts.

These three questions arise directly from scarcity, because a society with unlimited resources would not need to choose what, how or for whom; and every economic system, as the next chapter shows, is simply a different way of answering them.

The Master Key: what, how, for whom; all three spring from scarcity, and every economic system is only a different way of answering them.

BINDER Question 56

Scarcity does not merely limit us; it forces us to choose, and choice is where economics begins.

Explain how scarcity gives rise to choice.

Model Answer

Scarcity gives rise to choice because, when means are too few to satisfy all wants, a society or a person cannot have everything and must select which wants to satisfy and which to leave unmet.

It makes not-choosing impossible: with limited resources, using them for one purpose leaves them unavailable for another, so choosing is unavoidable.

It means ranking wants: to choose is to decide which wants come first, satisfying the more urgent and postponing the less urgent.

Every choice has a cost: because the resources used for the chosen want cannot serve the rejected one, choosing always means giving something up.

So scarcity and choice are two sides of one coin: because we cannot have all we want, we must choose; and because we must choose, we must give something up, which leads straight to opportunity cost.

The Master Key: scarcity forces choice, and choice forces sacrifice; that is why scarcity, choice and opportunity cost always travel together.

BINDER Question 57

Faced with more wants than money, a wise buyer does not choose at random; she lists her wants in order and works down the list.

Explain what a scale of preference is, and how it guides choice.

Model Answer

A scale of preference is a list of a person's wants arranged in order of importance, from the most urgent at the top to the least urgent at the bottom, which guides how limited means are spent.

It ranks wants by urgency: the most pressing wants are placed first, and the least pressing last.

It guides spending: with a limited income, a person satisfies the wants at the top of the scale first, and moves down only as far as the money allows.

It shows the margin of choice: the first want left unsatisfied, the one just below the line the income can reach, is the one given up, and so it measures the opportunity cost of the last want met.

So the scale of preference turns scarcity into an orderly decision: by ranking wants and satisfying them from the top down, a person draws the most satisfaction from a limited income, and can see exactly what is sacrificed at the margin.

The Master Key: a scale of preference ranks wants by urgency and is worked from the top down; the first want the income cannot reach is what is given up, which is the opportunity cost.

REAL Question 58

A new village cooperative in Njombe must set itself up from nothing. Read its situation, then answer for it.

> *The Njombe cooperative has one field, a small grant, and forty members. It could grow maize, or potatoes, or both. It could farm by hand, hiring many members, or buy one tractor and hire few. And it must decide whether to share the harvest equally among all members, or in proportion to the work each does.*

Show how the cooperative faces each of the three fundamental economic questions, and identify the choice in each.

Model Answer

The cooperative meets all three questions, and each is a choice forced by its scarce resources.

What to produce: whether to grow maize, potatoes or a mix; choosing more maize means less land for potatoes.

How to produce: whether to farm by hand with many members, or with a tractor and few; a choice between labour and capital.

For whom to produce: whether to share the harvest equally or in proportion to work done; a choice about distribution.

So even a single village cooperative cannot escape the three questions, because its one field and small grant are scarce, and every answer it gives is a choice that uses resources one way rather than another.

The Master Key: fit the scenario's decisions to what, how and for whom; the land-use choice is what, the labour-or-tractor choice is how, and the sharing choice is for whom.

REAL Question 59

A Form Five student has 20,000 shillings and more wants than the money can meet. Help her spend it well.

> Amina has 20,000 shillings. Her wants, and their costs, are: a textbook, 12,000; bus fare for the week, 6,000; a data bundle, 5,000; a snack, 3,000. She ranks them, in order of importance, as: textbook, bus fare, data bundle, snack.

Using Amina's scale of preference, decide which wants she can satisfy, and state the opportunity cost of her spending.

Model Answer

Working down her scale from the top, Amina can satisfy the first two wants but not the rest, and the first want she must forgo is the opportunity cost of her choice.

- **Textbook (12,000):** satisfied first, as the most important, leaving $20{,}000 - 12{,}000 = 8{,}000$ shillings.
- **Bus fare (6,000):** satisfied next, leaving $8{,}000 - 6{,}000 = 2{,}000$ shillings.
- **Data bundle (5,000):** cannot be satisfied, because only 2,000 shillings remain.
- **Snack (3,000):** also left unsatisfied.

So Amina buys the textbook and the bus fare, using 18,000 of her 20,000 shillings. The first want she has to give up is the data bundle, the next on her scale, so the data bundle is the opportunity cost of her spending.

The Master Key: satisfy wants from the top of the scale until the money runs out; the highest-ranked want you cannot reach is the opportunity cost, here the data bundle.

REAL Question 60

A student's notes on the economic problem contain errors. Find and correct them.

> (1) Scarcity means there are no resources at all. (2) The three questions are what, how, and how much to produce. (3) Choice exists because resources are unlimited. (4) A scale of preference lists wants in order of importance.

State whether each note is correct or wrong, and correct the wrong ones.

Model Answer

Notes 1, 2 and 3 are wrong; note 4 is correct.

Note 1 is wrong: scarcity does not mean no resources at all, but that resources are limited relative to unlimited wants.

Note 2 is wrong: the third question is for whom to produce, not "how much"; the three are what, how, and for whom.

Note 3 is wrong: choice exists because resources are limited, not unlimited; with unlimited resources no choice would be needed.

Note 4 is correct: a scale of preference does list wants in order of importance.

The Master Key: scarcity is limited-not-absent resources, the three questions end with for whom, and choice comes from limited resources; these are the commonest slips.

HOT Question 61

It is often said that without scarcity there would be no economic activity at all.

"Scarcity is the basis of all economic activity." How true is this statement?

Model Answer

The statement is very largely true, because scarcity is what sets economic activity in motion: production, exchange and choice all exist to cope with the gap between wants and means.

Scarcity drives production: goods are produced because they are scarce and wanted; a good so abundant that no one need make it, like air, calls forth no economic activity.

Scarcity drives exchange and choice: because no one can have everything, people specialise, trade and choose, and all of these are economic activities born of scarcity.

Remove scarcity and activity ceases: in a world where every want was met without effort, there would be nothing to produce, nothing to trade and nothing to choose, so economic activity would stop.

So the statement holds in its essentials: scarcity is not one cause of economic activity among many but its root cause, the reason production, exchange and choice exist at all. The one qualification is that human effort and organisation are also needed to respond to scarcity; scarcity sets the problem, but activity is how people answer it.

The Master Key: grant the strong core, no scarcity means no production, exchange or choice, then add one qualification, that effort answers the problem scarcity sets; that balance is the full answer to "how true".

HOT Question 62

A rich country and a poor one seem to face very different problems, yet an economist says their basic problem is the same.

"Every economy, however rich or poor, faces the same three fundamental questions." Discuss.

Model Answer

The statement is true: because scarcity exists in every economy, rich and poor alike must answer what, how and for whom to produce, though the answers they reach may differ widely.

Scarcity is universal: even the richest country cannot satisfy every want of every citizen, so it too faces limited means against unlimited wants, and must choose.

So the three questions are universal: every economy must decide what goods to make, by what methods, and for whom, because none can escape the choices scarcity forces.

But the answers differ: a rich country may produce luxuries with advanced machines, a poor one may struggle to produce necessities by hand, and different systems, as the next chapter shows, answer "for whom" very differently.

So the questions are the same everywhere, but the answers are not. Scarcity is the common problem of all economies, which is why all face the three questions; wealth, technology and the economic system decide only how each question is answered, not whether it must be faced.

The Master Key: separate the questions (universal, because scarcity is universal) from the answers (which differ with wealth, technology and system); that distinction is the heart of the discussion.

Opportunity Cost: The Real Price of Every Choice

Because scarcity forces choice, every choice has a price that no shilling can show: the next best thing given up to make it. This section defines that price, opportunity cost, then teaches the skill the textbook leaves out, reading it straight from a production schedule and computing it. From there it follows opportunity cost into its great use, comparative advantage, which decides who should produce what, and why specialising and trading leave everyone richer.

BINDER Question 63

The student who spends Saturday studying gives up the football match; the government that builds a road gives up the clinic it might have built instead. Each has paid a cost no money measures.

Define opportunity cost, and explain why even a choice that costs no money still has a cost.

Model Answer

Opportunity cost is the value of the next best alternative given up when a choice is made; it is what must be sacrificed to have the thing chosen.

The next best alternative, not all of them: only the single most valued option forgone counts as the opportunity cost, not everything that was not chosen.

It applies to every scarce choice: because resources used one way cannot be used another, choosing one thing always means forgoing another, whether or not money changes hands.

Free goods are the exception: a free good has zero opportunity cost, because using it sacrifices nothing, there being enough for all.

So a choice that costs no money still has a cost, because the time, land or effort it uses could have served the next best purpose instead; the student's free Saturday is not free, for its opportunity cost is the match not watched.

The Master Key: opportunity cost is the next best alternative forgone; it exists wherever resources are scarce, money or no money, and is zero only for free goods.

BINDER Question 64

A country cannot make everything. A production schedule shows the combinations it can manage, and hidden in the figures is the opportunity cost of every choice.

Study the production schedule below, then calculate the opportunity cost of raising cloth output from 10 to 20 thousand metres, and state what happens to opportunity cost as more cloth is made.

Model Answer

The opportunity cost of more cloth is the maize given up to make it, and the schedule shows that this cost rises as cloth output grows.

Combination	Maize (tonnes)	Cloth (thousand metres)
A	100	0
B	90	10
C	70	20
D	40	30
E	0	40

Moving from combination B to combination C, cloth rises from 10 to 20 thousand metres while maize falls from 90 to 70 tonnes, so the maize given up is:

$$\text{Opportunity cost} = 90 - 70 = 20 \text{ tonnes of maize}$$

Each further batch costs more: the four steps from A to E give up 10, then 20, then 30, then 40 tonnes of maize for each extra 10 thousand metres of cloth.

So opportunity cost rises: as more cloth is made, each extra batch costs more maize than the last, which is called increasing opportunity cost.

Opportunity cost rises because resources are not equally suited to both goods: as cloth output grows, land and labour better fitted to maize must be switched to cloth, and each switch sacrifices more maize than the one before.

The Master Key: read the opportunity cost straight from the schedule as the maize given up; when each extra batch costs more than the last, opportunity cost is increasing, because resources are not equally suited to both goods.

BINDER Question 65

Opportunity cost is not merely a definition to recite; it is the tool by which every wise decision is made.

Explain the significance of the concept of opportunity cost.

Model Answer

Opportunity cost matters because it reveals the true cost of every choice, and so guides individuals, firms and governments to use scarce resources where they are worth most.

It guides personal and business decisions: by weighing what must be given up, a person or firm can choose the option whose benefit exceeds its opportunity cost.

It underlies budgeting and planning: a government with a limited budget must compare the opportunity cost of each project, spending where the sacrifice is best repaid.

It explains specialisation and trade: opportunity cost shows who can produce a good most cheaply, and so who should specialise in it, which is the basis of comparative advantage and exchange.

So opportunity cost turns scarcity into a rule for choosing: do a thing only when its benefit is worth more than the next best thing given up; ignore opportunity cost, and resources are wasted on choices that cost more than they are worth.

The Master Key: opportunity cost is significant because it gives the true cost of a choice and so guides decisions, budgeting and specialisation; the rule it yields is to choose only where benefit exceeds the alternative forgone.

BINDER Question 66

Two neighbours, each able to do two jobs, grow richer if each does the job the other finds costlier. That is the logic of comparative advantage.

Explain comparative advantage, and how it leads to specialisation and gains from trade.

Model Answer

A producer has a comparative advantage in the good it can make at a lower opportunity cost than another producer, and each should specialise in that good and trade for the rest.

It rests on opportunity cost: it is not about who can make more, but about who gives up less of the other good to make it.

Specialisation follows: each producer concentrates on the good in which its opportunity cost is lowest, so total output is greater than if each tried to make both.

Trade shares the gain: by exchanging their surpluses, both producers end with more of both goods than they could have made alone, which is the gain from trade.

So comparative advantage explains why specialisation and exchange make everyone richer: when each does what it forgoes least to do, the same resources yield more, and trade spreads the extra output between them.

The Master Key: comparative advantage is lower opportunity cost, not greater output; it tells each producer what to specialise in, and trade then leaves both better off than self-sufficiency would.

REAL Question 67

Juma farms four acres near Kilosa, and is deciding whether to shift one acre from maize to beans.

> *On Juma's land, each acre yields either 20 sacks of maize or 12 sacks of beans. He plans to move one acre out of maize and into beans.*

Calculate the opportunity cost of the beans Juma gains, and state it as the cost of one sack of beans.

Model Answer

The opportunity cost of the beans is the maize Juma gives up by moving the acre.

By shifting one acre from maize to beans, Juma gains 12 sacks of beans and gives up the 20 sacks of maize that acre would have grown, so:

$$\text{Opportunity cost of 12 sacks of beans} = 20 \text{ sacks of maize}$$

Dividing to find the cost of a single sack, the opportunity cost of one sack of beans is:

$$20 \div 12 \approx 1.67 \text{ sacks of maize}$$

So each sack of beans costs Juma about 1.67 sacks of maize; he should make the switch only if a sack of beans is worth more to him than 1.67 sacks of maize.

The Master Key: opportunity cost is the maize given up for the beans gained; divide to get the cost per sack, and act only if the gain is worth more than that cost.

REAL Question 68

Neema and Juma each make baskets and mats. Deciding who should make what is a matter of opportunity cost, not of who is faster.

> *In a day, Neema can make either 6 baskets or 12 mats. In a day, Juma can make either 2 baskets or 8 mats.*

Using opportunity cost, decide which of them should specialise in baskets and which in mats.

Model Answer

Each should specialise where the opportunity cost is lower, so compare the cost of one basket for each.

For Neema, giving up a day of mats to make baskets, the opportunity cost of one basket is:

$$12 \div 6 = 2 \text{ mats}$$

For Juma, the opportunity cost of one basket is:

$$8 \div 2 = 4 \text{ mats}$$

Neema should specialise in baskets: her opportunity cost of a basket, 2 mats, is lower than Juma's, 4 mats.

Juma should specialise in mats: by the same figures his opportunity cost of a mat is lower, since he gives up a quarter of a basket per mat while Neema gives up a half.

So Neema makes the baskets and Juma the mats, each doing what they forgo least to do; they then trade, and between them they end with more baskets and mats than if each had tried to make both.

The Master Key: compare opportunity costs, not outputs; the one who gives up less of the other good has the comparative advantage and should specialise there.

REAL Question 69

A student's notes on opportunity cost contain errors. Find and correct them.

> (1) Opportunity cost is the money price of a good. (2) The opportunity cost of a choice is all the alternatives given up. (3) A free good has a high opportunity cost. (4) Increasing opportunity cost means each extra unit costs more than the last.

State whether each note is correct or wrong, and correct the wrong ones.

Model Answer

Notes 1, 2 and 3 are wrong; note 4 is correct.

Note 1 is wrong: opportunity cost is not the money price but the next best alternative given up, which may cost no money at all.

Note 2 is wrong: opportunity cost is only the single next best alternative forgone, not all the alternatives together.

Note 3 is wrong: a free good has zero opportunity cost, because using it sacrifices nothing.

Note 4 is correct: increasing opportunity cost does mean each extra unit costs more of the other good than the last.

The Master Key: opportunity cost is the next best alternative (not money, not all alternatives), it is zero for free goods, and it increases when each extra unit costs more than the last.

HOT Question 70

It is said that there is no such thing as a free lunch: every choice, even the government's, carries an opportunity cost. **Test the claim.**

Model Answer

The claim is almost always true: because resources are scarce, nearly every choice means forgoing an alternative, so nearly every choice has an opportunity cost; the one exception is the use of a genuinely free good.

Scarce resources make it true: whenever a scarce resource, time, money or land, is used one way, it cannot be used another, so the next best use is sacrificed and an opportunity cost is paid.

It holds for the government too: a shilling spent on a road is a shilling not spent on a clinic, so even public spending carries an opportunity cost, which is why "free" government services are not costless to society.

The exception is the free good: using a free good, such as air, sacrifices nothing because there is enough for all, so here alone the opportunity cost is zero.

So the claim holds wherever resources are scarce, which is nearly everywhere, and the saying that there is no free lunch is sound: someone, somewhere, gives up the next best use. Only the use of a truly free good escapes an opportunity cost, and such goods are few and growing fewer.

The Master Key: tie the claim to scarcity, every scarce resource used one way forgoes another, extend it to government spending, and note the single exception, the free good; that is the balanced answer.

HOT Question 71

A district has funds for one project only: a new road or a new clinic. An economist insists the choice be made by opportunity cost.

Explain how the concept of opportunity cost should guide the district's choice between a road and a clinic.

Model Answer

Opportunity cost should guide the choice by forcing the district to weigh the full benefit of each project against the benefit of the other, which is what it must give up, and to choose the one whose benefit is greater.

Each project's cost is the other project: with funds for only one, the opportunity cost of the road is the clinic forgone, and the opportunity cost of the clinic is the road forgone.

The rule is to compare benefits: the district should build the road only if the benefit of the road exceeds the benefit of the clinic it gives up, and build the clinic only if the reverse is true.

Money cost alone is not enough: even if the two cost the same in money, they differ in benefit, so the decision turns on opportunity cost, the value of what is sacrificed, not on the price tag.

So opportunity cost turns a hard choice into a clear rule: weigh the benefit gained against the benefit given up, and choose the greater. If the clinic would save more welfare than the road would add, the clinic's benefit is the higher opportunity cost, and the district should build the clinic.

The Master Key: frame each option's opportunity cost as the other option forgone, then choose the one whose benefit exceeds the benefit sacrificed; opportunity cost, not money price, decides.

HOT Question 72

A shopkeeper counts his cost as the money he paid. An economist says the true cost is something else entirely.

"The opportunity cost, not the money cost, is the true cost of anything." Discuss.

Model Answer

The statement is largely true: the true economic cost of a thing is the next best alternative given up to obtain it, and money cost captures this only when it measures that sacrifice well.

Money cost can understate the true cost: a shopkeeper who uses his own building pays no rent in money, yet the true cost includes the rent he could have earned by letting it, which the money accounts miss.

Money cost can mislead about effort: a farmer's "free" labour on his own land has a real opportunity cost, the wage he could have earned elsewhere, though no money is paid.

But money cost often reflects it: in a working market the price of a resource usually equals what it could earn in its next best use, so money cost and opportunity cost frequently agree.

So the economist is right in principle: the true cost of anything is what is given up to get it, its opportunity cost, and money cost is a true guide only so far as the price reflects that sacrifice. Where money paid and alternative forgone part company, as with an owner's own building or labour, it is the opportunity cost that measures the real burden of the choice.

The Master Key: the true cost is the alternative forgone; money cost is reliable only when the price equals that sacrifice. Show a case where they differ, an owner's own building or labour, to prove opportunity cost is the deeper measure.

The Production Possibilities Curve: Drawing the Limits of an Economy

Scarcity, choice and opportunity cost can all be drawn as a single curve, the most useful diagram in economics. This section builds the production possibilities curve from its assumptions, teaches how to read every point on it, explains the shape it takes and why, and shows how the whole frontier moves when an economy grows, declines or invents. Master this one diagram and much of the course becomes a picture you can see.

BINDER Question 73

The whole problem of scarcity and choice can be drawn as a single curve, the most famous diagram in economics.

Define the production possibilities curve, and state what it shows.

Model Answer

The production possibilities curve, also called the production possibilities frontier or the transformation curve, shows the maximum combinations of two goods that an economy can produce when all its resources are fully and efficiently used with a given technology.

It shows the limit of production: every point on the curve is a combination the economy can just achieve if it wastes nothing.

It shows the necessity of choice: to have more of one good, the economy must move along the curve and accept less of the other.

It shows opportunity cost: the amount of one good given up to gain more of the other, read from the slope of the curve, is the opportunity cost.

So the curve draws scarcity, choice and opportunity cost in one picture: scarcity as the limit the curve sets, choice as the point selected on it, and opportunity cost as the slope that must be paid to move along it.

The Master Key: the PPC shows the maximum combinations of two goods an economy can produce with full, efficient use of fixed resources; it pictures scarcity (the limit), choice (the point) and opportunity cost (the slope) together.

BINDER Question 74

Like every model, the curve holds only under stated conditions. **State the assumptions underlying the production possibilities curve.**

Model Answer

The production possibilities curve rests on a set of simplifying assumptions.

1. **Only two goods:** the economy produces just two goods, so the choice can be drawn on a two-dimensional graph.
2. **Fixed resources:** the quantity of the factors of production is given and unchanged during the period.
3. **Fixed technology:** the state of technical knowledge is constant, so output depends only on the resources used.
4. **Full and efficient employment:** all resources are fully used and used well, with no waste, so the economy produces on, not inside, the curve.
5. **Resources unequally suited to the two goods:** the factors differ in their fitness for each good, which is what makes the curve concave.

These assumptions are what let the curve stand still and slope as it does; relax them, and the curve shifts or changes shape, which is exactly how the model handles growth, decline and new technology.

The Master Key: two goods, fixed resources, fixed technology, full and efficient use, and resources unequally suited to the two goods; the last assumption is what gives the curve its concave shape.

BINDER Question 75

A point on the map of production tells its own story: whether the economy is thriving, wasteful, or dreaming beyond its means.

With the aid of a diagram, explain the meaning of a point on the curve, a point inside it, and a point outside it.

Model Answer

A point's position relative to the curve shows whether the economy is efficient, wasteful, or attempting the impossible, as the diagram shows.

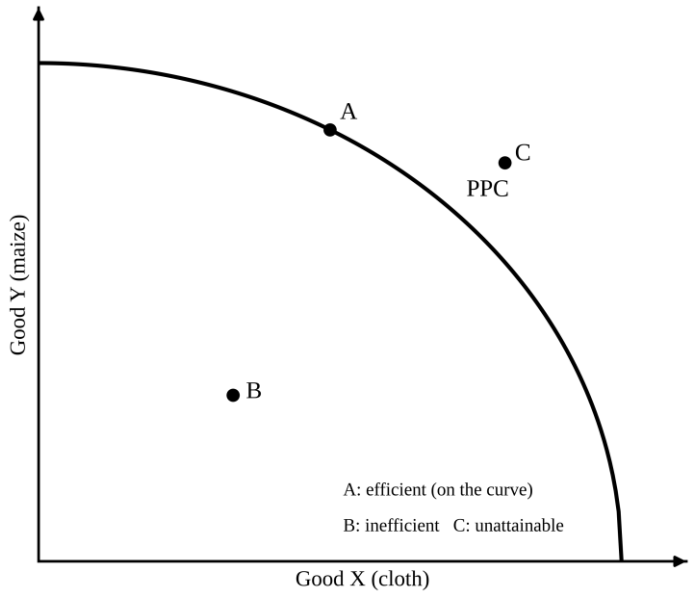


Figure 1.5: A point on the curve (A), inside it (B) and outside it (C).

A point on the curve (A): attainable and efficient; the economy uses all its resources fully and well, and can make more of one good only by making less of the other.

A point inside the curve (B): attainable but inefficient; some resources are idle or wasted, so the economy could make more of both goods, and is failing to.

A point outside the curve (C): unattainable; it lies beyond what the economy's resources and technology can produce, so it cannot be reached without growth.

So the curve is the boundary of the possible: on it, the economy does as well as it can; inside it, the economy wastes; beyond it, the economy cannot go until its resources or technology grow.

The Master Key: on the curve is efficient, inside is wasteful (idle resources), outside is impossible; the curve itself is the boundary between the attainable and the unattainable.

BINDER Question 76

Most production curves bow outward from the origin. The shape is not decoration; it is the law of increasing opportunity cost drawn as a line.

With the aid of diagrams, explain why the production possibilities curve is usually concave to the origin, and describe the two other shapes it can take.

Model Answer

The curve is usually concave to the origin because opportunity cost increases as more of one good is produced; but where opportunity cost is constant or decreasing, the curve is a straight line or convex instead, as the diagrams show.

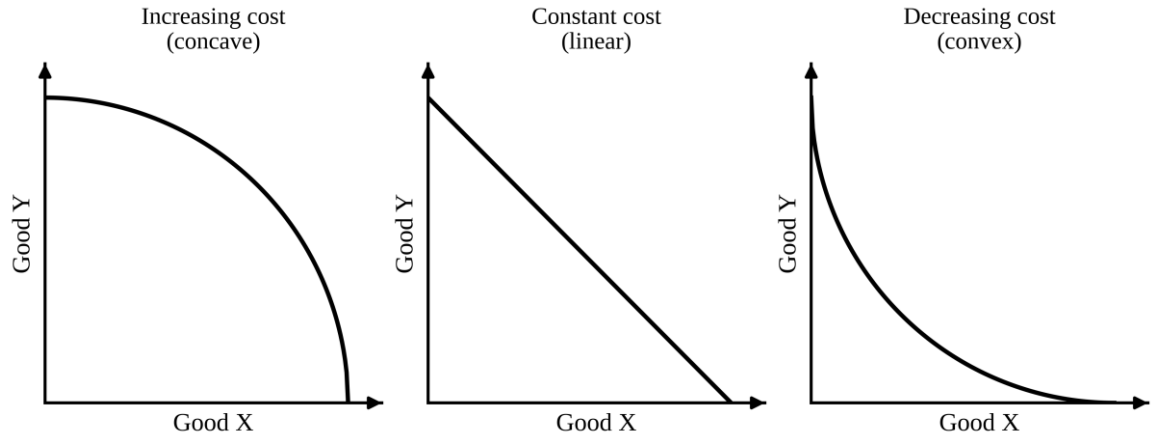


Figure 1.6: The three shapes: increasing, constant and decreasing opportunity cost.

Concave, increasing cost (the usual case): because resources are not equally suited to both goods, making more and more of one good means giving up ever-larger amounts of the other, so the curve bows outward.

Linear, constant cost: if resources are equally suited to both goods and perfectly transferable, each extra unit of one costs the same amount of the other, and the curve is a straight line.

Convex, decreasing cost: if each extra unit of one good costs less of the other than the last, the curve bows inward toward the origin; this is the rarest case.

So the shape of the curve reveals how opportunity cost behaves: concave for increasing cost, straight for constant cost, convex for decreasing cost, with the concave, increasing-cost case being the one the real world usually shows.

The Master Key: concave means increasing opportunity cost, and it arises because resources are not equally suited to both goods; a straight line means constant cost, and a convex curve means decreasing cost.

BINDER Question 77

The curve is not fixed for ever. When an economy grows, shrinks or invents, the whole frontier moves.

With the aid of diagrams, explain how the production possibilities curve shifts, and what causes each shift.

Model Answer

The curve shifts outward when the economy grows, inward when it declines, and pivots when technology or resources improve for one good only, as the diagrams show.

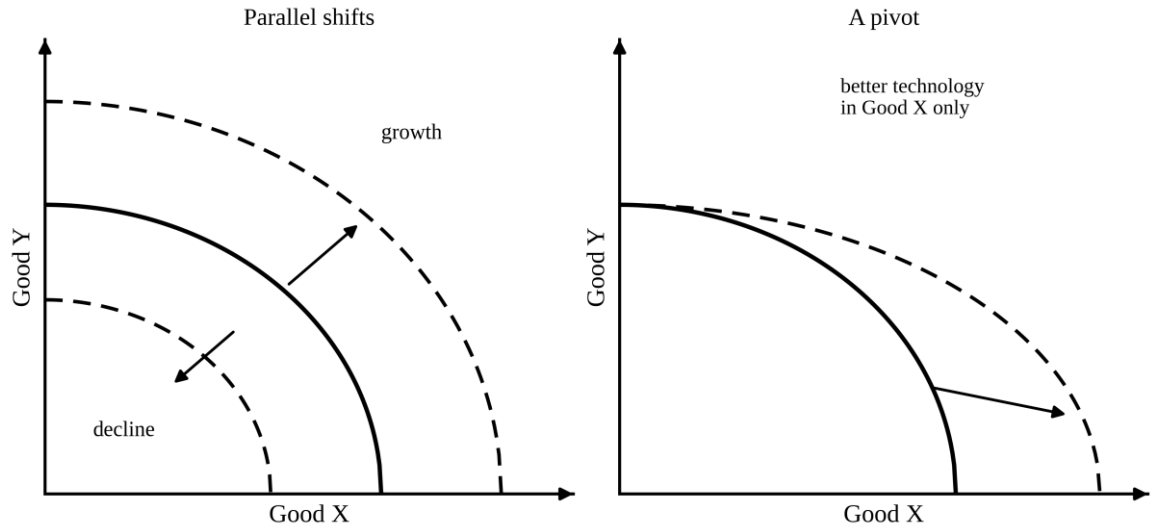


Figure 1.7: Shifts of the curve: parallel shifts (growth and decline) and a pivot.

An outward shift (economic growth): more resources, better technology or capital formation let the economy produce more of both goods, so the whole curve moves out.

An inward shift (decline): a loss of resources, through disaster, war or the using-up of capital, lets the economy produce less of both goods, so the curve moves in.

A pivot (uneven improvement): a better technology or new resource for only one good moves that good's intercept outward while the other stays fixed, so the curve rotates rather than shifting evenly.

So the curve records the fortunes of the whole economy: it moves out with growth, in with decline, and pivots when progress favours one good over the other; a movement of the curve is a change in what the economy can do, not merely in what it chooses to do.

The Master Key: outward for growth (more or better resources), inward for decline (lost resources), and a pivot when only one good's technology improves; a shift changes capacity, unlike a movement along the curve, which only changes the choice.

REAL Question 78

The Mtwara region can pour its land, labour and capital into cashew farming or into natural gas, or split them between the two.

> *Mtwara's resources can produce, at the extremes, either 100 thousand tonnes of cashew and no gas, or no cashew and 50 units of gas, or any efficient combination between.*

Describe and label a production possibilities curve for Mtwara, mark a point of full efficiency, a point of wasted resources, and a point Mtwara cannot yet reach, and state what each shows.

Model Answer

Mtwara's curve runs from all-cashew to all-gas, and a point's position on the map shows whether its resources are used well, wasted, or stretched beyond reach.

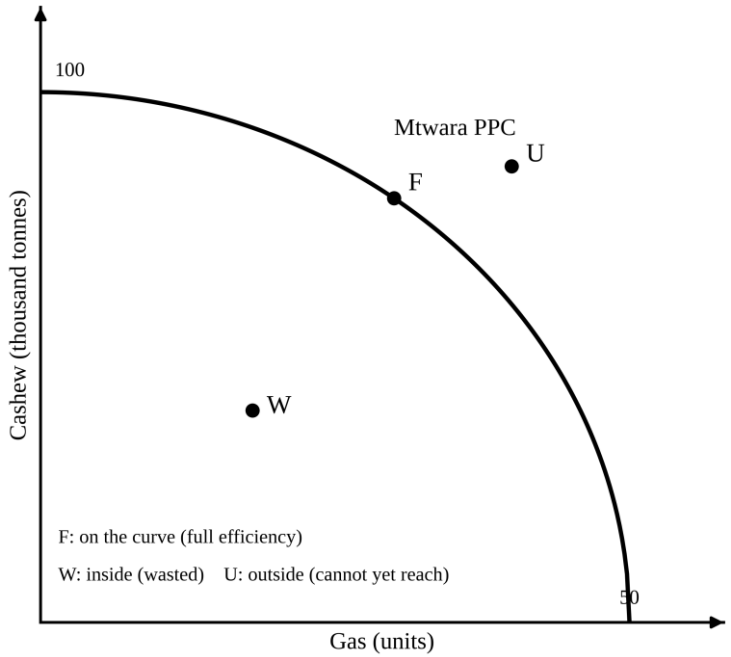


Figure 1.8: Mtwara: F on the curve (full efficiency), W inside (wasted), U outside (cannot yet reach).

The curve: drawn with cashew on one axis and gas on the other, bowing outward from the origin, from 100 thousand tonnes of cashew and no gas, to 50 units of gas and no cashew.

A point of full efficiency: any point on the curve itself, where all Mtwara's resources are fully and well used.

A point of wasted resources: a point inside the curve, where some land, labour or capital lies idle, so Mtwara could have more cashew and more gas at once.

A point Mtwara cannot yet reach: a point outside the curve, attainable only if its resources or technology grow.

So even a single region's choices fit the curve: it must choose a point on its frontier, avoid wasting resources inside it, and grow its resources to reach beyond it.

The Master Key: put the two goods on the axes, draw the concave frontier between the extremes, then place efficient (on), wasteful (inside) and unattainable (outside) points; the three positions carry the same three meanings everywhere.

REAL Question 79

Three things happen to Mtwara in three different years. Each moves its production possibilities curve in a different way.

> *Year 1: a long drought destroys much of the region's farmland. Year 2: a new gas-drilling technology arrives, but nothing changes for cashew. Year 3: heavy investment adds new roads, machines and trained workers across the whole region.*

For each year, state how Mtwara's production possibilities curve moves, and why.

Model Answer

Each event changes what Mtwara can produce, so each moves the curve, but in a different way.

Year 1 (drought): the curve shifts inward, because the loss of farmland reduces the resources available, so Mtwara can now produce less of both goods.

Year 2 (better gas technology only): the curve pivots, its gas intercept moving outward while its cashew intercept stays fixed, because only gas production has improved.

Year 3 (investment across the region): the curve shifts outward, because more roads, machines and trained workers raise the resources available for both goods.

So the curve is Mtwara's economic diary: it shrinks with disaster, pivots when progress favours one good, and grows when investment raises the region's whole capacity.

The Master Key: match each shock to a movement, a loss shifts the curve in, a one-good improvement pivots it, and a general gain shifts it out; ask always whether capacity fell, rose, or rose for one good only.

REAL Question 80

A student's notes on the curve contain errors.

> (1) A point inside the curve is unattainable. (2) A concave curve shows constant opportunity cost. (3) An outward shift of the curve shows economic growth. (4) A movement along the curve has no opportunity cost.

State whether each note is correct or wrong, and correct the wrong ones.

Model Answer

Notes 1, 2 and 4 are wrong; note 3 is correct.

Note 1 is wrong: a point inside the curve is attainable but inefficient, not unattainable; the unattainable points lie outside the curve.

Note 2 is wrong: a concave curve shows increasing opportunity cost, not constant; constant cost gives a straight line.

Note 3 is correct: an outward shift of the curve does show economic growth.

Note 4 is wrong: a movement along the curve does have an opportunity cost, since gaining more of one good means giving up some of the other.

The Master Key: inside is inefficient, not impossible; concave is increasing cost; and moving along the curve always has an opportunity cost; only the outward-shift-is-growth statement is right.

HOT Question 81

Using nothing but the production curve, an economist can prove that scarcity, choice and opportunity cost must always go together.

With the aid of a production possibilities curve, discuss the claim that "where there is scarcity, choice and opportunity cost are inevitable."

Model Answer

The claim is true, and the curve proves it: the curve exists because resources are scarce, its points force a choice, and its slope is the opportunity cost of that choice, so the three cannot be separated.

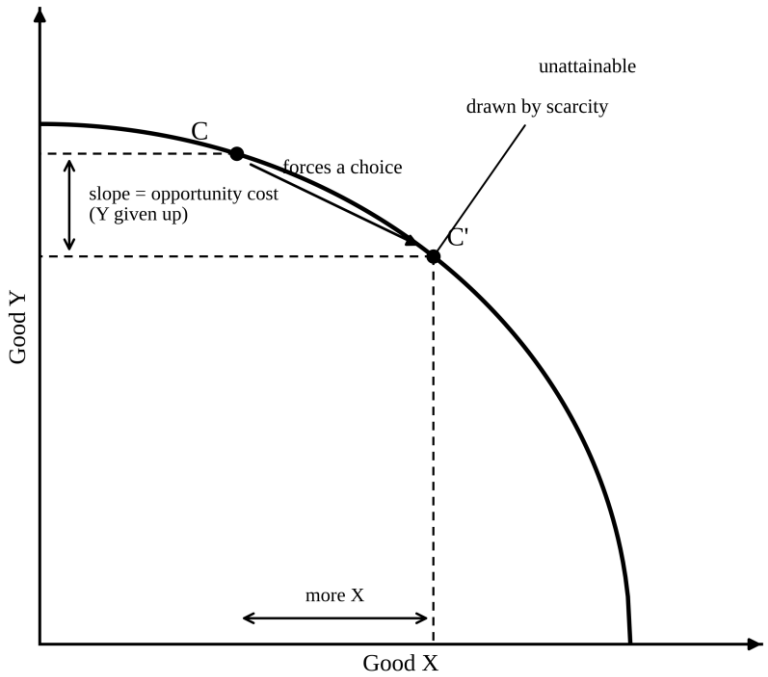


Figure 1.9: The frontier is drawn by scarcity, a point on it is the choice, and the slope of a move along it is the opportunity cost.

The curve is drawn by scarcity: the frontier is a limit, and there is a limit only because resources are scarce; with unlimited resources there would be no boundary to draw.

The curve forces a choice: because the economy cannot produce beyond the frontier, it must choose which point on the curve to occupy, that is, how much of each good to make.

The slope is the opportunity cost: to move to a point with more of one good, the economy slides along the curve and gives up some of the other, and that sacrifice is the opportunity cost.

So the three are inevitable together: scarcity draws the frontier, the frontier forces a choice of point, and the choice carries an opportunity cost measured by the slope. Remove scarcity and the frontier vanishes, and with it the choice and its cost; while scarcity remains, as it always does, choice and opportunity cost remain with it.

The Master Key: use the curve as proof: scarcity is the frontier, choice is the point chosen on it, opportunity cost is the slope moved along; because each follows from the last, the three are inseparable.

HOT Question 82

An economy sitting inside its own frontier is leaving output on the table. Ask what has gone wrong, and how it can be put right.

Explain why a point inside the production possibilities curve represents a failing economy, and how such an economy could move to the curve.

Model Answer

A point inside the curve represents a failing economy because resources are idle or wasted, so it produces less than it could of both goods; it can move to the curve by putting those resources back to full, efficient use.

It shows wasted resources: inside the curve some land, labour or capital is unemployed or misused, so the economy produces below its capacity.

The failure is avoidable: unlike a point outside the curve, which is impossible, a point inside is a loss the economy inflicts on itself, since it could produce more of everything with what it already has.

The cure needs no growth: by employing idle workers, using idle land and correcting inefficiency, the economy can move out to the frontier and gain more of both goods, with no new resources at all.

So a point inside the curve is the picture of an economy failing to use what it has, most often through unemployment; and its cure is not growth but the fuller and better use of existing resources, which moves it out to the frontier and raises output all round. This is why reducing unemployment can raise output without any increase in a nation's resources.

The Master Key: inside the curve means idle or wasted resources, a self-inflicted and avoidable loss; the cure is fuller, more efficient use, for example ending unemployment, which moves the economy out to the frontier without any new resources.

HOT Question 83

Two changes look alike on the diagram but mean opposite things: sliding along the curve, and moving the whole curve. Confusing them is a costly error.

Distinguish between a movement along the production possibilities curve and a shift of the curve.

Model Answer

A movement along the curve is a change in the economy's choice with its capacity unchanged, while a shift of the curve is a change in the economy's capacity itself; the first re-allocates existing resources, the second alters how much there is to allocate.

A movement along the curve: the economy stays on the same frontier and slides from one point to another, producing more of one good and less of the other; capacity is unchanged, and there is an opportunity cost.

A shift of the curve: the whole frontier moves outward or inward, so the economy can now produce more, or less, of both goods; capacity itself has changed, through growth or decline.

The cause differs: a movement along reflects a new choice with the same resources; a shift reflects a change in the resources or technology available.

So the two must never be confused: to make more cloth by making less maize is a movement along the curve, a matter of choice at fixed capacity; to make more cloth and more maize is a shift of the curve, a matter of grown capacity. The first is a trade-off; the second is growth.

The Master Key: a movement along is re-choosing on a fixed frontier (a trade-off, with opportunity cost); a shift is the frontier itself moving (a change in capacity, growth or decline). More-of-one-less-of-the-other is a movement; more-of-both is a shift.

HOT Question 84

A poor country deciding how much to invest is really choosing a point on today's curve that will decide where tomorrow's curve lies.

Using the production possibilities curve, explain the choice a developing country faces between producing consumer goods and producing capital goods.

Model Answer

On a curve with consumer goods on one axis and capital goods on the other, a developing country must choose how much of its resources to devote to each; and because capital goods build future capacity, today's choice decides how far tomorrow's curve will shift out.

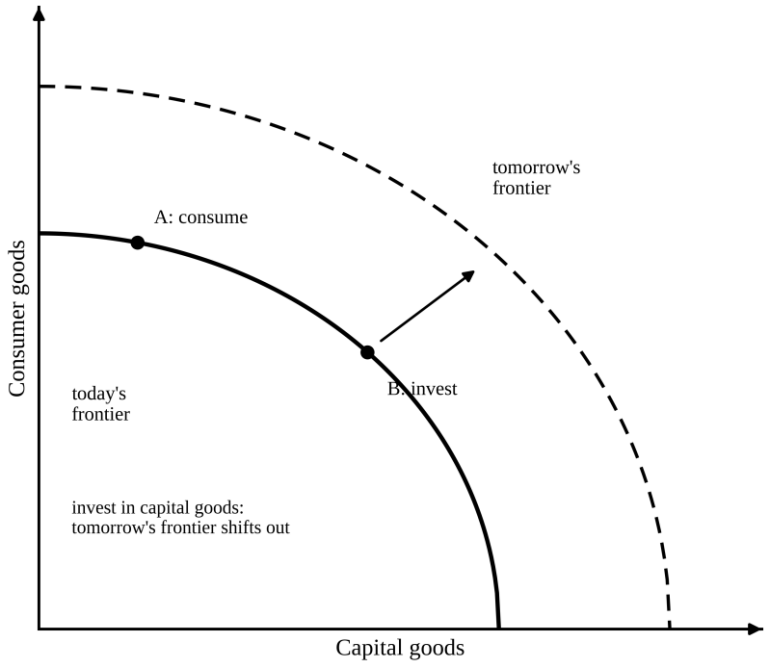


Figure 1.10: Choosing more capital goods (B) than consumption (A) shifts tomorrow's frontier further out.

The trade-off today: to make more capital goods, machines, tools and roads, the country must make fewer consumer goods now, moving along the curve and accepting less present consumption.

The reward tomorrow: capital goods add to the economy's resources, so producing more of them shifts next year's curve further outward, allowing more of both goods in the future.

The dilemma: a very poor country is tempted to use all its resources for consumer goods, to meet present needs, but by making no capital goods it leaves its future curve where it is, and stays poor.

So the curve turns development into a visible choice between present and future: consume everything now and the frontier does not move; sacrifice some present consumption for capital goods and the frontier shifts out, bringing more of everything later. The art of development is to give up enough present consumption to grow, without cutting it below what the people can bear.

The Master Key: put consumer goods against capital goods on the axes; choosing more capital goods costs present consumption (a movement along) but shifts the future curve outward (growth). Development is the deliberate sacrifice of some present consumption to move tomorrow's frontier out.

HOT Question 85

It is often said that economic growth is simply an outward shift of the curve. The picture is right, but it hides a second way an economy can produce more.

"Economic growth is always shown by an outward shift of the production possibilities curve." Discuss.

Model Answer

The statement is broadly true but incomplete: a true increase in an economy's capacity is shown by an outward shift, yet an economy can also produce more by moving from inside the curve to the frontier, which is a rise in output that is not, strictly, a shift.

Where the statement is right: genuine growth, more resources or better technology, does raise the economy's capacity, shown by the whole curve moving outward and allowing more of both goods.

Where it is incomplete: an economy at a point inside its curve can produce more of both goods simply by using its idle resources fully, moving out to the existing frontier; output rises, but the curve has not shifted.

So there are two ways to produce more: to shift the frontier outward, which is true growth in capacity, or to move from inside the frontier to it, which is the recovery of wasted capacity; only the first is growth in the strict sense.

So the statement holds for growth properly so called, an increase in what the economy can produce, which is indeed an outward shift; but it overlooks the gain from ending waste, a move from inside the curve to the frontier, which raises output without shifting the curve at all. A complete answer distinguishes growing the frontier from reaching a frontier one was failing to reach.

The Master Key: agree that true growth (more capacity) is an outward shift, but add the second case, moving from inside the curve to the frontier by ending waste, which raises output without a shift; distinguishing the two is the mark of a full answer.

The Economist's Toolkit: Models, Assumptions, Ceteris Paribus and the Margin

Every craft has its tools, and economics is no exception. Before the course moves on to demand, cost and the market, this section hands the student the four instruments the textbook uses without ever naming: the model that simplifies, the assumption that makes analysis possible, the phrase ceteris paribus that isolates a single cause, and the habit of thinking at the margin that lies behind every rational choice.

BINDER Question 86

No economist can hold a whole economy in the mind at once, so she builds a small, simple copy of it, a model, and studies that instead.

Explain what an economic model is, and why economists use models.

Model Answer

An economic model is a simplified picture of the economy, built from a few assumptions, that strips away detail to reveal how one thing depends on another.

It simplifies: a model leaves out the countless small details of the real economy and keeps only the forces that matter for the question in hand.

It rests on assumptions: to simplify, a model assumes away complications, for example that there are only two goods, or that other things stay equal.

It reveals relationships: by holding most things fixed, the model shows clearly how a change in one thing, say a price, affects another, say the quantity bought.

Economists use models for the same reason a map leaves out most of the landscape: a map that showed everything would be as useless as the land itself, and a model that kept every detail could not be reasoned with. The test of a model is not whether it is complete but whether it is useful, whether it predicts and explains.

The Master Key: a model is a simplified, assumption-based picture of the economy that reveals how one thing depends on another; like a map, it is judged by its usefulness, not its completeness.

BINDER Question 87

When an economist says a fall in price raises the quantity bought, she adds two silent Latin words that make the statement safe: ceteris paribus.

Explain the meaning of ceteris paribus, and why it is necessary in economic analysis.

Model Answer

Ceteris paribus is a Latin phrase meaning "other things being equal", and it is the assumption that, while one thing is allowed to change, all other influences are held constant so that its separate effect can be seen.

It isolates one cause: in the real economy many things change at once, so to study the effect of one, say a price, the economist assumes all others, income, tastes, the prices of other goods, stay fixed.

It makes laws possible: only by holding other things equal can economists state a clear law, such as the law of demand, that a fall in price raises the quantity demanded.

It is an assumption, not a fact: other things rarely do stay equal in reality, so ceteris paribus is a device of analysis, and its conclusions must be applied with care once it is relaxed.

So ceteris paribus is the economist's way of doing in the mind what a scientist does in a laboratory: holding everything constant but one, to see what that one thing does. Without it, no economic law could be stated, because every effect would be tangled with every other.

The Master Key: ceteris paribus means "other things being equal"; it isolates the effect of one variable by holding the rest constant, which is what makes economic laws possible; remember it is an assumption, not a description of reality.

BINDER Question 88

A trader does not ask whether selling is worthwhile in general; she asks whether selling one more crate is worthwhile. That small word, more, is the key to rational choice.

Explain what is meant by thinking at the margin, and state the rule it gives for rational choice.

Model Answer

Thinking at the margin means judging a decision by its effect at the edge, comparing the extra benefit of one more unit, the marginal benefit, with the extra cost of that one more unit, the marginal cost.

The margin is the next unit: a marginal change is one more, or one fewer, of something, one more crate sold, one more hour worked, one more shilling spent.

The rule compares the two margins: it is worth doing one more of a thing as long as its marginal benefit exceeds its marginal cost, and worth stopping when they are equal.

It explains rational behaviour: people decide not in all-or-nothing terms but unit by unit, doing more of a thing until the extra gain no longer covers the extra cost.

Suppose one more crate earns a trader 5,000 shillings and costs her 3,000 to buy and carry. The marginal benefit exceeds the marginal cost:

$$5{,}000 > 3{,}000$$

so she should sell it; she keeps selling more crates until the marginal benefit of the last crate just equals its marginal cost, and there she stops.

The Master Key: thinking at the margin compares the extra benefit of one more unit with its extra cost; do one more while marginal benefit exceeds marginal cost, and stop where they are equal. Rational choice is made at the margin, not in totals.

BINDER Question 89

An economic law does not fall from the sky; it is built, step by careful step, and tested against the world before it is trusted.

Explain how economists build and test an economic theory.

Model Answer

Economists build a theory by observing facts, forming a hypothesis to explain them, deducing its consequences, and testing those consequences against fresh evidence, keeping the theory only while it passes.

Observe and define: the economist gathers facts and defines the terms clearly, for example measuring how the quantity bought changes with price.

Form a hypothesis and model: from the facts a general statement is proposed, such as "a fall in price raises quantity demanded", and built into a simple model under stated assumptions.

Deduce and test: the consequences of the hypothesis are worked out and compared with new evidence; if the facts fit, the hypothesis stands and may become a law, and if they do not, it is revised or rejected.

So economics uses both the inductive method, reasoning from observed facts to a general rule, and the deductive method, reasoning from the general rule to particular predictions that can be tested. A theory is trusted not because it is elegant but because, so far, the facts have not refuted it.

The Master Key: observe, hypothesise and model, then deduce consequences and test them against evidence; economics uses induction (facts to rule) and deduction (rule to prediction), and keeps a theory only while it survives testing.

REAL Question 90

Mariam roasts and sells maize by the roadside in Arusha. A small table of her takings and costs shows exactly how many cobs she should roast.

Each cob sells for 500 shillings, so the marginal benefit of every cob is 500. The marginal cost of each successive cob rises as she tires and her charcoal runs low.

Cob	Marginal benefit (sh)	Marginal cost (sh)
1st	500	200
2nd	500	300
3rd	500	400
4th	500	500
5th	500	650

Using the table and marginal reasoning, decide how many cobs Mariam should roast, and explain why.

Model Answer

Mariam should roast each cob whose marginal benefit is at least its marginal cost, and stop where the marginal cost first exceeds the marginal benefit.

The first three cobs are worth roasting: for each, the marginal benefit of 500 shillings exceeds the marginal cost, 200, 300 and 400 shillings, so each adds to her profit.

The fourth cob is the stopping point: its marginal benefit of 500 just equals its marginal cost of 500, so it neither adds nor subtracts; this is the margin.

The fifth cob is not worth roasting: its marginal cost of 650 exceeds its marginal benefit of 500, since $500 < 650$, so roasting it would cut her profit.

So Mariam roasts four cobs, stopping where marginal benefit and marginal cost meet, because up to that point each cob adds more than it costs, and beyond it each cob costs more than it adds. She reaches this best output not by a grand calculation but by weighing one more cob at a time.

The Master Key: roast each unit while marginal benefit is at least marginal cost, and stop at the margin where they are equal; the best output is found one unit at a time, not in totals.

REAL Question 91

A student's notes on the economist's method contain errors.

> (1) Ceteris paribus means "all things change together". (2) A model is useless unless it includes every detail of the economy. (3) Thinking at the margin means considering one more unit. (4) Marginal cost is the total cost of all the units.

State whether each note is correct or wrong, and correct the wrong ones.

Model Answer

Notes 1, 2 and 4 are wrong; note 3 is correct.

Note 1 is wrong: ceteris paribus means "other things being equal", that is, other things held constant, not changing together.

Note 2 is wrong: a model is useful precisely because it leaves out detail; a model that included everything could not be reasoned with, like a map as large as the land.

Note 3 is correct: thinking at the margin does mean considering one more, or one fewer, unit.

Note 4 is wrong: marginal cost is the extra cost of one more unit, not the total cost of all the units.

The Master Key: ceteris paribus is "others held constant", models are useful because they simplify, and marginal means the extra unit, not the total; these three slips are the commonest in the topic.

HOT Question 92

A critic dismisses economic models because they assume things that are plainly untrue: only two goods, other things equal, perfect knowledge.

"Economic models are unrealistic, so they are useless." Discuss.

Model Answer

The charge fails: economic models are deliberately unrealistic, but that is their strength, not their weakness, because a model is meant to simplify, and it is judged by its usefulness, not its realism.

Unrealism is the point: a model simplifies on purpose, stripping away detail so that the force being studied stands out; a perfectly realistic model would be as complex as the economy itself and just as hard to understand.

Usefulness, not realism, is the test: a model earns its keep if it predicts and explains, just as a map that leaves out most of the landscape is still useful for finding the way.

But assumptions must be reasonable: a model is weakened if its assumptions leave out something that truly matters for the question, so the skill lies in simplifying without distorting.

So the critic confuses simplicity with error. Models are unrealistic by design, and rightly so, because their job is to make a complicated world thinkable; they are useless only when their assumptions omit something essential, not merely when they omit detail. The right question is not "is the model realistic?" but "is it useful for the problem in hand?"

The Master Key: defend models by distinguishing helpful simplification from harmful distortion. Unrealism is deliberate and necessary; the test is usefulness (does it predict and explain?), and a model fails only if its assumptions drop something that matters.

HOT Question 93

Economists claim that a rational person, without knowing it, weighs every decision at the margin.

"Rational people think at the margin." Explain and discuss this statement.

Model Answer

The statement is largely true: rational people make decisions not in all-or-nothing terms but by weighing the extra benefit of a little more against its extra cost, which is exactly what thinking at the margin means.

Decisions are made in small steps: a person decides not whether to eat at all, but whether to eat one more plate; not whether to work, but whether to work one more hour, judging each by its marginal benefit and cost.

The rule guides them to the best amount: by doing more while the extra benefit exceeds the extra cost, and stopping where they are equal, a person reaches the amount that gives the greatest net gain.

It fits real behaviour, if not the words: people rarely speak of "the margin", yet a trader who sells until one more sale is not worth the effort, or a student who studies until one more hour would help less than rest, is thinking at the margin without naming it.

So the claim holds well: rational choice is marginal choice, made one unit at a time by comparing extra benefit with extra cost, even when the chooser has never heard the term. The qualification is that people are not always fully rational, and may misjudge the margin; but in so far as they choose sensibly, they choose at the margin.

The Master Key: explain marginal thinking as one-more-unit reasoning (marginal benefit against marginal cost), show it fits real step-by-step decisions, and conclude that rational choice is marginal choice, with the caveat that people are not always perfectly rational.

HOT Question 94

The "other things equal" assumption lets economists state clear laws, yet in the real world other things never do stay equal.

Is the ceteris paribus assumption a strength or a weakness of economic analysis? Discuss.

Model Answer

Ceteris paribus is both: a strength because it makes clear economic laws possible, and a weakness because the real world, where other things do change, may not behave as the law alone predicts; on balance it is a necessary tool, provided its limits are remembered.

Its strength is clarity: by holding other influences constant, it isolates the effect of one variable and lets the economist state a definite law, such as the law of demand, which could not be stated if everything moved at once.

Its weakness is that reality is not so kind: in the real economy other things do change, so a prediction made "other things equal" may be overturned when they are not, as when a price falls but incomes fall further and demand drops anyway.

The remedy is to use it with care: the economist states the law under ceteris paribus, then relaxes the assumption and asks what else has changed, applying the law to reality only after allowing for the other movements.

So ceteris paribus is a strength that carries a warning. It is indispensable, because without it no law could be stated and analysis could not begin; but it is dangerous if forgotten, because the world does not hold other things equal. Used as a first step, and then relaxed, it is one of the economist's most powerful tools; mistaken for a description of reality, it misleads.

The Master Key: judge it as a tool with two edges: a strength (it isolates causes and makes laws possible) and a risk (reality does not hold other things equal). The verdict is that it is necessary but must be relaxed before the law is applied to the real world.

The Foundations Clinic: Traps, Distinctions and the Whole-Chapter Capstone

This last section does two things. First it runs a clinic on the confusable pairs that cost students most of their marks in this chapter, setting each pair beside the single test that separates it. Then it draws the whole chapter together, from scarcity to the production possibilities curve, in capstone questions of the kind the examination sets, so that the foundation the course rests on is secure before the next chapter begins.

BINDER Question 95

Half the marks lost in this chapter go to a handful of confusions between pairs that sound alike. Here they are, side by side, each with the test that separates it.

Distinguish the confusable pairs of this chapter, giving the test that separates each.

Model Answer

Each pair below is separated by a single test; learn the test, and the confusion disappears.

Pair	The test that separates them
Economic good vs free good	Scarce and priced (economic), or abundant and unpriced (free)?
Want vs need	Merely desired (want), or essential for survival (need)?
Free good vs public good	Free is abundant and unpriced; public is scarce but non-rival and non-excludable.
Positive vs normative	Can the facts settle it (positive), or does it rest on "ought" (normative)?
Micro vs macro	A single unit (micro), or the whole economy (macro)?
Movement along vs shift of the PPC	More of one and less of the other (movement); more of both (shift).
Wealth vs income	A stock owned at a moment (wealth), or a flow earned over time (income)?

So the confusions of this chapter reduce to a few quick tests: scarcity, survival, excludability, testability, the unit studied, the direction of change, and stock against flow. Apply the right test and each pair falls cleanly apart.

The Master Key: memorise the pairs by their tests, not their words: scarce-or-abundant, desired-or-essential, excludable-or-not, testable-or-value, unit-or-whole, one-or-both, and stock-or-flow.

BINDER Question 96

The concepts of this chapter are not a list to memorise but a single chain of reasoning, each link forged from the one before.

Show how the main ideas of this chapter form a single chain of reasoning, from scarcity to the production possibilities curve.

Model Answer

The chapter is one argument in a few links: unlimited wants meet limited resources, which is scarcity; scarcity forces choice; choice is ordered by a scale of preference; every choice carries an opportunity cost; and all of this is drawn together on the production possibilities curve.

Wants against resources: human wants are unlimited while resources are limited, and this gap is scarcity, the root of the whole subject.

Scarcity forces choice: because means cannot meet all wants, a society must choose which to satisfy, giving rise to the three questions, what, how and for whom.

Choice carries opportunity cost: since resources used one way cannot be used another, every choice sacrifices its next best alternative, which is its opportunity cost.

The curve draws it all: the production possibilities curve shows scarcity as its frontier, choice as the point on it, and opportunity cost as its slope, so the whole chain appears in one diagram.

So the chapter holds together as a single thought: scarcity is the problem, choice is the response, opportunity cost is the price of choosing, and the production possibilities curve is the picture of all three. Master the chain, and the separate ideas need never be memorised apart, for each calls up the next.

The Master Key: recite the chain: wants against resources gives scarcity, scarcity forces choice, choice carries opportunity cost, and the curve pictures all three; understanding the links is worth more than memorising the terms.

REAL Question 97

Sort each of the following correctly, using the tests from the clinic in Question 95.

> (1) Is national income micro or macro? (2) Is clean piped water an economic good or a free good? (3) Is "the government should tax the rich more" positive or normative? (4) Is a public road a private or a public good? (5) Is producing more of both goods a movement along or a shift of the PPC?

Answer each, giving the test you applied.

Model Answer

Each is settled by the matching test from the clinic.

1) **National income is macroeconomic:** it is a total for the whole economy, not a single unit.
2) **Piped water is an economic good:** it is scarce and priced, having been pumped and treated, not abundant and free.
3) **"Tax the rich more" is normative:** it rests on "should", a value judgement, not a testable fact.
4) **A public road is a public good:** it is non-rival and non-excludable, so no one can be shut out.
5) **More of both goods is a shift of the PPC:** more of both means grown capacity, not a trade-off along a fixed curve.

The Master Key: reach for the right test each time: unit-or-whole, scarce-or-abundant, testable-or-value, excludable-or-not, one-or-both; the test, not the wording, gives the answer.

REAL Question 98

Read this account of one family's week near Songea, and find the economics hidden in it.

> *The Mtei family has one income and many wants. This week they chose to pay school fees rather than repair the roof. The father, a carpenter, turned down a small job to finish a larger one. And the family debated whether to spend their small savings now or keep them to buy tools that would raise the father's future earnings.*

Identify the economic concept at work in each of the family's three decisions.

Model Answer

Each of the family's decisions illustrates a central concept of this chapter.

Fees rather than the roof: this is choice under scarcity guided by a scale of preference, the family ranking school fees above the roof and satisfying the more urgent want first.

The smaller job turned down: this is opportunity cost, the small job being the next best alternative given up to take the larger one.

Savings now or tools for later: this is the choice between present consumption and capital goods, spending now or investing to raise future capacity, exactly the development choice the PPC illustrates.

So a single family's week contains the heart of the chapter: scarcity forcing choice, a scale of preference ordering it, opportunity cost pricing it, and the present-against-future decision that shifts the family's own frontier outward.

The Master Key: read a real scene for the concepts beneath it: ranking wants (scale of preference), the alternative forgone (opportunity cost), and spending-now-or-investing (present against future); the chapter is a lens for everyday life.

REAL Question 99

A student's chapter summary contains one error in each line. Find and correct them.

> (1) Economics is the study of how to make money. (2) A free good has a high opportunity cost. (3) Robbins defined economics in terms of wealth. (4) A point outside the PPC is inefficient. (5) "Prices rose last year" is a normative statement.

Correct each of the five statements.

Model Answer

Every statement contains one error; each is corrected below.

Statement 1: economics is the study of how scarce resources are allocated among unlimited wants, not simply how to make money.

Statement 2: a free good has zero opportunity cost, not a high one, because using it sacrifices nothing.

Statement 3: Robbins defined economics in terms of scarcity, not wealth; the wealth definition is Adam Smith's.

Statement 4: a point outside the PPC is unattainable, not inefficient; the inefficient points lie inside the curve.

Statement 5: "prices rose last year" is a positive statement, a fact that can be checked, not a normative one.

The Master Key: these are the chapter's five commonest errors in one place: money-for-economics, cost-for-free-goods, wealth-for-Robbins, outside-for-inside, and fact-for-value; fix each by its test.

HOT Question 100

If the chapter had to be compressed into a single sentence, it might be this: economics is the science of choice.

"Economics is the science of choice." Discuss.

Model Answer

The sentence is a fair summary of the whole subject: because scarcity forces choice, and choice is what economics studies, to call economics the science of choice captures its heart, though it leaves the reason, scarcity, unspoken.

Choice is the subject: every economic question, what to produce, how, for whom, what to buy, whether to invest, is at bottom a choice, so the study of these questions is the study of choice.

Scarcity is the reason: choice arises only because resources are scarce; without scarcity nothing would be given up and no choice would be needed, so the science of choice is really the science of choice under scarcity.

It unites the chapter: scarcity, opportunity cost and the production possibilities curve are all ways of describing choice, its cause, its price and its picture, so the phrase gathers the whole chapter into one idea.

So the sentence is sound, provided the silent word is understood: economics is the science of choice under scarcity. Choice is its subject and scarcity its cause; drop scarcity and the definition floats free, but keep it in mind and "the science of choice" is as good a one-line summary of the subject as any.

The Master Key: accept the phrase but complete it: economics is the science of choice under scarcity; choice is the subject, scarcity the cause, and opportunity cost and the PPC are choice described. A good discussion adds the missing word.

HOT Question 101

This is the question the whole chapter has prepared you to answer, and it rewards the student who can hold every idea together at once.

Using the concept of scarcity, explain why every society must make choices, and show, with a diagram, how the production possibilities curve illustrates the cost of those choices.

Model Answer

Because resources are scarce while wants are unlimited, every society must choose what to produce; and the production possibilities curve shows those choices and their opportunity cost as a single picture.

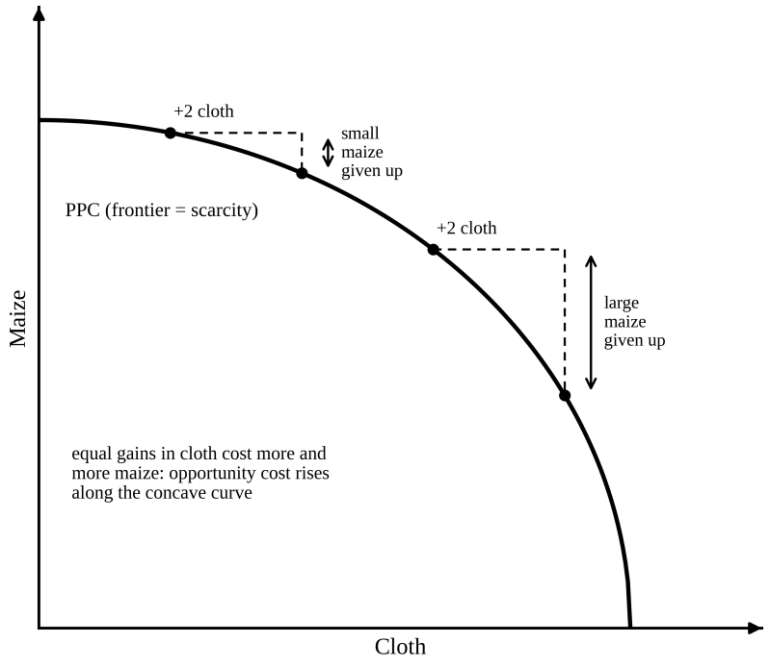


Figure 1.11: Equal gains in cloth cost more and more maize: the concave curve shows opportunity cost rising as a society specialises.

Scarcity makes choice unavoidable: no society has resources enough for all its wants, so each must decide which goods to make and in what amounts, that is, it must choose.

The curve maps the choices: every point on the production possibilities curve is a possible choice of how much of two goods to make, and the economy must pick one point on its frontier.

The slope is the cost of choosing: to choose a point with more of one good, the society slides along the curve and gives up some of the other, and that sacrifice, read from the slope, is the opportunity cost of the choice.

The shape shows rising cost: because the curve is concave, each extra unit of one good costs more of the other than the last, so opportunity cost increases as a society specialises.

So scarcity, choice and cost are one story told in one diagram. Scarcity draws the frontier and forces the society onto it; the point chosen is the choice; the slope is its opportunity cost; and the concave shape shows

that cost rising. A society cannot escape choosing, and cannot choose without cost, and the production possibilities curve makes both truths visible at a glance.

The Master Key: build the essay as scarcity to choice to cost to shape, and tie each to the curve: the frontier is scarcity, the point is the choice, the slope is the cost, the concavity is rising cost; a diagram that carries all four earns full marks.

HOT Question 102

A beggar with a few coins and a government with a vast budget seem worlds apart, yet an economist says they face one and the same problem.

"The fundamental economic problem is the same for a beggar and for a government." Discuss.

Model Answer

The statement is true: both the beggar and the government face scarcity, unlimited wants against limited means, and so both must make the same kind of choice, though the scale and the stakes differ enormously.

Both face scarcity: the beggar's wants exceed his few coins, and the government's tasks exceed even its large budget, so each has more it would do than it has the means to do.

So both must choose and forgo: the beggar must choose between food and shelter, the government between a road and a clinic, and each choice carries an opportunity cost, the alternative given up.

Only the scale differs, not the problem: the beggar reasons in coins and the government in billions, but the logic, rank the wants, choose the most urgent, bear the opportunity cost, is identical.

So the economist is right: scarcity is no respecter of persons, and the fundamental economic problem, unlimited wants against limited means, is the same for the poorest individual and the richest state. What differs is the size of the means and the gravity of the choice, not the nature of the problem, which is why the same tools, the scale of preference and opportunity cost, guide both.

The Master Key: show that scarcity, and therefore choice and opportunity cost, applies to beggar and government alike; only the scale differs, not the problem. The universality of the economic problem is the point.

HOT Question 103

Everything in this chapter bears on one real question: how can a country like Tanzania grow richer? **Using the concepts of this chapter, explain the central economic choice facing a developing country like Tanzania, and how it might raise its future output.**

Model Answer

Tanzania, like every economy, faces scarcity, and its central choice is how much present consumption to sacrifice for capital goods that would shift its production possibilities curve outward and raise future output.

Scarcity is acute: Tanzania's resources fall far short of its people's wants, so it sits on a modest production possibilities curve and must choose carefully what to produce.

The key choice is present against future: it may use its resources to produce consumer goods for today, or capital goods, machines, roads and trained workers, that add to tomorrow's capacity.

Investment shifts the curve out: by giving up some present consumption to make capital goods, Tanzania raises its future resources, so next year's curve lies further out, allowing more of both goods.

Efficiency matters too: if Tanzania is producing inside its curve, through unemployment or waste, it can raise output at once by using its resources fully, moving out to its existing frontier without any new investment.

So the path to a richer Tanzania runs through the chapter's own ideas: recognise scarcity, use existing resources fully to reach the frontier, and then sacrifice enough present consumption for capital goods to

shift the frontier outward year by year. Development is scarcity confronted deliberately, opportunity cost accepted for the sake of growth, and the production possibilities curve pushed steadily out.

The Master Key: bring scarcity, opportunity cost, efficiency and the outward shift together on Tanzania: reach the frontier by ending waste, then shift it out by investing in capital goods at the cost of present consumption. Development is the chapter applied to a nation.

HOT Question 104

One last question gathers the entire chapter, and the student who answers it well has mastered the foundation on which the rest of the course is built.

"Scarcity is the beginning and the production possibilities curve is the picture; everything in between is choice." Discuss this summary of the chapter.

Model Answer

The summary is apt: scarcity is indeed where economics begins, the production possibilities curve is where its logic is pictured, and the ideas that lie between, choice, the scale of preference and opportunity cost, are the working-out of choice under scarcity.

Scarcity is the beginning: the whole subject starts from the gap between unlimited wants and limited resources, without which there would be no economics at all.

Choice fills the middle: because of scarcity a society must choose, ordering its wants on a scale of preference and paying an opportunity cost for each choice, and this is the substance of the chapter.

The curve is the picture: the production possibilities curve gathers scarcity (its frontier), choice (its points) and opportunity cost (its slope) into one diagram, so the whole argument can be seen at once.

So the summary holds: the chapter is a single movement from a problem to a picture, with choice as its content. Scarcity sets the problem and can never be escaped; choice is how every society, firm and person responds; opportunity cost is the price each response exacts; and the production possibilities curve is the frame in which all of it becomes visible. This foundation now carries the whole course, for demand, cost and the market are only choice under scarcity worked out in greater detail.

The Master Key: endorse the summary and expand it: scarcity (the problem), choice with its scale of preference and opportunity cost (the middle), the PPC (the picture); then note that the rest of the course is this same foundation in more detail. A capstone answer shows the chapter as one connected whole.

Chapter Two

ECONOMIC SYSTEMS

Every society, rich or poor, must decide how to use resources that are never enough for all it wants, and the way it decides is its economic system. This chapter sets the four great answers side by side, the traditional, the command, the market and the mixed, and asks how each settles what is produced, how it is produced, and for whom. It then turns the lens on Tanzania itself, following the country from the ujamaa years, through the crisis of the 1980s, to the mixed economy of today. Work through it in order, because every later chapter on prices, costs and markets stands on the foundation laid here.

What an Economic System Is: The Coordinating Problem and the Three Questions

Before a single price is quoted or a single plan is drawn, every society meets the same quiet problem: its wants outrun its means, and somebody, or something, must decide what is made, how it is made, and who receives it. The answer a society settles on is its economic system. This opening section fixes the idea itself, sets out the three questions every economy must answer, and draws the circular flow of income that ties households to firms. Master these and the four systems that follow become only four different answers to one unchanging question.

BINDER Question 1

Each morning in Kariakoo a thousand strangers who have never met somehow feed a whole city. The hidden machinery that makes their choices fit together has a name.

Define an economic system and state the central problem it exists to solve.

Model Answer

An economic system is the set of institutions and arrangements through which a society decides how its scarce resources are used to produce, distribute and consume goods and services.

The problem it solves is scarcity: human wants are unlimited but the resources to meet them are limited, so a society cannot leave every choice to chance without waste and conflict.

What it coordinates is behaviour: the countless separate decisions of farmers, firms, workers and buyers are pulled into a working whole, so that what is made, how it is made, and who receives it hang together.

Because wants will always outrun resources, no society can escape the need to organise its choices; the economic system is simply the machinery it builds for that purpose.

The Master Key: Every definition in this chapter hangs on one idea, that scarcity forces coordinated choice. Fix that, and the four systems become four answers to the same problem.

BINDER Question 2

A family with one field must decide what to plant, whether to dig by hand or hire a tractor, and who eats first from the harvest. Three questions, and no society escapes them.

State and explain the three fundamental questions that every economy must answer.

Model Answer

Every economy, however rich or poor, must answer three fundamental questions: what to produce, how to produce, and for whom to produce.

What to produce: which goods and services, and in what quantities, because scarce resources cannot make everything at once, so more of one thing means less of another.

How to produce: by which method and combination of resources, because the same good can be made in a labour-intensive way or a capital-intensive way, and a society must pick.

For whom to produce: how the finished output is shared among the people, because production can never satisfy every want, so some rule must decide who receives what.

The way a society answers these three questions is exactly what gives its economic system its character; change the answers and you change the system.

The Master Key: Carry the three questions like a set of keys. Every system in this chapter is only a different hand turning them.

BINDER Question 3

It is tempting to think only the poor must ration and choose. Yet even the richest nation on earth cannot give its people everything they wish. Ask why not.

Explain why every society, however wealthy, must have an economic system.

Model Answer

Every society must have an economic system because scarcity is universal, and scarcity makes some way of coordinating choices unavoidable.

Wealth does not end scarcity: as a country grows richer its wants grow too, so even the most advanced economy still cannot produce everything its people desire.

Without coordination there is waste: if resources were used with no system at all, the same land might be ploughed twice and other land not at all, and effort would collide rather than combine.

So the system is not a luxury of the poor nor a burden of the rich; it is the standing answer every society gives to a problem none of them can avoid.

The Master Key: If you ever doubt whether a country needs a system, ask whether its people have run out of wants. They never have.

BINDER Question 4

Custom, a planning ministry, the price on a shelf, or a blend of all three: every economy on earth hands its greatest decisions to just one of four masters.

Name the four types of economic system and state, in one word, what answers the fundamental questions in each.

Model Answer

There are four types of economic system, and each is defined by who, or what, answers the three fundamental questions.

Economic system	**Who answers the three questions**	**In one word**
Traditional	Custom, history and inherited belief	Custom
Command	The government, through central planning	The state
Market	Buyers and sellers, through prices	Prices
Mixed	The market and the government together	Both

Read the table across and the rest of the chapter falls into place: each system is a different decision about whom to trust with the three questions.

The Master Key: Learn this one word for each system now, and the long lists of features later will simply hang off it.

BINDER Question 5

The wage a firm pays on Friday is the shopping a household spends on Saturday, which returns to the firm as its takings. Goods and money chase each other in a ring that never stops.

With the aid of a diagram, describe the circular flow of income in a simple two-sector economy of households and firms.

Model Answer

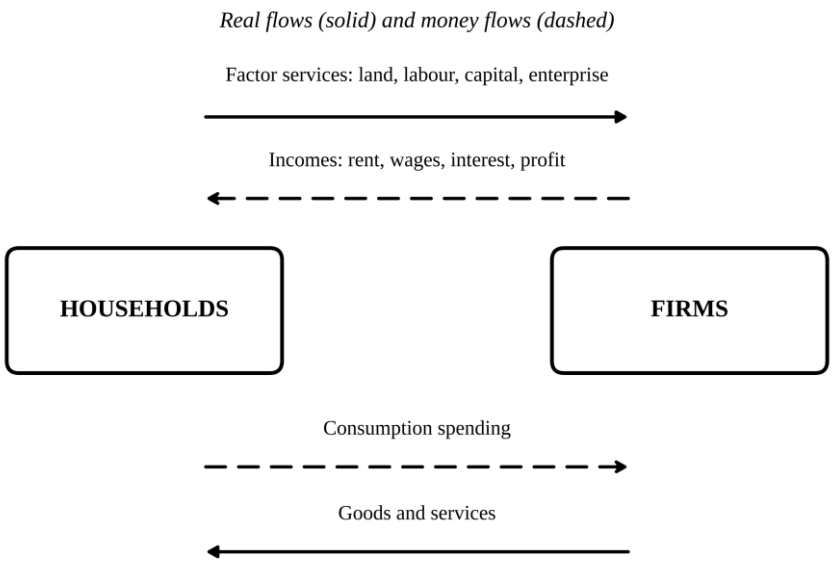


Figure 2.1: The circular flow of income between households and firms.

The circular flow of income shows how households and firms depend on each other through two continuous loops that turn in opposite directions, one of real things and one of money.

The real flow: households own the factors of production and supply their factor services, land, labour, capital and enterprise, to firms, while firms supply goods and services back to households.

The money flow: firms pay households the factor incomes of rent, wages, interest and profit, and households return that money as consumption spending when they buy the goods.

Because the two loops turn together, one firm's cost is another household's income, so the economy renews itself period after period without any single planner directing it.

The Master Key: The circular flow is the picture behind every system in this chapter: they differ only in who steers the loops, custom, the state, or the market.

BINDER Question 6

A field can grow maize or cotton, but not both at once; and once the maize is grown, someone must still decide who eats it. Two questions, two words, endlessly mistaken for each other.

Distinguish between resource allocation and resource distribution.

Model Answer

Resource allocation and resource distribution answer different halves of the economic problem: allocation concerns what resources are used for, while distribution concerns who ends up with the output.

Allocation is the assigning of scarce resources among competing uses, for example how much of a region's land is put to cotton rather than to maize.

Distribution is the sharing of the resulting income and output among people, for example how the harvest and the money it earns are divided between farmers, traders and the state.

A system can allocate resources efficiently yet distribute the output very unequally, which is why the two ideas must never be collapsed into one.

The Master Key: Allocation is the how-used; distribution is the who-gets. Nine confusions in this chapter dissolve the moment you separate them.

REAL Question 7

Follow the cashew of Mtwara from the growers' fields to the ships waiting at the port, and watch a whole economy settle its three great questions in a single season.

Using Tanzania's cashew-nut industry in the Mtwara region, show how the three fundamental economic questions appear in practice.

Model Answer

Tanzania's cashew industry answers all three fundamental questions every single season.

What to produce: the southern regions choose to devote much of their land to cashew rather than to more maize or sesame, a decision about what the country's scarce coastal soil will grow.

How to produce: the nation must decide whether to ship the nuts abroad raw or to shell and process them at home using machinery and local labour, two very different methods with very different costs.

For whom to produce: the export earnings are then shared among the farmers who grew the crop, the cooperative unions that buy it, the private traders, and the government that taxes it.

So the same three questions a textbook poses in the abstract are settled, in Mtwara, by real growers and real policy every year; the theory is only their shadow.

The Master Key: When a question feels abstract, plant it in a real place. Cashew in Mtwara turns what, how and for whom into things you can almost touch.

HOT Question 8

A student insists that if the world had no limits at all, the three questions would simply melt away. It sounds certain, until you ask who would still take the largest share.

Assess the claim that the three fundamental questions arise only because of scarcity.

Model Answer

The claim is essentially correct: it is scarcity, and scarcity alone, that forces the three questions onto every society.

The case for the claim: if resources were truly unlimited we could make every good, in every way, for everyone, so there would be nothing to choose and the three questions would never arise.

The strongest challenge: the for-whom question looks partly moral, since even in plenty a society might still argue over what counts as a fair share, so distribution seems not to vanish simply because scarcity does.

Why scarcity still underlies it: yet a real quarrel over shares only bites when there is not enough to go round, for with true superabundance each person could take all they wished and the question of who gets what would lose its force.

On balance the claim holds: strip scarcity away and all three questions lose their meaning, which is why scarcity, not greed or politics, is rightly called the economic problem.

The Master Key: Test any grand claim by imagining its opposite world. A world without scarcity is a world without economics, and that is the surest proof of what drives the subject.

HOT Question 9

Four economies face the very same three questions, yet each trusts a different master to answer them. Is who decides the whole difference between systems, or only where it begins?

"An economic system is simply a way of deciding who answers the three fundamental questions." How far do you agree?

Model Answer

I largely agree, because the four systems differ far less in the questions they face than in who is trusted to answer them.

The point in favour: a traditional economy trusts custom, a command economy trusts the state, a market economy trusts buyers and sellers acting through prices, and a mixed economy shares the answering between the market and the state.

Where the claim is incomplete: systems also differ in their motive, profit in the market against social welfare under command, and in their results, efficiency against equity, so who decides is not the whole story.

So the statement captures the heart of the matter but not all of it: choosing who answers the questions is the first difference between systems, though not the last.

The Master Key: A good definition names the main thing without pretending to name everything. "Who answers the questions" is the main thing; keep motive and outcome in reserve for the evaluation questions.

Custom as the Coordinator: The Traditional Economy

The oldest answer to the three questions is also the simplest: let custom decide. In a traditional economy nobody plans and nobody bargains, for the community does what its ancestors did, and inheritance settles what is made, how it is made, and who receives it. This section defines that system, sets out its features, and weighs its strengths of stability and belonging against its weaknesses of stagnation and poverty. It also explains barter and the double coincidence of wants that hobbles it, and grounds the whole picture in the Hadzabe who still hunt and gather near Lake Eyasi. Grasp how custom coordinates an economy and the command, market and mixed systems that follow stand out all the more sharply.

BINDER Question 10

A girl will grind grain because her mother ground grain, and her grandmother before that. What the village makes, how it makes it, and who eats: all answered before she can walk.

Define a traditional economy and explain how it answers the three fundamental questions.

Model Answer

A traditional economy is a system in which what to produce, how to produce and for whom to produce are all decided by custom, history and time-honoured belief, so that the community follows the answers handed down by its ancestors rather than any planner or market.

What to produce is answered by inheritance: the community produces what its ancestors produced, the same crops, game and crafts, because that is what has always been made and what the land is trusted to yield.

How to produce is answered by inherited method: work is done with the tools and techniques handed down the generations, so the son farms as the father farmed and the daughter shapes the clay as her mother did.

For whom to produce is answered by kinship and role: the output is shared according to a person's place in the family and the group, so age, sex and standing decide who receives what, not a wage or a price.

Because every answer is handed down rather than worked out afresh, custom does for this economy what prices or planners do for others; tradition sets the questions and supplies the answers in a single stroke.

The Master Key: Hold on to one idea: in a traditional economy the answers were settled long ago, so the living do not choose them, they inherit them. Every feature that follows grows from that single root.

BINDER Question 11

Grown food, handmade tools, a goat traded for cloth, a craft handed from parent to child. A handful of habits that look unrelated, yet never travel alone.

Outline the main features of a traditional economy.

Model Answer

A traditional economy is marked by a cluster of features that all follow from its reliance on custom: subsistence production, exchange by barter, relative isolation, fixed inherited roles, simple land-based activities and very slow technological change.

Production is for subsistence: households make just enough to meet their own needs, so there is little or no surplus left once the group has been fed and clothed.

Exchange is by barter: what little trade occurs swaps goods directly for goods, because there is no developed money and little need for one on so small a scale.

The community is relatively isolated: it stands apart from outside markets and outside forces, so foreign tastes, prices and technologies rarely reach in to disturb it.

Roles are fixed and inherited: a person's work is largely settled at birth and passed down the family, so it is neither chosen freely nor competed for.

Activities are simple and land-based: livelihoods rest on hunting, gathering, fishing and small-scale agriculture, close to whatever the environment offers directly.

Technological change is very slow: methods alter little across whole lifetimes, because the purpose of custom is to repeat what has always worked rather than to experiment.

So the features are not a random list but one temperament seen from several sides: a community that lives as it has always lived changes little in what it makes, how it makes it, or how it trades.

The Master Key: If you can hold on to the one word "custom", you can rebuild this whole list, because subsistence, barter, isolation, fixed roles and slow change are simply custom refusing to hurry.

BINDER Question 12

No one in the village is unemployed, no elder abandoned, no forest stripped bare. A life the busy city might secretly envy, though it earns barely a shilling.

Explain the main advantages of a traditional economy.

Model Answer

The strengths of a traditional economy all flow from its stability: clear roles, freedom from competitive pressure, self-sufficiency, a light hand on the environment, strong social bonds, and a life that is predictable.

Roles are clear, so conflict is rare: because each person knows their inherited place and task, there is little of the rivalry over jobs or status that unsettles other systems.

There is no pressure to compete or to chase profit: people work to meet the group's needs rather than to outdo a neighbour or to maximise gain, so the anxieties of the market are absent.

The community is self-sustaining: it feeds and supplies itself from its own land and labour, so it does not depend on distant markets that might one day fail it.

Resource use is light and sustainable: taking only what it needs, the community lives within the environment's means and rarely exhausts the soil, game or water it relies on.

Social cohesion and identity are strong: shared custom binds people together and tells each person who they are, giving a sense of belonging that wealthier societies often lose.

Life is predictable: because tomorrow is expected to resemble yesterday, people are spared much of the uncertainty that rapid economic change brings.

So the traditional economy buys peace, belonging and balance with nature; what it lacks in wealth it repays in security and a settled sense of place.

The Master Key: Notice that every advantage here is a form of stability. When you come to judge this system, stability is the treasure you must weigh against all that it costs.

BINDER Question 13

The very sameness that keeps life calm also keeps it still: no new tool, no new crop, and one failed rain enough to bring hunger. Safety and stagnation share a root.

Explain the main disadvantages of a traditional economy.

Model Answer

The weaknesses of a traditional economy are the shadow of its stability: economic stagnation, poor productive efficiency, little variety of work, dangerous exposure to shocks, resistance to useful change, and low material living standards.

The economy stagnates: output barely grows from one generation to the next, because custom repeats the past instead of searching for new and better ways to produce.

Productive efficiency is poor: inherited methods and simple tools mean resources yield far less than they could, so a great deal of possible output is never realised.

There is little variety of jobs or skills: with roles fixed at birth, talents that do not fit the traditional trades are wasted, and few genuinely new skills ever develop.

The community is vulnerable to shocks: because no surplus is stored, a single drought, flood or disease can bring hunger, for there is no buffer to fall back on.

Beneficial change is resisted: new crops, tools and ideas are distrusted simply for being new, so improvements that could ease daily life are often turned away.

Material living standards are low: with little surplus, little trade and little growth, people stay poor in goods, and comforts that other systems take for granted are missing.

So the price of a settled life is a poor and fragile one: the very refusal to change that holds the community together also leaves it hungry when the rains fail and idle when better methods beckon.

The Master Key: Every disadvantage here is the cost of standing still. Set them beside the advantages of the last question and you already hold both pans of the evaluation scale.

BINDER Question 14

A fisherman brings a basket of tilapia to trade for salt. But the salt trader wants no fish today; she needs a blanket. Two people, two goods, and still no deal.

Explain what is meant by barter, and show why the double coincidence of wants limits it.

Model Answer

Barter is the direct exchange of goods for goods without the use of money, and its central limitation is that every swap demands a double coincidence of wants.

Barter means goods for goods: one useful thing is exchanged straight for another, a pot of honey for a clay bowl, with no money passing between the two sides.

It requires a double coincidence of wants: a swap can happen only when each side happens to want exactly what the other offers, so the honey-seller must find not just anyone with a bowl, but someone with a bowl who also wants honey.

So trade is slow and often fails: because so exact a match is rare, much wanted exchange never takes place at all, and people waste effort hunting for a partner instead of producing.

So barter can serve a small, familiar community whose wants are few, but the double coincidence of wants strangles it the moment wants grow many and varied, which is precisely why money came to be invented.

The Master Key: Learn the phrase “double coincidence of wants” word for word, for it is the single clearest reason a traditional, moneyless economy can never trade its way to prosperity.

REAL Question 15

By Lake Eyasi, the Hadzabe still hunt with bow and arrow and share each kill by a custom older than any coin. Their whole economy runs on rules no one wrote down.

With reference to the Hadzabe community described in the box, explain why they form a traditional economy and how custom answers what, how and for whom for them.

> **The Hadzabe of Lake Eyasi**
>
> The Hadzabe are a small community living around Lake Eyasi, in the Rift Valley of northern Tanzania. They live much as their ancestors did: the men hunt wild game with hand-made bows and poisoned arrows and collect wild honey, while the women and children gather roots, berries and baobab fruit.
>
> They plant no fields and keep no herds; they store almost no surplus, and they move camp as the game and the seasons require.

Model Answer

The Hadzabe are a living traditional economy, because custom, and not the market or the state, still answers what, how and for whom they produce.

What they produce is set by custom: they take the same game, honey, roots and fruit that their ancestors took, drawing from the land what tradition has always drawn and little else.

How they produce is set by inherited skill: they hunt with hand-made bows and poisoned arrows and gather with digging sticks, using techniques taught by their elders rather than bought or freshly invented.

For whom they produce is set by sharing custom: the kill and the harvest are divided among the band by long-standing rules of kinship and role, so meat is shared by tradition rather than sold for a price.

The wider features fit too: their production is for subsistence with almost no surplus, their contact with outside markets is limited, and their way of life has changed remarkably little across the generations.

So the Hadzabe are not a museum piece but a working economy coordinated by custom; near Lake Eyasi the three questions are answered today just as this section describes, by inheritance rather than by choice.

The Master Key: When you need a traditional economy by name, reach for the Hadzabe of Lake Eyasi. One precise, real example anchors the whole theory far better than a page of general description.

HOT Question 16

Again and again, outsiders call these old ways backward and all but finished, sure the roads and shops will bury them. Yet the hunters are still here. Ask what keeps them.

"The traditional economy is backward and doomed to disappear." To what extent do you agree?

Model Answer

I agree only in part: the traditional economy is indeed poor and shrinking, yet to call it simply backward and doomed is to ignore the very strengths that explain why it survives at all.

The case that it is backward: measured by growth and material comfort it does lag far behind, because stagnation, poor efficiency and low living standards leave its people with little, and its resistance to change locks that poverty in place.

The case that it is doomed: as roads, money, schooling and markets reach once-isolated communities, custom loses its grip, the young drift away for wages, and many traditional economies have already shrunk to the margins.

But it is not simply backward: judged by sustainability, social cohesion and freedom from conflict it succeeds where richer systems struggle, so "backward" measures it by one yardstick alone, material wealth, and ignores all the others.

And it need not vanish altogether: communities like the Hadzabe endure, and their light, sustainable use of the environment is increasingly admired rather than dismissed, so the story is not one of certain extinction.

So on balance the claim is half true: the traditional economy is materially poor and clearly in retreat, but it is not merely backward, for it secures a sustainability and a belonging that its wealthier rivals often lose; the fair verdict is decline, not worthlessness.

The Master Key: In a "to what extent" answer, refuse the trap of all or nothing: grant what is true, that its wealth and growth are low, then defend what the claim overlooks, and let your judgement settle honestly between the two.

Planning from the Centre: The Command Economy

When a society distrusts the market, it can hand the whole task of coordination to one authority and let the state decide what is made, how it is made, and for whom. That is the command economy, the boldest answer to the economic problem: the government owns the resources, draws up the plan, and issues the orders the rest of the economy obeys. This section traces the system from its roots in Karl Marx through its features, the security and equality it promises, and the shortages, waste and lost freedom it tends to deliver. Its cases are real, namely the Soviet Union that collapsed in 1991, the Cuba and North Korea that plan on today, the China that reformed instead, and the Tanzania that walked this road after 1967.

BINDER Question 17

Here the shopkeeper cannot set his own price, nor the farmer choose his crop; one central authority owns and directs the whole economy. It answers to several names and one man's ideas.

Define a command economy, give its other common names, and state whose thinking it is associated with.

Model Answer

A command economy is an economic system in which the government owns and controls the major means of production and answers the three fundamental questions through central planning rather than through markets.

Its other names: it is also called a centrally planned economy, because a central authority draws up the plan, and a socialist economy, because the resources are held in common through the state rather than by private individuals.

The thinker behind it: the system is associated above all with Karl Marx, who argued that private ownership split society into owners and workers, and that the means of production should instead be held and directed by the state on behalf of all.

Where it has been tried: the clearest examples are the former Soviet Union with its five-year plans, China before its late-1970s reforms, and Cuba and North Korea today.

So the label points to one central idea: in a command economy the state, and not the private individual, owns the resources and issues the commands that the rest of the economy obeys.

The Master Key: Hold the two halves of the name together: command tells you the state gives the orders, and planned tells you it does so through a deliberate plan. Marx supplies the why.

BINDER Question 18

One committee in the capital decides which goods the nation makes, whether by hand or machine, and whose table they land on. The market itself is never once asked.

Explain how a command economy answers the three fundamental economic questions.

Model Answer

A command economy answers all three fundamental questions in the same way: the central planners decide, and the market is given no say.

Fundamental question	The tool the state uses	What it settles
What to produce	The national plan and its output quotas	which goods, and in what quantities, the country will make
How to produce	State direction of factories and resources	which methods and factors of production are used
For whom to produce	State distribution of the output	who receives what, with rough equality as the aim

So one authority turns all three keys: because a single plan decides what, how and for whom together, the command economy is the most centralised answer to the coordinating problem that any society has tried.

The Master Key: In a market the answers are scattered across millions of buyers and sellers; in a command economy they are gathered into one office. That single contrast drives every strength and weakness that follows.

BINDER Question 19

After the Arusha Declaration of 1967, Nyerere's state took the farms, the factories and the banks into public hands. Every other feature of a command economy grows from that single act.

Outline the main features of a command economy.

Model Answer

The features of a command economy all follow from one root: because the state owns the resources, the state also plans, targets, prices and profits on the nation's behalf.

State ownership of the means of production: land, factories, mines and machinery belong to the state rather than to private individuals, so there are no large private firms.

Central planning: a planning authority draws up a detailed plan, often covering several years at a time, setting what each industry must do.

Production targets and quotas: each factory and farm is given an output target it must meet, so the plan is turned into concrete orders.

Government-set prices: the state fixes prices administratively, so demand and supply play no part in setting them.

No private profit: enterprises are run to fulfil the plan and serve national goals, not to earn profit for private owners.

So the features are not a loose list but a chain: ownership makes planning possible, planning is enforced through quotas, and fixed prices with no profit motive complete a system the state controls end to end.

The Master Key: Remember the features as links off one hook, state ownership. Pull that hook and planning, quotas, fixed prices and the absence of profit all come with it.

BINDER Question 20

Let the harvest fail, and a market lets prices soar while the poorest go hungry. A plan can promise every family the same loaf. That promise is the system's proudest boast.

Explain the advantages claimed for a command economy.

Model Answer

The command economy is defended on the ground that it can deliver security and fairness a market may not: everyone is provided for, and no one is left behind.

Security and basic needs for all: the state can guarantee food, housing, health care and education to every citizen, so the fear of destitution is removed.

Full employment: because the state directs labour and need not fear a lack of profit, it can in principle give every willing worker a job.

Greater equality and less industrial unrest: since the state owns the firms and sets the wages, incomes can be held close together, and the pay disputes between employers and workers that disrupt other economies are largely removed.

Rapid mobilisation of resources: the state can direct the nation's resources at a chosen goal, such as fast industrialisation or arming for war, more quickly than a market of separate firms could.

Provision of public and merit goods: goods a market may under-provide, such as defence, public health and education, can be supplied in full because the planners simply decide to make them.

So the case for the command economy is essentially a case for deliberate provision: because one authority controls the whole economy, it can aim it straight at security, equality and national priorities.

The Master Key: The advantages all share one word, control. Weigh them honestly now, because the next question shows what that same control costs.

BINDER Question 21

The same hand that promises every family its ration also forbids you to open a shop, and cannot tell when a factory chasing its quota floods the land with goods nobody needs.

Explain the disadvantages of a command economy.

Model Answer

The command economy is attacked on the ground that the very control which makes it fair also makes it clumsy, wasteful and unfree.

Misallocation without a price mechanism: with no market prices to signal what is scarce and wanted, planners must guess, so resources are put to the wrong uses.

Persistent shortages and surpluses: because fixed prices cannot adjust, some goods are chronically short while others pile up unsold.

Inefficiency and weak innovation: with no profit to win and no competition to fear, managers have little reason to cut costs or invent better products, so quality and progress lag.

Loss of economic freedom: consumers must take what the plan provides and producers must make what they are told, so choice is narrowed for everyone.

Bureaucracy and concentration of power: running a whole economy from the centre needs a vast, slow administration, and it places enormous power in the hands of a few officials.

So the price of central control is paid in efficiency and liberty: because no office can know or want what millions of people know and want, planning tends to waste resources even as it commands them.

The Master Key: Set this list beside the last and the pattern is plain: what the command economy gains in security and fairness, it tends to lose in efficiency and freedom. That trade-off is the heart of every evaluation to come.

BINDER Question 22

One city, one week: a queue forms for bread that never comes while a warehouse fills with shoes nobody wants. Both point back to a price forbidden to move.

Explain why shortages and surpluses tend to arise in a command economy.

Model Answer

Shortages and surpluses arise in a command economy for one connected reason: the planners lack the information that prices carry, and the prices they fix are not allowed to move and clear the market.

The information problem: in a market a rising price shows that a good is scarce and wanted and a falling price that it is not, but planners have no such signal, so they set the wrong quantities.

Prices that cannot clear: once the state fixes a price, it cannot rise to choke off a shortage or fall to clear a surplus, so the gap between what is made and what is wanted simply persists.

The visible result: the shortage shows up as queues and empty shelves, while the surplus shows up as warehouses of goods no one will buy.

So the two faults are really one fault seen twice: because the price mechanism has been switched off, the economy loses both the knowledge to plan well and the automatic correction that would put a mistake right.

The Master Key: Think of price as a messenger the command economy has dismissed. Without the messenger, planners cannot hear what is wanted, and cannot be told when they have got it wrong.

REAL Question 23

A nation barely a year old, Kesho pins four economic policies to its founding charter. Read them as an economist would, and its chosen system will name itself.

Identify the economic system the new republic of Kesho has chosen, and justify your answer from each of its four policies.

The new republic of Kesho: four founding policies

Soon after independence, the leaders of Kesho announce how the whole economy will be run.

1. The state will take ownership of every major industry, farm and mine; there are to be no large private firms.

2. Every adult is promised a job, so that no one is left unemployed.

3. Enterprises will be run for the people and for national goals, not for private profit.

4. The government, not the market, will set the price of every good.

Model Answer

Kesho has chosen a command economy, also known as a centrally planned or socialist economy, because in every one of its four policies it is the state, not the market, that decides.

Policy 1 is state ownership: taking all major industry, farms and mines into public hands is the defining feature of a command economy, the state ownership of the means of production.

Policies 2 and 3 are planning for people, not profit: guaranteeing every adult a job and running firms for national goals rather than for gain are exactly the aims a central plan pursues, full employment and production for use.

Policy 4 is administered pricing: fixing every price by government rather than by demand and supply removes the price mechanism, the last thing a market economy would surrender.

So all four promises point one way: because Kesho hands ownership, employment, purpose and prices to the state, it has adopted the command system in full, and can expect both its promised security and its predictable shortages, much as Tanzania itself did after it took this same path in 1967.

The Master Key: To name a system, do not ask what it hopes for but who decides. When the state owns the firms and sets the prices, the answer is command, whatever the slogans on the banners.

REAL Question 24

On a Havana street a 1950s car still runs and a state ration book still buys the month's food, yet a private cafe has opened next door. One island between two systems.

Using Cuba today, explain why it is still regarded largely as a command economy and outline the problems it faces.

Model Answer

Cuba is still regarded largely as a command economy because the state continues to own the main industries, plan production and control prices, even though it has begun to allow small pockets of private enterprise.

State ownership and planning remain: most large enterprises, land and services are state owned and directed by a national plan, so the commanding heights of the economy are still in government hands.

Distribution aims at equality: basic foods and goods are handed to every citizen through a state ration book, the libreta, so all are provided for regardless of income, a distribution by plan rather than by price.

The problems are the classic ones: with prices fixed and profit absent, Cuba suffers chronic shortages, long queues, low wages and weak productivity, and it has leaned heavily on outside support; the United States trade embargo deepens the scarcity, but the shortages trace above all to planning itself.

Reform is creeping in: because the strains have grown, Cuba has cautiously licensed self-employment and small private businesses in recent years, an admission that pure planning cannot supply everything its people need.

So Cuba shows a command economy under pressure: because the state still owns and plans, it can promise equality and basic security, yet the same central control brings the shortages and stagnation that are now forcing careful reform.

The Master Key: Read Cuba as a living lesson, not a museum piece. It shows both what central planning can promise, care for all, and what it struggles to deliver, enough goods on the shelf.

HOT Question 25

Everyone earns nearly the same wage, yet everywhere the shelves stand equally bare. The slogan says the first was bought with the second. Test whether that bargain is really so clean.

"A command economy buys equality at the price of efficiency." Discuss.

Model Answer

The slogan captures a real trade-off but states it too cleanly: a command economy does compress inequality and does sacrifice efficiency, yet the equality it buys is imperfect and the efficiency it loses can be large enough to threaten the very security it promises.

The equality is real: through state ownership, planned distribution and set wages, a command economy narrows the gap between rich and poor and guarantees basic needs, so the first half of the slogan holds.

The efficiency cost is real too: without prices to allocate resources and without profit to spur effort, the system misallocates, runs short, innovates slowly and grows sluggishly, so the second half holds as well.

But the equality is overstated: officials and party insiders often enjoy privileges hidden from the plan, so what is bought is a rough equality among ordinary citizens, not a true equality for all.

And the price can be ruinous: if the loss of efficiency is severe, output stagnates and shortages spread, so the poor may end up worse off in absolute terms than in a growing mixed economy; the equality can become an equality of scarcity.

So on balance the slogan is a useful half-truth: because a command economy really does trade efficiency for equality, it names the central bargain honestly, but it flatters both sides, since the equality is partial and the efficiency lost may undermine the security that was the whole point.

The Master Key: Accept a neat slogan only after you have tested each half and the join between them. Here both halves are broadly true, but the trade is rougher and more dangerous than the tidy phrase admits.

HOT Question 26

Marx watched the mill owners of his age chase profit and predicted the whole machine would shake itself to pieces, crisis after crisis. A century on, ask how much came true.

To what extent was Karl Marx right that unchecked self-interest leads to crisis and disorder?

Model Answer

Marx was largely right in his diagnosis but wrong in his cure: unchecked self-interest does breed instability and unfairness, yet it does not follow that markets must be abolished, since regulated markets tame the excesses without the failures of full planning.

Where Marx was right: left entirely to itself, self-interest can produce booms and slumps, financial crises such as that of 2008, monopoly power, wide inequality and neglect of those who cannot pay, so his warning about unchecked markets has real force.

Where events went against him: capitalism did not collapse as he expected but proved adaptable, and living standards under it rose enormously, so the crisis he thought inevitable was not.

Where his remedy failed: the command economies built in his name produced their own crises of shortage, stagnation and lost freedom, often worse than the ills they were meant to cure.

What most countries actually chose: the working answer has been neither pure market nor pure plan but a mixed economy, in which the state regulates, competes with and cushions the market rather than replacing it.

So to a large extent Marx correctly saw the dangers of self-interest let loose, but the key word is unchecked: because a regulated market can curb crisis and inequality while keeping the market's energy, his leap from real faults to full central planning goes further than the evidence allows.

The Master Key: Separate a thinker's diagnosis from his prescription. Marx read the symptoms of unchecked markets shrewdly; the century that followed showed the cure lay in checking markets, not in abolishing them.

HOT Question 27

To price a kilo of rice, a planner must know every grower's cost and every family's hunger, a million facts scattered across a million minds. The market uses them all, gathering none.

Evaluate the view that no central planner can use information as well as a market can.

Model Answer

The view is broadly correct for the everyday running of an economy but too absolute as stated: for the millions of ordinary goods a market handles information far better than any planner, yet for a narrow set of goods and national goals a planner can match or even beat it.

The core of the argument: a market price gathers the scattered knowledge of millions of people, each with their own local circumstances, tastes and costs, into a single moving signal, and no central office can collect and update that ocean of detail; economists call this the knowledge problem.

The evidence for it: the chronic shortages and surpluses of real command economies are exactly what the argument predicts, so the record supports it.

Where the planner is not so outclassed: for public goods, natural monopolies and merit goods the market itself allocates poorly, and modern data and computing have narrowed the gap, so matching the market is not a high bar in those areas.

Where direction can win: to mobilise a whole nation quickly for a single clear goal, such as war, rapid industrialisation or a public-health drive, central direction can outperform a scattered market, because the aim, not the information, is what matters most.

So the view holds where it counts most, in the routine allocation of countless goods whose knowledge is hopelessly dispersed, but it overreaches: because some goods and some emergencies are exactly the cases markets handle badly, a planner is not always and everywhere the weaker user of information.

The Master Key: Judge a sweeping claim by finding its true home and its exceptions. The knowledge problem is real and usually decisive, but the word never in this view claims an always that the exceptions quietly deny.

HOT Question 28

When the Soviet Union broke apart in 1991, many read it as a verdict on every command economy. Yet one collapse with a dozen causes may prove far less than it seems.

"The collapse of the Soviet Union in 1991 proves that command economies must fail." How far do you agree?

Model Answer

I agree that the Soviet collapse exposes deep and probably unsustainable flaws in pure central planning, but not that it proves command economies must fail, because one case with many causes cannot establish an iron law, and other command economies did not collapse.

The strong case for the claim: Soviet planning did bring chronic shortages, shoddy goods, stagnation and vast waste, and by 1991 the system was exhausted and was dismantled, so the collapse is powerful evidence of structural weakness.

But the collapse had many causes: military overstretch and the arms race, the cost of empire, falling oil revenues, and the political loosening of glasnost and perestroika all pushed the Soviet Union over, so economics alone did not prove the outcome inevitable.

Other command economies did not collapse: Cuba and North Korea remain centrally planned decades later, impoverished and slowly reforming but still standing, so collapse is plainly not the only possible end.

Some reformed instead of falling: China did not collapse but from the late 1970s, under Deng Xiaoping, reformed its command economy into a booming market-oriented one, showing that transformation, not failure, can be the outcome.

So the honest verdict is split: because the Soviet record shows how badly unreformed central planning can perform, it warns that such a system tends in the long run towards crisis, yet because the collapse had political as well as economic causes, and because China reformed while Cuba and North Korea persist, 1991 illustrates the dangers of command planning without proving that every command economy must fail.

The Master Key: Distinguish a warning from a law. The Soviet collapse is a grave warning about central planning, but a single, over-determined event can never prove that an outcome was bound to happen everywhere.

The Market Economy and the Price Mechanism: The Invisible Hand at Work

Turn a market loose and, without any planner giving orders, it somehow feeds cities, stocks shops and moves resources to where they are wanted. The engine that performs this quiet miracle is the price mechanism, and the older name for its result is Adam Smith's invisible hand. This section explains how a market economy works: what defines it, how demand and supply meet at an equilibrium price, and how a single moving price signals, gives incentives and rations all at once. Watch it reallocate land into Mbeya rice or ration a sudden onion shortage, and the same lesson returns, namely that prices coordinate an entire economy with nobody in charge of it.

BINDER Question 29

No minister sets the price of tomatoes in Kariakoo, no official orders the trucks to roll, yet every stall is stocked by dawn. This system takes its orders from something else.

Define a market economy, give its other names, and name the economist most associated with it.

Model Answer

A market economy, also called a free enterprise, capitalist or laissez-faire economy, is one in which the three fundamental questions are answered by private buyers and sellers acting through prices, with little or no direction from the government.

Private ownership: individuals and firms own the resources and use them to produce for profit.

Coordination by prices: what, how and for whom to produce are settled by demand and supply, not by any planner.

The intellectual father is Adam Smith, who argued in 1776 that a market left largely to itself, laissez-faire, can serve society through what he called the invisible hand.

Because decisions are spread across millions of buyers and sellers, a market economy needs no central authority to run it; the price signal does the coordinating.

The Master Key: Fix the four names now, free enterprise, capitalist, laissez-faire, market, so that whichever one a question uses, you know it is talking about this single system.

BINDER Question 30

A trader in Mwanza owns her stall, keeps her profit, sets her own price, and fears the rival next door. Four small facts, and each marks the same kind of economy.

Describe the main characteristics of a market economy.

Model Answer

A market economy has a handful of defining features, all flowing from private ownership and free exchange.

Private property: resources and firms are privately owned, so owners keep the rewards and bear the risks.

Freedom of enterprise and choice: people may set up any business, take any job, and buy whatever they can afford.

The profit motive: the pursuit of profit is what drives producers to act.

Competition: many buyers and sellers compete, which disciplines prices and quality.

Prices set by demand and supply: no authority fixes prices; they emerge from the market.

A minimal government: the state mostly keeps order and enforces contracts, leaving the economy to run itself.

Read together, these features describe an economy that governs itself from below rather than from above.

The Master Key: Every advantage and every weakness of the market later in this chapter can be traced back to one of these features; keep the list close.

BINDER Question 31

The baker wakes before dawn not to feed the town but to feed his own family, and somehow the town is fed. Adam Smith gave that paradox a name.

Explain what Adam Smith meant by the invisible hand.

Model Answer

The invisible hand is Adam Smith's image for the way private self-interest, guided by prices and competition, is turned into public benefit that no one actually intended.

Each person pursues private gain: the baker bakes and the trader trades to earn a living, not out of kindness to strangers.

Competition redirects that gain: to earn the custom of others, each must offer them something good at a price they will pay, so self-interest is forced to serve the buyer.

Prices coordinate the plans: the separate decisions of thousands of self-interested people are pulled into order by the prices they all watch.

So the hand is invisible because no one plans the result, yet the outcome, resources flowing to what people want, can be as orderly as if a wise planner had arranged it.

The Master Key: The invisible hand is not magic; it is competition plus prices doing quietly what a planner would struggle to do loudly.

BINDER Question 32

Walk through any Tanzanian market and count the goods on offer, the stalls competing for you, the sellers striving to serve you better. Each is a quiet case for one system.

State the advantages of a market economy.

Model Answer

The market economy earns its reputation on efficiency, incentive and choice.

Efficiency: resources are drawn to their most valued uses, because only goods that people will pay for are produced.

Strong incentives: the reward of profit drives people to work hard, cut costs and invent new products.

Consumer choice: producers compete to please buyers, so variety is wide and the consumer is well served.

Automatic coordination: prices do the organising, so the economy needs no expensive planning bureaucracy.

Lower prices and better quality: competition punishes the dear and the shoddy and rewards the cheap and the good.

Because all of these work without central direction, supporters say the market delivers more, and more cheaply, than any planner could.

The Master Key: Notice that every advantage is really the same engine seen from a different angle, self-interest disciplined by competition.

BINDER Question 33

Buyers want it cheap, sellers want it dear, yet every market day they settle on a single price both can live with. One number, where two opposing wishes meet.

With the aid of a diagram, show how the equilibrium price and quantity of a good are determined in a market.

Model Answer

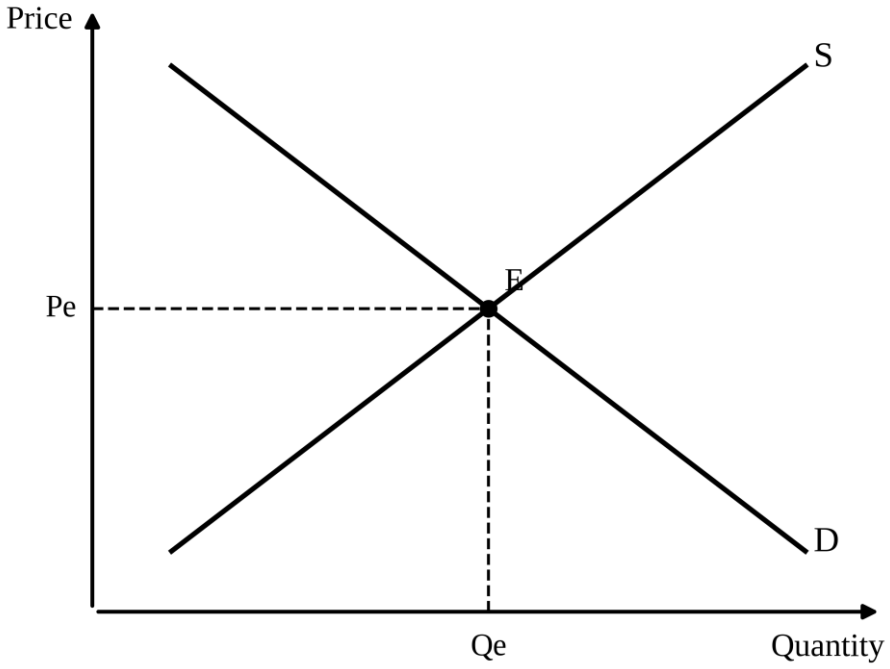


Figure 2.2: Equilibrium, where demand equals supply.

In a market the price settles where the quantity that buyers wish to buy equals the quantity that sellers wish to sell; that meeting point is the equilibrium.

Demand slopes down: buyers want more as the price falls.

Supply slopes up: sellers offer more as the price rises.

The market clears at E: where the two curves cross, at price Pe and quantity Qe, every unit offered finds a buyer.

The price is self-correcting: above Pe a surplus pushes the price down, and below Pe a shortage pushes it up, so the market is drawn back to Pe.

Because the equilibrium is reached automatically, the diagram is really a picture of the invisible hand at rest.

The Master Key: Draw this cross cleanly every time, label the axes Price and Quantity, mark E, Pe and Qe, and half the diagram questions in economics are already half answered.

BINDER Question 34

A number chalked on a sack of maize seems to do nothing at all. Yet it is quietly running the whole economy, doing three jobs no official ever assigned it.

State and explain the three functions of the price mechanism.

Model Answer

The price mechanism does three jobs at once: it signals, it gives incentives, and it rations.

The signalling function: a change in price carries information, so a rising price tells everyone that a good has become more wanted or scarcer, pointing resources toward it.

The incentive function: a price rewards action, so a higher price gives producers a reason to supply more and consumers a reason to economise, while a lower price does the reverse.

The rationing function: when a good is scarce its price rises, choking off some demand and sharing the limited supply among those most willing and able to pay.

Because these three functions work together and automatically, prices coordinate an entire economy with nobody in charge of it.

The Master Key: Signal, incentive, ration: say the three words in that order and you can explain almost anything a market does.

BINDER Question 35

In a market economy no committee ever meets to decide what to grow, how to make it, or who may eat. Yet all three questions get answered, by profit alone.

Explain how a market economy answers the three fundamental questions.

Model Answer

In a market economy prices, and the profits they create, answer all three fundamental questions.

What to produce: consumers vote with their money, so goods that earn a profit are made and goods that do not are dropped; demand decides.

How to produce: competition forces firms toward the lowest-cost method, because the cheapest producer wins the sale; cost decides.

For whom to produce: output goes to those with the income and the willingness to pay for it; purchasing power decides.

So the same profit signal settles what is made, how it is made, and who receives it, which is why the market needs no one to answer the questions on its behalf.

The Master Key: When asked how the market answers the three questions, always end each answer in one word, demand, cost, purchasing power; that is the marker of a complete reply.

REAL Question 36

Word spreads that buyers in Dar want more rice, and in the paddies of Mbeya something stirs: the price lifts, and land, labour and money begin to move. Watch them go.

With the aid of a diagram, explain how the price mechanism reallocates resources when the demand for rice rises in a Mbeya market.

Model Answer

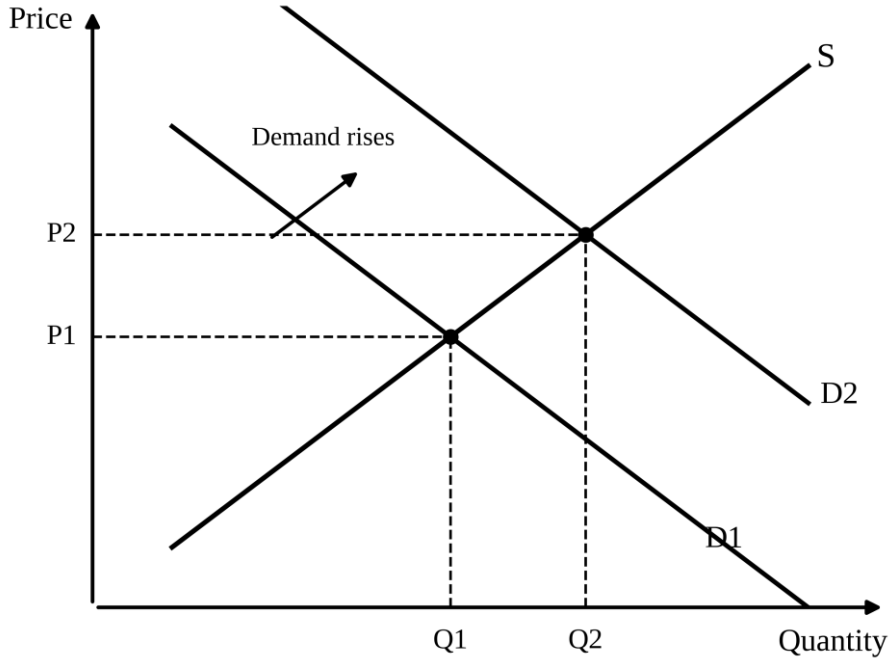


Figure 2.3: A rise in demand for rice raises the price and draws resources in.

When demand for Mbeya rice rises, the price mechanism quietly moves land and labour into rice growing, in three linked steps.

First it rations: at the old price P1 the extra demand opens a shortage, so the price is bid up to P2, and the dearer rice is shared among the buyers who value it most.

Then it signals: the higher price tells rice farmers that rice is now more wanted than before, a message no official had to send.

Then it gives an incentive: the higher price rewards rice growing, so farmers expand their output and move up the supply curve, drawing land and labour into rice and away from crops that now earn less.

As more is supplied, quantity rises from Q1 to Q2 and the market settles at the new, higher equilibrium; the whole reallocation happened with no planner, driven only by a moving price.

The Master Key: Reallocation is the three functions in sequence: ration now, signal the change, then reward the response. Trace that chain and any price-mechanism question unfolds itself.

REAL Question 37

Onions have doubled in price since last month, says the market report. Behind that dry line, the price mechanism is quietly at work, doing two of its essential tasks.

Read the market report, then explain how the price mechanism is at work.

> **Kariakoo Market, Dar es Salaam**
>
> Heavy rains cut the onion harvest around Singida, and lorries arrive with far fewer sacks than usual. Within days the wholesale price of a sack of onions at Kariakoo nearly doubles.

Model Answer

The jump in the onion price is the price mechanism doing its work of rationing and signalling.

It rations the scarce supply: the higher price prices out the least urgent buyers, so the reduced number of sacks reaches those who value onions most.

It signals and gives incentives: the high price tells traders to rush onions in from other regions and tells farmers that onions will pay well, so more will be planted.

So a price that looks merely painful to shoppers is in fact carrying the market back toward balance, pulling supply upward until the shortage eases.

The Master Key: A rising price in a shortage is not greed at work but information at work; read it as a message, not a mood.

REAL Question 38

One by one a government sells its state farms, frees its prices, and stops fixing what shops may charge. Read where each reform points, and name the destination.

Read the scenario and answer the question it poses.

> **A change of direction**
>
> After an election, new leaders return farms and factories to private owners, remove the controls that once fixed prices, invite firms to compete, and promise investors they may keep their profits. The government steps back from running businesses.
>
> ***What type of economic system is this country moving toward, and why?***

Model Answer

This country is moving toward a market economy.

Private ownership is restored: returning farms and factories to private hands is the first mark of the market system.

Prices are freed: removing the controls lets demand and supply set prices, the market's own way of deciding.

Profit and competition become the drivers: inviting competition and protecting profits puts the profit motive in charge.

The government withdraws: a state that steps back from directing business is the hallmark of laissez-faire.

Because ownership, prices, motive and the role of the state have all shifted the same way, the direction is unmistakably toward a market economy, the very road Tanzania itself travelled after 1986.

The Master Key: To classify a system, do not guess from one clue; check ownership, prices, motive and the role of government together, and let the pattern name the system.

HOT Question 39

Some call the price mechanism the finest allocator ever invented, no ministry or plan has ever matched it. A large boast; the question is where it starts to crack.

"The price mechanism is the most efficient way ever devised to allocate resources." Discuss.

Model Answer

There is much truth in the claim: for allocating ordinary goods efficiently, nothing yet devised matches the price mechanism, though it is far from flawless.

The strong case for it: prices act automatically and instantly, they harness dispersed knowledge that no planner could ever gather, and they reward low cost and invention, so they deliver both allocative and productive efficiency.

The case against: the mechanism fails with public goods, ignores externalities such as pollution, can be captured by monopoly, and leaves the poor unserved, so efficient allocation is not the same as a good outcome.

On balance the claim holds for what the market is good at, coordinating private goods, but efficiency is not the whole of welfare, which is exactly why even market economies keep a government.

The Master Key: Praise the mechanism for what it does and name what it cannot do; a fair judgement always fences the claim rather than swallowing or rejecting it whole.

HOT Question 40

The invisible hand feeds the city and stocks the shops without being asked. But ask it to clean the air or teach the poor, and its grip may loosen.

To what extent can the invisible hand be trusted to serve the whole of society?

Model Answer

The invisible hand can be trusted a long way, but not the whole way.

Where it can be trusted: in competitive markets, self-interest genuinely serves others, because a firm must please its customers to earn their money, so private greed and public good line up.

Where it cannot: the hand serves demand, not need, so it passes over those with no money; it under-provides public goods; it leaves externalities like pollution unpriced; and monopoly can turn self-interest against the very buyers it should serve.

So trust the hand to allocate most private goods well, but not to provide public goods, to protect the environment, or to deliver fairness; there its grip fails and a role for government appears.

The Master Key: This question is the doorway to market failure. When the invisible hand is asked to do too much, the next section, government, walks in.

HOT Question 41

Advertisers pour fortunes into changing her mind, yet we still call the shopper a queen who rules the market with every coin. Ask who truly holds the power.

Evaluate consumer sovereignty as a description of who really rules a market economy.

Model Answer

Consumer sovereignty is partly real and partly a flattering exaggeration.

The truth in it: firms that ignore what buyers want soon go bust, so in the end it is the spending choices of consumers that decide which firms survive.

The exaggeration in it: large producers shape wants through advertising, monopolies narrow the choices on offer, and because sovereignty is counted in money, the rich cast many votes and the poor cast few.

So the consumer rules at the margin and in the long run, but producer power and unequal incomes mean the crown sits less securely than the phrase suggests.

The Master Key: Treat every flattering slogan in economics as a claim to be tested, not a fact to be repeated; the testing is where real understanding is won.

HOT Question 42

Search every country on earth for a market with no tax, no rule, no government hand, and you will not find one. Perhaps the pure free market lives only on paper.

"A purely free market has never existed and never could." How far do you agree?

Model Answer

I agree strongly: a completely free market is a useful model, not a real place.

Why it cannot exist: every real economy rests on government-provided law, courts, money and defence, without which exchange could not even begin, so some state is always present.

Why markets force a role for the state: the market failures of public goods, externalities and monopoly compel even the most market-minded government to act, so pure laissez-faire is nowhere to be found.

The grain of truth on the other side: some economies have leaned very close to the ideal, as Britain did in the nineteenth century and Hong Kong in the twentieth, so the pure market can be approached even if it is never quite reached.

What the model is still worth: as a benchmark it shows clearly what prices can achieve, which is why we study it even though we never meet it.

So the pure free market is real as an idea and unreal as a place; agreeing with the statement is not dismissing the model but understanding its proper use.

The Master Key: An ideal type is a measuring stick, not a photograph. Judge real economies by how far they lean toward it, not by whether they reach it.

When the Market Fails: Diagnosing Market Failure

For all its power to coordinate buyers and sellers, the market does not always get things right; left to itself it can produce too much of some things, too little of others, and a share-out many find unjust. Where that happens we speak of market failure, the point at which prices and private gain steer resources away from what is best for society as a whole. This section sets out what market failure means and works through its main forms, namely public goods, merit and demerit goods, externalities both negative and positive, monopoly and income inequality. It shows why each arises, from the free-rider problem to the gap between private and social cost, and asks how far these failures justify the government stepping in. Diagnose the failure correctly and the remedy, whether a tax, a subsidy or direct provision, follows from it.

BINDER Question 43

For all its power to match buyer to seller, the market has a short list of cases it handles badly, making too much of some goods and too little of others.

Define market failure and state its main forms.

Model Answer

Market failure occurs when a free market, left to itself, allocates resources inefficiently or in a way society judges undesirable, so that too much or too little of something is produced.

Public goods: goods the market will barely provide at all, such as defence.

Merit and demerit goods: goods the market provides in the wrong quantity, too little schooling, too much alcohol.

Externalities: costs or benefits that spill onto third parties, such as pollution.

Monopoly: the abuse of market power to raise price and cut output.

Income inequality: a distribution the market produces but many judge unfair.

Each form is a case where the invisible hand, following prices and private gain alone, misses what is best for society as a whole, and that gap is precisely what we call market failure.

The Master Key: Market failure is not the market breaking down; it is the market working exactly as designed and still getting the answer society wants wrong.

BINDER Question 44

A lighthouse off Dar es Salaam warns every ship on the coast, yet none can be charged for the light it uses. Who would pay to build one?

Explain what a public good is and why the market under-provides it, using the free-rider problem.

Model Answer

A public good is one that is non-rival and non-excludable, and because of these two features the market provides almost none of it.

Non-rival: one person's use does not reduce what is left for others, as with the light from a street lamp.

Non-excludable: once provided, no one can be shut out, so a seller cannot force users to pay.

The free-rider problem: since people cannot be excluded, each waits for someone else to pay and then enjoys the good for free, so no one pays and the market supplies nothing.

Because a private firm cannot charge for a good it cannot withhold, profit-seekers will not provide defence, street lighting or flood control, so these fall to the government instead.

The Master Key: Test any good with two questions, can we share it without using it up, and can we shut non-payers out. Two noes mean a public good and a job the market will not do.

BINDER Question 45

Vaccination benches sit half empty at the clinic while the kiosk beside it never runs short of cigarettes. Two goods the market values exactly backwards.

Distinguish between merit goods and demerit goods, with examples.

Model Answer

Merit goods and demerit goods are both goods the market prices wrongly, but in opposite directions: merit goods are under-consumed and demerit goods are over-consumed.

Merit goods are better for people and for society than they realise, so the market under-provides them; examples are education, health care and vaccination.

Demerit goods are worse for people and for society than they admit, so the market over-provides them; examples are alcohol, cigarettes and harmful drugs.

Why the misjudgement: with a merit good people undervalue the benefit to themselves, and with a demerit good they understate the harm to themselves, so they choose badly quite apart from any spillover onto others.

Because the market cannot correct this on its own, the government steps in, subsidising or requiring merit goods and taxing or restricting demerit goods.

The Master Key: Merit good, under-consumed, encourage it; demerit good, over-consumed, discourage it. The whole of the next section grows from that one contrast.

BINDER Question 46

The owner of a textile mill counts his cloth and his workers, but never the smoke greying the washing on every line downwind. Someone pays that bill, and it is not him.

With the aid of a diagram, explain the effect of a negative externality such as pollution from a factory.

Model Answer

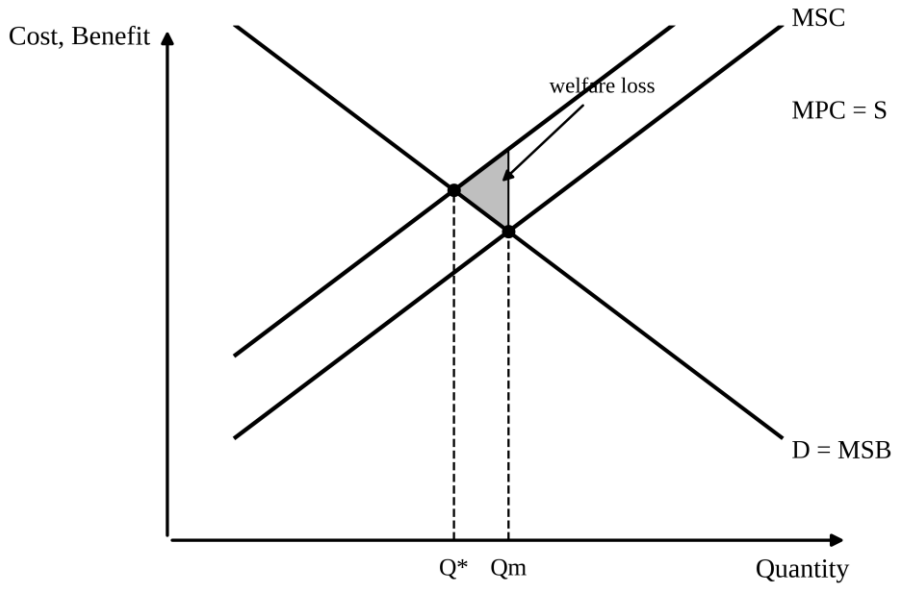


Figure 2.4: A negative externality: marginal social cost lies above marginal private cost.

A negative externality arises when production imposes costs on third parties that the producer does not pay, so the market over-produces the good.

Private versus social cost: the firm's marginal private cost, MPC, which is its supply curve, leaves out the pollution suffered by others, so the true marginal social cost, MSC, lies above it.

The market over-produces: the market settles where demand meets private cost, at quantity Qm, but the socially best quantity is the smaller Q*, where demand meets the full social cost.

The welfare loss: between Q* and Qm every unit costs society more than it is worth, and the shaded triangle measures that loss of welfare.

Because the polluter counts only private cost, the invisible hand pushes output past the social optimum, which is why pollution is a textbook case of market failure calling for correction.

The Master Key: For any negative externality, draw MSC above MPC and mark Qm to the right of Q*. Over-production and a welfare-loss triangle are the two features that earn the diagram its place.

BINDER Question 47

In the Tabora hills, one beekeeper's bees pollinate every farm for miles, a gift the neighbours enjoy but never pay for. Ask whether he keeps enough hives.

Explain what a positive externality is and why the market under-produces goods that create one.

Model Answer

A positive externality arises when an activity confers benefits on third parties who do not pay for them, so the market produces too little of the good.

Spillover benefits: when one person is educated or vaccinated, others gain too, through a more skilled workforce or less disease, so the social benefit exceeds the private benefit.

The market ignores the spillover: buyers weigh only the benefit to themselves, so they buy less than the amount that would be best for society.

Because the wider gains go uncounted in the price, output falls short of the social optimum, which is why governments subsidise or provide activities such as schooling and vaccination whose benefits spill onto the whole community.

The Master Key: A negative externality means over-production; a positive one means under-production. Ask who gains or loses without paying, and the direction of the failure is clear.

BINDER Question 48

One firm owns the only sugar mill for miles and prices as it pleases; the same market makes a few families rich and leaves the rest with nothing. Neither is an accident.

Explain how monopoly and income inequality are each a form of market failure.

Model Answer

Monopoly and income inequality are both outcomes a free market can produce that leave society worse off than it need be.

Monopoly: when a single firm dominates a market, it can restrict output and raise the price above the competitive level, so consumers get less at a higher price and resources are misallocated.

Income inequality: the market rewards those who own resources and skills and gives little to those who own neither, so it can concentrate wealth in a few hands while others go without necessities.

In both cases the market is working normally, yet the result, dear goods from monopoly and deep gaps between rich and poor, is one society may rightly wish to correct.

The Master Key: Monopoly is a failure of efficiency; inequality is a failure of fairness. A market can fail on either count, and often on both at once.

REAL Question 49

On the shore of Lake Victoria at Mwanza, a cannery pours its waste into the water the fishermen depend on, and never pays a shilling for the catch it ruins.

Read the case, then identify the market failure and explain why the market over-produces.

A fish factory on Lake Victoria, Mwanza

A fish-processing plant sells fillets at a healthy profit. To keep its own costs low it pipes untreated waste into the lake, killing fish stocks that nearby families depend on and fouling the water they drink. The plant pays nothing for this damage.

Model Answer

This is a negative externality, a classic market failure, because the plant imposes costs on others that it does not pay.

The uncounted cost: the lost fish stocks and dirty water are real costs, but they fall on the fishing families, not on the factory, so they never enter its price.

The over-production: because the plant weighs only its private cost, it produces more fillets than is good for society, pushing output past the point where the full social cost is covered.

So the market over-produces because the polluter is allowed to ignore the damage; make the plant pay for the harm and its output, and the pollution, would fall toward the level society would choose.

The Master Key: Whenever a producer can push a cost onto someone who never agreed to bear it, suspect a negative externality; the tell-tale sign is a cost that appears in the world but not in the price.

REAL Question 50

Every household on a dark street wants a lamp at the corner, yet each waits for a neighbour to buy it, since the light, once lit, shines free on all.

Read the situation and explain the market failure it reveals.

A neighbourhood in Dodoma

Residents of an unlit street agree that street lighting would make them all safer at night. A trader offers to install and pay for the lamps if each household contributes. Many families reply that they will benefit from the light anyway, so they would rather not pay, and in the end the lamps are never installed.

Model Answer

This reveals the public-good problem, driven by free-riding, which is why the market leaves the street dark.

Street lighting is a public good: it is non-rival, since one person's safety from the light does not dim it for another, and non-excludable, since no passer-by can be shut out of the glow.

Free-riding blocks provision: because no one can be excluded, each household waits for the others to pay and hopes to enjoy the light for free, so too little money is raised and the lamps are never bought.

So a good that everyone wants goes unprovided by the market, which is exactly why lighting, like defence and flood control, is normally supplied by the government out of taxes.

The Master Key: When everyone wants a thing yet no one will pay for it, you are almost certainly looking at a public good and the free-rider problem, not at simple meanness.

HOT Question 51

The maize, soap and sandals in any market change hands smoothly, no failure in sight. So it is tempting to call market failure a rare exception. Is that too comfortable a verdict?

"Market failure is the exception, not the rule; most markets work well." Discuss.

Model Answer

The claim is broadly fair for everyday private goods, but it understates how often and how seriously markets fail.

The case for the claim: for ordinary goods like food, clothing and furniture, competitive markets do allocate resources well, so failure there is rare and the invisible hand earns its praise.

The case against: failure is not a rare accident but a standing feature wherever there are public goods, externalities, monopoly power or deep inequality, and these cover defence, the environment, health, education and much else that matters most.

So the truth lies between the two: most simple markets work, yet the markets that fail are often the ones with the largest consequences, which is why no country trusts the market with everything.

The Master Key: Judge a claim by weight, not just by count. Failures may be fewer than successes and still matter more, and a strong answer says so.

HOT Question 52

When the market stumbles, the obvious cure is to call in the government. But the doctor summoned to fix one failure can carry a failure of its own.

To what extent does the existence of market failure justify government intervention?

Model Answer

Market failure gives a strong justification for government intervention, but not a blank cheque, because government can fail too.

The strong justification: where the market under-provides public and merit goods, over-provides demerit goods, ignores externalities or breeds monopoly, only an outside body with the power to tax, spend and regulate can correct it, and that body is the government.

The limit on the justification: governments have poor information, act slowly, can be captured by interest groups and may cause a government failure worse than the market failure they set out to cure, so intervention must be judged case by case.

So market failure justifies intervention up to the point where the cure is better than the disease, and no further; the case for the state is real but conditional.

The Master Key: Market failure opens the door to government, but the next section closes it partway: the question is never whether to intervene but how much, and how well.

HOT Question 53

A market can run with perfect efficiency and still leave one child in school shoes and another barefoot. Some say that gap, not any waste, is the market's gravest failure.

"The greatest failure of the market is not inefficiency but inequality." How far do you agree?

Model Answer

There is real force in the claim, and on balance I accept it, though the ranking rests partly on the values one brings to it.

The case for the claim: inefficiencies from externalities or monopoly can often be patched with a tax or a rule, but the market's tendency to reward the already-rich and neglect the poor strikes at fairness and social peace, which many hold to matter most.

The case against: inequality is partly a value judgement rather than a technical fault, and some inequality is the very incentive that makes the market efficient, so calling it the greatest failure risks confusing a moral objection with an economic one.

So I come down in agreement: judged over time, inequality is the market's gravest failure, because an efficiency loss from an externality or a monopoly can usually be patched with a tax or a rule, whereas entrenched inequality compounds down the generations and eats at the fairness a society rests on. The efficiency failures do real harm, but the harm from inequality cuts deeper and lasts longer.

The Master Key: When a claim ranks one thing above another, show that the ranking depends on values, then take a clear stand anyway. Fence-sitting earns less than a reasoned choice.

The Government's Toolkit: Correcting Market Failure

Once a market has failed, the question is no longer whether to act but how, and here the government reaches for a whole toolkit rather than a single instrument. This section sets out those tools, namely taxes and subsidies that adjust the price signal, regulation that commands behaviour by law, price controls that cap or prop the price, and direct provision that supplies what the market will not. Each is matched to a particular failure, because a tax that suits pollution would miss a public good, and a control that eases a crisis can breed a shortage. What ties them together is judgement: the skill lies not in knowing the tools but in choosing the one that fits, and in weighing the harm a clumsy intervention can do against the good a well-judged one achieves.

BINDER Question 54

No mechanic swings a hammer at a loose bolt; he reaches for the spanner that fits. Government keeps a toolbox too, and each tool answers a different fault.

State the main ways a government can intervene to correct market failure, and the failure each one addresses.

Model Answer

A government has a toolkit of measures, and the skill lies in matching each tool to the failure it is meant to correct.

Government tool	**The failure it corrects**
Taxes on a good	Over-production from a negative externality or a demerit good
Subsidies	Under-production of a merit good or a positive externality
Price controls (ceiling or floor)	Prices judged too high for buyers or too low for sellers
Regulation and law	Externalities, monopoly abuse, unsafe or harmful goods
Direct state provision	Public goods and under-provided merit goods
Redistribution (progressive taxes, transfers)	Income inequality

Because each failure has its own cause, the government does not reach for one tool but chooses the one that fits, taxing what there is too much of and providing what there is too little of.

The Master Key: Never answer an intervention question with a shapeless list. Name the failure first, then the tool that fits it; the pairing is what turns a list into an argument.

BINDER Question 55

A tannery fouls the river and pays nothing; a clinic vaccinates children and is thanked with nothing. One tax and one subsidy can put both prices right.

Explain how taxes and subsidies can correct externalities.

Model Answer

Taxes and subsidies correct externalities by changing the price so that private decision-makers face the true cost or benefit to society.

A tax on a negative externality: placing a tax on a polluting good raises its price and lowers its output toward the social optimum, because the producer must now pay for the harm it once ignored.

A subsidy for a positive externality: paying a subsidy on a merit good such as vaccination lowers its price and raises its use toward the social optimum, because the wider benefit is now rewarded.

In both cases the government does not abolish the market but adjusts the signal it runs on, so that self-interested choices line up with what is good for society.

The Master Key: Tax the bad, subsidise the good: the two are mirror images, one pushing output down to the optimum, the other pulling it up.

BINDER Question 56

To spare families a bitter price, a minister caps the cost of sugar. Within days the shelves sit bare. The kindness and the shortage turn out to be the same act.

With the aid of a diagram, show how a maximum price, or price ceiling, on an essential good creates a shortage.

Model Answer

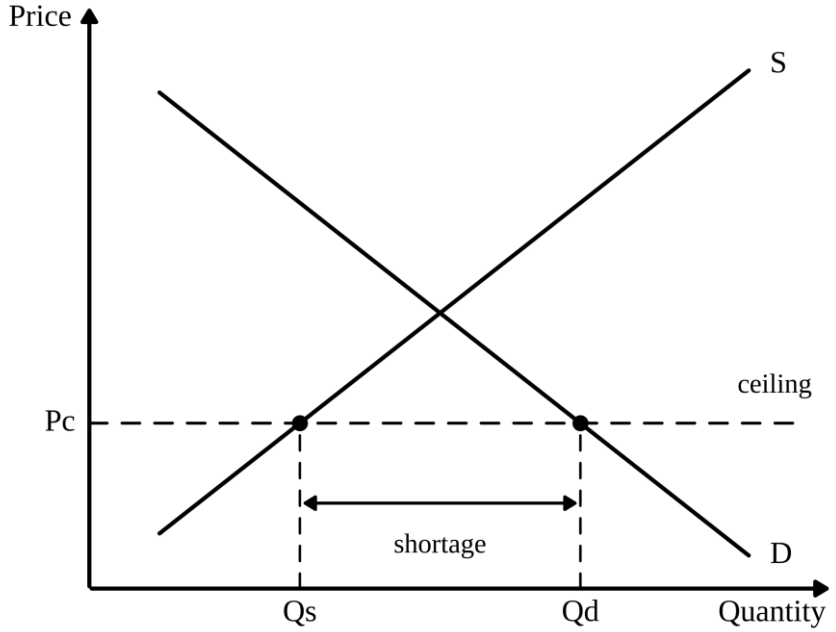


Figure 2.5: A price ceiling set below equilibrium creates a shortage.

A price ceiling is a legal maximum price, set below the equilibrium to keep an essential good affordable, but it creates a shortage.

The ceiling sits below equilibrium: at the capped price Pc, lower than the market price, the good looks cheap to buyers.

Demand exceeds supply: at Pc buyers want the large quantity Qd while sellers offer only the small quantity Qs, so a shortage of Qd minus Qs opens up.

The side effects: because price can no longer ration the good, it is rationed instead by queues, favouritism or a black market where it resells above the legal price.

So a ceiling meant to protect the poor can leave them queuing for a good that is no longer on the shelf, which is why price controls are a tool to use with great care.

The Master Key: A ceiling only bites when it is below equilibrium, and when it bites it creates a shortage. Draw the cap as a line under the cross, and mark Qs before Qd.

BINDER Question 57

Order that no wage may fall below a set floor, and every worker still hired earns more; yet a line of willing hands is left standing outside the gate.

With the aid of a diagram, show how a minimum price, or price floor, such as a minimum wage, creates a surplus.

Model Answer

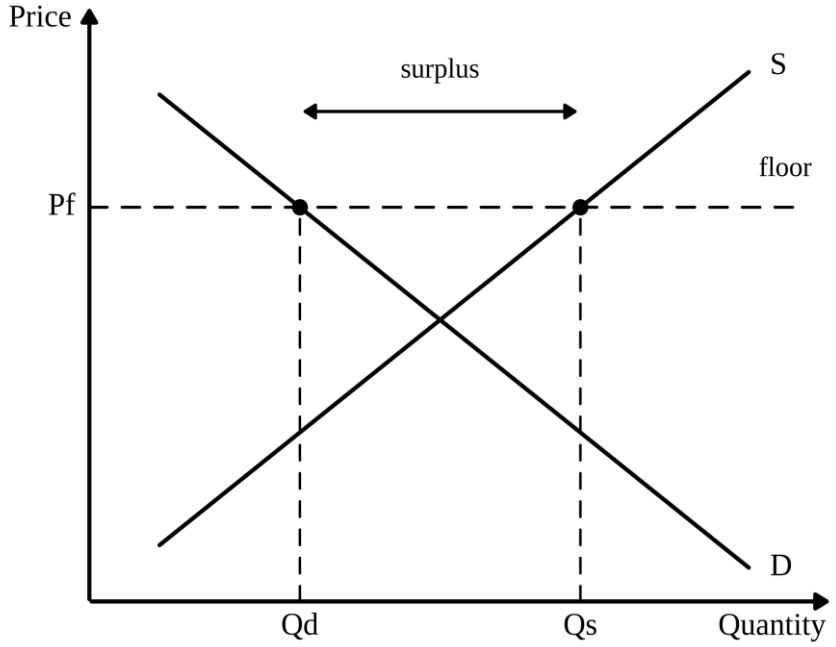


Figure 2.6: A price floor set above equilibrium creates a surplus.

A price floor is a legal minimum price, set above the equilibrium to protect sellers, but it creates a surplus.

The floor sits above equilibrium: at the propped price Pf, higher than the market price, the good or service looks rewarding to sellers.

Supply exceeds demand: at Pf sellers offer the large quantity Qs while buyers want only the small quantity Qd, so a surplus of Qs minus Qd builds up.

A worked case, the minimum wage: in the labour market a wage floor set above the going rate means more people want to work than firms wish to hire, and that surplus of labour is unemployment.

So a floor meant to protect sellers, or workers, can leave goods unsold or workers jobless, which is the standing danger of setting a price above the level the market would choose.

The Master Key: A floor only bites when it is above equilibrium, and when it bites it creates a surplus. Ceiling below, shortage; floor above, surplus, is worth memorising as a pair.

BINDER Question 58

Some failures no price can nudge away. When persuasion fails, the state turns to its firmest pair: a law that must be obeyed, and a good it provides itself.

Explain regulation and direct state provision as tools for correcting market failure.

Model Answer

Regulation and direct provision are the government's firmest tools, one commanding behaviour by law and the other supplying goods the market will not.

Regulation and law: the state can simply forbid or require an action, banning the dumping of waste, capping factory emissions, or making schooling compulsory, so that harmful behaviour is outlawed rather than merely priced.

Direct state provision: where the market provides nothing, as with public goods, or too little, as with merit goods, the government can produce the good itself and fund it from taxes, which is why the state builds roads, runs defence and supplies much health care and education.

Because these tools do not wait for prices to work, they act quickly and surely, though at the cost of the flexibility and choice that markets give.

The Master Key: Rank the tools by force: a tax nudges, a rule commands, provision replaces. The heavier the failure, the heavier the tool a government tends to reach for.

REAL Question 59

When Tanzania scrapped primary school fees, classrooms that had stood half empty filled overnight. Ask which failure the market had left, and which tool the government had just picked up.

Tanzania provides free basic education and abolished primary school fees. Explain the market failure this corrects and the tool being used.

Model Answer

Free basic education is the government correcting the under-provision of a merit good by using direct provision and subsidy.

The failure being corrected: schooling is a merit good with large positive externalities, a more skilled and healthier society, that families acting alone would under-consume, so the market would leave many children unschooled.

The tool being used: by providing schooling directly and removing fees, the government lowers the price to zero and raises take-up toward the level that is best for the whole country.

So a policy that looks like simple generosity is, in the language of this chapter, the state supplying a merit good the market would have under-provided, and reaping the wider gains for Tanzania.

The Master Key: Behind almost every big public programme sits a market failure. Learn to name it, and government spending stops looking like charity and starts looking like economics.

REAL Question 60

The government promises Mtwara's cashew growers a price above what any buyer will pay. The growers rejoice; an economist quietly reaches for the diagram of a price floor.

Read the policy, then explain its likely effect using what you know about price floors.

Guaranteeing a price for cashew

To protect growers in the southern regions, the government announces that it will guarantee a minimum price for raw cashew that is well above the price traders were offering, and promises to buy up whatever the traders will not.

Model Answer

A guaranteed price above the market level is a price floor, so it will tend to create a surplus of cashew that the government must buy and store.

Why a surplus appears: the attractive guaranteed price encourages farmers to grow more cashew while traders, facing the higher price, wish to buy less, so supply outruns demand.

Who is left holding it: because the state has promised to buy the unsold crop, it accumulates a costly buffer stock that must be stored, and storage and spoilage drain the budget.

So the floor does protect farmers' incomes in the short run, but at the price of a surplus and a growing bill, which is the trade-off every price floor forces a government to weigh.

The Master Key: A price floor helps the seller and burdens the buyer or the treasury. Whenever a government props a price up, ask at once who ends up holding the surplus.

REAL Question 61

A cement works on the edge of town coats the market stalls in grey dust, yet its owner counts only his profit. Choose the tool that makes him count the rest.

Read the problem and recommend, with a reason, the most suitable government tool.

Smoke over an industrial district

Factories in an industrial area of Dar es Salaam release smoke that harms the health of nearby residents. The factories pay nothing for this harm, and output of the goods they make is higher than is good for society.

Model Answer

The best fit is a tax on the pollution, backed where necessary by regulation, because the failure is a negative externality of over-production.

Why a tax fits: taxing the harmful output makes the factories pay for the damage they cause, raising their costs and cutting production back toward the level that is best for society.

Why regulation supports it: a firm emission limit or a requirement to fit filters can cap the very worst pollution directly, which a tax alone might not reach quickly enough.

So the tool is chosen to match the failure: because the problem is an uncounted external cost, the remedy is to make the polluter count it, through a tax and a rule rather than, say, a price control that would miss the point.

The Master Key: Match the medicine to the illness. An externality calls for a tax or a rule that reprices the harm, not for a subsidy or a price cap that would treat the wrong symptom.

HOT Question 62

Intervene to fix a market and you might misfire, overspend, or breed the very shortage you meant to cure. Is government's cure worse than the disease, or just harder to get right?

"Government intervention usually does more harm than good." Discuss.

Model Answer

The claim is too sweeping: intervention is often necessary and helpful, though it can indeed do harm, so the truth depends on how well it is done.

Where intervention helps: only the government can provide public goods, correct externalities, curb monopoly and relieve poverty, so without it many failures would simply go unaddressed and society would be worse off.

Where it harms, government failure: the state may act on poor information, respond slowly, be captured by interest groups, or create shortages and surpluses through clumsy price controls, so a cure can end up worse than the disease.

So intervention neither usually helps nor usually harms as a rule; it helps when it is well targeted and well judged, and harms when it is not, which is why the quality of the intervention matters more than the fact of it.

The Master Key: Government failure is the twin of market failure. A mature answer weighs the two against each other rather than treating the state as either saviour or villain.

HOT Question 63

Fix a low price for rent and flour, and the poor seem shielded. Yet the landlord stops repairing and the miller stops milling. Who is hurt when kindness becomes law?

To what extent are price controls a wise way to help the poor?

Model Answer

Price controls can help the poor a little in the short run, but they are a blunt tool that often ends up hurting the very people it is meant to protect.

The short-run appeal: a ceiling on an essential such as maize flour does lower its price at once, which can bring relief to poor buyers during a genuine crisis.

The longer-run damage: because the ceiling creates a shortage, the good vanishes from the shelves, queues and black markets appear, and it is often the poor, with the least time and the fewest connections, who lose out in the scramble.

So price controls may be defensible as a brief emergency measure, but as a lasting way to help the poor they are unwise, and a targeted subsidy or cash support usually does the job with fewer side effects.

The Master Key: A policy that treats the price rather than the poverty tends to backfire. Help the person, through income, rather than freezing the price, and the market can keep working.

HOT Question 64

One tool corrects the market by whispering a new price into it; the other shoulders the market aside and does the job itself. Which mends more, the nudge or the hand?

Evaluate the view that taxes and subsidies are a better way to correct market failure than direct state provision.

Model Answer

Taxes and subsidies are often the better tools because they work with the market rather than replacing it, but direct provision remains essential for the failures they cannot reach.

The case for taxes and subsidies: they correct the price signal while leaving choice, competition and the profit incentive intact, so they harness the market's efficiency instead of sacrificing it, as with a pollution tax or a vaccination subsidy.

Where direct provision is still needed: a pure public good such as defence earns no revenue and so will never be provided by a private firm however it is subsidised, so here the state must simply provide it itself.

So the wise rule is to prefer the lighter tools of tax and subsidy where the market can still function, and to reserve direct provision for the public goods and deep failures where the market cannot function at all.

The Master Key: Use the lightest tool that will do the job. Reprice where you can, provide where you must, and you will match most failures to their proper cure.

Combining the Hand and the State: The Mixed Economy

No real country trusts the market alone, and none leaves everything to the state, so almost every economy in the world is a blend of the two, and that blend is the mixed economy. This closing section shows how the hand of the market and the hand of the government share the work: the market answers the three questions first, and the state corrects those answers wherever the market would fail its people. It sets out the system's defining features, weighs its advantages against its dangers, and follows the money through a circular flow that now passes through the government as well. It then turns to Tanzania itself, where private firms and public bodies such as TANESCO and the DART network operate side by side, before asking the harder question of where the balance between market and state should sit.

BINDER Question 65

A Kariakoo trader sets his own prices, yet the state utility TANESCO powers the very stall he trades from. Two hands guide one economy, and a British economist explained why.

Define a mixed economy and explain the contribution of John Maynard Keynes to the idea.

Model Answer

A mixed economy is a hybrid system that combines the main features of the market and the command economies, so that individuals enjoy freedom of choice while the government also intervenes to protect the general welfare.

It borrows from both parents: most decisions are left to private buyers and sellers acting through prices, yet the government owns some industries and steps in wherever the free market would fail the people.

Keynes gave it its backbone: the modern case for the mixed economy is associated with John Maynard Keynes, who argued that when demand collapses the government should support it through its own spending, even by running a budget deficit, rather than by controlling all wages and prices as a central planner would.

So the mixed economy is not a vague middle muddle but a deliberate bargain: keep the energy of the market, but let the state stand guard where the market alone would leave people exposed.

The Master Key: Hold the definition in two beats: freedom of choice from the market, protection of welfare from the state. Keynes is the name that joins them; support demand, do not command it.

BINDER Question 66

In Mwanza a shopkeeper decides what to stock and charge, until medicine climbs beyond the poor and the government intervenes. The market gives the first answer, the state the last word.

Explain how a mixed economy answers the three fundamental questions of what, how and for whom to produce.

Model Answer

In a mixed economy the market answers the three questions most of the time, but the government corrects and guides the answers wherever the market fails.

What to produce: consumers and firms decide most output through prices, yet the government also funds goods the market under-provides, such as roads, defence and public health.

How to produce: firms choose their own methods in search of profit, but the state regulates them, for example through laws on safety and pollution, so private cost is not passed on as public harm.

For whom to produce: incomes earned in the market do most of the sharing, yet the government redistributes through progressive taxes and welfare so that the poorest are not left with nothing.

So the mixed economy takes the market's answers as its first draft and then edits them; prices lead, and policy corrects.

The Master Key: Remember the order: the market writes the first answer, the government edits it. Prices lead; policy corrects.

BINDER Question 67

Two doors face each other on a Dar street: behind one, a trader chasing profit; behind the other, a public clinic serving all. One economy holds both. What frames them?

Outline the main features of a mixed economy.

Model Answer

A mixed economy is marked above all by the co-existence of a private sector and a public sector, each driven by a different motive under a framework the government sets.

Two sectors stand side by side: privately owned firms trade for profit alongside publicly owned bodies that serve the community, so ownership is split rather than total.

Two motives run at once: the profit motive drives the private sector while the social-welfare motive drives the state, and the economy answers to both.

The government holds real tools: it intervenes through fiscal and monetary policy, price controls and redistribution by progressive taxes and minimum wages, together with some indicative planning that guides investment without dictating it.

Consumer freedom is real but bounded: people may buy, sell, own and choose their work freely, yet that freedom stops where the law and the public interest begin.

So the whole system is a partnership under one roof: private hands and the public hand at work together, neither left free to crowd the other out.

The Master Key: If you can point to two sectors, two motives and a government holding real tools, you are looking at a mixed economy. Miss any one and you have drifted toward an extreme.

BINDER Question 68

Private firms compete to cut costs and sharpen service, while the state guards the pension and the hospital. A mixed economy reaches for both prizes at once. Can it truly hold them?

Explain the main advantages of a mixed economy.

Model Answer

The great advantage of a mixed economy is that it can capture the efficiency of the market and the equity and security of state action at the same time.

It marries efficiency to fairness: the market keeps resources moving to where they are valued, while the state softens the harsh inequality a pure market would leave behind.

It supplies what the market neglects: the government provides the public and merit goods a pure market under-provides, such as street lighting, vaccination and schooling.

It curbs failure and shields the vulnerable: the state can act against pollution, monopoly and unemployment, and protect the old, the sick and the poor from being crushed by the market.

It still rewards enterprise: because private profit survives, the drive to work hard and innovate is not killed off as it can be under full central planning.

So the mixed economy tries to take the best of each system at once, keeping the market's drive while adding the state's conscience.

The Master Key: The mixed economy's promise is a single sentence: keep the market's engine, then fit it with the state's brakes and seatbelts.

BINDER Question 69

The state steps in to fix one market, then another, until its helping hand grows so heavy it crushes the trade it came to rescue. Where should it stop?

Explain the main disadvantages of a mixed economy.

Model Answer

The chief danger of a mixed economy is that intervention, once begun, can be pushed too far and distort the very market it was meant to improve.

Too much intervention distorts the market: when the state fixes prices the market can no longer clear, so shortages or surpluses appear where trade would otherwise have balanced.

Government failure is a real risk: heavy taxes, swollen bureaucracy and political interference can waste resources just as surely as market failure ever did.

The boundary of the state is always contested: no one agrees exactly where the government's role should end, so the mixture swings back and forth with each new administration.

It can breed protected monopolies: industries shielded by the state may grow lazy and inefficient behind that protection, with no rival free to punish them.

So the mixed economy is only as good as the judgement behind it; the same power that corrects the market can, in the wrong hands, cripple it.

The Master Key: Every advantage of intervention casts a shadow. Ask not whether the state acts, but whether it acts too much.

BINDER Question 70

Money circles endlessly from households to firms and back. Now a third figure joins the ring, taxing from the flow and paying back into it. The simple loop just grew more crowded.

With the aid of a diagram, describe the circular flow of income in a mixed economy, showing the government.

Model Answer

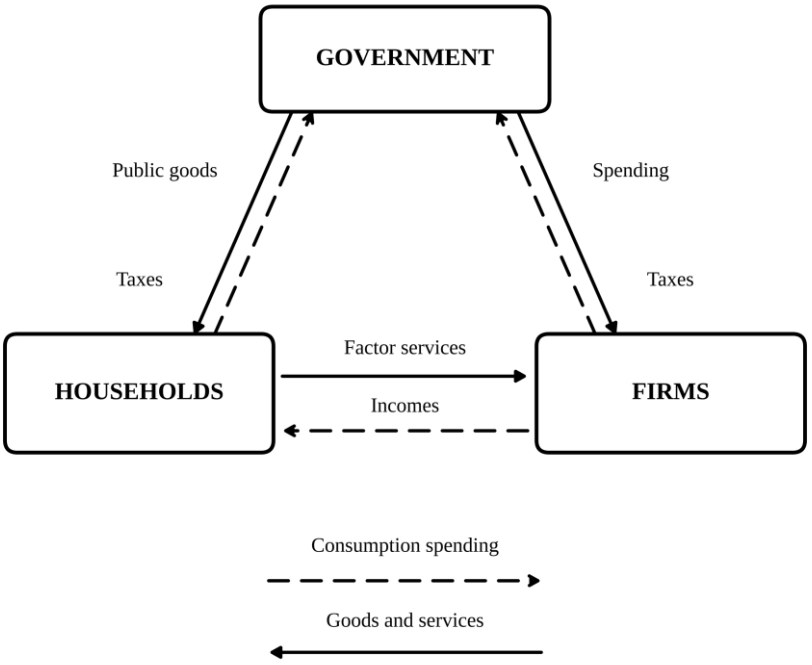


Figure 2.7: The circular flow in a mixed economy, with the government.

In a mixed economy the familiar loop between households and firms still turns, but a third party, the government, now sits within it, drawing in taxes and returning spending and services.

Taxes flow inward: both households and firms pay taxes to the government, so a slice of the money loop is drawn out of the private circle and into the state's hands.

Spending and services flow back: the government returns that money to the economy as public goods, its own spending and subsidies, so the loop is completed through the state as well as through the market.

So the government neither replaces the flow nor stands outside it; it becomes a third pump in the circuit, taking money from the loop and paying it back in.

The Master Key: Draw the government as a third box that both taxes the loop and pays back into it. If your arrows run only one way, the picture is wrong.

REAL Question 71

Board a UDART bus in Dar es Salaam: the state built the busway, a private firm runs the buses, and agreement sets the fare. One ride, a whole economic system.

Using examples from Tanzania today, explain why the country is best described as a mixed economy.

Model Answer

Tanzania today is a mixed economy, because private enterprise and public bodies operate side by side, and the two are increasingly joined in single partnerships.

Private firms and public utilities coexist: countless private businesses trade freely across the country, while the state still runs essential utilities such as TANESCO, the national electricity supplier.

Public and private share one project: the DART bus rapid transit system in Dar es Salaam is built and owned by the public DART agency, while the private operator UDART runs the buses that began carrying passengers in 2016.

The government still guides and redistributes: through taxes, regulation and public spending on health and schooling, the state shapes an economy it does not wholly control.

So neither label alone will fit: a commuter in Dar es Salaam rides a private bus along a public road, then lights the home from a state supplier, and that single day is the mixed economy in miniature.

The Master Key: When you must prove a country is mixed, name one thing the market runs and one thing the state runs. In Tanzania, private buses on public roads say it in four words.

REAL Question 72

A country in the box lets its people open shops and choose jobs freely, yet the state alone owns the banks, the power, the railways. Name the system wearing this disguise.

Read the scenario in the box. Identify the economic system it describes and justify your answer.

Scenario

A newly independent country decides that its largest and most essential industries, its electricity, its railways and its main banks, will be owned and run by the government.

The rest of the economy, its shops, farms and small workshops, is left in private hands, and citizens remain free to start businesses and to choose their own work.

The government also hires many people directly to staff public services such as hospitals and schools.

Model Answer

The country in the box has a mixed economy, because the state controls the commanding heights while private ownership and free choice survive everywhere else.

The command element is plain: the government owns and runs the largest and most essential industries and employs people directly in public services, which is deliberate state direction.

The market element is just as plain: the rest of the economy is left in private hands, so private property, the profit motive and consumer choice all continue to operate.

Because neither the state nor the market has been allowed to take over completely, the only accurate label for such a country is mixed, which is the very shape Tanzania itself settled into after its reforms.

The Master Key: Judge a system by what it does, not by what it is called. State control of the commanding heights plus private choice below, and the word mixed writes itself.

HOT Question 73

Best of both worlds, the slogan runs: the market's drive married to the state's compassion. But a marriage can inherit the faults of both partners, not only their gifts.

"The mixed economy is the best of both worlds." Discuss.

Model Answer

There is much truth in the claim, because the mixed economy is designed to keep the strengths of both systems; yet it can also inherit their weaknesses, so it is not automatically the best of both.

The case for the claim: it keeps the efficiency and enterprise of the market while adding the fairness and security of the state, so it can supply public goods and protect the poor without killing the profit motive.

The case against: a badly run mixed economy can instead combine the worst of both, leaving market failure uncorrected on one side while piling up government failure, heavy taxes and bureaucracy on the other.

What decides which it becomes: the outcome turns on how wisely the balance is struck, so the mixture is best only when the state intervenes with skill and restraint.

On balance the claim is a hope rather than a guarantee: the mixed economy can be the best of both worlds, but only where the state acts with good judgement.

The Master Key: Best of both worlds is a target, not a promise. The mixture rewards good judgement and punishes bad, just as surely as any other system.

HOT Question 74

In theory, two clean systems exist: the pure market and the pure command economy. Now point to either on today's world map. Your finger may hover a long time.

"In truth there is no purely market or purely command economy left today." How far do you agree?

Model Answer

I largely agree, because almost every modern economy now mixes market and state to some degree, so the pure types survive more as models than as places.

Why the pure types have faded: even the most market-driven nations tax, regulate and provide public goods, while even the most state-driven ones now allow some private trade, so both extremes have edged toward the middle.

Where a grain of doubt remains: a few economies still sit very close to one pole, so to say there is no pure type at all slightly overstates the case, though such places are rare exceptions.

So the statement is very nearly true: the pure market and pure command economies are best treated as the two ends of a line, on which real countries fall somewhere in between.

The Master Key: Stop hunting for pure types in the world; they live in the textbook. Real economies sit on a line, and your task is to place them, not to sort them.

HOT Question 75

The blend that steadies a wealthy nation might starve a poor one still building its roads. If the right mixture shifts with circumstance, can any single balance be called correct?

To what extent does the right balance between market and state depend on a country's circumstances?

Model Answer

To a very large extent, because the mixture that suits one country may fail another, so circumstances, not theory alone, decide where the balance should sit.

Circumstances that pull toward the state: where poverty is deep, markets are thin or public goods are missing, a country may need heavier state action to protect its people and lay its foundations.

Circumstances that pull toward the market: where enterprise is strong and institutions are trusted, lighter intervention may free the economy to grow faster than a heavy state would allow.

The limit of the argument: some truths hold everywhere, that both extremes fail and that market failure always needs some correction, so circumstances shift the balance without ever removing the need for one.

So the right balance is not fixed once for all: it is a judgement each country makes from its own stage of development, its resources and its institutions.

The Master Key: There is no single right balance, only a right balance for a place and a time. Read the country first, then prescribe.

The Four Systems Side by Side: Comparison and Distinctions

Each of the four systems has now been met on its own; this closing section brings them together and turns from description to comparison. It lays them out feature by feature and question by question, then sharpens the fine distinctions the earlier sections only touched: command against market, capitalism against socialism, and the pure types against the mixed middle where most real nations live. The work here is to weigh the systems against one another, to classify real economies from North Korea to the United States to Tanzania, and to judge which arrangement answers the economic problem best. Fix these contrasts and every argument that follows in the chapter falls into place, because each one rests on knowing exactly how the four systems part ways.

BINDER Question 76

A traditional village, a busy market, a planning ministry, and a nation that borrows from all three. Line their answers in columns and the resemblances, and the quarrels, appear at once.

Draw up a table comparing the four economic systems across their main features.

Model Answer

The four systems are easiest to hold in the mind when they are set side by side, feature by feature, so that each column becomes one society's whole answer to the economic problem.

Feature	Traditional	Command	Market	Mixed
Ownership of resources	Communal or tribal	State owns all	Privately owned	Private and public
Who decides	Custom and elders	Central planners	Buyers and sellers	Market and state
Main motive	Survival and custom	Social welfare	Private profit	Profit and welfare
How prices are set	Barter and custom	Fixed by the state	Demand and supply	Mainly the market
Role of government	Minimal	Total control	Very limited	Corrective, active
Efficiency	Low	Often low	High	Fairly high
Equality	Even but poor	High	Wide inequality	Gaps narrowed
Consumer choice	Very narrow	Narrow	Very wide	Wide

Read the table down any column and you have the character of one system; read across any row and you have four rival answers to a single question. Because every later argument in this chapter rests on these contrasts, this is the grid to fix first.

The Master Key: Learn the table by its columns, one system at a time, then test yourself across the rows. Master this single page and you carry the whole comparison in your head.

BINDER Question 77

A sack of maize sits in the store. Who decided it be grown, who chose the plough over the hoe, and who may carry it home? Four systems, four different answers.

Draw up a grid showing how each of the four systems answers the three fundamental questions.

Model Answer

Every system faces the same three questions, what to produce, how to produce and for whom to produce, but each hands them to a different authority.

The three questions	Traditional	Command	Market	Mixed
What to produce	What custom dictates	What planners set	What buyers demand	Demand, state guided
How to produce	Inherited methods	Methods set by plan	Cheapest, for profit	Firms, within rules
For whom to produce	By rank and custom	Shared by the state	Those able to pay	Market plus welfare

Reading across each row shows the very same question handed to custom, to the planner, to the price, and to a blend of price and planner. Because the questions are shared and only the answering differs, this grid is simply the four systems reduced to their core.

The Master Key: If you can rebuild this grid from memory, you can rebuild almost any comparison, because who answers what, how and for whom is the seed from which every other feature grows.

BINDER Question 78

In one land a ministry decides how many shirts its factories sew; in another, the price of cloth decides for itself. They sit at opposite poles, and a single question explains why.

Distinguish between a command economy and a market economy.

Model Answer

A command economy and a market economy differ above all in one thing: who owns the resources, and therefore who answers the three fundamental questions.

Ownership: in a command economy the state owns the farms, factories and shops, while in a market economy resources are owned privately by individuals and firms.

Who decides: a command economy is steered by central planners who issue targets, whereas a market economy is steered by buyers and sellers acting through prices.

The motive: command production is driven by the plan and by social need, but market production is driven by the search for private profit.

Prices and choice: in a command economy prices are fixed by the state and choice is narrow, while in a market economy prices move freely with demand and supply and choice is wide.

So the two systems are mirror images: one trusts the plan and the other trusts the price, and almost every further difference between them, in efficiency, equality and freedom, flows from that single parting of the ways.

The Master Key: Hold the pair as plan against price. Name that root difference first, and the rest of the contrast unrolls out of it on its own.

BINDER Question 79

Two people face one factory. One says it belongs to whoever built it; the other, to all who work in it. Behind that quarrel lie the two great beliefs of the age.

Distinguish between capitalism and socialism.

Model Answer

Capitalism and socialism are the two rival philosophies of ownership that lie behind the systems: capitalism trusts private property and self-interest, while socialism trusts collective ownership and shared provision.

Ownership of property: under capitalism the means of production are owned by private individuals, whereas under socialism they are owned by the community, usually through the state.

The guiding motive: capitalism relies on self-interest and the profit motive to drive effort, while socialism appeals to social welfare and the goal of equality.

The role of the state: a capitalist state stands back and mainly protects property and contracts, whereas a socialist state plans, owns and provides.

The prize each seeks: capitalism holds efficiency and freedom of choice highest, while socialism holds fairness and security for all highest.

So capitalism leans naturally towards the market system and socialism towards the command system; yet because pure forms are rare, most real countries borrow from both and settle somewhere in the middle.

The Master Key: Capitalism is private ownership plus profit; socialism is collective ownership plus welfare. Keep these two labels for the beliefs and the words market and command for the machines they build.

REAL Question 80

Read the account below. Notice who owns the land, and whose orders the factories obey, before you settle on the label it has been hiding all along.

Identify the economic system described below, and justify your answer with two features of the account.

Scenario

In the country of Zamara, the government owns all the land, factories and shops. A planning office in the capital decides each year what will be grown, how many tractors will be built, and what price every good will carry. Private firms are not allowed, and the state gives each citizen a job.

Model Answer

This is a command economy, because the state owns every resource and central planners, not prices, answer all three fundamental questions.

The clue of ownership: the government owns all the land, factories and shops and forbids private firms, which is the hallmark of state rather than private control.

The clue of planning: a central office decides what is grown, what is built and what every price will be, so the plan, not the market, does the allocating.

Put the two clues together and only one label fits. Arrangements very like Zamara's were built in Cuba and survive today in North Korea, and Tanzania itself leaned this way after the 1967 Arusha Declaration, before the plan gave way to the price.

The Master Key: Classify by ownership first and decision-maker second. State ownership plus central planning can only spell command, wherever in the world you find it.

REAL Question 81

Now the mirror image. No ministry gives orders; each owner keeps his stock, and the shelf price decides what a planner would elsewhere. A very different name waits in the details.

Identify the economic system described below, and justify your answer with two features of the account.

Scenario

In Faringa, nearly every farm, factory and bank is owned by private individuals. The government keeps mostly to defence and the courts. What gets produced is decided by what shoppers choose to buy, prices rise and fall freely, and firms compete to earn a profit. No office plans the economy from the centre.

Model Answer

This is a market economy, a capitalist economy, because resources are privately owned and prices, not planners, answer the three fundamental questions.

The clue of ownership: nearly every farm, factory and bank is in private hands and the government keeps to a few basic duties, which points to private rather than state control.

The clue of the price: what is produced follows what shoppers will buy, prices move freely, and firms chase profit, so demand and supply, not a plan, do the deciding.

The account is closest to the United States and the United Kingdom, the leading market-oriented economies; yet because even they keep some government role, they are best called market-oriented rather than purely market, while Tanzania today sits further from Faringa still, keeping a larger state, which is why it is called mixed.

The Master Key: Private ownership plus free prices plus the profit motive spells market. Add the honest footnote that real market economies always keep a little government, so pure is a direction, not a destination.

REAL Question 82

On paper the systems are tidy; the real world is not. Set North Korea beside the United States beside Tanzania, and the neat labels begin to blur at every edge.

Classify the economies of North Korea, the United States and Tanzania, giving one reason for each.

Model Answer

North Korea is a command economy, the United States is a market economy, and Tanzania is a mixed, market-oriented economy, each earning its label from who chiefly answers the three questions.

North Korea: command, because the state owns the means of production and a central plan, not the price, decides what is made and who receives it.

The United States: market (capitalist), because resources are privately owned and free prices and the profit motive, not planners, do most of the deciding.

Tanzania: mixed and market-oriented, because since the reforms of the 1980s and 1990s most enterprise has been private, yet the government still runs much of health, education and some utilities.

So the pure types sit at the ends and most nations, Tanzania among them, live in the mixed middle; classification is therefore less about a perfect fit than about which way a country leans.

The Master Key: When you classify a real country, name the type it leans toward and give the single clearest reason. Most of the world is mixed, so say which side of the mix is heavier.

HOT Question 83

Crown one system the champion of all three questions, and a problem appears: the arrangement that produces most cheaply may feed its people least fairly. Can one winner take every prize?

Evaluate which economic system best answers the three fundamental questions.

Model Answer

No single system answers all three questions best: the market answers what and how most efficiently, but it answers for whom least fairly, which is why most countries settle on a mixed economy.

The market on what and how: free prices signal exactly what buyers want and the profit motive pushes firms toward the cheapest methods, so the market answers the first two questions with great efficiency.

The market on for whom: output goes only to those with the money to pay, so the poor may go without and public goods may not be made at all, which is a weak answer to the third question.

The command mirror: central planning can answer for whom more equally, but without price signals it answers what and how badly, breeding shortages, gluts and waste.

Why the mix wins: a mixed economy lets the market answer what and how while the government corrects the for-whom, so it keeps most of the strengths and softens the worst faults.

On balance, then, the market is the best single answer to what and how, but only a mixed economy answers all three questions tolerably at once, which is exactly why the mixed system is now the most common on earth.

The Master Key: Split the verdict by question, not by system. Once you judge what, how and for whom separately, you see why no pure system wins outright and the mix so often does.

HOT Question 84

A saying holds that no single system fits every country, the way no one crop suits every soil. It sounds like a polite shrug, until you meet the nation it would ruin.

"No single economic system is best for every country." Discuss.

Model Answer

I agree with the claim, because the best system depends on a country's circumstances, so an arrangement that suits one nation at one time may fail another.

Circumstances differ: a poor farming country, a nation industrialising fast, and a wealthy service economy face different problems, and their history, culture and resources differ too, so the ideal balance of market and state differs with them.

Different countries need different fits: a small farming economy leaning on a few export crops, an oil-rich state, and a wealthy industrial nation each require a different balance of market and state, so the arrangement that serves one may misfit another at the very same moment.

The other side: some lessons do seem to travel, above all that markets usually allocate resources better than central plans, yet even granting that, the right amount of government still varies from place to place.

So the claim holds: markets may be broadly useful everywhere, but the precise blend that is best is decided by each country's own conditions, which is why no one system fits all.

The Master Key: Prove best-for-whom by contrast, not by theory. Set a poor farming economy beside a rich industrial one and the case that no single system fits all makes itself.

HOT Question 85

For half a century, market and command economies raced to show which served its people better. Call the market the plain winner, and someone will point at all it left behind.

To what extent is a market economy superior to a command economy?

Model Answer

A market economy is clearly superior in efficiency and choice, but not in equality or stability, so its superiority is real yet partial.

Where the market wins: free prices guide resources to their most valued use, the profit motive rewards effort and innovation, and consumers enjoy wide choice, so the market tends to grow faster and waste less.

Where command was meant to win: central planning aims at greater equality, full employment and the guaranteed provision of public goods, and it can marshal resources swiftly in war or crisis.

The market's own failures: left alone it breeds wide inequality, allows monopoly, under-provides public goods, and swings through booms and slumps, so its record is far from flawless.

What the world actually chose: when centrally planned economies faltered, most turned not to a pure market but to a market-oriented mixed economy, which is evidence that the market is better yet still needs the state.

So to a large extent the market is superior, above all for efficiency and growth, but the verdict stops short of total, because the very countries that abandoned command kept a firm role for government.

The Master Key: Answer to what extent with a measured largely, not a flat yes. The proof is in the choice the world made: market-oriented, but mixed, almost nowhere purely one or the other.

HOT Question 86

Two economies share the same resources and the same frontier of the possible. Both can reach every point on the curve, yet planner and market never choose alike. What pulls them apart?

Using a production possibilities curve, show how a command economy and a market economy might choose different points.

Model Answer

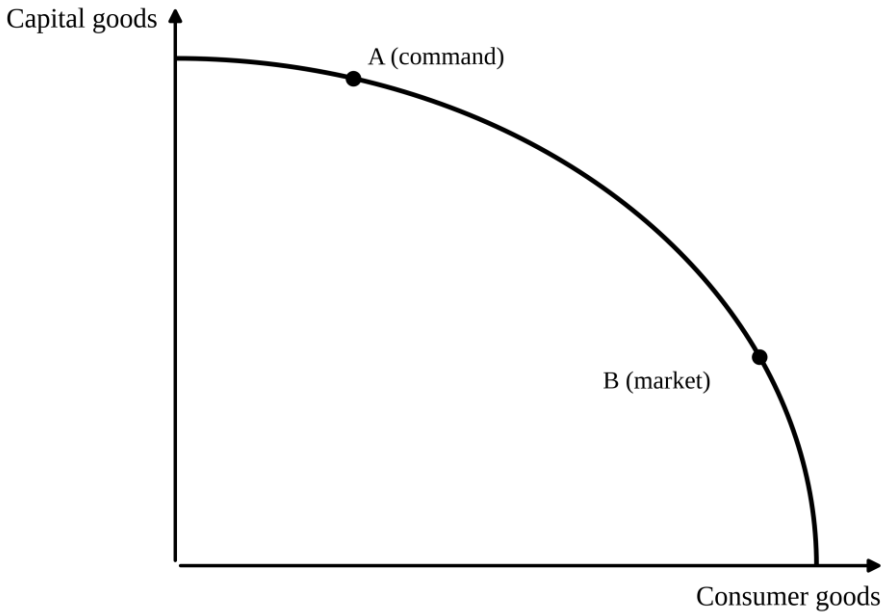


Figure 2.8: A command economy and a market economy choosing different points on the same frontier.

On one and the same production possibilities curve, a command economy and a market economy can sit at different points, because they answer the what-to-produce question with different priorities.

Point A, the command choice: the plan favours capital goods such as heavy machinery and steel over consumer goods, so the command economy chooses point A, high on the capital-goods axis.

Point B, the market choice: consumers' spending pulls resources toward the goods people want to buy, so the market economy chooses point B, further along the consumer-goods axis.

Same frontier, different values: both points lie on the curve, so both can be fully efficient; the systems are not disagreeing about how much can be made, but about what should be made.

The twist in time: because more capital goods today can push the whole curve outward faster tomorrow, the command choice trades present comfort for future capacity, while the market choice does the reverse.

So the curve makes the quarrel visible: command and market can use their resources equally fully and still choose opposite points, because they differ over what to produce, not over how much can be produced. The frontier cannot show the for-whom question, since the sharing of goods among people does not appear on its axes, but the clash over what is plain to see.

The Master Key: Draw the curve once and mark A high for capital goods and B wide for consumer goods. The diagram turns an argument about values into a picture you can point at, which is the surest way to remember it.

The Ujamaa Years: Tanzania Chooses Socialism

When a young nation wins its independence, it must decide not only who will govern but what kind of economy it will build, and in 1967 Tanzania gave its answer at Arusha. This section follows the country's first great transition, from the market-leaning economy it inherited into the state-directed, command system of Ujamaa and kujitegemea. It traces the Arusha Declaration and the nationalisation, parastatals and villagisation that carried socialism into practice, then weighs what the era achieved against what it cost. Read together, these questions explain why Tanzania is so often remembered as a social achievement built on an economic disappointment.

BINDER Question 87

Picture the old village homestead, where kin farm as one and lean on no stranger. From that scene Nyerere drew the two words that would carry Tanzania between economic worlds.

Define a transition period, and explain the terms Ujamaa and kujitegemea.

Model Answer

A transition period is the time during which a country changes from one economic system to another, and Tanzania has lived through two such changes built on the ideas of Ujamaa and kujitegemea.

Transition period: the stretch of years in which an economy is remade from one system into another, so that it carries features of both the old and the new at once.

Ujamaa, a Kiswahili word usually translated as familyhood, was Mwalimu Julius Nyerere's name for a Tanzanian, African form of socialism built on the cooperation of an extended family.

Kujitegemea, meaning self-reliance, was its partner idea: Tanzania should develop through the effort of its own people and its own resources rather than through dependence on foreign money.

Because these two ideas shaped every policy of the era, understanding them is the key that unlocks the whole of Tanzania's first transition.

The Master Key: Ujamaa and kujitegemea are not decorations; they are the engine of the 1967 turn. Define them exactly and the events fall into place.

BINDER Question 88

On the fifth of February 1967, in the northern town of Arusha, Nyerere's party set its name to a document that pointed the whole nation down a new road.

Describe what the Arusha Declaration of 1967 committed Tanzania to.

Model Answer

The Arusha Declaration, issued on the fifth of February 1967 by the ruling party TANU under President Nyerere, committed Tanzania to socialism and self-reliance.

Socialism: the state would take ownership and control of the major means of production, the banks, the large industries and the plantations, in the interest of the whole society rather than of private owners.

Self-reliance: the country would build its development on its own land, labour and effort, especially in agriculture, rather than lean on foreign aid and investment.

A change of system: together these turned Tanzania away from the private, market-leaning economy it had inherited and toward a state-directed, command path.

So the Declaration was not merely a speech but a decision to change the economic system itself, placing the state at the centre of the economy.

The Master Key: Anchor the whole chapter's Tanzanian content to one date, 1967, and one document, the Arusha Declaration; every later event is measured from it.

BINDER Question 89

The morning after the words were signed, a Dar es Salaam bank opened as always, yet it belonged now not to private owners but to the whole nation.

Explain nationalisation and the creation of parastatals in Tanzania after the Arusha Declaration.

Model Answer

After the Arusha Declaration the government carried socialism into practice by nationalising private businesses and running them as parastatals, that is, state-owned enterprises.

Nationalisation: the state took over private firms into public ownership, including the commercial banks, which were merged into the single National Bank of Commerce, along with insurance, major industries and the large sisal and other plantations.

Parastatals: these nationalised firms, together with new state corporations, were run as parastatals, owned by the government and directed to serve national goals rather than private profit.

Because ownership of the commanding heights now passed to the state, the government, and not the market, came to decide what was produced and how, which is the mark of a command economy.

The Master Key: Nationalisation is the how of Tanzanian socialism. When you see banks, industries and plantations pass to the state, you are watching a market economy being turned into a command one.

BINDER Question 90

Across the Tanzanian countryside families had always lived scattered, each on its own plot. Then lorries arrived to gather them into planned villages, sometimes whether they wished it or not.

Describe the villagisation programme of the Ujamaa years and its aims.

Model Answer

Villagisation was the policy of moving Tanzania's scattered rural families into planned communal villages, and in its compulsory phase, known as Operation Vijiji between about 1973 and 1976, several million people were resettled.

What was done: rural households were gathered from scattered homesteads into organised Ujamaa villages, and in the mid-1970s this became largely compulsory, moving on the order of five million people.

Why it was done: bringing people together was meant to make it possible to farm cooperatively and to deliver schools, clinics and clean water efficiently to a once-scattered population.

So villagisation was the rural face of Ujamaa, an attempt to build cooperative, self-reliant communities, though its compulsion and haste would later count among its heaviest costs.

The Master Key: Villagisation shows a good aim, delivering services, pursued by a coercive means, forced movement. Holding both halves in view is what a fair account requires.

REAL Question 91

Lay the Arusha Declaration beside the economy Tanzania inherited at independence, read it line by line, and a quiet revolution in who decides comes into view.

Using the Arusha Declaration, explain how Tanzania's economic system changed after 1967.

Model Answer

After 1967 Tanzania moved from an inherited, market-leaning economy toward a centrally planned, command economy directed by the state.

Ownership shifted to the state: with the banks, industries and plantations nationalised, the major means of production were now publicly owned, as a command system requires.

Decisions shifted to the plan: the government, through its parastatals and development plans, increasingly decided what to produce and at what price, so market forces gave way to state direction.

The motive shifted to social welfare: production was meant to serve the equality and self-reliance of the nation rather than the private profit of owners.

So the Declaration did not simply adjust the old economy; it changed its very type, carrying Tanzania across the line from a market-leaning system into a command one.

The Master Key: To prove a system has changed, track the same three things every time, ownership, decision-making and motive. When all three move together, the system itself has moved.

REAL Question 92

Nyerere had watched colonial rule leave a few rich and the many poor, foreign firms owning the wealth. The Ujamaa he now chose was built to undo exactly that.

Explain the aims of the Ujamaa policy, that is, why Tanzania chose socialism and self-reliance.

Model Answer

Tanzania chose Ujamaa in order to build an equal, united and independent nation on its own terms, rather than to repeat the inequalities of a colonial, market economy.

Equality: Nyerere wished to avoid a society split into a rich few and a poor many, so common ownership was meant to spread the fruits of development widely.

Self-reliance: having just won independence, the country wanted to develop through its own resources and effort, especially in farming, rather than depend on foreign powers.

Unity and social services: pooling effort was meant to knit a young nation of many peoples together and to fund schooling, health care and clean water for all.

So the policy grew from the hopes of a newly independent country, and it is only fair to judge its results against the goals it set itself.

The Master Key: Judge a policy first by its aims and then by its results. Ujamaa's aims, equality, independence and unity, are the yardstick its outcomes must be measured against.

REAL Question 93

A child in a remote village reads in Swahili, the one tongue shared across every region, under a school roof that stood nowhere ten years before. Ujamaa left traces like these.

Explain the main achievements of the Ujamaa years.

Model Answer

The Ujamaa years brought real gains in social services, national unity and relative equality, even as the economy struggled.

A leap in education and literacy: primary schooling was greatly expanded and a mass adult-literacy drive lifted the ability to read and write to among the highest levels in Africa at the time.

Wider health and water provision: rural clinics and water supplies reached communities that a purely private market would have passed over.

Unity and relative equality: a shared national language in Kiswahili and a leadership code that limited private wealth helped hold a diverse nation together and kept inequality low.

So whatever its economic troubles, the era left Tanzania more literate, more united and more equal, achievements that outlasted the policy itself.

The Master Key: An economy can fail on output yet succeed on welfare. Keep the two ledgers separate, and the Ujamaa record reads far more fairly.

REAL Question 94

By the late 1970s a Dar es Salaam shop's shelves stood half empty, and queues formed for sugar and cooking oil. Behind the shortages, an economy was quietly breaking down.

Explain the main economic failures and problems of the Ujamaa years.

Model Answer

The Ujamaa economy struggled with falling production, inefficient state firms and mounting shortages, so that living standards came under severe strain.

Falling farm output: the disruption of forced villagisation and low state-set prices for crops discouraged farmers, so food and export production stagnated or fell.

Inefficient parastatals: many state enterprises, shielded from competition and the profit test, ran at a loss and became a drain on the budget rather than a source of wealth.

Shortages and dependence: with production weak and no price mechanism to clear markets, goods grew scarce, queues lengthened, and the country came to rely on the foreign aid that self-reliance had meant to avoid.

So the very features of a command economy, state ownership, planning and fixed prices, produced in Tanzania the very weaknesses the theory predicts, and by the early 1980s the strain had become a crisis.

The Master Key: Notice how Tanzania's experience matches the textbook disadvantages of command almost point for point. Real history is the theory of this chapter come to life.

HOT Question 95

Some remember the Arusha Declaration as Tanzania's noblest hour, others as the wrong turn that emptied its shelves. Judge it by what 1967 knew, not only by what followed.

"The Arusha Declaration was the right choice for Tanzania in 1967." To what extent do you agree?

Model Answer

The Declaration was a defensible and even noble choice given the hopes of 1967, though its economic results suggest the means it chose were flawed.

The case that it was right: a newly independent nation had good reason to fear inequality and foreign domination, and Ujamaa delivered genuine gains in unity, literacy and equality that few doubt.

The case that it was mistaken: the command methods it relied on, nationalisation, planning and forced villagisation, sapped production and bred shortages, so the economic price of those social gains was heavy.

So I agree that the aims were right for Tanzania in 1967, while judging that the command means chosen to reach them proved costly; a fair verdict praises the vision and questions the method.

The Master Key: On a to-what-extent question, split the claim in two. Here the aims and the means deserve different verdicts, and saying so is what lifts an answer above a flat yes or no.

HOT Question 96

Ujamaa is often weighed on two scales at once: on the economic one it is said to have failed, on the social one to have triumphed. Can both verdicts stand together?

Evaluate the view that Ujamaa failed economically but succeeded socially.

Model Answer

The view captures the Ujamaa record well, because the era's social gains were real and lasting while its economic performance was genuinely poor.

The social success: the surge in literacy and schooling, the spread of rural health and water, national unity and low inequality are achievements that survived the policy and shaped modern Tanzania.

The economic failure: falling farm output, loss-making parastatals, chronic shortages and growing dependence on aid show an economy that did not deliver rising living standards.

The one qualification: the two are linked, since the weak economy eventually threatened even the social gains it was funding, so the success was real but not secure.

So the verdict is largely just: Ujamaa is best remembered as a social achievement built on an economic disappointment, which is why Tanzania kept the schools and clinics even as it abandoned the command economy.

The Master Key: The neatest summary of an era is often a balanced one. Ujamaa failed on output and succeeded on welfare, and holding both truths at once is the mark of real understanding.

From Crisis to the Market: Tanzania's Transition and Today

Every command economy that reaches too far eventually meets a reckoning, and Tanzania's came in the early 1980s, when a run of external shocks struck an economy the state had left with no cushion. This closing section follows the country out of that crisis, through the failed home-grown fixes, the decisive Economic Recovery Programme of 1986 under President Mwinyi, and the liberalisation and privatisation that remade the 1990s. It traces the whole arc, from the market economy inherited at independence, into the socialism of the Arusha Declaration, through collapse, and back out toward the market. What waits at the end of the road is the Tanzania of today, a mixed, market-oriented economy in which a private sector leads while the state still owns, provides and regulates. Master this and the long journey of the earlier sections arrives, at last, in the present.

BINDER Question 97

By the early 1980s a shopper in Dar could queue all morning and still find the shelves bare of sugar, soap and cooking oil. Something had broken.

Explain the main causes of Tanzania's economic crisis of the late 1970s and 1980s.

Model Answer

By the early 1980s Tanzania faced a deep economic crisis brought on by a run of external shocks striking an already weak, state-run economy.

The war with Uganda: the costly 1978 to 1979 war against Idi Amin's forces, the Kagera war, drained resources the country could ill afford.

The break-up of the East African Community: the collapse of the regional Community in 1977 cost Tanzania shared services and markets.

Oil shocks and drought: sharp rises in world oil prices raised the import bill, while drought cut the harvests of a farming economy.

Falling export prices and weak output: the world prices of Tanzania's exports fell, and loss-making parastatals and stagnant farms left too little to sell, so foreign exchange ran short and shortages spread.

So the crisis was not one blow but several at once, and because the command economy had left the country with little cushion, the shocks pushed it toward collapse.

The Master Key: Group the causes into external shocks and internal weakness. The shocks lit the fire, but it was the weak, state-run economy that let it spread.

BINDER Question 98

Twice Nyerere tried to mend the economy with plans of his own making, and twice it slipped further. The third attempt, in 1986, bore a different signature.

Describe the reform programmes Tanzania adopted from the early 1980s, and note who launched them.

Model Answer

Tanzania answered the crisis with three successive reform programmes, moving from home-grown efforts under Nyerere to a fuller market turn under Mwinyi.

The National Economic Survival Programme, 1981: a first, home-grown attempt under President Nyerere to boost exports and cut imports, which proved too limited to reverse the decline.

The Structural Adjustment Programme, 1982: a second, still home-grown programme of adjustment, again under Nyerere, which likewise fell short without outside finance.

The Economic Recovery Programme, 1986: launched by the new President Ali Hassan Mwinyi, who reopened talks with the International Monetary Fund and the World Bank, this was the decisive turn toward the market, backed by foreign loans.

So the reforms escalated as the crisis deepened, and it was the 1986 Recovery Programme, under a new president and with international backing, that truly began Tanzania's return to a market-oriented economy.

The Master Key: Keep the three straight by author and date: NESP 1981 and SAP 1982 under Nyerere, home-grown; the Economic Recovery Programme 1986 under Mwinyi, with the IMF. The turning point is 1986.

BINDER Question 99

From the flag raised at independence in 1961 to the crowded private markets of today, Tanzania's economy travelled a road marked by more than one sharp turn.

Using a timeline, trace Tanzania's economic transition from independence to today.

Model Answer

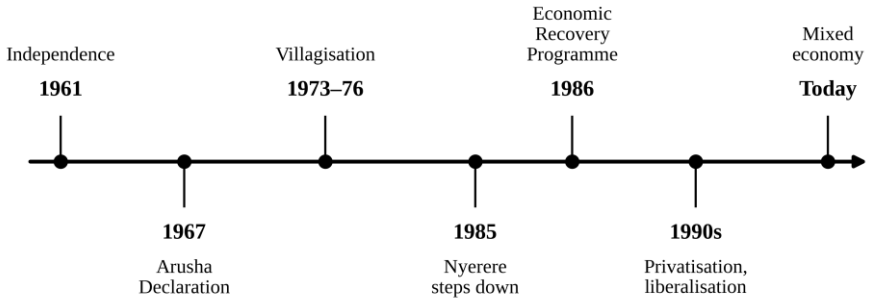


Figure 2.9: Tanzania's economic journey, from independence to a mixed economy.

Tanzania's economic history runs in a great arc, from an inherited market-leaning economy, into socialism, through crisis, and back out to a market-oriented mixed economy.

1961 to 1967: at independence the country inherited a private, market-leaning economy, until the Arusha Declaration of 1967 turned it toward socialism.

1967 to the early 1980s: the command era of nationalisation and villagisation gave way, under external shocks, to deep economic crisis.

1986 onward: the Economic Recovery Programme opened the market turn, followed through the 1990s by liberalisation and privatisation.

Today: Tanzania is a mixed, market-oriented economy, led by the private sector but with a continuing role for the state.

So the timeline is not a straight line but a loop: the country left the market in 1967 and, by a hard road, returned to it from the mid-1980s.

The Master Key: A timeline turns a tangle of dates into a shape. Learn the arc, market to command to crisis to market, and the individual years hang on it naturally.

REAL Question 100

When the state loosened its grip in the mid-1980s, the price of a kilo of rice was suddenly set by the market, not by a government office. That was only the start.

Explain the main measures of economic liberalisation adopted in Tanzania from the mid-1980s.

Model Answer

Liberalisation meant lifting the state's controls and letting market forces work, through a cluster of connected measures.

Devaluing the shilling: the heavily overvalued currency was devalued toward a market rate, making exports competitive again and ending an artificial price on foreign exchange.

Freeing trade and imports: schemes that let traders import using their own foreign exchange, and the later removal of import licensing, opened the economy to goods that had long been scarce.

Removing price controls and subsidies: the state stopped fixing many prices and cut subsidies, so demand and supply, not officials, increasingly set prices.

Dismantling marketing monopolies: the state marketing boards that had monopolised crop buying were opened to private traders, giving farmers competing buyers.

So liberalisation did not privatise ownership so much as free the price mechanism, letting prices, trade and competition do the work that planning had done before.

The Master Key: Liberalisation is about controls, not ownership. Devaluation, free trade and free prices are its signature, and they are the price mechanism being switched back on.

REAL Question 101

After the Arusha Declaration the state seized the country's factories; a generation later it began handing them back. Two opposite moves, and a third word is mistaken for both.

Explain privatisation in Tanzania, and distinguish it from nationalisation and liberalisation.

Model Answer

Privatisation is the transfer of state-owned enterprises into private hands, and in Tanzania it was carried out from the early 1990s to undo the nationalisations of the Ujamaa era.

What Tanzania did: from 1992 a Parastatal Sector Reform Commission was set up to sell or restructure the loss-making parastatals, and through the 1990s many state firms passed to private owners.

Privatisation versus nationalisation: privatisation moves firms from the state to private owners, while nationalisation moves them the opposite way, from private owners to the state, so the two are mirror images.

Privatisation versus liberalisation: privatisation changes who owns a firm, whereas liberalisation removes controls on prices and trade; a country can do either without the other.

So privatisation was the ownership half of Tanzania's market turn, reversing 1967, while liberalisation was the controls half, and together they remade the economy.

The Master Key: Three transition words, three precise meanings: nationalise, take into state hands; privatise, sell to private hands; liberalise, remove controls. Keep them apart and the whole transition reads clearly.

REAL Question 102

For nearly twenty years the state had run the shops, the farms and the factories, and run them into the ground. By 1986 the lenders at the door forced a hard admission.

Explain why Tanzania abandoned the command economy and moved toward the market.

Model Answer

Tanzania abandoned the command economy because it had failed to deliver, and by the mid-1980s both hard experience and outside pressure pointed to the market.

The command economy had underperformed: years of falling output, loss-making parastatals, chronic shortages and dependence on aid showed that state direction was not producing prosperity.

The crisis forced a choice: with the economy near collapse, the country needed foreign finance, and the International Monetary Fund and World Bank offered it only in return for market reforms.

A change of leadership eased the turn: the retirement of Nyerere in 1985 and the arrival of President Mwinyi allowed a decisive break with the old policy in the 1986 Recovery Programme.

So the move was driven by necessity as much as by conviction: the command path had reached a dead end, and the market offered the only way forward the moment allowed.

The Master Key: Big system changes rarely spring from theory alone; they are forced by failure and circumstance. Tanzania left command because command had stopped working, not merely because ideas had changed.

REAL Question 103

Today a private bus company, a state-owned railway and a government hospital all serve the same Dar commuter. No single hand runs this economy.

Describe Tanzania's economy today, and explain why it is best called a mixed economy.

Model Answer

Tanzania today is a mixed, market-oriented economy, in which a private sector leads but the government still owns, provides and regulates a great deal.

A private-led market: most production, trade and prices are now in private hands and set by demand and supply, the legacy of liberalisation and privatisation.

A continuing state: the government still provides public and merit goods such as roads, schooling and health care, runs utilities such as the electricity supplier TANESCO, and regulates the economy.

The two are woven together: public and private meet in the same sectors, as when private clinics and schools run alongside government ones, and public-private partnerships deliver roads and services the state could not fund alone.

Because neither the market nor the state governs alone, but the two work side by side, Tanzania sits squarely in the mixed category, like most countries in the world today.

The Master Key: Modern Tanzania is the mixed economy of this chapter made concrete. When you need a real example of a mixed system, you need look no further than home.

REAL Question 104

The account below sets private stalls and public offices in the same street. Read it, weigh the clues, then say which kind of economy stands before you.

Read the description, then classify the economy and justify your answer.

> **A morning in Dar es Salaam**
>
> A visitor passes private shops, banks and mobile-money stalls trading freely at market prices. She then boards a rapid-transit bus whose route and stations are owned by a public agency but whose buses are run by a private company, and reads that the state still supplies most of the city's electricity.

Model Answer

This is a mixed economy, because private enterprise and public activity plainly operate side by side.

The market side: private shops, banks and traders setting their own prices show a living private sector coordinated by the price mechanism.

The state side: public ownership of the transit system's infrastructure and of much of the electricity supply shows the government still active in the economy.

The blend: the bus service itself, publicly owned yet privately operated, is a partnership of the two, the very signature of a mixed system.

So the scene contains both halves of the definition at once, private prices and public provision, which is why the economy can only be called mixed.

The Master Key: Classify by evidence, not by label. When a scene shows both private prices and public provision working together, name it mixed and point to each half.

HOT Question 105

Some mourn Nyerere's Ujamaa as a noble dream betrayed; others call its abandonment plain common sense. A failed ideal can still leave the country poorer for losing it.

"Tanzania was right to abandon Ujamaa and embrace the market." To what extent do you agree?

Model Answer

On balance Tanzania was right to turn to the market, since the command economy had failed, though the change brought real costs that qualify the verdict.

The case that it was right: liberalisation ended the chronic shortages, refilled the shops, restored growth and drew in investment, so the market delivered what the command economy could not.

The case for caution: the reforms also brought job losses as parastatals were sold, fees for once-free services, and widening inequality, so the gains were unevenly shared and some Tanzanians lost out.

So I agree that the turn was right in its main direction, because the old system had reached a dead end, while insisting that its human costs were real and that managing them was as important as making the change.

The Master Key: Approving a direction is not the same as approving everything done in its name. Back the market turn and still name its costs; that is a judgement, not a cheer.

HOT Question 106

The reforms put sugar back on the shelf, but they also put a fee on the school desk and the clinic bed. For an ordinary family, was the bargain worth it?

Assess the costs and benefits of the structural adjustment and liberalisation reforms for ordinary Tanzanians.

Model Answer

For ordinary Tanzanians the reforms were a mixture: they ended shortages and revived growth, but they also brought hardship through cuts, fees and lost jobs.

The benefits: goods returned to the shelves, farmers gained competing buyers and better prices for their crops, and the wider economy began to grow again after years of decline.

The costs: cuts in state spending brought charges for health care and schooling that had once been free, the sale of parastatals cost many their jobs, and the gap between rich and poor widened.

So the reforms cannot be scored simply good or bad for ordinary people; they lifted the economy as a whole while pressing hard on the poorest, which is exactly why economists judge that such reforms must be paired with protection for the vulnerable.

The Master Key: Reforms rarely help everyone equally. Separate the gain to the economy from the pain to particular groups, and you can praise and criticise the same policy without contradiction.

HOT Question 107

Tanzania clung to the command economy well into the 1980s, then let it go. Does one country's surrender prove that every country must eventually yield?

"Tanzania's journey shows that no country can stay outside the market for long." How far do you agree?

Model Answer

Tanzania's journey lends real support to the claim, though it is a lesson about the limits of pure command rather than a law that the market must rule everything.

The support for the claim: Tanzania tried in earnest to build an economy without the market and found it could not sustain output, avoid shortages or fund its own ambitions, so in the end it returned to the market, as most command economies eventually did.

The qualification: what Tanzania embraced was not a pure market but a mixed economy, keeping a large role for the state in schooling, health and infrastructure, so the lesson is that ignoring the market fails, not that the state should withdraw.

So I largely agree: a country may lean away from the market for a time, but Tanzania's experience suggests it cannot abandon the price mechanism altogether without paying a heavy price, which is why the balanced mixed economy has proved so durable.

The Master Key: The deepest lesson of this chapter is written in Tanzania's own history: pure systems strain and break, and economies settle, in the end, on a blend. That is where the whole story has been leading.

Allocation, Distribution, Efficiency and Equity

Every economy must do two jobs with its scarce resources: allocate them, deciding what they are used for, and distribute what results, deciding who receives it. How well it does them is judged by two tests that do not always agree, namely efficiency, getting the most from what there is, and equity, sharing it fairly. This closing section sets those tests side by side: it separates allocative efficiency from productive efficiency, prises equity apart from equality, and asks whose wishes finally rule, the consumer's or the producer's. It ends where every real government lives, at the trade-off between a bigger cake and a fairer slice, and at the mixed economy's attempt to hold some of each.

BINDER Question 108

First a nation decides what its fields and factories will make; then, who walks away with the output. Two jobs, and four systems that trust them to very different hands.

Describe how each of the four economic systems allocates its resources and distributes its output.

Model Answer

Each economic system must both allocate resources, deciding what they are used for, and distribute output, deciding who receives it, but the four systems trust these two jobs to very different hands.

Economic system	How resources are allocated	How output is distributed
Traditional	By custom and inheritance	By kinship and social role
Command	By the central plan	By the state, aiming at fairness
Market	By prices and the profit motive	By what one's resources earn
Mixed	Mainly by prices, then state correction	By the market, reshaped by the state

Read the table down and a pattern appears: as you move from traditional to command to market, the decider changes from custom to the state to the price, while the mixed economy deliberately splits the work between the market and the state.

The Master Key: Hold allocation and distribution side by side for each system. A system's whole character is just its pair of answers to who decides the use and who receives the fruit.

BINDER Question 109

Push a coin across a counter and you cast a vote for what gets made next. In another economy that vote is never counted; the maker has already decided.

Distinguish between consumer sovereignty and producer sovereignty, and state which prevails in a market economy and which in a command economy.

Model Answer

Consumer sovereignty and producer sovereignty are rival answers to one question, namely whose wishes finally decide what an economy produces, the buyer's or the maker's.

Consumer sovereignty means the consumer is in charge: by choosing what to spend their money on, buyers direct firms on what to make, so production bends to follow demand.

Producer sovereignty means the producer is in charge: a state planner or a dominant firm decides what shall be made, and consumers must largely take what they are offered.

In a market economy consumer sovereignty dominates, because a firm that ignores its buyers earns no revenue and soon closes; in a command economy producer sovereignty dominates, because the central plan, not the shopper, settles what reaches the shelves.

The Master Key: Settle it with one question: who has the last word, the buyer or the maker? In the market it is the buyer, so demand leads; under command it is the maker, so the plan leads.

BINDER Question 110

A workshop may plane each chair until not a splinter is wasted, then find it has made chairs nobody wants. Efficiency, it turns out, asks two questions.

Explain what economists mean by an efficient outcome, distinguishing allocative efficiency from productive efficiency.

Model Answer

An efficient outcome is one in which scarce resources are put to their most valued use with nothing wasted, so no extra want could be met by using the same resources differently.

Allocative efficiency: the economy produces the very goods and services people most want, so resources are not tied up making things nobody values while wanted goods run short.

Productive efficiency: each good is made at the lowest possible cost, using the fewest resources per unit, so no material or effort is thrown away in the making.

Put the two together and the idea is complete: an efficient economy makes the right things, which is allocative efficiency, in the right way, which is productive efficiency, so the greatest possible want is satisfied from a fixed stock of resources.

The Master Key: Carry efficiency as two demands, not one: the right goods, made at least cost. Fail either and resources are being wasted, however busy the economy looks.

BINDER Question 111

Two labourers split a day's wage. Should each take an equal half, or the one who dug while the other rested take more? Fair and equal part ways here.

Explain what is meant by an equitable outcome, and distinguish equity from equality.

Model Answer

An equitable outcome is one in which income and output are shared in a way judged to be fair; but fair is not the same as equal, and that distinction is the whole of the idea.

Equity is fairness: it asks whether the division of income and goods among people is just, which is a value judgement, so it can be reasoned over and disagreed about, not read off like a length.

Equality is sameness: it asks only whether the shares are the same size, a plain fact you can measure, whether or not that sameness happens to be fair.

Fair need not mean equal: most people judge it fair that the worker who trains longer or toils harder should earn more, so an equitable share can be a deliberately unequal one.

So equity always carries a judgement about what people deserve or need, while equality is mere arithmetic; a perfectly equal distribution can still strike almost everyone as unfair, and an unequal one can be widely accepted as just.

The Master Key: Never swap the two words as if they were one. Equality is measured; equity is judged. Every quarrel about fairness lives in the gap between them.

REAL Question 112

Coffee fetches a higher price at a Kilimanjaro auction. No one gives an order, yet land and labour begin drifting toward the crop. Elsewhere, a planner would have to command it.

Using a rising price of coffee at a Kilimanjaro auction, show how a market economy reallocates land and labour, and contrast this with how a command economy would do the same.

A Kilimanjaro coffee auction, one season

A shortfall in the world's coffee crop sends buyers scrambling, and the price paid for Kilimanjaro coffee at auction climbs steeply.

Farmers on the mountain slopes must now decide what their land and labour will do in the season ahead.

Model Answer

In a market economy the rising coffee price does the reallocating by itself, drawing land and labour into coffee, while a command economy would reach the same shift only when a planner ordered it.

The market signals through price: the higher price lifts the profit from growing coffee, so Kilimanjaro farmers turn more of their slopes over to coffee and hire extra labour to tend and pick it, because the price now rewards them for doing exactly that.

Resources follow the reward: as land and workers shift into coffee, more coffee is grown, which is precisely the good that buyers signalled they wanted through the higher price, so resources end up in their most valued use.

The command alternative: under central planning the same move waits on the plan, because a ministry must first notice the shortage, decide to grow more coffee, and then direct land and labour into it by order rather than by price.

So the market reallocates quietly and quickly, each farmer chasing a higher price, while the command economy must first gather the information that a price carries automatically and then issue its instructions; the destination may be the same, but the market arrives without a planner.

The Master Key: Watch one price do a planner's whole day of work. On the Kilimanjaro slopes the coffee price gathers the news, weighs it and moves the resources, all at once and all on its own.

REAL Question 113

A clinic opens where the paying patients are, so a busy town gets three and a far Kigoma village gets none. The market calls that efficient. The village has another word.

Using health care and schooling in Tanzania's remote regions, explain why the market alone may give an outcome that is efficient yet inequitable, and how government provision changes it.

Model Answer

Left to the market alone, health care and schooling flow to wherever they pay, so a remote village in the Kigoma region is under-served, and the result can be efficient in the market's own narrow terms yet plainly inequitable; correcting this is exactly what government provision is for.

Why the market under-serves the remote: incomes in a far village are low, so a private clinic or school there earns little, while the same doctor or teacher earns more in a town, so market resources drain towards the town and leave the village bare.

Efficient yet inequitable: sending the doctor where she is paid most is efficient only in the narrow sense that resources chase their highest market value, but it is inequitable, because the child in Kigoma has the same need as the child in the city and still goes without.

How government provision changes it: the government builds a dispensary and a primary school in the village and funds them from taxes, so provision now follows need rather than ability to pay, pulling the outcome back towards equity.

The correction carries a cost, because public provision must be paid for by taxing the productive and may run less tightly than a profit-seeking firm, so some efficiency is surrendered to buy fairness; a mixed economy accepts that trade, judging a schooled and healthy citizen in Kigoma well worth the price.

The Master Key: The market asks who can pay; a fair society also asks who is in need. Public schooling and health care in remote Tanzania are that second question, answered from the public purse.

HOT Question 114

They say you cannot feed the hungry without slowing the mill: every shilling toward fairness is a shilling lost to output. Everything turns on whether "always" holds.

"Efficiency and equity are always in conflict." Discuss.

Model Answer

The claim holds often but not always: efficiency and equity frequently pull against each other, yet the word "always" claims too much.

The case for conflict: pursuing equity often costs efficiency, because taxing high earners to fund help for the poor can blunt the incentive to work and invest, so the cake may shrink even as it is shared more evenly.

Conflict runs the other way too: chasing pure efficiency can worsen equity, because a market that rewards only what pays will let the weak go without, as the untended village earlier showed.

Where the two agree: sometimes they move together, because schooling a poor child or treating a sick worker is both fairer and more efficient, turning a dependant into a productive citizen, so "always" cannot be right.

So the tension is real and common, and every government feels it, but it is not a law without exception; well chosen policies can serve fairness and efficiency at once, which is why "always" overstates a genuine truth.

The Master Key: Grant the conflict, then hunt the exception. The strongest answer accepts the usual trade-off and then names the cases, like educating the poor, where fairness and efficiency truly march together.

HOT Question 115

The mixed economy is sold as the best of both worlds, the market's drive married to the state's fairness. But no marriage gives everything; how much of each survives?

To what extent can a mixed economy achieve both efficiency and equity?

Model Answer

A mixed economy is the system best placed to secure both, because it keeps the market's efficiency while using government to buy equity; but securing both in full is beyond it, and the balance it strikes is always a compromise.

How it reaches for efficiency: it leaves most production to the market, so prices, competition and the profit motive still push resources towards their most valued use and firms towards their lowest costs.

How it reaches for equity: the government then corrects the market, taxing higher incomes and funding schooling, health care and support for the poor, so the distribution is made fairer than the market alone would leave it.

Why both in full is out of reach: the very taxes and spending that buy equity can dull incentives and raise costs, so pressing equity too hard costs efficiency, and every mixed economy must choose how far to push.

So the honest answer is, to a large extent but never completely: a mixed economy can capture much of the market's efficiency and much of the command economy's fairness, yet the harder it presses one the more it strains the other, so the balance, set by how far the government intervenes, is a matter of judgement rather than a solved sum.

The Master Key: The mixed economy does not abolish the trade-off; it manages it. How much efficiency to trade for how much equity is exactly the choice a government makes when it decides how far to intervene.

HOT Question 116

Better a small harvest fairly shared than a great one grabbed by a few, they say. Yet a famine split with perfect fairness still feeds no one. Which matters more?

"A fair distribution matters more than an efficient one." How far do you agree?

Model Answer

I agree only in part: fairness matters deeply, and a rich but grossly unjust economy is no true success; yet fairness cannot simply outrank efficiency, because without efficiency there is far less to share.

The case for putting fairness first: an economy exists to serve its people, so a distribution that leaves many in poverty while a few hold plenty fails its purpose, however efficiently it produces; fairness is what gives the output its point.

Why efficiency cannot be dismissed: there is little to share fairly if little is made, because an inefficient economy bakes a smaller cake, so its poor may end up worse off than the poor of a richer, less equal one.

The two lean on each other: efficiency creates the wealth that fairness shares out, and fairness, by schooling and healing the people, helps create that wealth, so ranking one flatly above the other misreads how they work.

So I agree that fairness must never be sacrificed wholesale to efficiency, because a just society is the point of the exercise; but I cannot agree that it simply matters more, because without efficiency there is too little to distribute, and the wise aim is enough of both rather than all of one.

The Master Key: Refuse the false choice. Fairness gives the economy its purpose and efficiency gives it the means, so an answer that crowns one and discards the other has missed how deeply the two need each other.

The Systems Clinic and Whole-Chapter Capstone

The ideas of this chapter are easiest to lose at the very points where they sit closest together, so this closing section works as a clinic. It takes the pairs most often blurred, namely command against mixed, socialism against communism, and market failure against government failure, and draws the one clean line that keeps each apart. It then turns the whole chapter loose on real cases and open verdicts: identifying the system behind a disguised description, judging Tanzania's turn from planning to the market, and weighing how far prices, or the state, should be trusted to answer the three questions. Here the separate topics stop being separate and become a single argument about how a country should be run.

BINDER Question 117

Three pairs of terms get mistaken for one another daily, like twins who share one face; yet each pair splits along a single clean line, once you find it.

Distinguish clearly between each of the following pairs: a command economy and a mixed economy; socialism and communism; and market failure and government failure.

Model Answer

Each of these pairs is confused because the two terms share a theme, yet in every case one clean line keeps them apart.

A command economy is one where the state owns the resources and a central plan answers all three questions, so private enterprise and freely moving prices are largely shut out.

A mixed economy lets the market and the state share the answering, so private firms and free prices run alongside public services and regulation; every working economy today, Tanzania included, is of this kind.

Socialism is a practised system in which the major means of production are collectively or state owned and output is steered toward social need, yet wages, money and a state all remain.

Communism is the theoretical end-stage beyond socialism in which class and the state itself wither away and goods are shared "to each according to need", a condition no country has ever actually reached.

Market failure is where the market, left to itself, allocates resources badly, by under-providing public and merit goods, ignoring externalities such as pollution, or letting monopoly and inequality grow, so society does not get the outcome it wants.

Government failure is the mirror danger, where the state's own attempt to correct the market leaves things worse, through poor information, slow decisions, waste or corruption, as an over-extended plan or a clumsy price control can show.

Hold the three dividing lines together: command against mixed is how much room the market is given; socialism against communism is a system practised against an end-state only imagined; market failure against government failure is the market getting the answer wrong against the state getting its cure wrong.

The Master Key: When two terms blur, do not recite two definitions, name the one line between them. A single clean cut remembers better than two loose descriptions.

BINDER Question 118

A Tanzanian bank passed into state hands in 1967, then back toward private owners a generation later, while a third reform changed neither owner, only the rules. Three words, three directions.

Distinguish between nationalisation, privatisation and liberalisation.

Model Answer

These three describe changes to an economy, but they move in different directions: nationalisation hands activity to the state, privatisation hands it back to private owners, and liberalisation frees it from control altogether.

Nationalisation is the transfer of privately owned firms or industries into state ownership, as Tanzania did after the 1967 Arusha Declaration when the banks and major industries were taken into public hands.

Privatisation is the reverse, the sale or transfer of state-owned enterprises to private owners, as Tanzania did from the 1990s when many loss-making parastatals were sold off.

Liberalisation is different again, the removal of controls and restrictions so that markets and prices can operate more freely, as when Tanzania lifted price controls and opened up trade in the reforms from the mid-1980s.

So ownership is the axis of the first two, state against private, while liberalisation is about control rather than ownership; a government can liberalise prices without selling a single firm, and can privatise a firm yet still regulate it tightly.

The Master Key: Sort them by the question they answer: nationalise and privatise both ask who owns it, while liberalise asks who controls it. Ownership and control are not the same lever.

REAL Question 119

In Kaskazi the state is everywhere you look, its offices and officials impossible to miss; yet the label that truly fits an economy is seldom the one shouting loudest.

Study the description below, then identify the economic system it operates and justify your answer.

The Republic of Kaskazi

The government of Kaskazi owns the electricity company, the railway and the main airline, and it fixes the price of the maize that feeds the towns. A state marketing board buys the country's main export crop from farmers, officials draw up a five-year development plan, and large parastatals dominate the ports and the power supply.

Yet most farms are privately owned and farmers sell their vegetables freely in open markets. Thousands of private shops, buses and workshops trade for profit, a stock exchange lists private companies, and foreign firms invest in mining. Prices for most goods rise and fall with supply and demand.

Model Answer

Kaskazi is a mixed economy, not a command economy, because although the state has a large and visible presence, private ownership and free prices decide most of what happens.

The command features are real but partial: the state owns some big utilities, plans development and fixes the price of one staple, which is why the country looks centrally run at first glance.

The market is doing most of the work: privately owned farms, shops, buses and workshops trade for profit, a stock exchange lists private firms, foreign capital flows into mining, and most prices move with supply and demand, none of which a true command economy would permit.

The two coexist: because the plan and the parastatals sit alongside private property and free markets, the answering of the three questions is shared, which is the defining mark of a mixed economy.

This is exactly Tanzania's own position today: since the reforms from the mid-1980s the state has kept a strong hand in power, ports and some crops through bodies like TANESCO and the marketing boards, while private traders, daladala buses and the Dar es Salaam Stock Exchange run the rest, so heavy state activity must never by itself be read as command.

The Master Key: A big state does not make a command economy; abolished private property and abolished free prices do. Count what is forbidden, not what is loud.

REAL Question 120

Kusi's markets roar with private trade, stalls and bargains on every corner; but ask who owns the ports, the power and the banks, and a much quieter story appears.

Study the description below, then identify the economic system it operates and justify your answer.

The Republic of Kusi

Kusi hums with private enterprise. Shopping malls, private banks and a busy stock exchange fill the capital, foreign investors are welcomed, and the prices of almost everything are set freely by buyers and sellers. Newspapers celebrate the country as a haven for business.

Look closer, however, and the commanding heights are in state hands. The government owns the electricity utility, the water company, the ports, the national airline and a controlling share in the largest mine. These state firms are protected from competition, and their charges are set by ministers rather than by the market.

Model Answer

Kusi is also a mixed economy, not a pure market economy, because behind the bustle of private trade the state still owns and controls the commanding heights of the economy.

The market features tempt the quick answer: private malls, banks, a stock exchange, welcomed foreign capital and freely set prices make Kusi look like a textbook market economy.

But the state owns the commanding heights: electricity, water, the ports, the national airline and the largest mine are state owned, shielded from competition and priced by ministers, so the government still answers the three questions for whole strategic sectors.

Shared answering, again: because free private markets and large-scale state ownership operate side by side, the system is mixed; it simply leans further toward the market than Kaskazi does.

Tanzania shows the same shape from the other side: a lively private sector of shops, banks and the Dar es Salaam Stock Exchange sits on top of a state that still runs TANESCO, the ports and Air Tanzania, so a loud private sector no more proves a market economy than a loud state proves a command one; you must look at who owns the commanding heights.

The Master Key: Two economies can both be mixed yet lean opposite ways. Do not classify by the mood of the high street; classify by who owns the power stations and the ports.

HOT Question 121

A mixed economy offers a young nation like Tanzania the market's energy and the state's protecting hand at once; yet a marriage of two systems can inherit the faults of both.

To what extent is the mixed economy the most suitable system for a developing country like Tanzania?

Model Answer

To a large extent the mixed economy is the most suitable system for a developing country like Tanzania, because it captures the energy of the market while keeping the state able to correct the market's failures, though its success depends on how well that balance is managed.

The market side drives growth: private farms, traders and investors respond to prices and the profit motive, so resources move to where they are wanted and output and employment can grow faster than central planning managed in the ujamaa years.

The state side protects the vulnerable: because pure markets leave the poor unserved and neglect public goods, the government can still provide roads, schools, clinics and rural electricity and regulate against exploitation, which a country with widespread poverty badly needs.

But the balance is hard to strike: a mixed economy can inherit the worst of both if the state sector is corrupt or loss-making and markets are left to widen inequality, so suitability is never automatic.

On balance the mixed economy remains the most suitable choice for Tanzania: its own history shows that pure command planning stalled growth while an unaided market would abandon the poor, so a managed middle path fits a country that must grow quickly and share fairly at the same time. The extent of its success, however, turns on the quality of governance, not on the label by itself.

The Master Key: "Most suitable" is a claim about fit, not perfection. The mixed economy fits Tanzania because the country must chase growth and guard fairness together, and only a mixed system sets out to do both.

HOT Question 122

For two decades after Arusha, Tanzania trusted the plan over the price, and growth stalled while queues lengthened; then it turned to the market. Was that turn wisdom, or surrender?

Discuss whether Tanzania was right to move away from a command economy toward a market-oriented one.

Model Answer

On balance Tanzania was right to move away from the command path toward a market-oriented economy, because the planned model of the Arusha years had run into deep shortages and stagnation, even though the reforms brought real costs of their own.

The command model had failed to deliver: after the 1967 Arusha Declaration the state nationalised industry and gathered farmers into ujamaa villages, but by the early 1980s the country faced falling output, empty shelves and mounting debt, so change had become unavoidable.

The reforms revived the economy: because the mid-1980s reforms freed prices, opened trade and sold loss-making parastatals, goods returned to the shops, private enterprise recovered and growth resumed, so the market-oriented turn brought measurable gains.

Yet the costs were real: liberalisation widened inequality, exposed some workers to job losses as protected firms closed, and left rural and poorer citizens behind the urban winners, so the move was not painless and its fairness can be questioned.

Weighing both, the decision was right in its direction if not flawless in its execution: the command economy had reached a dead end that no amount of tightening the plan could fix, while the market-oriented reforms restored a growth that has broadly continued since. The proper verdict is not that markets are good and planning bad, but that Tanzania needed the market's energy and now needs the state to spread its gains, which is precisely why it settled as a mixed economy rather than a pure market one.

The Master Key: When judging a policy turn, compare it with the road actually left behind, not with a perfect world. Tanzania left behind shortages and stagnation, and that is what makes the turn defensible.

HOT Question 123

Let the price decide everything, say the market's boldest friends: what to farm, who gets treated, whether the air stays clean. The claim dazzles, until you ask what a streetlight should charge.

Assess the view that the price mechanism should be left to allocate all of a nation's resources.

Model Answer

The view is only partly acceptable: the price mechanism allocates most resources superbly, but leaving it to allocate all of them would guarantee serious market failure, so it should be trusted widely yet not completely.

The strength of the price mechanism: prices signal what people want and ration what is scarce, so resources flow to their most valued uses automatically and without any planner, which is why market economies produce such variety and respond so fast.

But some goods it cannot handle: because public goods like street lighting and defence yield no direct price, and because merit goods like education would be under-consumed, the market under-provides them, so the state must step in.

And prices ignore third parties: where production creates externalities such as pollution, prices reflect only private costs, so too much of the harmful good is made, a failure the mechanism cannot correct on its own.

Assessed fairly, the price mechanism deserves to allocate the great bulk of a nation's resources, because nothing else matches its speed and its information; but the word all is a claim too far, since public goods, merit goods and externalities are precisely the cases where unaided prices misallocate. This is why even market-oriented Tanzania keeps the state in roads, schooling and the environment, and why the sensible position is a mixed economy that lets prices lead but not rule alone.

The Master Key: Trust the price mechanism as your default and treat its exceptions as a short, named list: public goods, merit goods, externalities. Knowing where it fails is how you know how far to trust it.

HOT Question 124

Grant full freedom to trade and some race ahead while others fall behind; enforce fairness and you must bind the freedom that drove it. Can any system truly hold both?

"Every economic system is a compromise between freedom and fairness." How far do you agree?

Model Answer

I largely agree, because most systems do trade the economic freedom of the individual against the fairness of the outcome, though the sharpest systems try to soften the trade-off rather than simply accept it.

The market end buys freedom with inequality: a pure market maximises the freedom to own, trade and profit, but because rewards follow purchasing power, it produces wide inequality, so freedom is bought at the price of fairness.

The command end buys fairness with control: a command economy can distribute output far more equally, but because the state must own and direct resources to do so, it strips away much individual economic freedom, so fairness is bought at the price of liberty.

The mixed economy manages, not escapes, the trade-off: because a mixed system keeps free markets but taxes and regulates to fund fairness, it eases the tension without abolishing it, so even the compromise is itself a compromise.

So the statement is largely true and usefully so: freedom and fairness pull against each other in every system, and each system is essentially a different settlement between them. Where I would qualify it is that the trade-off is not fixed; good institutions, such as fair taxes and honest public spending, can buy more

fairness for less lost freedom, which is exactly what a well-run mixed economy like Tanzania aims to do. The compromise is real, but its terms can be improved.

The Master Key: Read every system as an answer to one question: how much freedom will we trade for how much fairness? The systems differ only in the price they are willing to pay.

HOT Question 125

Try to invent an economy that never asks what to make, how, or for whom; a machine paradise, perhaps, or a commune of plenty. Every attempt smuggles the three questions back in.

Evaluate the claim that no economic system can escape the three fundamental questions.

Model Answer

The claim is correct and, in fact, almost impossible to deny: because every society faces scarcity, every economic system, without exception, must answer what to produce, how to produce and for whom to produce.

The questions come from scarcity, not from any system: since wants outrun resources everywhere, choices must be made everywhere, so the three questions are forced on rich and poor, planned and free alike.

Systems differ only in who answers them: a traditional economy answers by custom, a command economy by the state, a market economy by prices, and a mixed economy by both, but each is still answering the very same three questions, not escaping them.

Even a hypothetical escape fails: one might imagine a super-rich or fully automated society dodging the questions, yet as long as anything at all is scarce, be it land, time or clean air, the choices return, so the escape is only apparent.

Evaluated fully, the claim stands as one of the securest in economics: the three questions are not a feature of any particular system but a consequence of scarcity itself, which no system can abolish. Tanzania answered them by custom and the state in the ujamaa years and answers them today largely through the market, yet the questions never changed, only the hand that turns them. The claim is therefore not merely true but true by necessity.

The Master Key: The three questions are the ground floor of the whole subject. Systems are just the different staircases societies build on top of them; none can dig below the floor.

HOT Question 126

The same government hand that builds a clinic no market would can also fix a price until the shelves stand empty. Whether it heals or harms turns on one question: how far?

Examine whether government intervention does more good than harm in an economy.

Model Answer

Government intervention does more good than harm when it is aimed at the market's genuine failures, but it can do more harm than good when it overreaches, so the answer turns on how, and how far, the state intervenes rather than on intervention as such.

The good intervention does: because markets under-provide public and merit goods and ignore externalities, state action to build roads and schools, curb pollution and protect the poor corrects real failures and raises welfare, as Tanzania's public provision of rural electricity and schooling shows.

The harm it can do: because governments can be slow, ill-informed or corrupt, intervention can also create shortages, waste and dependence, as the over-extended parastatals of the command years did when they ran at a loss and starved the shops of goods.

It depends on design and limits: well-targeted, well-run intervention tends to help, while blanket control of prices and production tends to backfire, so the same tool can heal or harm depending on its use.

Examined evenly, intervention does more good than harm on balance, but only conditionally: its record is positive where it repairs specific market failures and negative where it replaces the market wholesale.

Tanzania's own experience captures both faces, the failed blanket planning of the 1970s and the useful targeted spending of today, which is why the mature position is not "more state" or "less state" but "better state".

The Master Key: Do not ask whether the government should intervene, ask where and how much. Intervention is medicine: the right dose cures, the wrong dose poisons.

HOT Question 127

Shoes that fit at five will pinch at fifteen. Perhaps a nation's economic system is the same, outgrown as the country grows. Is any system best forever, or only best for now?

"The best economic system is the one that suits a country's stage of development." Discuss.

Model Answer

There is much truth in the claim: because different stages of development bring different problems, the system that suits a country genuinely shifts as it grows, though what is best also depends on a society's values and not on stage alone.

Stage shapes what a country needs: a very poor country may need a strong state to build the first roads, ports and schools that no private investor will fund, while a richer country with deep markets can safely let private enterprise lead, so the useful balance of state and market moves with development.

Tanzania's own path illustrates it: the heavy state role after 1967 answered a moment when private capital was thin, and the market-oriented turn from the mid-1980s answered a later moment when planning had stalled and enterprise could carry more weight, so the country changed system as its circumstances changed.

But stage is not the whole story: because two countries at the same stage may still choose differently according to how much they value equality or freedom, the "best" system also reflects a society's goals, not just its level of income.

Discussed fully, the claim is largely persuasive: there is no single best system for all times and places, and fit to circumstance, including the stage of development, is the right test rather than any fixed ideal. Yet stage of development sets the menu more than it dictates the choice; values still decide. The safest conclusion is that the best system is the one that suits a country's stage and its aims together, which is why most nations, Tanzania included, converge on a mixed economy but mix it in their own proportions.

The Master Key: Stop hunting for the one perfect system. The right question is always "best for whom, and best for when", and a country's stage of development is the largest part of the when.

Chapter Three

PRICE THEORY

Every shilling you spend is a small vote. When you choose a plate of rice over a plate of chips, or a Vodacom bundle over an Airtel one, you send a signal that ripples back to farmers, factories and shopkeepers who never meet you. Price theory is the study of how those millions of silent votes are counted. It explains how the wants of buyers and the plans of sellers meet in a market and settle on a single number, the price, that guides an entire economy without anyone being in charge.

This chapter builds that machinery piece by piece. You will master demand and the law that governs it, supply and its own law, the schedules, curves and functions that record them, and the equilibrium where the two forces balance. You will then put the machinery to work: watching a market adjust when something changes, measuring the gains buyers and sellers enjoy, judging what happens when a government fixes a price, and following a tax as its burden is shared. Work through it in order, pen in hand, and by the end you will be able to answer any demand-and-supply question a paper can ask.

Price, the Market and the Meaning of Demand

Price theory begins with a handful of plain words that carry enormous weight. Before you can draw a single curve you must be sure what a price actually is, what a market actually is, and why an economist's demand is a stricter, sharper thing than everyday wanting. This first section fixes those foundations, so that every schedule, curve and calculation that follows rests on solid ground.

BINDER Question 1

In Kariakoo, a single cardboard sign reading 2,000 does more work than a hundred managers: it tells farmers what to grow, traders what to stock and shoppers what to skip. One number, three quiet commands.

Define price, and outline the three fundamental functions that prices perform in an economy.

Model Answer

Price is the amount of money a buyer must pay a seller in exchange for one unit of a good, service or resource at a given moment, and it is the signal around which the whole economy organises itself.

Price answers what to produce: a high price for a good tells producers that buyers value it, so resources are drawn towards making it, while a low price tells them to pull back.

Price answers how to produce: when the price of one input rises, producers switch to cheaper materials and methods, so price steers the very technique of production.

Price answers for whom to produce: goods flow to those willing and able to pay the ruling price, so price rations the limited output among competing buyers.

Because it performs all three tasks at once, a price works like an invisible manager whom no one appoints and no one pays.

The Master Key: a price is not merely a cost to a buyer; it is a message that coordinates strangers.

BINDER Question 2

A market need not have a roof. When a mama lishe in Mwanza agrees a plate of ugali with a hungry boda rider, a whole market has met, cleared and closed in ten seconds.

Define a market, and explain why demand and supply are described as the two sides of every market.

Model Answer

A market is any arrangement that brings buyers and sellers into contact so that they can exchange a good, service or resource.

The demand side: is made up of buyers or consumers, whose willingness and ability to purchase form the demand for the good.

The supply side: is made up of sellers or producers, whose willingness and ability to offer the good for sale form the supply.

The two sides need each other. A good with buyers but no sellers, or sellers but no buyers, has no market and no price. It is the meeting of the two that creates exchange, and their tug of war that settles the price.

The Master Key: demand without supply, or supply without demand, is only half a market.

BINDER Question 3

Almost every student in Dodoma would like a new iPhone; almost none of them counts, in an economist's ledger, as wanting one at all. The difference is a single word.

Define demand as an economist uses the term, and explain the idea of effective demand.

Model Answer

Demand is the willingness and ability of consumers to buy a good or service over a given period, expressed as the various quantities they would buy at each possible price.

Willingness: the consumer must actually desire the good, for a want they do not feel creates no demand.

Ability: the consumer must have the purchasing power to pay the price, since desire without money is idle wishing.

Effective demand: only when willingness and ability meet, at a stated price and period, does a want become effective demand, the demand that actually moves a market.

This is why demand is never the same as mere need or desire. A hungry child needs food, but if no one in the household can pay, that need places no order in the market.

The Master Key: demand is desire with money behind it.

BINDER Question 4

Ask a Tandale shopkeeper how many loaves she sold today and she names one number. Ask how her sales move with the price and she describes a whole story. Two questions, two different things.

Define quantity demanded, and distinguish it clearly from demand.

Model Answer

Quantity demanded is the specific amount of a good that consumers are willing and able to buy at one particular price, whereas demand is the whole relationship between price and quantity demanded across many prices.

Quantity demanded: is a single number tied to a single price, for example twenty loaves when the price is 1,000 shillings.

Demand: is the entire list or curve showing what would be bought at every possible price, of which quantity demanded is just one point.

So a change in the good's own price moves you from one quantity demanded to another along the same demand; it does not create a new demand. Keeping the two apart is the master skill of the whole chapter.

The Master Key: quantity demanded is a point; demand is the whole line.

BINDER Question 5

A carver in Arusha sizes up a browsing tourist in one glance, judging not whether the man likes the sculpture but whether he will really buy it today. She is checking three things at once.

State and explain the conditions a want must satisfy before it can be counted as demand.

Model Answer

A want becomes demand only when three conditions hold together: desire for the good, the ability to pay for it, and a definite price and period.

Desire for the good: the consumer must want the good, for without the wish to consume it there is nothing to demand.

Ability to pay: the consumer must command enough purchasing power to buy it at the ruling price.

A definite price and period: demand is always measured at a particular price and over a particular stretch of time, such as per day, month or year.

Remove any one of the three and demand collapses back into a mere wish. This is exactly why economists insist on the phrase effective demand rather than simple desire.

The Master Key: desire, ability and a price and period must arrive together, or there is no demand.

REAL Question 6

Neema passes the newest smartphone in a Kariakoo window every evening on her way home. She wants it fiercely. Her mobile-money balance says otherwise.

Study the situation in the box, then decide whether it can be described as demand and explain your answer fully.

> Neema wishes to buy the latest smartphone, which is priced at TShs 900,000. Her wish cannot come true because she has only TShs 150,000 saved and no other means to pay for it.

Model Answer

Neema's wish is not demand, because although she has the willingness to buy the smartphone she lacks the ability to pay its price.

Willingness is present: she clearly desires the phone and would buy it if she could, so the first condition of demand is satisfied.

Ability is absent: with only 150,000 shillings against a price of 900,000, she cannot pay, so the second condition fails.

The verdict: demand needs willingness and ability together, so with one missing her wish is only desire, not effective demand, and it places no order in the market.

Her longing would turn into demand the moment she saved or borrowed the full 900,000, because only then would desire and purchasing power finally meet.

The Master Key: a window full of longing shoppers who cannot pay generates no demand at all.

REAL Question 7

One dry season the price of rice in Mbeya doubles in a single month. Before any official reacts, farmers, millers and families have already changed their plans, nudged by nothing but that rising number.

Using the Mbeya rice market, explain how the price of rice guides the answers to what to produce, how to produce, and for whom to produce.

Model Answer

The rising price of rice in Mbeya quietly settles all three economic questions without any planner giving a single order.

What to produce: the higher price signals that buyers value rice, so more farmers plant paddy next season and fewer plant crops whose prices have not risen.

How to produce: to capture the good price, millers invest in better hulling machines and farmers irrigate or hire extra labour, choosing methods that raise output.

For whom to produce: the rice goes to those willing and able to pay the higher price, so the market rations the limited harvest among competing families.

As the price falls again after harvest, each of these signals reverses, which shows that the single number is doing the work of an entire planning office.

The Master Key: a moving price is a set of instructions that farmers and families obey before any government can act.

HOT Question 8

Picture Kariakoo for one morning with every price tag removed. Traders cannot say what is scarce, shoppers cannot judge what to save on, and the busiest market in the region falls silent with confusion.

To what extent is it true that, without prices, a modern economy could not decide what to produce? Discuss.

Model Answer

It is largely true that a modern economy cannot decide what to produce without prices, because prices are the one mechanism that gathers the scattered facts about scarcity and desire and turns them into a signal producers can follow.

Why prices are almost indispensable: in an economy of millions of goods, no planner can know every want and every shortage, yet prices summarise all of it in a single number that rises with scarcity and falls with plenty, guiding resources automatically.

The information they carry: a high price tells producers a good is wanted and scarce, so society should make more of it, while a low price says the opposite, coordinating strangers who never speak to one another.

The qualification: some decisions are made without prices, such as national defence, street lighting or a family sharing a meal, and command economies did allocate by plan, though often clumsily and with chronic shortages.

So the claim holds strongly for the vast, complex bulk of production, while leaving room for a limited sphere of public and non-market provision. On balance, strip out prices and a modern economy loses its compass, even if it does not lose every map.

The Master Key: prices are how an economy thinks; remove them and it must guess.

HOT Question 9

A Kariakoo wholesaler once stocked a shop full of goods that everybody admired and nobody could afford. He learned, expensively, which half of demand actually pays the rent.

Assess the claim that demand backed by desire alone, without the ability to pay, is meaningless to a producer deciding what to bring to the market.

Model Answer

The claim is broadly sound, because a producer is guided only by effective demand, the desire that is backed by money, although desire without present ability is not entirely without value.

Why the claim holds: a trader earns nothing from admirers who cannot pay, for it is willingness backed by purchasing power that generates sales, revenue and the signal to restock, so latent desire alone cannot guide production profitably.

The evidence in practice: shops price and stock their goods according to what their customers can actually afford, which is why a poorer market and a wealthier one carry different goods even when tastes are similar.

The qualification: desire without present ability is not worthless, because it becomes effective the moment incomes rise, credit appears or the price falls, so a farsighted producer treats today's latent wants as tomorrow's market.

On balance, a producer deciding what to bring today must follow effective demand, while a producer planning for the future keeps one eye on the desire that cannot yet pay.

The Master Key: producers chase the demand that can pay now, but the wisest also court the desire that will pay later.

The Law of Demand and Its Foundations

Everyone senses that dear things sell less and cheap things sell more, but an economist must say exactly why, and exactly when, that is true. This section states the law of demand with care, fixes the assumptions it quietly relies upon, and then digs beneath it to the substitution and income effects and, deeper still, to the

fading pleasure of each extra unit. By the end the humble downward-sloping curve should look less like a picture to memorise and more like a conclusion you could have reached yourself.

BINDER Question 10

When the price of sugar climbs at a Tabora duka, the same shoppers who carried home two kilos last week quietly reach for one. Nobody orders them to; the price alone does the persuading.

State the law of demand, and explain the inverse relationship between price and quantity demanded that it describes.

Model Answer

The law of demand states that, other things remaining constant, a rise in the price of a good reduces the quantity demanded of it while a fall in its price increases the quantity demanded, so that price and quantity demanded always move in opposite directions.

The inverse relationship: price and quantity demanded move in opposite directions, so when the price goes up the amount bought comes down, and when the price goes down the amount bought goes up; economists call this a negative relationship.

The ceteris paribus rider: the law holds only other things being constant, that is, so long as income, tastes and the prices of related goods do not change at the same time to disturb the picture.

Why buyers respond: a higher price forces a buyer to surrender more of her income for each unit, so she curbs her purchases, while a lower price asks less of her and coaxes her to buy more.

Notice that the law speaks of quantity demanded, not demand. It describes how the amount bought responds to the good's own price along one fixed relationship, and nothing more.

The Master Key: raise the price and the quantity bought sinks; lower it and the quantity bought swells; the two never rise together.

BINDER Question 11

One month fuel in Mtwara costs more yet sells more, and a hasty student declares the law of demand broken. The law has small print, and that month somebody had ignored it.

State the assumptions on which the law of demand rests, the conditions summed up in the phrase ceteris paribus.

Model Answer

The law of demand holds only under a set of assumptions, together called ceteris paribus or other things being equal, meaning that everything affecting demand except the good's own price is held constant.

Income is constant: the consumer's income does not change, because a change in income would alter how much she can afford at every price and so cloud the effect of price itself.

Tastes and preferences are constant: the consumer's likings stay put, since a new fashion, season or habit would change her purchases regardless of what the price was doing.

Prices of related goods are constant: the prices of substitutes and complements do not move, for a cheaper substitute or a dearer complement would shift the demand for this good on its own.

No expected change in price or income: buyers do not expect prices or incomes to change soon, as such expectations would tempt them to buy now or to wait, quite apart from today's price.

When every one of these is held still, only the good's own price is left free to move the quantity demanded, and the inverse relationship shows itself cleanly. Let one assumption slip, and the law can seem to fail even though it has not.

The Master Key: the law of demand is a promise about price alone, and it keeps that promise only while everything else stands still.

BINDER Question 12

Chart the daladala fares a Dar commuter would accept against the number of trips she makes, join the dots, and a familiar shape appears, tumbling gently from top left to bottom right.

With the aid of a diagram, illustrate the law of demand and explain why the demand curve slopes downwards from left to right.

Model Answer

The law of demand is pictured by a demand curve that slopes downwards from left to right, showing that a lower price is always matched by a larger quantity demanded and a higher price by a smaller one.

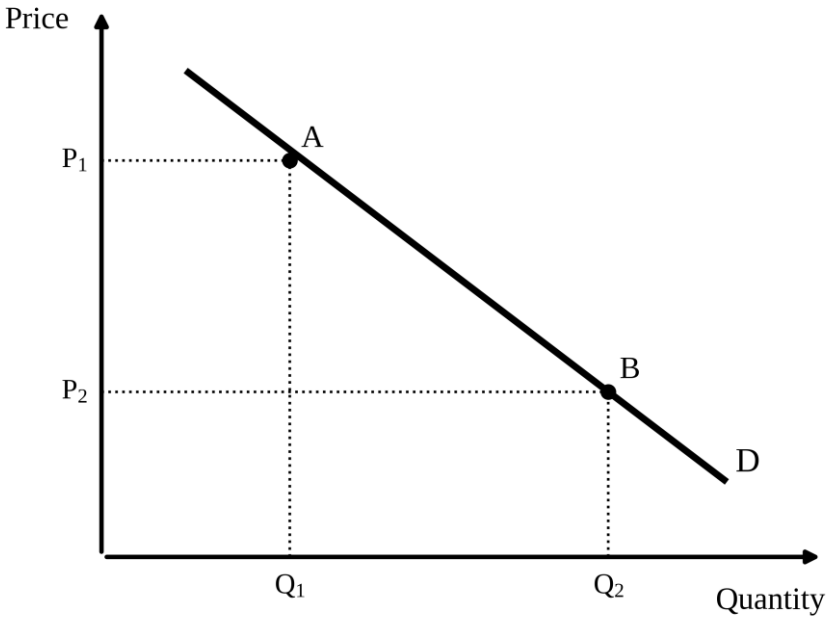


Figure 3.1: The demand curve D sloping downward, with points A and B

Reading the curve: each point on the curve pairs a price with the quantity demanded at that price, so the whole line drawn together is the picture of demand for the good.

The downward slope: as you look down the price axis the curve reaches out to larger quantities, which is simply the inverse relationship at the heart of the law drawn as a shape.

The two points: at the high price P_1 only the small quantity Q_1 is bought at point A, but when the price falls to P_2 the larger quantity Q_2 is bought at point B, so the fall in price from P_1 to P_2 raises quantity demanded from Q_1 to Q_2.

Because the move from A to B runs along the very same curve, it is a change in quantity demanded, not a change in demand. The curve itself has not budged; the buyer has merely slid to a new point on it.

The Master Key: the downward slope of the demand curve is nothing but the law of demand drawn as a single line.

BINDER Question 13

When cooking oil goes on offer in a Mwanza supermarket, a shopper fills her basket with more of it for two quiet reasons at once, and she could not tell you where the first reason ends and the second begins.

Explain the substitution effect and the income effect, and show how together they account for the law of demand.

Model Answer

When the price of a good falls, the quantity demanded rises for two reasons working side by side, the substitution effect and the income effect, and their sum is the total effect that gives the law of demand its force.

The substitution effect: when the good's price falls it becomes cheaper relative to its substitutes, so the consumer switches away from those now dearer alternatives and buys more of this good instead.

The income effect: the same fall in price raises the consumer's real income, that is, the purchasing power of the money in her pocket, so for a normal good she can now afford to buy a little more of it.

The total effect: for a normal good the two effects point the same way, both pushing quantity demanded upwards when price falls, and their combination is the total effect that the market actually shows.

In real life the two cannot be prised apart by watching a shopper. We see only that she bought more when the price dropped. Yet knowing that a substitution pull and an income boost lie underneath explains why the demand curve slopes down so reliably.

The Master Key: a price cut both makes a good look cheaper than its rivals and leaves you a shade richer, and both nudge you to buy more.

BINDER Question 14

The first cold soda on a scorching Dodoma afternoon is bliss; the third is merely wet. That fading pleasure, and not mere habit, is the hidden reason a shopkeeper must drop the price to sell you a fourth.

Explain how the law of diminishing marginal utility provides the deeper reason why the demand curve slopes downwards.

Model Answer

The demand curve slopes downwards ultimately because of diminishing marginal utility, since each extra unit of a good yields less additional satisfaction than the one before, so a consumer will buy more only if the price is lower.

What marginal utility means: the marginal utility of a good is the extra satisfaction a consumer gains from consuming one more unit of it, over and above what the earlier units already gave.

Why it diminishes: as a person consumes more of the same good within a period, each additional unit meets a less urgent want than the last, so the extra satisfaction it brings steadily falls.

The link to price: since a buyer will not pay more for a unit than the satisfaction it gives her, and later units give less, she is willing to buy those later units only at lower prices, which is exactly a downward-sloping demand curve.

So beneath the substitution and income effects lies a simpler human truth. Wants weaken as they are fed, and the price must fall to tempt a buyer into one more helping that she values a little less than the one before.

The Master Key: we pay less for each extra unit because each extra unit pleases us less.

REAL Question 15

Follow one week's takings at a Kariakoo sugar stall, where the trader jotted down how many kilos he sold each day at the different prices he tried.

Study the demand schedule for sugar in the table, then state whether it obeys the law of demand and explain your answer fully.

Price of sugar (TShs per kg)	Quantity demanded (kg per day)
2,000	50
2,500	40
3,000	30
3,500	20
4,000	10

Model Answer

The schedule obeys the law of demand, because as the price of sugar rises the quantity demanded falls steadily, which is exactly the inverse relationship the law describes.

The pattern in the numbers: at 2,000 shillings buyers take 50 kilos, but each 500 shilling rise in the price trims the quantity demanded, all the way down to just 10 kilos when the price reaches 4,000 shillings.

The inverse relationship: price and quantity demanded move in opposite directions at every step, up one column and down the other, which is precisely what the law of demand requires.

Reading it the other way: equally, every fall in the price raises the quantity demanded, so the same schedule read upwards confirms the law from its other end.

Plotted on a graph, these five pairs would trace a demand curve sloping downwards from left to right. The schedule and the curve are telling the very same story in two different languages.

The Master Key: a demand schedule obeys the law whenever its two columns march in opposite directions.

REAL Question 16

Follow the cooking oil in a Singida kitchen the month sunflower oil suddenly grew cheaper, and watch the household end up frying rather more than before, for two separate reasons braided into one.

When the price of sunflower cooking oil fell in Singida, a household bought more of it. Using the substitution effect and the income effect, explain fully why the quantity demanded rose.

Model Answer

The household bought more sunflower oil because its price fall set off both a substitution effect and an income effect, and for this normal good both effects pushed the quantity demanded upwards.

The substitution effect: with sunflower oil now cheaper than palm oil and other alternatives, the household switched towards it, replacing some of the dearer substitutes with the one good whose price had just dropped.

The income effect: the lower price also stretched the household's shillings further, raising the real purchasing power of its budget, so with something left over it could afford to buy more oil than before.

The combined result: both effects pulled in the same direction, so the total effect was a clear rise in the quantity of sunflower oil demanded, just as the law of demand predicts for a normal good.

The family itself would notice only that it bought more oil once the price fell. It could never point to the instant the substitution ended and the income effect began, because the two arrive fused together in a single decision at the shelf.

The Master Key: a price cut wins a good new sales by making it at once the cheaper choice and the more affordable one.

REAL Question 17

Follow a farmer at a Morogoro tea shop on market day as he orders chapati after chapati, each one tempting him a little less than the last until he finally pushes the plate away.

Using the idea of diminishing marginal utility, explain why the farmer would buy a fourth chapati only if its price were lower than what he happily paid for the first.

Model Answer

The farmer would pay for a fourth chapati only at a lower price because each chapati he eats gives him less extra satisfaction than the one before, so the fourth is simply worth less to him than the first.

The first chapati: arriving hungry after a morning in the fields, he gains great satisfaction from the first chapati, so he willingly pays a good price for it.

The falling marginal utility: by the third and fourth his hunger is nearly met, so each additional chapati adds less satisfaction than the last, its marginal utility steadily falling with every bite.

Why the price must fall: since he will not pay more for a chapati than the satisfaction it brings him, and the fourth brings little, he buys it only if its price drops to match its smaller worth to him.

Now multiply this one hungry farmer across a whole town of buyers and you have the demand curve itself. The market will absorb extra chapatis each day only at a lower price, because for every buyer the later units matter less.

The Master Key: the fourth chapati sells only cheaply, because a fed man values it far less than his first.

HOT Question 18

In a Morogoro revision class, two students answer the same question about sugar with equal confidence. One has understood the law of demand exactly; the other has quietly turned it inside out.

Two students explain why a rise in the price of sugar reduces the amount people buy. Study both answers in the box, then judge which one correctly states the law of demand and explain precisely where the other goes wrong.

> Student A: A rise in the price of sugar causes a fall in the demand for sugar, because a high price always causes low demand, and so the demand curve shifts to the left.
>
> Student B: A rise in the price of sugar, other things constant, causes a fall in the quantity demanded of sugar. Buyers move up along the same demand curve to a smaller quantity, so demand itself is unchanged.

Model Answer

Student B is correct and Student A is mistaken, because a change in a good's own price alters the quantity demanded along a fixed curve, not demand itself, and it certainly does not shift the curve.

Why Student B scores: B rightly says that a higher price, ceteris paribus, lowers the quantity demanded, and that buyers simply move up the same demand curve to a smaller quantity, so demand as a whole has not changed at all.

Where Student A fails: A confuses a change in quantity demanded with a change in demand, for a response to the good's own price is a movement along the curve, yet A wrongly reports it as a leftward shift of the whole curve.

The slogan that misleads: A's phrase that a high price always causes low demand mistakes the inverse price and quantity relationship for a link between price and demand, when in truth only quantity demanded responds to a good's own price.

The precise distinction: demand shifts only when something other than the good's own price changes, such as income or the price of a substitute, so sugar's own price can never shift sugar's demand curve, but only move a point along it.

Both students noticed the same everyday fact, that dearer sugar sells less. Only Student B described it in the exact language the law of demand requires, and that precision is the whole difference between an answer that scores and one that does not.

The Master Key: a good's own price moves you along its demand curve, never shifting the curve, and it changes quantity demanded, not demand.

HOT Question 19

A trader in Arusha swears the law of demand is false, for he has watched a price and his sales climb together. An economist listens, then asks him one quiet question about what else changed that month.

To what extent does the law of demand depend on the assumption of ceteris paribus? Discuss.

Model Answer

The law of demand depends heavily on ceteris paribus, because it is a statement about a good's own price alone, and it appears to fail only when some other influence is carelessly allowed to change at the same time.

Why the assumption is essential: the law isolates the effect of a good's own price, so it can hold only while income, tastes and the prices of related goods are kept constant, otherwise their effects are mistaken for the price effect.

How apparent exceptions arise: when the Arusha trader saw price and sales rise together, something else had plainly moved, perhaps his buyers' incomes rose or they expected further price rises, so the extra buying sprang from those changes, not from the higher price.

The law still holds underneath: strip those other changes away and the pure relationship reappears, since at the higher income the quantity demanded would still have been larger had the price been lower rather than higher.

A fair qualification: the assumption does make the law an abstraction rather than a raw description of every market, so it must be applied thoughtfully, checking first that nothing else of importance has shifted.

On balance the law does not so much depend on ceteris paribus as it is defined by it. Read as a claim about price alone it stands firm; read carelessly as a claim about everything at once it seems to break whenever the world moves on more than one front.

The Master Key: the law of demand never truly fails; it is only ever misread by someone who forgot what was supposed to stand still.

HOT Question 20

Two teachers in Iringa give different reasons for the same downward slope. One points to switching and stretched real income; the other to a pleasure that fades with each helping. A student wonders which of them is right.

Assess whether the downward slope of the demand curve is better explained by the income and substitution effects or by the law of diminishing marginal utility.

Model Answer

Both explanations are correct, and they do not really compete so much as sit at different depths, the income and substitution effects describing how a buyer reacts to a price change and diminishing marginal utility explaining why she reacts that way at all.

The income and substitution account: this explains the slope through a buyer's response to a price fall, as she switches from dearer substitutes and finds her real income stretched, both of which raise the quantity she demands.

The diminishing utility account: this reaches deeper, saying that the buyer values each extra unit less, so she will take more only at a lower price, which is why there is a downward-sloping demand curve to explain in the first place.

How they fit together: the two are layers of one explanation, for falling marginal utility is the underlying reason a buyer is even willing to substitute towards the good and to spend her freed-up income on more of it.

A cautious judgement: diminishing marginal utility is the more fundamental reason, yet the income and substitution effects are the more precise and observable mechanism, so a complete answer keeps both rather than choosing between them.

To ask which one is right is a little like asking whether a river flows because of the slope of the land or the pull of gravity. The substitution and income effects are the visible current; diminishing marginal utility is the gravity beneath, and the demand curve slopes down because of both at once.

The Master Key: diminishing marginal utility says why buyers want less at higher prices; the income and substitution effects say how that shows up in the market.

Demand Schedules and Demand Curves

A demand schedule is simply a table of how much a buyer will take at each price, and a demand curve is that same table drawn as a line. In this section you move from one shopper's list to the whole market's, learning to add quantities across buyers, to plot price against quantity, and to read any point you are given.

Master the small arithmetic of horizontal summation here, and the graphs in every later section will read themselves.

BINDER Question 21

In Morogoro, a stationery trader keeps a worn card. Beside each price for a box of pens he notes how many he would buy, and that quiet list already has a name.

Define an individual demand schedule, and using the schedule of pen boxes in the following table, explain what it shows.

Option	Price per box (TShs)	Quantity demanded (boxes)
A	1000	10
B	2000	8
C	3000	6
D	4000	4
E	5000	2

Model Answer

An individual demand schedule is a table showing the quantities of a good that a single consumer is willing and able to buy at each of a series of prices over a given period.

It pairs price with quantity: each row of the table matches one price to the amount the buyer would take at that price, so the schedule is really a list of price and quantity pairs.

It reads top to bottom: at option A the price is only 1,000 shillings and the buyer takes 10 boxes, while at option E the price has climbed to 5,000 and he takes just 2, so as price rises the quantity demanded falls.

It captures one buyer only: every figure in the table belongs to a single consumer, which is why it is called an individual demand schedule and not a market one.

Read as a whole, the schedule is the raw material of the demand curve. Turn each pair into a point on a graph and join them, and the table becomes a line you can see.

The Master Key: a demand schedule is a demand curve before it has been drawn.

BINDER Question 22

Give the same box-of-pens list to Fatuma and to John and their numbers differ, yet both, once plotted, slope the same way down the page. A table has quietly become a picture.

Explain how an individual demand curve is obtained from a demand schedule, and state clearly which variable is measured on each axis.

Model Answer

An individual demand curve is drawn by plotting each price and quantity pair from a consumer's demand schedule as a point, with price up the vertical axis and quantity along the horizontal axis, and then joining the points into a line.

Plot each pair: take one row of the schedule, find its price on the vertical axis and its quantity on the horizontal axis, and mark the spot where the two meet, then repeat for every row.

Join the points: connecting the plotted points gives a line that slopes downward from left to right, because each lower price is matched with a larger quantity demanded.

One curve for each buyer: Fatuma and John each have their own schedule, so each has their own curve; at a price of 1,000 shillings Fatuma would take 10 boxes and John only 5, so Fatuma's curve reaches further to the right, as the figure shows.

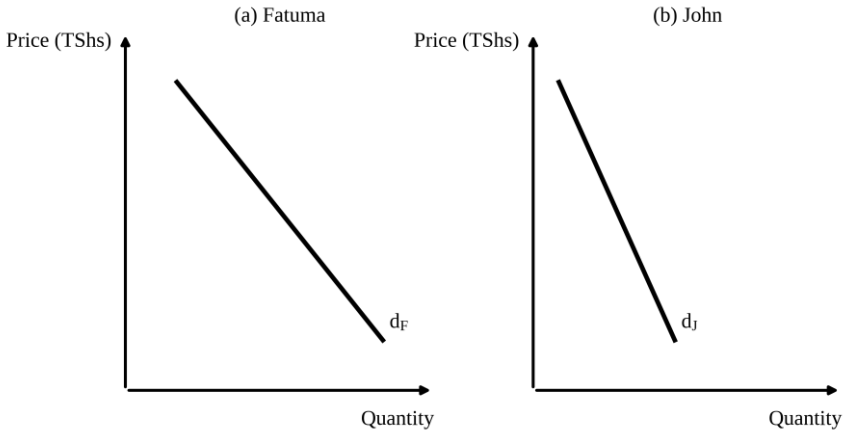


Figure 3.2: Individual demand curves for Fatuma and John, each plotted from that buyer's own schedule

Notice the order of the work: the schedule comes first and the curve second, so the curve holds no information the table did not already contain. It only lets the eye grasp at a glance what the numbers say row by row.

The Master Key: the curve is the schedule made visible, price up the side and quantity along the bottom.

BINDER Question 23

Fatuma buys her boxes and John buys his, and the two never meet. Yet the wholesaler watches only one figure: the total they take together at each price. Where does that total come from?

Define a market demand schedule, and using Fatuma's and John's figures in the table, show how it is derived from individual demand schedules.

Price (TShs)	Fatuma (boxes)	John (boxes)	Market (boxes)
1000	10	5	15
2000	8	4	12
3000	6	3	9
4000	4	2	6
5000	2	1	3

Model Answer

A market demand schedule is a table showing the total quantity of a good that all consumers together are willing and able to buy at each price, obtained by adding the individual quantities demanded at every price.

Add across each row: at each price you add the quantities demanded by the separate buyers, so at 1,000 shillings Fatuma's 10 boxes and John's 5 give a market total of 15, and at 5,000 their 2 and 1 give 3.

Add quantities, never prices: both buyers face the very same price, so the price is never added; only the quantities are summed, and this adding along each price row is what economists call horizontal summation.

The market schedule slopes too: since each buyer takes less as the price climbs, their total does the same, falling from 15 boxes at 1,000 shillings to just 3 boxes at 5,000.

The same rule scales to a whole nation. Whether there are two buyers or two million, market demand at any price is simply the sum of every individual quantity demanded at that price.

The Master Key: to build the market, add along each price row and leave the prices untouched.

BINDER Question 24

In almost every other subject, the cause runs along the bottom and the effect climbs the side. The demand curve turns that on its head, and it does so on purpose.

Explain why, by convention, economists place price on the vertical axis and quantity on the horizontal axis, even though quantity is treated as the variable that depends on price.

Model Answer

Economists place price on the vertical axis and quantity on the horizontal axis purely by long-standing convention, even though quantity demanded is the dependent variable that would ordinarily be drawn on the vertical axis.

The usual mathematical rule: in mathematics the dependent variable, the one that responds, is placed on the vertical axis, so since quantity depends on price, quantity should strictly go up the side.

Why economists reverse it: the layout was fixed by Alfred Marshall, who drew price up the vertical axis and quantity along the horizontal, and the profession has kept his arrangement ever since so that all demand diagrams can be compared at a glance.

It also aids analysis: with price on the vertical axis you can read straight across at a given price to compare the quantities of different buyers, which is exactly what horizontal summation of demand requires.

So the placement is a habit rather than a law of logic. The rule to remember is the reversal: on a demand diagram price is read up the side and quantity along the bottom, whatever ordinary mathematics would suggest.

The Master Key: price sits on the vertical axis by Marshall's habit, not by mathematical right.

REAL Question 25

Follow two regular buyers at a Tanga milk collection point, Amina with her tea shop and Juma buying for his family. Their daily orders are known; only the market total is missing.

Study the schedule in the table, complete the market column by horizontal summation, and describe the market demand curve it produces.

Amina and Juma are the only two buyers of milk at a small Tanga collection point. The table shows how many litres each will take per day at each price, but the market column has not yet been filled in.

Price per litre (TShs)	Amina (litres)	Juma (litres)	Market (litres)
1000	10	8	?
1500	8	6	?
2000	6	4	?
2500	4	2	?

Model Answer

Adding Amina's and Juma's litres at each price fills the market column with 18, 14, 10 and 6 litres, and these totals trace a market demand curve that slopes downward from left to right.

Complete each row: add the two buyers at every price, so 10 and 8 make 18 at 1,000 shillings, 8 and 6 make 14 at 1,500, 6 and 4 make 10 at 2,000, and 4 and 2 make 6 at 2,500.

Price per litre (TShs)	Amina (litres)	Juma (litres)	Market (litres)
1000	10	8	18
1500	8	6	14
2000	6	4	10
2500	4	2	6

Plot the market totals: pair each price with its market total, giving 1,000 and 18, 1,500 and 14, 2,000 and 10, and 2,500 and 6, then plot price up the vertical axis against quantity along the horizontal axis.

Describe the curve: joining these points gives a downward sloping market demand curve, because as the price per litre rises from 1,000 to 2,500 shillings the total quantity demanded falls steadily from 18 litres to 6.

This market curve is the horizontal sum of Amina's and Juma's own curves, so at every price it lies further to the right than either of them alone, since it carries the litres of both buyers at once.

The Master Key: fill the market column by adding across each price row, then let the totals draw the curve.

REAL Question 26

A Kariakoo maize dealer pins a single demand curve for sacks on his wall, two points marked A and B. His new clerk must read them, unsure what one point actually says.

Using the points in the box, explain what point A tells us, and what the move from A to B reveals about buyers of maize.

> On the market demand curve for maize in Kariakoo, point A lies at a price of TShs 90,000 with a quantity of 400 sacks per week. Point B lies at a price of TShs 70,000 with a quantity of 600 sacks per week.

Model Answer

Point A tells us that at a price of 90,000 shillings per sack, buyers in Kariakoo are together willing and able to take 400 sacks of maize each week, and the move from A to B shows that a lower price draws out a larger quantity.

A point is a pair: every point on a demand curve joins one price to the quantity demanded at that price, so point A simply reports the pair 90,000 shillings and 400 sacks per week.

Read it both ways: you may begin at the price of 90,000 and read across to find 400 sacks, or begin at 400 sacks and read up to the price of 90,000, for the point answers either question.

From A to B: when the price falls from 90,000 to 70,000 shillings, the quantity demanded rises from 400 to 600 sacks, which is the law of demand and the reason the curve slopes downward.

Both points sit on the same curve, so this is one demand for maize read at two prices, not two different demands. Nothing has shifted; we have only slid from one point to another along the line.

The Master Key: a point on a demand curve is one price meeting the quantity it can sell.

REAL Question 27

In Songea market, Fatuma and John run the only two stalls buying boxes of pens from one supplier. Lay their two demand curves side by side and a third curve appears almost by itself.

Explain how the market demand curve for boxes of pens is obtained from Fatuma's and John's individual curves, and state how the market curve compares with each of them.

Model Answer

The market demand curve is found by horizontal summation, adding Fatuma's and John's quantities at each price, and the resulting curve D lies to the right of both individual curves and is flatter than either.

Sum horizontally at each price: choose any price, read off the quantity Fatuma demands and the quantity John demands, and add the two, for their sum is the market quantity at that price.

Repeat and join: do this at every price and join the totals, and you obtain the market demand curve D, drawn in the figure beside the two individual curves d_F and d_J.

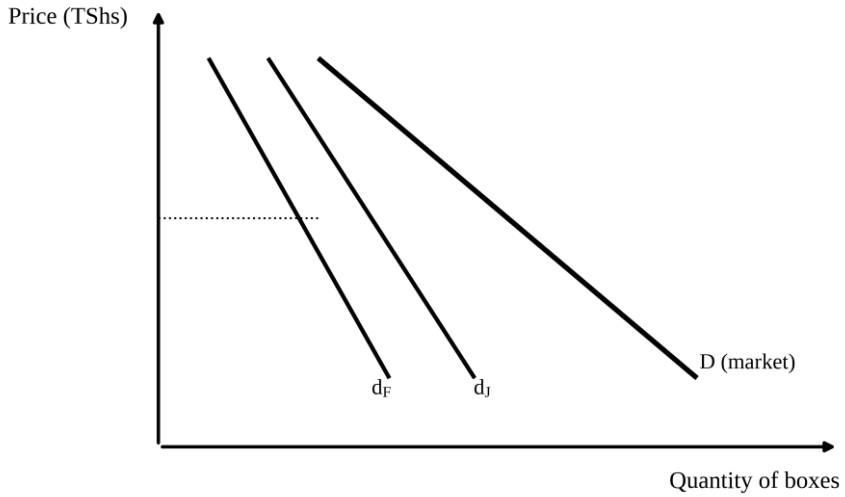


Figure 3.3: Fatuma's curve d_F and John's curve d_J summed horizontally into the market curve D

Further to the right: because the market quantity is the sum of both buyers, at every price it is larger than either buyer's alone, so D lies to the right of both d_F and d_J and is flatter than either.

At any chosen price, read Fatuma's quantity across to d_F and John's across to d_J, then add the two distances to reach D. Adding curves means adding along the quantity axis, never up the price axis.

The Master Key: lay the individual curves side by side, add them along each price line, and the market curve steps out to the right.

HOT Question 28

One student swears that adding more buyers must make the market demand curve steeper, since more people pull harder. Her deskmate bets it grows flatter. Only one line can be right.

The market demand curve is flatter and further to the right than any single buyer's curve. Explain why this must be so, and consider whether the market curve could ever be steeper than an individual's.

Model Answer

The market demand curve must lie to the right of every individual curve and be flatter than any of them, because it is their horizontal sum, and for that same reason it can never be steeper than a single buyer's curve.

Further to the right: at every price the market quantity is the total of all the individual quantities, so it is greater than any single buyer's, which places the market curve to the right of each individual curve.

Flatter, not steeper: a fall in price raises the quantity of every buyer at once, so the market quantity climbs by the sum of all those increases; because that total can never be smaller than any single buyer's response, the market curve can never be steeper than an individual one and is normally far flatter.

What flatter does not mean: this flatness comes from adding many buyers together, not from any one of them becoming more sensitive, for each individual keeps exactly the same curve and only their sum leans further over.

So the result is a certainty of the arithmetic rather than a coincidence: horizontal summation can only add quantity at each price, so every extra buyer pushes the market curve rightward and tips it flatter, and a buyer who joins only at lower prices flattens it further still.

The Master Key: adding buyers can only widen and flatten a demand curve, never narrow or steepen it.

Determinants of Demand: Movements and Shifts

A demand curve can change in two very different ways, and telling them apart is the skill this section drills hardest. When only the good's own price changes, you slide along a fixed curve; when anything else

changes, the whole curve jumps to a new position. Here you will learn to name each determinant, predict the direction it pushes demand, and never again confuse a movement along the curve with a shift of it.

BINDER Question 29

At a Dar es Salaam kiosk a cold water bottle falls from 600 to 400 shillings, and shoppers who bought ten now take twenty. Their demand, an economist insists, has not changed.

Define a change in quantity demanded, and explain why it shows as a movement along the demand curve.

Model Answer

A change in quantity demanded is the rise or fall in the amount of a good that buyers purchase when the good's own price changes, and it shows on a diagram as a movement from one point to another along the same, unchanged demand curve.

Caused by own price: the only thing that moves is the good's own price, so we slide up or down a curve that itself stays exactly where it is.

A fall brings an expansion: when the price falls, buyers extend their purchases, so quantity demanded rises and we move downwards along the curve to a new, lower point, an expansion of demand.

A rise brings a contraction: when the price rises, buyers cut back, so quantity demanded falls and we move upwards along the curve to a higher point, a contraction of demand.

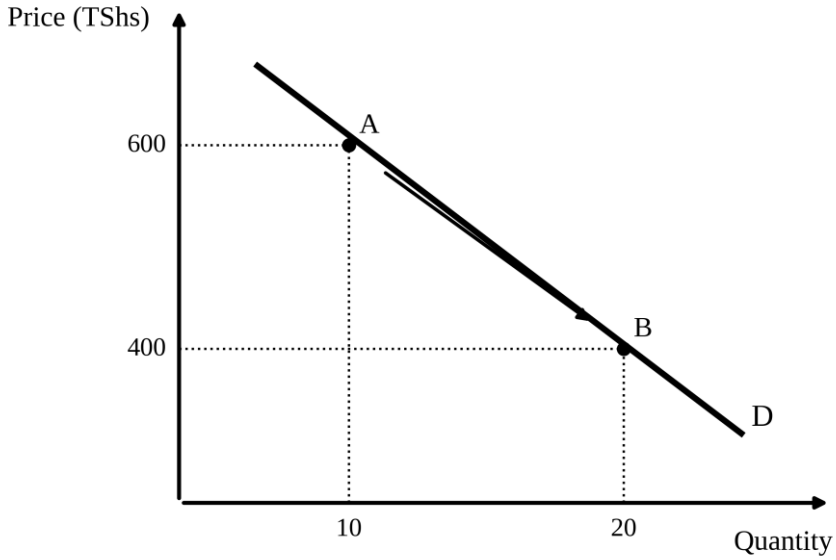


Figure 3.4: A price fall from 600 to 400 slides demand from A to B along one curve.

In the figure, point A sits at a price of 600 shillings with 10 units bought; when the price falls to 400 shillings, quantity demanded expands to 20 units at point B, all on one curve. Reverse the price change and B returns to A, a contraction.

The Master Key: when only the price tag moves, you travel along the curve, you do not redraw it.

BINDER Question 30

During Ramadhani the price of dates in Kariakoo holds steady, yet every stall sells far more than the month before. The tag never moved, so what did?

Define a change in demand, and explain how an increase and a decrease in demand appear on the demand diagram.

Model Answer

A change in demand is a rise or fall in the quantity buyers wish to purchase at every price, caused by a change in some determinant other than the good's own price, and it shows as a shift of the whole demand curve to a new position.

Driven by other factors: the good's own price is unchanged; instead something else moves, such as income, tastes or the price of a related good, so the entire curve relocates.

An increase shifts it right: when demand increases, buyers want more at each and every price, so the curve moves bodily to the right, from D_0 to D_1.

A decrease shifts it left: when demand decreases, buyers want less at each and every price, so the curve moves bodily to the left, from D_0 to D_2.

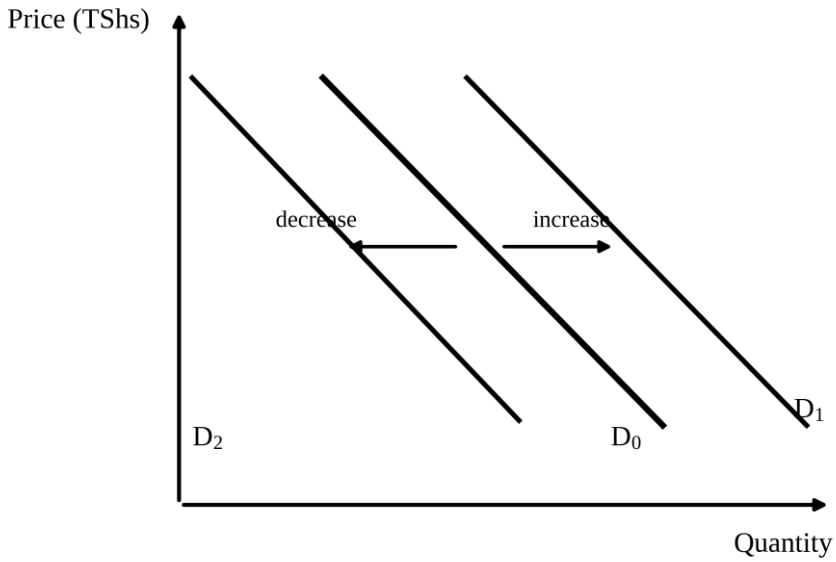


Figure 3.5: An increase shifts D_0 out to D_1; a decrease pulls it back to D_2.

Notice that at the very same price the quantity is larger on D_1 and smaller on D_2, which is the signature of a shift: the change happens at every price at once, not at a single point.

The Master Key: a shift changes what buyers want at every price, so the whole line, not one point, must move.

BINDER Question 31

A teacher draws one demand curve and asks what changed the sales of sugar. One student points along the line, another lifts the whole line, and both can be right.

Distinguish between a change in quantity demanded and a change in demand.

Model Answer

A change in quantity demanded is a movement along a fixed demand curve caused by the good's own price, whereas a change in demand is a shift of the whole curve caused by any other determinant.

Basis	Change in quantity demanded	Change in demand
Cause	The good's own price changes	A non-price determinant changes
On the diagram	Movement along the same curve	Shift of the whole curve
Direction words	Expansion (down) or contraction (up)	Increase (rightward) or decrease (leftward)
At other prices	Quantity at other prices is unchanged	Quantity changes at every price

The safest test is to ask one question: did the good's own price change? If yes, you have a movement along the curve and must say quantity demanded; if no, some other determinant moved and the curve itself shifts. Confusing the two is the commonest error in the whole topic.

The Master Key: own price moves you along the curve; everything else moves the curve.

BINDER Question 32

When a Mwanza clerk earns a pay rise, she buys more rice and, oddly, less of the dried cassava she once leaned on. One larger income, two opposite moves.

Explain how a change in consumer income affects demand, distinguishing a normal good from an inferior good.

Model Answer

A change in consumer income shifts the demand curve, but the direction of the shift depends on the kind of good: demand for a normal good moves the same way as income, while demand for an inferior good moves the opposite way.

Normal goods: for most goods, such as rice, meat or clothing, a rise in income lets buyers afford more, so demand increases and the curve shifts right; a fall in income shifts it left.

Inferior goods: for a few goods, such as dried cassava or the cheapest maize flour, a rise in income makes buyers switch away to better substitutes, so demand falls and the curve shifts left even though they can now afford more.

Why income shifts, not slides: because income is not the good's own price, its change alters what buyers want at every price, so it moves the whole curve rather than sliding along it.

So the label normal or inferior is not about quality alone but about how demand responds to income. A good can even be normal for a poor household and inferior for a richer one.

The Master Key: income lifts demand for normal goods and lowers it for inferior ones; either way the whole curve moves.

BINDER Question 33

The day beef grows dear in Arusha, the chicken sellers next door grow busy; the day fuel prices jump, the car dealers grow quiet. One good's price, another's fortune.

Explain how a change in the price of a related good affects the demand for a good, contrasting substitutes with complements.

Model Answer

A change in the price of a related good shifts the demand for a good, and the two kinds of related good, substitutes and complements, push it in opposite directions.

Substitutes move together: a substitute is a good that can replace another, such as chicken for beef; when the price of beef rises, buyers turn to chicken, so the demand for chicken increases and its curve shifts right.

Complements move oppositely: a complement is a good used together with another, such as fuel with cars; when the price of fuel rises, running a car costs more, so the demand for cars decreases and its curve shifts left.

Always a shift: because it is another good's price that changed, not the good's own price, the effect is a shift of the curve, not a movement along it.

So watch the relationship closely: a rise in a substitute's price raises demand for the good, while a rise in a complement's price lowers it. The two rules are mirror images.

The Master Key: a dearer substitute helps a good; a dearer complement harms it.

REAL Question 34

Follow the lunch tables of Kariakoo office workers. Radio health messages now steer them to grilled chicken over red meat, though not one price on the menu has changed.

Using this change in tastes, explain what happens to the demand for chicken and to the demand for beef, and show how each appears on a demand diagram.

Over six months, a series of popular radio programmes in Dar es Salaam persuades many consumers that eating less red meat is healthier. The prices of chicken and beef stay exactly the same throughout.

Model Answer

The change in tastes shifts both demand curves without any price moving: the demand for chicken increases and shifts right, while the demand for beef decreases and shifts left.

Chicken becomes fashionable: because buyers now judge chicken the healthier choice, they want more of it at every price, so the demand for chicken rises and its curve shifts to the right.

Beef falls out of favour: the same advice turns buyers away from beef, so at every price they want less, and the demand for beef shifts to the left.

Prices never moved: no price changed, so neither of these is a movement along a curve; a change in tastes is a non-price determinant, so each good's whole curve shifts.

This is why advertisers, health campaigns and fashions matter so much to sellers: they can enlarge or shrink a market without a single price being touched.

The Master Key: a favourable change in taste shifts a good's demand right; an unfavourable one shifts it left.

REAL Question 35

Follow a rumour through Mbeya market. Word spreads that next month a sack of sugar will cost more, and today, at an unchanged price, the sacks are flying off the stalls.

Explain how these expectations about the future price of sugar and about future income affect the demand for sugar today.

A widely believed report says that the price of sugar in Mbeya will rise sharply next month. Today's price has not yet changed. Meanwhile, civil servants in the town expect a salary increase in the new year.

Model Answer

Both expectations increase the present demand for sugar and shift its curve to the right, even though today's price has not changed at all.

Expecting a higher price: if buyers believe sugar will soon cost more, they bring their purchases forward to beat the rise, so demand today increases and the curve shifts right.

Expecting higher income: civil servants who expect a salary rise feel able to spend more now, drawing on savings or credit, so their present demand for a normal good like sugar also rises.

Today's price is unchanged: because it is expectations, not the current price, that changed, this is a shift of the curve and not a movement along it.

The mirror cases hold too: if buyers expected the price to fall, or feared a wage cut, they would delay buying and demand today would shift left. Expectations move demand before the future even arrives.

The Master Key: expecting a higher price tomorrow raises demand today; expectation shifts the curve, it does not slide along it.

REAL Question 36

Follow Dodoma since it became the seat of government. Ministries moved in, workers and families followed, and the markets swelled with new buyers though the goods on sale stayed the same.

Explain how the rise in the number of buyers affects the market demand for everyday goods in Dodoma, and show why this is a shift and not a movement.

When the national government relocated to Dodoma, tens of thousands of civil servants and their families moved into the city. The prices of everyday goods such as bread and vegetables were not directly changed by the move.

Model Answer

A rise in the number of buyers increases market demand and shifts the market demand curve to the right, because market demand is simply the sum of all the individual demands.

More buyers, more demand: each new household adds its own demand to the market, so at every price the total quantity demanded is larger, and the market curve shifts right.

Built by summation: market demand is found by adding the quantities all buyers want at each price, so adding buyers must raise the total at every price at once.

Why it is a shift: the price of bread or vegetables did not change; it is the size of the market that grew, and that is a non-price determinant, so the whole curve shifts rather than a point sliding along it.

The same logic runs in reverse: a town losing people, or a falling population, sees its market demand shift left. Population growth across Tanzania is, quietly, one of the strongest forces pushing demand curves outward.

The Master Key: add buyers and the market curve shifts right; the market is only as large as the crowd that shops in it.

HOT Question 37

A confident student writes that when the price of rice falls, the demand curve for rice shifts to the right. It sounds reasonable, it earns nods, and it is wrong.

A candidate claims that a fall in the price of rice shifts the demand curve for rice to the right. Identify the error and explain the correct analysis.

Model Answer

The claim is wrong, because a fall in the good's own price never shifts its demand curve; it causes a movement along the curve, an expansion of quantity demanded, not a shift.

Spotting the error: the price that changed is rice's own price, and a good's own price is the one determinant that moves you along the curve, so no shift can occur.

The correct term: a fall in the price of rice causes an expansion of quantity demanded, shown by sliding down the fixed demand curve from a higher point to a lower one.

When rice demand would shift: the curve for rice would shift only if a non-price determinant changed, for example a rise in incomes, a new taste for rice, or a rise in the price of a substitute like maize flour.

The candidate has confused a change in quantity demanded with a change in demand, the single commonest error in this topic. A useful check: if the good's own price is what moved, you must be sliding along the curve, never redrawing it.

The Master Key: rice's own price falling expands quantity demanded along the curve; only something other than rice's price could shift it.

HOT Question 38

A politician promises that as incomes rise across Tanzania, the demand for every good will rise with them, lifting all traders alike. An economist listening is only half convinced.

To what extent is it true that a general rise in household incomes will increase the demand for all goods? Discuss.

Model Answer

It is true for most goods but not for all, because rising income increases the demand for normal goods yet actually decreases the demand for inferior goods.

True for normal goods: the great majority of goods are normal, so as incomes rise buyers can afford more rice, meat, clothing and services, and each of these demand curves shifts right, just as the politician expects.

False for inferior goods: a minority of goods are inferior, such as dried cassava or the cheapest flour, and as incomes rise buyers abandon them for better substitutes, so their demand shifts left, not right.

It also depends on degree: how far demand rises differs by good; demand for luxuries like cars may rise sharply while demand for basic staples rises only a little, so not all traders gain equally.

On balance the claim holds for most of the market and captures the general truth that prosperity lifts demand, but it overstates the case by ignoring inferior goods and the uneven strength of the effect. The honest verdict is that it is largely true, but not for every good and not to the same degree.

The Master Key: rising income floats most boats, but the sellers of inferior goods watch the tide go out.

Exceptions to the Law of Demand

The law of demand is one of the most reliable rules in economics, but like every good rule it has its exceptions. In a handful of cases quantity demanded rises rather than falls as price rises, so the demand curve slopes upward instead of downward. This section gathers those exceptions, the Giffen good, the Veblen good, goods bought in expectation of a further rise, and the necessities of life, and shows for each exactly why the ordinary rule is turned on its head.

BINDER Question 39

Every rule an economist teaches seems to hold in Kariakoo until you reach the jeweller's counter, where a higher price pulls buyers in rather than driving them away. Some goods, it turns out, climb the wrong way.

Explain what is meant by an exception to the law of demand, and illustrate the exceptional demand curve with a sketch.

Model Answer

An exception to the law of demand is any case in which quantity demanded varies directly with price, rising as the price rises and falling as it falls, so that the demand curve slopes upward instead of downward.

The normal law: ordinarily price and quantity demanded move in opposite directions, so the demand curve slopes downward from left to right.

The exceptional case: for a handful of goods the two move together, quantity demanded increasing as price increases, which reverses the usual relationship.

An upward-sloping curve: plotting these price and quantity pairs gives a demand curve that rises from left to right, the mirror image of the ordinary curve.

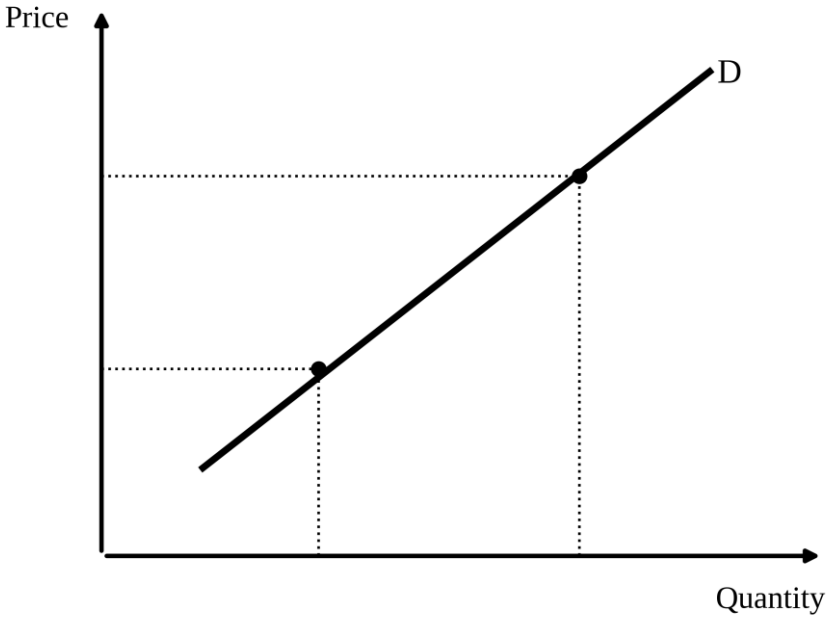


Figure 3.6: an exceptional, upward-sloping demand curve

Such goods are the exception and not the rule; they include Giffen goods, goods of ostentation, goods bought in expectation of a further price rise, and certain necessities, each of which the questions that follow examine in turn.

The Master Key: an exception does not break the law of demand so much as reveal the narrow ground on which it does not stand.

BINDER Question 40

It sounds impossible: a family that buys more of a food precisely because it has become dearer. Yet the Scottish statistician Robert Giffen saw exactly this among the poor, and gave the puzzle his name.

Define a Giffen good, and explain with an example why its quantity demanded rises when its price rises.

Model Answer

A Giffen good is a special type of inferior good whose quantity demanded rises when its price rises and falls when its price falls, because the negative income effect of the price change outweighs the substitution effect.

A staple of the poor: a Giffen good is a cheap basic food, such as a coarse staple, on which a poor household spends a large part of its income.

Real income falls: when the staple's price rises the household's real income falls sharply, because the staple takes so much of the budget.

They cannot reach the substitute: too poor now to afford the dearer, preferred food, the household falls back on the cheap staple and actually buys more of it to stay fed.

The good is named after the statistician Robert Giffen, who noted this behaviour among poor households. Its quantity demanded and its price therefore move together, giving an upward-sloping demand curve.

The Master Key: a Giffen good turns a price rise into a spur to buy more, because the buyer is now too poor to do anything else.

BINDER Question 41

A wealthy buyer in Arusha once walked away from a diamond the moment its price was cut, sure that anything so cheap could not be worth having. For some goods, the price is the point.

Define a Veblen or ostentatious good, and explain why such goods may be demanded more as their price rises.

Model Answer

A Veblen or ostentatious good is a luxury good that becomes more desirable as its price rises, because buyers value it for the wealth and status that a high price displays.

Bought for show: these are goods of conspicuous consumption, such as gold, diamonds, Tanzanite and luxury cars, bought partly to display the owner's wealth.

Snob value: a high price is attractive in itself, since it keeps the good exclusive and signals status, so demand rises as the price rises, an effect the economist Thorstein Veblen described.

A low price repels: cut the price and the good loses its prestige, so the wealthy buyer wants it less, which is why quantity demanded can fall when price falls.

For such goods the demand curve slopes upward over the relevant range. Tanzanite, a gemstone mined only in Tanzania, is a fitting example, since its rarity and its price are central to its appeal.

The Master Key: for goods of ostentation the high price is not a barrier to the buyer, it is the very thing on sale.

BINDER Question 42

Let word run through Kariakoo that sugar will soon be scarce and the shelves empty at a price that only rose yesterday; yet whatever the price of her malaria tablets, the patient in the queue still buys them. Two more ways the law bends.

Outline two further exceptions to the law of demand: the expectation of a future price change, and necessities.

Model Answer

Demand can also rise with price when buyers expect the price to climb further, and it can stay firm however high the price climbs in the case of necessities, so both stand as exceptions to the law of demand.

Expectation of a future rise: if buyers expect the price to go on rising, a present rise makes them buy more now to beat the higher price to come, so quantity demanded rises with price.

The speculative motive: this is common where goods can be stored or resold, such as fuel, sugar, cement or land, and it lasts only as long as the expectation of further rises.

Necessities: essential goods such as medicines, staple food and basic clothing have no close substitutes, so people go on buying nearly the same amount even as their price rises, which makes their demand highly price-inelastic rather than obedient to the usual fall.

In each case the ordinary inverse link between price and quantity is overridden, in the first by what buyers expect and in the second by the sheer necessity of the good.

The Master Key: expectation makes buyers chase a rising price, and necessity stops them fleeing one.

REAL Question 43

Follow the Mkumbo family of a village near Nachingwea through a hard month. Cassava, their cheapest food, grows dearer, and to everyone's surprise they come home with more of it, not less.

Study the box, then explain why the family's demand for cassava behaves as it does and identify the type of good this makes cassava for them.

> The Mkumbo family has TShs 14,000 a week for food. They eat cassava, their cheap staple, and a little rice, which they prefer but which costs far more.
>
> At first cassava costs TShs 500 a kilo and rice TShs 2,000 a kilo, and the family buys 20 kg of cassava and 2 kg of rice each week.
>
> When cassava rises to TShs 600 a kilo, the family can no longer stretch to any rice, and to keep everyone fed they spend the whole 14,000 on cassava, buying about 23 kg.

Model Answer

The family buys more cassava when its price rises, so for them cassava is behaving as a Giffen good, a special inferior good on which the negative income effect outweighs the substitution effect.

Cassava dominates the budget: nearly all of the family's food money goes on cassava, so a rise in its price sharply cuts what they can really afford, that is, it lowers their real income.

The dearer food is dropped: once real income falls they can no longer reach up to rice, the preferred but costly food, so the only way to stay fed is to fall back entirely on the cheap staple.

Quantity rises with price: as a result they buy about 23 kg of cassava at 600 shillings where they bought 20 kg at 500, so quantity demanded has risen as price rose, the reverse of the law of demand.

This makes cassava a Giffen good for this household. The two conditions both hold: it is inferior, since they would buy less of it and more rice if they grew richer, and it swallows so large a share of the budget that its income effect overwhelms the ordinary pull towards cheaper substitutes.

The Master Key: the poorer the household and the larger the staple in its budget, the more easily a price rise forces it to buy more, not less.

REAL Question 44

Follow a Tanzanite dealer on the streets of Arusha as he tries an experiment. He drops his price to sell faster, and the buyers melt away; he raises it again, and they come flocking back.

Using the box, explain why the dealer's Tanzanite does not obey the law of demand, and name the type of good it represents.

> A dealer in Arusha sells polished Tanzanite, the blue gem mined only in Tanzania, to wealthy tourists and collectors.
>
> When he lowers the price of a certain stone to attract more buyers, customers suspect it is fake or of poor quality, and fewer are sold.
>
> When he later raises the price and markets the stone as rare and exclusive, more buyers want it than before.

Model Answer

The dealer's Tanzanite sells better at a higher price, so it is a Veblen or ostentatious good, a luxury bought for the status that its high price advertises.

Price signals prestige: for a luxury like Tanzanite the price is part of the attraction, because a high price marks the buyer as wealthy and the stone as exclusive, which is the snob value Thorstein Veblen described.

A cut price backfires: when the dealer lowered the price the gem looked cheap or fake, so it lost exactly the prestige that the rich buyer was paying for, and demand fell.

Demand rises with price: raising the price and stressing the rarity of a stone found only in Tanzania made more collectors want it, so quantity demanded rose as price rose.

Over this range the demand curve for Tanzanite slopes upward, the opposite of an ordinary good, because the buyers are purchasing display and exclusivity as much as the gem itself.

The Master Key: for a Veblen good the price tag is not the cost of the luxury, it is the luxury.

REAL Question 45

Follow the pumps in Dar es Salaam the week EWURA lifts the petrol price. Word spreads that it will climb higher still, and instead of easing off, the queues at the filling stations grow longer.

Explain, using the box, why a rise in the petrol price was followed by a rise in the quantity bought, and which exception to the law of demand this illustrates.

> Late one month EWURA raises the capped pump price of petrol in Dar es Salaam, and radio reports warn that world oil prices will push it higher still next month.
>
> Instead of buying less, drivers and shop owners crowd the filling stations, topping up tanks and filling jerricans, and the quantity of petrol sold that week jumps.

Model Answer

Buyers bought more petrol as its price rose because they expected an even higher price soon, which is the exception based on the expectation of a future price change.

Expectations drive today's demand: when people believe a price will climb further, today's higher price looks cheap next to tomorrow's, so they rush to buy now to beat the coming rise.

Stocking up and hoarding: drivers fill tanks and traders fill jerricans to store fuel, adding a speculative demand on top of their normal use, so current quantity demanded jumps.

The law is suspended: the exception is temporary and the good is not broken, for the ordinary inverse link between price and quantity returns once buyers expect prices to settle.

If instead the news had promised a price fall next month, the same drivers would delay buying and today's demand would drop, which confirms that here it is the expected future price, not the present one, that is steering behaviour.

The Master Key: when a rising price is read as a warning of worse to come, buyers stampede towards it instead of away.

HOT Question 46

A student objects that a Giffen good is impossible: how can charging more ever sell more? The answer hides inside a single price change, in two effects that usually pull together but here pull apart.

Explain, using income and substitution effects, why the demand curve for a Giffen good slopes upward, and distinguish a Giffen good from an ordinary inferior good.

Model Answer

A Giffen good's demand curve slopes upward because it is an inferior good whose negative income effect is large enough to outweigh the substitution effect, so a price change moves quantity the opposite way to an ordinary good.

The substitution effect: whenever a good's price falls it becomes cheaper relative to its substitutes, so on this count alone the consumer always buys more of it, and a price rise always makes them buy less; this effect pushes price and quantity in opposite directions for every good.

The income effect: a price change also alters real income, and here goods differ, since a price fall makes the consumer better off, and for a normal good they then buy more, reinforcing the substitution effect, while for an inferior good they buy less, opposing it.

Why Giffen is special: a Giffen good is an inferior staple that fills a large share of a poor budget, so its income effect is not merely opposing but larger than the substitution effect, dragging total quantity the income effect's way.

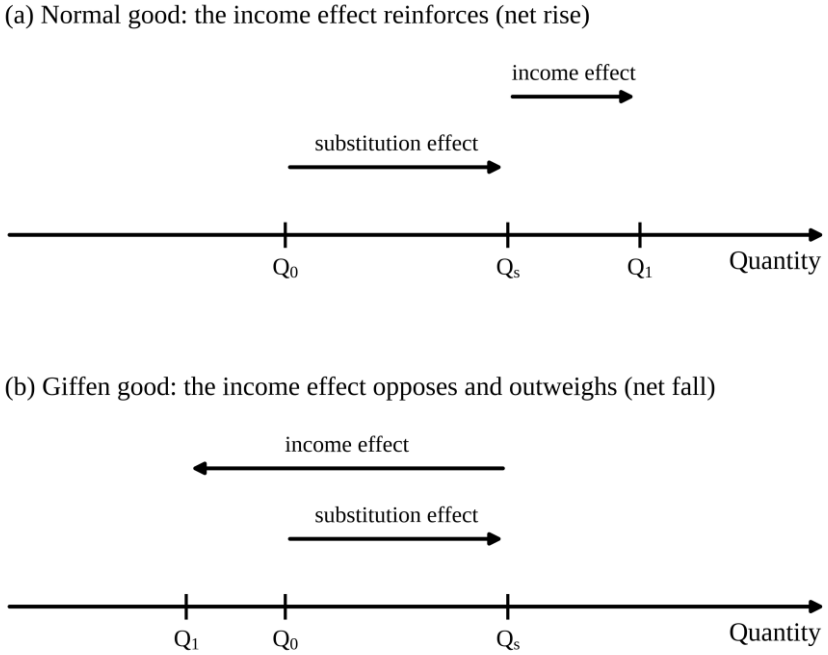


Figure 3.7: decomposing a price fall for a normal good and a Giffen good

The upward slope: read the same logic for a price rise, and the household, made poorer, can no longer afford the dearer substitute and buys still more of the cheap staple, so quantity demanded rises with price and the curve slopes upward.

This is why all Giffen goods are inferior, yet not all inferior goods are Giffen. An ordinary inferior good has an income effect too small to overturn the substitution effect, so its demand still slopes downward; only when the income effect actually outweighs the substitution effect, as with a dominant staple of the very poor, does the rare Giffen good appear.

The Master Key: a Giffen good is the rare inferior good whose income effect is so strong that a price rise, by making buyers poorer, drives them to buy more of it.

HOT Question 47

A gem trader in Arusha boasts that his Tanzanite and a poor family's cassava are really the same kind of good, since both sell more as they grow dearer. An economist reaches for two very different explanations.

To what extent is it correct to treat a Giffen good and a Veblen good as the same thing? Refer to cassava for a poor rural household and Tanzanite for the wealthy.

Model Answer

It is only superficially correct to treat them as the same, because although both cassava for the poor and Tanzanite for the rich can sell more as their price rises, the reasons behind the two are opposite.

What they share: both are exceptions to the law of demand, since for each the demand curve can slope upward, with quantity demanded rising as price rises.

Why cassava rises: cassava is a Giffen good, an inferior staple, and it sells more only because a price rise makes the poor household poorer, forcing it down onto the cheap staple, a negative income effect that outweighs the substitution effect.

Why Tanzanite rises: Tanzanite is a Veblen good, a luxury, and it sells more because a high price adds prestige and snob value, so the wealthy buyer wants it more, a matter of tastes and not of poverty.

Opposite buyers, opposite causes: the Giffen effect works on the poorest through real income, while the Veblen effect works on the richest through status, so grouping the two together hides the very thing that explains each.

On balance the trader is right that both break the law of demand, but wrong to call them the same. They are two distinct exceptions, one born of hardship and the income effect, the other of luxury and display, and their shared upward slope is a coincidence of appearance, not of cause.

The Master Key: cassava climbs because its buyers are too poor to escape it, Tanzanite because its buyers are rich enough to flaunt it; same slope, opposite worlds.

Demand Functions and Demand Algebra

A demand function is simply the law of demand written as algebra, and once you can read it you can compute a quantity, invert the equation and combine buyers with confidence. This section moves from the general function $Q_x = f(P_x, P_r, Y, U)$ to the workhorse linear form $Q_d = a - bP$, shows how to put a price in to read a quantity out and how to flip the equation into the inverse form we plot. It ends with the one operation students most often get wrong: building market demand by adding quantities across buyers, never by adding their prices.

BINDER Question 48

A price on a Kariakoo shelf is only half the story of a purchase: the shopper's income, the rival brand's price and even this month's fashion tug at the same choice.

Write the general demand function $Q_x = f(P_x, P_r, Y, U)$, explain what each argument means, and show how it simplifies to the own-price demand function.

Model Answer

The general demand function $Q_x = f(P_x, P_r, Y, U)$ says that the quantity demanded of good X depends on its own price, the prices of related goods, income and tastes, and holding the last three constant leaves the own-price function $Q_x = f(P_x)$.

Px, the own price: the price of good X itself, the leading influence, since a higher own price normally lowers the quantity demanded and a lower one raises it.

P_r, related prices: the prices of substitutes and complements, because a cheaper substitute or a dearer complement pulls the demand for X down, while the opposite pushes it up.

Y, income: the buyer's income, which for a normal good raises the quantity demanded as it grows and for an inferior good does the reverse.

U, tastes: the consumer's tastes and preferences, shaped by habit, fashion, advertising and season, which quietly enlarge or shrink demand.

The simplified form: holding P_r, Y and U constant by the ceteris paribus rule isolates the own price, leaving $Q_x = f(P_x)$, the narrow relationship that lies behind the demand curve.

The Master Key: the demand curve shows only the own-price strand of a much thicker rope.

BINDER Question 49

Every straight-line demand equation hides two numbers with plain jobs: one says how much would sell at a price of zero, the other how sharply buyers flee as the price climbs.

Explain the linear demand function $Q_d = a - bP$, saying what a and b measure, and why the sign before b is negative for a normal good.

Model Answer

In the linear demand function $Q_d = a - bP$ the term a is the quantity-axis intercept, the amount demanded when price is zero, while b is the slope, the number of units demand falls by for each one-unit rise in price, and the sign before it is negative because higher prices reduce quantity demanded.

The intercept a: setting $P = 0$ gives $Q_d = a$, so a is the largest quantity buyers would take if the good were free, the point where the line meets the quantity axis.

The slope b: b is the fall in quantity demanded for each one-shilling rise in price, so a large b means buyers are very responsive and a small b means they are stubborn.

Why the sign is negative: for a normal good price and quantity move in opposite directions, the law of demand, so as P rises Q_d must fall, which the minus sign in front of bP delivers.

The choke price: rearranging, quantity reaches zero when $P = a/b$, the price so high that the market shuts, which is where the line meets the price axis.

So the two little letters carry the whole shape of the line: a fixes where it starts on the quantity axis and b fixes how steeply it falls towards the choke price a/b.

The Master Key: a sets where the demand starts, b sets how fast it falls, and the minus sign keeps it obeying the law of demand.

BINDER Question 50

We write demand as quantity flowing from price, yet to draw it we flip the roles and send price up the side. The line we plot is not the line we wrote.

Explain what the inverse demand function is, derive $P = (a/b) - (1/b)Q$ from $Q_d = a - bP$, and say why it is the form we actually plot.

Model Answer

The inverse demand function simply rearranges $Q_d = a - bP$ to make price the subject, giving $P = (a/b) - (1/b)Q$, and we plot this form because the diagram measures price up the vertical axis.

Start from $Q_d = a - bP$: the ordinary demand function gives quantity as it depends on price, with quantity as the subject of the equation.

Make P the subject: add bP to both sides and subtract Q_d to get $bP = a - Q$, then divide every term by b to reach $P = a/b - (1/b)Q$.

Read the new numbers: the vertical intercept is now a/b, the choke price, and the slope is $-1/b$, the price rise needed before buyers shed one more unit of quantity.

Why we plot it: by convention the demand diagram puts price on the vertical axis and quantity along the horizontal, so the equation with P as the subject is the one that matches the axes.

The two functions are the same line seen from two sides: $Q_d = a - bP$ is handy for putting in a price and reading off a quantity, while $P = a/b - (1/b)Q$ is handy for drawing.

The Master Key: the inverse demand is the same relationship wearing the clothes the diagram requires.

REAL Question 51

In Dodoma the weekly demand for maize follows one tidy rule, $Q_d = 240 - 3P$. *Give the rule a price and it hands back an exact number of sacks.*

Taking P as the price per sack in thousands of shillings, calculate the quantity of maize demanded at prices of 20, 40 and 60, and set the results out as a schedule.

Model Answer

Substituting each price into $Q_d = 240 - 3P$ gives 180 sacks at $P = 20$, 120 sacks at $P = 40$ and 60 sacks at $P = 60$.

Read the function: $Q_d = 240 - 3P$ says that from a base of 240 sacks, every one-thousand-shilling rise in price removes 3 sacks from the week's demand.

Substitute $P = 20$: $Q_d = 240 - 3(20) = 240 - 60 = 180$ sacks.

Substitute $P = 40$: $Q_d = 240 - 3(40) = 240 - 120 = 120$ sacks.

Substitute $P = 60$: $Q_d = 240 - 3(60) = 240 - 180 = 60$ sacks.

Price P (000 TShs)	Working	Q_d (sacks)
20	$240 - 3(20) = 240 - 60$	180
40	$240 - 3(40) = 240 - 120$	120
60	$240 - 3(60) = 240 - 180$	60

Notice the rhythm: each 20-unit rise in price cuts demand by exactly 60 sacks, which is the constant slope of 3 at work, and if the price ever reached 80 the quantity would fall to zero.

The Master Key: a demand function is a machine: feed it a price and it returns the exact quantity.

REAL Question 52

A Coca-Cola depot in Mwanza reads its demand off the line $Q_d = 120 - 4P$. *Two small numbers in that line decide both where it starts and how fast it falls.*

With P as the price per crate in thousands of shillings, interpret the intercept and the slope of $Q_d = 120 - 4P$, find where the line meets each axis, and write the inverse function used for plotting.

Model Answer

Here $a = 120$ is the quantity taken if soda were free and $b = 4$ is the fall of 4 crates per one-unit rise in price, the line meets the axes at 120 crates and at a choke price of 30, and the inverse form we plot is $P = 30 - 0.25Q$.

The intercept a $= 120$: setting $P = 0$ gives $Q_d = 120$, so 120 crates is the most the depot could sell, the point where the line touches the quantity axis.

The slope b $= 4$: each one-thousand-shilling rise in price lowers the quantity demanded by 4 crates, so the coefficient carries a minus sign and the demand obeys the law of demand.

The choke price: set $Q_d = 0$, so $0 = 120 - 4P$ gives $P = 30$, meaning that above thirty thousand shillings a crate not a single crate is bought.

The inverse function: solve $Q_d = 120 - 4P$ for P: $4P = 120 - Q$, so $P = 30 - 0.25Q$, and this is the equation we actually draw, with price on the vertical axis.

Both forms describe one and the same line. $Q = 120 - 4P$ is convenient for feeding in a price, while $P = 30 - 0.25Q$ matches the diagram where price is measured up the side.

The Master Key: the intercept tells you where the line starts and the slope tells you how fast it falls.

REAL Question 53

Two neighbours in Tabora, Fatuma and John, buy rice from the same trader at the same price, yet each takes a different amount. Add them and you have the street's whole demand.

Given Fatuma's demand $Q = 60 - 2P$ and John's demand $Q = 40 - P$, derive the market demand function for rice on their street.

Model Answer

Because both neighbours face the same price, you add their quantities at that price, and $60 - 2P$ plus $40 - P$ gives the market demand function $Q = 100 - 3P$.

Write each demand: Fatuma's demand is $Q_1 = 60 - 2P$ and John's is $Q_2 = 40 - P$, both already in the form $Q = f(P)$, which is exactly what horizontal summation needs.

Add the constants: the intercepts 60 and 40 add to 100, the quantity the two would buy together if rice were free.

Add the slopes: the price coefficients 2 and 1 add to 3, so a one-shilling rise in price cuts their combined demand by 3 kilos.

State the market demand: therefore $Q = 100 - 3P$, valid over the price range where both are still buying, that is up to $P = 30$, the price at which Fatuma drops out.

Check it at $P = 10$: Fatuma buys $60 - 20 = 40$ and John buys $40 - 10 = 30$, together 70, while the market function gives $100 - 30 = 70$, so the sum is right.

The Master Key: add the quantities across buyers, never the prices; a market adds sideways.

REAL Question 54

Three Kariakoo wholesalers each name the top price they would pay for cartons of soap, written as $P = f(Q)$. *To combine them you cannot leave the equations facing that way.*

The three wholesalers have demands $P = 35 - 0.5Q$, $P = 50 - 0.25Q$ and $P = 40 - 2Q$. Derive the market demand function.

Model Answer

You must first turn each inverse equation into the form $Q = f(P)$ and then add the quantities, which produces the market demand function $Q = 290 - 6.5P$.

Why inversion comes first: each demand is written as $P = f(Q)$, but a market adds quantities at a common price, so every equation must be rearranged to $Q = f(P)$ before anything is added.

Invert the first: from $P = 35 - 0.5Q$, move terms to get $0.5Q = 35 - P$, then double both sides to reach $Q_1 = 70 - 2P$.

Invert the second: from $P = 50 - 0.25Q$, get $0.25Q = 50 - P$, then multiply both sides by 4 to reach $Q_2 = 200 - 4P$.

Invert the third: from $P = 40 - 2Q$, get $2Q = 40 - P$, then divide both sides by 2 to reach $Q_3 = 20 - 0.5P$.

Sum the quantities: add the constants $70 + 200 + 20 = 290$ and the coefficients $2 + 4 + 0.5 = 6.5$, giving the market demand $Q = 290 - 6.5P$.

This holds while all three are still buying, that is up to $P = 35$, the lowest of the three choke prices.

Check at $P = 20$: the three buy 30, 120 and 10, together 160, and the function gives $290 - 130 = 160$.

The Master Key: an inverse demand must be flipped to Q form before it can join the market sum.

HOT Question 55

A confident classmate waves away the inversion in the Kariakoo problem: just add the three price equations, he says, the algebra is neater and the answer drops out in one line.

To what extent is it correct to build the market demand function by adding the three inverse demand equations directly? Discuss.

Model Answer

It is not correct for market demand, because adding the price equations sums the wrong variable and forces every buyer to hold the same quantity, though the very same vertical addition is the right method for a different object, the demand for a public good.

Why the shortcut fails: in a market every buyer faces the same price and chooses a different quantity, so you add quantities at a common price, whereas adding $P = f(Q)$ equations adds prices at a common quantity, which answers a wholly different question.

The answer that fails: summing the three inverse equations gives $3P = 125 - 2.75Q$, so $P = 41.67 - 0.9167Q$, and at a price of 20 this returns only about 24 units.

The answer that scores: inverting first gives $Q_1 = 70 - 2P$, $Q_2 = 200 - 4P$ and $Q_3 = 20 - 0.5P$, whose sum $Q = 290 - 6.5P$ returns 160 units at that same price of 20.

The grain of truth: adding inverse demands vertically is not nonsense in general, for it correctly measures the combined willingness to pay when everyone consumes the same units, which is exactly how the demand for a public good such as street lighting is built.

So for an ordinary private good sold at one market price the classmate is simply wrong, and the gap between 160 units and about 24 shows how large the error is. The safe rule is to convert every demand to Q form and sum the quantities.

The Master Key: adding prices answers a public-good question; a private market adds quantities.

Interrelated Demand

Goods are rarely wanted in isolation. Buy rice and you may buy less maize flour; buy a car and you must buy tyres; the same crude oil is fought over by petrol, diesel and kerosene; and no one wants a factory worker except to make something people want. This section sorts these linkages into four clean families, competitive, joint, composite and derived demand, and shows how a single price change in one market ripples into the next.

BINDER Question 56

In Kariakoo a shopper who grabs rice quietly puts back the maize flour, while a dealer who sells one car knows he will soon sell four tyres. Few goods are wanted alone.

Define interrelated demand, and outline the four main kinds of interrelated demand that link one good to another.

Model Answer

Interrelated demand means that the quantity demanded of one good depends not only on its own price but on the price or demand for some other good, and it comes in four main kinds: competitive, joint, composite and derived demand.

Competitive demand: the demand for goods that are substitutes, bought instead of one another, so a rise in the price of one raises the quantity demanded of the other, as with rice and maize flour.

Joint (complementary) demand: the demand for goods that are used together, so a rise in the price of one lowers the quantity demanded of the other, as with a car and its tyres.

Composite demand: the demand for a single good wanted for several different uses that compete for it, as with crude oil wanted for petrol, diesel and kerosene.

Derived demand: the demand for a good wanted not for itself but as an input to make something else, so the demand for labour and raw materials follows the demand for the final good.

So the thread running through all four is that no market is an island: a change in one good's price or popularity is felt in the market for another.

The Master Key: no good is an island, so every price change you see is already echoing in a neighbouring market.

BINDER Question 57

Raise the price of Coca-Cola by a hundred shillings and something odd happens two shelves away: Pepsi, untouched and unchanged, suddenly starts to sell faster.

Explain competitive demand, and using a diagram show how a rise in the price of Coca-Cola affects the demand for Pepsi.

Model Answer

Competitive demand is the demand for goods that are substitutes, bought instead of one another, so that a rise in the price of one good raises the quantity demanded of the other, its rival.

Substitutes compete: the two goods satisfy the same want, so a buyer can switch freely between them, as a thirsty customer treats Coca-Cola and Pepsi, or a cook treats rice and maize flour.

The mechanism: when Coca-Cola's price rises, its own quantity demanded falls as buyers move up its demand curve, and those buyers turn to Pepsi, whose demand rises at every price.

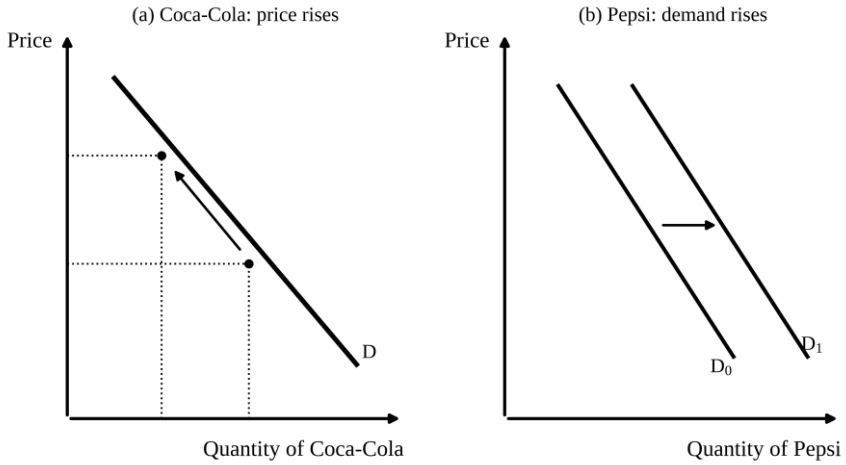


Figure 3.8: Coca-Cola's price rises, so quantity slides up its own curve, while Pepsi's demand shifts out from D_0 to D_1.

A positive cross relationship: the price of one good and the quantity demanded of the other move the same way, up with up, so substitutes are said to have a positive cross-price relationship.

This is why the diagram needs two panels: the change in Coca-Cola shows as a movement along its own curve, while the effect on Pepsi shows as a shift of the whole Pepsi curve to the right.

The Master Key: for substitutes, one seller's price rise is the rival's free advertising.

BINDER Question 58

When new-car prices jump, showrooms in Dar es Salaam fall quiet, and a tyre seller two streets away watches his own sales sag, though tyre prices never moved.

Explain joint (complementary) demand, and using a diagram show how a rise in the price of cars affects the demand for tyres.

Model Answer

Joint or complementary demand is the demand for goods that are used together, so that a rise in the price of one good lowers the quantity demanded of the other, its complement.

Complements go together: the two goods are consumed as a pair and give little satisfaction apart, as a car needs tyres, or fish needs cooking oil, so they are demanded jointly.

The mechanism: when the price of cars rises, fewer cars are bought as buyers move up the car demand curve, and because each unbought car means four tyres unbought, the demand for tyres falls at every price.

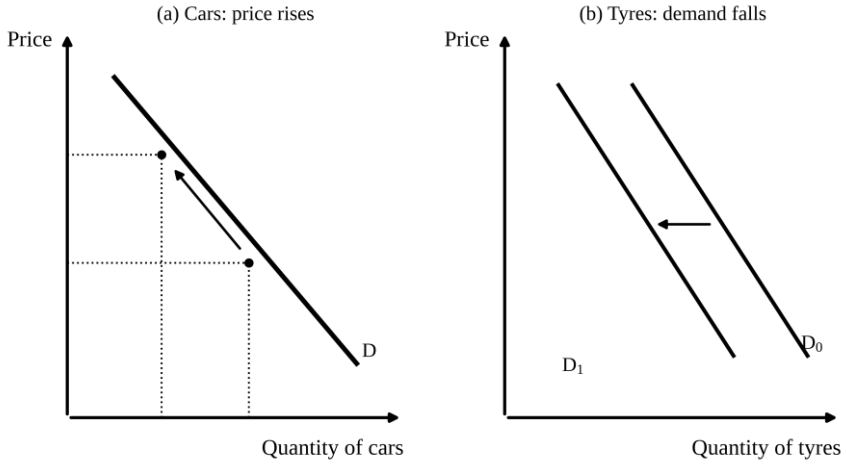


Figure 3.9: Cars' price rises, so fewer cars are bought, and the demand for tyres shifts left from D_0 to D_1.

A negative cross relationship: the price of one good and the quantity demanded of the other move in opposite directions, so complements are said to have a negative cross-price relationship.

So the mirror image of substitutes appears: the tyre curve shifts left rather than right, because a complement suffers when its partner becomes dear, while a substitute gains.

The Master Key: complements rise and fall together, so a tax on cars quietly punishes the tyre trade.

BINDER Question 59

One barrel of crude oil is pulled in three directions at once: the driver wants petrol, the lorry wants diesel, the village lamp wants kerosene. They cannot all be fully served.

Explain composite demand, using crude oil and land as examples.

Model Answer

Composite demand is the demand for a single good that is wanted for several different uses, so that the uses compete with one another and more of the good going to one use leaves less for the rest.

One good, many uses: the good is not wanted for a single purpose but for a range of them, so the total demand for it is the sum of the separate demands from each competing use.

The uses compete: because the supply is limited, the uses rival one another, so a rise in demand from one use raises the good's price and squeezes the quantity left for the others.

Crude oil: a barrel of crude can be refined into petrol, diesel, kerosene or jet fuel, so a surge in demand for diesel lifts the price of crude and leaves less, and dearer, crude for the kerosene lamp.

Land in Morogoro: the same acre can grow sugar, rice or sisal or instead carry houses, so when demand for building plots rises the land is bid away from farming into construction.

So composite demand differs from the earlier kinds because it concerns one good split among competing uses, rather than two different goods linked across separate markets.

The Master Key: with composite demand every extra litre poured into one use is a litre denied to another.

REAL Question 60

Follow the alizeti of Singida. Town caterers and supermarkets suddenly want far more sunflower cooking oil, and within weeks the pressing mills are advertising for extra hands.

Using a diagram, explain how the rise in demand for sunflower oil in Singida affects the demand for the labour that presses it, and name the type of demand shown.

Model Answer

The rise in demand for sunflower oil raises the demand for pressing labour, because labour is wanted only to make the oil, and this input demand that follows the demand for the final good is called derived demand.

Oil demand rises first: caterers and shops want more sunflower oil, so the demand curve for oil shifts to the right and, along the mill's supply curve, its price and output both rise.

Labour is only a means: no mill wants workers for their own sake but only to press seed into oil, so the demand for their labour flows entirely from the demand for the oil they produce.

So labour demand shifts out: to press the extra oil the mills must hire more hands, so the demand for pressing labour rises at every wage and its curve shifts to the right, lifting both employment and the wage.

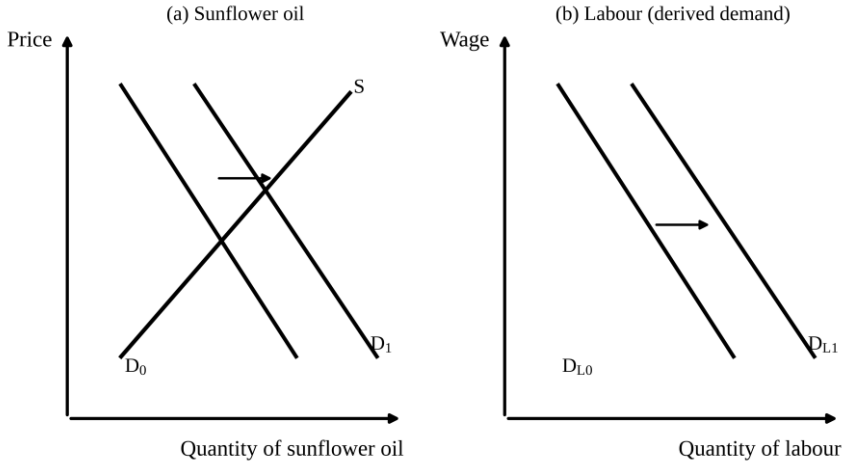


Figure 3.10: A rise in the demand for sunflower oil (D_0 to D_1) pulls the derived demand for labour outward too.

The name: because it is wanted not for itself but as an input to make something else, the demand for this labour, and for the sunflower seed, is derived demand.

The same chain runs backwards: if townspeople tired of sunflower oil, the mills would need less seed and fewer workers, because a derived demand can only be as strong as the final demand that feeds it.

The Master Key: no one wants a mill worker except to get the oil, so kill the demand for oil and the job dies with it.

REAL Question 61

In her Dodoma shop, Mama Halima keeps a sharp eye on how her goods move together. One week's notebook, below, records four odd patterns she cannot fully explain.

Study the four situations in the box, then classify the kind of interrelated demand each one shows and give a reason for your answer.

(i) When the price of maize flour rose, Mama Halima sold noticeably more rice, though the price of rice had not changed.

(ii) A jump in the price of fish left several bottles of cooking oil unsold on her shelf.

(iii) The maize she stocks is wanted by three buyers at once: families for ugali, a brewer for beer, and a farmer for chicken feed.

(iv) When a new sunflower oil mill opened nearby, it began advertising daily for workers to press the seed.

Model Answer

Situation (i) shows competitive demand, situation (ii) shows joint or complementary demand, situation (iii) shows composite demand, and situation (iv) shows derived demand.

(i) Competitive demand: rice and maize flour are substitutes, so when maize flour grew dearer buyers switched to rice, and the price of one good raised the quantity demanded of the other, a positive cross relationship.

(ii) Joint demand: fish and cooking oil are complements used together in the pan, so when fish became dear and less was bought, the cooking oil that goes with it was left unsold, a negative cross relationship.

(iii) Composite demand: the same maize is wanted for three competing uses, food, brewing and feed, so more maize going to the brewer leaves less, and dearer, maize for families and the poultry farmer.

(iv) Derived demand: the mill wants workers not for themselves but only to press seed into oil, so their labour is in derived demand, following the demand for the sunflower oil they will produce.

So one shopkeeper's week displays all four linkages at once: two of them across a pair of goods, one within a single good split between uses, and one running back from a final good to the input that makes it.

The Master Key: name the link before you predict the ripple: substitutes gain, complements lose, composite uses compete, and inputs merely follow.

HOT Question 62

A Kariakoo trader offers a confident rule of thumb: whenever one good gets dearer, sellers of every other good should rejoice, for the money must go somewhere. A neighbour is unconvinced.

To what extent is it true that a rise in the price of one good always raises the demand for another? Discuss.

Model Answer

It is true only for substitutes and false as a general rule, because whether a price rise lifts, lowers or ignores the demand for another good depends entirely on how the two goods are related.

True for substitutes: when the goods are substitutes the trader is right, for a rise in the price of maize flour sends buyers to rice and raises its demand, a positive cross relationship.

False for complements: when the goods are complements the opposite happens, for a rise in the price of cars lowers the demand for tyres, since the two are bought together, a negative cross relationship.

Often no link at all: many goods are unrelated, so a rise in the price of cement need not touch the demand for sugar in any way, and the cross relationship between them is simply zero.

A subtler case: for a good in composite demand a price rise from one use, such as diesel, bids the shared crude away from other uses and can cut the quantity they receive, which is again not a rise.

So the trader has grabbed one true case and stretched it into a false law. The honest answer is that a price rise raises another good's demand only when the two are substitutes, and the sign of the effect must be judged relationship by relationship, not assumed. To that extent the claim is largely untrue.

The Master Key: a price rise spills into other markets, but whether as a gift or a blow depends on the link, so never assume the sign.

HOT Question 63

A minister promises that Mtwara's new cashew factories will bring jobs that last. An old processor shakes his head: these jobs, he says, are borrowed from a market no one here controls.

To what extent does the theory of derived demand explain why cashew processing jobs in Mtwara rise and fall? Discuss.

Model Answer

Derived demand explains a great deal, because the jobs exist only to process cashew and so must rise and fall with the demand for cashew itself, yet it is not the whole story, since technology, harvests and policy also move employment.

Jobs follow the crop: processing labour is in derived demand, wanted not for itself but to turn raw cashew into kernels, so when world and local demand for cashew is strong the factories hire, and when it collapses they lay workers off.

Prices pass straight through: because the demand is derived, a fall in the export price of cashew cuts what processors can earn, so the derived demand for their labour drops even though the workers themselves are unchanged.

But technology matters too: derived demand is not the only force, for if mills mechanise and shelling machines replace hand labour, employment can fall even while cashew demand is high, which the simple theory alone would miss.

And supply and policy matter: a poor harvest, an export ban on raw nuts, or a change in the export levy can all swing the number of jobs, so the volume of cashew available, and not only the demand for it, shapes the work.

So derived demand is the main key, correctly explaining why Mtwara's cashew jobs live or die by the fortunes of the nut rather than by any local wish for employment, while leaving room for mechanisation, harvests and policy to alter the exact numbers. To a large extent, then, the old processor is right.

The Master Key: a derived job is borrowed from the final good, so when that market catches cold, the workers sneeze.

The Concept, Law and Determinants of Supply

Having mapped the buyers, we now cross the market to the sellers. Supply looks like demand's mirror image, yet it runs the other way, since the higher the price, the more producers wish to sell. This section fixes what supply means, separates it from quantity supplied, states the law of supply and the conditions it assumes, and then works through the forces that shift the whole relationship, from the cost of inputs and the state of technology to taxes, the weather and what sellers expect prices to do next.

BINDER Question 64

Ask a cement seller in Mtwara how much he will sell and he answers with a question of his own: at what price? One plain word, supply, hides a whole ladder of prices and quantities.

Define supply, and distinguish it clearly from quantity supplied.

Model Answer

Supply is the willingness and ability of sellers to produce and offer various quantities of a good for sale at different possible prices during a given period, while quantity supplied is the single amount offered for sale at one particular price.

Willingness and ability: supply needs both the desire to sell and the actual capacity to produce the good and bring it to market, just as demand needs the willingness and the ability to buy.

A whole relationship: supply is not one number but the entire set of price-and-quantity pairs, showing how much sellers would offer at each possible price during the period.

Quantity supplied is one point: quantity supplied is the amount offered at a single stated price, one rung on the ladder, so it is a part of supply and not the whole of it.

A flow over time: supply is measured as a flow, such as so many sacks per week or tonnes per season, which is why the definition always fixes a given period.

The distinction matters because a change in the good's own price changes only the quantity supplied, moving from one rung to another, whereas a change in other conditions such as costs or technology changes supply itself, lifting or lowering the whole ladder.

The Master Key: quantity supplied is one rung; supply is the whole ladder of prices and quantities.

BINDER Question 65

When the farm-gate price of maize climbs in Iringa, lorries that sat idle line up to carry more of it, and traders who hid their sacks bring them into the light. Higher prices, fuller stalls.

State the law of supply, and explain why quantity supplied varies directly with price.

Model Answer

The law of supply states that, other things remaining constant, the quantity supplied of a good rises as its price rises and falls as its price falls, so that price and quantity supplied move in the same direction, a direct or positive relationship.

The direct relationship: unlike demand, supply moves with price, so a higher price is met by a larger quantity supplied and a lower price by a smaller one, giving supply its upward tilt.

The profit incentive: a higher price, with costs unchanged, widens the profit earned on each unit, so existing firms expand their output to gather more of it and fresh sellers are drawn into the market.

Rising marginal cost: producing extra units usually costs more at the margin as firms stretch their capacity, so sellers will offer those dearer extra units only if the price rises far enough to cover the higher cost.

The ceteris paribus guard: the law holds only while other influences such as costs, technology and the number of firms stay put, because it deliberately isolates the effect of the good's own price.

So the upward slope of supply is no accident: it is profit pulling more units out of producers, while the higher price is exactly what makes the costlier extra units worth making.

The Master Key: raise the price and you widen the profit on every unit, so sellers answer with more.

BINDER Question 66

The law of supply promises more maize as the price rises, but it whispers a condition first: nothing else may move. Let wages jump or a drought strike, and the promise is off.

Outline the main assumptions, the ceteris paribus conditions, on which the law of supply rests.

Model Answer

The law of supply holds only under a set of ceteris paribus assumptions, chiefly that the cost of production, the state of technology, the number of firms and the prices of related goods all stay constant, so that the good's own price is the only thing allowed to change.

Constant cost of production: the prices of the factors of production, such as wages, raw materials, fuel and rent, are assumed fixed, because a change in them would move supply for reasons unconnected with the good's own price.

Constant technology: the method and productivity of production are held still, since an improvement would let firms supply more at every price and so spoil the clean comparison.

Constant number of firms: the number of sellers in the market is assumed unchanged, for the entry of new firms or the exit of old ones would alter the total supplied on its own.

Constant prices of related goods: the prices of goods a firm could make instead, or makes alongside, are fixed, so producers are not tempted to switch their resources to something more rewarding.

Other conditions, such as government taxes and subsidies, the weather facing farmers and what sellers expect prices to do next, are likewise assumed to hold still. Only when all of them are frozen does a change in quantity supplied trace purely to a change in the good's own price.

The Master Key: the law of supply lets price speak only after every other voice has been told to keep quiet.

BINDER Question 67

Two things can flood a market with cement without its price shifting a shilling: cheaper fuel for the kilns, or a new kiln that bakes more from less. Neither is the price of cement.

Explain how the prices of the factors of production and the level of technology each affect the supply of a good.

Model Answer

A rise in the prices of the factors of production raises the cost of making a good and so reduces its supply, while an improvement in technology lowers the cost of each unit and so increases supply, both acting on supply without any change in the good's own price.

Factor prices and cost: the factors of production, such as labour, raw materials, fuel and capital, must all be paid for, so their prices together make up the cost of producing the good.

Higher costs cut supply: when factor prices rise, each unit costs more to make, the profit at any given price is squeezed, and firms respond by producing less, so supply falls; cheaper inputs do the reverse and raise supply.

Technology and productivity: the level of technology sets how much output firms win from a given bundle of inputs, so better machines, methods or seeds raise productivity.

Better technology raises supply: an improvement in technology lowers the cost of each unit produced, so firms can profitably offer more at every price, and supply increases.

Notice that both forces work through cost. Dearer inputs push cost up and supply down, while better technology pulls cost down and supply up, and in each case the good's own price has not moved at all.

The Master Key: anything that changes the cost of a unit changes supply; cheaper inputs and better technology both pour more onto the market.

BINDER Question 68

A drought in the Southern Highlands, a new sugar levy, and a dozen fresh millers opening at once: none of the three touches the shelf price directly, yet each redraws how much reaches the market.

Outline three further determinants of supply: the number of firms, government taxes and subsidies, and weather or natural conditions.

Model Answer

Supply also depends on the number of firms in the market, on government taxes and subsidies, and, for farm goods, on the weather and natural conditions, each of which can raise or lower supply while the good's own price stays put.

The number of firms: the more sellers there are in a market, the greater the total quantity supplied at each price, so when new firms enter supply rises and when firms close or leave supply falls.

Taxes reduce supply: an indirect tax, such as an excise duty or VAT, adds to the cost of every unit a firm sells, so it behaves like a rise in cost and firms supply less at each price.

Subsidies raise supply: a subsidy is a government payment that lowers the effective cost of production, so it works as the opposite of a tax and encourages firms to supply more at each price.

Weather and natural conditions: for agricultural goods, good rains and healthy conditions bring a bumper harvest and raise supply, while drought, floods or pests destroy output and cut it, so farm supply can swing sharply from season to season.

In every case the good's own price is unchanged; it is a condition around the market, the crowd of sellers, the hand of government or the mood of the weather, that has moved the whole supply.

The Master Key: more sellers and subsidies swell supply, while taxes and bad weather starve it, all without touching the price.

REAL Question 69

Follow Mzee Kilonzo, a maize farmer near Iringa, as the harvest ends. Today's price is fair, but every neighbour swears it will be higher after the lean months, so his full granary stays shut.

Study the box, then explain why Mzee Kilonzo offers less maize for sale now even though today's price has not fallen, and name the determinant of supply at work.

> Mzee Kilonzo harvests 80 sacks of maize near Iringa. At the current price of TShs 60,000 a sack he would normally sell most of them soon after harvest.
>
> This year, traders and radio reports agree that the price will climb to around TShs 90,000 a sack within three months, once the season's surplus has been eaten up.
>
> Seeing this, Mzee Kilonzo sells only 20 sacks now and stores the remaining 60, planning to sell them later at the higher price.

Model Answer

Mzee Kilonzo supplies less maize now because he expects a higher price later, so he withholds most of his harvest to sell it when it is dearer, which is the determinant of expectations of a future price change.

The expected future price: he believes the price will rise from 60,000 to about 90,000 shillings a sack within three months, so every sack held back today promises a larger sum later.

Withholding today's stock: because maize can be stored, he keeps 60 sacks off the market now and offers only 20, so the quantity he supplies today falls even though today's price is unchanged.

Supply falls, not quantity supplied: nothing has happened to the current price of 60,000, so this is not a move to a different point on his supply; it is his whole supply for the moment that has shrunk, driven by expectation.

The mirror case: had he expected the price to fall instead, he would rush to sell all 80 sacks at once, so his current supply would rise, which shows expectations can push supply either way.

This is the reverse of what expectations do to buyers, who buy more now when they expect higher prices later. A seller who expects a higher future price holds back today, so current supply and the expected future price move in opposite directions.

The Master Key: expecting a richer market tomorrow, the seller starves the market today.

REAL Question 70

Follow a beast through a Shinyanga abattoir. When the beef price jumps, more cattle meet the knife, and out the back door comes something the tanners have long been waiting for.

Using the box, explain why a rise in the price of beef increases the supply of leather, and identify the type of relationship in production between the two goods.

> In Shinyanga, cattle are slaughtered for beef, and every animal also yields a hide that is tanned into leather.
>
> When the market price of beef rises, butchers slaughter more cattle in order to sell the extra meat.
>
> The price of leather itself has not changed, yet more hides now reach the tanneries than before.

Model Answer

A rise in the price of beef increases the supply of leather because the two are in joint supply, produced together from the same animal, so slaughtering more cattle for the dearer beef automatically yields more hides for leather.

Joint supply defined: beef and leather are jointly supplied, meaning one act of production, raising and slaughtering a beast, brings forth both goods at once, the meat and the hide.

Beef price pulls output up: when beef grows dearer, butchers find it profitable to slaughter more cattle, so the quantity of beef supplied rises in obedience to the law of supply.

Leather rides along: each extra beast slaughtered leaves an extra hide, so the supply of leather increases even though the price of leather itself has not moved at all.

A determinant, not the law: for leather this is a change in supply caused by the price of a related good, beef, and not a movement along leather's own supply, since leather's own price is unchanged.

The link runs in reverse too, since a collapse in the beef price would cut slaughtering and starve the tanneries of hides. Goods tied together in production like this, beef and leather, or cotton and cottonseed, rise and fall in supply together.

The Master Key: when two goods are born of one act of production, the price of one quietly governs the supply of the other.

REAL Question 71

Follow the night fishermen of Mwanza onto Lake Victoria. When EWURA lifts the price of the diesel that powers their boats, fewer fish reach the morning market, though the lake stays as full as ever.

Using the box, explain why the supply of fish falls when the diesel price rises, and state which determinant of supply this illustrates.

> The fishermen of Mwanza use diesel-powered boats to catch Nile perch and dagaa on Lake Victoria and land them for sale each morning.
>
> EWURA raises the pump price of diesel, so every fishing trip now costs far more in fuel than before.
>
> Some boats cut the number of nights they go out and a few tie up altogether, so fewer fish are landed and offered for sale, even though the price of fish has not changed.

Model Answer

The supply of fish falls because diesel is a factor of production whose price has risen, lifting the cost of every fishing trip, so with the fish price unchanged some boats find it no longer worth going out and land less, which illustrates the determinant of the prices of the factors of production, or cost of production.

Diesel is an input: the boats run on diesel, so fuel is one of the factors of production behind every catch, and its price forms part of the cost of landing fish.

Costs rise, margins shrink: when EWURA lifts the diesel price, each trip costs more, so at the unchanged fish price the profit on a night's catch is squeezed and some trips no longer cover their cost.

Boats cut output: in response, some fishermen reduce their nights out and a few stop altogether, so fewer fish are landed and offered for sale, and the supply of fish falls.

Supply shifts, price unmoved: the price of fish itself has not changed, so this is a fall in supply caused by a higher factor price, not a movement caused by the price of fish.

The same logic runs the other way, since cheaper diesel would lower the cost of a trip and coax more boats out, raising the supply of fish. Whatever changes the cost of an input changes supply while the good's own price stands still.

The Master Key: raise the price of a boat's fuel and you sink part of the fish supply, though not a shilling has moved on the fish itself.

HOT Question 72

A trader swears the rule is iron: a higher price always brings out more of a good. Yet a harvest already gathered cannot grow, and a well-paid worker may choose rest, so the iron can bend.

To what extent does the law of supply always hold? In your answer consider the very short run and the supply of labour.

Model Answer

The law of supply holds well as a general rule for produced goods once firms have time to vary their output, but it does not always hold, failing in the very short run when the quantity is already fixed and, over part of its range, for the supply of labour.

Where the law holds: for most goods over the short and long run firms can change how much they make, so a higher price does draw out a larger quantity supplied exactly as the law predicts, and this covers the great bulk of ordinary production.

The very short run: in the momentary period the quantity is already determined, such as a maize harvest already gathered or a catch of fish already landed, so however high the price rises no more can be produced at once, and the quantity supplied stays fixed instead of rising with price.

The supply of labour: for a worker the wage is the price of labour, and beyond a certain high wage a further rise can lead him to work fewer hours rather than more, because he now feels rich enough to prefer leisure, so his labour supply bends backward against the law.

Why the exceptions are limited: both cases are special, the first because it lasts only until output can be adjusted, and the second because it needs a wage high enough for the desire for leisure to outweigh the lure of more pay, so neither overturns the rule for goods in general.

On balance the law of supply is a reliable guide wherever producers can respond to a higher price by making more, which is most of the economy most of the time. Its failures are real but confined, to the fleeting moment when the quantity is fixed and to the richly paid worker who values his rest, so the rule stands with these clearly marked exceptions.

The Master Key: give producers time and the law of supply holds; freeze the quantity or pay a worker enough to rest, and it quietly steps aside.

HOT Question 73

A cement dealer in Tanga is sure that nothing makes a factory pour out more bags except a higher price. An economist grants him half the truth, then points firmly to the other half.

To what extent is it correct to say that a higher price is the only thing that makes firms supply more? Discuss.

Model Answer

It is only half correct, because a higher price is indeed what raises the quantity supplied under the law of supply, but it is not the only route to a larger supply, since a fall in costs, better technology, a subsidy, more firms or a kinder season can each raise supply while the price stays put.

The half that is right: holding other things constant, a higher price does draw out a larger quantity supplied, because it widens the profit on each unit and makes the costlier extra units worth producing, which is simply the law of supply at work.

The half that is missing: the quantity supplied is not the same as supply, for the whole supply can grow at an unchanged price when the conditions behind it improve, so price is only one influence among several.

Costs, technology and policy: cheaper inputs or an improvement in technology lower the cost of a bag of cement, and a government subsidy does the same, so firms willingly supply more at the very same price.

Sellers and seasons: more firms entering the industry add their output to the market, and for farm goods a good season lifts the harvest, so supply can rise for reasons that have nothing to do with the good's own price.

So the dealer is right that a higher price raises the quantity supplied, but wrong to call it the only cause of a larger supply. A change in price moves quantity supplied along a fixed relationship, whereas costs, technology, taxes, subsidies, the number of firms and the weather move the whole relationship. On balance the claim mistakes one cause for the only cause.

The Master Key: price is what draws more from a given supply; the determinants are what enlarge the supply itself.

Supply Schedules, Curves, and the Difference Between a Movement and a Shift

Supply is the mirror of demand, and it is built the same way: from one seller's schedule to the whole market's, and from a table of numbers to a rising curve. In this section you learn to add quantities across firms, to plot price against quantity for goods like beef, and above all to tell a movement along the supply curve, caused by the good's own price, from a shift of the whole curve, caused by anything else. Get that last distinction right and half the errors in price theory simply vanish.

BINDER Question 74

In Mbeya a butcher keeps a worn notebook. Beside each price for a kilo of beef he notes how many kilos he would supply, and the quiet list already has a name.

Define an individual supply schedule, and using the schedule of beef in the following table, explain what it shows.

Price of beef (TShs/kg)	Quantity supplied (kg)
1000	10
2000	20
3000	30
4000	40
5000	50

Model Answer

An individual supply schedule is a table showing the quantities of a good that a single producer is willing and able to offer for sale at each of a series of prices over a given period.

It pairs price with quantity: each row matches one price to the amount the seller would bring to market at that price, so the schedule is simply a list of price and quantity supplied pairs.

It reads upward: at 1,000 shillings a kilo the butcher offers only 10 kg, but at 5,000 shillings he offers 50 kg, so as the price rises the quantity supplied rises with it.

It captures one seller only: every figure in the table belongs to a single producer, which is why it is called an individual supply schedule and not a market one.

Read as a whole, the schedule is the raw material of the supply curve. Turn each pair into a point on a graph and join them, and this table becomes a rising line you can see.

The Master Key: a supply schedule is a supply curve before it has been drawn.

BINDER Question 75

A Dodoma charcoal seller brings only a little when the price is low, then far more the week the price climbs. Plot his offerings against price, and the points march steadily uphill.

Explain how a supply curve is drawn from a supply schedule, state which variable is measured on each axis, and say why the curve slopes upward.

Model Answer

A supply curve is drawn by plotting each price and quantity supplied pair from a producer's schedule as a point, with price up the vertical axis and quantity along the horizontal axis, and it slopes upward because a higher price calls forth a larger quantity supplied.

Plot each pair: take one row of the schedule, find its price on the vertical axis and its quantity on the horizontal axis, mark where the two meet, then repeat for every row.

Price up, quantity along: by the same convention used for demand, price is measured up the vertical axis and quantity supplied along the horizontal axis, so any supply diagram can be compared with any demand diagram at a glance.

It rises to the right: as the figure shows, at point A the firm offers 10 units at a price of 400 shillings, while at the higher point B it offers 20 units at 1,200 shillings, so the curve S climbs from left to right.

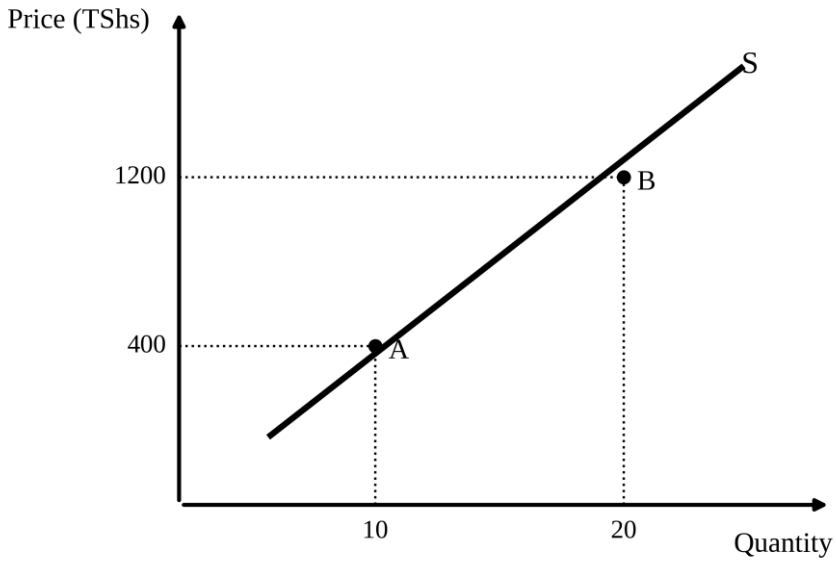


Figure 3.11: An upward-sloping supply curve S, with a larger quantity offered at the higher price at B than at A.

This upward slope is the law of supply at work: because a higher price makes production more profitable, sellers willingly offer more, so the curve for almost every good rises from left to right, the exact opposite of the demand curve.

The Master Key: the supply curve is the schedule made visible, and it climbs because reward and quantity rise together.

BINDER Question 76

Two Mwanza beef traders never share a stall, yet the wholesaler above them watches only one figure: the total beef they would bring at each price. Where does that total come from?

Define a market supply schedule, and using Supplier A's and Supplier B's figures in the table, show how it is derived from the individual supply schedules.

Price (TShs/kg)	Supplier A (kg)	Supplier B (kg)	Market (kg)
1000	10	5	15
2000	20	10	30
3000	30	15	45
4000	40	20	60
5000	50	25	75

Model Answer

A market supply schedule is a table showing the total quantity of a good that all producers together are willing and able to offer at each price, obtained by adding the individual quantities supplied at every price.

Add across each row: at each price you add the quantities the separate sellers offer, so at 1,000 shillings Supplier A's 10 kg and Supplier B's 5 kg give a market total of 15 kg, and at 5,000 shillings their 50 and 25 give 75 kg.

Add quantities, never prices: both sellers face the very same price, so the price is never added; only the quantities are summed, and this adding along each price row is what economists call horizontal summation.

The market schedule rises too: since each seller offers more as the price climbs, their total does the same, rising from 15 kg at 1,000 shillings to 75 kg at 5,000.

The same rule scales to a whole nation. Whether there are two sellers or two thousand, market supply at any price is simply the sum of every individual quantity supplied at that price.

The Master Key: to build market supply, add along each price row and leave the prices untouched.

BINDER Question 77

Lay Supplier A's rising line beside Supplier B's on the same beef diagram, and a third, longer line seems to step out to their right almost on its own.

Explain how the market supply curve for beef is obtained from the individual supply curves of Supplier A and Supplier B, and state how the market curve compares with each of them.

Model Answer

The market supply curve is found by horizontal summation, adding Supplier A's and Supplier B's quantities at each price, and the resulting curve S lies to the right of both individual curves and is flatter than either.

Sum horizontally at each price: choose any price, read off the quantity Supplier A offers and the quantity Supplier B offers, and add the two, for their sum is the market quantity supplied at that price.

Repeat and join: do this at every price and join the totals, and you obtain the market supply curve S, drawn in the figure beside the two individual curves s_A and s_B.

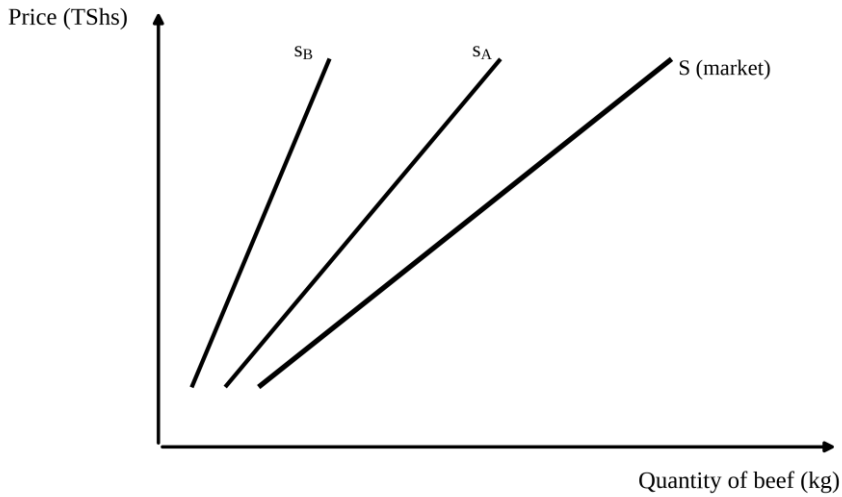


Figure 3.12: Supplier A's curve s_A and Supplier B's curve s_B summed horizontally into the market supply curve S.

Further right, and flatter: because the market quantity is the sum of both sellers, at every price it is larger than either seller's alone, so S lies to the right of both s_A and s_B and is flatter than either.

Adding curves always means adding along the quantity axis, never up the price axis. At any chosen price, measure Supplier A's quantity across to s_A and Supplier B's across to s_B, then add the two distances to reach S.

The Master Key: lay the sellers' curves side by side, add them along each price line, and the market supply curve steps out to the right.

REAL Question 78

Follow a Kilombero maize farmer as the price on the market board rises and falls. His fields are unchanged, yet the sacks he carries to town swing with that one number.

Using the price changes in the box, explain what happens to the farmer's quantity supplied, and show how each change appears on a supply diagram.

> At Kilombero the price of a sack of maize first rises from TShs 40,000 to TShs 60,000, and the farmer increases the quantity he supplies. Later in the season the price falls back to TShs 30,000, and he cuts the quantity he brings to market. His land, seeds and methods do not change at any point.

Model Answer

Because only the price of maize itself changes, each response is a change in quantity supplied, shown as a movement along one unchanged supply curve: the price rise brings an expansion, and the later price fall brings a contraction.

Caused by the own price: the only thing that moves is the price of maize itself, so the farmer slides up or down a supply curve that itself stays exactly where it is.

A rise brings an expansion: when the price climbs from 40,000 to 60,000 shillings a sack, the farmer offers more, so quantity supplied rises and we move upward along the curve from A to B, an expansion of supply.

A fall brings a contraction: when the price then drops to 30,000 shillings, he offers less, so quantity supplied falls and we move downward along the curve from A to C, a contraction of supply.

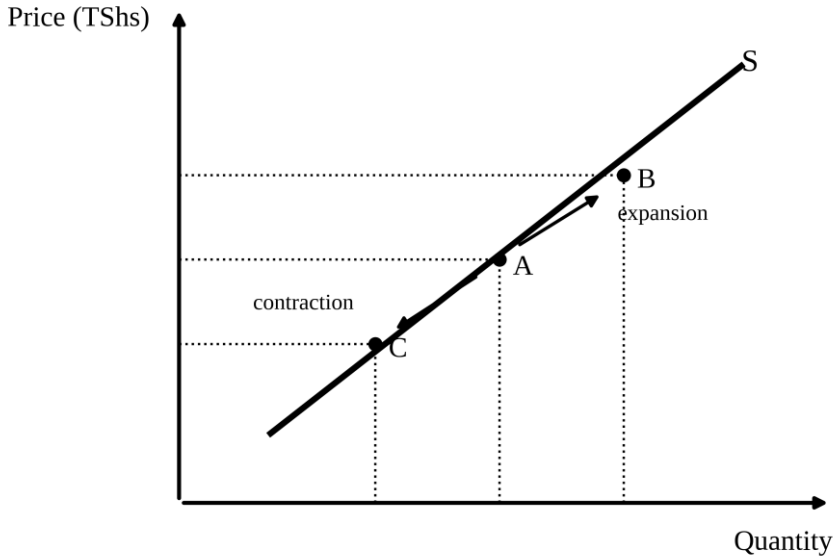


Figure 3.13: A price rise slides supply up from A to B (expansion); a price fall slides it down from A to C (contraction).

Notice that his land, seeds and methods never changed, so the curve itself never moved. This is the mark of a change in quantity supplied: one curve, and the seller merely travelling along it as the price alone rises and falls.

The Master Key: when only the price tag moves, the seller travels along the supply curve; a rise expands, a fall contracts.

REAL Question 79

Follow the fishermen of Mwanza on Lake Victoria. The shore price of fish has not moved all month, yet the catch laid out for sale is suddenly far larger than before.

Using the events in the box, explain what happens to the supply of fish in each case, and show how each appears as a shift of the supply curve.

> In Mwanza the shore price of fish stays the same throughout. First, a donor programme gives the fishermen better nets and engines, so they can land far more fish than before. Later, a sharp rise in the price of fuel makes going out to fish much more costly.

Model Answer

Because the shore price of fish never changes, neither event is a movement along the curve: the better nets increase supply and shift the whole curve to the right, while the costlier fuel decreases supply and shifts it to the left.

Driven by other factors: the fish price itself is unchanged; instead a non-price determinant moves, first the technology and then the cost of an input, so the entire supply curve relocates rather than a point sliding along it.

Better nets increase supply: with better nets and engines the fishermen can offer more fish at every price, so supply increases and the curve shifts bodily to the right, from S_0 to S_1.

Dearer fuel decreases supply: when fuel becomes costly, fishing is less profitable at every price, so the fishermen offer less, supply decreases, and the curve shifts bodily to the left, from S_0 to S_2.

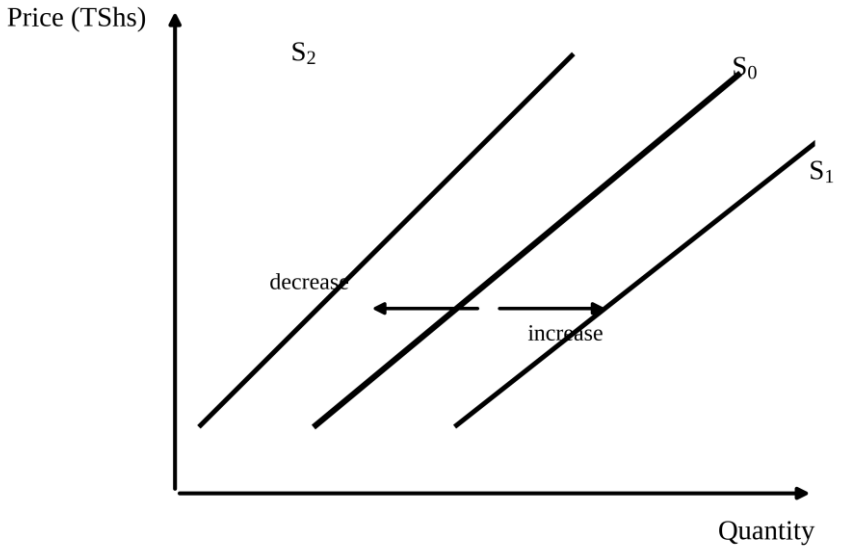


Figure 3.14: An increase shifts S_0 out to S_1; a decrease pulls it back to S_2.

At the very same shore price the quantity offered is larger on S_1 and smaller on S_2, which is the signature of a shift: the change happens at every price at once, not at a single point.

The Master Key: when anything but the good's own price changes, the whole supply curve moves, right for an increase and left for a decrease.

REAL Question 80

Follow a Singida cattle keeper through two headlines. First the price of beef itself jumps at the auction; then, weeks later, the government cuts the price of the cattle feed he buys.

For each event in the box, decide whether it causes a change in quantity supplied or a change in supply, and explain how each appears on the supply diagram.

Event 1: the auction price of beef rises, and the cattle keeper sells more cattle. Event 2: some weeks later, with the beef price now steady, the price of the cattle feed he must buy falls sharply, lowering his costs.

Model Answer

Event 1 is a change in quantity supplied, a movement along the curve caused by beef's own price, while Event 2 is a change in supply, a rightward shift of the whole curve caused by a fall in the cost of an input.

Event 1 is a movement: the beef price itself rose, and the good's own price is the one thing that moves the seller along a fixed curve, so this is an expansion of quantity supplied, an upward slide from one point to a higher one.

Event 2 is a shift: the beef price held steady while the cost of feed fell, so a non-price determinant changed; cheaper feed lets the keeper supply more at every price, so the whole curve shifts to the right, an increase in supply.

The test to apply: ask one question, did beef's own price change? If yes, you have a movement and must say quantity supplied; if no, some other determinant moved and the curve itself shifts.

Confusing these two is the commonest error in the topic. Event 1 slides a point along an unchanged curve, while Event 2 lifts the entire curve to a new position, even though both end with more beef being sold.

The Master Key: beef's own price moves the seller along the curve; the cost of feed moves the whole curve.

HOT Question 81

A confident student insists that a rise in the price of maize must shift the whole supply curve for maize to the right. The logic feels neat, and it is exactly the wrong way round.

A candidate claims that a rise in the price of maize shifts the supply curve for maize to the right. Identify the error, and explain the correct analysis.

Model Answer

The claim is wrong, because a rise in the good's own price never shifts its supply curve; it causes a movement along the curve, an expansion of quantity supplied, not a shift.

Spotting the error: the price that changed is maize's own price, and a good's own price is the one determinant that moves the seller along the curve, so no shift can occur.

The correct term: a rise in the price of maize causes an expansion of quantity supplied, shown by sliding up the fixed supply curve from a lower point to a higher one.

When maize supply would shift: the curve for maize would shift only if a non-price determinant changed, for example cheaper fertiliser, better weather, a new subsidy, or an improvement in farming technology.

The candidate has confused a change in quantity supplied with a change in supply, the exact mirror of the demand-side error. A useful check: if the good's own price is what moved, you must be sliding along the curve, never redrawing it.

The Master Key: maize's own price rising expands quantity supplied along the curve; only something other than maize's price could shift it.

Supply Functions and Interrelated Supply

Supply, like demand, can be written as algebra, and the same care that made the demand function precise now shapes the supply side. This section opens with the full supply function $Q_s = f(P_x, P_r, P_e, C, T, U)$, narrows it to the own-price form and the workhorse linear rule $Q_s = a + bP$ with its telling positive slope, then shows how the supplies of separate firms add into a market supply. It closes with two links that

tie one good's supply to another: joint supply, where goods leave the same gate together, and composite supply, where goods fight over the same resource.

BINDER Question 82

The price on the sack is only one hand on the tap: fertiliser bills, a rumour of higher prices next month and a new machine turn the flow of maize too.

Write the general supply function $Q_s = f(P_x, P_r, P_e, C, T, U)$, explain what each argument means, and show how it simplifies to the own-price supply function.

Model Answer

The general supply function $Q_s = f(P_x, P_r, P_e, C, T, U)$ says that the quantity supplied of a good depends on its own price, the prices of related goods, the expected future price, the cost of production, the state of technology and other factors, and holding all but the first constant leaves the own-price supply function $Q_s = f(P_x)$.

Px, the own price: the price of the good itself, the leading influence, since by the law of supply a higher own price makes production more profitable and coaxes out a larger quantity.

P_r, related prices: the prices of goods linked in production, so that a higher price for a good made alongside it in joint supply raises supply, while a higher price for a good that competes for the same resources lowers it.

P_e, the expected price: the price producers expect in the near future, because if they expect it to rise they hold stock back to sell later, cutting today's supply, and if they expect it to fall they release stock now.

C, cost of production: the cost of inputs such as seed, fertiliser, fuel and wages, since dearer inputs squeeze profit and shrink supply, while cheaper inputs enlarge it.

T, technology: the state of technique, because a better method or machine lowers unit cost and lets producers offer more at every price.

U, other factors: everything else that sways sellers, such as weather, taxes and subsidies, and the number of producers in the market.

Holding P_r, P_e, C, T and U constant by the ceteris paribus rule isolates the own price, leaving the simplified own-price supply function $Q_s = f(P_x)$, the narrow relationship that lies behind the supply curve.

The Master Key: price is only the loudest of six voices telling a producer how much to supply.

BINDER Question 83

Every straight supply line hides two numbers: one fixes where the line sets off along the quantity axis, the other how eagerly sellers pour out more as the price climbs.

Explain the linear supply function $Q_s = a + bP$, saying what a and b measure, and why the sign before b is positive.

Model Answer

In the linear supply function $Q_s = a + bP$ the term a is the quantity-axis intercept, the amount supplied when the price is zero, while b is the slope, the number of extra units offered for each one-unit rise in price, and the sign before b is positive because a higher price draws out a larger quantity.

The intercept a: setting $P = 0$ gives $Q_s = a$, so a is where the supply line meets the quantity axis; it may be positive, zero or negative depending on the good, but it fixes the line's starting height.

The slope b: b is the rise in quantity supplied for each one-shilling rise in price, so a large b means sellers respond eagerly and a small b means they respond sluggishly.

Why the sign is positive: by the law of supply price and quantity move in the same direction, so as P rises Q_s must rise, which the plus sign in front of bP delivers.

The mirror of demand: this is the opposite of the demand function, which carries a minus sign because buyers retreat as price rises, whereas supply carries a plus sign because sellers advance.

So the two letters set the whole line: a fixes where it starts along the quantity axis and b fixes how steeply it climbs, and the positive slope is the algebra's way of writing the law of supply.

The Master Key: a plus sign before bP is simply the law of supply written in algebra.

BINDER Question 84

Slaughter one more steer and you get more hides whether you want them or not; plant one more acre of rice and you get less sugar from the very same land.

Distinguish between joint supply and composite supply, giving a Tanzanian example of each.

Model Answer

Joint supply and composite supply are opposite kinds of production link: in joint supply two goods come out of one process together so their supplies rise and fall together, while in composite supply two goods compete for one shared resource so more of one means less of the other.

Joint supply means together: two or more goods are produced from a single process, so raising the output of one automatically yields more of the other; beef and hides from one steer, or cotton lint and cottonseed from one boll, come side by side.

Composite supply means rivalry: one resource has alternative uses, so the amount left for any one use falls as the others take more; land in Kilombero used for sugarcane is land no longer available for rice.

The tell-tale test: ask what happens to the second good when you make more of the first; if it also rises the link is joint, and if it falls the link is composite.

Feature	Joint supply	Composite supply
Production link	Two goods from one process	One resource, alternative uses
Movement	Supplies rise and fall together	More of one means less of the other
Also called	Complementary supply	Competitive or rival supply
Tanzanian example	Cotton lint and cottonseed	Kilombero land for rice or sugarcane

The Master Key: joint products travel together out of one gate; composite uses fight at one gate for the same resource.

REAL Question 85

In Mbeya ten identical rice mills each read their output from one rule, $Q_s = 15 + 3P$. *Combine them and the whole town's supply appears in a single line.*

Ten identical rice mills in Mbeya each supply according to $Q_s = 15 + 3P$, where P is the price per bag in thousands of shillings. Derive the market supply function, showing each step, and check your answer.

Model Answer

Because the ten mills are identical and all face the same price, you multiply one mill's quantity by ten, which turns $Q_s = 15 + 3P$ into the market supply function $Q_s = 150 + 30P$.

Write one mill's supply: each mill supplies $Q_s = 15 + 3P$, already in the form $Q_s = f(P)$, which is exactly what horizontal summation needs.

State the rule: market supply adds the quantities all sellers offer at each price, and when every seller is identical that sum is simply the firm's quantity multiplied by the number of firms, here ten.

Multiply the intercept: ten times the intercept 15 gives 150, the bags the cluster would offer even at a price of zero on this straight-line rule.

Multiply the slope: ten times the slope 3 gives 30, so each one-thousand-shilling rise in price now draws out 30 extra bags from the town instead of 3 from one mill.

State the market supply: putting the two together gives $Q_s = 150 + 30P$, the supply of the whole Mbeya milling cluster.

Price P (000 TShs)	One mill $15 + 3P$	Ten mills (market)
0	15	150
10	45	450
20	75	750

Check at $P = 10$: one mill offers $15 + 3(10) = 45$ bags, so ten offer 450, and the market function gives $150 + 30(10) = 450$, which matches. When mills are not identical you cannot multiply; you must add their separate quantity functions one by one, and multiplying is only the shortcut that works because here every mill is the same.

The Master Key: identical sellers let you multiply; different sellers make you add, but you always combine quantities, never prices.

REAL Question 86

Follow a boll of cotton from a Simiyu field into the ginnery: out comes white lint for the cloth mills and, in the same pass, seed the crushers press into cooking oil.

Using cotton and cottonseed, explain what joint supply is and why a rise in the price of cotton lint tends to raise the supply of cottonseed oil.

Model Answer

Joint supply arises when two goods come from a single production process, so cotton lint and cottonseed are produced together, and a higher lint price that expands the cotton crop automatically brings out more cottonseed and therefore more cottonseed oil.

One crop, two products: ginning raw cotton separates it into lint, which is spun into cloth, and seed, which is crushed for oil and cake; the two arise from the same boll and cannot be produced apart.

Why supplies move together: when the lint price rises, growing cotton becomes more profitable, so farmers plant more and ginneries process more, and every extra kilo of lint brings its fixed companion weight of seed with it.

From seed to oil: more cottonseed reaching the crushers means more raw material for cooking oil, so the supply of cottonseed oil rises even though its own price did not change; it rode in on the cotton boom.

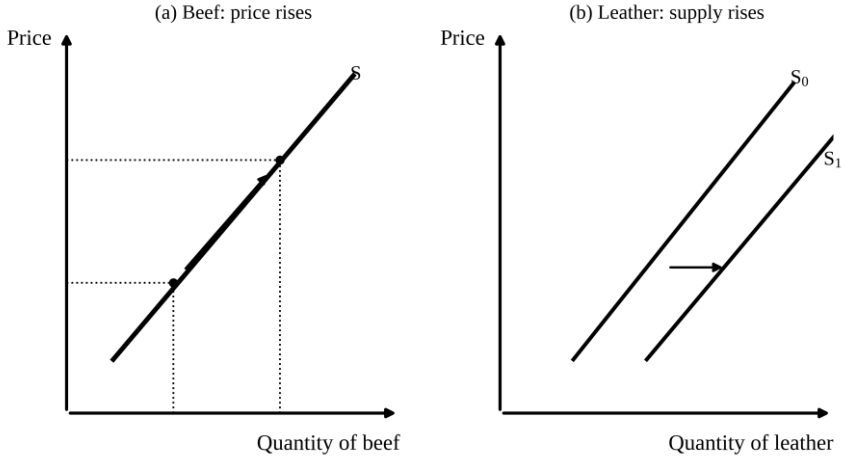


Figure 3.15: beef price rises, so the joint supply of hides and leather rises

Reading the diagram: the diagram shows the textbook case, where a rise in the price of beef expands cattle rearing and so shifts the supply of the joint product, leather, to the right; cotton and cottonseed follow exactly the same logic.

This is why the two are called complements in production: their supplies rise and fall together. If a pest were to ruin the cotton crop, both lint and cottonseed oil would grow scarce at once, from the single blow.

The Master Key: raise the cotton, and the cottonseed comes free with it; joint products share one fate.

REAL Question 87

In the Kilombero valley the same flat, well-watered land can carry either rice paddies or sugarcane, so every hectare handed to the sugar estate is a hectare taken from the rice farmers.

Using land in the Kilombero valley, explain what composite supply is and show how a rise in the price of sugar can reduce the supply of rice.

Model Answer

Composite supply arises when one resource has alternative uses, so Kilombero land is in composite supply between rice and sugarcane, and a higher sugar price that pulls land towards cane leaves less land for paddy and so reduces the supply of rice.

One resource, rival uses: the valley's fertile, watered land can grow either rice or sugarcane, but a given hectare cannot do both at once, so the two crops compete for a single fixed pool of land.

Price steers the land: when the sugar price rises, cane becomes the more profitable use, so landholders and the estate switch hectares from rice to cane to chase the higher return.

Rice supply falls: with fewer hectares left under paddy, the quantity of rice the valley can grow falls, so the supply of rice shifts left even though the price of rice itself has not moved.

The shared-input test: this is the mark of composite supply: the two goods never leave the same gate together but fight over the same input, so more of one must mean less of the other.

The competition runs both ways. If instead the rice price rose, land would swing back from cane to paddy and the supply of sugar would fall, because the binding constraint is the one valley floor that both crops must share.

The Master Key: when two crops must share one valley, feeding one starves the other.

HOT Question 88

A sharp student stares at $Q_s = 150 + 30P$ *and balks: set the price to zero, he says, and the line still offers 150 bags for free, which is surely absurd.*

To what extent is the student right that the positive intercept in $Q_s = 150 + 30P$ makes the linear supply function unrealistic? Discuss.

Model Answer

The student has spotted a real awkwardness but overstates it: a positive intercept does imply the odd claim that something is supplied at a zero price, yet this is a harmless feature of a straight-line approximation that is never meant to be read down at $P = 0$, so it does not make the function unrealistic over the prices that matter.

The grain of truth: taken literally, $Q_s = 150 + 30P$ says that at $P = 0$ the town still offers 150 bags, and since no one produces and sells for nothing, a strictly positive intercept is economically uncomfortable.

Why it is not fatal: the linear function is only an approximation fitted over the range of prices actually observed, so it is legitimate only within that range; pushing the price all the way to zero extrapolates far outside it, where the straight line was never meant to apply.

What the intercept really does: the intercept a merely sets the height at which the line meets the quantity axis; the economics lives in the positive slope of 30, which faithfully captures the law of supply that more is offered as price rises.

The realistic repair: a truer picture often gives the supply line a positive price intercept instead, meaning nothing is offered below some minimum price, which a fitted equation shows as a negative intercept a; the sign of a is an empirical detail, not a law.

So the student is right to refuse a literal reading at $P = 0$ but wrong to call the whole function unrealistic. Judged over the real trading range of prices, $Q_s = 150 + 30P$ behaves perfectly well, and its positive slope, not its intercept, is what carries the economic meaning.

The Master Key: never drive a fitted line to a price it never saw; read the slope for the law, not the intercept for a promise.

HOT Question 89

A regional official promises the Kilombero valley a rice boom and a sugar boom at the very same time, from the very same land. An agronomist beside him quietly raises an eyebrow.

To what extent can the Kilombero valley expand both its rice output and its sugar output at the same time? Discuss.

Model Answer

In the short run the promise is largely empty, because rice and sugarcane are in composite supply for one fixed area of land, so more of one must come at the expense of the other, but in the longer run both can grow together if the shared constraint of land itself is loosened.

The short-run limit: with the valley's cultivable land fixed, rice and cane compete for every hectare, so shifting land into cane to grow sugar directly subtracts from the land under rice, and at that margin one crop can only boom while the other shrinks.

Why composite supply bites: because the binding input is a single shared resource, the two outputs trade off against each other, and no price signal can conjure a hectare that is doing two jobs at once.

How both could rise: the trap is only as tight as the land constraint, so if new land is cleared and irrigated, if yields per hectare rise through better seed and fertiliser, or if swampy fringe is drained, the valley's whole capacity grows and both crops can expand together.

The realistic verdict: so the official is wrong if he means squeezing both booms from today's fixed fields, but right if his plan quietly includes more land, water and technology to enlarge the resource both crops draw from.

The honest answer therefore turns on one question the agronomist is asking with her eyebrow: is there a plan to relax the land constraint? Without it, a sugar boom is a rice bust; with it, composite rivals can both advance.

The Master Key: composite supply forbids two booms from one fixed field, but not from a field made bigger.

Market Equilibrium and Its Determination

Everything in price theory has been building towards a single point: the price at which a market comes to rest. This section shows what market equilibrium is, how to locate it both on a diagram and by algebra, and by what methods a price is actually determined. Above all it reveals the market's quiet genius, the way a surplus or a shortage sets in motion the very forces that rub it out, drawing the price back to the level where buyers and sellers finally agree.

BINDER Question 90

In Kariakoo the price of a crate of tomatoes wobbles all morning as buyers push down and sellers push up, then by ten o'clock it settles on one figure and stops moving. That resting figure has a name.

Define market equilibrium, and state the condition that must hold for a market to be in equilibrium.

Model Answer

Market equilibrium is the state of balance in a market at which the quantity demanded is exactly equal to the quantity supplied, so that the price has no tendency to change.

A balance of the two sides: at the equilibrium price the amount that buyers wish to buy matches exactly the amount that sellers wish to sell, so the plans of both sides agree.

No tendency to change: because there is neither a surplus pushing the price down nor a shortage pulling it up, the price settles and stays there until something disturbs demand or supply.

The market-clearing condition: the condition for equilibrium is simply $Q_d = Q_s$, quantity demanded equal to quantity supplied, and the price at which this holds is the equilibrium price.

Equilibrium does not mean the market never moves; it means that, left alone, it comes to rest at this point and returns towards it whenever it is nudged away.

The Master Key: equilibrium is not where the market starts, but where it stops when demand and supply finally agree.

BINDER Question 91

Two numbers hide inside every settled price tag in a Kariakoo stall: the figure on the tag itself, and the amount that actually changes hands at it. Economists give each its own name.

Define equilibrium price and equilibrium quantity, and explain how the two are related.

Model Answer

The equilibrium price is the price at which quantity demanded equals quantity supplied, and the equilibrium quantity is the amount actually bought and sold at that price.

The equilibrium price: this is the single price that clears the market, the one price at which the quantity buyers wish to buy is exactly the quantity sellers wish to sell.

The equilibrium quantity: this is the quantity actually traded at the equilibrium price, the common amount on which the plans of buyers and sellers meet.

Determined together: the two are found at the very same point, so once the equilibrium price is known the equilibrium quantity follows from it, and neither can be settled without the other.

On a diagram both are read off the single crossing point of the demand and supply curves: the equilibrium price on the vertical axis and the equilibrium quantity on the horizontal axis.

The Master Key: the equilibrium price is what one unit trades for; the equilibrium quantity is how many units trade; a single point on the diagram gives you both.

BINDER Question 92

Draw the buyers' plan sloping down and the sellers' plan sloping up on the same axes, and they can cross at only one place. Where two opposite intentions meet, the market finds its price.

With the aid of a diagram, explain how the equilibrium price and quantity are determined in a competitive market.

Model Answer

Equilibrium is determined at the point where the demand curve and the supply curve intersect, and that single crossing point fixes both the equilibrium price and the equilibrium quantity.

The two curves: the demand curve slopes downward, showing that buyers take more as price falls, while the supply curve slopes upward, showing that sellers offer more as price rises.

The crossing point: the two curves meet at exactly one point, labelled E, and only there does quantity demanded equal quantity supplied, so E is the equilibrium.

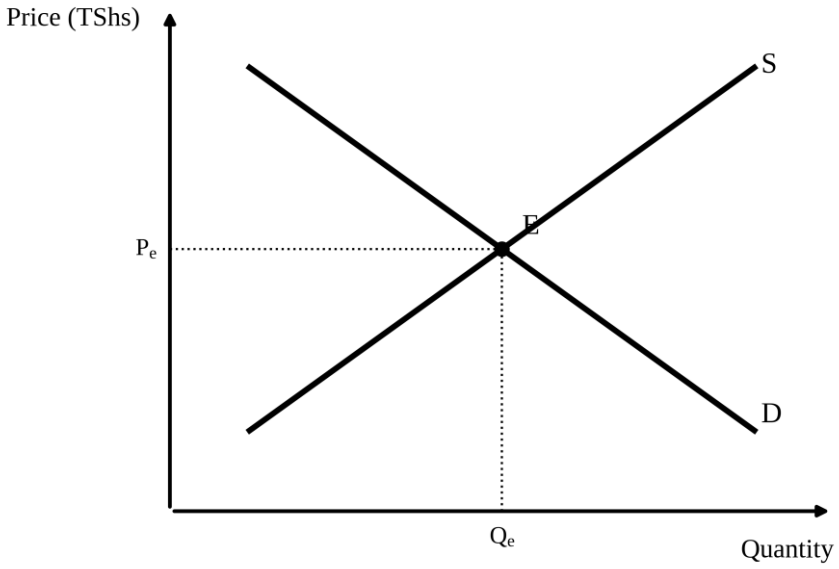


Figure 3.16: demand and supply crossing at equilibrium E

Reading off the values: drop a line from E across to the price axis to read the equilibrium price, and drop a line down to the quantity axis to read the equilibrium quantity.

At any other price the two curves are apart, leaving a gap between what buyers want and what sellers offer, and that gap is exactly what drives the price back towards E.

The Master Key: the market's price is chosen by no one; it is simply the height at which the buyers' curve and the sellers' curve happen to cross.

BINDER Question 93

Set the price of a good too high and it piles up unsold; set it too low and it vanishes by noon. Either mistake quietly corrects itself, and the good tells you so through the pile or the empty shelf.

Explain how a surplus and a shortage each push the market price back towards equilibrium.

Model Answer

A price above equilibrium creates a surplus that pushes the price down, while a price below equilibrium creates a shortage that pushes the price up, so the market moves itself back to the equilibrium price where it clears.

A surplus above equilibrium: when the price is set above the equilibrium, quantity supplied exceeds quantity demanded, leaving unsold stock, so sellers cut the price to shift it and the price falls towards equilibrium.

A shortage below equilibrium: when the price is set below the equilibrium, quantity demanded exceeds quantity supplied, so eager buyers bid against one another and sellers raise the price, which climbs towards equilibrium.

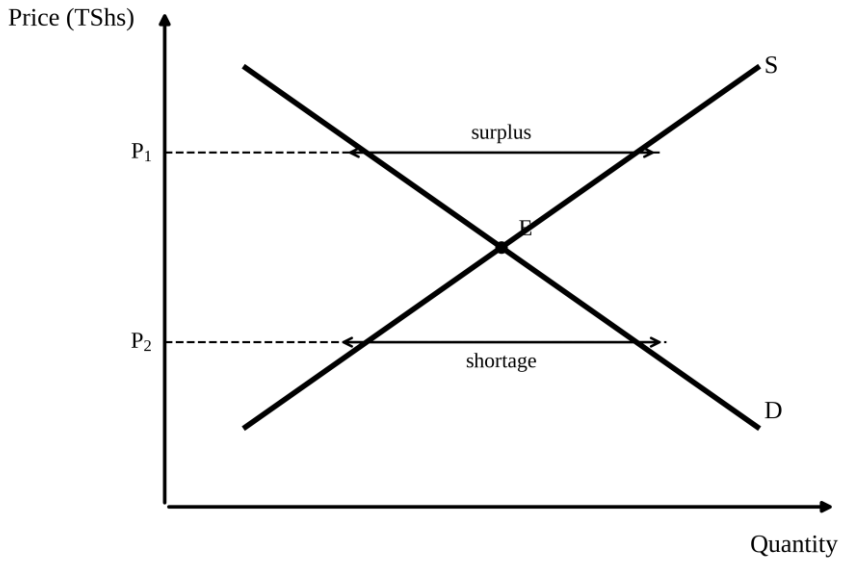


Figure 3.17: a surplus above and a shortage below the equilibrium price

The market clears: the pressure stops only at the equilibrium price, because there the surplus and the shortage both vanish and quantity demanded equals quantity supplied.

This self-correcting movement is why the equilibrium is called stable: pushed above it the market sinks back, pushed below it the market climbs back, and at the equilibrium it rests.

The Master Key: a surplus is the market's way of shouting 'too dear' and a shortage its cry of 'too cheap'; the price obeys until both fall silent.

BINDER Question 94

Not every price is found the same way. A Kariakoo trader haggles, an auctioneer at the fish landing takes bids, a ministry fixes a ceiling, yet behind all three stand the same two forces.

Outline the main methods by which the price of a good may be determined in a market.

Model Answer

A price may be determined in four main ways: the free interaction of demand and supply, haggling or bargaining between buyer and seller, price control by government, and auction.

Interaction of demand and supply: in a competitive market the price is set impersonally by the meeting of demand and supply, settling at the level where the two are equal, which is the equilibrium price.

Haggling or bargaining: in many local markets buyer and seller negotiate face to face, each opening from a different figure and settling on a price in between, as is common in Kariakoo.

Price control by government: the state may fix the price directly, setting a maximum price or ceiling to protect buyers, or a minimum price or floor to protect sellers, overriding the free market.

Auction: goods such as fish, flowers or livestock are sold to the highest bidder, so open competition among buyers determines the price on the spot.

Even where haggling or an auction sets the actual figure, demand and supply lie underneath, since no seller can hold out for a price buyers will not meet, and no buyer can force a price below which sellers will not part with the good.

The Master Key: haggling, auction and control decide how a price is announced, but demand and supply decide what it can be.

REAL Question 95

Follow the soap wholesalers of Kariakoo, whose weekly buying and selling plans have been written as two neat equations. Somewhere between them lies the one price at which the market clears.

The weekly demand and supply for cartons of soap in Kariakoo are $Q_d = 20 - 0.5P$ and $Q_s = -10 + 1.5P$. Determine the equilibrium price and quantity, showing each step.

In the Kariakoo soap trade, weekly demand is $Q_d = 20 - 0.5P$ and weekly supply is $Q_s = -10 + 1.5P$.

P is the price in thousands of shillings per carton and Q is the quantity in thousands of cartons per week.

Model Answer

Setting quantity demanded equal to quantity supplied gives an equilibrium price of 15, that is TShs 15,000 per carton, and an equilibrium quantity of 12.5 thousand cartons per week.

Apply the equilibrium condition: the market is in equilibrium where $Q_d = Q_s$, so set the two functions equal: $20 - 0.5P = -10 + 1.5P$.

Collect the price terms: add $0.5P$ to both sides and add 10 to both sides, giving $20 + 10 = 1.5P + 0.5P$, that is $30 = 2P$.

Solve for the price: divide both sides by 2 to get $P = 15$, so the equilibrium price is 15 thousand shillings per carton.

Find the quantity: substitute $P = 15$ into demand: $Q = 20 - 0.5(15) = 20 - 7.5 = 12.5$ thousand cartons.

Check with supply: put $P = 15$ into supply: $Q_s = -10 + 1.5(15) = -10 + 22.5 = 12.5$, the same quantity, which confirms the answer.

So the Kariakoo soap market clears at TShs 15,000 per carton with 12,500 cartons traded each week; at any higher price soap would pile up unsold, and at any lower price it would sell out.

The Master Key: to find equilibrium algebraically, set Q_d equal to Q_s, solve for the price, then put that price back into either equation for the quantity.

REAL Question 96

Follow the dawn trade in Nile perch at a Mwanza landing on Lake Victoria, where the mongers' demand and the boats' supply have each been captured in an equation. Find where they meet.

At a Mwanza fish market the daily demand and supply for Nile perch are $Q_d = 48 - 3P$ and $Q_s = 8 + 2P$. Determine the equilibrium price and quantity, showing each step.

For Nile perch, called sangara, at a Mwanza landing, daily demand is $Q_d = 48 - 3P$ and daily supply is $Q_s = 8 + 2P$.

P is the price in thousands of shillings per kilo and Q is the quantity in hundreds of kilos per day.

Model Answer

Setting quantity demanded equal to quantity supplied gives an equilibrium price of 8, that is TShs 8,000 per kilo, and an equilibrium quantity of 24 hundred kilos, or 2,400 kilos, per day.

Apply the equilibrium condition: equilibrium requires $Q_d = Q_s$, so set the functions equal: $48 - 3P = 8 + 2P$.

Collect the price terms: add $3P$ to both sides and subtract 8 from both sides, giving $48 - 8 = 2P + 3P$, that is $40 = 5P$.

Solve for the price: divide both sides by 5 to get $P = 8$, so the equilibrium price is 8 thousand shillings per kilo.

Find the quantity: substitute $P = 8$ into demand: $Q = 48 - 3(8) = 48 - 24 = 24$ hundred kilos.

Check with supply: put $P = 8$ into supply: $Q_s = 8 + 2(8) = 8 + 16 = 24$, the same figure, so the equilibrium is confirmed.

The Mwanza perch market therefore clears at TShs 8,000 a kilo with 2,400 kilos sold each morning, the price at which the mongers' demand and the boats' catch exactly agree.

The Master Key: once the boats and the buyers are written as equations, the market price is no longer haggled but simply solved.

REAL Question 97

Follow a new private library in Dodoma that opens its doors with a bold monthly fee, sure that readers will flock in. Weeks pass, and the reading room stays half empty.

Study the box, then explain in terms of surplus and equilibrium why the library must lower its monthly fee, and where the fee will settle.

> A private library in Dodoma has room for 400 monthly members and sets the membership fee at TShs 30,000 a month.
>
> At that fee only 150 people join, so 250 places stay empty month after month.
>
> Studies suggest that at a fee of about TShs 18,000 the library would just fill its 400 places.

Model Answer

The library has set its fee above the equilibrium, creating a surplus of empty places, so the pressure to fill the room will push the fee down until it settles near the equilibrium fee of about TShs 18,000, where the 400 places just fill.

The fee is above equilibrium: at TShs 30,000 only 150 people are willing and able to join, well short of the 400 places, so quantity supplied exceeds quantity demanded.

A surplus appears: the 250 empty places are a surplus, or excess supply, of membership, and they earn the library nothing while its costs run on.

The surplus forces the fee down: to fill the room the library must cut the fee, and as it falls more readers can afford to join, so the gap between places and members narrows.

Where it settles: the fee stops falling at about TShs 18,000, because there the number wishing to join just equals the 400 places, the surplus is gone, and the market for membership clears.

The empty seats were not a sign that Dodoma has no readers, but a sign that the fee was simply too high; the equilibrium fee is the one that the demand for membership will actually support.

The Master Key: a room of empty chairs at a proud price is a surplus in disguise, and the only cure is a price that comes down to meet the buyers.

REAL Question 98

Follow a rice trader who reaches Tandale market in Dar one morning determined to sell fast, so he chalks up a price well below what his rivals ask. By nine o'clock his stall is bare and a queue is still waiting.

Using the box, explain in terms of shortage and equilibrium why the trader's low price could not last, and which way the price must move.

> A trader brings 100 sacks of rice to Tandale market in Dar es Salaam and prices them at TShs 90,000 a sack to sell quickly.
>
> At that price buyers want 160 sacks, far more than the 100 he has, and the rice sells out within two hours while a queue still waits.
>
> Rival stalls are asking about TShs 110,000 a sack and are still selling steadily.

Model Answer

The trader has set his price below the equilibrium, creating a shortage, so disappointed buyers will bid the price up and it must rise towards the equilibrium of about TShs 110,000 a sack, where the quantity wanted matches the quantity available.

The price is below equilibrium: at TShs 90,000 buyers want 160 sacks but only 100 are available, so quantity demanded exceeds quantity supplied.

A shortage appears: the missing 60 sacks are a shortage, or excess demand, shown plainly by the queue that remains once the stall is bare.

The shortage forces the price up: buyers who cannot get rice offer more rather than go without, and sellers, seeing the eager queue, raise their asking price, so the price climbs.

Where it settles: the price rises until buyers want just what is on sale, at about TShs 110,000 a sack, the equilibrium at which the shortage disappears and the market clears.

Selling out in two hours felt like success, but it was really the mark of a price set too low; the equilibrium price is the one at which the last sack goes to the last willing buyer with no queue left waiting.

The Master Key: a stall that empties too fast and a queue that will not leave are a shortage speaking, and the price rises until the queue is gone.

HOT Question 99

A market trader swears his prices always find their own level if left alone; a planner retorts that markets get stuck, overshoot and fail. Each has seen something real.

To what extent is it true that a competitive market always returns by itself to equilibrium? Discuss.

Model Answer

It is largely true that a competitive market returns to equilibrium on its own, because surpluses and shortages generate the very pressures that correct them, yet the self-correction is neither instant nor guaranteed in every case.

The self-correcting mechanism: above equilibrium a surplus makes sellers cut the price, and below it a shortage makes buyers bid it up, so in an ordinary competitive market the price is always pushed back towards the point where $Q_d = Q_s$.

Why it usually works: no one has to organise this, since the private interest of each buyer and seller does it automatically, which is why free markets clear day after day with no manager in charge.

Where it is slow or blocked: prices can be sticky, so adjustment takes time; and a government control, a ceiling or a floor, can hold the price away from equilibrium and lock in a lasting shortage or surplus.

Where it may overshoot: in farming, where this year's planting depends on last year's price, the price can swing above and below equilibrium for several seasons before it settles, and in some cases may not settle neatly at all.

So the trader is right for the great majority of competitive markets, where the pull back to equilibrium is strong and reliable, while the planner is right that the return can be slow, blocked by controls, or unsteady. On balance the tendency towards equilibrium is real and powerful, but it is a tendency, not an iron law.

The Master Key: a free market leans back towards equilibrium the way a pushed pendulum leans back, reliably in the end, but not always quickly or in a straight line.

HOT Question 100

A Kariakoo shopkeeper insists the price is whatever he chalks on the board; the customer walking away untouched suggests he is not quite the master he thinks.

To what extent does the seller alone determine the market price? Discuss.

Model Answer

It is only partly true that the seller determines the price, because although the seller names the figure on the tag, it is the interaction of demand and supply that decides which figure can actually hold, and a seller who defies it is punished by surplus or shortage.

The grain of truth: the seller does post the price and may set it wherever he likes, so at the moment of sale the figure on the board is indeed his to choose.

But demand disciplines him: if he sets it above the equilibrium, buyers melt away and his stock piles up as a surplus, forcing him to cut the price, so the market, not his wish, sets the ceiling.

And a low price disciplines too: if the price is pushed below equilibrium a shortage forms and buyers bid it back up, which shows that the buyer can no more dictate the price than the seller can.

The real determinant: the price that can last is the equilibrium price, fixed by the meeting of demand and supply, and haggling or posting a figure only searches for it, it does not overrule it.

So the seller determines the asking price but not the market price. He is free to name any figure, and equally free to watch his goods rot or vanish if that figure ignores what buyers will pay and what rivals will supply. On balance the market price is made by both sides together, with the seller proposing and demand and supply disposing.

The Master Key: a seller can write any price on the board, but only demand and supply decide which price the board is allowed to keep.

Changes in Equilibrium: Comparative Statics

An equilibrium holds only while demand and supply stand still, so the moment a festive season, a bumper harvest, a drought or a fuel-price rise moves one of the curves, the old price and quantity give way to new ones. Comparative statics is the disciplined art of comparing the equilibrium before a shift with the equilibrium after it, and reading off exactly how price and quantity have changed. You will first master the four single-shift rules, where the answer is always clean and certain. Then you will meet the harder and more realistic case in which both curves move at once, so that one of price and quantity stays certain while the other waits on which force is stronger.

BINDER Question 101

A sack of maize holds one price for weeks, jumps after a rainless month, then settles at a new price. The economist compares the two calm figures, not the leap between them.

Define comparative statics, and outline the three steps an economist follows to work out how an equilibrium changes.

Model Answer

Comparative statics is the method of comparing one market equilibrium with another after a determinant of demand or supply has changed, so as to read off the change in equilibrium price and quantity without studying the messy path between them.

Start at the first equilibrium: identify the original equilibrium price and quantity where the initial demand and supply curves cross, the position P_0 and Q_0 that ruled before anything changed.

Shift one curve: decide which determinant has changed and therefore which single curve moves and in which direction, holding the other curve perfectly still by the ceteris paribus rule.

Read the new equilibrium: find where the new curve cuts the unmoved one, giving the fresh equilibrium P_1 and Q_1, then compare it with the old to state the direction of change in price and in quantity.

The word static is the clue: we photograph the market before and after and compare the two still pictures, rather than film the turbulent adjustment in between.

The Master Key: comparative statics compares two resting points and ignores the scramble that links them.

BINDER Question 102

In one week a Kariakoo trader hears of a bumper harvest, a coming festival, a fuel-price jump and a new rival across the aisle. Each tugs the price of sugar a different way, yet between them they can do only four things.

State the effect on equilibrium price and quantity of each of the four single shifts, when only one curve moves at a time.

Model Answer

When one curve moves alone there are exactly four outcomes: an increase in demand raises both price and quantity, a decrease in demand lowers both, an increase in supply lowers price but raises quantity, and a decrease in supply raises price but lowers quantity.

Increase in demand: the demand curve shifts right, creating a shortage at the old price that bids the price up and draws out more quantity, so both price and quantity rise.

Decrease in demand: the demand curve shifts left, leaving a surplus at the old price that pushes the price down while less is traded, so both price and quantity fall.

Increase in supply: the supply curve shifts right, creating a surplus at the old price that drives the price down while the larger flow of goods raises quantity, so price falls and quantity rises.

Decrease in supply: the supply curve shifts left, creating a shortage at the old price that lifts the price while the thinner flow cuts quantity, so price rises and quantity falls.

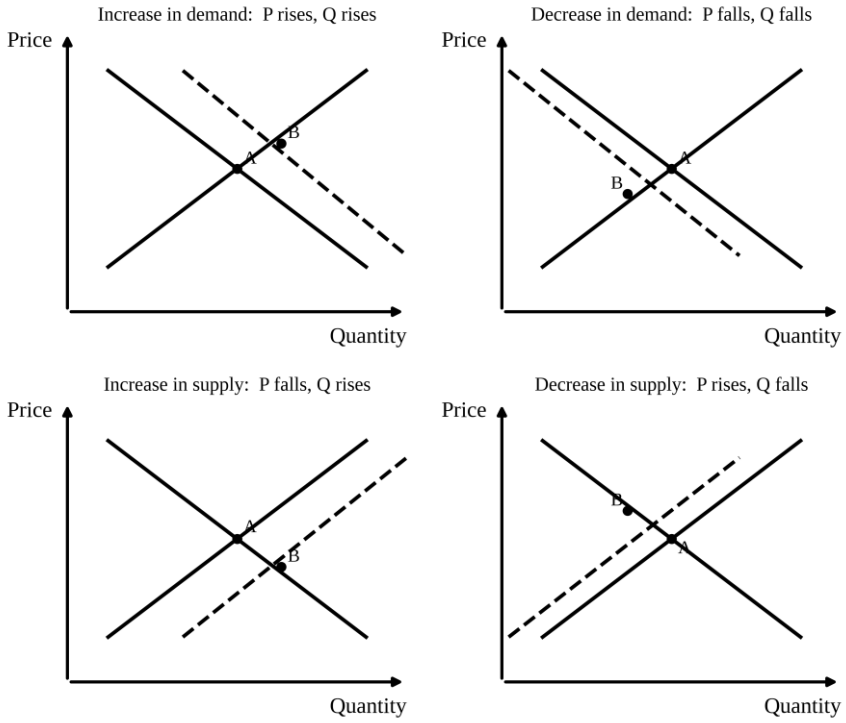


Figure 3.18: the four single shifts and their equilibrium outcomes

Shift	Price	Quantity
Demand increases (right)	rises	rises
Demand decreases (left)	falls	falls
Supply increases (right)	falls	rises
Supply decreases (left)	rises	falls

The Master Key: demand pushes price and quantity the same way; supply pushes them opposite ways.

BINDER Question 103

As Ramadhani approaches, every household in Dar buys extra sugar for dates and juice, and the shelves empty faster than the wholesalers expected. By Eid the price is visibly higher, yet more sugar is changing hands than before.

Explain, step by step, why the festive rise in the demand for sugar raises both its equilibrium price and the quantity traded.

Model Answer

The festive season increases the demand for sugar and shifts the demand curve to the right, and because the old price now leaves buyers short, the price is bid up and the quantity traded rises, so both the equilibrium price and quantity end higher.

Demand shifts right: Ramadhani is a change in tastes and needs, not in the price of sugar, so the whole demand curve moves outward, with more sugar wanted at every price.

A shortage appears: at the old equilibrium price the new demand exceeds the unchanged supply, so shops sell out and a shortage forms, the pressure that starts the price moving.

Price is bid up: buyers compete for the scarce sugar and bid the price upward, which persuades sellers to offer more, an expansion along the supply curve.

The new equilibrium: the price stops rising only when it has climbed enough to choke the extra demand back to the larger quantity now supplied, leaving both price and quantity above their starting points.

Notice that supply itself never shifted; the greater quantity comes from a movement along the supply curve, drawn out by the higher price, not from any new willingness to supply.

The Master Key: an increase in demand lifts price and quantity together, and the extra quantity is supply expanding, not supply shifting.

BINDER Question 104

When EWURA announces a higher pump price, the lorries that carry tomatoes from Iringa to Dar cost more to run, and within days the city's tomato crates are fewer and dearer. One cost, felt at both ends.

Explain why a rise in fuel costs, by raising the cost of transport, lowers the equilibrium quantity of Iringa tomatoes sold in Dar while raising their price.

Model Answer

A rise in fuel costs raises the cost of bringing tomatoes to market and shifts the supply curve to the left, so that at the old price a shortage forms, the price is driven up and the quantity traded falls, leaving price higher and quantity lower.

Supply shifts left: fuel is an input into transport, so dearer fuel raises the cost of every crate delivered, and suppliers offer less at each price, moving the whole supply curve inward.

A shortage forms: at the former equilibrium price the reduced supply no longer meets demand, so a shortage appears and buyers begin to compete for the fewer crates.

Price rises, quantity falls: the shortage bids the price up, which chokes off some demand along the demand curve, and the market settles where the smaller quantity clears at the higher price.

Demand never moved; the fall in quantity is buyers retreating up their own demand curve as the price climbs, not a decrease in demand itself.

The Master Key: a decrease in supply is the one case where dearer goods and fewer goods arrive together.

REAL Question 105

Follow a sack of maize out of Rukwa after the rains have been kind. The season's harvest is a bumper one, and the swollen crop reaches Mbeya market all at once.

The Mbeya maize market has demand $Q_d = 200 - 2P$ and supply $Q_s = -40 + 4P$, with P in thousands of shillings per sack. A bumper harvest raises supply by 60 sacks at every price. Find the equilibrium before and after, and describe the change.

Model Answer

Solving before and after shows the equilibrium moving from a price of 40 and quantity of 120 to a price of 30 and quantity of 140, so the bumper harvest lowers the price and raises the quantity, exactly the increase-in-supply result.

The first equilibrium: set $Q_d = Q_s$, so $200 - 2P = -40 + 4P$, giving $240 = 6P$, hence $P = 40$ and $Q = 200 - 2(40) = 120$ sacks.

Supply shifts right: adding 60 sacks at every price turns $Q_s = -40 + 4P$ into $Q_s' = 20 + 4P$, the whole supply curve moved outward by the harvest.

The new equilibrium: set $Q_d = Q_s'$, so $200 - 2P = 20 + 4P$, giving $180 = 6P$, hence $P = 30$ and $Q = 200 - 2(30) = 140$ sacks.

Compare the two: price falls from 40 to 30 thousand shillings while quantity rises from 120 to 140 sacks, the textbook signature of an increase in supply, cheaper and more plentiful.

	Price (000)	**Quantity (sacks)**
Before harvest	40	120
After harvest	30	140
Change	falls	rises

The gain to buyers is plain: they pay less and get more, which is why a bumper harvest, welcome as it is to eaters, can dismay farmers whose price per sack has dropped.

The Master Key: a bumper harvest is an increase in supply: it fills the market and lowers the price.

REAL Question 106

Follow the charcoal sellers of Dar as more kitchens light a gas ring instead of a sigiri. Bag by bag, the households that once queued for mkaa are drifting away.

As Dar households switch from charcoal to bottled gas, explain what happens to the equilibrium price and quantity of charcoal, and identify the cause of the shift.

Model Answer

The switch to gas is a fall in demand for charcoal that shifts its demand curve to the left, so a surplus forms at the old price, the price is driven down and less is traded, leaving both the equilibrium price and quantity lower.

The cause of the shift: gas is a substitute for charcoal, and as it becomes cheaper and more available, buyers want less charcoal at every price, a change in substitutes and tastes that moves the demand curve left.

A surplus forms: at the former price the sellers still bring the usual charcoal, but fewer buyers want it, so unsold bags pile up as a surplus.

Price and quantity both fall: to clear the surplus sellers cut the price, and as the price falls some supply is withdrawn along the supply curve, so the market settles at a lower price and a smaller quantity.

Supply did not shift; the charcoal burners are as willing as ever, but the leftward pull of demand drags both price and quantity down, the mirror image of a festive demand rise.

The Master Key: when buyers walk away, price and quantity fall together, and the sellers who stay earn less on fewer sales.

REAL Question 107

Follow the tomatoes of Arusha through a lucky season. A new sauce factory has opened and lifted demand, while gentle rains have swollen the harvest and lifted supply. Both blades of the scissors move at once.

The Arusha tomato market starts at $Q_d = 100 - 2P$ and $Q_s = -20 + 2P$. A new factory raises demand by 20 crates at every price, while good rains raise supply by 40 crates at every price. Find the new equilibrium and explain which of price and quantity was certain in advance.

Model Answer

Solving shows the equilibrium moving from a price of 30 and quantity of 40 to a price of 25 and quantity of 70, so quantity was certain to rise because both shifts push it up, while the fall in price was not certain in advance and followed only because supply rose by more than demand.

The first equilibrium: set $100 - 2P = -20 + 2P$, giving $120 = 4P$, so $P = 30$ and $Q = 100 - 2(30) = 40$ crates.

Both curves shift right: demand becomes $Q_d' = 120 - 2P$ and supply becomes $Q_s' = 20 + 2P$, each moved outward by its own piece of good news.

The new equilibrium: set $120 - 2P = 20 + 2P$, giving $100 = 4P$, so $P = 25$ and $Q = 120 - 2(25) = 70$ crates.

Quantity was certain: an increase in demand and an increase in supply both raise quantity, so quantity had to rise, here from 40 to 70 crates, no matter which shift was larger.

Price was ambiguous: demand rising pulls price up while supply rising pulls it down, so the direction depends on the sizes; here supply rose by 40 against demand's 20, the downward pull won, and price fell from 30 to 25.

Had the factory been hungrier and raised demand by 60 while supply rose by only 20, the same method gives a new price of 40, above the old 30, so the very same combined shift can send price either way.

The Master Key: when both curves shift right, quantity must rise, but price hangs on which shift is larger.

HOT Question 108

A rice trader in Shinyanga swears the price can only go up this year: the fields are parched by drought and the town's new mining wages are fat. A student objects that we cannot be sure what happens to the amount sold.

A drought and rising incomes strike the rice market at the same time. To what extent can we predict what happens to the equilibrium price and quantity? Discuss.

Model Answer

We can predict the price with confidence but not the quantity, because the drought and the higher incomes both push the price up, yet they pull the quantity in opposite directions, so the price certainly rises while the quantity is genuinely uncertain.

The drought cuts supply: less rain means a smaller crop, so the supply curve shifts left, a force that on its own raises price and lowers quantity.

Higher incomes raise demand: with rice a normal good, fatter mining wages make households want more of it at every price, so the demand curve shifts right, a force that on its own raises price and raises quantity.

Price rises for certain: both forces press the price the same way, the drought by making rice scarce and the richer buyers by bidding harder for it, so their effects add and the price must rise.

Quantity is ambiguous: the drought pulls quantity down while the richer demand pulls it up, so the outcome depends on which force is stronger; a fierce drought with mild income growth means less rice traded, while a mild drought with a wage boom means more.

So the trader is right about the price and the student is right about the quantity. Comparative statics settles the price because the two shifts agree on it, but it can only give the quantity a direction once we know the relative sizes of the drought and the income rise.

The Master Key: when two shifts agree on price but quarrel over quantity, price is settled and quantity must be measured, not guessed.

HOT Question 109

As Christmas nears, demand for Kilombero sugar swells; in the same weeks the mill's new boiler lifts its output. One analyst insists the price must rise, another that it must fall. Both cannot be right.

Demand for Kilombero sugar and its supply both increase at once. To what extent is it possible to say what happens to the equilibrium price? Discuss, and state what happens to the quantity.

Model Answer

It is not possible to say what happens to the price without knowing which increase is larger, because a rise in demand pushes price up while a rise in supply pushes it down, whereas the quantity is not in doubt at all, since both increases raise it.

Quantity certainly rises: an increase in demand and an increase in supply each raise the quantity traded, so together they must raise it, and the new equilibrium sits to the right of the old one for sure.

Price pulls two ways: the festive demand bids the price up, but the mill's extra sugar pushes it down, so the two forces fight over the price and the winner is whichever shift is larger.

If demand rises more: should the Christmas surge outweigh the boiler, the upward pull wins and the price rises, even as the quantity rises too.

If supply rises more: should the extra output outweigh the festive demand, the downward pull wins and the price falls, again with the quantity higher.

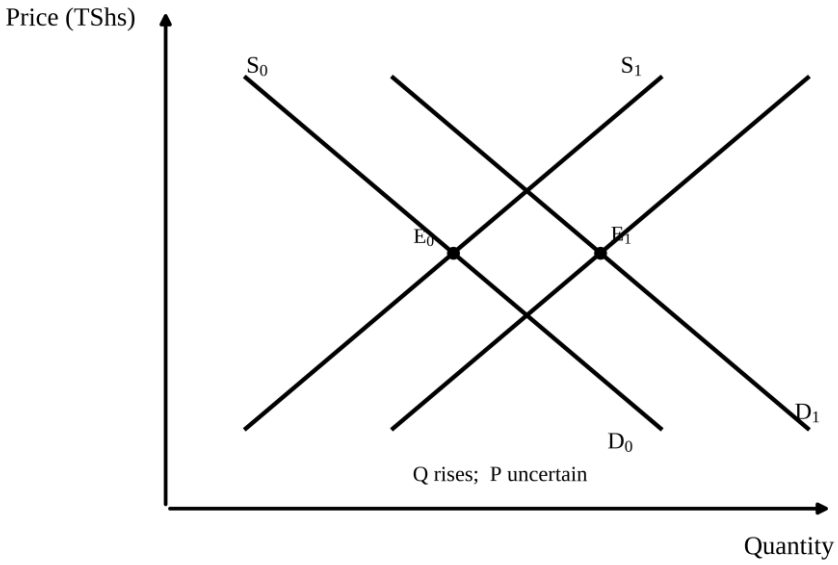


Figure 3.19: both curves shift right: quantity rises, price uncertain

So the first analyst and the second are each describing one possible case, not a law; only the relative sizes of the two shifts decide the price. What both must accept is that more sugar is traded either way.

The Master Key: shift both curves out and the market speaks plainly on quantity but keeps its counsel on price.

HOT Question 110

A textbook offers four neat rules and a confident student declares that price prediction is now a solved problem. A market woman in Tandale, who has watched prices jump for reasons no arrow on a diagram captures, only smiles.

To what extent do the four single-shift rules allow us to predict real market prices? Discuss.

Model Answer

The four rules are a powerful and correct guide when only one curve moves, but their predictive power fades in the real world because both curves usually move at once, the shifts take time, and the ceteris paribus assumption they rest on rarely holds cleanly.

Where the rules are strong: when a single determinant changes and the other curve genuinely stays put, the four outcomes are exact and dependable, letting us call the direction of both price and quantity at once.

Both curves usually move: in a real market a festive season, a harvest and a fuel-price change can all land together, so demand and supply shift at the same time, and then one of price and quantity becomes ambiguous until we know the relative sizes.

The rules ignore time: comparative statics compares two resting points but says nothing about how long the journey takes, yet a price that adjusts over a whole season behaves very differently from one that jumps overnight.

Ceteris paribus rarely holds: the rules assume all else is equal, but expectations, hoarding and sudden government action can move a price while the curves are still settling, so the diagram is a guide, not a forecast.

So the rules deserve their central place, for they organise our thinking and are exact in the single-shift case that underlies every harder one. But a wise analyst treats them as the skeleton of an answer, then adds the flesh of relative magnitudes, time and real-world noise before trusting any prediction.

The Master Key: the four rules tell you which way the market leans; only the real world tells you how far and how fast.

Consumer Surplus and Producer Surplus

Every voluntary trade leaves both sides better off, and this section measures exactly how much. Consumer surplus captures the bargain a buyer enjoys when she pays less than the most she would have given, while producer surplus captures the bonus a seller earns when he receives more than the least he would have taken. You will learn to read these as triangles on the demand and supply diagram, to compute them exactly with one half times base times height, and to see how their sum, the total welfare, shrinks whenever a price is held away from its equilibrium.

BINDER Question 111

A shopper in Kariakoo would gladly have paid 5,000 shillings for the phone charger she grabs for 3,000, and walks off quietly pleased. That hidden 2,000 of pleasure has a name.

Define consumer surplus, and explain how it is measured on a demand diagram.

Model Answer

Consumer surplus is the difference between the maximum price a consumer is willing to pay for a good and the price she actually pays, and on a diagram it is the area under the demand curve and above the price line.

Willingness to pay: every buyer carries a top price she would give for a unit, fixed by how much she values it, and she never willingly pays more than that.

The bargain she enjoys: when the market price sits below that top price, the buyer keeps the difference as a gain, and that gain is the consumer surplus on the unit.

Reading it on the diagram: the demand curve shows the willingness to pay for each successive unit, so the surplus is the area trapped under the demand curve and above the price line.

Adding across buyers: summing this gain over every unit bought gives the total consumer surplus in the market, which appears as the shaded triangle in the usual diagram.

So consumer surplus is never printed on a receipt. It is the invisible value a buyer walks away with, the gap between what the good was worth to her and the smaller sum the market asked her to hand over.

The Master Key: consumer surplus is the quiet profit a buyer carries home whenever the price turns out kinder than the most she would have paid.

BINDER Question 112

A Mbeya farmer would have let his bag of potatoes go for 20,000 rather than watch it rot, yet the market hands him 30,000. That extra 10,000 is not luck; it has a name.

Define producer surplus, and explain how it is measured on a supply diagram.

Model Answer

Producer surplus is the difference between the price a producer actually receives for a good and the minimum price he would have been willing to accept, and on a diagram it is the area above the supply curve and below the price line.

The lowest acceptable price: every seller has a minimum price that just covers the cost of supplying a unit, and below that price he would rather not sell it at all.

The bonus he earns: when the market price rises above that minimum, the seller keeps the difference as a gain, and that gain is the producer surplus on the unit.

Reading it on the diagram: the supply curve traces the minimum acceptable price for each successive unit, so the surplus is the area caught above the supply curve and below the price line.

Adding across sellers: summing the gain over every unit sold gives the total producer surplus, the shaded triangle that sits below the price line in the diagram.

Producer surplus is thus the mirror image of consumer surplus. Where the buyer gains by paying less than a good is worth to her, the seller gains by receiving more than the least he would have taken for it.

The Master Key: producer surplus is the reward a seller keeps whenever the market pays him more than the smallest sum he would have accepted.

BINDER Question 113

Draw demand and supply crossing just once, and that single equilibrium point quietly splits the whole gain from trade into two neat triangles, one for the buyers above and one for the sellers below.

With the aid of a diagram, show consumer surplus and producer surplus at equilibrium, and explain what is meant by total welfare.

Model Answer

At the equilibrium price the gains from trade divide into two triangles, consumer surplus above the price and producer surplus below it, and their sum is the total welfare, or economic surplus, that the market creates.

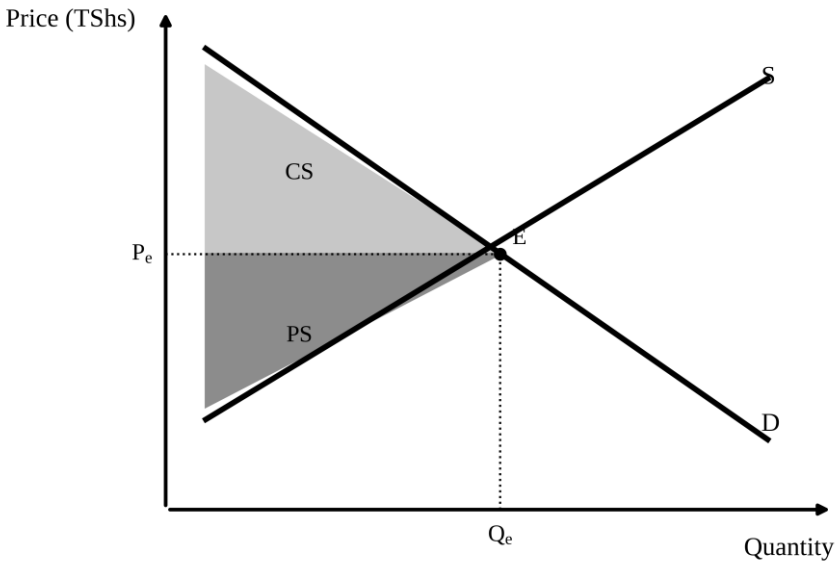


Figure 3.20: Consumer surplus (CS) and producer surplus (PS) at equilibrium E

Consumer surplus above: the upper triangle, lying between the demand curve and the equilibrium price P*, measures how much the buyers value the good beyond the sum they actually pay for it.

Producer surplus below: the lower triangle, lying between the equilibrium price P* and the supply curve, measures how much the sellers receive beyond the least they would have accepted.

Total welfare is the sum: adding the two triangles gives the total welfare, also called economic surplus, the whole gain that buyers and sellers share simply because the market exists.

Why equilibrium matters: at the competitive equilibrium quantity Q* this combined area is as large as it can be, so a free market resting at equilibrium squeezes the greatest possible welfare out of the trade.

So the crossing point does two jobs at once. It fixes the price and the quantity, and it shares out the gains, handing the region above the price to consumers and the region below it to producers.

The Master Key: total welfare is the whole cake baked by a trade, sliced by the price line into a consumer's share above and a producer's share below.

REAL Question 114

Follow the rice of Mbeya, where the town's daily demand runs $P = 100 - Q$ *and the millers' supply runs* $P = 20 + Q$*, with P in thousands of shillings a sack. One crossing fixes every number that follows.*

Find the equilibrium price and quantity, then calculate the consumer surplus, the producer surplus and the total welfare, treating each as a triangle.

Model Answer

The market clears at $Q = 40$ sacks and $P = 60$ thousand shillings, which gives a consumer surplus of 800, a producer surplus of 800 and a total welfare of 1600, each figure in thousands of shillings.

Find the equilibrium: set demand equal to supply, $100 - Q = 20 + Q$, so $2Q = 80$ and $Q = 40$ sacks, and putting this back gives $P = 100 - 40 = 60$.

Consumer surplus: the demand curve starts at 100 when $Q = 0$, so the CS triangle has base 40 and height $100 - 60 = 40$, giving $0.5 \times 40 \times 40 = 800$.

Producer surplus: the supply curve starts at 20 when $Q = 0$, so the PS triangle has base 40 and height $60 - 20 = 40$, giving $0.5 \times 40 \times 40 = 800$.

Total welfare: add the two surpluses, $800 + 800 = 1600$, the whole gain the rice market creates for the town of Mbeya each day.

Measure	Triangle working	Value (000 TShs)
Consumer surplus	$0.5 \times 40 \times (100 - 60)$	800
Producer surplus	$0.5 \times 40 \times (60 - 20)$	800
Total welfare	$800 + 800$	1600

In money terms the buyers of Mbeya gain 800,000 shillings, the millers gain another 800,000, and the town as a whole is 1,600,000 shillings better off than it would be if no rice were traded at all.

The Master Key: the two triangles come out equal here only because the curves are equally steep; always read each surplus from its own curve, never by assuming they must match.

REAL Question 115

Follow the beans of Mwanza after a heavy harvest, when the price a shopper pays slides from 60 to 40 thousand shillings a sack along the demand line $P = 80 - Q$*. Watch the buyers' gain swell.*

Taking demand as $P = 80 - Q$ with P in thousands of shillings a sack, calculate the consumer surplus before and after the price falls from 60 to 40, and find the gain to consumers.

Model Answer

Consumer surplus rises from 200 before the fall to 800 after it, so the cheaper beans hand the buyers of Mwanza a gain of 600, all figures in thousands of shillings.

Quantities at each price: in the demand $P = 80 - Q$, a price of 60 gives $Q = 20$ sacks and a price of 40 gives $Q = 40$ sacks, so cheaper beans are bought in larger amounts.

Surplus before the fall: the demand curve starts at 80, so at $P = 60$ the CS triangle has base 20 and height $80 - 60 = 20$, giving $0.5 \times 20 \times 20 = 200$.

Surplus after the fall: at $P = 40$ the CS triangle has base 40 and height $80 - 40 = 40$, giving $0.5 \times 40 \times 40 = 800$.

The gain to consumers: the rise in consumer surplus is $800 - 200 = 600$, the extra bargain the buyers enjoy once the price drops.

The gain splits neatly in two. On the 20 sacks they were already buying, shoppers save 20 thousand each, worth $20 \times 20 = 400$, and on the 20 extra sacks the lower price tempts out they win a fresh triangle of $0.5 \times 20 \times 20 = 200$, and 400 plus 200 is the same 600.

The Master Key: a fall in price always lifts consumer surplus, partly as a saving on the units already bought and partly as fresh surplus on the new ones it draws out.

REAL Question 116

Follow the cashew of Mtwara the season strong export orders lift the farm-gate price from 40 to 60 thousand shillings a sack, moving the growers up their supply line $P = 30 + 2Q$. *Their bonus climbs with it.*

Taking supply as $P = 30 + 2Q$ with P in thousands of shillings a sack, calculate the producer surplus before and after the price rises from 40 to 60, and find the gain to the growers.

Model Answer

Producer surplus climbs from 25 before the rise to 225 after it, so the stronger market hands the growers of Mtwara a gain of 200, all figures in thousands of shillings.

Quantities at each price: in the supply $P = 30 + 2Q$, a price of 40 draws out $Q = 5$ sacks and a price of 60 draws out $Q = 15$ sacks, so a better price coaxes more cashew to market.

Surplus before the rise: the supply curve starts at 30, so at $P = 40$ the PS triangle has base 5 and height $40 - 30 = 10$, giving $0.5 \times 5 \times 10 = 25$.

Surplus after the rise: at $P = 60$ the PS triangle has base 15 and height $60 - 30 = 30$, giving $0.5 \times 15 \times 30 = 225$.

The gain to growers: the rise in producer surplus is $225 - 25 = 200$, the extra bonus the growers keep once the price climbs.

Again the gain has two parts. On the first 5 sacks they would have sold anyway, growers now earn 20 thousand more each, worth $5 \times 20 = 100$, and on the 10 extra sacks the higher price tempts out they win a further triangle of $0.5 \times 10 \times 20 = 100$, and 100 plus 100 makes the 200.

The Master Key: a rise in price lifts producer surplus twice over, once on the units already sold and once again on the new units it calls into the market.

HOT Question 117

When a bumper maize harvest crashes the price, a Dodoma shopper cheers while a Kilosa farmer groans. A minister declares the whole nation richer; the farmer is far from sure.

To what extent does a fall in the price of a good leave society as a whole better off? Discuss, using consumer surplus, producer surplus and total welfare.

Model Answer

A price fall is largely a transfer that enriches consumers at the producers' expense, so whether society as a whole gains depends entirely on what happens to total welfare, the sum of the two surpluses, and not on either side alone.

Consumers clearly gain: a lower price lifts consumer surplus, both as a saving on what buyers were already taking and as fresh surplus on the extra units the low price tempts out, so buyers are plainly better off.

Producers clearly lose: the same lower price cuts producer surplus, since sellers receive less on every unit and some withdraw from the market, so the buyers' gain is paid for in part by a loss to sellers.

Look to total welfare: because one side wins much of what the other loses, the real test for society is the combined area; if the fall reflects a genuine rise in supply, more is traded and total welfare grows, so the nation truly is richer.

When the claim fails: if instead the price is forced down by a control that chokes output below the equilibrium quantity, trades once worth more to buyers than they cost sellers are destroyed, a deadweight loss opens up and total welfare shrinks.

So the minister is right only under one condition. A price fall that springs from abundance enlarges the cake even as it re-slices it towards consumers, while a price fall forced upon a scarce market shrinks the very cake it shares out. Who gains more is a question of distribution; whether the nation gains at all is a question of total welfare.

The Master Key: a falling price always cheers buyers and wounds sellers, but the country is better off only when the two surpluses together add up to more, not less.

HOT Question 118

Set a ceiling on the rice of Mbeya to shield the poor, and fewer sacks reach the market than before. The price looks kinder, yet a slice of the town's welfare has silently vanished.

To what extent does holding a price away from its equilibrium reduce a nation's total welfare? Refer to deadweight loss and to both price controls and taxes.

Model Answer

Holding a price away from equilibrium always destroys some total welfare, the loss economists call deadweight loss, because it blocks trades that were worth more to buyers than they cost sellers, though a government may still judge the sacrifice worthwhile for other ends.

What deadweight loss is: deadweight loss is the fall in total welfare that occurs when a market is kept from its equilibrium output, and it equals the value of the mutually beneficial trades that no longer take place.

A price ceiling on rice: in the Mbeya market where demand is $P = 100 - Q$ and supply is $P = 20 + Q$, equilibrium sits at $Q = 40$ and $P = 60$ with a total welfare of 1600; a ceiling of 40 lets sellers offer only $Q = 20$, so output falls by half.

Measuring the loss: on the units from 20 to 40 that are now lost, buyers valued the good at up to 80 while sellers could have supplied it for as little as 40, so the destroyed surplus is a triangle of $0.5 \times 20 \times 40 = 400$, and total welfare falls from 1600 to 1200.

Taxes do the same: an indirect tax drives a wedge between the price buyers pay and the price sellers keep, again pulling the quantity traded below equilibrium and carving out a deadweight-loss triangle, so the revenue raised comes partly at the cost of lost welfare.

The qualification: a government may accept this loss on purpose, using a ceiling to protect poor consumers or a tax to raise revenue or to curb a harmful good, so efficiency is traded for equity or for other goals rather than thrown away by mistake.

So the pure welfare verdict is clear. Any price held off its equilibrium shrinks the total surplus, and the deadweight loss measures exactly how much. Whether that loss is a price worth paying is a separate judgement, weighing the 400 of welfare surrendered against whatever fairness or revenue the policy buys.

The Master Key: a controlled price or a tax can move welfare from one pocket to another, but the deadweight loss is welfare that simply disappears from every pocket at once.

The Price Mechanism and the Invisible Hand

An economy must somehow settle what to produce, how to produce it and for whom, yet in a free market no official is placed in charge of those decisions. This section shows how the price mechanism shoulders that immense task by itself, through Adam Smith's famous invisible hand and the three quiet jobs a price is always doing at once, signalling scarcity, rewarding the producers who respond and rationing goods

among buyers. It then weighs the mechanism honestly, praising its efficiency and its freedom while facing the market failures that stop even the freest economy from trusting prices with everything.

BINDER Question 119

No minister in Dodoma decides how many tomatoes reach Kariakoo each dawn, nor which farmer grows them or which shopper carries them home. Yet every one of those questions is answered by breakfast.

Define the price mechanism, and explain how the free interaction of demand and supply answers the three basic questions of what to produce, how to produce and for whom to produce.

Model Answer

The price mechanism is the system by which the free interaction of demand and supply, working through prices, decides what to produce, how to produce it and for whom to produce, with no central planner directing the outcome.

What to produce: where buyers demand a good strongly its price rises, so producers move resources towards making it, and where a good is little wanted its price sinks and resources drain away, so consumer demand decides the pattern of output.

How to produce: producers seeking the largest profit choose the cheapest combination of resources, so when a wage rises relative to machinery they lean towards machines, and the prices of inputs steer the very method of production.

For whom to produce: goods flow to those willing and able to pay the ruling price, so the distribution of income and the prices people will bear together decide who actually receives the output.

Because demand and supply are forever shifting, these answers are never fixed for good. A change in tastes or in costs moves prices at once, and the mechanism quietly redirects resources without anyone announcing a new plan.

The Master Key: the price mechanism is an unplanned plan, answering the three great questions through prices that no one commands.

BINDER Question 120

A rice trader in Mbeya rises before dawn thinking only of his own profit, never of the strangers in Dar he will feed. Yet feed them his self-interest surely does.

Explain what Adam Smith meant by the invisible hand, and how self-interested buyers and sellers, guided only by prices, are led to outcomes that benefit society.

Model Answer

By the invisible hand Adam Smith meant that individuals pursuing only their own gain in a free market are led, as if by an unseen hand and guided solely by prices, to promote the good of society even though that was no part of their intention.

Smith's idea: in The Wealth of Nations of 1776, Adam Smith observed that a butcher, a brewer or a baker serves us not from kindness but from self-interest, yet in serving themselves they end up serving us.

Prices do the guiding: each person watches only prices, the seller chasing the high price and the buyer avoiding it, and because prices reflect what society wants and what is scarce, following them steers private effort towards socially useful ends.

Self-interest turned to public good: the trader who ships rice to where it is dearest is chasing profit, yet he thereby carries food to where it is most needed, so his private motive and the public benefit point the same way.

The hand is invisible because no one plans this result and no one gives orders. Society is served not by anyone intending to serve it, but by countless people each minding their own advantage while prices silently harness their effort.

The Master Key: the invisible hand turns private gain into public plenty, without anyone meaning it to.

BINDER Question 121

When word spreads that petrol is short in Mwanza, the price at the pump climbs overnight. That single jump does three separate jobs before the queue has even formed.

Explain the three functions that prices perform within the price mechanism: the signalling function, the incentive function and the rationing function.

Model Answer

Within the price mechanism a price performs three functions at once, signalling information about scarcity and wants, giving producers the incentive to respond, and rationing the scarce good among competing buyers.

The signalling function: a price carries information, rising when a good grows scarce or more wanted and falling when it is plentiful or less wanted, so it tells buyers and sellers at a glance where shortages and surpluses lie.

The incentive function: a price rewards those who respond to it, for a higher price offers producers greater profit and so spurs them to supply more, while it also nudges buyers to economise, and a lower price does the reverse.

The rationing function: when a good is scarce its price rises until only those willing and able to pay it still buy, so the price shares out the limited supply and keeps it from simply running out.

The three work as one. The high petrol price in Mwanza signals the shortage, gives suppliers the incentive to rush more fuel to the city, and meanwhile rations the little that is there among those who most need it, all through a single number.

The Master Key: one price is forever doing three jobs at once: it informs, it rewards, and it rations.

BINDER Question 122

No government office fixes the price of onions in Arusha, orders the lorries or counts the sacks, and no clerk is paid to plan it. Somehow the market still clears by nightfall.

Outline the main advantages of the price mechanism as a way of allocating a country's scarce resources.

Model Answer

The price mechanism's chief advantages are that it works automatically and without central direction, allocates resources efficiently, spurs enterprise and competition, and needs no costly bureaucracy to run it.

Automatic and decentralised: the mechanism runs itself, since prices adjust on their own to clear shortages and surpluses, so resources are allocated by millions of private decisions rather than by any central command.

Efficient allocation: because resources follow prices towards the goods consumers most value, they are drawn to their most wanted uses, so the mechanism tends to produce the goods society wants in the quantities it wants them.

Enterprise and competition: the lure of profit rewards those who spot a want and satisfy it cheaply, so the mechanism encourages enterprise, innovation and competition, which push costs and prices down and quality up.

No costly bureaucracy: since prices coordinate the economy by themselves, there is no need for an army of planners gathering information and issuing orders, so the resource cost of running the system stays small.

These strengths explain why so much of Tanzanian life, from a Kariakoo stall to a village market, is left to find its own prices. Where the mechanism works well it is hard to better, quietly matching what is made to what is wanted.

The Master Key: the price mechanism is a manager that never sleeps, charges no salary, and answers to everyone at once.

REAL Question 123

Follow a sack of maize in Dodoma the season the rains failed. The harvest came in thin, the stores emptied early, and within weeks the market price had climbed by half.

Study the situation in the box, then explain how the price mechanism, through its signalling, incentive and rationing functions, responds to the shortage.

> A poor rainy season cuts the maize harvest around Dodoma. With far fewer sacks reaching the market than usual, the price of a sack of maize rises sharply over a few weeks, from about 60,000 shillings to about 90,000 shillings.

Model Answer

The rising maize price is the price mechanism at work, for the higher price signals the shortage, gives farmers and traders the incentive to supply more, and rations the scarce maize among buyers until the market clears.

Signalling the shortage: the jump from 60,000 to 90,000 shillings is information, telling everyone at once that maize has become scarce and more valuable, without anyone needing to announce that the harvest has failed.

The incentive to supply: the higher price promises greater profit, so traders are drawn to bring maize in from other regions or to release grain they had stored, and farmers are encouraged to plant more next season.

Rationing the scarce maize: as the price rises, buyers who cannot or will not pay 90,000 shillings cut back or drop out, so the limited stock is shared among those who value it most rather than vanishing on the first day.

The shortage self-corrects: because the same high price both draws in fresh supplies and trims demand, it sets in motion the very forces that will close the gap and, in time, ease the price back down.

Notice that no official ordered any of this. The single rise in the maize price did the signalling, the rewarding and the rationing together, steering resources towards Dodoma exactly when they were most needed.

The Master Key: a rising price is not merely bad news for buyers; it is the mechanism curing the shortage that caused it.

REAL Question 124

Follow a trader in Mbeya who learns that rice is cheap at home yet dear in Dar. He thinks only of his own margin. Yet trace where that self-interest quietly leads.

Using the idea of the invisible hand, explain how the Mbeya trader, seeking only his own profit and guided only by prices, ends up benefiting society.

> Rice sells for about 1,800 shillings a kilo around Mbeya, where the harvest was good, but for about 2,600 shillings a kilo in Dar es Salaam, where it is scarce. A Mbeya trader loads a lorry with rice and drives it to Dar to sell at the higher price.

Model Answer

The trader is the invisible hand in action, for while he moves the rice only to pocket the price gap for himself, his self-interested journey carries food from where it is plentiful to where it is scarce and needed, which benefits society.

The private motive: the trader acts purely for gain, buying at about 1,800 shillings in Mbeya and selling at about 2,600 in Dar, and the profit on each kilo is his only reason for loading the lorry.

The price gap as a signal: the two prices tell him instantly that rice is abundant in Mbeya and scarce in Dar, so by simply chasing the higher price he is guided, as if by an unseen hand, to exactly where the rice is most wanted.

The social benefit: his lorry relieves the Dar shortage, easing the price there for hungry buyers, while the extra buying in Mbeya rewards its farmers, so a self-interested trip feeds the city and supports the countryside at once.

How the gap closes: as traders keep moving rice to Dar the price there falls and the Mbeya price rises, until the gap narrows to little more than the cost of transport, and the shortage is quietly resolved.

No one instructed the trader to help Dar es Salaam, and helping it was no part of his plan. Yet by following the prices in front of him he did precisely what a wise planner would have ordered, which is Adam Smith's insight exactly.

The Master Key: chasing the price gap, the trader feeds a city he never meant to serve.

HOT Question 125

A market trader insists the government should keep its hands off prices and let business breathe. A civil servant replies that pure markets left the poor behind. Both are describing the same country.

To what extent should Tanzania rely on the price mechanism rather than government direction to allocate its resources? Discuss.

Model Answer

Tanzania should rely on the price mechanism for most of its resource allocation because of its efficiency and freedom, but not entirely, since important failures oblige the government to direct resources alongside it, which is why a mixed economy is the sensible answer.

The case for the mechanism: the price mechanism is automatic, efficient and cheap to run, allocating resources by millions of private choices without a costly bureaucracy, and it rewards the enterprise and competition a developing economy badly needs, so most goods, from Kariakoo cloth to farm produce, are best left to prices.

Where the mechanism fails: left alone it under-provides public goods such as roads and defence, ignores externalities such as pollution, under-supplies merit goods such as schooling and health, over-supplies demerit goods, lets monopolies exploit buyers, and can leave great inequality, since it serves only those able to pay.

Why government direction is needed: to correct these failings the state must step in, building the roads and providing the security no trader would, taxing harms and subsidising benefits, funding education and health, curbing monopoly, and supporting the poor whom the market passes by.

The link to economic systems: this is the old debate between economic systems in miniature, for a pure free-market system is efficient but harsh while a pure command system is fair in aim yet clumsy and slow, so nearly every country, Tanzania included, settles on a mixed economy that keeps the best of each.

On balance, Tanzania should lean heavily on the price mechanism as its main engine of allocation, because nothing else matches its efficiency, while reserving a firm role for government where the mechanism plainly fails. The right question is not markets or the state, but how much of each, and the answer is a mixed economy that trusts prices widely yet corrects them where it must.

The Master Key: rely on the price mechanism as the engine and on the government as the brakes and the map; a wise economy keeps both.

HOT Question 126

A newspaper column declares that the invisible hand always guides a free market to the best possible outcome for society. An economist reading it in Iringa reaches quietly for her red pen.

Assess the claim that the price mechanism, left to itself, always allocates a nation's resources both efficiently and fairly.

Model Answer

The claim is only partly true, for while the price mechanism allocates most private goods efficiently, it fails in several well-known ways and takes no care of fairness at all, so left entirely to itself it does not guarantee the best outcome for society.

The grain of truth: for ordinary private goods the mechanism does work well, drawing resources to what consumers value and clearing markets automatically, so the claim holds across a large part of everyday economic life.

Efficiency is not guaranteed: the mechanism misfires wherever there are externalities, as pollution is over-produced and its costs ignored, public goods such as street lighting are not provided at all because no one can be made to pay, and monopolies restrict output to force prices up.

Merit and demerit goods: guided only by willingness to pay, the market under-provides merit goods such as education and vaccination, whose wider benefits it overlooks, and over-provides demerit goods such as tobacco, whose wider harms it ignores.

Fairness is a separate matter: even where it is efficient the mechanism says nothing about justice, for it serves only those able to pay, so it can leave a hungry family with no claim on food while luxuries are made for the rich, and great inequality can persist.

So the invisible hand is powerful but not infallible. It allocates private goods efficiently and answers the three questions cheaply, yet it neglects externalities, public and merit goods, and fairness, which is precisely why governments intervene. The honest verdict is that the mechanism is an excellent servant and a poor master, indispensable but always in need of correction.

The Master Key: the invisible hand is brilliant at what is wanted and blind to what is right; efficiency is not the same as fairness.

HOT Question 127

When fuel ran short, the pump price leapt and a politician in Dar called it daylight robbery, demanding a legal maximum. An economist warned that the cap would empty the pumps by noon.

During a fuel shortage the price rises sharply and the government considers fixing a maximum price below it. To what extent should the rationing function of the price mechanism be overridden in this way? Discuss.

Model Answer

The government should be very cautious about overriding the rationing function with a maximum price, because although a high price during a shortage looks unfair, capping it below the market level would create a worse shortage, so the case for interfering is weak and, where accepted at all, must be handled with great care.

Why the high price does a job: when fuel is scarce the rising price rations it, choking off less urgent uses and sharing the little there is among those who need it most, while also signalling suppliers to rush more fuel in, so the pain of the price is also the cure for the shortage.

What a price ceiling would do: a legal maximum below the market price would hold the price down but not the scarcity, so at the cheap price far more fuel would be demanded than supplied, the pumps would run dry, and fuel would then be rationed by queues, favouritism or a black market instead.

The genuine concern: the worry is not foolish, for a sharp price rise hits the poor hardest and can look like profiteering, so there is a real fairness case for the state to act, especially over a necessity like fuel.

The better remedies: yet the answer is usually to help people rather than to fix the price, by targeted support for the poor, by releasing strategic reserves, by easing supply, or through a regulator such as EWURA smoothing prices, all of which relieve hardship without destroying the rationing signal.

On balance the rationing function should rarely be overridden by a simple price cap, because a ceiling treats the symptom and worsens the disease, turning a shortage into an empty pump. The fair aim of protecting the poor is better met by supporting buyers and boosting supply, leaving the price free to do the rationing that no queue does as well. Interfere with the mechanism's verdict, then, only with great caution and better tools.

The Master Key: a price cap hides a shortage without curing it; hold the price down and you empty the pump.

Price Controls: Ceilings and Floors

When a government dislikes the price the market settles on, it can try to overrule it by law, fixing a maximum the price may not exceed or a minimum it may not fall below. This section shows why a ceiling set below the equilibrium breeds shortages, queues and black markets, while a floor set above it leaves unsold surpluses that someone must buy or waste. From EWURA's cap on petrol to the government's minimum price for Mtwara cashew and the minimum wage in the labour market, you will meet the same iron logic: push a price away from its balance and the quantities on the two sides refuse to match.

BINDER Question 128

A price in Kariakoo is normally written by the market itself. Yet now and then a government official picks up the pen, crosses it out, and fixes a different number by law.

Define a price control, and distinguish clearly between a maximum price (a price ceiling) and a minimum price (a price floor).

Model Answer

A price control is a government-imposed legal price that overrides the market equilibrium, and it takes two opposite forms: a maximum price, or ceiling, which the price may not legally rise above, and a minimum price, or floor, which it may not legally fall below.

A price control defined: it is a price fixed by the government rather than by the free interplay of demand and supply, backed by law so that trading outside the set limit becomes an offence.

The maximum price: a ceiling is a legal upper limit, set below the equilibrium to hold the price down and protect buyers, so that sellers may not lawfully charge more than the stated figure.

The minimum price: a floor is a legal lower limit, set above the equilibrium to hold the price up and protect sellers, so that buyers may not lawfully pay less than the stated figure.

Why the direction matters: a ceiling only bites when it sits below equilibrium and a floor only bites when it sits above it, for set the other way round each is simply ignored because the market price already obeys it.

So the two controls are mirror images: one caps the price from above to help the consumer, the other props it up from below to help the producer, and each pushes the market away from the point where quantity demanded and quantity supplied would naturally meet.

The Master Key: a ceiling pushes a price down for the buyer, a floor holds it up for the seller, and both defy the equilibrium.

BINDER Question 129

Imagine the government caps the price of sugar in Dar es Salaam far below what shops would charge. The queue forms before dawn, yet the shelves empty by nine.

Using a diagram, explain how a price ceiling set below the equilibrium price creates a shortage.

Model Answer

A price ceiling set below the equilibrium forces the price down so that buyers want more while sellers offer less, and the gap between the two, a shortage, is the excess of quantity demanded over quantity supplied.

The ceiling holds P_c below P_e: the law fixes a maximum price P_c beneath the equilibrium price P_e, so the market may not climb back to the level where the two sides would balance.

Quantity demanded expands: at the lower price P_c the good looks cheap, so buyers want a large quantity Q_d, more than they wanted at the equilibrium price.

Quantity supplied contracts: at that same low price many sellers find production unprofitable and cut back, so the quantity supplied Q_s falls short of what they offered at equilibrium.

The shortage is the gap: because Q_d exceeds Q_s, the difference Q_d minus Q_s is a shortage, an excess demand that the market is not allowed to cure by letting the price rise.

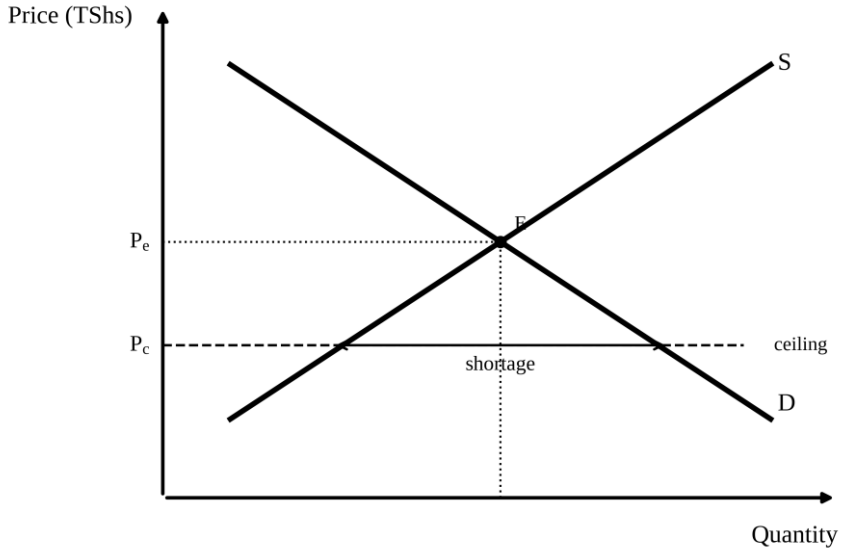


Figure 3.21: a maximum price P_c set below the equilibrium P_e, so quantity demanded Q_d outruns quantity supplied Q_s and the gap between them is the shortage

The deeper the ceiling is pushed below equilibrium, the wider this gap grows, because demand keeps expanding and supply keeps shrinking as the controlled price falls further from its natural level.

The Master Key: a ceiling below equilibrium does not create more of a good; it creates more buyers chasing less of it.

BINDER Question 130

The capped price looks kind on the label, but the true cost has only moved: now it is paid in hours of queuing, in bribes, and in goods that quietly grow shoddier.

Explain the main consequences of a binding price ceiling, beyond the shortage itself.

Model Answer

A binding price ceiling does more than create a shortage; it forces the scarce good to be rationed by non-price means, breeds queues and black markets, and lets quality slide as sellers no longer compete on price.

Rationing without price: since the price is not allowed to ration the scarce good, something else must, so sellers ration by first-come-first-served, by favouritism, by relationship or by their own discretion.

Queues and wasted time: buyers compete by arriving early and waiting, so the good is won by those with the most time to queue rather than the greatest need, and long hours are simply lost.

Black or parallel markets: because many buyers would gladly pay more than the ceiling, an illegal market springs up where the good is resold above the legal price, defeating the very purpose of the control.

Falling quality: with buyers queuing for whatever they can get, the seller has no reason to keep quality high, so the capped good is quietly allowed to deteriorate.

Each of these is a hidden price. The money price is held down by law, but the real cost reappears as time, bribes, connections and poorer goods, often landing hardest on the very poor the ceiling was meant to help.

The Master Key: a ceiling does not abolish the cost of scarcity; it only changes the currency in which that cost is paid.

BINDER Question 131

To help farmers, a government promises a crop will never sell below a set price. The price stays high, and the warehouses fill with grain nobody will buy.

Using a diagram, explain how a price floor set above the equilibrium price creates a surplus.

Model Answer

A price floor set above the equilibrium props the price up so that sellers offer more while buyers take less, and the gap between the two, a surplus, is the excess of quantity supplied over quantity demanded.

The floor holds P_f above P_e: the law fixes a minimum price P_f above the equilibrium price P_e, so the market may not fall back to the level where the two sides would balance.

Quantity supplied expands: at the higher price P_f production looks rewarding, so sellers offer a large quantity Q_s, more than they offered at the equilibrium price.

Quantity demanded contracts: at that same high price buyers pull back, so the quantity demanded Q_d falls short of what they bought at equilibrium.

The surplus is the gap: because Q_s exceeds Q_d, the difference Q_s minus Q_d is a surplus, an excess supply that the market is not allowed to cure by letting the price fall.

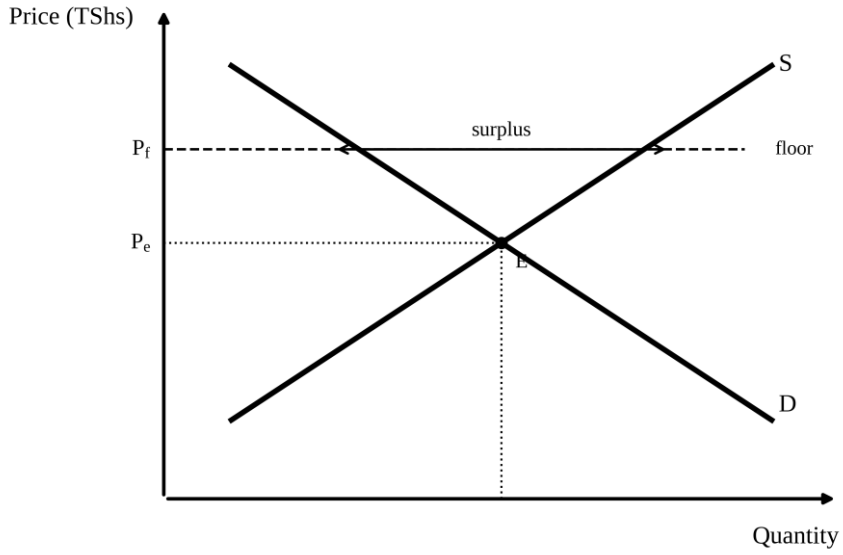


Figure 3.22: a minimum price P_f set above the equilibrium P_e, so quantity supplied Q_s outruns quantity demanded Q_d and the gap between them is the surplus

The surplus does not vanish. Unless the government or someone else buys and stores it, the unsold stock piles up, which is why a floor usually forces the state to purchase the excess it has created.

The Master Key: a floor above equilibrium does not create more buyers; it creates more of a good than anyone will buy.

BINDER Question 132

A new law lifts the lowest lawful wage in a Mwanza factory. Those still employed take home more, yet the gate now turns away job-seekers it once let in.

Using a diagram, explain why a minimum wage set above the equilibrium wage can cause unemployment.

Model Answer

A minimum wage is a price floor in the labour market, and when it is set above the equilibrium wage it makes workers offer more labour than employers wish to hire, so the excess of labour supplied over labour demanded appears as unemployment.

A wage is a price: the wage is simply the price of labour, so a legal minimum wage is a price floor, and like any floor it bites only when it is set above the market-clearing wage We.

Labour supplied expands: at the higher wage W_m more people wish to work, so the quantity of labour supplied Ls rises above the equilibrium number.

Labour demanded contracts: at that same higher wage employers find labour dearer and hire fewer hands, so the quantity of labour demanded Ld falls below the equilibrium number.

The gap is unemployment: because Ls exceeds Ld, the difference Ls minus Ld is a surplus of labour, that is, people willing to work at the going wage who cannot find a job.

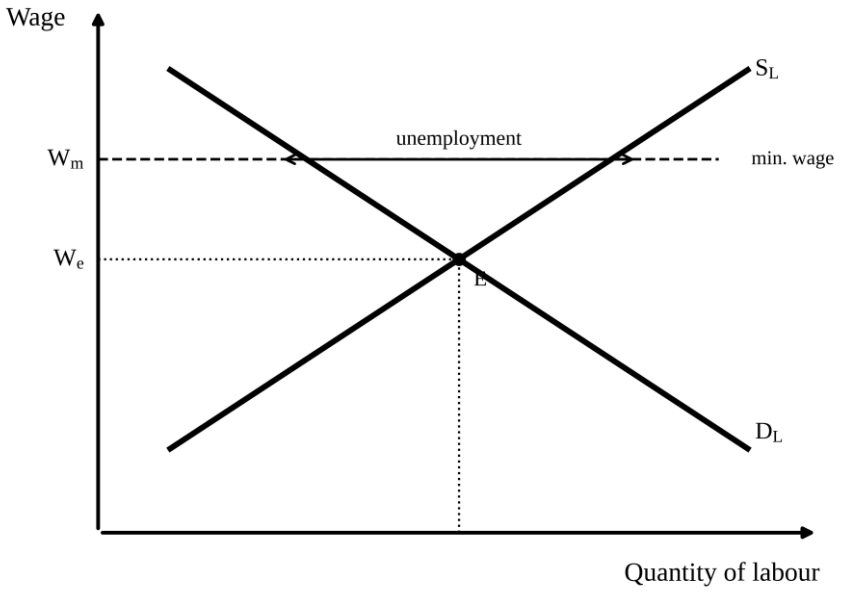


Figure 3.23: a minimum wage W_m above the market wage We, so labour supplied Ls exceeds labour demanded Ld and the gap between them is unemployment

Those who keep their jobs are better off, which is the law's intention, but the cost falls on the outsiders, often the young and unskilled, who are priced out of work altogether. Whether the trade is worth it depends on how strongly employment falls when the wage is raised.

The Master Key: a minimum wage lifts the pay of those in work by pricing some of the jobless out of it.

REAL Question 133

Each month EWURA publishes the highest price a Dodoma station may charge for a litre of petrol or diesel. Follow that capped pump price and see what a maximum price really does.

Explain why EWURA's capped fuel price is a form of price ceiling, and state the conditions under which it would, or would not, cause a fuel shortage.

> EWURA, Tanzania's energy regulator, sets a monthly cap on the retail price of petrol, diesel and kerosene. The cap is built from the world oil price, shipping, taxes and a regulated margin. No filling station may lawfully sell above the published figure, though it may sell below it.

Model Answer

EWURA's monthly cap is a price ceiling because it is a legal maximum above which no station may sell, and it causes a shortage only if it is set below the price that would clear the market, while a cap set at or above that level leaves supply and demand undisturbed.

Why it is a ceiling: the cap is a legal upper limit on the pump price, exactly the definition of a maximum price, imposed to shield consumers and transporters from overcharging.

When it does no harm: if EWURA sets the cap at roughly the cost of importing and distributing fuel plus a fair margin, the ceiling sits at or above the market price, so it merely prevents overcharging and no shortage appears.

When it causes a shortage: if the cap is pushed below that cost-covering level, perhaps when world prices jump but the cap lags behind, importers and stations lose money on every litre, cut back or stop selling, and queues and dry pumps follow.

The tell-tale signs: a binding fuel ceiling shows itself in queues at stations, rationing by the vehicle, and fuel quietly sold off the record above the capped price.

This is why EWURA revises the cap frequently and ties it to import costs. The aim is to stop profiteering without pushing the ceiling so low that it starves the market of the very fuel it is trying to keep affordable.

The Master Key: a fuel cap is harmless when it tracks costs and dangerous when it is held below them.

REAL Question 134

One dry season, Dodoma caps maize at 40,000 shillings a sack, well under the market price. Put the town's demand and supply schedules side by side and count the missing sacks.

From the schedule, find the free-market equilibrium, then find the shortage created by the 40,000-shilling ceiling and explain who gains and who loses.

Price (000 TShs/sack)	Q_d (sacks)	Q_s (sacks)
40	900	300
50	800	400
60	700	500
70	600	600
80	500	700

Model Answer

The market clears at a price of 70,000 shillings and 600 sacks, so the 40,000-shilling ceiling, sitting well below that, leaves quantity demanded at 900 sacks and quantity supplied at only 300, a shortage of 600 sacks.

Find the equilibrium: equilibrium is the price where quantity demanded equals quantity supplied, and in the schedule both equal 600 sacks at a price of 70,000 shillings, so that is the free-market outcome.

Apply the ceiling: at the capped price of 40,000 shillings, buyers want 900 sacks while sellers offer only 300, because the low price attracts buyers and discourages sellers.

Measure the shortage: the shortage is quantity demanded minus quantity supplied, 900 minus 300, which is 600 sacks that willing buyers cannot obtain.

	At $P_e = 70$	At ceiling = 40
Quantity demanded	600	900
Quantity supplied	600	300
Shortage $(Q_d - Q_s)$	0	600

Who gains and who loses: the lucky buyers who actually get a sack pay less, but the 300 sacks fall far short of the 900 wanted, so most buyers get nothing, sellers earn less, and the maize is rationed by queues or sold quietly above the cap.

So the low legal price helps only those few who manage to buy at it. The 600 missing sacks are the true cost of the ceiling, felt as empty stalls, long queues and a black market in the very grain the council tried to make cheap.

The Master Key: the ceiling made maize cheaper on paper and scarcer in fact, by 600 sacks.

REAL Question 135

Follow the cashew of Mtwara. In 2018 the government refused to let it sell below 3,300 shillings a kilo and bought up whatever traders would not. See a price floor at work.

Explain how a minimum price for cashew acts as a price floor, why it creates a surplus, and why the government must then buy that surplus.

Model Answer

Setting a minimum price of 3,300 shillings a kilo, above the price the market would have settled on, is a price floor: it lifts what farmers receive but makes them grow and sell more than private buyers will take at that price, so the unsold surplus must be bought by the government to hold the price up.

A price floor for cashew: the 3,300-shilling minimum is a legal lower limit on the price of cashew, set above the market level to raise farmers' incomes, which is exactly a price floor protecting producers.

Why a surplus appears: the high guaranteed price encourages farmers to bring more cashew to market, while private traders and processors, facing that same high price, want to buy less, so supply outruns private demand.

Government buys the surplus: if the extra cashew simply piled up unsold, its price would collapse back below the floor, so to make the minimum price real the government itself buys the surplus that private buyers reject.

Price (TShs/kg)	Farmers supply (000 t)	Private demand (000 t)
2,000 (market)	200	200
3,300 (floor)	300	120

The surplus in figures: at the floor, farmers offer 300 thousand tonnes but private buyers want only 120 thousand, so the government must buy the surplus of 180 thousand tonnes and store, sell or export it.

This is the hard truth of every floor. The higher price genuinely helps farmers who sell, but only because the state shoulders the surplus, paying to buy, store and dispose of a mountain of cashew that private buyers were never willing to take at that price.

The Master Key: a floor lifts the farmer's price only as far as the state is willing to buy what no one else will.

REAL Question 136

In Kinondoni, Dar es Salaam, suppose the law froze rents well below what tenants would pay. The sitting tenant rejoices, but the family hunting for a room finds every door shut.

Explain why rent control is a price ceiling, and analyse its likely effects on the Dar es Salaam housing market.

> Tanzania once controlled rents under the Rent Restriction Act, which capped rents and protected sitting tenants, until it was repealed in 2005. Suppose such a cap returned to Kinondoni, fixing rents well below the market level.

Model Answer

Rent control is a price ceiling in the housing market, a legal maximum rent set below the market level, and while it cuts the rent of tenants already housed, it causes a housing shortage, decay of the existing stock, and a scramble for the few rooms available.

Rent is a price: rent is simply the price paid for the use of a dwelling, so a legal maximum rent is a price ceiling, imposed to keep housing affordable for tenants.

A housing shortage appears: below the market rent, more families want to rent while landlords supply fewer rooms, some converting property to other uses or leaving it empty, so housing demanded outruns housing supplied.

The stock decays: with rents capped and tenants queuing, landlords have little reason to repair or improve, so the controlled housing is allowed to run down, a fall in quality that hurts tenants over time.

Rationing and key money: the scarce flats are rationed by waiting lists, personal connections or illegal side payments, so a hidden extra charge often creeps back in above the legal rent.

Winners and losers: sitting tenants who keep their cheap flats gain, but newcomers, the young and the mobile lose, because for them there is simply nothing to rent at the controlled price.

So rent control helps a fortunate insider group at the expense of everyone still looking, and over the years it can shrink and shabby the very housing stock a growing city like Dar es Salaam most needs.

The Master Key: rent control protects the tenant who has a room and abandons the one still searching for it.

HOT Question 137

A politician insists that capping fuel protects the poor daladala commuter; an economist warns it may empty the pumps the commuter depends on. Who is right?

To what extent does a maximum price on fuel genuinely help poor consumers? Discuss.

Model Answer

A maximum price on fuel helps poor consumers only to a limited extent, because it lowers the pump price they pay yet risks the shortages, queues and black markets that hit the poor hardest, so its success depends entirely on whether the cap is set below the cost of supply.

The case for the cap: if the ceiling merely stops stations from overcharging above their true costs, it protects commuters and transporters from profiteering and keeps daladala fares and delivery costs down, a real gain for the poor.

When the cap backfires: but if it is pushed below the cost of importing and distributing fuel, supply dries up, and the poor, who cannot bribe, hoard or buy on the black market, are the first to be left at dry pumps.

The hidden costs: even a mild shortage shifts the burden onto time and connections, so the commuter pays in hours of queuing and in fares that rise anyway once fuel is scarce, undoing the intended help.

The better targeting question: a blanket cap helps rich and poor drivers alike, so if the aim is really to protect the poor, targeted support such as subsidised public transport may reach them more surely than a price the whole market must obey.

On balance, a fuel ceiling helps the poor when it is set realistically at cost plus a fair margin and merely curbs overcharging, but it harms them when it is forced below cost and breeds scarcity. The verdict is not the ceiling itself but where it is set.

The Master Key: a fuel cap that tracks costs shields the poor; one held below costs queues them out.

HOT Question 138

A labour leader calls the minimum wage simple justice for the low-paid; an employer calls it a tax on hiring the young. Both point to the same law.

Assess the case for and against a minimum wage set above the market wage.

Model Answer

A minimum wage above the market wage is neither purely good nor purely bad: it raises the pay and dignity of workers who keep their jobs, but it risks pricing the least-skilled out of work, so the balance turns on how many jobs are actually lost.

The case for: a wage floor lifts the earnings of the lowest-paid, reduces exploitation where employers hold the whip hand, and can raise morale and productivity, so those in work are clearly better off.

The case against: because it sits above equilibrium, it makes labour dearer than employers wish to pay, so some hire fewer workers, turn to machines, or slip into the informal economy, and the young and unskilled bear the unemployment.

What decides the balance: the size of the job loss depends on how sensitive hiring is to the wage, for if labour demand responds only weakly the pay gain outweighs a small fall in jobs, but if it responds strongly, unemployment may swamp the benefit.

The Tanzanian setting: with a large informal sector, a minimum wage may cover only formal firms, so it can help protected workers while pushing others into unregulated work the law never reaches.

So a modest minimum wage, set with an eye on productivity and not far above the market level, can raise the low-paid at little cost in jobs, whereas one set far too high mainly creates unemployment. The instrument is defensible; the setting is everything.

The Master Key: a minimum wage trades higher pay for some against no pay for others, and its wisdom lies in the size of that trade.

HOT Question 139

When the cashew floor was set, farmers cheered the guaranteed price; the treasury groaned at the warehouses it had to fill. Did the floor truly leave farmers better off?

To what extent do minimum crop prices actually make farmers better off? Discuss.

Model Answer

Minimum crop prices help farmers only up to a point, because the higher guaranteed price genuinely raises the income of those who sell, but it creates costly surpluses, depends on a government able and willing to buy them, and can leave farmers worse off if that support later collapses.

The genuine benefit: a floor above the market price raises the revenue of farmers who sell their crop and shields them from ruinous price crashes in a bumper year, steadying incomes in a risky trade.

The surplus problem: the high price makes farmers grow more while buyers want less, so a surplus appears that must be bought and stored, and the cost of doing so falls on the taxpayer or the crop board.

The buyer of last resort: the floor is only as good as the government's ability to pay for the surplus, and when funds run short, payments to farmers are delayed or the scheme collapses, as stored crops rot or are sold at a loss.

Longer-run distortions: a guaranteed high price can also lure farmers into overproducing one crop, discourage attention to quality, and invite smuggling from neighbouring areas eager to sell at the propped-up price.

So a crop floor clearly helps farmers in a good year and when the state pays promptly, but the surpluses, storage costs and risk of broken promises mean the benefit is real yet fragile. It supports farmers best when paired with processing, storage and a market for the surplus, not as a price propped up on its own.

The Master Key: a crop floor lifts the farmer only as long as someone can afford to buy the surplus it creates.

HOT Question 140

Ceilings, floors and minimum wages all promise to protect someone by law. Yet each leaves a shortage or a surplus in its wake. Are price controls a cure, or a costly disguise?

To what extent do price controls achieve their intended aims? Discuss with reference to ceilings and floors.

Model Answer

Price controls achieve their aims only partly, because although a ceiling or a floor does move the price in the intended direction and helps one favoured group, it always opens a shortage or a surplus, breeds black markets and misallocation, and shifts the true cost onto others.

They do move the price: a ceiling genuinely lowers the price for buyers and a floor genuinely raises it for sellers, so in the narrow sense of changing the price, controls work and the intended group can gain.

The quantities stop matching: away from equilibrium the two sides no longer meet, so a ceiling leaves a shortage and a floor a surplus, and the good is no longer rationed by price but by queues, connections or a government purchase.

Black markets and misallocation: because a controlled price no longer reflects scarcity, resources are misdirected, illegal markets appear at the true value, and the good often reaches those with time, contacts or cash for bribes rather than those who need it most.

The cost only hides: the scarcity or glut is real, so the cost the control seemed to abolish simply reappears as waiting, poorer quality, taxpayer-funded buying or lost jobs, frequently landing on the very people it was meant to protect.

When they can be justified: controls are most defensible when temporary, mild and aimed at a genuine market failure or emergency, and least defensible when large, permanent and fighting the basic forces of supply and demand.

So price controls are a blunt tool that can bring short-term relief or protect a vulnerable group, but they cannot repeal scarcity. Set gently and briefly they may do more good than harm; set hard against the market they mostly relocate the pain. The lasting cure for a high price is more supply, and for a low one more demand, not a number fixed by law.

The Master Key: a price control can move a price but never abolish the scarcity behind it; it only decides who pays and how.

Taxes, Subsidies and Price Stabilization

A tax and a subsidy are the same tool pointed in opposite directions: one lifts the supply curve and splits the price into what the buyer pays and what the seller keeps, the other lowers it and hands the gap back. This section works through the incidence of a tax and the deadweight loss it leaves, then the mirror image of a subsidy, and finally two ways governments try to tame farm prices, the buffer stock that buys gluts and sells shortages to defend a price band, and the cobweb that explains why those prices swing in the first place. Keep one rule in view throughout: the side of the market that cannot escape, the more inelastic side, bears the larger share of a tax and captures the larger share of a subsidy.

BINDER Question 141

At an Arusha pump the fuel levy is a fixed sum on every litre; on imported wine the tax is a slice of the price itself. One word, two shapes.

Define an indirect tax and distinguish a specific (per-unit) tax from an ad valorem (percentage) tax, showing in each case how the supply curve shifts.

Model Answer

An indirect tax is a tax on spending, levied on a good or service and collected from the seller who builds it into the price, and it takes two shapes: a specific tax of a fixed sum on each unit, and an ad valorem tax of a fixed percentage of the price.

An indirect tax: it is a charge on a transaction rather than on income or wealth, imposed on the good so that the seller remits it to the authority but passes it into the price the buyer pays.

A specific tax: this is a fixed number of shillings on every unit sold, such as a levy per litre of petrol or per kg of sugar, and it does not change when the price changes.

An ad valorem tax: this is a fixed percentage of the value, such as VAT at 18 percent or an excise set as a share of the price, so the shillings collected grow as the price grows.

How each shifts supply: a specific tax lifts the supply curve straight up by the full amount t, a parallel shift, while an ad valorem tax swings it up by a widening gap, since a percentage of a high price is more shillings than the same percentage of a low price.

In both cases the curve moves up and to the left, because at every quantity sellers must now receive their old asking price plus the tax before they will supply, but the specific tax keeps that gap constant while the ad valorem tax makes it fan out as the price rises.

The Master Key: a specific tax adds the same shillings to every unit; an ad valorem tax adds the same percentage, so it bites harder as the price climbs.

BINDER Question 142

Add a levy to a sack of Twiga cement and something odd follows: the buyer pays more, the seller keeps less, and a wedge opens between the two prices that belongs to neither.

Using a diagram, explain how a specific tax of t per unit affects the equilibrium price and quantity, the price buyers pay and the price sellers keep, government revenue and the deadweight loss.

Model Answer

A specific tax of t per unit shifts the supply curve up by t, so the quantity traded falls, the price buyers pay rises to P_b, the price sellers keep falls to $P_s = P_b$ - t, the government collects t on every unit sold, and a deadweight loss appears because some worthwhile trades no longer take place.

Supply shifts up by t: at each quantity sellers must now receive the tax on top of their old asking price, so the supply curve rises vertically by the full amount t to S+tax.

Price and quantity: the taxed supply meets demand at a smaller quantity Q_t, where buyers pay a higher price P_b while sellers, after handing t to the authority, keep the lower price $P_s = P_b$ - t, so the distance between the two prices is exactly the tax.

Government revenue: the state collects t on each of the Q_t units still traded, a revenue of t × Qt, shown by the rectangle between P_b and P_s out to the quantity Q_t.

Deadweight loss: because output shrinks from Q_e to Q_t, the mutual gains from those lost trades disappear for both sides, and this waste is the deadweight loss, the shaded triangle just to the right of Q_t.

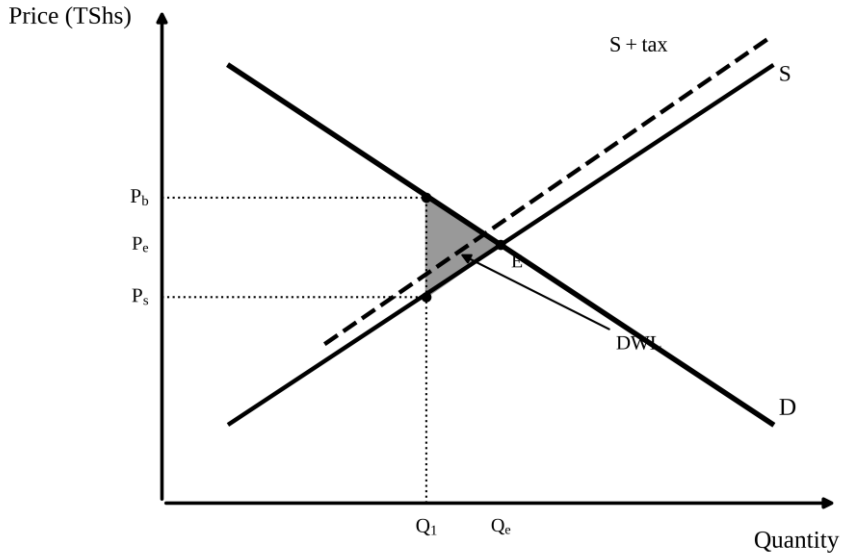


Figure 3.24: a specific tax lifts supply to S+tax, splitting the price into P_b and P_s and opening a deadweight loss

The Master Key: a tax quietly saws the price in two, lifting what the buyer pays above what the seller keeps, and the gap between them is the government's.

BINDER Question 143

The law tells the trader to hand the tax to the TRA, yet it is often the Kariakoo shopper whose pocket ends up lighter. Who pays is not who is charged.

Explain what is meant by the incidence of a tax, and state the rule that determines how the burden is shared between buyers and sellers.

Model Answer

The incidence of a tax means where the burden of the tax finally rests, and although the law usually places it on the seller, the real burden is shared between buyer and seller according to their relative elasticities, with the more inelastic side bearing the larger share.

Formal versus effective incidence: the formal (legal) incidence is on whoever must hand the tax to the authority, usually the seller, but the effective (economic) incidence is on whoever actually ends up poorer, which can be someone else entirely.

How the burden splits: the seller shifts part of the tax forward by raising the price, so the buyer's share is $P_b - P_e$ and the seller's share is $P_e - P_s$, and how the wedge divides depends on the slopes, that is the elasticities, of demand and supply.

The inelastic side pays more: whichever side is less able to escape the tax bears more of it, so if demand is more inelastic than supply the buyer carries the larger share, while if supply is the more inelastic the seller does.

The two extremes: if demand is perfectly inelastic the buyer pays the whole tax, since the quantity does not fall at all, and if demand is perfectly elastic the seller pays it all, because any price rise would lose every customer.

This is why a tax on a necessity with few substitutes, such as salt or fuel, falls mostly on the consumer, while a tax on a good ringed by close rivals is largely swallowed by the producer.

The Master Key: a tax settles on the side that cannot run away, and elasticity is simply the ability to escape.

BINDER Question 144

Onion farmers in Singida saw a fat price last season, so everyone planted onions; now the market drowns in them and the price has collapsed, so next season few will plant at all.

Explain the cobweb theorem of agricultural price instability, and state the condition under which the cobweb converges towards equilibrium.

Model Answer

The cobweb theorem explains why farm prices can swing from year to year, because farmers decide this season's planting on last season's price and cannot change output until the next harvest, and the swings settle towards equilibrium only when supply is more inelastic than demand.

The one-season lag: a crop takes a whole season to grow, so farmers must commit their acreage using the price they saw last season, long before this season's price is known.

Why prices oscillate: a high price this year tempts everyone to plant more, so next year's harvest is a glut and the price crashes; the low price then scares farmers off, so the following harvest is small and the price shoots up again.

The converging case: when the supply curve is steeper, that is more inelastic, than the demand curve, each swing is smaller than the last, so the price spirals inward towards equilibrium, the case drawn here.

The diverging case: if instead demand is the steeper curve, each swing is larger than the last and the price explodes away from equilibrium, while equal slopes give a swing that repeats forever and never settles.

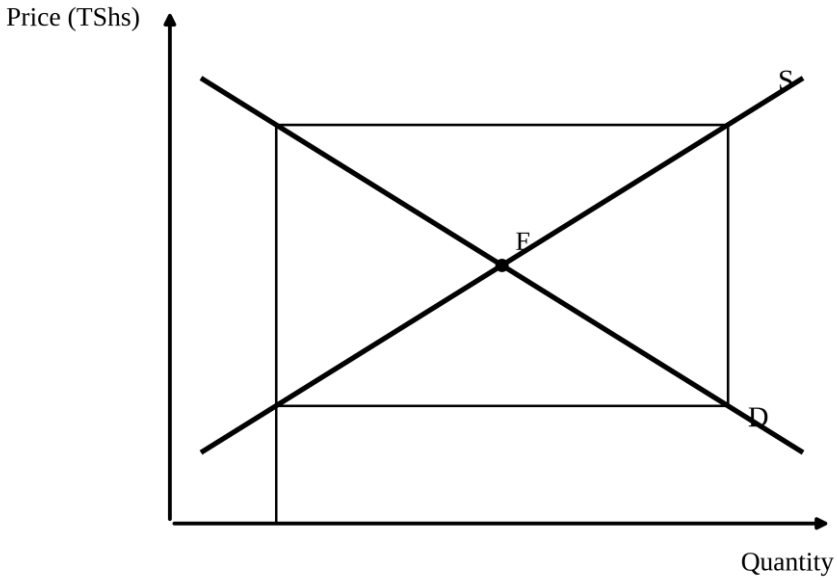


Figure 3.25: a converging cobweb spiralling inward towards the equilibrium E

The Master Key: farmers steering by last year's price is why a good harvest quietly sows the seed of next year's shortage.

REAL Question 145

Follow a kilo of Kilombero sugar as the Treasury adds a specific tax of 800 shillings to every kilo. The old price sat at 4,000; watch where the two new prices land.

Using the data in the box, find the original equilibrium, then the price buyers pay, the price sellers keep and the quantity after the tax, and show how the tax is shared between buyers and sellers.

Weekly market for Kilombero sugar (P in hundreds of shillings per kg, Q in tonnes):
Demand: $Q_d = 100 - P$
Supply: $Q_s = -60 + 3P$
The Treasury imposes a specific tax of t = 8 (that is, 800 shillings) on each kg.

Model Answer

The sugar market starts at a price of 40 and a quantity of 60; the tax raises the price buyers pay to $P_b = 46$, cuts the price sellers keep to $P_s = 38$ and lowers the quantity to 54, so of the tax of 8 the buyer bears 6 and the seller bears 2.

The original equilibrium: set $Q_d = Q_s$, so $100 - P = -60 + 3P$ gives $4P = 160$, hence $P = 40$ and $Q = 100 - 40 = 60$, the price and quantity before the tax.

Supply after the tax: sellers now need their old price plus 8 on every unit, so writing the seller price as $P_b - 8$ the supply becomes $Q_s = -60 + 3(P_b - 8) = -84 + 3P_b$.

The new buyer price: set demand equal to the taxed supply, $100 - P_b = -84 + 3P_b$, so $4P_b = 184$ and $P_b = 46$, the price buyers now pay.

Quantity and seller price: at $P_b = 46$ the quantity is $Q_t = 100 - 46 = 54$, and the seller keeps $P_s = 46 - 8 = 38$ once the tax is handed over.

Splitting the burden: the buyer's price rose by $46 - 40 = 6$ and the seller's fell by $40 - 38 = 2$, so of the tax of 8 the buyer bears 6 and the seller 2, a three-to-one split.

Item	Before tax	After tax
Price buyers pay	40	46
Price sellers keep	40	38
Quantity traded	60	54

Buyers shoulder three quarters of the tax because their demand is the more inelastic side: with a quantity slope of 1 against supply's slope of 3, buyers cut back far less than sellers when the price moves, so more of the tax sticks to them.

The Master Key: the numbers obey the rule: the inelastic buyer of a staple like sugar swallows the larger share of the tax.

REAL Question 146

Follow a bag of fertiliser to a maize farmer in Njombe as the government pays sellers 6,000 shillings a bag. The old price was 30,000; see who really pockets the help.

Using the data in the box, find the free-market equilibrium, then the price farmers pay, the price sellers receive and the quantity after the subsidy, and show how the benefit of the subsidy is shared.

Seasonal market for fertiliser in Njombe (P in thousands of shillings per bag, Q in thousands of bags):
Demand: $Q_d = 80 - P$
Supply: $Q_s = -100 + 5P$
The government pays sellers a subsidy of s = 6 (that is, 6,000 shillings) on each bag.

Model Answer

Without help the fertiliser price is 30 and the quantity 50; the subsidy lowers the price farmers pay to $P_b = 25$, raises the price sellers receive to $P_s = 31$ and lifts the quantity to 55, so of the subsidy of 6 the farmer gains 5 and the seller 1.

The free-market equilibrium: set $Q_d = Q_s$, so $80 - P = -100 + 5P$ gives $6P = 180$, hence $P = 30$ and $Q = 80 - 30 = 50$ bags before any subsidy.

Supply after the subsidy: the subsidy lets sellers accept 6 less from the buyer for the same reward, so writing the seller price as $P_b + 6$ the supply becomes $Q_s = -100 + 5(P_b + 6) = -70 + 5P_b$.

The new buyer price: set demand equal to the subsidised supply, $80 - P_b = -70 + 5P_b$, so $6P_b = 150$ and $P_b = 25$, the lower price farmers now pay.

Quantity and seller price: at $P_b = 25$ the quantity rises to $Q = 80 - 25 = 55$, and the seller receives $P_s = 25 + 6 = 31$ once the subsidy is added to what the farmer hands over.

Sharing the benefit: the farmer's price fell by $30 - 25 = 5$ and the seller's rose by $31 - 30 = 1$, so of the subsidy of 6 the farmer captures 5 and the seller 1, a five-to-one split.

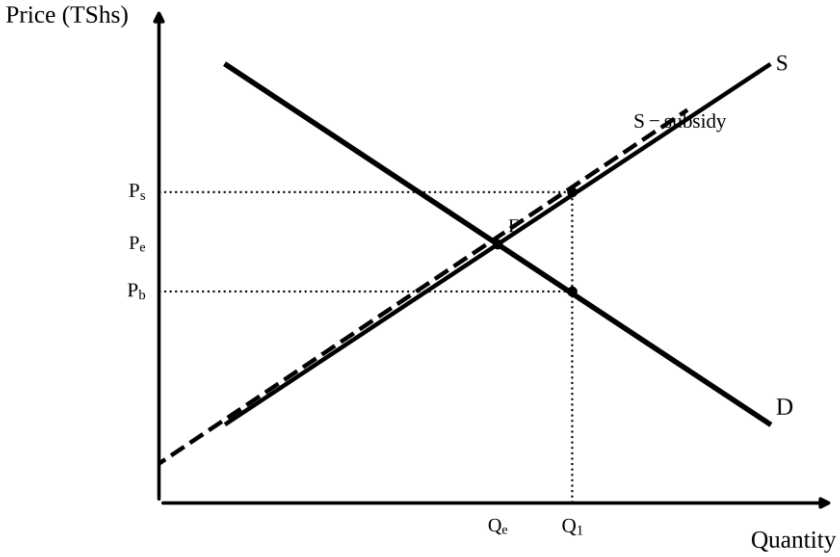


Figure 3.26: a subsidy lowers the buyer price to P_b and raises the seller price to P_s, expanding the quantity

The farmer captures the larger share because demand here is the more inelastic side, and a subsidy is simply a tax in reverse: it slides the price the buyer pays down, the price the seller gets up, and pushes the quantity out beyond the free-market level.

The Master Key: a subsidy is a tax stood on its head, and the more inelastic side, here the farmer, pockets the larger share of the gift.

REAL Question 147

Follow the cashew of Mtwara through two seasons: one year the trees groan with nuts, the next they barely yield, yet the Cashewnut Board fights to hold the farm-gate price inside one narrow band.

Using the case in the box, explain how a buffer-stock scheme defends the price band, stating exactly how much the Board buys in the good harvest and how much it sells in the poor one.

> The Cashewnut Board in Mtwara defends a price band for raw cashew:
>
> Floor price Pmin = 2,000 shillings per kg; ceiling price Pmax = 3,000 shillings per kg.
>
> Good harvest: at 2,000 the crop offered is 100 while buyers want only 70 (thousand tonnes).
>
> Poor harvest: at 3,000 buyers want 60 but the crop offered is only 45 (thousand tonnes).

Model Answer

The Board defends the band by buying the glut into store when a good harvest would push the price below the floor, and selling from that store when a poor harvest would push it above the ceiling, so here it buys 30 in the good year and sells 15 in the bad one.

Why the price would swing: cashew supply lurches with the weather while demand barely moves, so a bumper crop would crash the farm-gate price and a failed crop would send it soaring, wrecking planning for farmers and buyers alike.

Buying in the glut: in the good harvest, at the floor price of 2,000 the crop offered is 100 but buyers want only 70, so to stop the price falling below the floor the Board buys the surplus of 30 and puts it into store.

Selling in the shortage: in the poor harvest, at the ceiling price of 3,000 buyers want 60 but only 45 is grown, so to stop the price rising above the ceiling the Board releases 15 from the store to fill the gap.

Holding the band: by absorbing surpluses at the floor and releasing them at the ceiling, the scheme keeps the price inside the band Pmin to Pmax across the seasons, far steadier than a free market would ever allow.

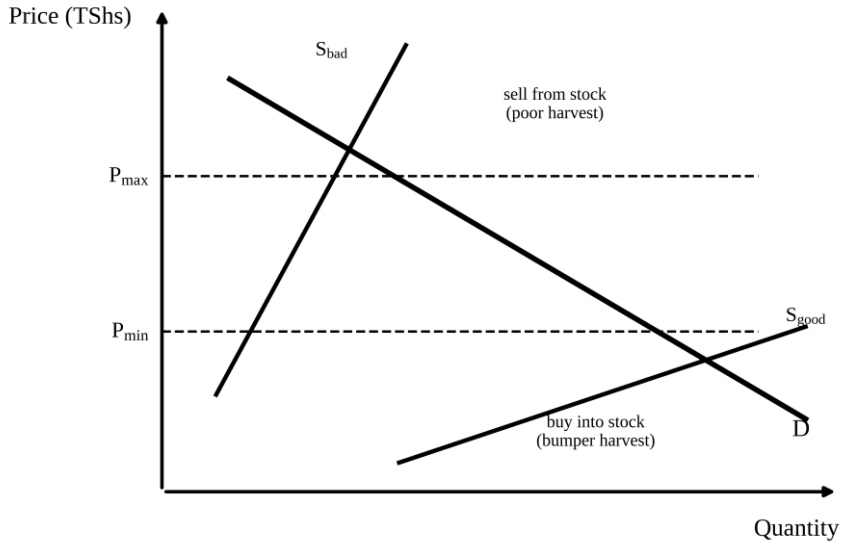


Figure 3.27: a good-harvest supply and a bad-harvest supply held within the band Pmin to Pmax

The store is the heart of the scheme: it fills in the fat years and empties in the lean ones, which only works if the good and bad harvests roughly balance over time and the warehouses, and the money to buy, hold out.

The Master Key: a buffer stock defends a price band by buying the surplus in gluts and selling from the store in shortages.

HOT Question 148

A daladala driver in Dar swears the new fuel levy is paid by drivers, never by the oil firms; an economist replies that it all turns on one thing. Who is right?

To what extent does a specific tax on fuel fall mainly on consumers? Discuss.

Model Answer

It is largely true that a specific tax on fuel falls mainly on consumers, but only because fuel demand is highly inelastic, and the claim would fail for a good whose buyers could easily cut back or switch away.

Why the driver is often right: the burden lands more heavily on whichever side is more inelastic, and fuel has few substitutes and is a necessity for transport, so its demand is very inelastic and buyers cannot escape by cutting back, leaving them with most of the tax.

The rule behind it: incidence is decided by relative elasticity, not by who legally pays, so the tax splits in the ratio of the elasticities of supply and demand, and the more inelastic fuel demand is, the larger the buyer's share.

Where the oil firms do pay: the driver overstates the case, because supply is not infinitely elastic, so sellers give up some margin too, and in the short run, when refiners and importers cannot quickly change their volumes, they may absorb a noticeable slice.

When the claim collapses: for a good with many substitutes, say one brand of cooking oil among many, demand is elastic and the seller, not the buyer, would bear the tax, since any price rise would drive customers to rivals.

So the driver is right about fuel but for the wrong reason: the burden rests on drivers not because they are ordinary people but because their demand is hard to escape. Weighing it up, most of a fuel tax does fall on the consumer, yet not the whole of it, and the exact split is an empirical matter of elasticities.

The Master Key: who bears a tax is settled not by the law that charges it but by the elasticity that cannot dodge it.

HOT Question 149

The Cashewnut Board promises Mtwara that a floor price will steady incomes; a critic points to warehouses stacked with nuts no one will buy. A promise of calm, or a costly illusion?

To what extent can a buffer-stock scheme stabilize the incomes of cashew farmers? Discuss.

Model Answer

A buffer stock can genuinely steady the price of cashew within its band, but steadying farmers' incomes is a harder and dearer promise, because income depends on the size of the harvest as well as the price, and the scheme carries heavy costs and risks.

The case for calm: by buying gluts and selling shortages the Board holds the price inside a known band, which removes the wild swings, lets farmers plan and invest, and guarantees a floor beneath which the price cannot fall.

Price is not income: income is price times quantity, so fixing the price does not fix income: with the price pinned at the floor a farmer's earnings now rise and fall with the size of the harvest, and a poor crop still means a thin year even at a fair price.

The costs mount: the scheme must build warehouses, finance large purchases and bear the risk that cashew spoils in store, so the running cost is high, and if the money or the storage runs short the floor cannot be defended.

The band can be set wrong: if the floor is fixed too high the Board buys year after year and the store overflows with unsold nuts, draining funds, while if the ceiling is too low the store empties and the defence collapses, which is the critic's warehouse full of nuts.

There is also the world price, which a single country's board cannot control, so a lasting slump in global demand will defeat any band. On balance the scheme can stabilise the price and put a floor under the worst years, which is worth a great deal, but it steadies income only partly, and only so long as its finances and its price band are set with care.

The Master Key: a buffer stock steadies the price with ease and the income only with luck, and never for free.

HOT Question 150

A minister calls the fertiliser subsidy a gift to the poor farmer; a Treasury official mutters that much of the money never reaches the field. Whose account is nearer the truth?

To what extent are fertiliser subsidies the best way to raise the incomes of maize farmers? Discuss.

Model Answer

A fertiliser subsidy can raise the yields and incomes of maize farmers, but it is not automatically the best use of the money, because much of it can leak away and cheaper routes to the same goal often exist.

The genuine gains: by lowering the price of a key input the subsidy encourages farmers to use enough fertiliser, so yields rise, food output grows and the poorest farmers, who could not otherwise afford it, are helped, which is a real and important benefit.

Who really captures it: the benefit splits by elasticity just as a tax burden does, so if fertiliser supply is inelastic, because it is imported through a few hands, much of the subsidy is pocketed by suppliers as a higher price P_s rather than reaching the farmer as a lower price P_b.

Leakage and targeting: vouchers can be sold on, diverted or captured by the larger and better-connected farmers, so a subsidy meant for the smallholder may enrich traders and elites, while the fiscal cost is large and has to be paid every season.

The alternatives: the same shillings might do more through rural roads, irrigation, extension advice, better seed or a guaranteed output price, any of which can lift farm incomes without distorting input use or inviting the same leakage.

None of this makes the subsidy worthless: where fertiliser use sits far below the efficient level and delivery is honest, it can pay for itself in higher output and food security. But its value stands or falls on how it is delivered and who captures it, so it is one tool among several rather than the obvious best, worth having as part of a wider package but not as a substitute for the roads, seeds and markets that decide whether the extra fertiliser ever bears fruit.

The Master Key: a subsidy helps the farmer only to the extent that the farmer, and not the supplier or the middleman, actually captures it.

Price Theory Clinic and Capstone

This closing section is a clinic and a capstone in one. First a rapid round fixes every key definition of the chapter in a single precise sentence, then three clinic cases put a candidate's flawed answer under the light so that you can diagnose the error and supply the answer that scores. The final seven questions are the most demanding in the chapter: full evaluative essays that trace a shock to its new equilibrium, weigh the price mechanism against the state, and end, every time, in a clear and reasoned judgement.

BINDER Question 151

Ten plain sentences hide beneath every curve in this chapter. A trader in Kariakoo could not recite a single one of them, yet he obeys all ten each morning he chalks a fresh price on his board.

Define, in one precise sentence each, the ten key terms of price theory: demand, supply, market equilibrium, a change in quantity demanded, a change in demand, a price ceiling, a price floor, consumer surplus, producer surplus, and deadweight loss.

Model Answer

Price theory rests on a handful of exact terms, beginning with the two that start everything: demand is the quantity of a good that buyers are willing and able to purchase at each price over a period, and supply is the quantity that sellers are willing and able to offer at each price over a period.

Market equilibrium: the price and quantity at which quantity demanded exactly equals quantity supplied, so the market just clears, with neither shortage nor surplus and no tendency for the price to change.

A change in quantity demanded: a movement along a fixed demand curve from one point to another, caused only by a change in the good's own price, an expansion when the price falls and a contraction when it rises.

A change in demand: a shift of the whole demand curve to a new position, caused by a change in a non-price determinant such as income, tastes, the price of a related good, expectations or the number of buyers.

A price ceiling: a legal maximum price, which to bind must be set below the equilibrium price, and which then creates a shortage because quantity demanded exceeds quantity supplied.

A price floor: a legal minimum price, which to bind must be set above the equilibrium price, and which then creates a surplus because quantity supplied exceeds quantity demanded.

Consumer surplus: the difference between the maximum price a buyer is willing to pay and the price actually paid, shown as the area under the demand curve and above the price.

Producer surplus: the difference between the price a seller actually receives and the lowest price they would have accepted, shown as the area above the supply curve and below the price.

Deadweight loss: the loss of total welfare, that is consumer surplus plus producer surplus, that arises when output is pushed away from the equilibrium quantity by a control, a tax or a quota.

The Master Key: every hard question in price theory is one of these ten plain ideas wearing a disguise.

REAL Question 152

A candidate wrote, with real confidence, that when the price of maize rises the demand curve for maize shifts to the left. It sounds right. It is quietly wrong.

Study the candidate's claim in the box, diagnose the error precisely, and give the answer that scores.

> Candidate's answer: 'When the price of maize goes up, buyers want less of it, so the demand curve for maize shifts to the left.'

Model Answer

The candidate has confused a movement along the demand curve with a shift of the whole curve, because a change in a good's own price never shifts its demand curve; it only slides you from one point to another along a curve that stays exactly where it is.

The claim that fails: the candidate treats a rise in the maize price as a cause that moves the whole curve, so the diagram would show the line sliding bodily to the left, which wrongly says buyers now want less at every price.

Why it is wrong: the demand curve is already drawn to show what happens as the good's own price changes, so a change in that own price cannot shift it; a curve shifts only when a non-price determinant changes, such as income, tastes or the price of a related good.

The right name for it: a rise in the own price causes a change in quantity demanded, a contraction, which is a movement upward along the fixed curve from one point to another, exactly the picture you drew earlier when a single curve carried points A and B.

The answer that scores: when the maize price rises, quantity demanded falls, shown by a movement up along an unchanged demand curve; the curve itself would shift left only if something other than the maize price, such as a fall in incomes, reduced demand at every price.

Hold the two phrases apart and the error cannot return: a change in quantity demanded is a movement along the curve caused by the own price, while a change in demand is a shift of the curve caused by anything else.

The Master Key: the good's own price moves you along the curve; only something else can move the curve itself.

REAL Question 153

Two Sumbawanga maize farmers hand in their supply equations written as $P = f(Q)$. *A candidate simply adds the two prices together and moves on. One step in, the whole market is already lost.*

The two farmers have inverse supply functions $P = 20 + 2Q$ and $P = 20 + 4Q$. Diagnose the candidate's method of adding them directly, then derive the market supply function correctly.

> Candidate's method: 'Add the two supply equations. $(20 + 2Q) + (20 + 4Q) = 40 + 6Q$, and this equals $2P$, so $P = 20 + 3Q$ is the market supply.'

Model Answer

The candidate has aggregated by adding prices at a common quantity instead of adding quantities at a common price, which is the wrong operation for a market, so the equations must first be turned into the form $Q = f(P)$ and only then summed, giving the market supply $Q_s = 0.75P - 15$.

The method that fails: adding the two right-hand sides sets the sum equal to $2P$, which forces both farmers to offer the very same quantity Q and adds their prices; but in a market both farmers face one common price and each offers a different quantity, so this answers the wrong question entirely.

Invert each first: from $P = 20 + 2Q$ you get $2Q = P - 20$, so $Q_1 = 0.5P - 10$, and from $P = 20 + 4Q$ you get $4Q = P - 20$, so $Q_2 = 0.25P - 5$, each now in the $Q = f(P)$ form that horizontal summation needs.

Add the quantities: at the common price add Q_1 and Q_2, so the constants -10 and -5 give -15 and the coefficients 0.5 and 0.25 give 0.75, producing the market supply $Q_s = 0.75P - 15$, valid for a price of 20 or more where both farmers are in the market.

The answer that scores: check it at $P = 40$: farmer one offers $0.5(40) - 10 = 10$ and farmer two offers $0.25(40) - 5 = 5$, together 15, and the market function gives $0.75(40) - 15 = 15$, while the candidate's $P = 20 + 3Q$ would return only about 6.7, so the gap between 15 and 6.7 is the size of the error.

The rule is the same for supply as for demand: a market adds sideways along the quantity axis, never up the price axis, so every equation written as $P = f(Q)$ must be flipped to $Q = f(P)$ before a single sum is taken.

The Master Key: to build a market, add the quantities at each shared price; adding the prices answers a question no market ever asks.

REAL Question 154

A candidate labelled EWURA's maximum pump price a price floor and predicted a glut of fuel at every station. Two mistakes are stacked in one sentence, and they compound.

Study the candidate's claim in the box, correct both errors, and give the answer that scores.

> Candidate's answer: 'EWURA's maximum price for petrol is a price floor. Because it is a floor, it will create a surplus of fuel, so stations will have more than they can sell.'

Model Answer

The candidate has both mislabelled the control and reversed its effect, because a maximum price is a price ceiling, not a floor, and an effective ceiling sits below equilibrium and creates a shortage of fuel, not a surplus.

The first error, the label: a maximum price is a price ceiling, since it caps how high the price may go, whereas a price floor is a minimum price that props the price up from below, so the very name in the answer is the opposite of the truth.

The second error, the effect: to bite, a ceiling must be set below the equilibrium price, and at that low price drivers want more fuel than sellers will supply, so quantity demanded exceeds quantity supplied and the result is a shortage, the empty pumps and queues, not a glut.

Which control does which: a ceiling below equilibrium causes a shortage and is aimed at protecting buyers, while a floor above equilibrium causes a surplus and is aimed at protecting sellers, exactly the two pictures you drew when you first met controls.

The answer that scores: EWURA's maximum pump price is a price ceiling; if it is set below the market price it causes a shortage of fuel, with queues and dry stations, and it would create a surplus only if it were instead a floor set above the market price, which a maximum price is not.

Fix the pairings once and the trap springs shut: maximum means ceiling means shortage means protect the buyer, while minimum means floor means surplus means protect the seller.

The Master Key: a maximum price is a ceiling that dries the pumps; only a minimum price is a floor that floods the market.

HOT Question 155

A market trader says the government should fix the price of everything and end the daily haggling. An economist warns that the haggling is the system quietly working. Who is right?

To what extent does the free price mechanism allocate a nation's resources better than a government could? Discuss and reach a judgement.

Model Answer

It is largely true that the price mechanism allocates resources better than any government could, because prices gather scattered information and coordinate millions of strangers automatically, yet it is not wholly true, for the mechanism fails in ways that justify a limited, corrective role for the state.

The case for the market: a price signals, incentivises and rations all at once; a high price tells producers to make more and buyers to economise, drawing resources to their most valued use without any planner needing to know a single want, which is the invisible hand that Adam Smith described.

It uses knowledge no planner has: the facts of scarcity and desire are scattered across millions of people and change by the hour, so no ministry can gather them, yet each price summarises them in one number, which is why the market answers what to produce faster and more cheaply than any command office, whose chronic shortages and queues proved the point.

But the market can fail: it rations by ability to pay, so the poor are priced out of essentials like maize in a drought; it ignores externalities and public goods that carry no price; it lets farm prices swing violently from season to season; and it lets a monopoly exploit buyers, none of which the price signal corrects on its own.

On balance the price mechanism is the best everyday allocator we have and should run the vast bulk of the economy, but it is a good servant and a poor master. The sensible course is not to replace it, as the command economies tried and failed to do, but to let it work while government mends its sharpest edges with safety nets, strategic reserves and the regulation of monopoly.

The Master Key: leave the market to allocate the many, but keep the state to catch what the price cannot see.

HOT Question 156

One failed rains season, and the price of a sack of maize in Dodoma doubles by June. No official ordered the rise, yet the whole market obeyed. Follow the shock to its end.

Trace the full market story when a drought cuts the maize harvest, from the shock to the new equilibrium, and analyse the welfare effects.

Model Answer

A drought cuts the maize supply and shifts the supply curve to the left, so at the old price a shortage appears, the price is bid up until quantity demanded and the reduced quantity supplied meet again at a new equilibrium of higher price and lower quantity, and along the way consumer surplus is squeezed while society bears the real loss of the missing harvest.

The shock hits supply: the drought destroys part of the crop, so at every price farmers can offer fewer sacks, and the whole supply curve shifts to the left, the decrease in supply you drew earlier, while the demand for the staple is unchanged.

A shortage opens at the old price: at the pre-drought price the reduced supply now falls short of the unchanged demand, so quantity demanded exceeds quantity supplied and a shortage appears, exactly the gap below the equilibrium you met in the market-clearing diagram.

The price is bid up: hungry buyers compete for the scarce sacks and bid the price upward, and because a staple has few substitutes its demand is inelastic, so the price must climb far; as it climbs, quantity demanded contracts along the demand curve while the little remaining supply expands along the new curve, closing the gap.

A new equilibrium settles: the price stops rising only when quantity demanded once again equals quantity supplied, at a new equilibrium with a higher price and a lower quantity than before, so the market clears itself without a single official order being given.

The welfare effects: consumers pay more for less, so their consumer surplus shrinks sharply; sellers who still have grain enjoy the higher price, but far fewer sacks change hands, and the harvest that the drought destroyed is a genuine reduction in society's welfare that no price can bring back.

So the price mechanism does its job, rationing the scarce maize to those who value it most and signalling everyone to economise, but it does so harshly, for it is the poorest who are priced out of the staple first. That harshness, not any failure of the mechanism, is precisely what tempts a government to step in with a reserve release or a subsidy.

The Master Key: a supply shock is rationed by a rising price, quietly and efficiently, but never gently.

HOT Question 157

When world oil prices jump, some demand that EWURA freeze the pump price, while others warn that a frozen price means dry pumps. The fuel queue is where the theory meets the road.

To what extent should the Tanzanian government intervene in the fuel market? Discuss and reach a judgement.

Model Answer

The government is right to intervene in the fuel market to steady a strategic, universally used good against volatile world prices and the risk of cartel behaviour, but its intervention should regulate and stabilise the price rather than freeze it below cost, for a frozen price would only create shortages.

Why fuel invites intervention: fuel is a strategic input whose price passes straight into transport, food and production costs, so a spike is inflationary for everyone at once; and with only a few large importers, buyers risk being overcharged, which is why EWURA publishes a capped price each month.

How careful intervention helps: by building that ceiling price from world costs and from bulk procurement, EWURA curbs profiteering, smooths the shock of world price swings and gives every station one clear price, so consumers are protected without the pumps running dry.

Where intervention goes wrong: if the cap is frozen below the true import cost, sellers cannot cover their costs, supply is withdrawn and stations run dry, exactly the shortage a binding ceiling creates; and holding the price down with subsidies instead is costly and mostly benefits heavier fuel users, who tend to be the better off.

So the extent of justified intervention is real but bounded. Government should regulate the few importers and stabilise the price around its world-determined level, as EWURA broadly does, but it should not suppress the price beneath cost, for that would trade a high price the market can supply for a low price it cannot. Intervene to smooth and to police, not to freeze.

The Master Key: cap fuel to tame the cartel and the shock, but never so low that the pumps run dry.

HOT Question 158

In 2018 the government promised cashew farmers 3,300 shillings a kilo and, when private buyers walked away, bought the entire crop itself. A generous floor, or a costly trap?

Weigh who gains and who loses from a guaranteed minimum price for cashew, and reach a judgement.

Model Answer

A guaranteed minimum price for cashew gains the farmers of Mtwara and Lindi a higher price in the short run, but it loses for private buyers, for taxpayers and, if the floor sits above what the world market will pay, for the farmers themselves once the unsold surplus and its costs come due.

The winners at first: a floor set above the market price raises the return to cashew growers, lifting incomes across the southern regions and rewarding the effort of planting, which is why such support is popular and politically attractive.

The immediate losers: because the floor lies above equilibrium, quantity supplied exceeds quantity demanded, so a surplus of cashew appears; private buyers and exporters, unwilling to pay above the world price, withdraw, as they did in 2018 when the government itself had to buy the crop at 3,300 shillings a kilo.

The hidden losers: the taxpayer then funds the purchase, the warehousing and the eventual loss on cashew that cannot be sold at the guaranteed price, while the crop risks spoiling in store, so the deadweight loss of over-producing a good the market will not absorb falls on the whole nation.

The farmers, later: if the scheme drains the budget and buyers stay away, payments are delayed and the next season's market is thinner, so the very farmers the floor was meant to help can end up unpaid and worse off than before it was offered.

On balance a support price can genuinely raise farm incomes and is defensible as modest, funded insurance against a collapse in the cashew price, but a high floor divorced from world prices simply manufactures unsellable surpluses and heavy fiscal losses. The wiser policy is a modest, funded floor paired with better productivity and marketing, not a generous price the world will not honour.

The Master Key: a crop floor above the world price buys farmers one good season and the treasury a warehouse of unsold nuts.

HOT Question 159

Raise the lowest legal wage, says one camp, and the poorest workers are lifted at a stroke. Raise it too far, says the other, and they are lifted straight out of a job.

To what extent does a minimum wage protect low-paid workers in Tanzania? Discuss and reach a judgement.

Model Answer

A minimum wage protects the lowest-paid workers where employers hold wage-setting power, but because it is a price floor in the labour market, set too high it produces a surplus of labour, that is unemployment, and in an economy as informal as Tanzania's it reaches only the minority who hold formal jobs.

The case for the floor: where a few large employers dominate hiring, they can push wages below what a competitive market would pay, so a minimum wage can lift the poorest workers, reduce in-work poverty and even raise morale and productivity, with little loss of jobs if it is set near the going wage.

The price-floor danger: a wage set above the market-clearing level is a floor above equilibrium, so the quantity of labour supplied exceeds the quantity demanded and the gap is unemployment; firms hire fewer workers, and the young and unskilled are shed first, the very people the law meant to help.

The informal escape: much of Tanzania's labour force works informally, beyond the reach of the wage law, so a high minimum wage can push firms and jobs into the informal sector where no protection applies, leaving the law to cover only a formal minority.

So the extent of the benefit turns on the level. A modest minimum wage, set near the market wage and firmly enforced, can protect vulnerable formal workers at little cost in jobs, especially against employers with wage-setting power; but a high minimum wage in a largely informal economy mostly prices the low-skilled out of formal work and into unprotected informal work. Set it carefully, enforce it, and pair it with training, rather than setting it high and hoping.

The Master Key: a minimum wage lifts the workers who keep their jobs and sinks the ones it prices out.

HOT Question 160

When sugar vanished from the shelves, a maximum price was fixed to protect the poor. Yet the poor queued longest and paid the black-market dealer most. Did the cap really help them?

To what extent is it true that a price ceiling always helps the poor? Use the market for a staple such as sugar, and reach a judgement.

Model Answer

It is not true that a price ceiling always helps the poor, because although a maximum price does lower what a lucky buyer pays for a staple like sugar, a binding ceiling creates a shortage whose queues, rationing and black markets usually fall hardest on the very poor it was meant to protect.

The grain of truth: a ceiling set below the equilibrium price does cut the price of sugar, so a poor household that manages to buy at the controlled price genuinely pays less, which gives real short-run relief during a price spike.

The shortage it creates: because the maximum price sits below equilibrium, quantity demanded exceeds quantity supplied, so sugar runs short; the low price that looks kind on paper cannot summon the sugar that is simply not there at that price.

Who really loses: the scarce sugar is then rationed by queues, connections and favouritism, and the well-connected and better-off usually win that scramble, while the poorest, unable to queue all day or pay a bribe, are driven to the black market where the price runs above what the free market would have charged, and quality falls as sellers cut corners.

So the claim is false as a general rule. A ceiling helps the poor only when the shortage is small and the scarce good is shared out fairly, for instance through targeted ration cards or a subsidy; a blanket cap on a staple like sugar tends to help the lucky and the connected while driving the poorest into black markets. Better to protect the poor directly than to freeze a price and hope the shortage is kind.

The Master Key: a price cap gives the poor a low price on paper and a long queue in practice.

HOT Question 161

A ministry proposes one clean rule: cap the maize price at 14 and hunger will ease. Before the ink dries, work the whole market through and see what the cap really does.

For a maize market with demand $Q_d = 200 - 5P$ and supply $Q_s = -40 + 5P$, taking P in thousand shillings per sack, find the equilibrium, then evaluate a price ceiling of 14 by tracing its effect on quantity, welfare and the parties involved, and reach a judgement.

Model Answer

Working the maize market through shows the cap backfiring: the free market clears at a price of 24 and a quantity of 80, but a ceiling of 14 lets buyers want 130 while sellers offer only 30, so a shortage of 100 opens, producer surplus collapses and society loses 500 in deadweight loss, which means the policy fails the consumers it was meant to feed.

Find the free equilibrium: set quantity demanded equal to quantity supplied, so $200 - 5P = -40 + 5P$ gives $240 = 10P$, hence $P = 24$ and $Q = 80$, the price and quantity at which the maize market clears itself with neither shortage nor surplus.

Impose the ceiling: at the maximum price of 14, quantity demanded rises to $Q_d = 200 - 5(14) = 130$ while quantity supplied falls to $Q_s = -40 + 5(14) = 30$, so only 30 sacks reach the market and a shortage of 100 sacks opens up, the excess demand you first met under the price-ceiling diagram.

Weigh the welfare: on the 30 sacks still sold, buyers value the last sack at 34 but it costs only 14 to supply, and this gap over the 50 sacks no longer traded is a deadweight loss of 0.5 times 20 times 50, that is 500, while producer surplus is crushed from 640 down to just 90, so the farmers are the heaviest losers.

Stage	Working	Result
Free equilibrium	$200 - 5P = -40 + 5P$, so $240 = 10P$	$P = 24$, $Q = 80$
At the ceiling $P = 14$	$Q_d = 200 - 70 = 130$; $Q_s = -40 + 70 = 30$	$Q_d = 130$, $Q_s = 30$
Shortage	$Q_d - Q_s = 130 - 30$	100 sacks
Deadweight loss	$0.5 \times (34 - 14) \times (80 - 30)$	500

The consumer catch: the lucky buyers who get maize do pay only 14 instead of 24, so their surplus can even rise, but 100 sacks of willing demand go unmet, and the queues, favouritism and black-market premiums that ration the scarce 30 sacks drain that paper gain away from the poorest households.

So the clean rule fails the market it was meant to help. The cap does lower the price, but it guts the quantity, destroys 500 of welfare, and weakens the incentive to farm so that next season's supply shrinks further, while it hands the scarce maize to whoever can queue or bribe. If the government wants a low price to stick, it must add maize, by releasing a strategic reserve or paying a subsidy, not merely forbid the high price.

The Master Key: a price can be forbidden by decree, but the maize behind it cannot be conjured by the same decree.

Chapter Four

ELASTICITY

In Chapter Three you learned that a change in price moves us along a demand or a supply curve, and that a change in any other condition shifts the whole curve. Those curves tell you the direction of a change, but not its force. When the government raises the duty on petrol, when a bumper harvest floods Kilombero with rice, or when a trader in Kariakoo marks a shirt up by a thousand shillings, the question that decides who gains and who loses is not whether quantity responds, but by how much. Elasticity is the measure of that force. This chapter teaches you to measure the responsiveness of demand to a good's own price, to income and to the price of a related good, and the responsiveness of supply to price; to read the five degrees of each from a diagram; to name what makes demand or supply stubborn or nimble; and to turn those numbers into decisions about pricing, taxation, wages and the fate of a farmer after a good season. Work every calculation to the last step, then say in one plain sentence what the number means, because in this chapter the interpretation is the answer.

The concept of elasticity

Every curve you drew in the last chapter answered a yes-or-no question: does quantity move when a condition changes? Elasticity answers the harder question that follows: by how much? This opening section fixes the idea in your mind before any formula arrives. You will learn what responsiveness means, why the law of demand alone cannot tell you the strength of a reaction, how the four members of the elasticity family divide the work between them, and why elasticity is deliberately built out of percentages so that it never depends on whether you count in kilograms, litres or sacks.

BINDER Question 1

Press a ripe mango and it dents at once; press a green one and it barely gives. Two goods can meet the very same price rise and answer just as differently, and economics keeps one word for that difference.

Define elasticity and state, in general terms, what it measures.

Model Answer

Elasticity is the measure of how strongly one economic quantity responds, in proportionate terms, to a change in a factor that influences it.

The idea it captures: elasticity is responsiveness put into a number. It records the size of the reaction of a quantity, such as the quantity demanded or the quantity supplied, to a change in one of its determinants, such as price or income.

How it is built: it is always a ratio of a proportionate change to a proportionate change, written in general as the percentage change in the responding quantity over the percentage change in the influencing factor.

$$e = \frac{\%\Delta Q}{\%\Delta X}$$

Why proportion and not amount: because it compares percentages, elasticity is a pure number with no units. A response measured in kilograms of rice and one measured in litres of petrol can then sit on the very same scale and be compared directly.

So while the law of demand tells you that a reaction happens, elasticity tells you how large that reaction is, in a form you can calculate and compare across any two goods.

The Master Key: elasticity is proportionate responsiveness, always a ratio of percentage changes, and therefore always a unit-free number.

BINDER Question 2

The law of demand promises only that when the price of maize flour climbs, the sacks leaving the shop will fall. It never whispers whether they fall by a handful or by half the store.

Explain why the law of demand, on its own, is not enough, and what elasticity adds to it.

Model Answer

The law of demand gives the direction of a change but is silent on its size, and elasticity is the tool that supplies the missing measure of size.

What the law gives: it states only the sign of the relationship: a rise in price lowers quantity demanded, a fall raises it. It fixes the direction of the arrow and nothing more.

What the law hides: it cannot say whether a ten per cent rise in price trims quantity demanded by one per cent or by thirty. Two goods that both obey the law can react in wildly different degrees.

What elasticity adds: it measures the degree of the reaction, turning a known direction into a known magnitude. Only with elasticity can a trader in Mbeya predict how far sales will fall before deciding whether the price rise is worth it.

The two ideas therefore work as a pair: the law of demand points the way, and elasticity measures how far along that way the market actually travels.

The Master Key: the law of demand supplies direction; elasticity supplies degree, and a decision needs both.

BINDER Question 3

A single household in Iringa buys less of a good when its own price rises, less again when the family income shrinks, and more when a rival good grows dear. Three different pressures, and a separate measuring rod for each.

Name the members of the elasticity family and state, for each, the change it measures the response to.

Model Answer

Elasticity comes in four working members, three that measure the responsiveness of demand and one that measures the responsiveness of supply.

Price elasticity of demand: measures how the quantity demanded of a good responds to a change in the good's own price.

Income elasticity of demand: measures how the quantity demanded of a good responds to a change in the consumer's income.

Cross-price elasticity of demand: measures how the quantity demanded of one good responds to a change in the price of a related good.

Price elasticity of supply: measures how the quantity supplied of a good responds to a change in the good's own price.

Each member isolates one cause and holds the others still, so that the number it reports can be traced to a single influence.

The Master Key: three demand elasticities, sorted by what changes (own price, income, a related price), and one supply elasticity for a change in own price.

BINDER Question 4

Draw a demand line gently, then draw it steeply, and it is tempting to call the steep one less responsive. A careful economist checks the arithmetic before trusting the eye.

Distinguish price elasticity from the slope of a curve, and explain why the two are not the same thing.

Model Answer

Slope and elasticity both describe how a curve leans, but slope is measured in units while elasticity is measured in proportions, so the two carry different information.

What slope measures: slope is the ratio of an absolute change in price to an absolute change in quantity. Its size depends on the units chosen, so switching from shillings to hundreds of shillings, or from single fruits to dozens, changes the slope without changing anything real.

What elasticity measures: elasticity is the ratio of a percentage change in quantity to a percentage change in price. Because both sides are proportions, the units cancel and the number stands on its own.

Why they diverge: along a single straight-line demand curve the slope is the same at every point, yet the elasticity differs from point to point. A constant lean can therefore hide a changing responsiveness, which is exactly why the eye can mislead.

Slope influences elasticity, but it does not equal it; the honest measure of responsiveness is always the proportionate one.

The Master Key: slope is a units-bound ratio of absolute changes; elasticity is a unit-free ratio of percentage changes, and the two need not agree.

BINDER Question 5

A fishmonger in Mwanza raises her price by one hundred shillings; a car dealer in Dar raises his by one hundred thousand. The same shilling figures mean nothing until you ask what share of the old price each rise represents.

Explain why elasticity is expressed in percentages rather than in absolute amounts, and give the benefit this brings.

Model Answer

Elasticity is built from percentages so that the responses of goods with very different prices and units can be compared on one honest scale.

The problem with absolute amounts: a rise of one hundred shillings is trivial on a car but ruinous on a single fish. Absolute changes cannot be compared across goods because they carry the units and the price levels of each good with them.

The cure of percentages: turning each change into a percentage of its own starting value strips away the units and the price level, leaving a proportion that any two goods share in common.

The benefit: responsiveness becomes portable. You can lay the reaction of dagaa beside the reaction of a television set and say at once which is the more elastic, because both are now pure numbers.

This is why every elasticity formula divides one percentage by another, and why the answer never carries a unit after it.

The Master Key: percentages remove units and price levels, so elasticity can compare the responsiveness of any two goods on the same scale.

REAL Question 6

One morning EWURA lifts the pump price of petrol and, in the same week, the price of a fashionable phone brand climbs by the same tenth. By Friday the fuel queues are as long as ever, while the phone shop stands quiet.

Using the idea of responsiveness, explain which good shows the greater elasticity of demand and why, without yet computing any number.

Model Answer

The phone shows the greater elasticity of demand, because the same proportionate price rise drives buyers away from it far more than from petrol.

Reading the two reactions: petrol's quantity demanded barely moves when its price rises by a tenth, so its response is small relative to the price change. The phone's quantity demanded falls sharply for the same tenth, so its response is large relative to the price change.

Turning the reactions into elasticity: elasticity is the size of the quantity response measured against the size of the price change. A small quantity response to a given price rise is low elasticity; a large one is high elasticity.

Why petrol is the stubborn one: a driver in Dar has few ready substitutes for fuel and cannot easily postpone the journey to work, so quantity holds firm. A buyer eyeing a fashion phone has many rival brands and can simply wait, so quantity collapses.

The queues and the quiet shop are the visible face of two different elasticities: petrol inelastic, the fashion phone elastic.

The Master Key: the good whose quantity reacts more to the same proportionate price change is the more elastic; here that is the phone, while petrol is inelastic for want of substitutes.

REAL Question 7

A trader in Kariakoo keeps two shelves. When she nudges up the price of sugar, the sacks keep moving; when she nudges up the price of a soft drink by the same fraction, the crates sit still.

Explain, in terms of the concept of elasticity, why the two shelves behave so differently.

Model Answer

The two shelves differ because sugar and the soft drink have very different elasticities of demand: sugar's quantity is unresponsive to price, while the drink's is highly responsive.

Sugar, the unresponsive shelf: sugar is a near-necessity in a Tanzanian kitchen with few close substitutes and a small share of the weekly budget, so a modest price rise leaves the quantity bought almost unchanged. Its demand is inelastic.

The soft drink, the responsive shelf: the drink is a comfort with many rivals a shelf away and is easily done without, so the same proportionate price rise sends buyers to a substitute or to nothing at all. Its demand is elastic.

The concept at work: elasticity records exactly this contrast: it is the proportionate fall in quantity set against the proportionate rise in price. Sugar returns a small ratio, the drink a large one, and the two shelves display the difference.

The trader who understands this will raise the sugar price without fear for her sales, but think twice before doing the same to the drink.

The Master Key: unresponsive sugar is inelastic, responsive soda is elastic; the concept of elasticity is simply the size of the quantity reaction relative to the price change.

HOT Question 8

A shopkeeper waves away the mathematics: everyone knows that dearer goods sell less, he says, so why dress plain sense in Greek letters and fractions?

To what extent is elasticity merely common sense expressed in mathematics? Argue your case.

Model Answer

Elasticity begins in common sense but goes decisively beyond it, because measuring the size of a response yields decisions that intuition alone cannot reach.

The grain of truth: the shopkeeper is right that the direction of the effect is obvious: nobody needs algebra to know that a price rise lowers sales. To that extent elasticity only confirms what everyone already senses.

Where sense runs out: common sense cannot say whether a ten per cent price rise will cost one per cent of sales or forty, and it is precisely that number which decides whether the rise raises or ruins revenue. Intuition gives the sign; only measurement gives the magnitude.

What the magnitude unlocks: with a measured elasticity a firm knows whether to cut or raise price to lift revenue, a government knows which goods to tax without killing the tax base, and a farmer knows whether a good harvest is a blessing or a trap. None of these follow from sense alone.

The balanced verdict: elasticity is common sense at its root and a precise instrument in its use. Dismissing the mathematics keeps the shopkeeper forever ignorant of the one thing he most needs, the size of the reaction he is about to provoke.

So the fractions are not decoration; they are the step from knowing that demand reacts to knowing how much, and that step changes real decisions.

The Master Key: elasticity shares common sense's direction but adds the magnitude that common sense cannot supply, and the magnitude is what drives pricing, tax and farm decisions.

HOT Question 9

Two demand lines are drawn on the same board. One is steep, one is gentle, and a confident student announces that the steep line must be the less elastic of the two. The teacher only smiles and asks for the units.

Assess the claim that a steeper demand curve is always the less elastic one.

Model Answer

The claim is unreliable, because steepness reflects slope, and slope is not the same as elasticity, so a steeper curve is not always the less elastic one.

Why the claim seems right: on two curves drawn to the very same axes and units, the steeper one does respond less in quantity to a given price change, so over that narrow comparison steepness and lower elasticity move together.

The first crack: units: steepness depends on the scale of the axes. Stretch the quantity axis or shrink the price axis and a curve looks steeper without any change in its true responsiveness. Slope carries the units; elasticity does not.

The second crack: position: along one straight-line demand curve the slope never changes, yet elasticity falls steadily from very high near the top to very low near the bottom. A single steepness therefore hosts a whole range of elasticities, which the claim cannot allow.

The measured verdict: steepness is at best a rough hint and at worst a trap. The only dependable judgement of responsiveness is the proportionate one, computed at the point in question.

The confident student mistook a picture for a measurement; the teacher's question about units is the whole correction.

The Master Key: steepness is slope, and slope depends on units and changes elasticity along its own length, so a steeper curve is not reliably the less elastic one.

Price elasticity of demand: meaning and measurement

The opening section fixed what elasticity means in general; now its senior member takes the floor. Price elasticity of demand asks one sharp question: when a good's own price moves, by what proportion does the quantity demanded answer back? Here you will meet the formula that pins that question down, learn to compute each half of it from a before-and-after pair of figures, and follow real Tanzanian scenes all the way from raw shillings to a finished coefficient. You will also see why the answer always arrives wearing a minus sign, why we then strip that sign away, and how to read the size that remains as elastic, inelastic or the knife-edge between.

BINDER Question 10

At a Dodoma duka the price of cooking oil ticks up by a fifth, and the buyer's hand hesitates over the bottle. Economics keeps one precise word for how far that hesitation goes.

Define price elasticity of demand.

Model Answer

Price elasticity of demand is the degree of responsiveness of the quantity demanded of a good to a change in the good's own price, all other things held constant.

The responding quantity: the thing that reacts is the quantity demanded of the good itself. Price elasticity of demand watches how many kilos, litres or units buyers take up as the reaction unfolds.

The cause it isolates: the only permitted cause of the reaction is a change in the good's own price. Income, the prices of other goods and tastes are all frozen, which is exactly what ceteris paribus means here.

Why own price and nothing else: by holding every other influence still, the measure traces the whole of the quantity change to the price change alone. Any number it reports can then be read as pure price responsiveness.

So price elasticity of demand is not just demand reacting in a vague way, but a precise pairing: the proportionate change in quantity demanded set against the proportionate change in that good's own price, with the rest of the world kept quiet.

The Master Key: price elasticity of demand measures how strongly the quantity demanded of a good responds to a change in its own price, holding everything else constant.

BINDER Question 11

Two traders both swear their sales dropped a lot after a price rise, but a lot settles no argument. To measure the reaction you need two percentages and a single division.

State the formula for price elasticity of demand and show how each percentage in it is calculated.

Model Answer

Price elasticity of demand is found by dividing the percentage change in quantity demanded by the percentage change in price.

$$e_p^d = \frac{\%\Delta Q^d}{\%\Delta P}$$

The top line: the numerator is the percentage change in quantity demanded, worked out as the change in quantity over the starting quantity, times one hundred.

$$\%\Delta Q^d = \frac{Q_1 - Q_0}{Q_0} \times 100$$

The bottom line: the denominator is the percentage change in price, worked out in the very same fashion from the starting price.

$$\%\Delta P = \frac{P_1 - P_0}{P_0} \times 100$$

Why each is a percentage of its own start: each change is measured against its own original value, so the shillings and the kilos cancel out before the division even begins. What survives is a pure ratio of two proportions.

Feed any before-and-after pair of prices and quantities into these two lines, divide the first percentage by the second, and the responsiveness of the good stands revealed as a single number.

The Master Key: $e_p^d = \frac{\%\Delta Q^d}{\%\Delta P}$, where each percentage change is the change divided by its own starting value, times one hundred.

BINDER Question 12

On a demand curve drawn for maize, one dot marks today's price and today's sales. Elasticity can be read right at that dot, provided you know which four numbers the formula is hungry for.

Show how the price-elasticity formula can be expanded to measure elasticity at a point on the demand curve.

Model Answer

The percentage formula can be rearranged into a point form that reads elasticity straight off a single starting price and quantity together with the changes measured from them.

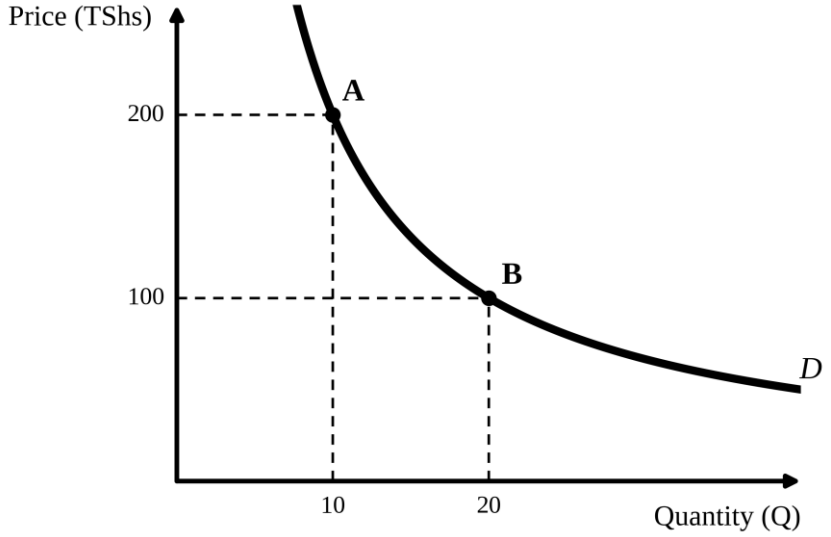


Figure 4.1: *A demand curve showing the arc and point price elasticities of demand*

Writing the changes in full: replace each percentage by its definition, and the formula becomes a ratio of the two raw changes multiplied by the starting price over the starting quantity.

$$e_p^d = \frac{Q_1 - Q_0}{P_1 - P_0} \times \frac{P_0}{Q_0}$$

The compact point form: gathering the two raw changes into ΔQ^d and ΔP gives the working form used for a point on the curve.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$$

Reading it at point A: the term $\frac{\Delta Q^d}{\Delta P}$ is the reciprocal of the curve's slope, while $\frac{P_0}{Q_0}$ fixes the exact point A from which the price sets off. Elasticity is therefore always measured at a stated starting point, never floating free of one.

In the figure the curve carries points A and B; feeding A's own price and quantity into the point form measures how demand responds as the price begins its journey from A toward B.

The Master Key: the point form $e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$ measures responsiveness at one stated starting point on the demand curve.

BINDER Question 13

A downward-sloping demand curve makes price and quantity pull in opposite directions, so the formula almost always hands back a minus sign. The real question is what that minus is worth.

Explain why price elasticity of demand is negative for a normal good, and state the range of values it can take.

Model Answer

Price elasticity of demand is negative for a normal good because price and quantity demanded always move in opposite directions, and once the sign is set aside its size can run anywhere from zero to infinity.

The source of the minus: along a normal, downward-sloping demand curve a rise in price brings a fall in quantity, and a fall in price brings a rise. One of the two changes is therefore always positive while the other is negative, so their ratio is negative.

$$\frac{\Delta Q^d}{\Delta P} < 0$$

Why it is a small nuisance, not a puzzle: the minus merely restates the law of demand, which we already hold to be true. It confirms a direction we are sure of rather than the size we are actually seeking.

The range of the size: once the sign is dropped, the magnitude of price elasticity of demand runs from 0 to ∞. A value of 0 means quantity does not budge at all, a value approaching ∞ means quantity reacts without limit, and the interesting everyday cases lie between those two extremes.

$$0 \leq \left| e_p^d \right| \leq \infty$$

So the sign tells you the direction, which the law of demand already guaranteed, while the size, lying somewhere from 0 to ∞, tells you the one thing you did not yet know: how strong the reaction really is.

The Master Key: a normal good gives a negative e_p^d because price and quantity move oppositely, and its magnitude lies between 0 and ∞.

BINDER Question 14

Beef in Arusha climbs from 6,000 to 8,000 shillings a kilo, and the butchers' daily sales slip from 100,000 kilos to 80,000. A single coefficient can capture the whole reaction.

Using the point method, calculate the price elasticity of demand for the beef and interpret your result.

Beef in Arusha Municipality
Price: 6,000 to 8,000 shillings per kg
Quantity demanded: 100,000 to 80,000 kg per day

Model Answer

The price elasticity of demand for the beef is 0.6, which means demand is inelastic: the quantity demanded falls by proportionately less than the price rises.

Set out the starting values and the changes: take point A as the starting position, so $P_0 = 6{,}000$ and $Q_0 = 100{,}000$, moving to $P_1 = 8{,}000$ and $Q_1 = 80{,}000$.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$$

Substitute the figures: insert the two changes over the starting point A.

$$e_p^d = \frac{80{,}000 - 100{,}000}{8{,}000 - 6{,}000} \times \frac{6{,}000}{100{,}000}$$

$$e_p^d = \frac{-20{,}000}{2{,}000} \times \frac{6{,}000}{100{,}000}$$

$$e_p^d = -10 \times 0.06 = -0.6$$

Report the size: dropping the minus that the law of demand guarantees leaves a reported magnitude of 0.6.

$$\left| e_p^d \right| = 0.6$$

Interpret the number: because 0.6 is less than 1, demand is inelastic. The 33.3 per cent price rise met only a 20 per cent fall in quantity, so buyers in Arusha cut back by proportionately less than the price climbed, which is the signature of a good they are reluctant to give up.

A coefficient below one is the fingerprint of a near-necessity: beef is wanted enough that even a steep price rise thins the butchers' queue only modestly.

The Master Key: $e_p^d = 0.6 < 1$, so beef demand is inelastic and quantity falls proportionately less than price rises.

BINDER Question 15

A student computes an elasticity of minus nought point six and dutifully writes the minus down; the teacher gently crosses it out. The sign, it turns out, was never earning its keep.

Explain why price elasticity of demand is conventionally reported as a positive number, even though its calculated sign is negative.

Model Answer

We report price elasticity of demand as a positive number because the minus sign only repeats the law of demand, so removing it lets attention fall where it belongs, on the size of the response.

What the sign is saying: for a normal good the calculation returns a negative value, since price and quantity always move in opposite directions. The raw coefficient is therefore just minus its own magnitude.

$$e_p^d = -|\, e_p^d \,|$$

Why the sign carries no fresh news: the direction is something we already know for certain from the law of demand. A sign that only confirms the obvious adds nothing to what we are trying to measure, which is how strong the reaction is.

What the convention keeps in view: by taking the absolute value, or by prefixing a minus so the reported figure comes out positive, we place every good on one scale from 0 upward. Comparisons then turn on size alone, so a larger number simply means a stronger response.

So the crossed-out minus is not a fault in the student's arithmetic but a tidying of the report: the sign has done its small job of naming the direction and can now step aside so the magnitude may speak.

The Master Key: the negative sign only restates the law of demand, so we report the magnitude of e_p^d and compare goods by size alone.

REAL Question 16

Follow a sack of rice in Kariakoo: its price rises from 400 to 500 shillings a kilo, and one stall's weekly sales fall from 2,500 kilos to 2,000. Now put a firm figure on the response.

Calculate the price elasticity of demand for the rice and interpret what your answer says about the buyers at this stall.

Rice at one Kariakoo stall
Price: 400 to 500 shillings per kg
Quantity demanded: 2,500 to 2,000 kg per week

Model Answer

The price elasticity of demand for the rice is 0.8, an inelastic value, so the stall's buyers trim their purchases by proportionately less than the price rises.

Fix the starting point and the changes: start at $P_0 = 400$ and $Q_0 = 2{,}500$, moving to $P_1 = 500$ and $Q_1 = 2{,}000$, so that $\Delta P = 100$ and $\Delta Q^d = -500$.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$$

$$e_p^d = \frac{-500}{100} \times \frac{400}{2{,}500}$$

$$e_p^d = -5 \times 0.16 = -0.8$$

Report and read the size: the reported magnitude is 0.8, and since 0.8 is less than 1 the demand is inelastic. A 25 per cent price rise drew out only a 20 per cent cut in quantity.

What it says about the buyers: rice is a staple on the Kariakoo shopper's table with few ready substitutes, so a dearer price pares the weekly basket only a little. Most of the volume stays on the stall's scale even after the rise.

The signal to the trader is reassuring: this rice is something her customers will not easily give up, so within this range a sharp price rise costs her proportionately fewer sales than the shillings she adds to each kilo.

The Master Key: $e_p^d = 0.8 < 1$, so the rice is inelastic and its quantity falls proportionately less than its price rises.

REAL Question 17

The NEMC reports that each ten per cent rise in the charcoal price trims the quantity city households burn by only five per cent. Officials want to know whether dearer charcoal can move families off it.

Calculate the price elasticity of demand for the charcoal and advise whether raising its price would substantially reduce charcoal cooking.

Model Answer

The price elasticity of demand for the charcoal is 0.5, a firmly inelastic value, which warns that a price rise on its own would not move most households off charcoal.

Read the two percentages straight off: the figures already arrive in percentage form, so they drop directly into the formula: quantity demanded falls by 5% while price rises by 10%.

$$e_p^d = \frac{\%\Delta Q^d}{\%\Delta P} = \frac{-5\%}{10\%} = -0.5$$

Report the size: the reported magnitude is 0.5, and because 0.5 sits well below 1 the demand is inelastic.

$$\left| e_p^d \right| = 0.5$$

Advise on the policy: since quantity falls by only half the proportion that price climbs, a price rise removes charcoal far more slowly than it raises the cost of using it. Households cling to it because for many it is the only affordable fuel, with gas and electricity out of reach.

So the honest advice to the Council is that price alone is a weak lever: to clear the smoke it must pair any price rise with cheaper, genuinely available substitutes, or the main result will be poorer families still cooking on charcoal.

The Master Key: $e_p^d = 0.5 < 1$, so charcoal demand is inelastic and a price rise trims its use only modestly.

REAL Question 18

Follow one fashionable phone brand in a Dar showroom: the price edges up from 300,000 to 360,000 shillings, and monthly sales tumble from 200 handsets to 120. Weigh how sharply the buyers walked away.

Calculate the price elasticity of demand for the phone and explain why it differs so sharply from that of a staple food.

One phone brand, Dar es Salaam showroom
Price: 300,000 to 360,000 shillings per handset
Quantity demanded: 200 to 120 handsets per month

Model Answer

The price elasticity of demand for the phone is 2, an elastic value, so its buyers cut back by proportionately more than twice the size of the price rise.

Set the starting point and the changes: start at $P_0 = 300{,}000$ and $Q_0 = 200$, moving to $P_1 = 360{,}000$ and $Q_1 = 120$, so that $\Delta P = 60{,}000$ and $\Delta Q^d = -80$.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$$

$$e_p^d = \frac{-80}{60{,}000} \times \frac{300{,}000}{200}$$

$$e_p^d = \frac{-80}{60{,}000} \times 1{,}500 = -2$$

Report and read the size: the reported magnitude is 2, and since 2 is greater than 1 the demand is elastic. A 20 per cent price rise drove a 40 per cent fall in sales, a reaction twice as large in proportion as its cause.

Why it differs from a staple: a fashion phone is a luxury crowded with rival brands, so buyers can switch, delay or do without at the first price rise. A staple such as the Kariakoo rice has few substitutes and cannot be postponed, so its quantity barely stirs. Plenty of close substitutes make demand elastic; their absence makes it inelastic.

That is why a showroom cannot treat a fashion phone the way a stall treats rice: raise the price and buyers scatter to rival brands in proportionately greater numbers than the price ever moved.

The Master Key: $e_p^d = 2 > 1$, so the phone is elastic; abundant substitutes make its quantity react far more than a staple's would.

HOT Question 19

A confident student announces that a good with an elasticity of minus nought point five reacts more strongly than one at minus two, because nought point five is the larger number. A classmate frowns and reaches for the absolute values.

Assess the claim that a price elasticity of demand of -0.5 represents a stronger response than one of -2.

Model Answer

The claim is wrong, because responsiveness is judged by the magnitude of elasticity and not by its signed value, and the magnitude of -2 is the larger by far.

Where the student goes astray: the student is ranking the signed numbers as if on a plain number line, where -0.5 does indeed sit above -2. But the minus sign is no part of the size; it only records that price and quantity move in opposite directions.

The correct comparison: responsiveness is read from the absolute value, which strips the sign away and leaves only the size. Set side by side, the two magnitudes settle the matter at once.

$$|-2| = 2 > 0.5 = |-0.5|$$

What each number actually means: a magnitude of 2 says quantity changes twice as fast, in proportion, as price, an elastic and lively response. A magnitude of 0.5 says quantity changes only half as fast as price, an inelastic and sluggish one. The good at -2 is plainly the more responsive of the two.

The grain of truth rescued: the student's instinct that the sign matters is not wholly empty, for the sign does carry the direction of the reaction. The error is to let that sign masquerade as size, which is precisely the confusion the absolute-value convention exists to prevent.

So we report elasticity as a positive magnitude for good reason: it forces every comparison onto size, where the real information lives, and stops a stray minus sign from dressing a strong reaction up as a weak one.

The Master Key: responsiveness is measured by magnitude, so $|-2| = 2$ beats $|-0.5| = 0.5$; the student mistook the signed value for the size.

Point versus arc elasticity

The last section taught you to read price elasticity off two points on a demand curve, but it left a crack unmentioned. The point formula rests on the price and quantity you choose as your starting base, so reading the very same pair of points as a price fall and then as a price rise can hand back two different elasticities. This section opens that crack and then seals it. You will see exactly why the starting point changes the answer, meet the arc or mid-point method that leans on the average of the two prices and the average of the two quantities to return a single direction-free figure, watch the two methods worked side by side on one set of numbers, and learn when each is the tool to reach for.

BINDER Question 20

A grocer climbs the price ladder from 100 to 200 shillings and pronounces her good stubborn; her neighbour walks the very same ladder down and calls it flighty. One curve, two verdicts.

Using the two points A and B from the previous section, show that point elasticity gives a different answer for a price rise than for a price fall, and explain why.

Model Answer

Point elasticity leans on the point you start from, so reading the climb from B up to A as a price rise yields one figure while reading the slide from A down to B as a price fall yields quite another, even though it is the very same pair of points on one curve.

The two points: recall A and B from the previous section, with A at the higher price of 200 shillings where only 10 units are bought, and B at the lower price of 100 shillings where 20 units are bought. The point formula takes the price and quantity of wherever you begin as its base.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_0}{Q_0}\right)$$

The price rise, from B to A: start at B, so the base is its own price 100 and quantity 20, and the price climbs to 200 while quantity falls to 10.

$$e_p^d = -\left(\frac{10 - 20}{200 - 100}\right)\left(\frac{100}{20}\right)$$
$$e_p^d = -(-0.1)(5) = 0.5$$

The price fall, from A to B: now start at A, so the base becomes its price 200 and quantity 10, and the price slides down to 100 while quantity recovers to 20.

$$e_p^d = -\left(\frac{20 - 10}{100 - 200}\right)\left(\frac{200}{10}\right)$$
$$e_p^d = -(-0.1)(20) = 2.0$$

Why the two disagree: the change in quantity over the change in price is the same -0.1 whichever way you travel, so it is not the movement that shifts the result. What shifts is the base ratio P_0/Q_0, which is $100/20 = 5$ starting at B but $200/10 = 20$ starting at A, and that fourfold jump in the base drags the elasticity from 0.5 up to 2.0.

So the same two points read as inelastic on the way up and elastic on the way down, which is plainly unsatisfactory for a single stretch of one demand curve.

The Master Key: point elasticity leans on the base you start from, so one pair of points can read as inelastic climbing and elastic falling.

BINDER Question 21

Whether you climb a Mbeya hillside or slither back down it, its slope stays one fixed fact. A fair measure of demand ought to behave the same way, yet the point method flatly refuses.

Explain the arc, or mid-point, method of measuring price elasticity, and show that it returns a single answer for the two points A and B whichever way the price moves.

Model Answer

The arc method cures the direction problem by measuring the change against the average of the two prices and the average of the two quantities, so the base no longer depends on where you begin and one interval yields one elasticity.

The idea: instead of anchoring on either endpoint, the arc method uses the mid-point of the two prices and the mid-point of the two quantities as a shared base. Because both directions share the very same averages, they are bound to return the very same elasticity.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_1 + P_0}{Q_1 + Q_0}\right)$$

Applied to A and B: with A at 200 and 10 and B at 100 and 20, the two prices sum to 300 and the two quantities sum to 30, whichever end you start from.

$$e_p^d = -\left(\frac{20 - 10}{100 - 200}\right)\left(\frac{100 + 200}{20 + 10}\right)$$
$$e_p^d = -(-0.1)\left(\frac{300}{30}\right) = -(-0.1)(10) = 1.0$$

The same answer in reverse: read the interval the other way, from B up to A, and the change in quantity over the change in price is still -0.1, the two prices still sum to 300 and the two quantities still sum to 30, so the arc elasticity is again exactly 1.0.

Where the point method offered 0.5 one way and 2.0 the other, the arc method settles the same stretch at a single, unarguable 1.0, sitting squarely between the two point readings.

The Master Key: the arc method averages the two prices and the two quantities, so the base is shared and one interval returns one elasticity regardless of direction.

BINDER Question 22

The Arusha beef whose elasticity you pinned at 0.6 last section keeps a second answer in reserve: measure the very same price rise by the mid-point method and the coefficient climbs.

Return to the Arusha beef of the previous section, where the price rose from 6,000 to 8,000 shillings and quantity demanded fell from 100,000 to 80,000 kilograms a day. Work out its price elasticity of demand by the point method and by the arc method, and compare the two results.

Beef in Arusha Municipality, the same case as the previous section:

Price: 6,000 shillings per kilogram, rising to 8,000.

Quantity demanded: 100,000 kilograms a day, falling to 80,000.

Model Answer

Both methods report inelastic demand, but the point method returns 0.6 **and the arc method** 0.78**, the gap arising only because the point method rests on the single opening base while the arc method rests on the average of the two ends.**

The point method: take the opening price of 6,000 and quantity of 100,000 as the base, exactly as you did last section, with the price rising by 2,000 and quantity falling by 20,000.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_0}{Q_0}\right)$$

$$e_p^d = -\left(\frac{80{,}000 - 100{,}000}{8{,}000 - 6{,}000}\right)\left(\frac{6{,}000}{100{,}000}\right)$$

$$e_p^d = -(-10)(0.06) = 0.6$$

The arc method: keep the same change but swap the single base for the averaged one, adding the two prices and adding the two quantities.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_1 + P_0}{Q_1 + Q_0}\right)$$

$$e_p^d = -\left(\frac{80{,}000 - 100{,}000}{8{,}000 - 6{,}000}\right)\left(\frac{8{,}000 + 6{,}000}{80{,}000 + 100{,}000}\right)$$

$$e_p^d = -(-10)\left(\frac{14{,}000}{180{,}000}\right) = 10 \times \frac{14{,}000}{180{,}000}$$

The averaged ratio $\frac{14{,}000}{180{,}000}$ works out close to 0.0778, so the arc elasticity is

$$e_p^d = 10 \times 0.0778 = 0.78$$

Reading the comparison: both numbers sit below 1, so both call the beef a near-necessity whose buyers trim their purchases only mildly. The point figure of 0.6 is the very one you found last section; it differs from the arc result because the point method divides the lower opening price 6,000 by the full opening quantity 100,000, while the arc method uses the averaged price 7,000 over the averaged quantity 90,000. The averaged base is the larger ratio, so it lifts the reading from 0.6 to 0.78.

For a jump this large the arc figure of 0.78 is the fairer single summary, because it does not privilege the starting end over the finishing one.

The Master Key: on one set of figures the point method read 0.6 and the arc method 0.78, both inelastic, parting only because one uses the opening base and the other the average.

BINDER Question 23

One instrument touches the demand curve at a single spot, like a thermometer to the skin; the other stretches a tape between two spots. Choose wrongly and the answer quietly bends.

Distinguish point elasticity from arc elasticity, and state when each should be used.

Model Answer

Point elasticity measures responsiveness at a single point on the demand curve, while arc elasticity measures it across an interval between two points, and the size of the price change decides which one is honest.

Point elasticity: reads the curve at one location, using that location's own price and quantity as the base. It is exact for a very small, almost pinpoint change, but for a large jump it depends on which end you chose, so it can disagree with itself.

Arc elasticity: reads the curve across the stretch between two points, using the average of their prices and the average of their quantities as the base. It gives up the pinpoint precision of a single spot in return for one figure that does not care about direction.

When to use point: reach for the point method when the price change is tiny, or when you are handed a demand equation and asked for the elasticity at one stated price, where a single base is exactly what you want.

When to use arc: reach for the arc method when the price change is large and you have two separate observations, and you want one dependable figure that reads the same whether the price rose or fell.

The two are not rivals so much as tools for different jobs: the point method for a spot, the arc method for a span.

The Master Key: point elasticity is for a small change at one spot, arc elasticity for a large change across a span where a single direction-free figure is wanted.

BINDER Question 24

The mid-point formula carries two small one-halves that quietly vanish before the final answer, and most students copy the tidy result without once asking where the halves went.

Show how the arc formula is built from percentage changes measured against average bases, and explain why the two one-halves cancel.

Model Answer

The arc formula is simply the ordinary elasticity ratio with each percentage change measured against the average of the two values, and because a one-half sits in the base of both the top and the bottom, the two cancel and vanish.

Percentages against the average: the arc method forms the percentage change in quantity by dividing the change by the average quantity, and the percentage change in price by dividing the change by the average price. Each average carries a factor of one half.

$$\%\Delta Q^{d} = \frac{Q_1 - Q_0}{\frac{1}{2}(Q_1 + Q_0)} \times 100$$

$$\%\Delta P = \frac{P_1 - P_0}{\frac{1}{2}(P_1 + P_0)} \times 100$$

Forming the ratio: elasticity divides the first percentage by the second. The two factors of 100 cancel at once, top against bottom, and bringing the change in quantity over the change in price to the front leaves the two average bases stacked as a ratio, each still wearing its one half.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{\frac{1}{2}(P_1 + P_0)}{\frac{1}{2}(Q_1 + Q_0)}\right)$$

The halves cancel: a one half in the numerator over a one half in the denominator is just one, so both disappear, leaving the sum of the prices over the sum of the quantities.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_1 + P_0}{Q_1 + Q_0}\right)$$

This is why the printed arc formula shows plain sums rather than averages: the halving is real but self-cancelling, and the mid-point idea survives inside the sums.

The Master Key: the arc formula is percentage changes taken against the averages, and the one half in each average base cancels to leave the sums of prices and quantities.

REAL Question 25

Read the week's figures from a busy Mwanza airtime kiosk: when a data bundle climbed from 4,000 to 6,000 shillings, the bundles sold each day slid from 100 down to 60.

Measure the price elasticity of demand for the data bundle by the arc method, and interpret the result.

A rival network's data bundle at a Mwanza kiosk, week on week:

Price per bundle: 4,000 shillings, rising to 6,000 shillings.

Bundles sold per day: 100, falling to 60.

Model Answer

The arc method gives a price elasticity of 1.25**, so the bundle is elastic and its buyers cut back more than in proportion when the price climbs, slipping across to rival networks.**

Choosing the method: the price jump from 4,000 to 6,000 is large and there are two clear observations, so the arc method is the honest tool, sparing us the direction problem that dogs the point formula.

$$e_p^d = -\left(\frac{\Delta Q^d}{\Delta P}\right)\left(\frac{P_1 + P_0}{Q_1 + Q_0}\right)$$

$$e_p^d = -\left(\frac{60 - 100}{6{,}000 - 4{,}000}\right)\left(\frac{6{,}000 + 4{,}000}{60 + 100}\right)$$

$$e_p^d = -\left(\frac{-40}{2{,}000}\right)\left(\frac{10{,}000}{160}\right)$$

$$e_p^d = -(-0.02)(62.5) = 1.25$$

Reading 1.25: the figure tops 1, so demand is elastic: a given proportionate rise in price brings a larger proportionate fall in quantity. The kiosk sheds custom faster than the higher price makes up for.

Why so responsive: a data bundle has many close substitutes, since a buyer can switch to a rival network in minutes and lose nothing. Plentiful substitutes are the classic mark of elastic demand.

So a network that raises its bundle price alone should expect daily sales to fall away more than in proportion, exactly as the 1.25 warns.

The Master Key: with a large price jump and two firm observations the arc method fits, and its 1.25 marks the bundle as elastic, its buyers quick to defect to rival networks.

REAL Question 26

Read one line from a trade circular: a 50 per cent rise in a popular bottled-water brand's price met an 80 per cent fall in the quantity bought. Only percentages are given, no shilling prices.

Compute the price elasticity of demand from the two percentages alone, and say what it tells you.

From a trade circular on a popular bottled-water brand:

Price: a rise of 50 per cent.

Quantity demanded: a fall of 80 per cent.

Model Answer

When both percentage changes are already in hand, elasticity is nothing more than their ratio, and here 80 over 50 gives 1.6**, an elastic demand.**

No base to choose: the whole quarrel between point and arc is about which base turns raw prices and quantities into percentages. Once the percentages are handed to you ready-made, that quarrel is over, because the bases have already been used up in forming them.

$$e_p^d = \frac{\%\Delta Q^d}{\%\Delta P}$$

The computation: the price rose by 50 per cent and quantity fell by 80 per cent, opposite signs as the law of demand promises, so the ratio comes out negative and we report its size.

$$e_p^d = \frac{-80}{50} = -1.6$$
$$e_p^d = |-1.6| = 1.6$$

Reading 1.6: the value exceeds 1, so demand is elastic: in proportion, quantity moved more than half as much again as price. Buyers of this brand evidently have ready alternatives on the shelf and switch to a rival label the moment it grows dear.

Given the two percentages, then, neither the point nor the arc formula is needed at all; the single ratio settles the matter, and settles it as elastic.

The Master Key: handed the two percentage changes, elasticity is just their ratio, here 1.6 and elastic, with no base left to argue about.

HOT Question 27

A teacher calls the mid-point method the more correct of the two; a sharp student insists it is only the more consistent. They cannot both mean the same thing by the word correct.

To what extent is the arc, or mid-point, method more correct than the point method, rather than merely more consistent? Weigh the claim.

Model Answer

The arc method is more consistent than the point method but not more correct in any deep sense, because its real virtue is that it reads the same in both directions, not that it captures a truer elasticity.

The case for more correct: the point method embarrasses itself by handing back two answers for one stretch, 0.5 climbing and 2.0 falling, while the arc method returns a single 1.0. A measure that will not contradict itself looks, at first glance, like the more correct one.

Why consistency is the real gain: what the arc method actually secures is symmetry: by averaging the two bases it guarantees the same answer whichever way the price moves. That is consistency, or direction-independence, and it is a genuine merit, but it is not the same thing as truth.

Why it is not more correct: elasticity truly varies along a demand curve, differing at every single point. Over an interval there is no one true value for the arc method to hit; it reports an average across the stretch. The point method, by contrast, is exact at the very point it is taken, so for a genuine single point it is the more correct of the two.

The balanced verdict: call the arc method more consistent and, for a large discrete change, more useful and fairer, but do not call it more correct. It is a well-chosen convention, not a truer law, and its average is no more the real elasticity than either endpoint reading was.

The teacher and the student are each half right: the mid-point method wins on consistency and fairness over an interval, and loses any claim to a deeper correctness the moment you recall that elasticity changes from point to point.

The Master Key: the mid-point method is more consistent and often more useful, but not more correct: it averages an interval where no single true value exists, while the point method stays exact at its own point.

The five degrees of price elasticity of demand

A single number can point anywhere along a line that runs from zero to infinity, and where it lands gives price elasticity of demand five distinct characters. This section takes each of the five degrees in turn, fixes its coefficient, draws its curve, and hands you a real good that behaves that way. You will see why a lone farmer faces a flat line while a life-saving drug faces an upright one, what a one per cent move in price does to quantity under each degree, and how to name a degree from the shape on the page. One warning is threaded through: the tidy straight line often used for unit elasticity is a convenience, and the honest unit-elastic curve is a rectangular hyperbola that keeps total outlay the same at every point.

BINDER Question 28

At the Kilombero market gate a hundred farmers heap up maize that looks identical sack for sack. Ask a shilling more than the rest, and every buyer simply turns to the next heap.

Interpret and draw perfectly elastic demand, stating its coefficient and a real example.

Model Answer

Perfectly elastic demand carries the coefficient $e_p^d = \infty$ and is drawn as a horizontal line, because buyers will take any quantity at the ruling price but none whatever at a price even a shade higher.

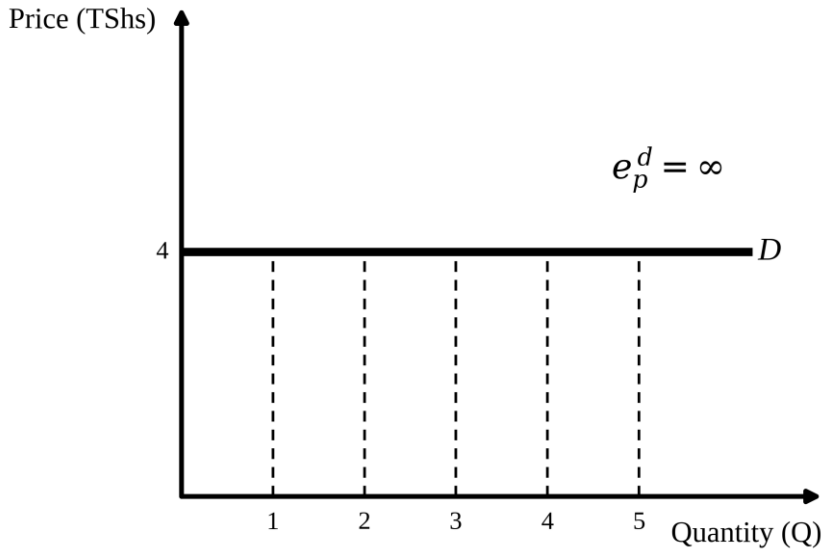


Figure 4.2: *Perfectly elastic demand curve*

The shape and what it says: the demand curve lies flat, parallel to the quantity axis, at one single price. Along that line the price never changes as quantity rises or falls, so the market will absorb an unlimited amount at the going figure and nothing at all above it.

Why the coefficient is infinite: elasticity divides the proportionate change in quantity by the proportionate change in price. Along the flat curve price does not change at all as quantity varies, so the denominator shrinks to zero and the ratio grows without bound, which we record as a coefficient of infinity.

$$e_p^d = \infty$$

A real good that fits: the single small farmer taking his maize to a crowded market is the classic case. He is one seller among hundreds offering an identical grain, so he must accept the price the market has set; charge more and buyers desert him at once, while at the ruling price he can sell his entire load.

No ordinary good is quite this responsive, but the small price taker in a large competitive market comes so close that the horizontal line is the honest picture of the demand he faces.

The Master Key: perfectly elastic demand, $e_p^d = \infty$, is a horizontal line at the ruling price, the demand faced by a lone price taker such as one maize farmer in a crowded market.

BINDER Question 29

A diabetic in Dodoma measures the same dose each morning whether the pharmacy has raised its price or dropped it. The body keeps its own count, and the purse is not consulted.

Interpret and draw perfectly inelastic demand, stating its coefficient and a real example.

Model Answer

Perfectly inelastic demand carries the coefficient $e_p^d = 0$ and is drawn as a vertical line, because the quantity bought stays fixed no matter how far the price is pushed up or down.

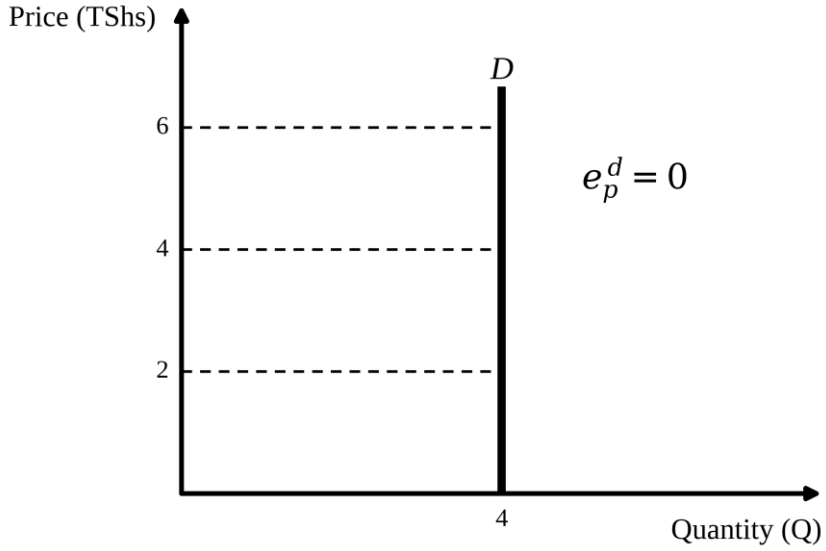


Figure 4.3: *Perfectly inelastic demand curve*

The shape and what it says: the demand curve stands upright, parallel to the price axis, above one single quantity. Whatever the price does, the same amount is taken, so the line neither leans nor bends.

Why the coefficient is zero: the proportionate change in quantity is nil for any change in price at all, and a numerator of zero divided by any denominator leaves zero.

$$e_p^d = \frac{0}{\%\Delta P} = 0$$

A real good that fits: a life-saving medicine is the surest example. A diabetic needs a fixed daily dose of insulin and will find the same amount whether its price rises or falls, since the body sets the quantity and the purse has no vote. Common salt behaves almost the same way, wanted in a small fixed amount that price hardly touches.

Demand this rigid is rare and never quite absolute over every price, but for essentials with no substitute the vertical line is the fair approximation.

The Master Key: perfectly inelastic demand, $e_p^d = 0$, is a vertical line at a fixed quantity, the demand for an essential with no substitute such as insulin or salt.

BINDER Question 30

A soda seller halves her price and watches the crates leave twice as fast, yet at closing time the cash box holds exactly what it held yesterday.

Interpret and draw unitary elastic demand, stating its coefficient and explaining the shape of its curve.

Model Answer

Unitary elastic demand carries the coefficient $e_p^d = 1$ and is drawn as a rectangular hyperbola, because quantity changes in exactly the same proportion as price and so total outlay stays constant at every point on the curve.

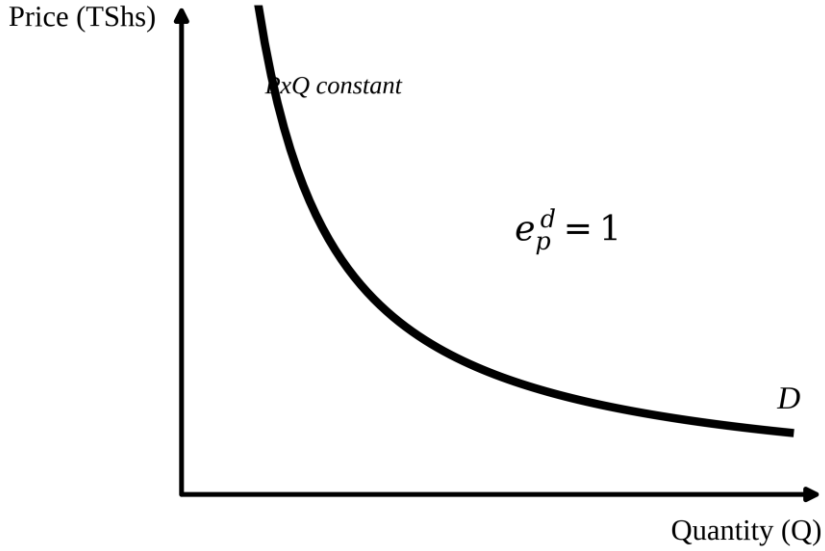


Figure 4.4: *Unitary elastic demand curve (a rectangular hyperbola on which total outlay is constant)*

What the coefficient of one means: the proportionate rise in quantity matches the proportionate fall in price, size for size, so the ratio of the two is exactly one. A one per cent cut in price calls forth a one per cent rise in quantity, and the two movements cancel.

The constant total outlay: because they cancel, the money spent by buyers and taken by sellers does not move. Sell at 300 for a quantity of 100 and total outlay is 30,000; drop the price to 150 and quantity climbs to 200, and outlay is 30,000 still.

$$P \times Q = 30{,}000$$

Price (TZS)	Quantity	Total outlay (TZS)
300	100	30,000
200	150	30,000
150	200	30,000
100	300	30,000

Why the true curve must bow: the genuine unit-elastic curve is a rectangular hyperbola, a line that bends toward the origin and never meets either axis. A straight demand line cannot hold the coefficient at one all along its length; it reaches exactly one only at its midpoint, so the tidy straight sketch often used for unit elasticity is a simplification, not the real thing.

Read the rectangular hyperbola as the picture of steady spending: every fall in price is met by a rise in quantity so exactly proportioned that the trader's takings never stir.

The Master Key: unitary elastic demand, $e_p^d = 1$, is a rectangular hyperbola on which total outlay is constant, because quantity always moves in the same proportion as price.

BINDER Question 31

A phone brand in Morogoro shaves a fifth off its price and the stall cannot restock fast enough, while three rival brands one counter away suddenly look dull.

Interpret and draw relatively elastic demand, stating its coefficient and working it from a real example.

Model Answer

Relatively elastic demand carries a coefficient greater than one, $e_p^d > 1$, and is drawn as a gently sloping, relatively flat curve, because quantity responds by a larger proportion than the price change that provokes it.

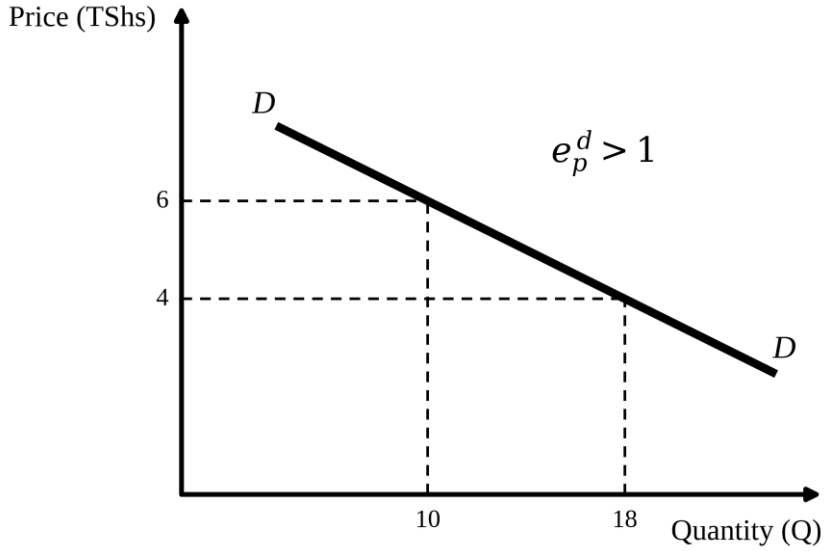


Figure 4.5: *Relatively elastic demand curve*

The shape and what it says: the curve lies flat rather than steep, so a small slide in price sweeps quantity a long way along the horizontal. A modest price cut wins a generous rise in sales, and a modest rise loses them just as fast.

Working the coefficient: take a fashionable phone brand in Morogoro whose price is cut from 400,000 to 320,000 and whose weekly sales climb from 20 to 30 units.

$$\%\Delta Q^d = \frac{30 - 20}{20} \times 100 = 50\%$$

$$\%\Delta P = \frac{320{,}000 - 400{,}000}{400{,}000} \times 100 = -20\%$$

$$e_p^d = \left| \frac{50\%}{-20\%} \right| = 2.5$$

Reading the number: a coefficient of 2.5 says quantity moves two and a half times as hard as price in proportionate terms, which is the reason for the flat curve. Such responsiveness belongs to luxuries with many close substitutes, where a dearer brand is quickly abandoned for a rival on the next counter.

The flatter the line, the more freely buyers switch, and a coefficient above one is the sign that they can and will.

The Master Key: relatively elastic demand, $e_p^d > 1$, is a flat curve on which quantity outruns price, typical of a luxury with many substitutes such as a branded phone.

BINDER Question 32

EWURA lifts the pump price again and the boda riders grumble at every station, yet by dusk they have bought very nearly the same litres as the week before.

Interpret and draw inelastic demand, stating its coefficient and working it from a real example.

Model Answer

Inelastic demand carries a coefficient below one, $e_p^d < 1$, and is drawn as a steep curve, because quantity responds by a smaller proportion than the price change that provokes it.

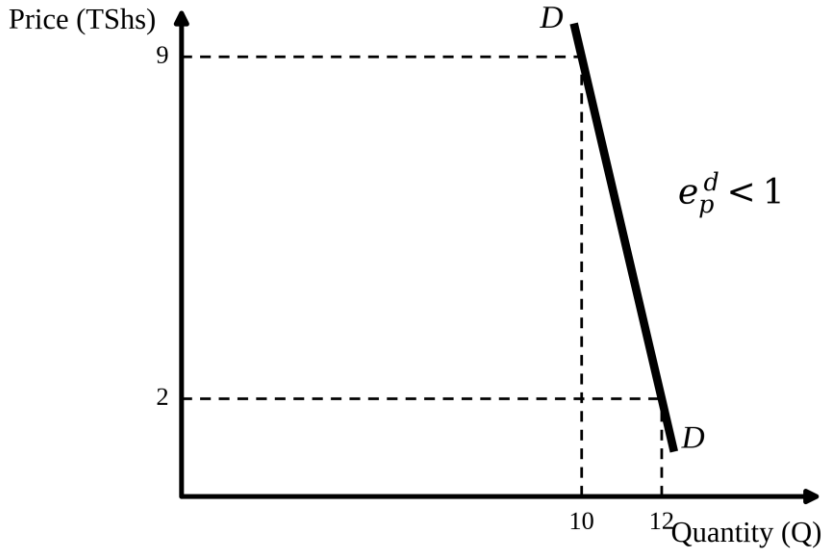


Figure 4.6: *Inelastic demand curve*

The shape and what it says: the curve stands steep, so even a sharp move in price shifts quantity only a little along the horizontal. Buyers grumble at a higher price yet go on buying almost as much as before.

Working the coefficient: suppose EWURA lifts the pump price of petrol from 3,000 to 3,300 a litre, and the quantity a station sells falls only from 100 to 95.

$$\%\Delta Q^d = \frac{95 - 100}{100} \times 100 = -5\%$$

$$\%\Delta P = \frac{3{,}300 - 3{,}000}{3{,}000} \times 100 = 10\%$$

$$e_p^d = \left|\frac{-5\%}{10\%}\right| = 0.5$$

Reading the number: a coefficient of 0.5 says quantity moves only half as hard as price, which is the reason for the steep curve. Such stubbornness belongs to necessities with few substitutes, like fuel, which a rider needs for the day's work and cannot easily replace or postpone.

The steeper the line, the more captive the buyer, and a coefficient below one is the sign that price can rise without emptying the pump.

The Master Key: inelastic demand, $e_p^d < 1$, is a steep curve on which quantity lags price, typical of a necessity with few substitutes such as fuel.

BINDER Question 33

Five demand curves, five different fates for the same tap on the price. One good shrugs, one collapses, and three land somewhere in between.

Explain what one per cent change in price leads to X per cent change in quantity means for each of the five degrees.

Model Answer

The coefficient of price elasticity is itself the answer to the one per cent question, since it states directly how many per cent quantity moves for each one per cent that price moves.

Reading the coefficient as a rate: elasticity is the proportionate change in quantity over the proportionate change in price, so a coefficient of 0.5 means a one per cent price change brings a half per cent quantity change, while a coefficient of 3 means a three per cent one. The number is the exchange rate between the two movements.

Degree	e_p^d	Effect of a one per cent rise in price
Perfectly elastic	∞	quantity falls without limit
Relatively elastic	> 1	quantity falls by more than one per cent
Unit elastic	1	quantity falls by exactly one per cent
Inelastic	< 1	quantity falls by less than one per cent
Perfectly inelastic	0	quantity does not change at all

The two extremes explained: at the top of the scale a one per cent rise drives quantity away entirely, so the response is boundless and the coefficient infinite. At the foot of the scale the same rise moves quantity not at all, so the response is nil and the coefficient zero. Every real good lies somewhere between these poles.

So to know a good's degree is simply to know how hard its quantity answers a one per cent nudge in price, from no answer at all to an unlimited one.

The Master Key: the coefficient is the quantity response to a one per cent price change, running from zero for the perfectly inelastic to infinity for the perfectly elastic.

BINDER Question 34

Two students glance at the same sketch and call it two different degrees. The lines on the board tell the truth, but only to an eye that knows exactly what to look for.

Explain how to read the degree of price elasticity of demand off a diagram.

Model Answer

You can name a degree from its diagram by reading the tilt and the bend of the curve, provided you remember that the eye gives a first impression while the coefficient gives the proof.

The upright and the flat extremes: a curve lying flat and horizontal, parallel to the quantity axis, is perfectly elastic with a coefficient of infinity. A curve standing vertical, parallel to the price axis, is perfectly inelastic with a coefficient of zero. These two are unmistakable at a glance.

The flat and the steep between them: between the extremes, the flatter the curve the more elastic the good, with a coefficient above one, and the steeper the curve the more inelastic, with a coefficient below one. A curve drawn as a rectangular hyperbola, bending evenly toward the origin, is the unit elastic case with a coefficient of one and constant total outlay.

Why the eye needs checking: steepness alone can deceive, because it depends on the scale of the axes and because a single straight demand line runs through many different elasticities from top to bottom. A picture suggests the degree; only the proportionate calculation confirms it.

Read the shape first for its hint, horizontal, vertical, flat, steep or evenly bowed, then trust the coefficient for the verdict.

The Master Key: horizontal means infinite, vertical means zero, flat means elastic, steep means inelastic and an even hyperbola means unit elastic, but the coefficient is the final word.

REAL Question 35

Read this account of one week in Dar: EWURA lifts the pump price, a hospital re-prices its insulin, and a boutique lifts the tag on a fashion sneaker, each rise the same tenth.

Identify the degree of price elasticity of demand for each of the three goods, and justify your classification.

Model Answer

The three goods sit at three different points on the scale: fuel is inelastic, insulin is perfectly inelastic, and the fashion sneaker is relatively elastic.

EWURA fuel, inelastic: petrol is a necessity with few substitutes and a small share of most budgets, and the journey to work cannot simply be postponed. A tenth on the price therefore trims quantity only slightly, giving a coefficient below one, $e_p^d < 1$, and a steep demand curve.

Hospital insulin, perfectly inelastic: a diabetic must take a fixed dose to stay alive and has no substitute to turn to, so the quantity bought holds firm however the price moves. Demand is as near to perfectly inelastic as a real good comes, with a coefficient of about zero, $e_p^d = 0$, and a vertical demand curve.

The fashion sneaker, relatively elastic: a branded sneaker is a luxury with many rival brands a shelf away, and the purchase can always wait. The same tenth on the price sends buyers to a substitute or to patience, so quantity falls by a larger proportion, giving a coefficient above one, $e_p^d > 1$, and a flat demand curve.

One price rise of the same size, three very different reactions, because the goods differ in how far buyers can do without them or replace them.

The Master Key: fuel is inelastic, insulin is perfectly inelastic and the fashion sneaker is elastic, and the dividing line is always how many substitutes the buyer has and how easily the good can be deferred.

REAL Question 36

Follow three sellers in one market: a lone maize farmer at the gate, a salt vendor by the door, and a soda stall whose takings never move however its price is set.

Identify the degree of price elasticity of demand facing each seller, and justify each answer.

Model Answer

The three sellers face the three special degrees: the lone maize farmer meets perfectly elastic demand, the salt vendor meets perfectly inelastic demand, and the soda stall meets unitary elastic demand.

The lone maize farmer, perfectly elastic: he is one of hundreds selling identical grain at the going market price, so he is a pure price taker. Ask a shilling more and every buyer moves to the next heap; at the ruling price he can sell his whole load. The demand he personally faces is horizontal, with a coefficient of infinity, $e_p^d = \infty$.

The salt vendor, perfectly inelastic: a household wants only a small fixed amount of salt, has no real substitute for it, and spends so little on it that price hardly matters. Quantity bought stays put whether the price rises or falls, so the demand curve is vertical, with a coefficient of zero, $e_p^d = 0$.

The soda stall, unitary elastic: when the stall drops its price the extra crates sold rise in just the proportion the price fell, so the takings hold steady. Selling 40 bottles at 1,000 or 50 bottles at 800 leaves total outlay at 40,000 either way, the signature of a coefficient of one, $e_p^d = 1$.

Three sellers, three textbook degrees, each revealed not by the good alone but by how its quantity answers a change in price.

The Master Key: the price-taking farmer faces perfectly elastic demand ($e_p^d = \infty$), the salt vendor perfectly inelastic demand ($e_p^d = 0$), and the constant-takings soda stall unitary elastic demand ($e_p^d = 1$).

HOT Question 37

A textbook draws one demand curve perfectly flat and another bolt upright; a trader who has sold both kinds of good for thirty years swears he has never once met either in the flesh.

To what extent are perfectly elastic and perfectly inelastic demand ever exactly seen in reality, rather than merely approached? Judge the claim.

Model Answer

Both extremes are limiting cases that real goods draw close to but essentially never reach exactly, so the trader is right in substance while the textbook is right in purpose.

How the extremes are approached: the lone maize farmer in a crowded market comes very near to perfectly elastic demand, since a shilling above the going price loses him every buyer. A life-saving drug or common salt comes very near to perfectly inelastic demand, since the quantity scarcely stirs when the price moves. In daily trade these are the closest living examples.

Why they are never exactly reached: even the small farmer could depress the price a little if he flooded the market, and a few loyal or hurried buyers might still pay a shade more, so his demand is not truly horizontal. Even the diabetic will, at a high enough price, be forced to ration or be priced out altogether, so no demand stays perfectly vertical across every price. Pushed far enough, every real curve bends.

Why the extremes still earn their place: the two poles are the fixed ends of the scale that runs from zero to infinity, and every ordinary good is located by how near it sits to one end or the other. They are also fair working approximations: horizontal for the price taker, vertical for the essential over its normal price range.

So reality lives strictly between the extremes, yet the extremes are indispensable, the honest ends of the ruler against which every real elasticity is measured.

The Master Key: perfectly elastic and perfectly inelastic demand are limiting cases, approached by price takers and by essentials but never exactly attained, and valuable precisely as the fixed ends of the scale.

HOT Question 38

A student rules a neat straight line and calls it unit elastic from top to bottom; the teacher touches only its midpoint and asks what total outlay is doing everywhere else.

Judge the claim that a demand curve which is unit elastic throughout must be a rectangular hyperbola rather than a straight line.

Model Answer

The claim is correct, because unit elasticity everywhere means constant total outlay everywhere, and only a rectangular hyperbola holds outlay constant at every point, whereas a straight line manages it at just one.

What unit elasticity requires: a coefficient of one means quantity always changes in the same proportion as price, so their product, total outlay, never changes. To be unit elastic at every point, then, a curve must keep the product of price and quantity equal to the same figure all along its length.

$$P \times Q = k$$

Why that shape is a hyperbola: the set of all price and quantity pairs whose product is a constant is exactly the rectangular hyperbola, the curve given by quantity equal to that constant divided by price. It bows toward the origin and approaches each axis without ever touching it.

$$Q = \frac{k}{P}$$

Why a straight line cannot do it: a downward-sloping straight line has one constant slope but a changing elasticity, infinite where it meets the price axis, exactly one only at its midpoint, and zero where it meets the quantity axis. It is therefore unit elastic at a single point and nowhere else, so its outlay rises and falls as you move along it instead of holding still.

The verdict: constant unit elasticity and constant outlay are the same requirement stated two ways, and the rectangular hyperbola is the one curve that satisfies it everywhere. The straight-line sketch is a convenience that tells the truth only at its middle, which is why the careful picture of unit elasticity always bends.

The student drew the easy line; the teacher's finger on the midpoint is the whole lesson, that only the bowed curve keeps takings the same from end to end.

The Master Key: a curve unit elastic throughout must keep total outlay constant, and only the rectangular hyperbola $P \times Q = k$ does so, while a straight line is unit elastic at its midpoint alone.

Elasticity along a straight-line demand curve

A straight-line demand curve looks like the simplest object in economics, one lean and no bends, and yet it hides a surprise: its price elasticity is different at every single point. This section unpicks that surprise. You will first see the pattern - perfectly elastic at the top, unit elastic at the midpoint, perfectly inelastic at the foot - then learn why the unchanging slope cannot be the cause and the moving ratio of price to quantity must be. A worked line and a ruler-and-segment shortcut turn the idea into arithmetic you can trust, and two Tanzanian traders show why knowing your place on the line decides whether a price cut is a blessing or a blunder.

BINDER Question 39

Draw one demand line with a single ruler and its lean never changes from top to foot. Yet slide a price down it and buyers first stampede, then stroll, then scarcely stir.

Describe how price elasticity of demand changes along a straight-line demand curve, even though the slope stays constant.

Model Answer

Along a straight-line demand curve the price elasticity of demand is not one fixed value but a whole range, running from infinite at the top where the line meets the price axis, down to exactly one at the midpoint, and on toward zero at the foot where the line meets the quantity axis.

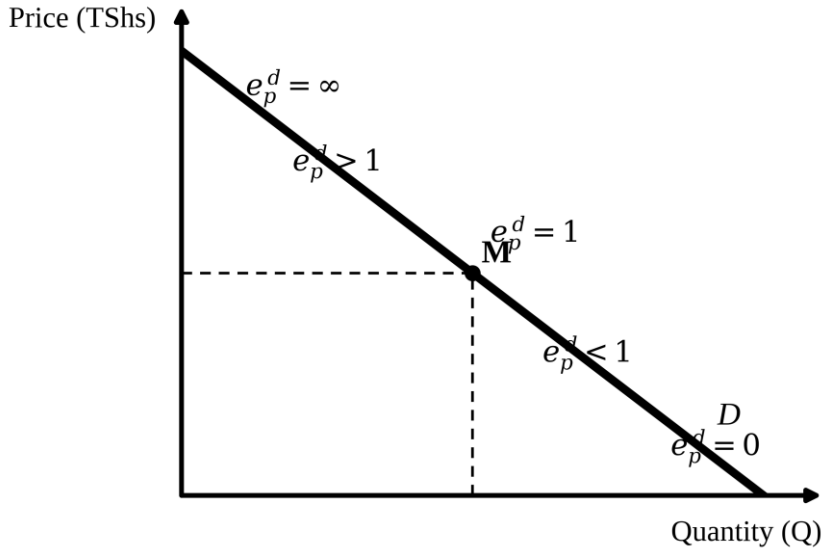


Figure 4.7: *How price elasticity of demand changes along a straight-line demand curve*

The upper half is elastic: above the midpoint the elasticity is greater than one, so quantity responds more than proportionately to a change in price. Here $e_p^d > 1$, and as you climb toward the very top it rises without limit toward $e_p^d = \infty$.

The midpoint is the turning point: exactly halfway down the line the elasticity equals one, so $e_p^d = 1$. This single point of unit elasticity divides the responsive stretch above from the sluggish stretch below.

The lower half is inelastic: below the midpoint the elasticity is less than one, so quantity responds less than proportionately. Here $e_p^d < 1$, and as you near the foot it dwindles toward $e_p^d = 0$.

The slope holds still throughout: the line's steepness is identical at every one of these points, because a straight line has one slope from end to end. The thing that changes is the elasticity, not the lean, which is the whole surprise of the curve.

So a single ruler-straight demand curve carries every degree of elasticity along its length, from perfectly elastic at the summit through unit elastic at the middle to perfectly inelastic at the base.

The Master Key: a straight-line demand curve runs from $e_p^d = \infty$ at the top through $e_p^d = 1$ at the midpoint to $e_p^d = 0$ at the foot, elastic above the middle and inelastic below it.

BINDER Question 40

The slope of a straight demand line is frozen the instant you draw it, the same at the summit as at the foot. Something else must be moving to make responsiveness melt away as you descend.

Explain why elasticity varies from point to point along a straight-line demand curve while its slope does not.

Model Answer

Elasticity varies because it depends on the ratio of price to quantity, and as you move down a straight-line demand curve that ratio falls steadily even though the slope never changes.

The formula splits elasticity into two parts: point elasticity is the slope term multiplied by the ratio of price to quantity. Writing the slope magnitude as b, the elasticity is one over b times P over Q.

$$e_p^d = \left|\frac{\Delta Q^d}{\Delta P}\right| \times \frac{P}{Q} = \frac{1}{b} \times \frac{P}{Q}$$

The slope term is frozen: along a straight line the ratio of a change in quantity to a change in price is constant, so $\frac{1}{b}$ takes the same value at every point. This part cannot be the source of the variation.

The price-to-quantity ratio does the work: as you slide down the line price P falls while quantity Q rises, so the ratio $\frac{P}{Q}$ shrinks steadily. Multiplying the frozen slope term by an ever-smaller ratio yields an ever-smaller elasticity.

The two ends explain themselves: near the top Q is almost nothing, so $\frac{P}{Q}$ is enormous and elasticity is near infinite; near the foot P is almost nothing, so $\frac{P}{Q}$ is tiny and elasticity is near zero.

The lesson is that slope and elasticity are different animals: the slope fixes only the first factor, while the moving ratio of price to quantity is what drives responsiveness high at the top and low at the foot.

The Master Key: elasticity varies because $e_p^d = \frac{1}{b} \times \frac{P}{Q}$, and while $\frac{1}{b}$ stays constant the ratio $\frac{P}{Q}$ falls as you move down the line.

BINDER Question 41

Take the tidy line where price is one hundred minus quantity and stop at three places on the way down. The very same rule spits out three strikingly different numbers.

Using the demand curve $P = 100 - Q$**, compute the price elasticity of demand at** $Q = 25$**,** $Q = 50$ **and** $Q = 75$**, and interpret each result.**

Model Answer

On the demand curve $P = 100 - Q$ **the elasticity is three at** $Q = 25$**, exactly one at** $Q = 50$ **and one third at** $Q = 75$**, so the same line is elastic high up, unit elastic in the middle and inelastic low down.**

Set up the rule: the line $P = 100 - Q$ has a slope magnitude of $b = 1$, so the point-elasticity formula $e_p^d = \frac{1}{b} \times \frac{P}{Q}$ collapses to simply $\frac{P}{Q}$.

$$e_p^d = \frac{1}{1} \times \frac{P}{Q} = \frac{P}{Q}$$

At $Q = 25$, high on the line: price is $P = 100 - 25 = 75$, so the elasticity is seventy-five divided by twenty-five, which is three. Because this is above one, demand at this point is elastic.

$$e_p^d = \frac{75}{25} = 3$$

At $Q = 50$, the midpoint: price is $P = 100 - 50 = 50$, so the elasticity is fifty divided by fifty, which is exactly one. This is the single point of unit elasticity, dead centre on the line.

$$e_p^d = \frac{50}{50} = 1$$

At $Q = 75$, low on the line: price is $P = 100 - 75 = 25$, so the elasticity is twenty-five divided by seventy-five, which is one third. Because this is below one, demand at this point is inelastic.

$$e_p^d = \frac{25}{75} = \frac{1}{3}$$

Three points on one straight line return three different elasticities - three, one and a third - confirming that responsiveness falls steadily as price gives way to quantity on the way down the curve.

The Master Key: on $P = 100 - Q$ the elasticity is 3 at $Q = 25$, 1 at $Q = 50$ and $\frac{1}{3}$ at $Q = 75$, elastic then unit then inelastic as you descend.

BINDER Question 42

You need the elasticity at a single point but have mislaid the arithmetic. A ruler alone, laid along the demand line, can hand you the answer as a plain ratio of two lengths.

State and explain the geometric (point) method for reading price elasticity of demand at a point on a straight-line demand curve.

Model Answer

The geometric point method reads elasticity straight off the diagram: at any point on a straight-line demand curve the elasticity equals the length of the lower segment divided by the length of the upper segment.

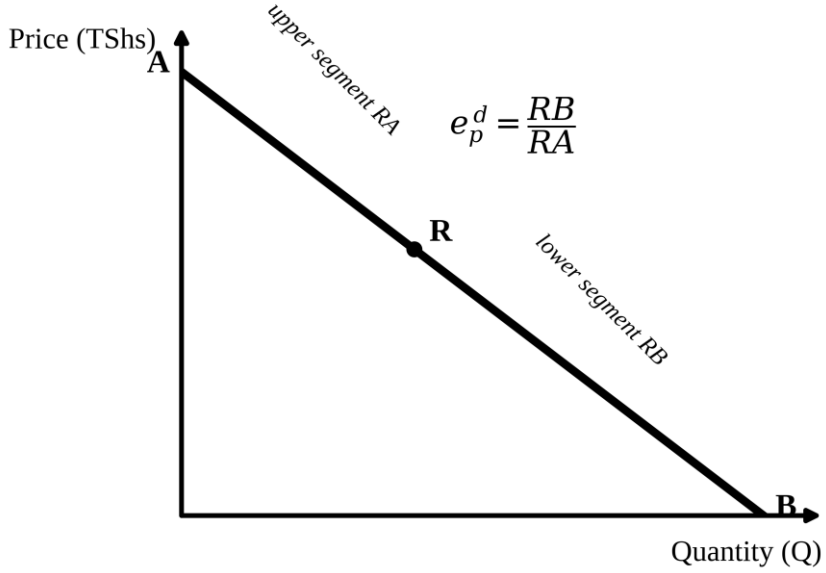


Figure 4.8: *Measuring point elasticity as the lower segment divided by the upper segment*

What the two segments are: take the point in question and split the demand line at it. The lower segment runs from the point down to where the line meets the quantity axis, and the upper segment runs from the point up to where the line meets the price axis.

The rule itself: the elasticity at the point is simply the lower length over the upper length, written with the labelled points as $e_p^d = \frac{RB}{RA}$, where R is the point, A the price-axis end and B the quantity-axis end.

$$e_p^d = \frac{RB}{RA}$$

Why it matches the pattern: at the midpoint the point sits halfway, so the lower and upper segments are equal and their ratio is one, giving $e_p^d = 1$. Above the midpoint the lower segment is the longer of the two, so the ratio is above one and demand is elastic; below the midpoint the lower segment is the shorter, so the ratio is below one and demand is inelastic.

The ruler and the algebra agree because the segment ratio is the ratio of price to quantity in disguise, so measuring two lengths is the same as computing $\frac{P}{Q}$ with the slope already divided out.

The Master Key: the point method gives $e_p^d = \frac{RB}{RA}$, the lower segment over the upper, equal at the midpoint, larger above it and smaller below.

BINDER Question 43

A point sits high on the demand line, cutting it so the stretch below is three times the stretch above. Before any formula is written, the two lengths already whisper the elasticity.

A point on a straight-line demand curve divides it so that the lower segment is three times the upper segment. Find the elasticity there and show that it agrees with the algebra.

Model Answer

Where the lower segment is three times the upper segment the elasticity is three, and this agrees exactly with the algebra, which returns the same three at the matching point on the line.

Read it from the segments: the point method says the elasticity is the lower length over the upper length. If the lower segment is three times the upper, that ratio is three to one, so the elasticity is three.

$$e_p^d = \frac{RB}{RA} = \frac{3}{1} = 3$$

Locate the same point by algebra: a lower segment three times the upper means the point sits one quarter of the way down from the top, since the upper part is one of the four equal shares of the line. On $P = 100 - Q$ that quarter point is $Q = 25$, where $P = 75$.

$$e_p^d = \frac{P}{Q} = \frac{75}{25} = 3$$

The two methods meet: the ruler gave three from two lengths and the formula gave three from price and quantity, because both are measuring the very same thing at the very same point. Demand there is firmly elastic.

This agreement is the reassurance that the geometric shortcut is no trick: it is the point-elasticity formula rewritten as a comparison of two lengths.

The Master Key: a lower segment three times the upper gives $e_p^d = 3$, the identical value the formula returns at $Q = 25$ on $P = 100 - Q$.

REAL Question 44

Follow Furaha, who sells imported speakers in Mwanza at a proud price and shifts only a handful a day. She wonders whether dropping the price would be folly or fortune.

Advise Furaha, using the idea of elasticity along a straight-line demand curve, on whether a price cut will help or hurt her takings.

Model Answer

Furaha should cut her price, because selling at a high price and a low quantity places her high on her demand line where demand is elastic, so a cut will win her more than enough extra buyers to raise her total takings.

Where she stands on the line: a proud price with only a handful of speakers sold puts Furaha near the top of her straight-line demand curve, in the stretch where price is high relative to quantity. That is the elastic region, with $e_p^d > 1$.

What elasticity there means for a cut: because demand is elastic, a fall in price brings a more than proportionate rise in the number of speakers bought. The extra sales outweigh the lower price collected on each unit, so her total takings climb.

How responsiveness changes as she descends: if she keeps cutting she slides down the line toward the midpoint and then the inelastic foot, where buyers respond less and less to each further cut. The first cuts from the top do the most for her, and later ones do progressively less.

The practical rule for her: while she is high on the line a price cut is a friend, because responsiveness is on her side. Once she passes the midpoint into inelastic ground a further cut would shed takings, so that is where she should stop.

Furaha's decision turns on seeing that the same demand line is generous to a price cut at the top and punishing at the foot, so her position on the line, not habit, should set her price.

The Master Key: high on the line demand is elastic, so Furaha's price cut lifts takings; the gain shrinks as she nears the midpoint and reverses once she crosses into the inelastic lower half.

REAL Question 45

Read the week of a Tanga charger seller: she cut her price, then cut it again, and watched her takings climb once and then sink. The demand line she is sliding down explains both turns.

Using the following demand schedule, compute the elasticity at each price and explain why the trader's takings rose and then fell as she kept cutting.

Price per charger (TShs)	Chargers sold per day
15,000	5
10,000	10
5,000	15

Over three trading days a phone-charger seller in Tanga cut her price twice, from 15,000 to 10,000 and then to 5,000 shillings, and noted how many chargers she sold each day.

Model Answer

The trader's takings rose and then fell because her three prices sit at three very different points on one straight-line demand curve: the first cut moved her through the elastic upper half where takings grow, while the second carried her past the midpoint into the inelastic lower half where takings shrink.

Find the demand line and its slope: the two ends of her schedule, five chargers at fifteen thousand and fifteen at five thousand, lie on the line $P = 20000 - 1000Q$, whose slope magnitude is $b = 1000$. Point elasticity is therefore $e_p^d = \frac{1}{1000} \times \frac{P}{Q}$.

At the high price, demand is elastic: at fifteen thousand shillings she sells five chargers, so the elasticity works out well above one.

$$e_p^d = \frac{1}{1000} \times \frac{15000}{5} = 3$$

At the middle price, demand is unit elastic: at ten thousand shillings she sells ten chargers, the midpoint of the line, where the elasticity is exactly one.

$$e_p^d = \frac{1}{1000} \times \frac{10000}{10} = 1$$

At the low price, demand is inelastic: at five thousand shillings she sells fifteen chargers, deep in the lower half, where the elasticity has fallen to one third.

$$e_p^d = \frac{1}{1000} \times \frac{5000}{15} = \frac{1}{3}$$

Why the takings rose then fell: cutting from fifteen to ten thousand crossed elastic ground, so takings rose from seventy-five thousand to one hundred thousand shillings. Cutting again from ten to five thousand crossed inelastic ground, so takings slid back to seventy-five thousand. Her takings peaked at the unit-elastic midpoint.

The schedule is a lesson in position: the same act of cutting the price helped while she was above the midpoint and hurt once she dropped below it, so she should have stopped cutting at ten thousand shillings.

The Master Key: her elasticities of 3, 1 and $\frac{1}{3}$ show takings rising through the elastic half to a peak at the unit-elastic midpoint, then falling through the inelastic half, which is why each cut behaved differently.

HOT Question 46

A student swears that two demand lines drawn with the very same lean must be equally elastic. His deskmate is sure the neat claim is hiding a trap.

Assess the claim that two goods whose demand curves share the same slope must have the same price elasticity of demand.

Model Answer

The claim is false, because two demand curves can share the very same slope and still carry different price elasticities, since elasticity depends on the ratio of price to quantity at the chosen point and not on the slope alone.

Why the claim tempts: slope and elasticity both describe how demand leans, and a flatter line does look more responsive, so it is easy to assume that equal slopes must force equal elasticities. The assumption quietly treats the two as one and the same measure.

The formula that separates them: point elasticity is $e_p^d = \frac{1}{b} \times \frac{P}{Q}$. Two goods with the same slope share the same $\frac{1}{b}$, but if they sit at different combinations of price and quantity their $\frac{P}{Q}$ differ, and so do their elasticities.

A concrete pair: let two goods have parallel demand lines of slope one, so $b = 1$ for both. The first, at $Q = 25$, has price $P = 75$ and elasticity $\frac{75}{25} = 3$; the second, at $Q = 25$ on its lower line, has price $P = 25$ and elasticity $\frac{25}{25} = 1$. Same slope, different elasticity.

The sharpest version of the point: even a single straight line, which has one slope from end to end, carries every elasticity from $e_p^d = \infty$ to $e_p^d = 0$ along its length. If one slope can host all elasticities at once, then equal slopes plainly cannot compel equal elasticities.

Slope is only one of the two ingredients of elasticity; position on the line, through the ratio of price to quantity, is the other, and it is enough to prise the two goods apart.

The Master Key: equal slopes leave $\frac{1}{b}$ equal but say nothing about $\frac{P}{Q}$, so two goods with the same slope can differ in elasticity, and a single line proves it by holding them all.

HOT Question 47

A trader argues that a price cut is a price cut, so it ought to work the same wherever she stands on her demand line. Her bookkeeper, eyeing the takings, disagrees.

Explain why the same proportionate price cut can raise takings at one point on a straight-line demand curve and lower them at another.

Model Answer

The same proportionate price cut raises takings high on the line and lowers them low down, because elasticity is greater than one in the upper half and less than one in the lower half, so the identical cut meets a strong quantity response in one place and a weak one in the other.

Elasticity, not the cut, sets the outcome: a cut of a given percentage does the same thing to price everywhere on the line, so any difference in the result must come from how strongly quantity answers. That strength is exactly the elasticity, and it changes as you move along the line.

High on the line the cut pays: in the elastic upper half a cut brings a more than proportionate rise in quantity. A ten per cent cut where $e_p^d = 3$ lifts quantity by about thirty per cent, and the flood of extra buyers more than makes up for the lower price, so takings rise.

Low on the line the cut costs: in the inelastic lower half a cut brings only a slight rise in quantity. The same ten per cent cut where $e_p^d = \frac{1}{3}$ lifts quantity by only about three per cent, far too few extra buyers to cover the lower price, so takings fall.

The midpoint is the watershed: between the two halves lies the unit-elastic midpoint, where a small cut leaves takings all but unchanged. Cutting above it helps and cutting below it hurts, which is how one and the same action can point in opposite directions.

The cut is identical in every case; what differs is the ground it lands on, so a trader must read her position on the demand line before trusting that a cut is wise.

The Master Key: the same proportionate cut meets elastic demand above the midpoint, where quantity leaps and takings rise, but inelastic demand below it, where quantity barely stirs and takings fall.

The total-outlay (total-revenue) method

The point and arc methods measure elasticity from a pair of prices and quantities, but a trader watching her till has a quicker guide. This section develops the total-outlay method, also called the total-revenue method, which reads elasticity straight from the way a seller's takings move when the price changes. You will learn what total revenue is, the simple rule that links its direction to elasticity, and the reason a price cut fills the till for one good yet empties it for another. A worked schedule then follows total revenue up to its peak and down again, and a paired diagram shows why that peak sits exactly where demand is unit elastic. By the end you will be able to judge elasticity without computing a single coefficient, simply by asking which way the money moved.

BINDER Question 48

At the close of the day a Moshi trader empties her till and counts what the day has left her. That single heap of shillings has a name in economics, and it is built from just two numbers.

Define total revenue, also called total outlay, and show how it is calculated.

Model Answer

Total revenue, or total outlay, is the whole amount a seller takes in from selling a good, found by multiplying the price of the good by the quantity sold.

$$TR = P \times Q$$

What the two names capture: it is one sum seen from two sides. Total revenue is the money the seller receives, while total outlay is the money the buyers spend, and these are the very same shillings counted once at the till and once out of the pockets that filled it.

How it is built: multiply the price of each unit by the number of units sold. A higher price lifts the takings earned on every unit, while a larger quantity spreads the takings over more units, so both the price and the amount bought have a hand in the total.

Why it matters here: because total revenue answers to both price and quantity, it becomes a mirror of elasticity. When the price moves, the quantity demanded answers back, and the direction the takings then travel reveals how strong that answer was.

So total revenue is never a matter of price alone; it is price and quantity working together, which is exactly what allows it to reveal the responsiveness of demand.

The Master Key: total revenue (total outlay) is price times quantity, $TR = P \times Q$, the seller's takings and the buyers' spending seen as one and the same sum.

BINDER Question 49

Two traders each raise a price; by evening one finds her takings swollen and the other finds his shrunk. Without a single sum, the till has already measured how responsive the buyers of each good really are.

State the total-outlay rule for judging the price elasticity of demand from the movement of total revenue.

Model Answer

The total-outlay rule reads elasticity from the direction total revenue takes when price changes: opposite directions mean elastic demand, the same direction means inelastic demand, and no change at all means unit elasticity.

Price and revenue move in opposite directions: demand is elastic, $e_p^d > 1$. A cut in price raises total revenue and a rise in price lowers it, so the takings always travel the opposite way to the price that set them moving.

Price and revenue move in the same direction: demand is inelastic, $e_p^d < 1$. A cut in price lowers total revenue and a rise in price raises it, so the takings travel the same way as the price.

Revenue does not move at all: demand is unit elastic, $e_p^d = 1$. Total revenue holds perfectly steady whether the price rises or falls, so the takings are left indifferent to the change.

The rule works because total revenue is price times quantity: whichever of the two forces wins the tug-of-war between them decides which way the takings move, and that direction alone is enough to name the elasticity.

The Master Key: price and total revenue moving oppositely means elastic, moving together means inelastic, and staying unchanged means unit elastic.

BINDER Question 50

Cut a price and two things happen at once: every unit now earns less, yet more units leave the shelf. The fate of your takings hangs entirely on which of these two pulls the harder.

Explain why total revenue moves as it does when price changes, using the opposing price and quantity effects.

Model Answer

Every price change sets a price effect against a quantity effect, and total revenue rises or falls according to which of the two is the stronger, which is precisely what elasticity measures.

The two opposing effects: a cut in price works on total revenue in two contrary ways at the same moment. The price effect lowers the takings because each unit now sells for less, while the quantity effect raises the takings because more units are sold. The net outcome is a tug-of-war between them.

Why elastic demand lets the quantity effect win: when demand is elastic, $e_p^d > 1$, the quantity effect is the stronger. Quantity rises by a larger proportion than price falls, so the flood of extra units more than replaces the shillings surrendered on each one, and total revenue climbs as the price is cut.

Why inelastic demand lets the price effect win: when demand is inelastic, $e_p^d < 1$, the price effect is the stronger. Quantity rises by a smaller proportion than price falls, so the few extra units cannot make up the shillings surrendered on each one, and total revenue slips as the price is cut.

The knife-edge of unit elasticity: when demand is unit elastic, $e_p^d = 1$, the two effects cancel exactly. The proportionate gain in quantity equals the proportionate loss in price, so the extra units earn back precisely what the lower price gave away, and total revenue is left unchanged.

So the total-outlay rule is no coincidence but a consequence: elasticity is simply the name for which effect, the price effect or the quantity effect, carries the day.

The Master Key: a price change pits a price effect against a quantity effect; elastic demand lets quantity win, inelastic demand lets price win, and unit elasticity is the exact draw.

BINDER Question 51

Follow a roadside maize roaster as she tries every price from high to low. Her takings do not simply grow or simply shrink; they climb to a summit, pause, and then slide back down.

A maize roaster faces the demand relation $P = 10 - Q$, with price in hundreds of shillings and quantity from 1 to 8 cobs. Work out her total revenue at each price and show where it is greatest.

Model Answer

Total revenue climbs from 9 up to a peak of 25 at a price of 5 and a quantity of 5, then falls away again, so the greatest takings sit at the midpoint of the schedule where demand is unit elastic.

Find total revenue at each price: in every row multiply the price by the quantity, since total revenue is nothing more than price times quantity. The takings are read straight off the two columns the roaster already knows.

$$TR = P \times Q$$

Two rows worked in full: at a price of 6 the quantity is 4, so the takings are 24; at a price of 5 the quantity is 5, so the takings are 25, the highest figure the schedule reaches.

$$TR = 6 \times 4 = 24$$

$$TR = 5 \times 5 = 25$$

Price (P)	Quantity (Q)	Total revenue (TR)
9	1	9
8	2	16
7	3	21
6	4	24
5	5	25
4	6	24
3	7	21
2	8	16

Where the takings peak: total revenue rises 9, 16, 21, 24 to a summit of 25 at $P = 5$ and $Q = 5$, then falls back through 24, 21, 16. The peak sits at the midpoint of the demand relation, where $e_p^d = 1$.

Confirm it with the total-outlay reading: as the price falls from 8 to 5 the takings rise from 16 to 25, price and revenue moving in opposite directions, so the upper half of the schedule is elastic. As the price falls on from 5 to 2 the takings drop from 25 back to 16, price and revenue now moving together, so the lower half is inelastic.

The single hump of total revenue therefore tells the whole story at a glance: elastic on the way up, unit elastic at the crown, and inelastic on the way down.

The Master Key: total revenue peaks at 25 where $P = Q = 5$, rising through the elastic upper half and falling through the inelastic lower half, exactly as the total-outlay rule predicts.

BINDER Question 52

Draw the demand curve, and beneath it the curve of the takings it earns. The takings rise, crest and fall, and the crest sits directly above one special point on the demand line.

Explain why total revenue reaches its maximum where demand is unit elastic, and illustrate with the demand and total-revenue curves.

Model Answer

Total revenue is greatest at the point of unit elasticity because that point is the exact border between the elastic stretch, where cutting price still adds to takings, and the inelastic stretch, where cutting price begins to subtract from them.

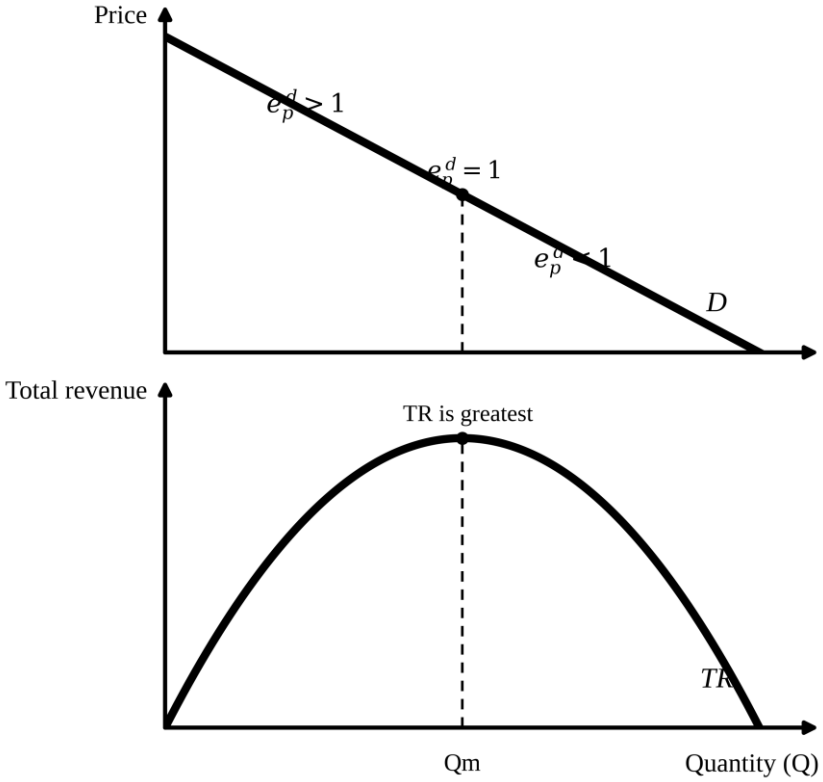


Figure 4.9: *The demand curve and the total-revenue curve; total revenue peaks where demand is unit elastic*

Climbing the elastic upper half: above the midpoint demand is elastic, $e_p^d > 1$, so each cut in price raises total revenue as the quantity effect wins. The takings therefore rise as the price falls from the top of the demand curve toward the middle.

The crown at unit elasticity: at the midpoint demand is unit elastic, $e_p^d = 1$, where the price and quantity effects exactly balance. The takings can climb no higher, so the total-revenue curve reaches its peak directly beneath this point.

Falling down the inelastic lower half: below the midpoint demand is inelastic, $e_p^d < 1$, so any further cut in price now lowers total revenue as the price effect wins. The takings slide away as the price falls from the middle toward the foot of the demand curve.

Approached from above the takings are still rising, and approached from below they are already falling, so they can be at their greatest only at the single point between the two, the unit-elastic midpoint the diagram marks as Q_m.

The Master Key: total revenue peaks at unit elasticity because it rises through the elastic region and falls through the inelastic region, so its summit falls exactly on the point where $e_p^d = 1$.

REAL Question 53

Read the ledger of a Dar-to-Dodoma coach operator. He wonders whether dropping the fare will fill enough empty seats to leave him better off, and the total-outlay method can settle it.

Using total revenue, decide whether the fare cut leaves the operator better off, and identify the elasticity of demand it reveals.

Dar to Dodoma coach service
Fare: 30,000 to 24,000 shillings per seat
Seats sold: 40 to 60 per trip

Model Answer

The fare cut lifts the operator's takings from 1,200,000 to 1,440,000 shillings a trip, so he is better off, and because price and total revenue moved in opposite directions the demand is elastic.

Takings before the cut: at the old fare of 30,000 the coach filled 40 seats, so the takings on each trip were 1,200,000 shillings.

$$\mathrm{TR}_0 = 30{,}000 \times 40 = 1{,}200{,}000$$

Takings after the cut: at the new fare of 24,000 the fuller coach carried 60 seats, so the takings on each trip rose to 1,440,000 shillings.

$$\mathrm{TR}_1 = 24{,}000 \times 60 = 1{,}440{,}000$$

Read the direction: the fare fell yet the takings rose, by 240,000 shillings a trip. Price and total revenue moved in opposite directions, which by the total-outlay rule is the plain signature of elastic demand, $e_p^d > 1$.

Why the seats filled so readily: a traveller can choose a rival coach, take the train, or simply postpone the journey, so a cheaper fare draws in many extra passengers. The quantity effect easily outweighs the smaller sum now earned on each seat.

The advice is to cut with confidence: on this route demand is elastic, so the lower fare more than pays for itself in the empty seats it fills.

The Master Key: the fare cut raised takings from 1,200,000 to 1,440,000; price and revenue moved oppositely, so demand is elastic and the cut was worthwhile.

REAL Question 54

Read the week's figures from a Moshi sugar wholesaler. Tempted to cut his price to shift more sacks, he first asks what the total-outlay method predicts will happen to his takings.

Using total revenue, advise the wholesaler whether the price cut would raise his takings, and state the elasticity it reveals.

Sugar wholesaler, Moshi
Price: 2,000 to 1,800 shillings per kg
Quantity sold: 500 to 540 kg per week

Model Answer

The price cut would pull the wholesaler's takings down from 1,000,000 to 972,000 shillings a week, so he should not cut, and because price and total revenue moved together the demand is inelastic.

Takings before the cut: at the old price of 2,000 he sold 500 kilos, so the week's takings stood at 1,000,000 shillings.

$$\mathrm{TR}_0 = 2{,}000 \times 500 = 1{,}000{,}000$$

Takings after the cut: at the lower price of 1,800 he sold 540 kilos, so the week's takings slipped to 972,000 shillings.

$$\mathrm{TR}_1 = 1{,}800 \times 540 = 972{,}000$$

Read the direction: the price fell and the takings fell with it, by 28,000 shillings a week. Price and total revenue moved in the same direction, which by the total-outlay rule marks the demand as inelastic, $e_p^d < 1$.

Why the extra sacks could not save it: sugar is a near-necessity with few close substitutes, so a cheaper price coaxes out only a handful of extra kilos. That small quantity gain cannot cover the shillings given away on every one of the 500 kilos he was already selling.

The honest advice is to hold the price, or even raise it: with demand inelastic, chasing volume through a lower price only thins the takings the wholesaler already had.

The Master Key: the cut would drop takings from 1,000,000 to 972,000; price and revenue fell together, so demand is inelastic and the cut should be avoided.

REAL Question 55

Read what happened at a Mbeya charcoal depot after the owner raised her price. She feared the dearer sack would empty her yard, yet the week's takings came in higher than before.

Using the total-outlay method, judge the elasticity of demand for the charcoal and say whether the price rise was a sound move.

Charcoal depot, Mbeya
Price: 30,000 to 33,000 shillings per sack
Quantity sold: 100 to 95 sacks per week

Model Answer

The price rise lifted the depot's takings from 3,000,000 to 3,135,000 shillings a week, and because price and total revenue climbed together the demand is inelastic, so the rise was a sound move.

Takings before the rise: at the old price of 30,000 the depot cleared 100 sacks, so the week's takings were 3,000,000 shillings.

$$\mathrm{TR}_0 = 30{,}000 \times 100 = 3{,}000{,}000$$

Takings after the rise: at the higher price of 33,000 the depot still cleared 95 sacks, so the week's takings rose to 3,135,000 shillings.

$$\mathrm{TR}_1 = 33{,}000 \times 95 = 3{,}135{,}000$$

Read the direction: the price rose and the takings rose with it, by 135,000 shillings. Price and total revenue moving in the same direction is, by the total-outlay rule, the mark of inelastic demand, $e_p^d < 1$.

Why the yard did not empty: for many Mbeya households charcoal is the only affordable fuel, with gas and electricity out of reach, so a dearer sack turns only a few buyers away. The slight fall in sacks is easily outweighed by the extra shillings earned on each of the sacks still sold.

The reading is reassuring for the owner: with demand inelastic, the higher price is the surer road to fuller takings, and the total-outlay method confirmed it without a single coefficient.

The Master Key: takings rose from 3,000,000 to 3,135,000 as price rose; the same-direction move marks inelastic demand, so the price rise was sound.

HOT Question 56

A shrewd manager insists the golden rule of pricing is to sit where demand is unit elastic; the cost accountant beside him shakes his head and reaches for the expense book.

Discuss the claim that a firm seeking the greatest possible revenue should set its price where demand is unit elastic.

Model Answer

The claim is exactly right for a firm whose only aim is revenue, but it misleads once costs enter the room, because most firms seek profit, and the profit-maximising price lies in the elastic region above the unit-elastic point.

Why the claim holds for revenue: total revenue is greatest at unit elasticity, since above it demand is elastic and a price cut still adds to takings, while below it demand is inelastic and only a price rise adds to takings. A firm minded to maximise revenue is therefore pushed toward $e_p^d = 1$ from both sides and can do no better than to settle there.

The point the claim forgets: a firm rarely wants revenue for its own sake; it wants profit, which is revenue left over after cost. Selling the extra units that carry demand all the way down to the unit-elastic point is not free, so those last few sales may add less to the takings than they add to the costs of making them.

Where profit actually sits: because producing more costs more, the profit-maximising firm stops short of the revenue peak, holding a higher price and a smaller quantity. That places it in the elastic region where $e_p^d > 1$, not at the unit-elastic midpoint. At the very peak an extra unit adds nothing at all to takings yet still adds to cost, so a firm minding its costs would never sell that far.

The balanced verdict: the claim is sound as a rule for maximising revenue, and useful for a seller who can fairly ignore costs, such as one clearing perishable stock before it spoils or buying market share. As a general rule of pricing it fails, because the aim most firms actually hold, profit, points to the elastic region instead.

So the manager and the accountant are each half right: unit elasticity does crown revenue, but profit wears its crown a little higher up the demand curve, where demand is still elastic.

The Master Key: unit elasticity does maximise revenue, but firms seeking profit price in the elastic region above it, so the claim holds only for a pure revenue-maximiser.

HOT Question 57

A politician promises that a lower price will always swell the takings of those who sell the good. An economist warns that the promise is safe only inside a fence few people can see.

Assess whether a price cut can ever be certain to raise a seller's revenue.

Model Answer

A price cut is certain to raise revenue only when demand is known to be elastic over the whole range of the cut and other conditions are held still; in the general case it is not certain at all, because inelastic demand or a large enough cut can leave revenue flat or lower.

When the outcome is genuinely certain: if demand is elastic across the whole stretch of price the seller is cutting through, the total-outlay rule guarantees that takings rise. Within a known elastic range, then, the promise does hold and the cut is a sure gain.

Why it usually is not certain: elasticity is not fixed along a demand curve; it falls as price falls. So a cut that begins in the elastic upper half can carry the price past the unit-elastic midpoint into the inelastic lower half, where the further cutting destroys the very takings the first part of the cut had built.

The inelastic case outright: if the good is inelastic to begin with, a cheaper price coaxes out too few extra sales to replace the shillings lost on every unit, so the cut lowers revenue from the first shilling. For a staple such as sugar or maize flour this is the ordinary case, not the exception.

The hidden fence of ceteris paribus: the rule assumes nothing else stirs. In the open market a rival may match the cut so the expected buyers never arrive, or a fall in incomes may swallow the gain whole. Once other conditions move, even an elastic good can disappoint the seller who cut its price.

So certainty is possible but narrow: it lives only inside a known elastic range with all else held constant, and the politician's blanket promise steps well outside that fence.

The Master Key: a price cut is certain to raise revenue only within a known elastic range with all else constant; inelastic demand, crossing the midpoint, or shifting conditions can each defeat it.

Determinants of price elasticity of demand

A price rises by the same tenth on two shelves, and one empties while the other barely stirs. The reason lies not in the size of the price change but in the character of the good itself. This section opens up the handful of forces that decide whether demand will flinch or hold firm: how many close substitutes stand nearby, whether the good is a necessity or a luxury, how large a bite it takes from income, how much time the buyer has, how many uses it serves, whether the purchase can wait, how narrowly the market is drawn, and whether habit has taken hold. Master these, and you can predict the elasticity of almost any good before you reach for a single formula.

BINDER Question 58

Nudge up one soda brand in a Tabora duka and the crate sits untouched, a rival an arm's length away; do the same to salt, and the shopper simply pays.

Explain why the number and closeness of substitutes is the most important determinant of the price elasticity of demand.

Model Answer

The more numerous and the closer the substitutes for a good, the more elastic its demand, which is why substitutability is treated as the leading determinant of price elasticity.

How a substitute does the work: when a good's price rises, a close substitute offers the buyer an easy escape, so quantity demanded falls sharply as spending flows to the rival. A good with no such escape holds its buyers, and its quantity barely moves.

Closeness counts as much as number: two goods that satisfy almost the same want, such as one soda brand and another, are close substitutes, so even a small price gap tips buyers across. Distant substitutes tempt no one, so a good surrounded only by poor alternatives stays inelastic.

Why salt sits at one extreme: salt has no near-substitute in a Tanzanian kitchen, so however its price moves the household keeps buying much the same amount. Its demand is strongly inelastic for want of any rival to turn to.

Why a branded soda sits at the other: a single soda brand faces a shelf of rivals that taste and cost almost the same, so a price rise sends drinkers straight to the next bottle. Its demand is elastic because the substitutes are both many and close.

This is why anyone judging a good's elasticity looks first at the company it keeps: the nearer and the more plentiful its rivals, the more elastic it will be.

The Master Key: the more and the closer the substitutes, the greater the elasticity, so substitutability is the first thing to check and the strongest force at work.

BINDER Question 59

A family finds money for sembe whatever the mill charges, yet walks past the showroom the moment the sticker climbs; one good it cannot refuse, the other it can always decline.

Distinguish between the price elasticity of demand for a necessity and for a luxury, and explain why they differ.

Model Answer

A necessity has inelastic demand because the buyer cannot easily do without it, whereas a luxury has elastic demand because it can be given up or delayed the moment its price climbs.

Why a necessity holds firm: a necessity such as maize flour, cooking salt or basic medicine meets a want the household cannot postpone or refuse, so even a steep price rise trims the quantity only a little. Its demand is inelastic.

Why a luxury gives way: a luxury such as a new saloon car or a piece of Tanzanite jewellery meets a want that can wait, so a price rise easily persuades the buyer to hold off. Its demand is elastic.

The luxury's hidden company of substitutes: a costly car also sits among many rivals, for a buyer weighing a Benz can turn to a BMW or a Toyota just as readily, and this abundance of alternatives deepens the elasticity. A necessity rarely enjoys such a crowd of substitutes.

Why the line can shift: what counts as a necessity depends on the household, so a good that is a luxury to a low-income family may be a necessity to a richer one. The elasticity therefore travels with the buyer, not with the good alone.

So the nature of the good sets the tone: the more a purchase can be refused or deferred, the more elastic it becomes, while the truly indispensable stays stubbornly inelastic.

The Master Key: necessities are inelastic because they cannot be refused, luxuries elastic because they can be delayed and because rival makes stand ready to replace them.

BINDER Question 60

A box of matches could double and no one would notice the extra shilling; let a term's school fees rise by a mere tenth, and the whole household sits down to count.

Explain how the proportion of income spent on a good affects its price elasticity of demand.

Model Answer

The larger the share of income a good absorbs, the more elastic its demand, because a price change on a big-ticket item is felt keenly while the same change on a trifling one passes unnoticed.

The trifling purchase: a good that takes only a sliver of income, such as a box of matches or a sachet of salt, can rise steeply in price and still cost so little that the buyer does not bother to cut back. Its demand is inelastic.

The heavy purchase: a good that swallows a large part of income, such as a term's school fees, a refrigerator or a vehicle, forces the household to feel every percentage of a price rise. Buyers then hunt for alternatives, delay, or go without, so demand is elastic.

Why the size of the bite matters: a price rise on a small-share good barely dents the total budget, so there is little reason to respond, whereas the same proportionate rise on a large-share good threatens real hardship and provokes a real reaction. The reaction is what elasticity measures.

So it is not the price of the good alone but its weight in the wallet that shapes the response: the heavier the burden, the more elastic the demand.

The Master Key: a good that eats a large share of income is elastic because its price rise really bites, while a good that costs a pittance stays inelastic because its rise is scarcely felt.

BINDER Question 61

A bajaji driver cannot escape today's fuel price, yet give him a year and he may fit a thriftier engine; time changes what a buyer can do, and so it changes elasticity.

Explain how the time horizon, the number of uses a good serves, and the ability to postpone a purchase each affect the price elasticity of demand.

Model Answer

Demand grows more elastic as time lengthens, as the number of uses a good serves widens, and as the purchase becomes easier to postpone, because each of these gives the buyer more room to react to a price change.

The time horizon: in the days after a price rise a buyer is trapped by old habits and old equipment, so quantity barely moves, but over months and years substitutes are found and routines rebuilt, so demand becomes steadily more elastic. Fuel bought from an EWURA-regulated pump is a clear case, stubborn in the short run and more yielding in the long.

The number of uses: a good put to many uses, such as electricity or water, can be spread across more or fewer of them as its price falls or rises, so the quantity demanded has more ways to move. The wider the range of uses, the more elastic the demand.

The power to postpone: a purchase that can wait, such as a new phone, a fresh kanga or a vehicle, is easily shelved when its price climbs, because the old one will serve a while longer. A purchase that cannot wait, such as urgent medicine, must be made at any price, so it stays inelastic.

Each force works the same way underneath: the more freedom a buyer has to adjust, whether through time, through varied uses or through delay, the more elastic the demand becomes.

The Master Key: more time, more uses and more scope to postpone all widen the buyer's room to react, and every widening makes demand more elastic.

BINDER Question 62

Salt, a soda, a saloon car, a matchbox and a cigarette share one imagined counter, yet no two answer a price rise alike. A single table can hold the reason behind each.

Draw up a table summarising the main determinants of price elasticity of demand, showing for each the condition that makes demand more elastic and a Tanzanian example.

Model Answer

The main determinants of price elasticity can be gathered into a single table, each paired with the condition that raises elasticity and a Tanzanian good that illustrates it.

How to read the table: each row names a determinant, states the condition under which demand becomes more elastic, and offers a Tanzanian good that shows the force at work. The reverse of each condition makes demand more inelastic.

Determinant	More elastic when	Tanzanian example
Number and closeness of substitutes	many close substitutes stand nearby	a soda brand among its rivals in Tabora
Nature of the good	the good is a luxury, not a necessity	a saloon car against a sack of sembe
Share of income spent	the good takes a large slice of the budget	a term's school fees against a box of matches
Time horizon	more time has passed since the price change	petrol a year after an EWURA rise
Number of uses	the good serves many different uses	TANESCO electricity for light, cooking and ironing
Ability to postpone	the purchase can be deferred	a new phone or a fresh kanga
Definition of the market	the good is defined narrowly	one soda brand rather than all soft drinks
Habit or addiction	the good is free of habit	a snack brand, easily dropped, is elastic

Read down the middle column and one thread runs through every row: demand turns elastic whenever the buyer gains a way to escape a price rise, and stays inelastic wherever that escape is shut.

The Master Key: every determinant is one route of escape from a price rise, so demand is elastic where the buyer can flee and inelastic where the buyer is trapped.

REAL Question 63

Follow the fuel at a Dar pump: EWURA lifts the price a tenth on Monday, and by Friday the queues are as long as ever, the daladala still running, the commute still made.

Using the determinants of price elasticity, explain why the demand for fuel is price-inelastic.

Model Answer

The demand for fuel is price-inelastic because several determinants pull the same way at once: it has few close substitutes, it is a necessity for daily travel, and in the short run there is no way to use less without travelling less.

Few close substitutes: a motorist or a daladala owner has no ready replacement for petrol or diesel in the tank, so a price rise offers no easy rival to switch to. With nowhere to turn, quantity demanded holds firm.

A necessity for the journey to work: the trip to work, to market or to school must still be made when the pump price climbs, because the day's living depends on it. A good tied so tightly to daily need cannot be refused, so its demand stays inelastic.

No short-run escape: in the days after an EWURA rise the vehicle, the route and the job are all fixed, so the buyer has no way to cut fuel use without cutting the journey itself. The absence of any quick adjustment keeps demand unresponsive.

Why the budget share does not rescue the buyer: fuel can take a large slice of a commuter's income, which would ordinarily raise elasticity, yet with no substitute and no way to skip the journey the household pays the higher price and trims elsewhere. Necessity and missing substitutes override the budget effect.

So fuel carries every feature of an inelastic good: indispensable, hard to replace and impossible to postpone in the short run, its quantity scarcely bends when the price rises.

The Master Key: fuel is inelastic because its substitutes are few, the journey it powers is a necessity, and in the short run there is simply no way to use less without travelling less.

REAL Question 64

In one Mwanza shop the salt and a favourite soda climb by the same fraction on one morning; by evening the salt has sold as always, while the soda crates have hardly moved.

Explain, using the determinants of elasticity, why the demand for salt is inelastic while the demand for a branded soda is elastic.

Model Answer

Salt is inelastic and the branded soda elastic because the determinants divide them sharply: salt has no substitute, is a necessity and costs a pittance, while the soda has close rivals, is an easily refused comfort and is narrowly defined by its brand.

Salt has no rival and no refusal: salt answers a want no other kitchen good can meet, and it takes so tiny a share of the budget that a price rise is barely felt. With no substitute and no reason to economise, the household buys the same amount, so demand is inelastic.

The soda is surrounded by substitutes: a single soda brand sits among many others that taste and cost almost the same, so a price rise sends the drinker to the next bottle. Close and plentiful substitutes make its demand elastic.

The soda can be refused and is narrowly named: a soft drink is a comfort rather than a need, easily done without, and because it is defined narrowly as one brand rather than as all drinks its buyers have somewhere to go. Both forces deepen its elasticity.

The same proportionate price rise therefore lands quite differently: on salt it meets a wall of necessity and finds no response, while on the soda it meets a crowd of alternatives and empties the crate.

The Master Key: salt is inelastic for having no substitute, being a necessity and costing little, while the branded soda is elastic for its close rivals, its refusability and its narrow definition.

REAL Question 65

Consider dagaa on two Mwanza tables: on the poorer it is the only protein the budget affords; on the richer, one dish among many. The same fish holds the two buyers quite differently.

Explain why the demand for dagaa may be price-inelastic for a low-income household yet more elastic for a wealthier one.

Model Answer

The demand for dagaa is inelastic for the low-income household because it is a necessary protein with no cheaper substitute, yet more elastic for the wealthier household to whom it is only one choice among many affordable alternatives.

For the poor household, a necessity without a cheaper rival: to a low-income family in Mwanza dagaa is the protein the budget can bear, and meat or chicken cost far more, so a rise in the dagaa price offers no cheaper escape. The family keeps buying much the same amount, and demand is inelastic.

For the wealthier household, one option among plenty: to a richer family dagaa is not a need but a choice set beside beef, chicken, eggs and fish of every kind, so a price rise simply nudges them to another dish. With close substitutes within easy reach, their demand for dagaa is more elastic.

Why the same good gives two answers: the good has not changed, but the buyer's circumstances have, so the determinants of substitutes and necessity read differently on each table. Elasticity therefore belongs to the good in the hands of a particular buyer, not to the good alone.

So dagaa shows on one plate how income reshapes the determinants: where it is a necessity without a cheaper rival the demand is inelastic, and where it is one affordable option among many the demand turns elastic.

The Master Key: dagaa is inelastic for the household that has no cheaper protein to turn to and elastic for the household that has many, so the buyer's income decides which determinant rules.

HOT Question 66

A teacher lists eight determinants; a sharp student objects that the list is padded, and that one force, the availability of substitutes, secretly drives the rest. Is the student right?

Which single determinant of price elasticity matters most, and to what extent do the others reduce to it? Argue your case.

Model Answer

The availability and closeness of substitutes is the determinant that matters most, because nearly every other determinant works by changing how easily a buyer can find a substitute, though a few forces keep an independent life of their own.

The central force: elasticity is at bottom a measure of escape: demand is elastic when a price rise can be dodged and inelastic when it cannot, and the readiest way to dodge it is to buy a substitute. Substitutability therefore sits at the heart of the concept.

How the others fold into it: a necessity is inelastic largely because it has no substitute, while a luxury is elastic partly because rival makes abound, as a Benz gives way to a BMW or a Toyota. A narrowly defined good is elastic because a brand has close rivals, and a good with much time behind it is elastic because time is what lets substitutes be found. Each of these is substitutability wearing a different coat.

Where the reduction is only partial: a few forces are not purely about substitutes, for the share of income a good takes and the sheer strength of a habit can hold demand inelastic even when substitutes exist. A smoker surrounded by rival brands may still respond little to price, because the habit, not the absence of substitutes, is what binds him.

The balanced verdict: substitutability is rightly called the leading determinant, since most of the list collapses into it once examined, yet it is not the whole story. Income share and habit remind us that the escape route can be closed by the buyer's budget or by compulsion as well as by the market.

So the student is largely right: substitutes are the linchpin of elasticity, and the longer list is best read as the many ways in which substitutes become easy or hard to reach, with income share and habit as the honest exceptions.

The Master Key: the closeness of substitutes is the leading determinant because necessity, luxury, market definition and time all work through it, though income share and habit can bind demand independently.

HOT Question 67

One report calls the demand for fuel almost fixed; another insists that drivers do respond to price. Both cite EWURA figures, and both may be right, once each names the period it means.

Assess why the demand for fuel can be price-inelastic in the short run yet more elastic in the long run.

Model Answer

The demand for fuel is inelastic in the short run and more elastic in the long run because the passage of time steadily opens up the substitutes and adjustments that are simply unavailable in the days after a price rise.

The short run: a buyer with fixed choices: in the weeks after an EWURA price rise the motorist owns the same vehicle, drives the same route and holds the same job, so there is no way to use less fuel without

abandoning the journey. Locked in by fixed circumstances, the buyer pays the higher price and quantity barely falls.

The long run: choices reopen: given a year or more the same motorist can fit a thriftier engine, move nearer to work, shift onto the daladala or bus, or share rides with neighbours, and a firm can re-plan its fleet and routes. Each of these is a substitute for costly fuel that time alone makes possible, so quantity demanded falls further and demand grows elastic.

Why time is really about substitutes: the good has not changed and the need to travel remains, but the range of ways to meet that need widens as time passes. Time raises elasticity because it is the ingredient that converts an impossible adjustment into an ordinary one.

The judgement for policy: an authority leaning on fuel duty may collect handsomely in the short run, when demand cannot escape, yet should expect the yield to soften over the years as buyers adjust. Reading fuel as inelastic full stop would mistake a short-run truth for a permanent one.

So both reports can stand together: fuel is inelastic when measured over a few weeks and more elastic when measured over years, and the whole disagreement dissolves once the time horizon is named.

The Master Key: fuel is inelastic in the short run because the buyer's choices are fixed and more elastic in the long run because time opens up substitutes, so any statement of its elasticity must fix the period.

Importance and applications of price elasticity of demand

A coefficient you can compute is only worth the trouble if it changes a decision, and price elasticity of demand changes many. This section takes the number off the page and puts it to work: setting a firm's price, splitting a market for price discrimination, choosing which goods a government can safely tax, judging whether a weaker shilling will earn more abroad, and gauging how hard a union can press for pay. In every case the same question is being asked, how strongly does quantity answer a change in price, and in every case the answer decides who gains. Learn to read a situation for its elasticity, and these applications become one idea wearing many coats.

BINDER Question 68

A shop raises the price of cooking oil and counts more money at closing; it raises the price of biscuits and counts less. One number could have told it which to expect.

Explain how a firm uses the price elasticity of demand for its product to decide whether to raise or cut its price.

Model Answer

A firm reads its price policy straight from the price elasticity of demand for its own product: where demand is inelastic it raises the price, and where demand is elastic it cuts the price, because that is the move that lifts total revenue.

Why elasticity governs revenue: total revenue is price multiplied by quantity, so any price change pulls revenue two ways at once, upward through the higher price and downward through the lost quantity. Elasticity decides which pull wins.

$$\mathrm{TR} = \mathrm{P} \times \mathrm{Q}$$

When demand is inelastic, raise the price: quantity then falls proportionately less than the price rises, so the price gain outweighs the quantity loss. Picture a sack of maize flour lifted from 2,000 to 2,400 shillings, a fifth dearer, while weekly sales slip only from 100 sacks to 90, a tenth fewer, so that $e_p^d = 0.5$.

$$\mathrm{TR}_0 = 2{,}000 \times 100 = 200{,}000$$
$$\mathrm{TR}_1 = 2{,}400 \times 90 = 216{,}000$$

Revenue climbs from 200,000 to 216,000 shillings, a clear 16,000 gained on fewer sacks sold. On an inelastic good the price rise pays for itself.

When demand is elastic, cut the price: here quantity rises proportionately more than the price falls, so the flood of extra sales more than replaces the thinner margin and revenue grows on a cheaper tag. A firm surrounded by close rivals lives in this world and prospers by undercutting.

So the firm need not guess. It measures whether e_p^d sits above or below one, then moves the price the way revenue rewards.

The Master Key: read a firm's price policy from its PED, raising the price when demand is inelastic and cutting it when demand is elastic, because that is the move total revenue rewards.

BINDER Question 69

The same room at a Serengeti lodge is billed high to a visitor from abroad and gently to a Tanzanian, and both bookings are welcome. The clerk is reading elasticities.

Explain how a seller who can separate two markets uses their different elasticities to set prices, and illustrate the idea.

Model Answer

A seller who can split buyers into separate markets and stop them trading with one another will charge the higher price in the market whose demand is more inelastic and the lower price in the market whose demand is more elastic, because two tailored prices earn more than any single one.

What must be true first: price discrimination needs three things at once: some power over price, two markets that can be kept apart, and no leakage of the good from the cheap market into the dear one. Remove any of these and the scheme unravels.

The rule itself: charge more where demand is inelastic. In the inelastic market buyers have few substitutes and cling on even at a high price, while in the elastic market only a low price draws the large extra quantity. Each group is priced to its own tolerance.

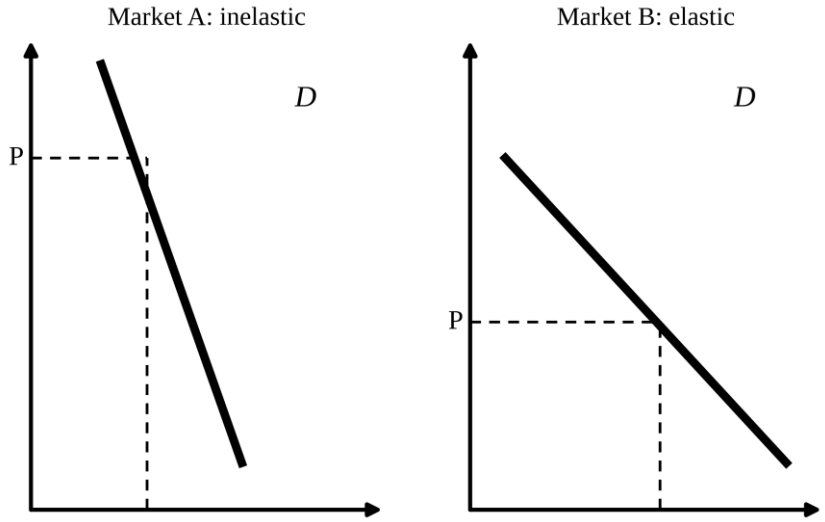


Figure 4.10: *Price discrimination: the higher price is charged in the market with the more inelastic demand*

Why two prices beat one: a single middling price is wrong in both markets at once, too high for the elastic buyers, who desert it, and too low for the inelastic buyers, who would gladly have paid more. Splitting the price recovers both the sales lost in the first market and the revenue forgone in the second.

The shapes it takes: a lodge charging tourists more than residents, a bus line charging peak riders more than off-peak, a cinema charging adults more than students. Each pairs a captive, inelastic buyer with a flexible, elastic one.

What looks like favouritism is really one good priced by two elasticities.

The Master Key: a discriminating seller charges the higher price in the more inelastic market and the lower price in the more elastic one, and so earns more than any single price could.

BINDER Question 70

Two goods sit on the finance minister's desk: a box of imported chocolate and a litre of petrol. She may tax either, but only one keeps paying when the tax bites.

Explain why a government seeking to raise revenue chooses to tax goods whose demand is inelastic.

Model Answer

A government chasing dependable revenue taxes goods whose demand is inelastic, because when the tax raises the price the quantity bought barely falls, so the base the tax feeds on stays broad.

Revenue needs a base that stays put: a tax works by raising the price the buyer pays; if that sharply shrinks the quantity, the government is left taxing a vanishing base. Inelastic demand holds quantity almost steady, so the revenue holds too.

The dependable targets: fuel, cigarettes and alcohol are taxed the world over precisely because each has few substitutes and a grip of habit or necessity. Buyers keep buying as the price climbs, and the collection climbs with it.

Why elastic goods disappoint the treasury: tax a good with many substitutes and buyers simply switch to an untaxed rival. Quantity collapses, little revenue arrives, and the tax has changed behaviour more than it has filled the purse.

Who ultimately carries the duty, buyer or seller, is a separate question taken up in a later section; here the lesson is only where the revenue is safe, on the good the buyer cannot easily drop.

The Master Key: for steady revenue a government taxes inelastic goods such as fuel and tobacco, because the quantity, and so the tax base, barely falls when the price rises.

BINDER Question 71

When the shilling weakens, cashew from Mtwara suddenly looks cheap to a buyer abroad; meanwhile a union whose members are hard to replace clears its throat. Two rooms, one hidden number.

Show how price elasticity of demand guides two further decisions: an exporter judging a currency depreciation, and a trade union pressing for higher wages.

Model Answer

Price elasticity of demand reaches well past the shop counter: it tells an exporter whether a weaker shilling will earn more foreign sales, and it tells a trade union whether it can safely press an employer for higher pay.

A depreciation and export earnings: when the shilling falls, Tanzanian goods grow cheaper in foreign money. If foreign demand for those exports is elastic, the lower price wins a more than proportionate rise in the quantity sold, so export earnings swell and the balance of payments improves.

Elasticity is the hinge: were foreign demand inelastic instead, the cheaper price would coax out only a little extra quantity and earnings could even fall. Whether a depreciation helps at all depends entirely on how elastic the foreign buyer is.

Labour demand and the wage claim: the same reasoning runs in the job market. If the demand for a kind of labour is inelastic, because those workers are hard to replace or to do without, an employer cannot easily cut hiring when wages rise, so a union can push pay upward with little fear of lost jobs.

Where labour is elastic, the claim weakens: if the workers are readily swapped for machines or for other hands, demand for them is elastic and a wage push simply costs jobs. A union's true strength is the inelasticity of the demand for its members.

From the export docks to the bargaining table, one question settles the outcome: how elastic is the demand on the other side?

The Master Key: a depreciation lifts export earnings only where foreign demand is elastic, while a union bargains from strength only where the demand for its labour is inelastic.

REAL Question 72

Read the budget: the TRA lifts the duty on cigarettes and petrol once more, and still the Treasury pencils in a larger collection than last year. Follow the reasoning.

Explain why the Treasury can expect higher revenue from taxing cigarettes and fuel, and what the elasticity of demand for these goods implies for the campaigners' hope.

In its budget, the TRA again raises the excise duty on cigarettes and petrol.

Health campaigners expect smoking and driving to fall sharply.

The Treasury expects its collection from both to rise.

Both expectations cannot be equally correct.

Model Answer

The Treasury can expect higher revenue because the demand for cigarettes and fuel is inelastic, so the duty raises the price without cutting quantity by much, and it is that very inelasticity that lets the campaigners down, since consumption falls only a little.

Why the revenue is safe: with few substitutes and the pull of habit or necessity, smokers and drivers keep buying when the duty lifts the price. Quantity barely moves, so the base the tax feeds on stays broad and the collection grows.

Why the campaigners are half-disappointed: the same inelasticity that guards the revenue means the quantity smoked or burned drops only slightly. A tax is a strong tool for raising money from an inelastic good but a weak tool for breaking the habit.

A number to see it: suppose the duty raises the cigarette price by a fifth while the quantity smoked falls only a twentieth. Then $e_p^d = 0.25$, firmly inelastic, so quantity holds and revenue rises even as smoking scarcely stirs.

This is why revenue authorities lean so heavily on fuel, tobacco and alcohol. Who finally bears the duty is a later question; the point here is simply that the money arrives.

The Master Key: inelastic demand for cigarettes and fuel keeps the tax base broad, so the duty reliably raises revenue even though it barely dents consumption.

REAL Question 73

Follow two guests through a lodge door near Ngorongoro. One pays a dollar rate for the room, the other a lower shilling rate, for the same bed and the same breakfast.

Using price elasticity of demand, explain why the lodge charges non-residents more than residents, and why the passport check matters.

The Ngorongoro Serena quotes two tariffs for one room:

a non-resident rate charged in US dollars, and a lower resident rate in shillings.

The front desk checks a passport or residence permit before applying a rate.

Model Answer

The lodge charges non-residents more because their demand for a Tanzanian safari is far more inelastic than a resident's, and the passport check matters because price discrimination only works while the two markets can be kept apart.

The tourist's inelastic demand: a visitor who has flown across the world for the Ngorongoro crater has few substitutes and has already budgeted heavily for the trip, so a higher room rate scarcely alters the decision to stay. Demand is inelastic, and the high price is safe.

The resident's elastic demand: a Tanzanian family has many cheaper ways to spend a weekend and can simply stay home, so the same high rate would leave the room empty. Demand is elastic, and only the lower rate fills the bed.

Why the passport check is essential: if a resident could book cheaply and resell to a tourist, the dear market would drain into the cheap one and the two prices would collapse into a single one. Checking a passport blocks that leak and keeps the markets separate.

The result for the lodge: pricing each market to its own tolerance earns more than any single rate could: the room fills with residents at the low price while the tourist is charged closer to the full value placed on the trip.

It is not favouritism but two elasticities, priced apart.

The Master Key: the lodge prices the inelastic tourist high and the elastic resident low, and the passport check is what stops the cheap market leaking into the dear one.

REAL Question 74

Read the figures of a Mwanza soap maker hemmed in by a dozen look-alike brands, weighing whether to drop her price by a fifth. Brave, or foolish?

Advise Zainabu whether to cut her price, using the price elasticity of demand for her soap and a total-revenue calculation.

Zainabu makes bar soap in Mwanza and sells it in Songea beside a dozen near-identical brands.

She currently sells 200 cartons a week at 1,000 shillings each.

She is weighing a cut to 800 shillings, which she thinks might lift weekly sales to about 280 cartons.

Model Answer

Zainabu should cut her price, because her soap sits among many close substitutes and so faces elastic demand, which means the lower price will win more than enough extra sales to raise her total revenue.

Read the elasticity first: with a dozen near-identical brands a shelf away in Songea, the smallest price gap sends buyers to whoever is cheapest. Her demand is highly elastic, so quantity will answer a price cut strongly.

Put numbers to the cut: take the drop from 1,000 to 800 shillings, a fifth off the price, lifting weekly sales from 200 to 280 cartons, two-fifths more, so that $e_p^d = 2$.

$$TR_0 = 1{,}000 \times 200 = 200{,}000$$

$$TR_1 = 800 \times 280 = 224{,}000$$

Read the result: revenue rises from 200,000 to 224,000 shillings, a gain of 24,000 a week, because the two-fifths jump in cartons more than covers the fifth shaved off the price. On elastic demand, the cut pays.

Had her soap been a unique, must-have brand with inelastic demand, the same figures would reverse and the advice with them; but in her crowded market the price cut is sound.

The Master Key: because Zainabu's soap faces elastic demand, cutting the price from 1,000 to 800 shillings lifts weekly revenue from 200,000 to 224,000, so the cut is wise.

HOT Question 75

A minister calls the fuel levy plain revenue sense; a community organiser calls it a tax on the poor, who cannot escape it. Both are studying the same inelastic demand.

To what extent is it fair for a government to raise revenue by taxing goods with inelastic demand that poorer households cannot avoid? Argue your case.

Model Answer

Taxing inelastic goods is efficient revenue policy but frequently unfair, because the very inelasticity that secures the revenue also corners the poorest buyers, who spend a larger share of a smaller income on the necessities being taxed.

The case in its favour: inelastic goods give a treasury a dependable base, and public money for roads and clinics must come from somewhere. Fuel, sugar and paraffin are taxed precisely because people keep buying them, so the revenue arrives without the base melting away.

Why fairness objects: a tax on a necessity is regressive. Because a poor family spends a larger fraction of its income on paraffin, cooking oil and bus fares than a rich family does, the same duty takes a heavier proportionate bite from those least able to bear it.

The inelasticity is the trap: inelastic demand for a necessity means the buyer cannot substitute away, and so cannot escape the tax by changing behaviour. The tool works on the revenue side only because it corners the very households with the least room to move.

A balanced judgement: fairness need not forbid the tax, but it demands a remedy: sparing the rawest essentials, taxing luxuries alongside, or returning the revenue as services the poor actually use. Efficiency and equity can be reconciled, but only on purpose.

So the minister and the organiser are each half right, the tax being sound revenue and poor equity at once, and a wise policy is built to answer both.

The Master Key: taxing unavoidable inelastic necessities is efficient but regressive, so it is fair only when paired with exemptions or spending that shield the poor it corners.

HOT Question 76

Cut the price and win the crowd, urges the eager salesman. His accountant, eyeing a near-vertical demand curve, quietly disagrees. Which of them has the elasticity right?

When is cutting the price a mistake for a firm? Assess your answer using the price elasticity of demand.

Model Answer

Cutting the price is a mistake whenever a firm's demand is inelastic, because the lower price then wins too little extra quantity to make up for the thinner margin, so total revenue falls.

The salesman's half-truth: a price cut does pull in more buyers, and where demand is elastic that flood of extra quantity more than pays for the lower price, so revenue rises. In that world the eager salesman is right.

Where the cut backfires: if demand is inelastic, a good with few substitutes, a near-necessity, a loyal following, then quantity barely stirs when the price drops. The firm sells a little more for a lot less, and revenue shrinks.

A count of the loss: picture a pharmacy dropping a needed medicine from 1,000 to 800 shillings, a fifth off, while sales rise only from 100 to 105 packs, a twentieth, so that $e_p^d = 0.25$.

$$TR_0 = 1{,}000 \times 100 = 100{,}000$$

$$TR_1 = 800 \times 105 = 84{,}000$$

Read the damage: revenue falls from 100,000 to 84,000 shillings, 16,000 thrown away, because a twentieth more packs cannot cover a fifth off the price. The mistake was one the elasticity could have predicted.

So the accountant eyeing that near-vertical demand curve is right to object: on inelastic demand a firm should hold or raise the price, never cut it.

The Master Key: a price cut is a mistake whenever demand is inelastic, for then quantity rises too little to offset the lower price and total revenue falls.

Income elasticity of demand

Price is not the only pressure a household feels. When a salary rises in Iringa or a harvest pays well in Mbeya, families buy differently even though no price tag has moved, and it is income that has done the steering. This section measures that second pressure. You will define income elasticity of demand, build its formula from the percentage change in quantity and the percentage change in income, and learn to read its value: how a number above one signals a luxury, a fraction a necessity, a zero an essential, and a minus sign an inferior good. Along the way the Engel curve will show how one good can change its nature as a family, and a nation, grows richer.

BINDER Question 77

A family in Iringa sees no price tag change this month, yet after a pay rise the basket quietly refills: more meat, more fruit, a little less of the plainest flour.

Define income elasticity of demand and state what it measures.

Model Answer

Income elasticity of demand measures how strongly the quantity demanded of a good responds, in proportionate terms, to a change in the consumer's income, with all prices held constant.

The relationship it isolates: it links quantity demanded to income alone, holding the good's own price and every other price still, so that any change in the quantity bought can be traced to the change in income and to nothing else.

Why income deserves its own measure: as a household's income rises or falls, the quantities it buys shift even when prices do not move at all. Income elasticity puts a single number on the size and the direction of that shift.

The direction it can take: unlike price elasticity, income elasticity can come out positive or negative, because a richer household buys more of some goods and less of others. The sign therefore carries real information about the good, not just the size.

So where price elasticity watches the price tag, income elasticity watches the wage packet, asking how far demand moves when the household simply has more, or less, to spend.

The Master Key: income elasticity of demand is the proportionate responsiveness of quantity demanded to a change in income, and its sign as well as its size tells you about the good.

BINDER Question 78

A shopkeeper in Dodoma knows her regulars bought more soda the month salaries rose, but 'more' is a loose word until she turns two changes, in income and in crates, into a single ratio.

State the formula for income elasticity of demand and explain each part, including how the percentage changes are found.

Model Answer

Income elasticity of demand is the percentage change in quantity demanded divided by the percentage change in income, which can equally be written as a ratio of the absolute changes weighted by the opening income and quantity.

The percentage form: the headline definition sets the proportionate change in quantity against the proportionate change in income, so both the top and the bottom of the ratio are pure percentages.

$$e_y^d = \frac{\%\Delta Q^d}{\%\Delta Y}$$

Finding each percentage: each percentage is a change measured against its own starting value, times one hundred, so the quantity change is compared with the opening quantity and the income change with the opening income.

$$\%\Delta Q^d = \frac{Q_1 - Q_0}{Q_0} \times 100$$

$$\%\Delta Y = \frac{Y_1 - Y_0}{Y_0} \times 100$$

The working point form: substituting those two percentages into the ratio and cancelling the hundreds leaves the change in quantity per unit change in income, scaled by the opening income over the opening quantity. This is the form to use when you are handed raw figures.

$$e_y^d = \frac{\Delta Q^d}{\Delta Y} \times \frac{Y_0}{Q_0}$$

The two forms are the same number reached by two roads: use percentages when they are given to you directly, and the point form when you must start from the incomes and quantities themselves.

The Master Key: income elasticity of demand is $\frac{\%\Delta Q^d}{\%\Delta Y}$, the very same number as $\frac{\Delta Q^d}{\Delta Y} \times \frac{Y_0}{Q_0}$.

BINDER Question 79

Give three Iringa households the same pay rise and watch three answers: one grabs far more airtime and gadgets, one adds a little sugar, and one finally drops the cheapest flour altogether.

State the range of values income elasticity of demand can take and classify the good in each case.

Model Answer

Income elasticity of demand can be greater than one, equal to one, between zero and one, exactly zero, or negative, and each value sorts the good into a distinct class.

Greater than one, the income-elastic luxury: quantity demanded rises faster than income, so a rise in income of a tenth lifts quantity by more than a tenth. Goods that behave this way, such as a private car or a restaurant meal, are luxuries.

Between zero and one, the income-inelastic necessity: quantity still rises with income but more slowly, so the share of the budget spent on the good falls as the household grows richer. Everyday necessities like sugar and cooking oil sit in this band.

The two boundary cases: at exactly one, quantity and income move in equal proportion, a unitary response; at exactly zero, quantity does not respond to income at all, the mark of an essential such as salt, of which a household buys the same pinch whether rich or poor.

Below zero, the inferior good: quantity demanded actually falls as income rises, giving a negative value. The household abandons the good for something it now prefers and can afford.

Value of e_y^d	How quantity responds	Type of good	Example
$e_y^d > 1$	rises faster than income	normal, luxury	private car
$e_y^d = 1$	rises in step with income	normal, unitary	certain clothing
$0 < e_y^d < 1$	rises slower than income	normal, necessity	sugar
$e_y^d = 0$	does not respond	essential	salt
$e_y^d < 0$	falls as income rises	inferior	dagaa

The number thus does two jobs at once: its size separates the eager luxury from the sluggish necessity, and its sign separates the goods that grow with prosperity from the one that shrinks before it.

The Master Key: the size of income elasticity separates luxuries (above one) from necessities (between zero and one), while zero identifies an essential and a negative value an inferior good.

BINDER Question 80

The dagaa that fed a Mwanza household through its lean years is the first thing to leave the basket once the pay rises; the fish never changed, the wallet did.

Explain how the sign of income elasticity of demand distinguishes a normal good from an inferior good, and give a Tanzanian example of each.

Model Answer

The sign of income elasticity tells you the direction in which demand moves with income: a positive sign identifies a normal good, bought in greater quantity as income rises, and a negative sign identifies an inferior good, bought in smaller quantity as income rises.

The positive sign, a normal good: when income and quantity move the same way, the elasticity comes out positive. Most goods behave like this, from rice to meat to clothing, because a richer household simply buys more of what it already likes.

The negative sign, an inferior good: when income rises but quantity falls, the elasticity comes out negative. The good has not worsened in any way; the household has merely traded up, replacing it with something it prefers now that it can afford to.

The Tanzanian picture: dagaa and cassava often behave as inferior goods, alongside second-hand clothing (mitumba) and the crowded daladala, all of which lose custom as families climb into fresh fish, new clothes and private transport. Rice, meat and a family car are the normal goods they climb toward.

Why the sign is the classifier: the same formula returns a minus sign only when the change in quantity on top fights the change in income on the bottom. Reading that sign is the quickest single test of whether a good is normal or inferior, before any size is even considered.

So the sign alone already sorts the shopkeeper's shelves into the goods that grow with rising incomes and the goods that shrink before them, and the size of the number only fills in the detail.

The Master Key: a positive income elasticity identifies a normal good that grows with income; a negative one identifies an inferior good, such as dagaa or mitumba, that shrinks as income rises.

BINDER Question 81

Cassava is a blessing to a struggling family in Mtwara and an afterthought to a prosperous one down the road; the very same root can be a normal good and an inferior one.

Explain, with the help of an Engel curve, how a good can be a normal good at low incomes and an inferior good at high incomes.

Model Answer

A single good can change its character as income rises, behaving as a normal good while the household is poor and as an inferior good once the household is comfortable, and the Engel curve draws exactly this turn.

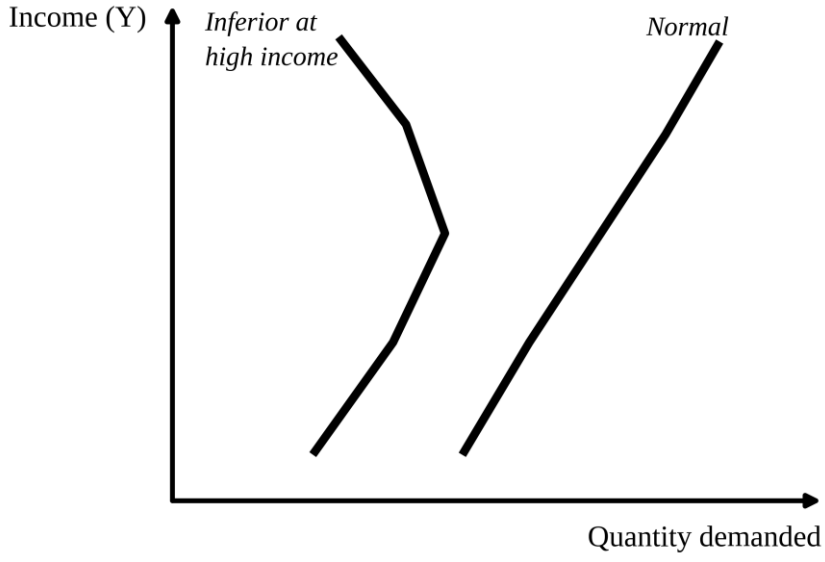


Figure 4.11: *Engel curves: a normal good, and a good that becomes inferior as income rises*

What an Engel curve shows: an Engel curve plots the quantity a household buys of a good against its income, holding all prices constant. Its slope is the visual face of income elasticity: sloping upward where the good is normal, sloping downward where the good is inferior.

The turning good: for a good like cassava the curve first rises, as a poor household gaining income buys more of the staple it leans on. Beyond a certain income the curve bends back and falls, as the now comfortable household switches toward rice, meat and fresh produce.

Reading two elasticities off one curve: on the rising stretch income elasticity is positive and the good is normal; at the peak it passes through zero; on the falling stretch it turns negative and the good is inferior. One good, one curve, three readings, all set by the level of income.

The development angle: this is the story of a growing economy in miniature. As Tanzanian incomes rise, demand shifts away from staples such as cassava and dagaa toward higher-value foods and manufactured goods, so a farmer or firm that reads the Engel curve early can move up the value chain before demand for the basic good turns down.

The lesson is that inferiority is not stamped on a good forever; it is a stage a good can enter once its buyers have grown rich enough to leave it behind.

The Master Key: the Engel curve shows income elasticity as a slope, and a good can rise as a normal good then bend back as an inferior one, mirroring how a developing economy trades staples for higher-value goods.

BINDER Question 82

A Musoma trader notices that when a regular's income doubled, his order of a cheap grain was cut clean in half; put the two changes together and the good confesses its type.

Calculate the income elasticity of demand for the grain and classify the good.

A household's monthly income rises from 100,000/= to 200,000/=. Its purchase of a certain grain falls from 40 units to 20 units.

Model Answer

The income elasticity of demand works out to -0.5, and because the value is negative the grain is an inferior good.

Setting out the figures: the opening income and quantity are $Y_0 = 100{,}000$ and $Q_0 = 40$; income rises while quantity falls, so the change in income is positive and the change in quantity is negative.

$$\Delta Q^d = 20 - 40 = -20$$
$$\Delta Y = 200{,}000 - 100{,}000 = 100{,}000$$

Substituting into the point form: the working formula scales the quantity change per unit of income change by the opening income over the opening quantity.

$$e_y^d = \frac{\Delta Q^d}{\Delta Y} \times \frac{Y_0}{Q_0}$$
$$e_y^d = \frac{-20}{100{,}000} \times \frac{100{,}000}{40}$$

Simplifying to the result: the opening income of $100{,}000$ appears on both the top and the bottom and cancels, leaving $\frac{-20}{40}$.

$$e_y^d = \frac{-20}{100{,}000} \times 2{,}500 = \frac{-50{,}000}{100{,}000} = -0.5$$

Interpreting the sign and the size: the sign is negative, so as income rose the household bought less: the good is inferior. The size, one half in absolute terms, says the fall in quantity was proportionally half the rise in income, but for classifying the good it is the minus sign that decides.

A quick check confirms the answer: quantity fell by 50 per cent ($\frac{-20}{40} \times 100$) while income rose by 100 per cent ($\frac{100{,}000}{100{,}000} \times 100$), and $\frac{-50}{100} = -0.5$.

The Master Key: with income up and quantity down, income elasticity works out to -0.5, and any negative value brands the good inferior.

REAL Question 83

Read this account from a Mwanza stall: as one regular's income doubled from 1,000/= to 2,000/=, her weekly order of a certain good rose only from 25 to 30 units.

Calculate the income elasticity of demand for the good and comment on the type of good it is.

A consumer's income rises from 1,000/= to 2,000/=.

Her quantity bought of the good rises from 25 units to 30 units.

Model Answer

The income elasticity of demand is 0.2**, a small positive value, so the good is a normal good, and more precisely an income-inelastic necessity.**

The two changes: quantity rises by five units while income rises by one thousand, and both changes are positive, so the elasticity will carry a positive sign before any arithmetic is finished.

$$\Delta Q^d = 30 - 25 = 5$$
$$\Delta Y = 2{,}000 - 1{,}000 = 1{,}000$$

Applying the point form: substitute the changes and the opening values $Y_0 = 1{,}000$ and $Q_0 = 25$; the opening income of $1{,}000$ then cancels top and bottom, leaving $\frac{5}{25}$.

$$e_y^d = \frac{\Delta Q^d}{\Delta Y} \times \frac{Y_0}{Q_0} = \frac{5}{1{,}000} \times \frac{1{,}000}{25}$$
$$e_y^d = \frac{5}{25} = 0.2$$

What the number says about the good: the value is positive, so income and quantity rise together and the good is normal; it is less than one, so demand is income-inelastic, the signature of a necessity. Quantity grew far slower than income, so the good takes a shrinking share of the budget as the shopper prospers.

The check holds: quantity rose by 20 per cent ($\frac{5}{25} \times 100$) while income rose by 100 per cent ($\frac{1{,}000}{1{,}000} \times 100$), and $\frac{20}{100} = 0.2$.

The Master Key: income up and quantity up only a little gives a positive income elasticity of 0.2, the sign of a normal good that is an income-inelastic necessity.

REAL Question 84

Consider a boom year in Arusha: households see income climb 40 per cent, while their quantity demanded of good M leaps 80 per cent, twice as fast as the money behind it.

Calculate the income elasticity of demand for good M, classify it, and name three goods that behave like M.

In the boom, household income rises by 40 per cent.

Quantity demanded of good M rises by 80 per cent.

Model Answer

The income elasticity of demand for good M is 2**, comfortably above one, so M is a normal good of the luxury type and its demand is income-elastic.**

Using the percentage form: here the two percentage changes are handed to us directly, so there is no need for the point form; simply set the percentage change in quantity over the percentage change in income.

$$e_y^d = \frac{\%\Delta Q^d}{\%\Delta Y} = \frac{80}{40} = 2$$

Classifying good M: the value is positive, so M is a normal good; it is greater than one, so demand is income-elastic, the mark of a luxury. Each one per cent of extra income brings two per cent more quantity, the pattern of a good bought more lavishly as households prosper.

Three goods that behave like M: a private car, a restaurant meal and jewellery such as Tanzanite all tend to show income elasticities above one, because each is a postponable comfort that a household indulges in only once its basic needs are met. Air travel and large televisions belong to the same family.

Where a necessity's demand crawls behind income, a luxury's demand outruns it, which is exactly why firms selling goods like M thrive first in a boom and suffer first in a slump.

The Master Key: an 80 per cent quantity rise on a 40 per cent income rise gives an income elasticity of 2, the mark of an income-elastic luxury such as a car, a restaurant meal or Tanzanite jewellery.

REAL Question 85

Read the fortunes of two Dar firms across a rising decade: a maize-flour miller and a maker of upholstered furniture, both watching incomes climb. One boardroom is calm; the other is racing to expand.

Using income elasticity of demand, explain why rising national income affects the two firms so differently, and advise what each should do.

Model Answer

Rising incomes pull the two firms in opposite directions because their goods carry very different income elasticities: the furniture is an income-elastic luxury whose demand races ahead of income, while the maize flour is an income-inelastic necessity whose demand barely stirs.

The furniture maker's boom: upholstered furniture is a comfort bought once basic needs are met, so its income elasticity is well above one. As incomes climb its demand climbs faster still, which is why the boardroom is racing to widen capacity before rivals do.

The miller's flat horizon: maize flour is a staple with an income elasticity between zero and one, so its demand grows only slowly as incomes rise and may stall if households begin trading up to rice or wheat. Building more mills here risks leaving them idle.

What income elasticity advises each: the furniture firm should invest, widen its range and site new outlets where incomes are rising fastest, since a boom is its friend and a slump its danger. The miller should hold capacity steady, guard its cost advantage and diversify into higher-value products before the staple's demand turns.

The warning hidden in the sign: the miller must also watch for the moment maize flour behaves as an inferior good among its richer customers, its income elasticity slipping below zero. At that point loyalty to the staple becomes a trap rather than a comfort.

The same rising tide of income lifts one firm and strands the other, and income elasticity is the instrument that told each which it was before the tide came in.

The Master Key: because furniture is income-elastic and maize flour income-inelastic, a rising national income rewards the furniture maker and barely helps the miller, so each must plan capacity and location by its own income elasticity.

HOT Question 86

A shopkeeper insists economists are rude: to call dagaa an inferior good, he says, insults a fish that has fed the coast for generations. An economist shakes her head.

Assess the claim that an inferior good is simply a good of poor quality.

Model Answer

The claim confuses an everyday word with a technical one, for in economics an inferior good is defined purely by a negative response to income and not at all by its quality.

The grain of truth in the claim: inferior goods are often the cheaper, more basic options that richer buyers replace, so in ordinary speech they can look like lower-quality goods. To that extent the shopkeeper's instinct is not baseless.

What the term actually means: in economics a good is inferior when its quantity demanded falls as income rises, giving a negative income elasticity. The label describes a behaviour of demand, not a chemistry of the good; dagaa is nutritious and valuable, yet inferior in this precise sense because richer households buy less of it.

Why quality is the wrong test: the same good can be normal for a poor household and inferior for a rich one, though its quality never changed between the two. And a genuinely fine good can turn inferior if buyers desert it for something they prefer once they prosper. Quality sits in the good; inferiority lives in the response to income.

The balanced verdict: the claim holds only as a loose everyday association and fails as economics. Judged by the definition, inferiority is a statement about the sign of income elasticity, so a nutritious, respectable good can be inferior while a flashy, wasteful one can be perfectly normal.

So the economist is not insulting the fish; she is reporting how demand for it moves with income, which is a different thing entirely from judging what is on the plate.

The Master Key: an inferior good is defined by a negative income elasticity, not by low quality, so a nutritious good like dagaa can be inferior while quality has nothing to do with the label.

HOT Question 87

A regional official predicts that as Tanzania grows richer, demand for cassava and dagaa will simply collapse, and tells farmers to abandon them now. A development economist counsels caution.

Discuss, using income elasticity of demand, the view that rising national incomes will inevitably cause demand for staple foods to collapse.

Model Answer

The view captures a real tendency but overstates it into a certainty, because income elasticity does predict falling demand for inferior staples as incomes rise, yet that fall is neither uniform, immediate, nor the same for every staple or every household.

The truth the view rests on: staples such as cassava and dagaa often carry a negative income elasticity, so as a household grows richer it buys less of them and trades up to rice, meat and fresh produce. Across a rising economy this pull is genuine, and the official is right to see it coming.

Why collapse overstates it: income elasticity is not a fixed stamp on a good. For the many households still on low incomes these staples remain normal goods with a positive elasticity, bought in greater quantity as their incomes rise; and some staples are necessities rather than inferior goods, with an elasticity between zero and one, so their demand keeps growing, only slowly. A large and unevenly prosperous population therefore keeps demand alive long after the richest have moved on.

The prudent response: the caution is therefore sound. Rather than abandoning the crops overnight, farmers and firms should read the Engel curve and move gradually up the value chain, adding processing and higher-value products, while export and food-security demand can support the staple even as domestic tastes shift.

The measured verdict: rising incomes will erode demand for the truly inferior staples over time, but the words ’collapse’ and ’inevitable’ are too strong. Income elasticity forecasts a managed decline for some goods, a slow steady growth for others, and a long transition rather than a cliff.

The official has read the direction correctly and the speed wrongly; income elasticity supplies both, and it is the speed that saves the farmer from acting too soon.

The Master Key: income elasticity predicts falling demand for inferior staples as incomes rise, but because the elasticity varies with income level and differs across staples, the decline is gradual and partial, not an inevitable collapse.

Importance and applications of income elasticity of demand

You have learned to measure income elasticity and to read its sign; now comes the question of what the measure is for. A coefficient is only as valuable as the decisions it sharpens, so this section puts income elasticity to work. You will see how it warns a producer whether its fortunes are chained to the business cycle, how it guides a firm to the right place to open its doors, how it lets a government tax the comfortable without wounding the poor, and how it helps a nation’s planners foresee the goods a richer people will demand. By the end the number stops being something to compute and becomes a guide for everyone who must plan for a world in which incomes rise and fall.

BINDER Question 88

When incomes rise, the flat-screen sellers can barely keep up; let wages slip a season and their shelves gather dust, while the flour seller beside them keeps the same unbroken queue.

Explain why producers of goods with a high income elasticity of demand face a more unstable trading cycle than producers of necessities.

Model Answer

Goods with a high income elasticity swing sharply with the state of the economy, so the firms that make them ride a boom-and-slump cycle that the makers of necessities are largely spared.

The meaning of a high income elasticity: a luxury has an income elasticity above one ($e_y^d > 1$), which means its quantity demanded rises and falls more than in proportion to income. A necessity has an income elasticity between zero and one, so its demand barely stirs when incomes move.

What a boom does: when the economy grows and household incomes climb, spending on luxuries races ahead while spending on necessities inches up. The luxury producer enjoys a rush of orders far larger than the rise in incomes that caused it.

What a slump does: when incomes fall in a downturn the same steep responsiveness works in reverse: buyers abandon luxuries first, so their sales collapse, while necessities keep selling because families must still eat and wash. The luxury firm's revenue drops much faster than incomes do.

Why this is riskier: the luxury producer therefore faces wide swings between feast and famine that are hard to plan for, invest around or borrow against, whereas the necessity producer sits on a steady floor of demand through good years and bad.

This is the first lesson income elasticity teaches a firm: the higher a good's income elasticity, the more tightly its fortunes are chained to the business cycle, and the greater the risk its maker must carry.

The Master Key: high income elasticity ties a good's sales tightly to the business cycle, so luxury producers boom and slump while necessity producers rest on a steady floor.

BINDER Question 89

A supermarket owner weighs two plots, one in a leafy Dar suburb of salaried families, the other in a hard-pressed rural town, and must guess which will fill her tills.

Explain how a firm can use income elasticity of demand to decide where to locate or which market to serve.

Model Answer

A firm reads income elasticity as a map of where its goods will sell, siting itself where the incomes of buyers match the income sensitivity of what it offers.

The signal income elasticity gives: income elasticity tells a firm how far demand for its product moves with the incomes of the people around it. A high-elasticity good needs customers with high or rising incomes, while a low-elasticity necessity finds buyers almost anywhere.

Placing a high-elasticity business: a seller of cars, furniture or restaurant meals - all income-elastic - looks for a district where incomes are high or climbing, such as a salaried Dar suburb, because that is where each extra shilling of income turns into extra sales of exactly its kind of good.

Placing a low-elasticity business: a trader in maize flour, soap or paraffin - all income-inelastic - can settle in a modest or rural market without fear, since demand for these goods holds up even where incomes are low and grows little where incomes are high.

Watching where incomes are rising: the shrewd firm studies not only where incomes are high today but where they are rising fastest, siting ahead of the wave so that a growing district's new spending on income-elastic goods flows first to its own counter.

In this way income elasticity turns a blank map into a plan, matching the income profile of a place to the income sensitivity of the product.

The Master Key: a firm places income-elastic goods where incomes are high or rising and income-inelastic goods almost anywhere, matching the responsiveness of the product to the wealth of the place.

BINDER Question 90

A finance official must raise a set sum from one of two goods, the salt in every kitchen or the perfume on a few tables, and asks which choice spares the poor.

Explain how a government can use income elasticity of demand in designing its tax and welfare policy.

Model Answer

A government leans on income elasticity to place the heavier taxes on goods the well-off buy as their incomes rise, while shielding the essentials on which poorer families depend.

Sorting goods by income elasticity: income elasticity separates a country's goods into those with a high elasticity, bought increasingly by richer households as incomes climb, and those with a low or zero elasticity, bought by nearly everyone whatever their income.

Taxing the income-elastic: a tax on high-elasticity goods such as imported cars, perfume or air travel falls mostly on discretionary spending and on those with income to spare, so the burden rests where it can be borne and the base grows naturally as the economy expands.

Protecting the income-inelastic: essentials such as salt, maize flour and cooking oil carry a low or zero income elasticity and take a large share of a poor family's budget, so a government that wants to spare the vulnerable keeps taxes on these light or lifts them altogether.

The welfare logic: because the two groups of goods are bought by different income classes, taxing according to income elasticity lets the state raise revenue and pursue fairness at once, tilting the load toward those most able to pay.

Income elasticity thus becomes a tool of equity, guiding the tax toward the goods of the comfortable and away from the goods of the poor.

The Master Key: taxing high-income-elasticity goods while sparing low-elasticity essentials lets a government fall on discretionary spending and protect poorer households at the same time.

REAL Question 91

Read these two account books: a car dealer on Nyerere Road in Dar and a maize miller in Iringa open the lean year alike, yet close it in very different health.

Using income elasticity of demand, explain which of the two firms suffers more as incomes fall, and why.

A downturn settles over the region and household incomes fall for a full year.

Firm A - a car dealer on Nyerere Road in Dar - sells imported vehicles.

Firm B - a maize miller in Iringa - sells sacks of flour to the same households.

By the year's end, one firm's sales have collapsed while the other's have hardly moved.

Model Answer

The car dealer suffers far more than the maize miller, because cars carry a high income elasticity while maize flour carries a low one, so the same fall in incomes strikes the two firms with very unequal force.

The car dealer's exposure: a car is a classic luxury with an income elasticity well above one ($e_y^d > 1$), so when incomes fall its quantity demanded falls even faster. Buyers postpone the purchase, keep the old vehicle another year, and the showroom empties.

The miller's shelter: maize flour is a necessity with an income elasticity below one ($0 < e_y^d < 1$). However far incomes drop, households must still eat, so the sacks keep leaving the mill in much the same numbers.

Why one shock lands unequally: the single cause - a fall in regional incomes - passes through two very different elasticities. The high elasticity magnifies the shock for the dealer, while the low elasticity absorbs it for the miller, so an identical downturn produces opposite fortunes.

What each firm should do: knowing this, the dealer holds cash and trims costs against the lean years, while the miller can plan on steady sales, for demand for flour barely bends even as incomes tighten.

The downturn does not treat the two alike, and income elasticity is the reason one ledger bleeds while the other holds firm.

The Master Key: the high income elasticity of cars magnifies the downturn for the dealer, while the low elasticity of maize flour shelters the miller, so the same fall in incomes ruins one and spares the other.

REAL Question 92

Follow a supermarket chain scouting Arusha: one plot lies in salaried Njiro, another in a ward where most income goes on food, and the board must pick where to build.

Using income elasticity of demand, advise the chain on which site to choose, and why.

A supermarket chain will open one new store in Arusha, stocked with imported and branded goods.

Site 1 - Njiro - a suburb of salaried and business families whose incomes are high and rising.

Site 2 - a low-income ward where most of what households earn is spent on basic food.

The board must choose a single site.

Model Answer

The chain should choose the Njiro site, because a store of income-elastic goods thrives where incomes are high and rising and would struggle where nearly all income is already claimed by necessities.

What the shelves are stocked with: imported and branded goods are largely income-elastic, with an income elasticity above one, so the quantity bought rises more than in proportion as customers' incomes grow. Such a store lives on discretionary spending.

Why Njiro fits: in a suburb of high and rising incomes, families have income left over once the essentials are met and spend a growing share of it on exactly the branded and imported goods the store carries. The site's income profile matches the store's income sensitivity.

Why the low-income ward does not: where most of what households earn goes on maize, oil and soap, there is little income to spare for income-elastic goods, so demand for the store's stock would be thin however large the surrounding population.

Reading the direction of incomes: because incomes in Njiro are not only high but rising, the store also buys into future growth, for each shilling of new income there will flow disproportionately toward the income-elastic goods on its shelves.

Income elasticity turns the siting question into a matching exercise, and the match points clearly to Njiro.

The Master Key: a store of income-elastic goods belongs where incomes are high and rising, so income elasticity sends the chain to Njiro rather than the low-income ward.

HOT Question 93

An entrepreneur swears the smart money in shaky times sits in luxuries; a cautious banker retorts that only necessities outlast a downturn. Which has read the cycle right?

In an uncertain economy, is a firm better off producing luxuries or necessities? Assess the case using income elasticity of demand.

Model Answer

In an uncertain economy the producer of necessities holds the safer position, but being "better off" trades that safety against the richer rewards a luxury producer reaps in the good years, so the honest answer is a judgement rather than a rule.

The case for necessities: a necessity has a low income elasticity, so its demand holds firm whether incomes rise or fall. Its maker is cushioned against downturns and can count on a floor of sales, which under uncertainty is worth a great deal.

The case for luxuries: a luxury has a high income elasticity, so in a boom its sales race ahead and its margins are often fatter than a necessity ever earns. The upside in the good years can be large, and a firm willing to bear risk may prize it.

Where the balance tips under uncertainty: the sharper the uncertainty, the more a low and steady demand is worth, because a luxury producer who cannot foresee the next downturn may be caught with stock, debt and idle capacity when incomes suddenly fall. Safety gains value precisely when the future is unclear.

The shrewd middle path: a firm need not choose only one, for it can spread across goods of different income elasticities, or even add an inferior good whose demand actually rises when incomes fall, so that the slump years help to carry the boom years. Diversification tames the cycle better than either extreme alone.

So necessities are the safer harbour in troubled times and luxuries the richer prize in calm ones, and the wisest firm reads its own appetite for risk before it reads the market.

The Master Key: necessities offer safety and luxuries offer upside, so under uncertainty the low-elasticity producer is better protected, though the soundest course is to spread across income elasticities rather than bet on one.

HOT Question 94

A planner in Dodoma wants income elasticity to steer the whole development plan, forecasting the goods a richer Tanzania will crave; an older economist warns the tool can lead a nation astray.

Assess the claim that a government should use income elasticity of demand to guide its national development strategy.

Model Answer

Income elasticity is a genuinely useful compass for a development strategy because it forecasts how the pattern of demand will change as a nation grows richer, yet it is a compass and not a map, and a plan that trusts it alone will lose its way.

The strength of forecasting the structure of demand: as national income rises, income elasticity predicts that spending will shift away from low-elasticity staples toward high-elasticity manufactured goods, durables and services. A planner who knows this can steer investment toward the industries a richer Tanzania will demand rather than the ones it is outgrowing.

The strength of timing and targeting: income elasticity also shows which sectors will grow fastest for a given rise in income, helping planners time the roads, training and credit that new industries need so that supply is ready before the demand arrives rather than after.

The weakness that elasticities do not stand still: an income elasticity measured today need not hold tomorrow, for a good that is a luxury at low incomes can become an everyday necessity, and a staple can slip into an inferior good as incomes climb. A strategy built on fixed numbers may misread the very change it is trying to plan for.

The weakness that income elasticity is not the whole story: it describes what people will want, not what the country can supply, nor how the gains are shared. Uneven income growth, the limits of local production, food security and the environment all press claims that income elasticity is silent upon, and a low-elasticity staple may still deserve protection for the sake of a secure food supply.

Used as one instrument among several, income elasticity sharpens a development plan; treated as the whole plan, it flatters the forecaster and misleads the nation.

The Master Key: income elasticity is a valuable guide to how demand will shift as incomes grow, but it must be joined to supply, equity and food-security judgements, so it should inform a development strategy without dictating it.

Cross-price elasticity of demand

The first two members of this family watched a good answer to its own price and to the buyer's income. Cross-price elasticity turns the gaze sideways, asking how the quantity demanded of one good stirs when the price of a different but related good moves. Its special gift is a sign: a positive value reveals substitutes that compete, a negative value reveals complements used together, and a zero reveals goods that are strangers to each other. You will fix the definition and its two percentages, learn to read first the sign and then the size that measures how close the bond runs, and work fresh cases from a kiosk in Mwanza to a supermarket till until a shelf of shillings collapses into one telling number.

BINDER Question 95

Raise the price of beef in Arusha and something odd happens two stalls away: the chicken seller suddenly runs short. Her own price never moved, yet her queue grew, and economics keeps one measure for that borrowed reaction.

Define cross-price elasticity of demand and state what it measures.

Model Answer

Cross-price elasticity of demand measures how strongly the quantity demanded of one good responds, in proportionate terms, to a change in the price of a second, related good.

The reaction it captures: it records the responsiveness of the quantity demanded of a good, call it X, when nothing about X itself changes except that the price of some other good Y rises or falls. The good's own price is held still, and only the neighbour's price is allowed to move.

Why the goods must be related: the measure only carries meaning when the two goods are linked in the buyer's mind, as substitutes she can swap between or as complements she uses together. Between two goods with no link at all the reaction is nil.

What the number then reveals: the value that emerges carries a sign and a size, and from those two facts alone you can name the relationship between the goods and judge how close it runs.

So where price elasticity looks inward at a good's own price, cross elasticity looks sideways, asking how the fortunes of one good are tied to the price of another.

The Master Key: cross-price elasticity is the proportionate responsiveness of one good's quantity demanded to a change in the price of a related good.

BINDER Question 96

A shopkeeper senses that dearer bread empties his butter shelf, but a hunch will not settle an argument. To turn the feeling into a figure he needs two percentages and the fraction that joins them.

State the formula for cross-price elasticity of demand and show the two percentage changes it is built from.

Model Answer

Cross-price elasticity is found by dividing the percentage change in the quantity demanded of good X by the percentage change in the price of the related good Y.

The defining ratio: the measure sets the proportionate change in one good's quantity over the proportionate change in the other good's price, written compactly as follows.

$$e_c^d = \frac{\%\Delta Q_X^d}{\%\Delta P_Y}$$

The top line, spelled out: the numerator is the change in the quantity of X taken as a fraction of the quantity you started with, then turned into a percentage.

$$\%\Delta Q_X^d = \frac{Q_X^1 - Q_X^0}{Q_X^0} \times 100$$

The bottom line, spelled out: the denominator is the change in the price of Y taken as a fraction of the price you started with, likewise turned into a percentage.

$$\%\Delta P_Y = \frac{P_Y^1 - P_Y^0}{P_Y^0} \times 100$$

The working form: folding the two percentages together gives the point formula, which multiplies the ratio of the raw changes by the starting price over the starting quantity, and this is the version you compute with.

$$e_c^d = \frac{\Delta Q_X^d}{\Delta P_Y} \times \frac{P_Y^0}{Q_X^0}$$

Keep the two labels straight - X is the good whose sales you are watching, Y is the good whose price you are moving - and the fraction will always point the right way.

The Master Key: cross elasticity is the percentage change in one good's quantity demanded over the percentage change in a related good's price, or equally the raw change ratio times the starting price over the starting quantity.

BINDER Question 97

Two price rises, two very different endings: when petrol costs more the car showroom quietens, but when beef costs more the chicken stall fills. The direction taken by the second good hides the whole secret of the relationship.

Explain how the sign of cross-price elasticity classifies the relationship between two goods.

Model Answer

The sign of the cross-elasticity number classifies the relationship between the two goods: a positive value means substitutes, a negative value means complements, and a zero means the goods are unrelated.

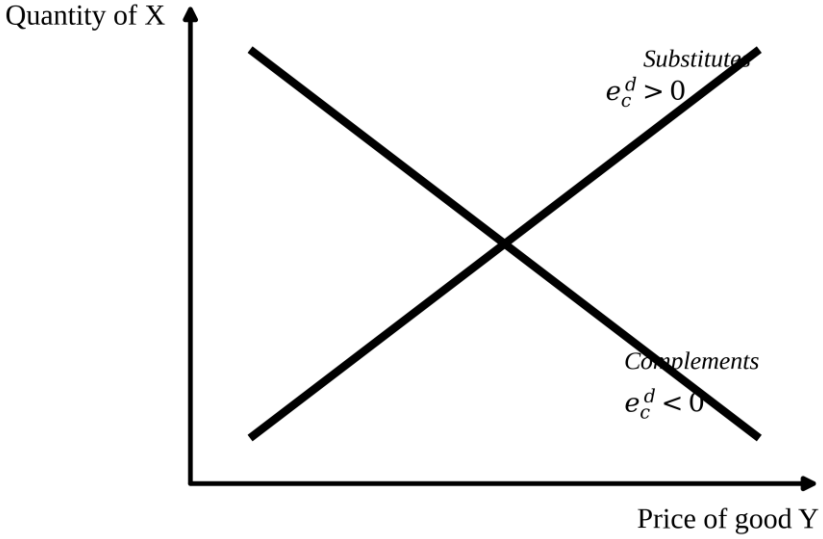


Figure 4.12: *Cross-price elasticity: substitutes slope upward, complements slope downward*

A positive value: substitutes: when a rise in the price of Y raises the quantity demanded of X, the two move in step and $e_c^d > 0$. The goods are substitutes, also called competitively demanded, because buyers driven from the dearer good flock to its rival, as with beef and chicken or Coca-Cola and Pepsi.

A negative value: complements: when a rise in the price of Y lowers the quantity demanded of X, the two move in opposite directions and $e_c^d < 0$. The goods are complements, also called jointly demanded,

because they are consumed together, so dearer petrol drags down car use and dearer airtime dampens phone sales.

A zero value: unrelated goods: when a change in the price of Y leaves the quantity of X untouched, $e_c^d = 0$ and the goods are independent, their fortunes meeting only by coincidence, as with tea and cement.

Read the figure the same way: in the plane of the quantity of X against the price of Y, the substitute line climbs while the complement line falls, and a flat line would show goods that ignore one another.

The Master Key: a positive cross elasticity signals substitutes, a negative one signals complements, and a zero one signals unrelated goods.

BINDER Question 98

Coca-Cola and Pepsi trade blows over every shilling, while Coca-Cola and a loaf of bread barely notice each other. Both pairs may share a sign, yet one bond is tight and the other loose, and only the size of a number can tell them apart.

Explain what the magnitude of cross-price elasticity, as distinct from its sign, tells you about two goods.

Model Answer

While the sign of cross elasticity names the relationship, the size of the number measures how close that relationship runs.

A large positive value: near-perfect substitutes: the further a positive cross elasticity climbs above zero, the more readily buyers swap one good for the other, so two products that are almost interchangeable, like Coca-Cola and Pepsi, show a high positive value.

A large negative value: strong complements: the further a negative cross elasticity falls below zero, the more tightly the two goods are yoked in use, so a machine and the fuel it cannot run without show a strongly negative value.

A value near zero: only a faint link: as the number shrinks toward zero from either side, the bond loosens, until goods that are barely related, like a soft drink and a bag of cement, sit almost on top of zero.

So the sign and the size work as a pair - the sign tells you which of the three relationships you are in, and the size tells you how firmly the two goods are bound within it.

The Master Key: the sign of cross elasticity fixes the kind of relationship while its distance from zero measures the closeness, from near-perfect substitutes through faint links to strong complements.

BINDER Question 99

A charcoal seller in Iringa drops her price, and by nightfall the firewood vendor beside her has sold far fewer bundles than the day before. Put the four figures into one fraction and the quiet rivalry becomes a single number.

Compute the cross-price elasticity of demand for firewood with respect to the price of charcoal, and interpret its sign.

Iringa, cooking-fuel market, one week.
Price of charcoal: falls from 1,000 to 800 shillings a tin.
Quantity of firewood demanded: falls from 200 to 180 bundles a day.

Model Answer

With the figures in hand, the cross elasticity works out to a positive 0.5, which shows charcoal and firewood to be substitutes.

Set out the two percentage changes: take firewood as the good X whose quantity you track and charcoal as the related good Y whose price moves. The quantity of firewood falls from 200 to 180, and the price of charcoal falls from 1,000 to 800.

$$\%\Delta Q_X^d = \frac{180 - 200}{200} \times 100 = -10\%$$

$$\%\Delta P_Y = \frac{800 - 1{,}000}{1{,}000} \times 100 = -20\%$$

Divide to reach the coefficient: dividing the quantity change by the price change gives the cross elasticity.

$$e_c^d = \frac{-10\%}{-20\%} = 0.5$$

Read the sign, then the size: the two minus signs cancel, so the result is positive, and a positive cross elasticity means substitutes. Because cheaper charcoal lured households away from firewood, the two fuels compete for the same cooking fire, while the size, 0.5, says the substitution is real but moderate rather than fierce.

Notice that both figures fell together, and it is exactly that shared direction - price and quantity moving the same way - that produces the positive sign of substitutes.

The Master Key: a cross elasticity of positive 0.5 shows charcoal and firewood to be moderate substitutes, since the quantity of one and the price of the other moved in the same direction.

BINDER Question 100

A phone dealer prices his handsets one week and his airtime bundles the next, never guessing that the two decisions are secretly chained. A single elasticity would have told him which of his lines rise and fall as partners.

Explain the practical uses of cross-price elasticity of demand to a firm.

Model Answer

Cross elasticity earns its keep by guiding two practical decisions: how to price goods that sell as partners, and how to tell whether two products truly compete.

Pricing linked product lines: a firm selling complements, which carry a negative cross elasticity, knows that cutting the price of one lifts demand for the other. A dealer who lowers handset prices should therefore expect airtime and accessory sales to climb, and can price the pair as a package rather than in isolation.

Drawing the boundary of an industry: a large positive cross elasticity between two products means buyers treat them as rivals, so they belong in the same market. TECNO, Samsung and Apple handsets show high positive cross elasticities among themselves, and are counted as one competitive industry.

Ranking rivalry and partnership by strength: because the size of the coefficient measures closeness, a manager can judge which rival's price change threatens him most, or which complement would most reward a joint promotion, instead of guessing.

So a single cross-elasticity figure quietly informs both the price a firm sets and the list of rivals it must watch.

The Master Key: cross elasticity guides a firm's pricing of partner goods and identifies which products share an industry, because its sign shows the link and its size shows the strength.

REAL Question 101

Follow the crates at a lakeside duka in Mwanza. In the week Coca-Cola lifted its price from 500 to 600 shillings, the Pepsi standing beside it climbed from 200 to 260 bottles sold.

Calculate the cross-price elasticity of demand for Pepsi with respect to the price of Coca-Cola, and say what the result reveals about the two drinks.

A lakeside duka in Mwanza, one trading week.
Price of Coca-Cola: rises from 500 to 600 shillings a bottle.
Quantity of Pepsi demanded: rises from 200 to 260 bottles.

Model Answer

The cross elasticity comes to a positive 1.5, a firmly positive figure that shows Coca-Cola and Pepsi to be close substitutes.

The two percentage changes: Pepsi is the good X whose quantity is tracked, and Coca-Cola the related good Y whose price rises. Pepsi sales climb from 200 to 260 bottles while the Coca-Cola price climbs from 500 to 600 shillings.

$$\%\Delta Q_X^d = \frac{260 - 200}{200} \times 100 = 30\%$$

$$\%\Delta P_Y = \frac{600 - 500}{500} \times 100 = 20\%$$

The coefficient: dividing the quantity change by the price change gives the value.

$$e_c^d = \frac{30\%}{20\%} = 1.5$$

What the sign and size say together: the sign is positive, so the drinks are substitutes: shoppers put off by the dearer Coca-Cola simply reached for Pepsi instead. The size exceeds one, which tells you the switch is brisk and the two colas are very close rivals, near the top of the substitute scale.

For the bottler this is a warning and a weapon at once, since every shilling added to a rival's price flows visibly onto its own shelf.

The Master Key: a cross elasticity of positive 1.5 places Coca-Cola and Pepsi firmly among close substitutes, buyers switching briskly from the dearer drink to the cheaper.

REAL Question 102

Read the till roll at Mwamvua supermarket. When Milky Bread went from 2,500 to 3,000 shillings a loaf, the Tamu Butter on the next shelf slipped from 120 to 100 packets a day.

Work out the cross-price elasticity of demand for Tamu Butter with respect to the price of Milky Bread, and interpret the sign with care.

Mwamvua supermarket, daily till roll.
Price of Milky Bread: rises from 2,500 to 3,000 shillings a loaf.
Quantity of Tamu Butter demanded: falls from 120 to 100 packets a day.

Model Answer

The cross elasticity works out to a negative 0.83, and that minus sign shows Milky Bread and Tamu Butter to be complements, bought and used together.

The two percentage changes: Tamu Butter is the good X whose quantity is tracked, and Milky Bread the related good Y whose price rises. Butter sales fall from 120 to 100 packets while the bread price rises from 2,500 to 3,000 shillings.

$$\%\Delta Q_X^d = \frac{100 - 120}{120} \times 100 = -16.67\%$$

$$\%\Delta P_Y = \frac{3{,}000 - 2{,}500}{2{,}500} \times 100 = 20\%$$

The coefficient: dividing the quantity change by the price change gives the value.

$$e_c^d = \frac{-16.67\%}{20\%} = -0.83$$

Handling the sign: here the quantity fell while the price rose, so the two moved in opposite directions and the ratio is negative. A negative cross elasticity means complements: dearer bread meant fewer loaves bought, and with fewer loaves the household needed less butter to spread, so butter sales sank alongside. The size, 0.83, shows a fairly strong partnership, though still short of one.

The single minus sign carries the whole message - drop it and you would wrongly file two inseparable partners as rivals.

The Master Key: a cross elasticity of negative 0.83 shows Milky Bread and Tamu Butter to be complements, the rise in one good's price pulling down the other good's quantity.

REAL Question 103

At a Dodoma wholesaler the price of a bag of cement jumped from 12,000 to 15,000 shillings, and through the same fortnight the sugar sold on the opposite counter held stubbornly at 200 kilograms a day.

Determine the cross-price elasticity of demand for sugar with respect to the price of cement, and explain what your answer says about the two goods.

A Dodoma wholesaler, over one fortnight.
Price of cement: rises from 12,000 to 15,000 shillings a bag.
Quantity of sugar demanded: holds at 200 kilograms a day.

Model Answer

The cross elasticity is exactly zero, which shows cement and sugar to be unrelated goods whose demands move independently.

The two percentage changes: sugar is the good X whose quantity is tracked, and cement the related good Y whose price rises. Sugar sales do not budge from 200 kilograms while the cement price climbs from 12,000 to 15,000 shillings.

$$\%\Delta Q_X^d = \frac{200 - 200}{200} \times 100 = 0\%$$

$$\%\Delta P_Y = \frac{15{,}000 - 12{,}000}{12{,}000} \times 100 = 25\%$$

The coefficient: a numerator of zero settles the matter at once, whatever the denominator beneath it.

$$e_c^d = \frac{0\%}{25\%} = 0$$

Reading the zero: a zero cross elasticity means the goods are neither substitutes nor complements but independent, so what happens to the price of cement has no bearing on how much sugar a household buys. Be careful, though, that a figure merely close to zero rather than exactly zero would signal goods that are only faintly related, not perfectly separate.

Zero is therefore the quiet middle of the scale, the point at which the upward line of substitutes and the downward line of complements both flatten into indifference.

The Master Key: a cross elasticity of zero shows cement and sugar to be unrelated goods, a change in one price leaving the other good's quantity wholly unmoved.

HOT Question 104

The morning EWURA raised the pump price of petrol, a columnist declared the car dealers of Dar finished, since petrol and cars go together and one now cost more. An economist read the same page and reached for a calculator, unconvinced.

'Now that EWURA has raised the pump price of petrol, the car dealers of Dar are finished, for petrol and cars go together.' Assess how far cross-price elasticity of demand supports so strong a claim.

Model Answer

Cross elasticity supports the direction of the claim but not its drama, because petrol and cars are indeed complements yet the strength of that link is far too weak to finish an industry.

The grain of truth in the claim: petrol and cars are genuine complements, jointly demanded, so their cross elasticity is negative and a rise in the fuel price does pull the quantity of cars demanded downward. To that extent the columnist has the sign right.

Why the magnitude undercuts the drama: the size of that negative cross elasticity is small, because fuel is only a modest running cost set against the price of the car itself. A buyer choosing a vehicle weighs its

purchase price and his income far more heavily than the pump, so the quantity of cars barely flinches, and the word finished wildly overstates a gentle nudge.

The other elasticities crowding in: car demand answers chiefly to income and to the car's own price, so its income elasticity and own-price elasticity dwarf this cross effect. Reading the fuel price alone, while ignoring incomes, credit and the flood of used imports, mistakes one small influence for the whole story.

The ceteris paribus and time cautions: cross elasticity holds every other thing still, which the real market never does, and it is measured at a single point that can shift. Over a longer horizon buyers may drift toward fuel-thrifty models rather than abandon cars altogether, softening the effect still further.

So the honest verdict splits the claim in two: the sign is sound and dearer petrol does lean against car sales, but the magnitude is slight, and cross elasticity gives no warrant for predicting collapse.

The Master Key: a negative cross elasticity confirms petrol and cars as complements, yet its small size shows a fuel price rise can only dent, never destroy, the demand for cars.

Importance and applications of cross elasticity of demand

A number earns its keep only when someone puts it to work, and cross elasticity of demand is put to work the moment two goods must be priced, grouped or judged together. This section turns the sign of e_c^d into action. You will see how a seller of complements cuts the price of one good to move the other, how a strong positive reading draws the boundary of an industry and warns a firm what it dare not charge, and how a competition authority leans on the same figure to decide who truly competes. You will also follow a single price change as it ripples along the shelves of related goods, and weigh where the measure, used alone, can quietly mislead.

BINDER Question 105

At a stall in Mtwara the razor is almost a gift, while the blades that follow it home are where the seller has hidden the price. The near-gift is not kindness but arithmetic, and the arithmetic has a name.

Explain how a firm that sells two complementary goods can use cross elasticity of demand to price them.

Model Answer

A firm that sells two jointly-demanded goods can deliberately cut the price of one to lift the demand for the other, because their strongly negative cross elasticity turns a cheaper partner into a busier product line.

The sign that makes it work: complements are jointly demanded, so their cross elasticity is negative, $e_c^d < 0$. A fall in the price of one good then raises the quantity demanded of the other, which is exactly what the defining ratio records.

$$e_c^d = \frac{\%\Delta Q_X^d}{\%\Delta P_Y}$$

The strategy it licenses: because the two goods travel together, the firm need not profit on each one separately. It can price a printer low to move a long run of cartridges, or sell a smartphone modestly to earn on the airtime bundles bought month after month, letting the partner good carry the profit.

Why the size guides the cut: the stronger the negative reading, the more a given price cut on one good swells demand for the other, and the bolder the firm can afford to be. A weak coefficient warns that the cut would move little, so the same tactic would only bleed revenue.

So the seller reads the sign to know the tactic and reads the size of the coefficient to know how far to push it, pricing the pair as one decision rather than two.

The Master Key: with complements the cross elasticity is negative, so a firm cuts the price of one good to drive the demand and the profit of its partner.

BINDER Question 106

Ask a phone seller in Arusha to name her rivals and she reaches for no rulebook; she simply watches which shops fill up the moment she lifts her own price.

Explain how cross elasticity of demand is used to define the boundary of an industry and to measure the rivalry between firms.

Model Answer

A high positive cross elasticity identifies two goods as close substitutes that belong in the same industry, and the same figure measures how fiercely their sellers compete for one another's buyers.

Positive readings draw the boundary: when $e_c^d > 0$ and large, a rise in the price of one good sends buyers streaming to the other, which can only happen if the two are close substitutes. Samsung, Apple and TECNO handsets, or Coca-Cola and Pepsi, are filed in one industry precisely because their cross elasticities with each other are high and positive.

The size measures rivalry: the larger the positive coefficient, the more readily buyers desert one seller for another, so the figure is a direct gauge of how substitutable, and therefore how competitive, the two products are.

The rein it puts on pricing: a firm whose product has a high positive cross elasticity with a rival's cannot lift its price freely, because buyers would switch and its sales would drain away. A near-zero cross elasticity, by contrast, tells a firm that its good stands more or less alone and its pricing hand is far freer.

The coefficient therefore does two jobs at once: it sorts goods into industries and it tells each seller how tightly its rivals hold its price in check.

The Master Key: a high positive cross elasticity places goods in the same industry and measures the rivalry that stops any one seller from raising price at will.

BINDER Question 107

When EWURA lifts the pump price of diesel, the change refuses to stay at the fuel station; it climbs onto the daladala and walks along the shelves of a dozen related goods.

Explain how cross elasticity of demand helps a firm or a government forecast the knock-on effects of a change in the price of one good.

Model Answer

Cross elasticity lets a decision-maker trace how a change in the price of one good ripples outward to its complements and its substitutes, turning a single price move into a map of predictable knock-on effects.

Following the complements: a good with a negative cross elasticity moves against the price that changed, so when a fuel levy raises the price of diesel, demand for its complements, such as transport and the goods that must be carried to market, falls with it. A firm can foresee the dip before it arrives.

Following the substitutes: a good with a positive cross elasticity moves with the price that changed, so the same dearer diesel pushes buyers toward substitutes, favouring a crowded bus over a private car or a nearer market over a distant one. Demand for the rival good climbs.

Why the size matters too: a large coefficient warns that the ripple will be strong and worth planning for, while a small one says the disturbance will soon fade. The number tells the planner which knock-on effects deserve attention and which can be ignored.

Armed with the sign and the size, a firm can stock ahead of a shift in demand and a government can anticipate where a levy will land next, instead of being taken by surprise.

The Master Key: cross elasticity forecasts the ripple of a price change, negative for complements that fall with it and positive for substitutes that rise, and its size shows how strong the ripple will be.

REAL Question 108

Walk the aisles of a supermarket in Mwanza and notice the loaf of bread marked down hard this week, while the tub of butter beside it holds its price. Read the shelf and the plan behind the discount appears.

Using cross elasticity of demand, explain the supermarket's decision to cut the price of the bread and how it expects the butter shelf to respond.

Model Answer

The supermarket cuts the bread price to exploit a strongly negative cross elasticity between bread and butter, expecting the cheaper loaf to pull extra packets of butter off the neighbouring shelf.

Reading the pairing: bread and butter are jointly demanded, spread together at breakfast, so their cross elasticity is negative. A fall in the price of bread raises the quantity of bread bought, and butter is carried along in its wake.

The tactic on the shelf: by discounting the loaf the store draws shoppers to buy more bread, and because butter completes the meal, more butter leaves its shelf at an unchanged price. The thin margin surrendered on the cheap bread is repaid by the fuller margin kept on the butter.

Why the store watches the coefficient: the plan pays only if the negative cross elasticity is strong enough that a modest bread discount lifts butter sales substantially. Were the two goods only loosely linked, the markdown would sacrifice bread revenue for very little butter in return.

The marked-down loaf is therefore not a loss but a lure, and the butter shelf is where the store quietly expects to collect its reward.

The Master Key: because bread and butter have a negative cross elasticity, the store discounts one to lift the sales of the other, pricing the pair as a single plan.

REAL Question 109

Vodacom trims the price of a data bundle on Monday, and by Wednesday the kiosks selling Airtel and Tigo lines in Dodoma stand strangely quiet. Trace the missing customers and the reason resolves.

Using cross elasticity of demand, explain why one network's price cut pulls subscribers away from its rivals, and what this reveals about the market they share.

Model Answer

The networks are close substitutes with a high positive cross elasticity, so when Vodacom cuts its bundle price the quantity demanded of its rivals' bundles falls and subscribers migrate toward the cheaper line.

The sign of substitutes: bundles from competing networks satisfy the very same want, so their cross elasticity is positive, $e_c^d > 0$. A fall in the price of one network's bundle lowers the quantity demanded of the others.

Why the pull is so strong: switching networks is cheap and quick, and many buyers keep more than one line already, so the positive coefficient is large. A small price gap shifts a great many subscribers, which is why the rival kiosks empty so fast.

What it reveals about the market: the high positive reading confirms that the networks sit inside a single, closely fought industry. None can raise its price alone without watching its subscribers stream to a competitor, so the coefficient both defines the market and disciplines every price within it.

The quiet kiosks are the cross elasticity made visible: a positive sign, a large size, and a market where no network prices in peace.

The Master Key: a high positive cross elasticity makes rival networks close substitutes, so one firm's price cut drains its competitors' subscribers and no firm can price alone.

HOT Question 110

An officer at the Fair Competition Commission holds two firms' records and a high cross elasticity between their products, and is minded to call them rivals and refuse their merger on that figure alone. A cautious economist asks what a single number leaves out.

Should a competition authority rely on cross elasticity of demand alone to decide whether two firms compete and to block their merger? Discuss.

Model Answer

Cross elasticity is a powerful first test of whether two firms compete, but it is too narrow to carry a merger decision by itself, so an authority should treat it as strong evidence rather than sole proof.

The strength of the measure: a high positive cross elasticity is direct evidence that buyers treat the two firms' products as substitutes, which is the very heart of competing. For sorting goods into the same market, no simpler figure does the job as well.

Why the number is fragile: a cross elasticity is estimated from past behaviour and can shift with fashion, income or the arrival of new sellers. A coefficient measured in a calm year may misjudge rivalry in a changed one, so a lone figure can mislead.

Why rivalry runs wider: firms also compete through quality, branding, service and access to inputs, none of which a demand-side number captures, and a merger may bring lower costs or fresh investment that the same number is silent about. Competition is broader than substitution alone.

The balanced verdict: the authority should open with cross elasticity to define the market and gauge rivalry, then weigh barriers to entry, likely cost savings and the wider public interest before it rules. To lean on the coefficient alone is to answer a broad question with a single narrow instrument.

Used as the opening move, cross elasticity is indispensable; used as the whole case, it asks one number to settle a question that has always needed several.

The Master Key: cross elasticity is the right place to begin a merger judgement and the wrong place to end it, because rivalry runs wider than a single demand-side coefficient.

HOT Question 111

A manager swears by one golden rule: sell the razor cheap, charge dearly for the blades, and let the profit take care of itself. A colleague mutters that the same rule has quietly ruined firms before.

Assess the claim that a firm selling complements should always price one good low and take its profit on the other.

Model Answer

The tactic is sound when the two goods are tightly bound and the firm controls the profitable one, but as an unconditional rule it is unsafe, so its wisdom turns on the strength of the cross elasticity and the firm's grip on the partner good.

Why the rule often works: when the cross elasticity is strongly negative, a cheap first good draws in buyers who then return again and again for the profitable partner, as with a low-priced printer and its steady stream of cartridges. It is the lifetime of the pair, not the first sale, that carries the profit.

The danger of a loose link: if the negative coefficient is weak, the cheap good fails to pull enough of the partner along, and the firm merely surrenders margin on one good for too little gain on the other. The rule quietly assumes a tight bond that is not always present.

The danger of losing the partner: the tactic collapses when buyers can source the profitable good elsewhere. A cheap printer earns nothing if refilled or rival cartridges are freely on sale, so the firm must fence off the partner good or watch the whole plan unravel.

The measured verdict: the strategy is a strong tool rather than a golden rule. It rewards the firm that has checked the coefficient is strongly negative and secured the follow-on sales, and it punishes the firm that discounts on faith.

Sell the razor cheap by all means, but only once you are sure the blades are firmly tied to it and cannot be bought from anyone else.

The Master Key: pricing one complement low to profit on the other works only when the cross elasticity is strongly negative and the profitable good is locked to the firm, so it is a conditional tactic and not a universal law.

Price elasticity of supply: meaning and measurement

Demand has now had its full measure taken; supply steps forward to be measured in the very same way. Price elasticity of supply asks the mirror question: when a good's own price moves, by what proportion does the quantity offered for sale answer back? Here you will meet the formula that pins that question down, learn to work each half of it from a before-and-after pair of figures, and follow real Tanzanian scenes from raw shillings to a finished coefficient. You will also see why this answer, unlike its demand-side cousin, almost always arrives wearing a plus sign, and how to read the size that follows as elastic, inelastic or the knife-edge unit-elastic case between.

BINDER Question 112

When the farm-gate price of maize climbs, more sacks somehow find their way to the Iringa depot by month's end. Economics keeps one precise word for how eagerly that extra supply answers the price.

Define price elasticity of supply.

Model Answer

Price elasticity of supply is the degree of responsiveness of the quantity supplied of a good to a change in the good's own price, all other things held constant.

The responding quantity: the thing that reacts is the quantity supplied of the good itself. Price elasticity of supply watches how many kilos, litres or units producers offer for sale as the reaction unfolds.

The cause it isolates: the only permitted cause of the reaction is a change in the good's own price. The cost of inputs, the state of technology and the number of firms are all frozen, which is exactly what ceteris paribus means here.

Why own price and nothing else: by holding every other influence still, the measure traces the whole of the quantity change to the price change alone, so any number it reports can be read as pure price responsiveness on the supply side.

So price elasticity of supply is not just supply reacting in a vague way, but a precise pairing: the proportionate change in quantity supplied set against the proportionate change in that good's own price, with the rest of the market kept quiet.

The Master Key: price elasticity of supply measures how strongly the quantity supplied of a good responds to a change in its own price, holding everything else constant.

BINDER Question 113

Two millers both boast that higher prices brought them more output, but more settles nothing. To measure how eagerly supply answered, you need two percentages and a single division.

State the formula for price elasticity of supply and show how each percentage in it is calculated.

Model Answer

Price elasticity of supply is found by dividing the percentage change in quantity supplied by the percentage change in price.

$$e_p^s = \frac{\%\Delta Q^s}{\%\Delta P}$$

The top line: the numerator is the percentage change in quantity supplied, worked out as the change in quantity over the starting quantity, times one hundred.

$$\%\Delta Q^s = \frac{Q_1^s - Q_0^s}{Q_0^s} \times 100$$

The bottom line: the denominator is the percentage change in price, worked out in the very same fashion from the starting price.

$$\%\Delta P = \frac{P_1 - P_0}{P_0} \times 100$$

Why each is a percentage of its own start: each change is measured against its own original value, so the shillings and the kilos cancel out before the division even begins. What survives is a pure ratio of two proportions, free of any unit.

Feed any before-and-after pair of prices and quantities into these two lines, divide the first percentage by the second, and the responsiveness of the good's supply stands revealed as a single number.

The Master Key: $e_p^s = \frac{\%\Delta Q^s}{\%\Delta P}$, where each percentage change is the change divided by its own starting value, times one hundred.

BINDER Question 114

Work out a supply elasticity and the answer almost never wears the minus sign that haunts demand. The reason lies in the way a supply curve leans.

Explain why price elasticity of supply is normally positive, and contrast this with the sign of price elasticity of demand.

Model Answer

Price elasticity of supply is normally positive because a supply curve slopes upward, so price and quantity supplied move in the same direction, the exact opposite of the demand side where the two move against each other.

The source of the plus: along an upward-sloping supply curve a rise in price brings a rise in quantity supplied, and a fall in price brings a fall. The two changes always share the same sign, so their ratio is positive.

$$\frac{\Delta Q^s}{\Delta P} > 0$$

The contrast with demand: price elasticity of demand comes out negative, because a downward-sloping demand curve makes price and quantity move in opposite directions. Supply keeps its natural plus sign, so there is no minus to strip away before the value is reported.

The range of the value: the size of price elasticity of supply runs from 0 upward. A value of 0 means quantity supplied does not stir at all when price moves, while larger values mean an ever more eager response, with no fixed ceiling short of ∞.

$$0 \leq e_p^s < \infty$$

So the very sign of the coefficient tells the two elasticities apart: a plus signals the responsiveness of supply, a minus the responsiveness of demand, and only the size that follows tells you how strong either reaction really is.

The Master Key: supply gives a positive e_p^s because price and quantity supplied move together, unlike the negative e_p^d of demand, and its magnitude runs from 0 upward.

BINDER Question 115

At a Dodoma roadside grill the price of a roasted maize cob edges up, and by evening more cobs are turning over the coals. A single coefficient can say just how eager that response was.

Using the point method, show how price elasticity of supply is computed, and interpret the value you obtain.

Roasted maize at a Dodoma grill Price: 400 to 500 shillings per cob Quantity supplied: 200 to 260 cobs per day

Model Answer

The point method reads price elasticity of supply straight from one starting price and quantity together with the changes measured from them; for the maize it gives 1.2, an elastic supply.

Write the changes in full: replace each percentage by its definition, and the formula becomes the ratio of the two raw changes multiplied by the starting price over the starting quantity.

$$e_p^s = \frac{Q_1^s - Q_0^s}{P_1 - P_0} \times \frac{P_0}{Q_0^s}$$

The compact point form: gathering the two raw changes into ΔQ^s and ΔP gives the working form used at a point on the supply curve.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

Substitute the grill's figures: start at $P_0 = 400$ and $Q_0^s = 200$, moving to $P_1 = 500$ and $Q_1^s = 260$, so that $\Delta P = 100$ and $\Delta Q^s = 60$.

$$e_p^s = \frac{60}{100} \times \frac{400}{200} = 0.6 \times 2 = 1.2$$

Interpret the number: because 1.2 is greater than 1, supply is elastic. Put in words, a one per cent rise in price calls forth about a 1.2 per cent rise in quantity supplied, so the vendor answers a dearer price with a proportionately larger tray of cobs.

The point form therefore does two jobs at once: it fixes the exact starting position from which the price sets off, and it turns the raw before-and-after figures into a single, readable measure of how eager the supply response is.

The Master Key: the point form $e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$ gave $1.2 > 1$, so the maize supply is elastic and quantity rises proportionately more than price.

BINDER Question 116

In Mbeya the price of beef leaps from four thousand to seven thousand shillings a kilo, and the butchers bring three times as much to the block. A single number captures the whole surge.

Using the point method, calculate the price elasticity of supply for the beef and interpret your result.

Beef in Mbeya Price: 4,000 to 7,000 shillings per kg Quantity supplied: 50,000 to 150,000 kg per day

Model Answer

The price elasticity of supply for the beef is 2.67, an elastic value, so the quantity supplied rises by proportionately more than the price.

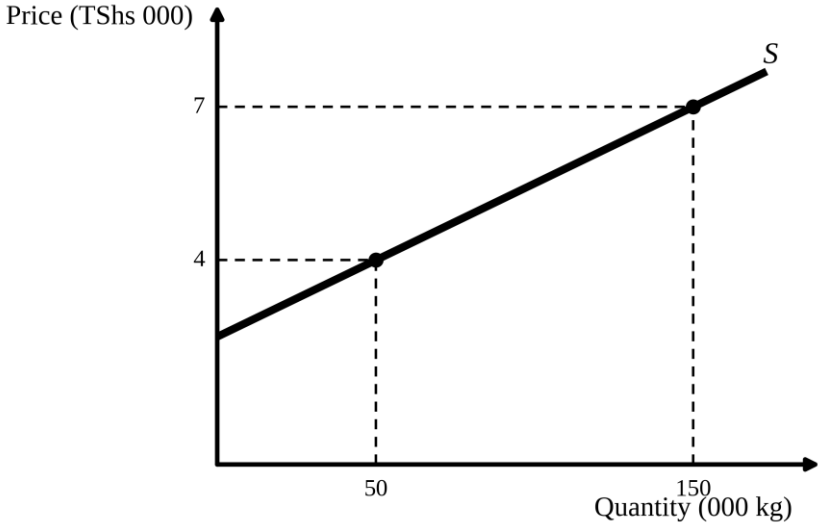


Figure 4.13: *A supply curve with two points used to compute the price elasticity of supply*

Read the two points off the curve: the supply curve rises through a lower point A, where a price of 4,000 draws out 50,000 kg, to an upper point B, where 7,000 draws out 150,000 kg. Taking A as the starting position, $P_0 = 4{,}000$ and $Q_0^s = 50{,}000$, moving to $P_1 = 7{,}000$ and $Q_1^s = 150{,}000$.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

Substitute the figures: insert the two changes over the starting point A.

$$e_p^s = \frac{150{,}000 - 50{,}000}{7{,}000 - 4{,}000} \times \frac{4{,}000}{50{,}000}$$

$$e_p^s = \frac{100{,}000}{3{,}000} \times \frac{4{,}000}{50{,}000}$$

$$e_p^s = 33.33 \times 0.08 = 2.67$$

Interpret the number: because 2.67 is greater than 1, supply is elastic. The 75 per cent price rise called forth a 200 per cent rise in quantity supplied, so each one per cent added to the price brought about 2.67 per cent more beef to the block.

A coefficient well above one is the fingerprint of a supply that can stretch freely: butchers in Mbeya can draw in far more beef when the price makes it worth their while, so quantity outruns price by a wide margin.

The Master Key: $e_p^s = 2.67 > 1$, so the Mbeya beef supply is elastic and quantity supplied rises proportionately more than price.

REAL Question 117

Follow one firewood seller on the Iringa road: when the price of a bundle slips from six hundred to five hundred shillings, the load he bothers to gather shrinks by half.

Calculate the price elasticity of supply for the firewood and interpret what your answer says about this seller.

Firewood bundles on the Iringa road
Price: 600 to 500 shillings per bundle
Quantity supplied: 40 to 20 bundles per week

Model Answer

The price elasticity of supply for the firewood is 3.0, a strongly elastic value, so the seller cuts his quantity by proportionately far more than the price falls.

Fix the starting point and the changes: start at $P_0 = 600$ and $Q_0^s = 40$, moving to $P_1 = 500$ and $Q_1^s = 20$, so that $\Delta P = -100$ and $\Delta Q^s = -20$.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{-20}{-100} \times \frac{600}{40}$$

$$e_p^s = 0.2 \times 15 = 3.0$$

Note the sign and read the size: both the price and the quantity fell, so the two minus signs cancel and the coefficient comes out positive, exactly as supply should. Since 3.0 is well above 1, the supply is elastic.

What it says about the seller: gathering firewood is easily scaled up or down, so when the price slips the seller judges the trek barely worth it and drops his load sharply. A 16.7 per cent fall in price drew a 50 per cent fall in quantity, three times as large in proportion.

The lesson for anyone buying from him is that his supply is nimble: a small price change swings the number of bundles he brings by a great deal more, in proportion, than the price itself moved.

The Master Key: $e_p^s = 3.0 > 1$, so the firewood supply is elastic and quantity supplied moves proportionately much more than price.

REAL Question 118

Follow the cashew of the Mtwara zone: the farm-gate price rises by half in a single season, yet the sacks leaving the villages swell by only a tenth.

Calculate the price elasticity of supply for the cashew and explain why it comes out so low.

Cashew (korosho) in the Mtwara zone
Farm-gate price: 2,000 to 3,000 shillings per kg
Quantity supplied: 800,000 to 880,000 kg per season

Model Answer

The price elasticity of supply for the cashew is 0.2, a firmly inelastic value, so the quantity supplied rises by proportionately far less than the price.

Fix the starting point and the changes: start at $P_0 = 2{,}000$ and $Q_0^s = 800{,}000$, moving to $P_1 = 3{,}000$ and $Q_1^s = 880{,}000$, so that $\Delta P = 1{,}000$ and $\Delta Q^s = 80{,}000$.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{80{,}000}{1{,}000} \times \frac{2{,}000}{800{,}000}$$

$$e_p^s = 80 \times 0.0025 = 0.2$$

Read the size: since 0.2 sits well below 1, the supply is inelastic. A 50 per cent rise in the farm-gate price drew out only a 10 per cent rise in the quantity supplied.

Why it comes out so low: the cashew trees are already planted and their crop is largely set for the season, so a higher price cannot conjure more nuts from them at once. The most a farmer can do within the year is harvest a little more carefully and waste less, which lifts quantity only slightly.

Only over several seasons, once higher prices have coaxed farmers to plant and tend new trees, can supply answer price with any vigour; in the short season the crop is close to fixed, and the coefficient is bound to be small.

The Master Key: $e_p^s = 0.2 < 1$, so the cashew supply is inelastic because a standing crop cannot expand its output within a single season.

REAL Question 119

Read this account of a Singida sunflower mill, whose daily output is logged against the price it can fetch for a litre of oil.

Using the schedule, calculate the price elasticity of supply as the price rises from 2,000 to 2,400 shillings, and interpret the value.

Price (TShs per litre)	Quantity supplied (litres per day)
2,000	400
2,400	480
2,800	540
3,200	580

Model Answer

The price elasticity of supply over this range is 1.0, the knife-edge unit-elastic value, because quantity supplied and price change in exactly the same proportion.

Read the two rows you need: at a price of 2,000 the mill offers 400 litres a day, and at 2,400 it offers 480, so $P_0 = 2{,}000$, $Q_0^s = 400$, $\Delta P = 400$ and $\Delta Q^s = 80$.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{80}{400} \times \frac{2{,}000}{400}$$

$$e_p^s = 0.2 \times 5 = 1.0$$

Interpret the number: a coefficient of exactly 1 is unit elastic. Here the price rose by 20 per cent and the quantity supplied rose by 20 per cent as well, so a one per cent rise in price brings a one per cent rise in quantity supplied.

Why reading it from a schedule matters: the same table lets a producer test any price step in turn, so responsiveness need never be guessed from the shape of a curve when the raw before-and-after figures are sitting in the columns.

Between these two prices, then, the sunflower mill expands its output in step with the price, neither dragging behind it as an inelastic supply would nor outrunning it as an elastic one does.

The Master Key: $e_p^s = 1.0$ over this range, the unit-elastic case, where quantity supplied and price change in the very same proportion.

HOT Question 120

A regional officer promises that a higher price will swell this season's cashew harvest just as surely as it swells a soap factory's output. An economist is not so sure.

To what extent is the officer right that a higher price raises the output of a cashew crop as surely as it raises the output of a soap factory?

Model Answer

The officer is only partly right: a higher price does lift both outputs, since supply responds positively in each case, but it lifts them by very different amounts, so this season's cashew will not swell as surely as the factory's soap.

The grain of truth: both goods obey the law of supply, so a higher price does raise the quantity supplied of each, and the price elasticity of supply is positive on both sides. To that extent the officer is right that price is a genuine lever on output.

Where the claim slips: the officer treats a shared direction as if it were an equal degree. Measurement asks not merely whether output rises but by how much, and on that question the two goods part company sharply.

The nimble factory: the soap factory has spare capacity, ready inputs and a simple, repeatable process, so it can add a shift and lift output quickly. Its supply is elastic, and a modest price rise brings a large rise in quantity.

The fixed crop: the cashew trees are already planted and their nuts largely set for the season, so a higher price cannot draw much more from them at once. Its supply is inelastic in the short season, and even a steep price rise brings only a little more.

Why time is the hidden divider: the gap between the two is rooted in time and the nature of the good. The factory needs only hours to respond, while the crop needs years, for only after new trees are planted and matured can a higher price call forth a much larger harvest.

So the officer is right on the sign and wrong on the size: a higher price is a strong lever on soap and a weak one on this season's cashew, and to call the two responses equally sure is to mistake the shared plus sign for the magnitude that measurement exists to reveal.

The Master Key: both supplies rise with price, so both carry a positive e_p^s, but soap is elastic and this season's cashew inelastic, so a higher price swells factory output far more surely than the crop.

The degrees of price elasticity of supply

Supply answers to price just as demand does, and its answer comes in the same five strengths. At one extreme a supplier will pour out any quantity while the price stands perfectly still; at the other the quantity is frozen and only the price can move. Between them lie the everyday cases, and price elasticity of supply, always a positive number because supply slopes upward, measures exactly where a good falls on that scale. This section teaches you to read each of the five degrees, to attach its coefficient, and above all to recognise it from the picture, because a supply line betrays its elasticity by where it meets the axes.

BINDER Question 121

At the bottling plant's gate the board price never flickers: one crate or a thousand, each leaves at the same shilling, and it would sooner sell none than a cent less.

Explain and illustrate perfectly elastic supply, state its coefficient value, and give a real example.

Model Answer

Perfectly elastic supply is the case where suppliers offer any quantity at one ruling price but nothing at all below it, so its coefficient is infinite, $e_p^s = \infty$, and its curve is a horizontal line.

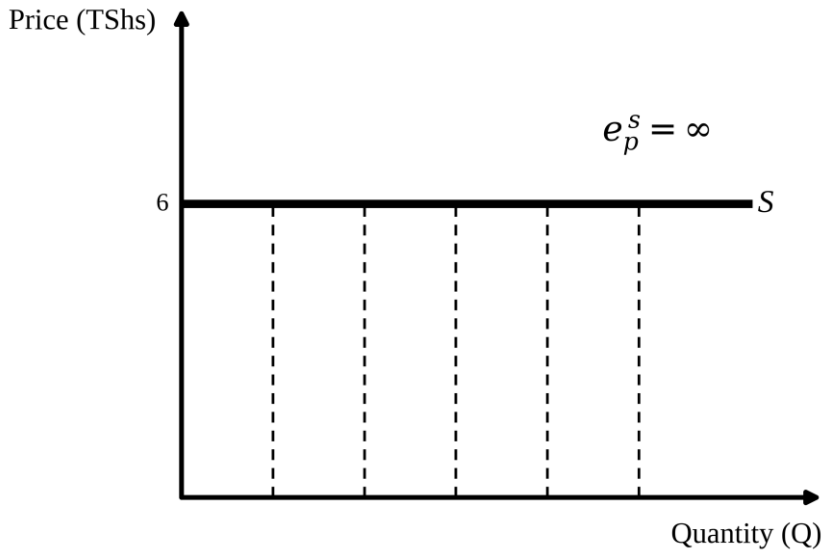


Figure 4.14: *Perfectly elastic supply curve*

The picture: the supply line is drawn flat, parallel to the quantity axis, resting at the single ruling price. Every quantity is offered at that one height, so the curve has no upward tilt at all and stretches away sideways.

Why the coefficient is infinite: at that price the smallest imaginable rise draws out an unlimited extra quantity, while the price itself scarcely moves, so the percentage change in quantity is enormous set against a percentage change in price near zero.

$$e_p^s = \frac{\%\Delta Q^s}{\%\Delta P} = \infty$$

A real example: a good that can be turned out in any amount at the same unit cost, such as bottled water from a plant with plentiful inputs. Because one more unit costs no more than the last, the firm gladly supplies whatever buyers take at the going price and supplies none if the price dips beneath it.

For such a good the market decides the quantity while the price holds still, so every adjustment to a change in demand shows up in quantity and none of it in price.

The Master Key: perfectly elastic supply is a flat line at one price with $e_p^s = \infty$, offering any quantity at that price and none below it.

BINDER Question 122

At a Kigoma auction the bidding climbs and climbs, yet the pile on the table never grows by a single item however high the price is driven.

Explain and illustrate perfectly inelastic supply, state its coefficient value, and give a real example.

Model Answer

Perfectly inelastic supply is the case where the quantity offered is completely fixed and cannot answer a price change at all, so its coefficient is zero, $e_p^s = 0$**, and its curve is a vertical line.**

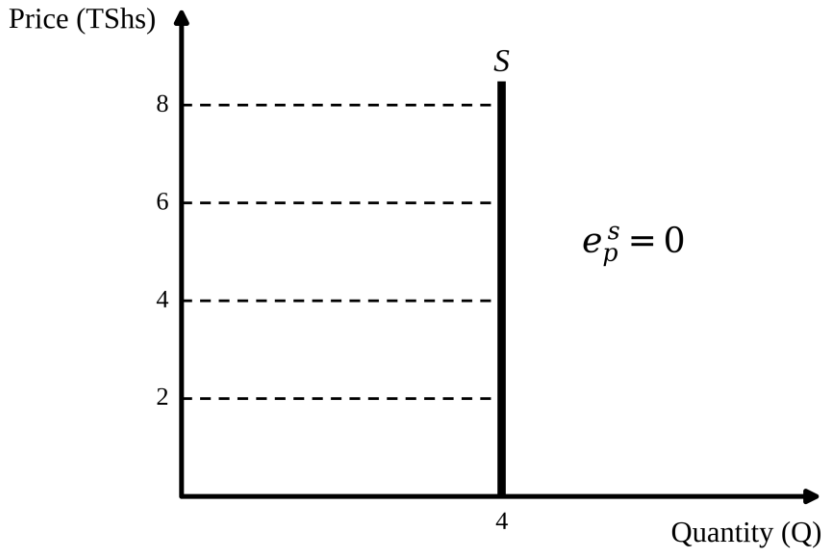


Figure 4.15: *Perfectly inelastic supply curve*

The picture: the supply line stands straight up, parallel to the price axis, pinned to one quantity. Price may travel up or down the line, but the quantity never leaves its single value.

Why the coefficient is zero: however large the percentage change in price, the percentage change in quantity is nil, and zero divided by any number is zero. Let the price double while the quantity stays put, and the ratio collapses to nothing.

$$e_p^s = \frac{0\%}{100\%} = 0$$

Real examples: land, whose total area no price can enlarge, and a harvest already reaped, whose baskets are all ashore before the selling begins. In the moment of sale neither can be added to, whatever price is offered.

With quantity frozen, a rise in demand spends itself entirely on price: the fixed stock simply changes hands at a higher figure.

The Master Key: perfectly inelastic supply is a vertical line at one quantity with $e_p^s = 0$, so price moves but quantity cannot.

BINDER Question 123

A carver in Mto wa Mbu brings twenty pieces at three hundred and thirty at four hundred and fifty; the price and the pieces swell by the very same fraction, as if tied by one string.

Explain and illustrate unitary elastic supply, state its coefficient, and set out the geometric rule that identifies it.

Model Answer

Unitary elastic supply is the case where quantity and price change by exactly the same proportion, so the coefficient is one, $e_p^s = 1$**, and it is drawn as any straight line through the origin whatever its slope.**

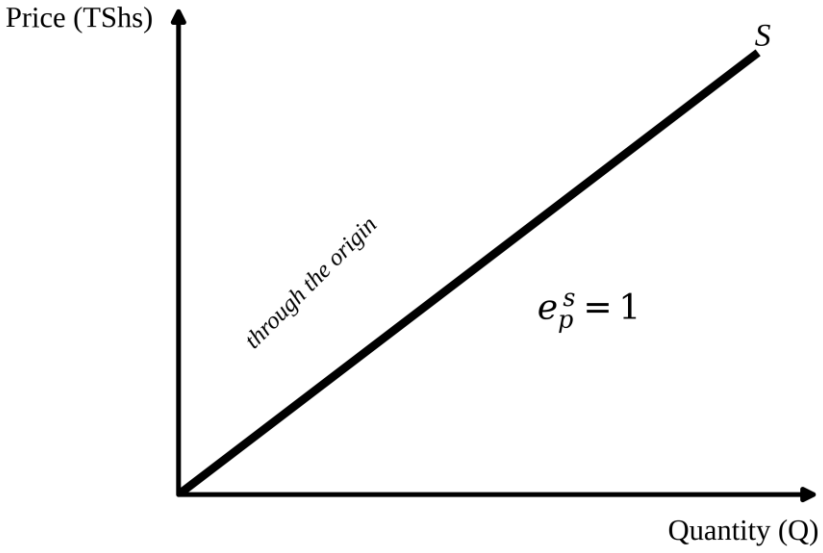


Figure 4.16: *Unitary elastic supply: any straight line through the origin*

The picture and its rule: a straight supply line that, extended, passes through the origin is unit-elastic at every point along it, and this holds whether the line is steep or gentle. The steepness does not matter; passing through the origin is the whole condition.

The computation: with the carver's figures the price rises from 300 to 450 and the quantity from 20 to 30.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{30 - 20}{450 - 300} \times \frac{300}{20}$$

$$e_p^s = \frac{10}{150} \times \frac{300}{20} = 1$$

Why the origin does it: on a line through the origin the ratio P/Q is the same at every point and equals the line's own slope, and since elasticity is P/Q divided by the slope, the two are equal and the answer is always one. Here the line is $P = 15Q$, so $P/Q = 15$ matches the slope of 15, and a 50 per cent rise in price brings exactly a 50 per cent rise in quantity.

Such a supplier expands output in lock-step with price, neither outrunning it nor lagging behind, which is what the coefficient of one records.

The Master Key: unitary elastic supply has $e_p^s = 1$ and is any straight line through the origin, because there P/Q equals the slope at every point.

BINDER Question 124

In a workshop with machines to spare, a modest lift in the order price is met by a rush of extra output that more than matches the rise.

Explain and illustrate elastic supply ($e_p^s > 1$**), state its coefficient with a real example, and say where such a line meets the axes.**

Model Answer

Elastic supply is the case where quantity responds more than in proportion to price, so the coefficient exceeds one, $e_p^s > 1$**, and the supply line, if extended, cuts the price axis**

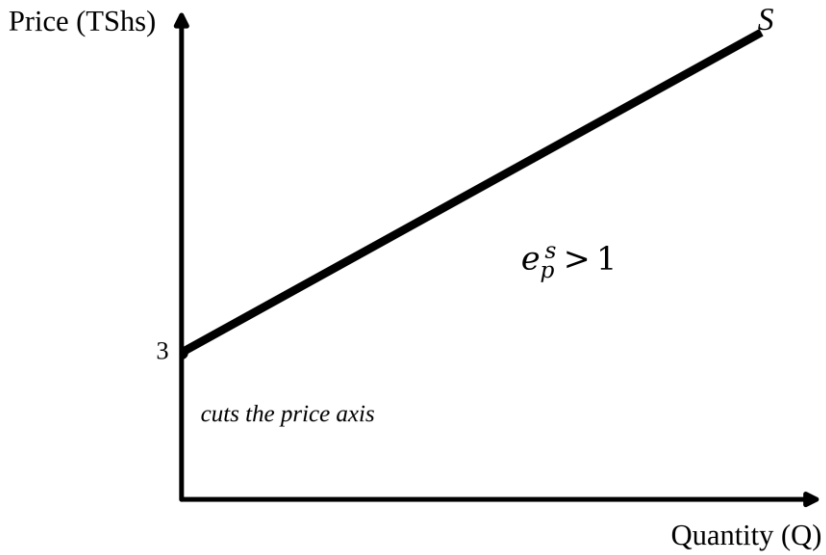


Figure 4.17: *Elastic supply: a straight line cutting the price axis*

The computation: take a good whose price rises from 400 to 500 while the quantity offered rises from 20 to 30.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{30 - 20}{500 - 400} \times \frac{400}{20}$$

$$e_p^s = \frac{10}{100} \times \frac{400}{20} = 2$$

Reading the result: a 25 per cent rise in price brought a 50 per cent rise in quantity, so the response is twice the stimulus and $e_p^s = 2$, comfortably above one. The quantity does the heavy lifting.

Where it meets the axes: traced back, this line strikes the price axis above the origin, a positive price-intercept. Here the line is $P = 200 + 10Q$, meeting the price axis at 200, which is the tell-tale sign of elastic supply.

A real example: a manufactured good made by a simple technique from plentiful inputs, or any firm holding spare capacity and stocks, so output can leap when price rises without a steep climb in unit cost.

For elastic supply a small price incentive calls forth a large extra flow of goods, so the firm that can expand easily gains most from a rising price.

The Master Key: elastic supply has $e_p^s > 1$, quantity outrunning price, and its line cuts the price axis.

BINDER Question 125

Coffee prices may climb, but the trees on the Kilimanjaro slopes were planted years ago; a grower picks a little more keenly, yet cannot conjure new bushes this season.

Explain and illustrate inelastic supply ($e_p^s < 1$), state its coefficient with a real example, and say where such a line meets the axes.

Model Answer

Inelastic supply is the case where quantity responds less than in proportion to price, so the coefficient lies below one, $e_p^s < 1$, and the supply line, if extended, cuts the quantity axis.

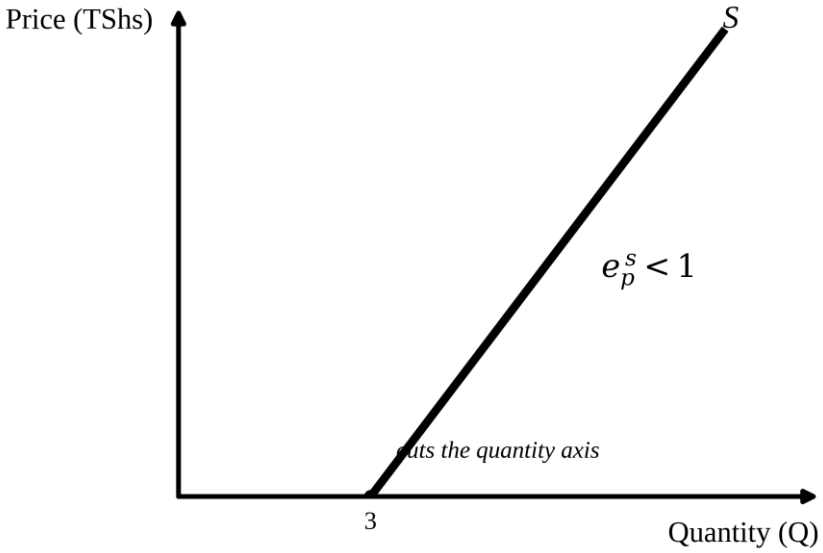


Figure 4.18: *Inelastic supply: a straight line cutting the quantity axis*

The computation: take a good whose price rises steeply from 200 to 400 while the quantity offered creeps from 30 to 40.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{40 - 30}{400 - 200} \times \frac{200}{30}$$

$$e_p^s = \frac{10}{200} \times \frac{200}{30} = \frac{1}{3}$$

Reading the result: a 100 per cent rise in price brought only a 33 per cent rise in quantity, so the response is a third of the stimulus and $e_p^s < 1$. Now the price does the heavy lifting while quantity barely stirs.

Where it meets the axes: traced back, this line strikes the quantity axis to the right of the origin, a positive quantity-intercept. Here the line is $P = 20Q - 400$, meeting the quantity axis at 20, which is the tell-tale sign of inelastic supply.

A real example: a perennial crop such as coffee, whose trees take years to mature, or any good needing heavy fixed investment to expand, so quantity can grow only slowly however tempting the price.

For inelastic supply a large price rise is met by only a small extra quantity, so the good stays scarce and dear until time lets output catch up.

The Master Key: inelastic supply has $e_p^s < 1$, price outrunning quantity, and its line cuts the quantity axis.

BINDER Question 126

Two students draw supply lines of the same steepness; one calls hers elastic, the other his inelastic, and both are right, for the secret is not the tilt but the axis each line cuts.

State and justify the rule that a straight supply line is unitary elastic through the origin, elastic if it cuts the price axis, and inelastic if it cuts the quantity axis.

Model Answer

For a straight supply line the degree of elasticity is fixed not by its slope but by where it meets the axes: through the origin it is unitary elastic, cutting the price axis it is elastic, and cutting the quantity axis it is inelastic.

The one formula behind it: point elasticity of supply is the ratio P/Q divided by the slope of the line, because $\Delta Q^s / \Delta P$ is simply one divided by the slope.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P}{Q}$$

Through the origin, ratio equals slope: a line drawn from the origin has P/Q equal to its own slope at every point, so the two cancel and $e_p^s = 1$ regardless of steepness. A steep ray and a gentle ray alike return one.

Cutting the price axis, ratio beats slope: a line that starts above the origin on the price axis lies so that, at any point on it, the ray from the origin is steeper than the line itself, making P/Q larger than the slope and $e_p^s > 1$.

Cutting the quantity axis, slope beats ratio: a line that starts to the right of the origin on the quantity axis lies so that the ray from the origin is flatter than the line itself, making P/Q smaller than the slope and $e_p^s < 1$.

This is why the eye must read the intercept and not the tilt: a steep line and a gentle line can share any degree, and only the axis a line cuts settles which degree it is.

The Master Key: since e_p^s is P/Q over the slope, the intercept decides: the origin gives one, a price-axis cut gives more than one, and a quantity-axis cut gives less than one.

REAL Question 127

Read two cases: at the Mwanza shore the night's dagaa lie landed and drying, every basket that will exist today already ashore; and in central Dodoma a surveyor pegs the last vacant plot the city centre will ever hold.

Classify the supply of (i) freshly caught Lake Victoria dagaa that must sell before the day is out and (ii) a plot of land in central Dodoma by degree of price elasticity of supply, and justify each.

Model Answer

Both supplies are perfectly inelastic, each a vertical line with $e_p^s = 0$, because in each case the quantity is wholly fixed and no price, however high, can add to it.

The landed dagaa: the catch is already reaped and will spoil by nightfall, so the number of baskets is settled before trading even starts. A higher price cannot summon another fish from the lake in the hours left, so the quantity supplied today holds at its single value and $e_p^s = 0$.

The Dodoma plot: the land at the centre of the city is fixed by nature and by the map, so however the rent is bid up, not one extra central plot can be created. The quantity is frozen at what already exists, and again $e_p^s = 0$.

One degree, two reasons: the same coefficient arises from two different causes - the dagaa is a perishable harvest fixed by time, the land a natural factor fixed in total. Both draw a vertical supply line, and both leave the quantity unable to answer price.

When supply is perfectly inelastic a jump in demand cannot raise the quantity, so it raises only the price: the fixed dagaa and the fixed plot simply change hands at a dearer figure.

The Master Key: freshly caught dagaa that must sell today and central Dodoma land are both perfectly inelastic, $e_p^s = 0$, one frozen by time and the other by nature.

REAL Question 128

Read this: a Dar workshop keeps three of its eight machines idle and a bale of spare cloth in the back, and when the order price edges up the foreman simply flips the idle machines on.

Classify the supply of the manufactured good from this factory holding spare capacity and input stocks, justify the degree, and compute the coefficient from the figures given.

When the order price rose from TZS 400 to TZS 480 a shirt, the workshop's weekly output climbed from 200 to 300 shirts.

Model Answer

The factory's supply is elastic, $e_p^s > 1$, because its spare machines, labour and input stocks let output expand more than in proportion to the price rise.

Reading the figures: the price rose from 400 to 480, a rise of one fifth, while output rose from 200 to 300, a rise of one half. The quantity moved further than the price, the mark of elastic supply.

$$e_p^s = \frac{\Delta Q^s}{\Delta P} \times \frac{P_0}{Q_0^s}$$

$$e_p^s = \frac{300 - 200}{480 - 400} \times \frac{400}{200}$$

$$e_p^s = \frac{100}{80} \times \frac{400}{200} = 2.5$$

Interpreting the coefficient: a 20 per cent rise in price brought a 50 per cent rise in output, giving $e_p^s = 2.5$, well above one. The quantity response is two and a half times the price change.

Why it is elastic: idle machines and stored inputs mean extra output costs little more per unit and can be raised at once, so a small price incentive draws out a large extra quantity. Such a line, traced back, cuts the price axis, confirming the degree.

Spare capacity is the classic maker of elastic supply, which is why a firm with machines to spare can seize a price rise that a fully stretched rival cannot.

The Master Key: with spare capacity and input stocks the factory's supply is elastic, here $e_p^s = 2.5$, because quantity can outrun price.

HOT Question 129

A trader grumbles that farmers are greedy: prices doubled, he says, yet the maize on the market scarcely grew. An economist answers that greed has nothing to do with it.

Why is the supply of most agricultural goods closer to perfectly inelastic in the short run? Discuss.

Model Answer

The supply of most farm goods is close to perfectly inelastic in the short run because the quantity is bound by nature to a growing season and cannot be enlarged at will once the crop is in the ground or in the barn.

The biological lag: crops need a whole season from planting to harvest, and trees need years, so within a short period the farmer cannot add to output however tempting the price. The quantity is all but fixed until the next harvest arrives.

Fixed land and a finished harvest: the land under cultivation and the crop already reaped are given for the season, so a price rise finds no new fields to plant and no way to hurry the rains. The supply line therefore stands close to vertical, with e_p^s near zero.

Why not perfectly inelastic, quite: some slack remains - a grower can harvest more thoroughly, release grain from store, or hire an extra hand - so quantity bends a little and the coefficient is small rather than exactly zero. The case is near perfectly inelastic, not always dead vertical.

Time frees it: given several seasons the farmer clears new land, plants more, or switches crops, so supply becomes far more elastic in the long run. The steep short-run line for Kilombero rice pivots flatter as the horizon lengthens.

This is also why a bumper harvest can dismay farmers: inelastic supply meeting inelastic demand can push the price down faster than the extra quantity lifts revenue. Nature, not greed, sets the short-run shape.

The Master Key: farm supply is near perfectly inelastic in the short run because growing seasons and fixed land freeze quantity, though time makes it far more elastic.

HOT Question 130

A student states it as a law: any supply line through the origin is unit-elastic, however steep or shallow. A classmate protests that a steep line and a flat line cannot possibly share one elasticity.

Assess the claim that any straight supply line through the origin is unitary elastic whatever its slope.

Model Answer

The claim is exactly true as geometry, since every straight line through the origin does have $e_p^s = 1$ whatever its slope, though it is a property of the picture rather than a deep law of behaviour and is rarely met exactly in the real world.

Why the claim holds: elasticity is P/Q divided by the slope, and on a line through the origin P/Q equals the slope at every point, so they cancel to one. A steep ray and a gentle ray alike return $e_p^s = 1$, which settles the classmate's protest.

Slope is a red herring here: the classmate assumes steepness must change elasticity, but for rays from the origin it does not. What would change the degree is a shift of the intercept, not a change of tilt, so two very different-looking rays genuinely share the one coefficient.

But it is knife-edge geometry: the result depends on the line passing exactly through the origin, and a real supply curve seldom does. Nudge the intercept a hair onto the price axis and it turns elastic, onto the quantity axis and it turns inelastic, so the unit-elastic ray is a boundary case, not a typical one.

A benchmark, not a norm: the through-origin ray earns its keep as a reference line and a quick way to read a diagram, dividing elastic supply from inelastic. Few real firms expand output in the exact proportion the rule demands, so it describes a border rather than everyday behaviour.

So the student is right and the classmate wrong on the mathematics, yet the deeper lesson is the classmate's instinct redirected: look to the intercept, not the slope, and treat the unit-elastic ray as the exact line dividing elastic from inelastic supply.

The Master Key: the through-origin rule is geometrically exact, $e_p^s = 1$ at any slope, but it is a boundary case set by the zero intercept, not a law of how firms behave.

Determinants of price elasticity of supply and the time periods

You have learned to put a number on how eagerly supply answers a price rise; this section asks what decides the size of that answer. A producer's willingness is never in doubt, since a higher price always tempts it to sell more, but its ability to deliver is another matter, and that ability turns on how its costs behave, how it produces, what reserves of capacity and stock it holds, and how boldly it will gamble on a changed price. Above all it turns on time, for almost every other limit on supply melts away once the producer is given long enough to adjust. By the end you will read a supply curve not as a fixed line but as a picture that grows flatter the longer the clock is allowed to run.

BINDER Question 131

Two farmers hear the same good news that the price of their crop has jumped. One doubles his sacks by the weekend; the other cannot add a single grain until next year.

State the main determinants of the price elasticity of supply and explain briefly how each shapes it.

Model Answer

The price elasticity of supply depends on how quickly and cheaply a producer can lift output, which is governed by the behaviour of costs, the technique of production, the reserves of capacity and stock available, the producer's readiness to bear risk, and above all the length of time allowed to respond.

The behaviour of production costs: if pushing output higher raises the cost of each extra unit only gently, the producer expands freely and supply is elastic; if that cost climbs steeply, expansion is quickly choked and supply is inelastic.

The technique of production: a good made by a simple, easily repeated method can be multiplied at will, so its supply is elastic, whereas a good needing intricate skills or specialised equipment cannot be rushed, and its supply stays inelastic.

The reserves of capacity, inputs and stock: spare capacity, spare factors waiting to be hired and unsold stock in the store all let a firm answer a price rise at once, so the fuller these reserves, the more elastic the supply.

The producer's nerve and the passage of time: a producer willing to risk expansion responds more fully than a cautious one, but the master condition is time, since almost every barrier to a larger output can be overcome once the period is long enough.

These forces rarely act alone; a single good can be inelastic in supply one week and elastic the next, purely because the calendar has moved on.

The Master Key: supply is more elastic when costs rise gently, technique is simple, reserves are ample, the producer is bold, and, most of all, when time is long.

BINDER Question 132

A charcoal seller in Iringa can stack a few more bags without spending much more on each. A miner at Mererani finds every extra gram of tanzanite costs far more to bring up than the last.

Explain how the behaviour of production costs as output expands determines whether supply is elastic or inelastic.

Model Answer

Supply is elastic when the cost of producing each additional unit rises only slowly as output grows, and inelastic when that cost rises steeply, because a producer expands output only as far as the rising cost still leaves the higher price worth chasing.

Costs that rise gently: when extra output can be drawn out with little increase in unit cost, a modest rise in price comfortably covers the cost of many more units, so the producer expands generously and quantity supplied leaps. Supply is elastic.

Costs that rise steeply: when each extra unit costs sharply more than the last, the higher price is soon swallowed by the rising cost, and the producer dares add only a little. Quantity supplied barely moves and supply is inelastic.

Why the two differ: the difference lies in how strained the resources become. A firm drawing on plentiful, cheap inputs keeps its extra costs low, while one forced to bid for scarce land, skilled labour or specialised machinery watches its costs mount with every added unit.

So before you judge how supply will react, ask what happens to the cost of the next unit as the producer reaches for it: a gentle rise promises elastic supply, a steep one promises the opposite.

The Master Key: supply is elastic when the extra cost of each unit rises slowly and inelastic when it rises fast, because rising cost is what finally halts expansion.

BINDER Question 133

Anyone can be taught to mould and fire clay bricks in an afternoon, and a village can double its output within a week. Cut and polish a gemstone to order, and the queue of skilled hands moves at its own slow pace.

Explain how the technique of production affects the price elasticity of supply.

Model Answer

Supply is more elastic when the good is made by a simple technique that can be copied and multiplied quickly, and less elastic when the technique is complex and demands rare skills or specialised equipment that cannot be assembled in a hurry.

The simple technique: a good produced by a straightforward, widely known method can be scaled up almost at once, because more hands, more moulds or more plots are easy to add. A price rise is met with a

swift flood of extra output, so supply is elastic; brick-making, charcoal burning and vegetable growing sit here.

The complex technique: a good needing intricate processes, long training or purpose-built machinery cannot be multiplied on demand, because the skilled workers and the equipment are themselves slow to come by. Quantity supplied answers a price rise only sluggishly, so supply is inelastic; cutting tanzanite at Mererani or assembling precision machinery sits here.

Why technique bites: the technique fixes how fast the factors of production can be recruited and combined. The simpler the recipe, the shorter the delay between a price signal and the extra output that answers it.

Two goods facing the very same price rise can therefore diverge sharply, and the reason is written into how each is made.

The Master Key: a simple, easily copied technique makes supply elastic; a complex technique that resists quick expansion makes it inelastic.

BINDER Question 134

Two bottling plants in Mbeya read the same rise in the price of juice. One runs half idle with a warehouse full of crates; the other is already flat out, its shelves bare behind it.

Explain why some producers can respond to a price rise quickly and fully while others cannot, referring to spare capacity, the availability of inputs, unsold stocks and the willingness to bear risk.

Model Answer

A producer answers a price rise quickly and fully when it holds spare capacity, can readily hire more inputs, keeps unsold stock and is willing to gamble on the higher price, so its supply is elastic; a producer lacking these cannot expand, and its supply is inelastic.

Spare capacity: a firm with machines and space standing partly idle can lift output almost at once when the price rises, because the means to produce more are already in place and merely waiting to be used. Its supply is elastic.

The availability of inputs and unsold stock: if extra land, labour and materials can be hired without delay, and if goods already sit unsold in the store, the firm can meet a price rise from stock today and from expanded output tomorrow. Both reserves make supply elastic; their absence makes it inelastic.

The willingness to bear risk: even a firm that can expand may choose not to, for a price rise may prove temporary and the extra output may fail to sell. A bold producer expands boldly and supply is elastic, while a cautious one holds back and supply is inelastic, so nerve as well as means shapes the response.

The idle plant with full shelves and a daring owner floods the market when price rises; the plant already at full stretch, short of stock and wary of risk, can barely respond at all.

The Master Key: supply is elastic when the producer has spare capacity, ready inputs, unsold stock and the nerve to use them, and inelastic when any of these is missing.

BINDER Question 135

Raise the price of rice this afternoon and not one extra grain appears by nightfall. Offer that price for a season and the sacks multiply; offer it for years and whole new farms answer the call.

Explain how the elasticity of supply changes across the momentary, short-run and long-run periods, and illustrate with a diagram.

Model Answer

Supply grows steadily more elastic as the period of adjustment lengthens, moving from perfectly inelastic in the momentary period, through a partial response in the short run, to its most elastic in

the long run, because the longer the producer is given, the more of the factors of production can be changed.

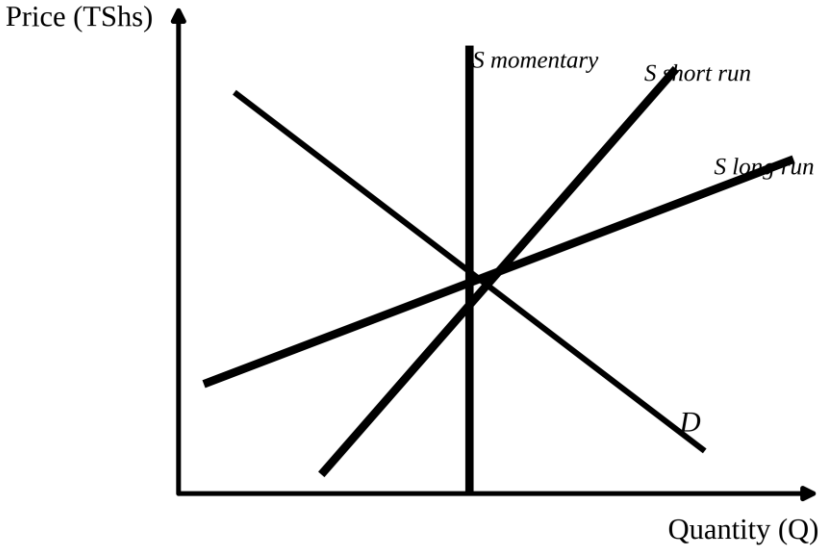


Figure 4.19: *Supply in the momentary, short-run and long-run periods*

The momentary or market period: in the instant after a price rise the quantity in existence is simply fixed, for nothing new can be produced so soon. Supply is perfectly inelastic and drawn as a vertical line, with $e_p^s = 0$; the whole daily catch of dagaa landed at Mwanza must be sold as it is, however the price moves.

The short run: given a little time the producer can work the fixed factors harder, adding more labour, hours or materials to the plant and land already held, though the plant and land themselves cannot yet be enlarged. Some extra output appears, so supply slopes upward and is less than perfectly inelastic, a partial response with a positive but modest e_p^s.

The long run: given long enough, every factor becomes variable: new machines are installed, new land is cleared, new firms enter the trade. Output can now expand fully to meet the higher price, so supply is at its most elastic and drawn as the flattest of the three curves, with the largest e_p^s.

This is why a price rise lifts quantity only a little at first and far more as the seasons pass, and why the three curves fan out from steep to flat as the clock is allowed to run; read against the figure, the momentary line stands upright, the short-run line leans, and the long-run line lies almost flat.

The Master Key: supply is perfectly inelastic in the momentary period, partly elastic in the short run and most elastic in the long run, because time is what frees the factors of production to respond.

REAL Question 136

Follow the rice of Kilombero through one year. In March the price jumps, but the crop is already in the ground and the harvest is fixed; by the next planting, though, every farmer has read the signal.

Using the idea of the time periods, explain why the supply of Kilombero rice is inelastic within a growing season yet elastic across seasons.

Model Answer

The supply of Kilombero rice is inelastic within a single growing season because the crop already planted cannot be enlarged whatever the price, but it is elastic across seasons because farmers respond to a higher price by planting more the next time round.

Within the season, the crop is fixed: once the seed is sown and the fields are set, the size of this year's harvest is settled by nature and cannot be raised by a mid-season price rise. In this window supply behaves like the momentary period, close to perfectly inelastic, and a higher price only rewards the farmers who already have rice to sell.

Across seasons, the farmer can adjust: by the next planting the farmer can clear more land, buy more seed and hire more hands, so the high price of last season pulls out a visibly larger crop this season. Supply now behaves like the long run and is elastic, with e_p^s rising well above the near-zero value of the growing season.

Why the horizon decides: rice is bound to the biological clock of a growing season, so the quantity cannot answer price until that clock comes round again. Time, not willingness, is the true constraint on the farmer of Kilombero.

A trader who forgets this will misread the market, expecting a price rise to conjure rice within weeks when in truth the fields will answer only with the next harvest.

The Master Key: Kilombero rice is inelastic in supply within a season because the planted crop is fixed, and elastic across seasons because the next planting can be enlarged.

REAL Question 137

Read the account of a cashew grower in Mtwara. When the Cashewnut Board announces a richer price he longs to supply more at once, yet the trees he would need will not bear a single nut for years.

Explain why the supply of Mtwara cashew is even more inelastic in the short run than an annual crop, and what this reveals about the availability of inputs over time.

Model Answer

The supply of Mtwara cashew is extremely inelastic in the short run because the trees that yield the nuts take several years to mature, so a higher price cannot raise output until newly planted trees at last come into bearing.

The tree is the fixed input: this year's crop hangs on trees planted long ago, and no price, however generous, can hurry a mature harvest from them beyond what they already carry. The key input to expansion is itself years away, so short-run supply is close to perfectly inelastic.

The long run reaches further for a tree crop: a grower who plants in response to today's price must wait three or four seasons before those trees bear, so the long run for cashew is measured in years, not months. Only across that long horizon does the arrival of new bearing trees make supply elastic.

Why cashew is stubborn where rice is merely slow: an annual crop answers a price rise by the next planting, but a perennial tree crop must first be grown before it can produce, so its supply stays inelastic over a far longer stretch of time. The lag in the availability of the key input sets the length of the wait.

The Cashewnut Board therefore cannot lift this year's harvest by price alone, for the orchards that will answer a good price are the ones being planted for the harvests of years to come.

The Master Key: cashew supply is inelastic for years because new trees take years to bear, so the availability of the key input, not the price, sets how fast supply can grow.

REAL Question 138

Step inside a furniture workshop in Morogoro that runs only two of its three daily shifts, its warehouse stacked with unsold chairs. The price of chairs rises by a fifth, and the manager smiles.

Explain why a factory with spare capacity and unsold stock enjoys an elastic supply, and illustrate with a simple calculation of e_p^s.

Price of a crate of juice: rises from TShs 2,000 to TShs 2,400.
Crates supplied per week: rises from 1,000 to 1,600.
The plant used only part of its capacity, with unsold stock in the warehouse.

Model Answer

A factory with spare capacity and unsold stock enjoys an elastic supply because it can lift output quickly and cheaply the moment the price rises, so quantity supplied grows by a larger proportion than the price that called it forth.

Spare capacity turns willingness into output: the idle third shift and the machines standing part-used mean the plant can produce far more without waiting to build anything new, so the higher price is answered within days rather than seasons. This is the very opposite of the farm bound to its harvest.

Unsold stock answers even faster: chairs already made and waiting in the warehouse can be released the instant the price rises, so part of the extra quantity reaches the market immediately, before a single new crate is filled.

Putting a number on the response: the price rises from TShs 2,000 to TShs 2,400, a rise of 20%, while weekly output climbs from 1,000 to 1,600 chairs, a rise of 60%. The elasticity of supply is the second proportion divided by the first.

$$e_p^s = \frac{\%\Delta Q^s}{\%\Delta P}$$

$$e_p^s = \frac{60\%}{20\%} = 3$$

A coefficient of 3 is well above one, so supply is elastic: quantity supplied has answered the price rise three times as strongly in proportion, exactly as spare capacity and ready stock allow.

The Master Key: spare capacity and unsold stock let a factory expand at once, so its supply is elastic, here $e_p^s = 3$, far more responsive than any crop tied to a harvest.

HOT Question 139

A lecturer calls the other determinants of supply elasticity mere servants of one master, time. A student objects that spare capacity and simple technique surely stand on their own.

To what extent is time the master determinant of the price elasticity of supply? Argue your case.

Model Answer

Time is the master determinant of the price elasticity of supply, because every other influence on supply works only within the room that time allows and given long enough almost all of them can be overcome, yet the other determinants still decide how fast supply responds within any given period.

Why time governs the rest: spare capacity, ready inputs, simple technique and unsold stock all matter because they let a firm respond before time would otherwise permit, but each is itself a creature of time. Given long enough, capacity can be built, inputs can be found, skills can be learned and stock can be grown, so the barriers the other determinants describe are exactly the ones that time dissolves.

The proof in the periods: the same good is perfectly inelastic in supply in the momentary period and elastic in the long run, though nothing about it has changed except the clock. Only time can turn one supply curve from vertical to nearly flat, which no single other determinant can do by itself.

Where the student is right: within a fixed period the other determinants still decide the outcome, for two firms given the same short run will differ sharply if one holds spare capacity and the other does not. Time sets the outer limit of the response, but capacity, technique and stock decide how much of that limit is reached.

The balanced verdict: time is therefore the deepest determinant, since it commands all the others and alone can move supply from one extreme to the other, yet it is not the only one, because at any moment the producer's reserves and methods still shape how fully the price is answered.

Call time the master, then, but not a lone ruler; it decides how far supply can travel, while the other determinants decide how far along that road the producer has already come.

The Master Key: time is the master determinant because it can free every other constraint and alone shifts supply from perfectly inelastic to highly elastic, though within any fixed period the other determinants still govern the response.

HOT Question 140

A minister promises that raising the guaranteed price of maize will fill the nation's stores within the year. An economist quietly wonders whether the fields will listen so quickly.

A government wants more of a staple crop and proposes to achieve it by raising the price paid to farmers. Assess whether a price rise alone can be relied upon to deliver the extra output.

Model Answer

A price rise alone cannot be relied upon to deliver more of a staple crop quickly, because the supply of crops is inelastic in the short run, so the higher price mostly raises farm incomes at first and lifts output substantially only over later seasons, which means it should be paired with measures that ease the deeper constraints on supply.

Why the price rise disappoints at first: within the current season the planted crop is fixed, so a higher price cannot summon extra grain from land already sown. The short-run supply of the crop is close to perfectly inelastic, and the immediate effect of the price rise is to enrich the farmers who already have the crop, not to enlarge the harvest.

Why it works, but slowly: across later seasons farmers respond to the sustained price by planting more, clearing land and buying inputs, so supply becomes elastic and output does grow. The policy is sound in the long run, provided the higher price is believed to last, but the nation may wait seasons for the stores to fill.

What the price rise cannot fix by itself: if farmers lack seed, fertiliser, credit, roads or irrigation, the price signal meets a wall, for willingness without the means to expand yields little extra output. A price rise raises the reward for producing more but does nothing to remove the barriers that keep production low.

The measured judgement: the government should therefore treat the price rise as one instrument among several, coupling it with better access to inputs, credit and infrastructure that shorten and steepen the response. Relied on alone, a price rise is a slow and partial remedy; combined with supply-side support, it can deliver the extra crop far sooner.

The minister's promise mistakes willingness for ability; the fields will answer a good price, but only once they are also given the means to do so, and only when the seasons have had time to turn.

The Master Key: a price rise alone lifts a staple's output only slowly because short-run crop supply is inelastic, so it should be combined with input, credit and infrastructure support that make supply respond faster and further.

Applications of price elasticity of supply

The last section measured how quickly supply can stretch; this one spends that measure. Price elasticity of supply turns out to be a quietly practical number, guiding a worker weighing a wage offer, a government choosing which crop to reward, a factory deciding which line to grow, and a nation trying to steady the earnings that swing when supply cannot bend. In every case the same question decides the outcome: *when the price rises, does the quantity supplied leap or barely stir?* Where supply is elastic the reward calls forth a flood of extra output; where it is inelastic the reward mostly lifts the price and leaves the quantity much as it was. Learn to ask that one question and these applications fall into place.

BINDER Question 141

A hospital in Dodoma doubles the pay it offers a specialist surgeon, yet the post stays empty; nudge the daily wage for porters at Kariakoo and a queue forms by dawn.

Explain how the price elasticity of supply applies to labour, and why an inelastic supply of a scarce skill means a wage rise draws out little extra labour.

Model Answer

Applied to labour, the price elasticity of supply measures how strongly the quantity of labour offered responds to a change in the wage, and when a skill is scarce that response is small, so a higher wage buys little extra labour.

The wage is the price of labour: here the good being supplied is work itself and its price is the wage, so the price elasticity of supply becomes the responsiveness of the quantity of labour offered to a proportionate change in the wage. It compares the percentage change in labour supplied with the percentage change in the wage, just as $e_p^s = \frac{\%\Delta Q^s}{\%\Delta P}$ does for any good.

A scarce skill supplies inelastically: when a skill takes years to train and few people hold it, the quantity offered cannot rise quickly however tempting the wage, because a trained surgeon or pilot cannot be conjured in a single season. Its supply is inelastic and e_p^s is small.

Why the wage rise underwhelms: a higher wage offered for such a skill lands mostly on those already qualified, lifting their pay rather than their number. The extra reward struggles to become extra labour while the training route stays as slow as ever.

Abundant labour supplies elastically: where the work needs little training, as with the porters who gather at Kariakoo before dawn, a small wage rise pulls in many extra hands, so supply is elastic and the same money buys a genuine rise in quantity.

So the wage lever works powerfully on abundant labour and feebly on a scarce skill, and only the passage of time, as training swells the pool, turns the scarce skill's supply elastic.

The Master Key: for labour the wage is the price, and where a scarce skill makes supply inelastic a wage rise raises pay far more than numbers.

BINDER Question 142

Two ministers would spend the same shillings on a crop-price support to swell exports. One backs a vegetable any farmer can plant next week; the other a tree that bears only after four years.

Explain why a government aiming to raise export volume should support the price of a good whose supply is elastic rather than one whose supply is inelastic.

Model Answer

A price support lifts export volume only where supply is elastic, because only an elastic supply answers the higher price with a large rise in quantity, while an inelastic supply turns the same support mostly into higher prices.

What a price support is meant to do: raising or guaranteeing a good's price rewards producers so that they supply more, and the extra output is what becomes extra export tonnage. The policy is only as good as the quantity response it provokes.

Elastic supply repays the support: where supply is elastic, a supported price a fifth higher can call forth a much larger proportionate rise in quantity, so $e_p^s > 1$ and the shillings spent turn into sacks at the port. The vegetable any farmer can plant at once behaves this way.

Inelastic supply wastes it: where supply is inelastic, the same support meets a quantity that can barely move in the short run, so $e_p^s < 1$ and the money mostly inflates the price while the tonnage stands nearly still. The tree that bears only after four years behaves this way.

The rule this yields: to buy export volume, reward the good whose supply can stretch; to lift incomes without much extra output, support the inelastic good with open eyes. The government must read the elasticity before it spends.

So the price elasticity of supply decides whether a support scheme fills ships or merely fills pockets, and a government that ignores it will pay for volume it never receives.

The Master Key: a price support raises export volume only when supply is elastic; against an inelastic supply it raises price far more than quantity.

BINDER Question 143

A workshop owner in Kariakoo can sense a price rise coming for two of her products. One she could flood the market with by next week; the other she could not double in a year.

Explain how the price elasticity of supply guides a producer in choosing which line of goods to expand.

Model Answer

A producer favours the line whose supply is elastic, because only a line that can be expanded quickly lets her seize a price rise with a large rise in quantity sold.

The chance a price rise offers: when the price of a good climbs, the gain goes to whoever can put more of it on the market at once. The size of that gain depends on how far the producer can raise her quantity in the time available.

The elastic line seizes it: a line with spare machine capacity, a simple technique and inputs ready to hand can be scaled up fast, so its supply is elastic and a price rise is met with a flood of extra units. The producer captures the higher price on a much larger quantity.

The inelastic line lets it pass: a line that needs a scarce input, a complex technique or long preparation cannot be expanded in time, so its supply is inelastic and much of the price rise slips by uncaptured. The reward arrives before the output can.

Reading the determinants: spare capacity, ease of technique, availability of inputs and the ability to hold stock are exactly the conditions that make a line's supply elastic, and a shrewd producer weighs them before deciding where to grow.

So the producer steers her effort toward the elastic line, where a rising price turns quickly into rising sales rather than into a chance she could only watch go by.

The Master Key: a producer grows the line whose supply is elastic, because only there can a price rise be seized as extra quantity rather than missed.

REAL Question 144

Follow the cashew of Mtwara through a single decision. Before the buying season opens, the board that guides the crop raises the price it promises growers, hoping to send far more nuts abroad.

Using the price elasticity of supply, explain why the higher price adds so little export volume in the first season yet so much across five, computing e_p^s for each.

> The Cashewnut Board lifts the price promised to Mtwara growers by 40 per cent before the new buying season opens.
>
> That season the marketed crop rises by only about 8 per cent. Five seasons later, with newly planted trees now bearing, the marketed crop stands about 60 per cent above where it started.

Model Answer

In the first season the cashew's supply is inelastic, so the higher price swells growers' incomes far more than the tonnage shipped, but across five seasons supply turns elastic as new trees bear, and only then does the price finally buy the extra volume.

The short-run response is tiny: in a single season the trees already standing are the whole crop, so a price 40 per cent higher coaxes out only about 8 per cent more nuts through closer picking and less waste. Divide the one by the other and the elasticity is small.

$$e_p^s = \frac{\%\Delta Q^s}{\%\Delta P}$$

$$e_p^s = \frac{8}{40} = 0.2$$

So the first season is inelastic: a coefficient of 0.2 sits far below one, so supply is inelastic. The support lands mostly on price and on grower incomes, while the port sees little of the promised extra volume.

The long-run response is large: a higher price that holds tempts growers to plant and tend more trees, and once those bear, the same 40 per cent higher price is matched by roughly 60 per cent more marketed crop.

$$e_p^s = \frac{60}{40} = 1.5$$

So five seasons on it is elastic: a coefficient of 1.5 now exceeds one, so supply has turned elastic. Time is the determinant at work, for what is scarce in a season grows plentiful across the years as the orchard fills out.

So the price rise is not wasted, only delayed; the cashew pays in grower income first and in export volume only once its slow supply has had the years it needs to stretch.

The Master Key: cashew supply is inelastic within a season ($e_p^s = 0.2$) but elastic across years ($e_p^s = 1.5$), so a price rise buys grower income now and export volume only later.

REAL Question 145

Read the choice facing a garment factory in the Dar es Salaam export zone. A foreign buyer offers a fifth more for whatever it can ship, and two very different lines wait to answer.

Advise the factory which line to expand to seize the offer, computing e_p^s for each and naming the determinants behind the difference.

> Line one stitches plain cotton T-shirts from local cotton on machines that often stand idle; the stitch is simple and any trained hand can run it.
>
> Line two tailors suits from imported cloth cut by a few skilled cutters who are already fully booked.
>
> The buyer offers 20 per cent more on either line. The T-shirt line can raise output by about 30 per cent; the suit line by about 4 per cent.

Model Answer

The factory should expand the T-shirt line, because its supply is elastic and answers the better price with a large rise in output, while the suit line's inelastic supply can barely move.

The T-shirt line is elastic: idle machines, a simple stitch and local cotton on hand let output rise about 30 per cent against a price 20 per cent higher, so the quantity response outruns the price.

$$e_p^s = \frac{30}{20} = 1.5$$

The suit line is inelastic: imported cloth and a few fully booked cutters cap the rise at about 4 per cent for the same 20 per cent better price, so the quantity barely stirs.

$$e_p^s = \frac{4}{20} = 0.2$$

The determinants explain the gap: spare capacity, a simple technique and ready inputs make the T-shirt supply elastic, while a scarce skilled input, a complex technique and no spare hands make the suit supply inelastic.

So the factory captures the buyer's offer on the elastic line, where 20 per cent more money brings 30 per cent more shirts, and leaves the suit line to a slower kind of growth.

The Master Key: the T-shirt line is elastic ($e_p^s = 1.5$) and the suit line inelastic ($e_p^s = 0.2$), so the elastic line is the one to expand to seize a price rise.

HOT Question 146

A minister backs cashew and coffee, the tree crops the world knows us for; an economist replies that if export earnings are the goal, we should back a crop whose supply can actually grow.

Should a government promote a crop whose supply is elastic or one whose supply is inelastic if the aim is to raise export earnings? Weigh the case.

Model Answer

For lifting export volume through a price policy the elastic-supply crop wins, yet export earnings turn on world demand and comparative advantage too, so the inelastic tree crops cannot simply be dropped and the honest answer is a balance.

The case for the elastic crop: a crop whose supply is elastic answers a price support or an investment with a large rise in quantity, so tonnage at the port climbs and the money buys real extra output rather than mere price. For raising volume this is decisive.

Earnings are price times quantity: export earnings are the world price multiplied by the quantity sold, so volume is only half the story. Where a country looms large in the world supply of a crop with inelastic world demand, flooding the market can push the world price down and shrink the very earnings it sought.

Comparative advantage favours the tree crops: cashew, coffee and cloves are where Tanzania holds a natural edge and earns a premium abroad, even though their supply is inelastic in the short run. Deserting them for an easily grown crop means competing with every other producer on price alone.

Inelastic is only a short-run verdict: today's slow tree crop becomes an elastic supplier once new plantings mature, so the wise course is to invest in the tree crops and raise their long-run elasticity rather than write them off. Where earnings swing from year to year because supply cannot bend, a buffer stock can steady them, a matter a later section takes up.

The balanced verdict: if the single aim is more export volume soon, promote the elastic-supply crop or make a crop elastic through investment; but because earnings also ride on world demand and on where the country's advantage lies, the inelastic tree crops keep their place. Policy should raise their elasticity, not abandon them.

So the minister and the economist are each half right: the elastic crop lifts volume fastest, yet the nation's lasting earnings still flow from the slow crops it grows best, coaxed to supply more with time.

The Master Key: promote the elastic-supply crop to raise volume quickly, but since earnings hinge on world demand and comparative advantage, invest in the inelastic tree crops rather than abandon them.

HOT Question 147

A permanent secretary is sure of his cure for the shortage of upcountry doctors: pay enough and they will come. A labour economist warns the money may arrive years before the doctors do.

Assess the claim that raising wages is a reliable way to draw out a scarce skill.

Model Answer

Raising wages draws out a scarce skill only slowly and only if training can respond, so as a short-run lever for numbers it is unreliable, though over the long run and alongside training it does help.

The grain of truth: the wage is the price of labour, and a higher price does raise the quantity supplied, so over a long enough horizon better pay pulls more people toward the skill and signals that the work is valued.

Where it fails in the short run: a scarce skill that takes years to train has an inelastic supply, so a wage rise cannot lift the number available this year. It lands on those already qualified, raising their pay far more than their headcount, because you cannot train a surgeon or a gas engineer in a budget cycle.

What actually shifts the supply: more training places, scholarships and a shorter route to qualifying are what raise the number who can offer the skill, shifting the whole supply and lifting its long-run elasticity. Wages alone leave the training route untouched.

When wages do bite: once trained people already exist but work abroad or in other fields, a higher wage can draw them back, for that pool is far more elastic. The lever works where the skill exists and is merely misplaced, not where it must first be created.

The measured verdict: raising wages is a slow signal, not a switch. It draws out a scarce skill dependably only over the long run and only if training expands to meet it, so a government that leans on pay alone will wait years for numbers that better training could have delivered.

So the permanent secretary is not wrong to raise the pay, only wrong to expect it to work quickly; the sure cure for a scarce skill is to widen the road into it, with the wage as the sign that points the way.

The Master Key: wages draw out a scarce skill only slowly, because its short-run supply is inelastic, so pay must be paired with training to raise numbers rather than merely raise incomes.

Tax incidence and elasticity

When the government lays a tax on a crate of soda or a litre of petrol, it names one party to hand over the money, yet the law cannot dictate who finally feels the loss. That is the puzzle of tax incidence: the way an indirect tax is split between the buyer, who meets a higher price, and the seller, who keeps a lower one. This section shows that elasticity, and almost nothing else, settles the division. You will lift a supply curve upward by the tax, read each side's burden off the diagram, and then reduce the whole matter to a single fraction in the two elasticities. Armed with it, you will follow the fuel, cigarette and luxury taxes that the TRA weighs every day, and see exactly whose pocket each one finds.

BINDER Question 148

The law names the soda bottler to pay the new tax. Yet by month's end the shelf price has climbed, and it is the customer's pocket, not the bottler's, that feels the lighter.

Define tax incidence and explain how a specific (per-unit) tax is shared between buyer and seller.

Model Answer

Tax incidence is the way the burden of an indirect tax finally settles on buyers and sellers, and a specific tax splits that burden by raising the price the buyer pays while lowering the price the seller keeps.

What incidence means: the party who hands the tax to the authority is not always the party who bears it. Incidence asks where the weight of the tax finally rests once the market has adjusted, which can be far from where the law placed it.

How a specific tax enters the market: a specific tax is a fixed sum on each unit sold, so it adds the same amount to the cost of supplying every unit and lifts the whole supply curve vertically upward by the size of the tax.

How the gap splits: the price the buyer pays rises from P_0 to P_1, while the seller, after surrendering the tax, keeps only $P_s = P_1 - t$, where t is the tax per unit. The buyer's burden is $P_1 - P_0$ and the seller's is $P_0 - P_s$, and the two add up to exactly the tax.

$$(P_1 - P_0) + (P_0 - P_s) = t$$

So the tax opens a wedge of size t between what the buyer pays and what the seller receives, and the only question that remains is how that wedge is divided.

The Master Key: tax incidence is where a tax finally rests, not where it is levied; a specific tax lifts supply by the tax and splits the gap between a higher buyer price and a lower seller price.

BINDER Question 149

Tax maize flour and the sacks still leave the Iringa shop at nearly the old pace, for a family must eat. The price climbs, the buying scarcely bends, and one pocket quietly pays.

Using a demand-and-supply diagram, explain why the burden of a specific tax falls mainly on the consumer when demand is inelastic.

Model Answer

When demand is inelastic the consumer bears the greater part of the tax, because buyers cling to the good even as its price rises and so absorb most of the tax in a higher price.

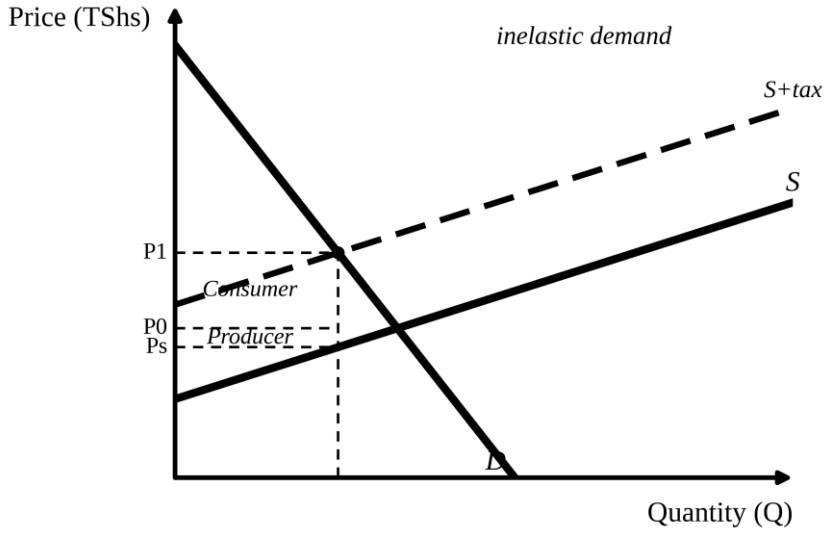


Figure 4.20: *Tax incidence with inelastic demand: the consumer bears the greater share*

The supply curve lifts by the tax: the tax raises the cost of every unit, so supply shifts up by the full tax. A new equilibrium forms where the raised supply curve meets the unchanged, steep demand curve.

The price rises almost by the whole tax: because demand is steep, buyers barely reduce the quantity they take when the price climbs, so the seller passes on nearly all of the tax as a higher price without losing many sales, and P_1 ends up close to $P_0 + t$.

Reading the split off the diagram: the tall upper slice, from P_0 up to P_1, is the consumer's burden, while the shallow lower slice, from P_0 down to P_s, is the producer's. The inelastic demand makes the consumer's slice the larger one.

This is the ordinary fate of a necessity: with nowhere else to turn, the buyer shoulders the tax, which is exactly why the government aims it here.

The Master Key: inelastic demand means buyers will not walk away, so the seller passes on most of the tax and the consumer carries the heavier burden.

BINDER Question 150

Tax a fashionable imported trainer and the shelves in Mlimani City go quiet: shoppers shrug and reach for another brand. The seller, watching the sales vanish, quietly swallows the tax himself.

Using a demand-and-supply diagram, explain why the burden of a specific tax falls mainly on the producer when demand is elastic.

Model Answer

When demand is elastic the producer bears the greater part of the tax, because buyers desert the good as soon as its price rises, forcing the seller to absorb most of the tax rather than lose the sale.

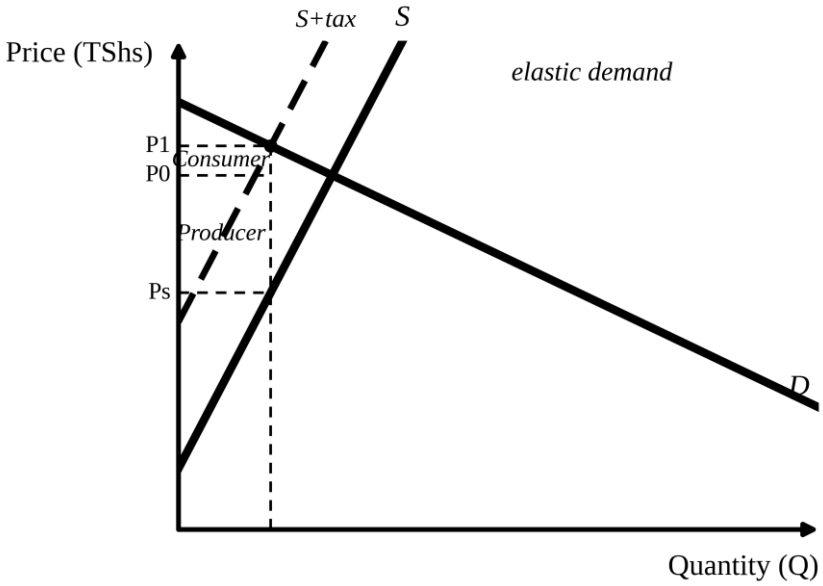


Figure 4.21: *Tax incidence with elastic demand: the producer bears the greater share*

The same upward shift, a different result: the tax again lifts supply by its full amount, but now the demand curve is flat, so even a small rise in price would drive away a large volume of buyers.

Why the price can barely rise: because buyers flee at the smallest increase, the seller dare not pass much of the tax on. The market price rises only a little above P_0, so the consumer's slice $P_1 - P_0$ stays small.

Where the tax lands instead: the seller is left with a much lower net price P_s, so the producer's slice $P_0 - P_s$ is the large one. The tax has slid onto the producer, the party who cannot escape it.

A tax on an easily-avoided good is thus paid mostly by whoever makes it, not by whoever buys it, the exact reverse of the outcome for the necessity.

The Master Key: elastic demand means buyers vanish at a higher price, so the seller must swallow most of the tax and the producer carries the heavier burden.

BINDER Question 151

Two numbers, the elasticity of demand and the elasticity of supply, walk into the same market. Between them they decide, to the last shilling, who pays a tax, and a single fraction settles the argument.

State the formula for the share of a specific tax borne by each side, use it to explain the effect of inelastic supply, and compute the split of a tax of TShs 400 per crate when $e_p^d = 0.5$ and $e_p^s = 1.5$.

Model Answer

The consumer's share of a specific tax equals the elasticity of supply divided by the sum of the two elasticities, and the producer's share is the elasticity of demand over that same sum, so the more inelastic side always pays the larger share.

The incidence formula: writing e_p^d and e_p^s for the magnitudes of the two elasticities, the consumer's share of the tax is $\frac{e_p^s}{e_p^s + e_p^d}$ and the producer's share is $\frac{e_p^d}{e_p^s + e_p^d}$, the two together making up the whole tax.

Why inelastic supply loads the tax onto the seller: when supply is inelastic, e_p^s is small, so the producer's share $\frac{e_p^d}{e_p^s + e_p^d}$ swells toward one. A seller who cannot cut output when the net price falls is trapped, and the tax settles on him just as it settles on an inelastic buyer.

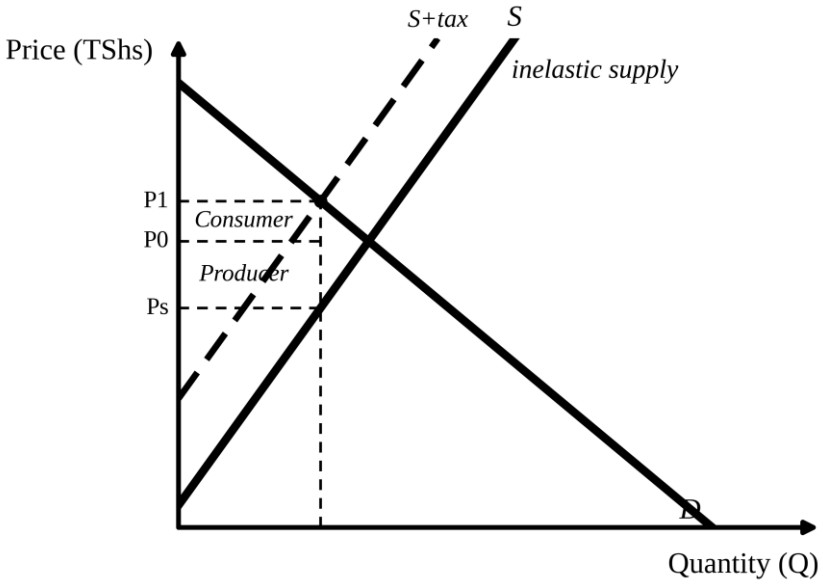


Figure 4.22: *Tax incidence with inelastic supply: the producer bears the greater share*

The crate of soda, worked through: with $e_p^d = 0.5$ and $e_p^s = 1.5$, supply is three times as responsive as demand, so the consumer carries three-quarters of the tax and the producer one-quarter.

$$\frac{e_p^s}{e_p^s + e_p^d} = \frac{1.5}{1.5 + 0.5} = \frac{1.5}{2.0} = 0.75$$

$$0.75 \times 400 = 300$$

$$0.25 \times 400 = 100$$

The buyer thus meets TShs 300 of the TShs 400 tax and the seller only TShs 100, the burden leaning onto the more inelastic demand side. The same fraction runs in reverse for a subsidy, a negative tax that shifts supply downward and shares its benefit in the identical proportions, so a subsidy on an inelastic-demand staple reaches mainly the consumer. It is this arithmetic that steers the TRA toward taxing inelastic goods, where the burden sticks to the buyer and the takings hold firm.

The Master Key: the consumer's share is $\frac{e_p^s}{e_p^s + e_p^d}$, so with $e_p^d = 0.5$ and $e_p^s = 1.5$ the buyer bears TShs 300 and the seller TShs 100, and the very same fraction shares out a subsidy.

REAL Question 152

Read this account: the TRA adds TShs 300 of excise to every litre of petrol, and because the bus and the boda-boda must still reach work, fuel demand scarcely bends. Follow the levy from depot to pump.

Determine how the TShs 300 fuel levy is split between motorist and supplier, and interpret the result.

A TRA excise of TShs 300 is laid on each litre of petrol.

Fuel demand is inelastic, $e_p^d = 0.25$; fuel supply is more elastic, $e_p^s = 1.0$.

Model Answer

The motorist bears about TShs 240 of the TShs 300 levy and the supplier only about TShs 60, because fuel demand is far more inelastic than fuel supply and the burden slides onto the rigid side.

The consumer's share: the buyer's share of the levy is the supply elasticity over the sum of the two elasticities.

$$\frac{e_p^s}{e_p^s + e_p^d} = \frac{1.0}{1.0 + 0.25} = \frac{1.0}{1.25} = 0.8$$

The two burdens in shillings: applying the shares to the TShs 300 levy divides it as follows.

$$0.8 \times 300 = 240$$

$$0.2 \times 300 = 60$$

What it means at the pump: the pump price rises by about TShs 240, so the motorist pays four-fifths of the levy, while the supplier's net receipt falls by only TShs 60. The levy finds the driver because there is no easy substitute for fuel and the trip to work cannot wait.

This is why a fuel levy is so dependable a source of revenue: the quantity sold hardly falls, so almost the whole tax is gathered, and it is gathered from the motorist.

The Master Key: because fuel demand is inelastic, the motorist carries about TShs 240 of the TShs 300 levy and the supplier only about TShs 60, and the revenue stays firm.

REAL Question 153

Read this account: the TRA raises the excise on a packet of cigarettes, sure that a smoker quits slowly. A health officer hopes the tax will cut smoking; the treasury hopes it will not. Follow the packet.

Explain who bears the excise on cigarettes, compute the split of a TShs 800 excise, and say why such 'sin taxes' are prized for revenue.

The TRA sets an excise of TShs 800 on each packet of cigarettes. Cigarette demand is highly inelastic, $e_p^d = 0.25$; supply is more elastic, $e_p^s = 0.75$.

Model Answer

The smoker bears three-quarters of the excise, about TShs 600 of the TShs 800, because cigarette demand is far more inelastic than its supply, and it is this stickiness that makes the tax a reliable earner.

The split, computed: the smoker's share is the supply elasticity over the sum of the elasticities, applied to the TShs 800 excise.

$$\frac{e_p^s}{e_p^s + e_p^d} = \frac{0.75}{0.75 + 0.25} = \frac{0.75}{1.0} = 0.75$$

$$0.75 \times 800 = 600$$

$$0.25 \times 800 = 200$$

Why the smoker cannot dodge it: an addictive good has few substitutes and a firm hold on its buyer, so the quantity barely falls when the price rises. The seller passes on most of the tax, and the smoker meets TShs 600 while the producer loses only TShs 200.

Why the TRA prizes such taxes: because the quantity sold scarcely shrinks, the tax base survives the tax and revenue arrives steadily. Beer excise behaves the same way, which is why alcohol and tobacco are perennial targets of the tax collector.

The health officer's hope and the treasury's hope pull against each other, for the very inelasticity that guarantees the revenue also means the tax does little to curb the habit.

The Master Key: inelastic cigarette demand places about TShs 600 of the TShs 800 excise on the smoker, making sin taxes a steady earner even as they barely dent consumption.

REAL Question 154

Follow the imported wine onto which a luxury tax is dropped, a bottle a shopper can happily do without. Watch the tax struggle to reach the customer and settle somewhere else instead.

Determine how a TShs 3,000 luxury tax on imported wine is split, and explain why the importer bears the greater share.

A luxury tax of TShs 3,000 is laid on each bottle of imported wine.

Wine demand is elastic, $e_p^d = 2.0$; supply is less elastic, $e_p^s = 1.0$.

Model Answer

The importer bears two-thirds of the tax, about TShs 2,000 of the TShs 3,000, because wine is an elastic luxury whose buyers walk away the moment the price climbs, leaving the seller to absorb most of the tax.

The consumer's small share: with demand twice as elastic as supply, the buyer's share of the tax is only one-third.

$$\frac{e_p^s}{e_p^s + e_p^d} = \frac{1.0}{1.0 + 2.0} = \frac{1}{3}$$

$$\frac{1}{3} \times 3000 = 1000$$

$$\frac{2}{3} \times 3000 = 2000$$

Where the tax lands: the seller can lift the price only a little before buyers switch to beer, spirits or nothing at all, so the shelf price rises by about TShs 1,000 while the importer swallows the remaining TShs 2,000 in a lower net price.

The revenue warning: an elastic good is a poor tax target, for the quantity falls sharply, the base shrinks, and most of the little raised comes from the producer rather than the consumer. The tax discourages the luxury more than it fills the treasury.

A luxury tax therefore works better as a signal against extravagance than as an engine of revenue, the mirror image of the fuel and cigarette taxes.

The Master Key: elastic wine demand puts two-thirds of the tax, about TShs 2,000, on the importer, and the collapsing quantity makes the luxury a weak source of revenue.

HOT Question 155

A politician defends the new fuel levy by insisting it falls on the oil companies, not on ordinary wananchi. An economist listening at the back is already reaching for a diagram.

The government says a fuel levy is a tax on oil companies, not on citizens. Assess this claim.

Model Answer

The claim is largely false, because although the oil companies hand the levy to the TRA, the inelasticity of fuel demand means citizens end up paying most of it through a higher pump price.

The grain of truth: statutory incidence: the oil company is indeed the party the law names to remit the levy, so on paper the tax is on the companies. This is the legal, or statutory, incidence, and to that extent the politician speaks truly.

The reality: economic incidence: yet who signs the cheque is not who bears the loss. Because fuel demand is inelastic, the company passes almost the whole levy forward as a higher price, so the economic incidence rests on the motorist. A levy of TShs 300 that lifts the pump price by about TShs 240 is being paid four-fifths by the citizen.

Why the confusion is convenient: naming the company as taxpayer lets the levy be sold as painless to voters, when in truth the burden has been quietly shifted onto them. The elasticity of demand, not the wording of the law, decides who finally pays.

The measured verdict: the levy is statutorily on the companies but economically on the citizens. Only if fuel demand were elastic, which it is not, would the companies carry the greater share.

The politician has described where the tax is collected; the economist can show where it is felt, and for fuel the two lie far apart.

The Master Key: statutory incidence sits on the oil companies, but inelastic demand shifts the economic incidence onto citizens, who pay the greater part of any fuel levy.

HOT Question 156

The TRA leans on taxes on fuel, sugar and paraffin because the revenue is sure. A social worker in Mtwara asks whether 'sure' and 'fair' are the same word.

'Because the burden sticks to the buyer, taxing inelastic necessities is the cleverest way to raise revenue.' Discuss whether it is also fair.

Model Answer

Taxing inelastic necessities is efficient at raising revenue but is often unfair, because the burden falls on buyers who cannot avoid it and weighs most heavily on the poor.

Why it is efficient: an inelastic good keeps selling when taxed, so the base holds and the revenue is large and predictable. From the treasury's view, taxing fuel, sugar and paraffin is indeed shrewd, and the incidence formula shows the buyer carrying most of it.

Why it may be unfair: regressivity: necessities take a larger share of a poor family's budget than of a rich one's, so a tax that sticks to the buyer of paraffin or maize flour takes a bigger bite, in proportion to income, from the poor than from the wealthy. The inelasticity that guarantees the revenue also traps the buyer who can least afford to pay.

The equity-efficiency trade-off: the cleverness and the hardship thus share one root: the tax is efficient precisely because the buyer cannot escape, and it is regressive for exactly the same reason. Revenue and fairness pull in opposite directions here.

How the sting can be drawn: a government minded to serve both can spare the rawest staples, lean instead on inelastic goods bought mainly by the better-off, such as fuel for private cars, and return part of the revenue to poor households. Incidence analysis shows it exactly where the burden falls and so where relief is owed.

The claim is right about the revenue and blind to the burden, for taxing necessities is efficient, but without deliberate relief it asks the most of those who have the least.

The Master Key: taxing inelastic necessities raises sure revenue but is regressive, since the unavoidable burden falls hardest on the poor, who spend the largest share on essentials.

HOT Question 157

A minister proposes a stiff tax on an elastic luxury to fill the budget. An adviser warns it may empty the shelves faster than it fills the treasury.

Assess the claim that taxing an elastic good is self-defeating as a way of raising revenue.

Model Answer

The claim is largely sound, because an elastic good loses so much of its quantity when taxed that the revenue collected is small and most of it comes from the producer, though the tax may still serve other ends.

Why the revenue disappoints: revenue is the tax multiplied by the quantity that still sells. When demand is elastic, the price rise sends buyers away in droves, the quantity collapses, and the tax base shrinks with it, so a high rate on a vanishing quantity yields very little.

Who pays the little that is raised: because buyers flee, the seller cannot pass the tax forward and must absorb most of it. The luxury-wine split, two-thirds falling on the importer, showed as much: the tax lands on the producer and discourages the trade rather than funding the state.

Where the claim overreaches: yet revenue is not the only aim. If the purpose is to discourage a good, say an import that drains foreign exchange or a product judged harmful, then a large elastic response is a success, not a failure, for the tax does its work by cutting the quantity even while it collects little.

The measured verdict: as an engine of revenue, taxing an elastic good is indeed close to self-defeating; as a tool to curb consumption or defend the balance of payments, it can be well aimed. The verdict turns entirely on what the tax is for.

So the adviser is right about the treasury and incomplete about the purpose, for an elastic good is the wrong place to seek money but can be the right place to change behaviour.

The Master Key: taxing an elastic good raises little revenue and falls on the producer, so it is self-defeating for the treasury yet can still succeed at discouraging the good.

Elasticity in the real economy: agriculture and the elasticity family

The formulas are behind you; now watch them earn their keep where the stakes are real. This closing section carries elasticity out of the textbook and into the fields and the marketplace, to the two places the theory proves its worth. First comes the paradox of plenty, the hard truth that a bumper harvest of a staple can leave a farmer poorer than a failed one, together with the policies a government reaches for to soften the blow. Then the elasticity family is gathered back together, so that a single good can be read through all three of its demand elasticities at once and named in a single breath. Agriculture shows you why elasticity matters; the family shows you how completely it can describe a good.

BINDER Question 158

The rains fell just right this year, the maize stands tall in every field from Iringa to Rukwa, and the harvest is the finest in living memory. Yet when the sacks reach the market, the farmer counts less money into his hand than he did the year the crop half failed.

Explain the paradox of plenty: how a bumper harvest of a staple food can leave farmers with less total revenue than a poor one.

Model Answer

A bumper harvest can leave farmers poorer because a staple food has inelastic demand, so the flood of extra grain drives the price down by a larger proportion than it raises the quantity sold, and total revenue falls.

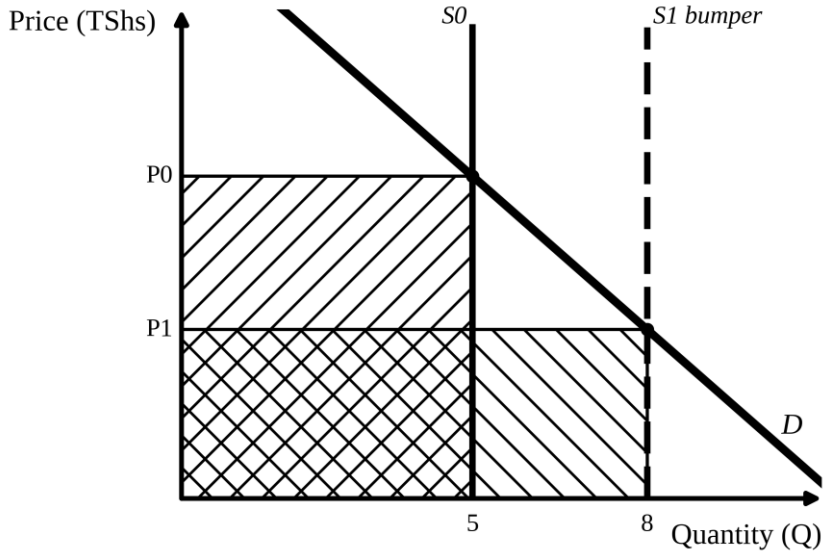


Figure 4.23: *The paradox of plenty: with inelastic demand a bumper harvest lowers price so far that farm revenue falls*

The extra grain can only be sold cheaply: a bumper harvest shifts the supply of the staple to the right, and the market must be coaxed into absorbing every extra sack. Because a staple such as maize or rice is a necessity with few substitutes, its demand is inelastic, so buyers will take the extra grain only if the price falls steeply.

Count the revenue in both seasons: take a normal harvest that sells 6 units at TShs 60 each, and a bumper harvest that sells 8 units but at a collapsed price of TShs 40. Total revenue is price times quantity in each case.

$$TR_0 = P_0 \times Q_0 = 60 \times 6 = 360$$

$$TR_1 = P_1 \times Q_1 = 40 \times 8 = 320$$

Why more grain means less money: revenue falls from 360 to 320 even though output rose from 6 units to 8. Measured from the midpoint the price drops by about two-fifths while the quantity climbs by under a third, so the proportionate loss on price outweighs the proportionate gain on quantity. The arc elasticity confirms the demand is inelastic, and the total-outlay test agrees, since price and revenue fell together.

$$e_p^d = \left|\frac{\Delta Q^d}{\Delta P}\right| \times \frac{P_0 + P_1}{Q_0 + Q_1} = \frac{2}{20} \times \frac{100}{14} = 0.71$$

This is the paradox of plenty: when every farmer prospers in the field at once, they crowd a market that pays less for more, and the good harvest quietly cuts the very income it promised to swell.

The Master Key: for a staple with inelastic demand, a bumper harvest pushes the price down more than it lifts output, so total revenue falls from 360 to 320, more grain for less money.

BINDER Question 159

A shopkeeper in Dodoma watches one good leave her shelf and wonders which force is moving it: its own price, her customers' wages, or the price of the thing it is always bought beside. Three questions, and the elasticity family answers each with a number of its own.

A good has price elasticity of demand $e_p^d = 0.5$, income elasticity $e_y^d = -0.2$ and cross elasticity $e_c^d = -0.3$ against a related good. Read the three coefficients together and characterise the good.

Model Answer

Read as a set, the three coefficients describe one good that is an inelastic necessity, an inferior good, and a complement to its partner good.

The own-price number says necessity: $e_p^d = 0.5$ is a positive value below one, so demand is inelastic: when the good's own price changes, the quantity bought barely moves. That unresponsiveness is the behaviour of a necessity with few close substitutes.

The income number says inferior: $e_y^d = -0.2$ is negative, and a negative income elasticity is the signature of an inferior good: as the consumer's income rises, the quantity demanded falls, because the buyer trades up to something better.

The related-price number says complement: $e_c^d = -0.3$ is negative, and a negative cross elasticity means a complement: the good is jointly demanded with its partner, so a rise in the partner's price pulls this good's quantity down with it.

There is no contradiction in wearing all three labels, because each answers a different question, own price, income and a related price, and the three questions are independent. Read the signs first and the size second, and the good stands fully described.

The Master Key: read the two signs first (income negative, cross negative) and then the size (own price below one), and the good is revealed as an inelastic, inferior complement.

BINDER Question 160

The price of maize can double in a year of drought and halve after a glut, lurching from season to season. Yet walk into any kitchen and the family buys almost the same few sacks whatever the price, and in that steadiness lies the whole trouble.

Explain why the demand for staple foods tends to be price-inelastic, and why this inelasticity makes farm prices and incomes unstable.

Model Answer

Staple foods have inelastic demand because they are near-necessities with few substitutes and a small share of the budget, and it is precisely this inelasticity that makes their prices and their growers' incomes swing so violently whenever the harvest changes.

Few substitutes and no doing without: a staple like maize, rice or cassava sits at the centre of the plate with no close everyday substitute, and a family must eat whatever the price. Buyers therefore cannot switch away or go without when the price rises, so the quantity bought holds firm.

A small slice of spending: the staple takes only a modest share of a household's budget, so even a sharp change in its price leaves total spending barely dented and the quantity bought almost unchanged. A necessity, few substitutes and a small budget share together make demand steep and inelastic.

Why steep demand breeds instability: when demand is inelastic, any shift in the harvest must be cleared by a large movement in price rather than in quantity, so a glut crashes the price and a shortage spikes it. Because the price moves more than proportionately, revenue swings the opposite way to output, and a bumper harvest can cut incomes while a poor one can raise them.

So the same inelasticity that keeps families fed through the lean years is what condemns the farmer to wild prices and uncertain income across the good years and the bad.

The Master Key: staples are inelastic because they are near-necessities with few substitutes and a small budget share, and that inelasticity turns every swing in the harvest into a larger swing in price and an opposite swing in income.

REAL Question 161

Read the account of Neema, who grows rice in the Kilombero valley, across two seasons: the year the rains were kind to every farmer, and the year they were not.

Calculate Neema's total revenue in each season and explain why the better harvest left her worse off.

Neema grows rice in the Kilombero valley.

Normal season: she harvests 100 sacks and sells each at TShs 80,000.

Bumper season: the whole valley harvests well, she brings 120 sacks to market, but the price has slumped to TShs 60,000 a sack.

Model Answer

Neema's total revenue falls from TShs 8,000,000 in the normal season to TShs 7,200,000 in the bumper season, so the larger harvest actually paid her less.

The normal season: revenue is price times quantity, so 100 sacks at TShs 80,000 each bring in a total that sets the year's benchmark.

$$\mathrm{TR}_0 = 80{,}000 \times 100 = 8{,}000{,}000$$

The bumper season: the valley's fine harvest floods the market, so although Neema carries 120 sacks, each fetches only TShs 60,000, and her total comes to less than before.

$$\mathrm{TR}_1 = 60{,}000 \times 120 = 7{,}200{,}000$$

Why more rice brought less money: rice is a staple with inelastic demand, so the valley's extra sacks could be shifted only by dropping the price hard. The price fell by about a quarter while output rose only a fifth, so the proportionate loss outran the proportionate gain. The total-outlay test seals it, since price and revenue fell together, and that happens only when demand is inelastic.

Neema farmed well and was punished for it, because every grower in Kilombero sold more into the same market at once, and a market for a staple pays less, not more, when it is flooded.

The Master Key: Neema sold more rice for less money, 8,000,000 down to 7,200,000, because a valley-wide bumper crop met the inelastic demand of a staple.

REAL Question 162

Follow the raw cashew of Mtwara from the tree to the store, and watch the Cashewnut Board lower a floor beneath a price that would otherwise fall clean through the ground.

Explain how a minimum guaranteed price and a buffer stock can stabilise cashew farmers' incomes, and give one cost of the scheme.

The Cashewnut Board buys raw cashew from farmers in Mtwara and Lindi.

It sets a minimum guaranteed price the farmer is sure to receive.

In a glut it buys the surplus into store, a buffer stock, to hold the price up.

In a poor year it can release stored nuts to keep the price from spiking.

Model Answer

By promising a floor price and by buying the surplus in a glut to release it again in a shortage, the Board holds the cashew price within a band, so farmers' incomes stop lurching with the harvest, though the buying and storing cost real money.

The guaranteed price sets a floor: the Board promises to buy at a stated minimum, so even when a bumper crop would have collapsed the open-market price, the farmer is still paid the floor and his income is shielded from the worst of the fall.

The buffer stock does the smoothing: in a glut the Board buys up the surplus and takes it off the market, stopping the price from falling; in a lean year it sells from store, adding supply and stopping the price from spiking. Because cashew demand is inelastic, these modest changes in what reaches the market move the price a great deal, which is exactly why buying or releasing a small surplus can steady it.

The cost of the scheme: storage sheds, spoilage, pests and the working capital locked up in unsold nuts all cost money, and a floor set too high tempts farmers to grow ever more, leaving the Board with mounting stocks it must keep funding from the public purse.

The scheme buys income stability at the price of a standing bill for warehouses and working capital, so its worth turns on keeping the guaranteed price near the market's true long-run level rather than far above it.

The Master Key: a buffer stock and a guaranteed price steady farm incomes by buying gluts and releasing shortages, but storage, spoilage and tied-up capital are a bill someone must pay.

REAL Question 163

A market study lands on the desk of a trader who sells a premium branded rice beside the ordinary loose grain. It carries three numbers, and she must decide whether to raise her price for the coming season.

Characterise the branded rice from its three elasticities, and advise the trader whether raising its price would raise her revenue.

Market study of a premium branded rice, sold beside ordinary loose rice:

Price elasticity of demand: 1.8

Income elasticity of demand: +1.3

Cross elasticity of demand with ordinary loose rice: +0.9

Model Answer

The three coefficients reveal the branded rice as a price-elastic, income-elastic normal good and a substitute for ordinary rice, so lifting its price would shrink her revenue rather than swell it.

The own-price number says elastic: $e_p^d = 1.8$ is above one, so demand is elastic: because the ordinary loose grain sits right beside it, a price rise sends buyers straight to the cheaper substitute and the quantity falls more than proportionately.

The income number says a normal good buyers trade up to: $e_y^d = +1.3$ is positive, so the rice is a normal good, and being above one it is income-elastic: as households grow richer they move toward the branded grain faster than their income climbs.

The related-price number says substitute: $e_c^d = +0.9$ is positive, and a positive cross elasticity identifies a substitute: when ordinary rice grows dearer, buyers switch across to the branded bag.

The pricing verdict: with demand elastic, a price rise loses a larger share of sales than it gains in price. A ten per cent rise would cut the quantity sold by eighteen per cent, so total revenue falls, and to lift revenue she should hold or shave the price, not raise it.

$$\%\Delta Q^d = e_p^d \times \%\Delta P = 1.8 \times 10\% = 18\%$$

Read together, the three numbers tell her both what her rice is, a discretionary grain with a cheaper twin, and why raising its price in a market full of substitutes would only empty her till.

The Master Key: the branded rice is elastic, income-elastic and a substitute, so with buyers ready to switch to ordinary grain, raising its price would cut her revenue, not grow it.

HOT Question 164

The granaries are overflowing after a magnificent harvest. The Minister for Agriculture calls it a national triumph; the farmers' cooperative calls an emergency meeting. Both are staring at the very same full sacks.

Assess whether a bumper harvest of a staple crop is good for the farmer, good for the nation, or both.

Model Answer

A national bumper harvest is largely good for the nation yet often bad for farmers as a group, because the same fall in price that feeds the country cheaply is the fall that shrinks the growers' income.

Bad for farmers taken together: with staple demand inelastic, a harvest that swells every farmer's output at once crashes the price by more than the extra output is worth, so their combined revenue falls. This is the paradox of plenty, and it strikes hardest precisely when the harvest is best.

Good for the nation: consumers enjoy cheaper staples, food security improves, hunger and food-price inflation ease, and any surplus can be stored against a poor year or sold abroad. Judged by the nation's plate, the bumper harvest is plainly a gain.

The twist that saves the individual: the paradox bites only because all farmers gain together. A single farmer whose plot alone does well sells his extra sacks at a price the whole market has barely moved, so he is better off. To assume that what enriches one farmer enriches them all is the fallacy of composition.

The balanced verdict: weighed nationally the harvest is a gain in food and welfare; weighed from the farmers' bank accounts it is a loss, unless policy such as a buffer stock or guaranteed price catches the falling price. Whether it counts as good depends on whose ledger you read and whether the state steps in.

The full granary is a single event seen from two sides, a fuller plate for the nation and a thinner envelope for the farmer, which is why governments so often plant themselves between the two.

The Master Key: a national bumper harvest feeds the nation cheaply but shrinks farmers' combined income, and only the individual farmer whose crop alone thrives escapes the paradox.

HOT Question 165

One adviser urges the Treasury to guarantee every farmer a fair price and end the yearly gamble of the harvest. Another warns that the warehouses of unsold grain will empty the budget long before the farmers are safe.

Discuss whether the government should intervene to stabilise farm prices, weighing the benefits against the costs.

There is a genuine case for stabilising farm prices to protect incomes and secure the food supply, but the fiscal and storage costs, and the danger of encouraging permanent surpluses, mean intervention is justified only when it is modest and carefully judged.

The case for stepping in: prices that lurch from season to season leave farmers unable to plan, invest or borrow, and a price that collapses in a glut can ruin them outright. A buffer stock or a guaranteed price steadies incomes, secures the nation's food, and keeps rural communities from breaking up.

The cost of the warehouses: buying and storing surpluses ties up public money, and stored grain rots, is eaten by pests, or must be insured and guarded. The buffer stock is a standing charge that the taxpayer carries year after year, whether or not the harvest ever needs it.

The distortion of a price set too high: a guaranteed price pitched above the market's long-run level tempts farmers to overproduce, so the surplus never clears and the store only swells. The scheme then ends up funding a glut of its own making, an ever-growing mountain no one will buy.

The balanced verdict: limited stabilisation, a buffer stock that buys in gluts and sells in shortages around the market's true average, can be well worth its cost. A permanent floor propped far above that average is not, since it buys calm today by building an unsellable stock for tomorrow. The test is whether the price is smoothed or merely fixed.

The aim should be to shave the peaks and fill the troughs, not to silence the market's signal altogether, because a price held permanently above its natural level purchases stability at the cost of a surplus that never ends.

The Master Key: smooth the peaks and troughs around the market's true average and stabilisation can be worth its cost; fix the price permanently above that average and the warehouses bankrupt the scheme.

HOT Question 166

A student objects that to call one good a necessity, an inferior good and a complement all at once is simply to contradict yourself three times over. Her teacher says nothing, and sets a tin of kerosene on the desk.

Can a single good be, at the same time, a necessity, an inferior good and a complement? Justify your answer.

Model Answer

Yes, one good can be all three at once, because each label is the verdict of a different elasticity, and the three elasticities answer three logically independent questions.

Three separate measuring rods: the word necessity is a verdict of price elasticity ($e_p^d < 1$, inelastic); inferior is a verdict of income elasticity ($e_y^d < 0$); complement is a verdict of cross elasticity ($e_c^d < 0$). They read three different causes, the good's own price, the buyer's income and a related price, so they cannot contradict one another.

A living example on the desk: kerosene for a lamp is a necessity to a household off the grid, its quantity barely bending when the price rises; an inferior good, since as income rises the family switches to electricity; and a complement to the lamp and stove it fuels, so dearer lamps mean less kerosene. One good, three true labels, no clash.

The single caution, hold income and time still: a good can change its labels as circumstances change. A grain that is a normal good for a poor family can turn inferior as that family grows rich, which is how Engel's law works. The three labels therefore describe the good at one income and one moment, not for all time.

So there is no contradiction, only three separate answers to three separate questions, and that is exactly why the elasticity family keeps three demand members rather than collapsing them into one.

The Master Key: one good can be a necessity, inferior and a complement at once because the three labels come from three independent elasticities, not from a single one.

Elasticity clinic and capstone

A chapter of formulas ends not with more formulas but with a reckoning. This closing section is at once a clinic and a capstone: first you sit in judgement on the errors that trip most students, the dropped sign, the percentage confused with the raw amount, the slope mistaken for elasticity, the arc method fed the wrong base; then you rework a run of real cases from first principles, deriving every coefficient yourself and

reading what each one means. The clinic sharpens your eye for the mistake before it is committed; the capstone proves you can carry a calculation from raw prices all the way to a confident interpretation. By the last line, elasticity should feel less like a set of rules and more like a single habit of mind: measure the response, then say plainly what it means.

BINDER Question 167

A diligent student in Morogoro divides one shilling figure straight into another, writes the price elasticity as minus nought point nought two, and looks pleased. Two lines up, the error was already made.

Read the working in the box, identify every error, and produce the correct price elasticity of demand.

> A shopkeeper raises the price of an exercise book from TShs 2,000 to TShs 2,500, and weekly sales fall from 50 to 40.
>
> Student's working: $\Delta Q = -10, \Delta P = 500$, so $e_p^d = \frac{-10}{500} = -0.02$. Demand is extremely inelastic.

Model Answer

The working commits the classic error of dividing absolute amounts instead of percentages, and once that is repaired the true price elasticity is 0.8, inelastic.

The first error, absolute in place of proportionate: elasticity is built from percentage changes, never from raw shilling and unit differences. Dividing a fall of ten books by a rise of five hundred shillings even mixes the units together, so the figure of -0.02 measures nothing real.

The repair, work in percentages: turn each change into a percentage of its own starting value, and the two honest proportions appear.

$$\%\Delta Q^d = \frac{40 - 50}{50} \times 100 = -20\%$$

$$\%\Delta P = \frac{2{,}500 - 2{,}000}{2{,}000} \times 100 = +25\%$$

A word on the sign: the student's own minus sign is right, since for a normal good price and quantity move in opposite directions; keep that sign to show the good is normal, then report the size by taking its absolute value or by prefixing a minus deliberately.

$$e_p^d = \frac{\%\Delta Q^d}{\%\Delta P} = \frac{-20\%}{25\%} = -0.8$$

Reported as its magnitude, the price elasticity is 0.8, inelastic because quantity fell less than proportionately to price, a world away from the meaningless -0.02 the student first wrote.

The Master Key: elasticity divides one percentage by another, and the minus sign is reported rather than discarded, so the honest answer here is 0.8, not -0.02.

BINDER Question 168

Two demand lines share a blackboard in Dodoma, one steep, one gentle. A quick student reads the steep line as the less elastic and, warming to the idea, declares its elasticity equal to its slope.

Diagnose and correct the two claims in the box about slope and elasticity.

> Claim 1: this demand curve is steeper than that one, so it must be the less elastic of the two.
>
> Claim 2: elasticity is just the slope of the demand curve, so a curve with a slope of 2 has an elasticity of 2.

Model Answer

Both claims mistake a picture for a measurement, because steepness is slope, slope is not elasticity, and neither claim survives a careful look.

Slope and elasticity are different animals: the slope of a demand curve is a ratio of absolute changes that carries the units of the axes, while elasticity is a ratio of percentage changes with no units at all. Elasticity uses the reciprocal of the drawn slope multiplied by the price-quantity ratio, so a bare slope figure is never itself an elasticity.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P}{Q}$$

Why steeper does not settle it, the units: steepness depends on the scale chosen for the axes. Stretch the quantity axis or shrink the price axis and the very same curve looks steeper without any change in its real responsiveness, so two people drawing the very same data on different scales could disagree about which line is the steeper.

Why steeper does not settle it, the position: along one straight demand line the slope never changes, yet the elasticity runs from very high near the top, through 1 at the midpoint, down to very low near the foot. A single steepness therefore hosts every degree of elasticity, which the claim cannot allow.

The comparison steeper equals less elastic holds only for two curves drawn to identical axes and read at the same point; the eye sees steepness, but only the proportionate calculation sees elasticity.

The Master Key: steepness is slope, slope is units-bound and changes elasticity along its own length, so elasticity is never simply the slope's number.

BINDER Question 169

In an Iringa classroom a neat calculation reaches for the arc formula but feeds it a single starting price, the axes sit reversed, and nobody noticed that incomes had quietly risen over the same week.

Find and repair the three faults in the box, then state the correct arc elasticity of demand.

Between point A (P = 200, Q = 10) and point B (P = 100, Q = 20), the arc elasticity is worked as:

$$e_p^d = -\frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0} = -\frac{10}{-100} \times \frac{200}{10} = 2.0$$

(The curve was drawn with price on the horizontal axis, and over the same period household incomes also rose.)

Model Answer

Three faults hide in these lines, a point base used where the arc method needs the average, reversed axes, and a broken ceteris paribus, and once the averages are used the arc elasticity is 1.0, not 2.0.

The arc method averages the two ends: the arc, or mid-point, method divides by the sum of the two prices and the two quantities, not by a single starting pair. What the box computed, leaning on P_0 and Q_0 alone, is the point elasticity at A; the genuine arc figure uses both ends.

$$e_p^d = -\frac{\Delta Q^d}{\Delta P} \times \frac{P_1 + P_0}{Q_1 + Q_0}$$

$$e_p^d = -\frac{10}{-100} \times \frac{100 + 200}{20 + 10} = 0.1 \times 10 = 1.0$$

The axes carry a fixed convention: price belongs on the vertical axis and quantity on the horizontal. Drawing price along the horizontal inverts the apparent slope and invites every later misreading, so the diagram must be relabelled before the eye is trusted.

Ceteris paribus keeps the price effect clean: price elasticity isolates the response to price with everything else held still. If incomes rose at the same moment, part of the quantity change is an income effect, so the raw ratio no longer measures price responsiveness alone; hold income constant or the number is simply not a price elasticity.

One base, one convention and one assumption, each set right, turn a confident 2.0 into a defensible 1.0, unit elastic.

The Master Key: the arc method divides by the averaged base, giving 1.0 here, price sits on the vertical axis, and ceteris paribus must hold or the figure is no price elasticity at all.

REAL Question 170

Follow Anania, who keeps the stationery corner beside a school in Iringa. He nudges the price of his best counter book up by a quarter, and two of every ten buyers quietly drift away.

Compute the price elasticity of demand for Anania's counter books, classify it, and interpret what it means for his takings.

Anania's counter book: the price rises from TShs 3,000 to TShs 3,750, and daily sales fall from 10 to 8.

Model Answer

The price elasticity of demand is 0.8, so demand for Anania's counter books is inelastic, and the two lost sales cost him nothing in revenue.

Set the two percentage changes side by side: measure each change against its own starting value, the price against 3,000 and the quantity against 10.

$$\%\Delta P = \frac{3{,}750 - 3{,}000}{3{,}000} \times 100 = +25\%$$

$$\%\Delta Q^{d} = \frac{8 - 10}{10} \times 100 = -20\%$$

Divide to reach the coefficient: the elasticity is the quantity response over the price change, and the minus only records that the two moved in opposite directions, so the reported size is 0.8.

$$e_{p}^{d} = \frac{-20\%}{25\%} = -0.8$$

Read the number, inelastic: since $0.8 < 1$ the quantity fell less than proportionately to the price, so buyers are relatively unresponsive. A counter book is a study necessity with no close substitute for a pupil who needs one that morning.

Because the 20 per cent fall in copies sold is smaller than the 25 per cent rise in price, demand is inelastic: the quantity gives way by proportionately less than the price climbs, so Anania sells only a little less after the rise.

The Master Key: a 25% price rise against a 20% quantity fall gives a price elasticity of 0.8, inelastic, so quantity gives way by proportionately less than the price rise, and Anania loses only a sale or two.

REAL Question 171

Read the case of Mariam, a cook in Lindi whose appetite for pumpkin bends by a constant nine-tenths. She buys four at 1,500 shillings apiece; then the price eases to 1,000.

Given a constant price elasticity of 0.9, work out how many pumpkins Mariam buys when the price falls from TShs 1,500 to TShs 1,000, showing every step.

Mariam's price elasticity of demand for pumpkins is a constant 0.9. She buys 4 pumpkins at TShs 1,500 each, then the price falls to TShs 1,000.

Model Answer

Mariam buys about 5 pumpkins, because a one-third fall in price lifts her quantity demanded by roughly 30 per cent.

Find the percentage change in price: the price drops by 500 shillings from a base of 1,500, which is a fall of a third.

$$\%\Delta P = \frac{1{,}000 - 1{,}500}{1{,}500} \times 100 = -33.3\%$$

Turn the elasticity round to find the quantity response: with the elasticity fixed at 0.9, the quantity change is that coefficient multiplied by the price change; because the price fell, the quantity rises, so the response is positive.

$$\%\Delta Q^d = 0.9 \times 33.3\% = +30\%$$

Apply the rise to her original four: grow the starting quantity of four by thirty per cent.

$$Q_1 = 4 \times (1 + 0.30) = 4 \times 1.30 = 5.2$$

Rounded to whole pumpkins she carries home about 5. Since her elasticity is below 1, her quantity grows less than proportionately, a 30 per cent rise against a 33 per cent price cut, so the cheaper pumpkins tempt her to just one extra, not a basketful.

The Master Key: with a constant elasticity of 0.9, a 33% price cut raises quantity by 30%, taking Mariam from 4 pumpkins to about 5.

REAL Question 172

Read the ledger of two goods on a Lindi street. In one week the price of A slides from 600 to 500, and the weekly sales of B halve from 40 to 20. What binds the two?

Name the elasticity concept this calls for, compute it, classify the relationship between A and B, and give two examples.

In one week the price of good A falls from TShs 600 to TShs 500, while the quantity of good B sold falls from 40 units to 20.

Model Answer

This calls for the cross-price elasticity of demand, and at +3.0 it identifies A and B as close substitutes.

Name the concept: because the price of one good, A, is changing while we watch the quantity of another, B, the right tool is the cross-price elasticity of demand, the responsiveness of the quantity of B to the price of A.

$$e_c^d = \frac{\%\Delta Q_B}{\%\Delta P_A}$$

Compute the two percentage changes: measure the price of A against 600 and the quantity of B against 40.

$$\%\Delta P_A = \frac{500 - 600}{600} \times 100 = -16.7\%$$

$$\%\Delta Q_B = \frac{20 - 40}{40} \times 100 = -50\%$$

Divide and read the sign: both the price of A and the quantity of B fell together, so the ratio is positive, and a positive cross elasticity signals substitutes, while a value as large as 3 shows them to be close ones.

$$e_c^d = \frac{-50\%}{-16.7\%} = +3.0$$

As A grew cheaper, buyers switched toward A and away from B, exactly how rivals behave. Coca-Cola and Pepsi, or beef and chicken on the butcher's slab, would return the same positive sign.

The Master Key: a positive cross elasticity, here +3.0, means A and B are substitutes, so a cheaper A steals sales from B just as Pepsi steals from Coca-Cola.

HOT Question 173

A revenue officer eyes the cigarette trade: 0.55 in Unguja, 0.15 in Dar es Salaam. To the officer both numbers spell easy money, yet they do not tell quite the same story.

Explain what the elasticities of 0.55 and 0.15 mean, say which region is more responsive, find the effect of a 2% price rise in Unguja, and draw out the implication for taxing cigarettes.

Price elasticity of demand for cigarettes: 0.55 in Unguja, 0.15 in Dar es Salaam.

Model Answer

Both figures reveal inelastic demand for cigarettes, but Unguja at 0.55 is the more responsive of the two, and a 2% price rise there trims quantity demanded by 1.1%.

What each number means: both lie below 1, so in each place smokers cut back less than proportionately when the price climbs; cigarettes are addictive and short of substitutes, the classic inelastic good. The two figures differ only in the degree of that stubbornness.

Which region responds more: the larger the coefficient, the stronger the reaction, so Unguja at 0.55 is over three times as responsive as Dar es Salaam at 0.15. Dar's smokers are the more firmly hooked and the harder to move by price.

The 2% price rise in Unguja: multiply the elasticity by the price change to size the quantity fall.

$$\%\Delta Q^{d} = 0.55 \times 2\% = 1.1\%$$

The tax implication: quantity demanded falls by only 1.1%, while the same rise in Dar would shave a mere $0.15 \times 2\% = 0.3\%$. Because demand is inelastic, an excise duty raises a great deal of revenue with barely a dent in consumption, and the buyer rather than the seller carries most of the burden, which is why the TRA leans on cigarettes for revenue and why the same duty does little to end the habit.

The two numbers agree that cigarettes are a reliable purse for the treasury, and warn that taxing them fills the coffers far more surely than it clears the air, least of all in Dar.

The Master Key: inelastic demand, 0.55 and 0.15, makes cigarettes a tax officer's friend, raising revenue with only a 1.1% quantity fall in Unguja and less in Dar, while curbing the habit hardly at all.

HOT Question 174

A cafe talker in Arusha waves the subject away: elasticity, he says, is a pastime economists enjoy on a slow afternoon, of no use to anyone with a real shop to run.

Discuss and refute the claim that elasticity of demand is useless and calculated only for leisure.

Model Answer

The claim is plainly false, because elasticity is one of the most decision-loaded numbers in economics, steering pricing, taxation, farming and trade alike.

The grain of truth conceded: it is true that elasticity begins life as an abstract ratio, and a trader can scrape by on instinct for a while. That much, and no more, the claim may borrow before it collapses.

It rules the pricing decision: a firm that knows its demand is elastic cuts price to lift revenue, while one facing inelastic demand raises price for the same end. Without the measured coefficient the very direction of a profitable move is a guess.

It shapes taxation: a treasury taxes goods whose demand is inelastic, cigarettes, fuel and alcohol, to raise revenue without killing the base, and elasticity also decides whether the buyer or the seller bears the heavier share of the tax.

It explains the fate of farmers: because demand for staples is inelastic, a bumper harvest can push the price down so far that total farm income actually falls, the paradox of plenty, which is the standing case for buffer stocks held by bodies like the Cashewnut Board. Currency and wage questions turn on the same measure.

Far from an idle pastime, elasticity is the hinge on which pricing, tax policy and a farmer's survival all turn; the cafe talker enjoys the luxury of ignoring it only until the morning he must set a price of his own.

The Master Key: elasticity drives pricing, taxation, agriculture and trade, so dismissing it as leisure mistakes the most practical number in demand analysis for a toy.

HOT Question 175

A Mwanza marketing team hands you three numbers for one product: a price elasticity of 2, an income elasticity of 2.5, and a cross elasticity of +1.2. They ask what kind of good they are really selling.

Characterise a good whose price elasticity is 2, income elasticity is 2.5 and cross-price elasticity with a rival is +1.2, reading all three numbers together.

A new product reports: price elasticity of demand 2, income elasticity of demand 2.5, cross-price elasticity with a rival good +1.2.

Model Answer

Read together, the three numbers describe an elastic luxury with a close substitute, a good that is thrilling in a boom and fragile in a price war.

Price elasticity of 2, highly elastic: since $e_p^d = 2$, above 1, quantity moves twice as fast as price, so a price rise cuts sales sharply and shrinks revenue. The good has many substitutes and no captive buyer, so its price must be set with great caution.

Income elasticity of 2.5, a luxury: since $e_y^d = 2.5$, positive and well above 1, demand races ahead of income, so this is a superior, luxury item that surges when incomes rise and slumps when they fall.

Cross elasticity of +1.2, a close rival: the positive sign of $e_c^d = +1.2$ signals a rival that is competitively demanded, and a value above 1 says the rival is a close one, so when its price rises buyers pour toward this good.

Put together, this is a branded discretionary product, a mid-range smartphone or a fashion label, that must price with care, ride the wave of rising incomes, and watch its rival's price like a hawk; all three elasticities point the same way, toward a good that lives and dies by choice rather than need.

The Master Key: a price elasticity of 2, income elasticity of 2.5 and cross elasticity of +1.2 together spell an elastic luxury with a close rival: price-sensitive, income-hungry and locked in competition.

HOT Question 176

One coefficient sits quietly inside a formula, yet the same number decides a shopkeeper's price, a minister's tax and whether a good harvest blesses or bankrupts a farmer. Ask how one idea reaches so far.

Examine how a single idea, elasticity, reaches across pricing, taxation and the fortunes of farmers.

Model Answer

One measure, the size of the quantity response, threads through pricing, taxation and farming, because each of those decisions turns on how much quantity moves, not merely on which way.

Pricing turns on it: a firm raises its price where demand is inelastic and cuts it where demand is elastic, because the elasticity alone decides whether revenue follows the price up or fights it down. The same coefficient, read once, sets the whole strategy.

Taxation turns on it: a treasury taxes inelastic goods to raise revenue with little loss of quantity, and the more inelastic side of the market, buyer or seller, carries the heavier share of any tax. Elasticity both picks the target and splits the burden.

The farmer's fate turns on it: demand for staples like maize or rice is inelastic, so a bumper harvest pushes the price down faster than quantity rises and total farm revenue falls, the paradox of plenty. That same inelasticity is the argument for buffer stocks and price supports.

Pricing, taxation and the farmer's fortune look like three separate problems, but each is the one question of magnitude wearing a different coat, which is why a single elasticity can answer them all at once.

The Master Key: because pricing, taxation and farm income each depend on how much quantity responds, the single coefficient of elasticity quietly governs all three.

HOT Question 177

Told that the mid-point method always gives the tidier answer, a student resolves to abandon the point method for good. A wiser voice asks whether one tool can truly retire another.

Judge whether the mid-point (arc) method should always be preferred to the point method.

Model Answer

The arc method should not always be preferred, because each method answers a different question, and the point method is indispensable exactly where the arc method cannot reach.

Where the arc method wins: between two separated points the point formula gives two different answers depending on which end supplies the base, while the arc method divides by the average of both prices and quantities and returns a single figure whichever way the price moved. For a large, discrete jump between two observations it is the fairer tool.

$$e_A = 2.0, e_B = 0.5, e_{arc} = 1.0$$

Where only the point method serves: when elasticity is wanted at a single price, or must be read from a demand function or its derivative, there is no second point to average, so the point method is the only one that applies.

$$e_p^d = \frac{\Delta Q^d}{\Delta P} \times \frac{P_0}{Q_0}$$

Each measures a different thing: the arc figure is an average responsiveness over a stretch of the curve, while the point figure is the responsiveness exactly where you stand. For the same A and B the point method reads 2.0 from one end and 0.5 from the other, and the arc method settles them at 1.0; preferring either blindly throws away what the other keeps.

So the rule is to fit the tool to the purpose, the arc method for a measured move between two points and the point method for elasticity at a precise spot or from an equation; neither retires the other.

The Master Key: prefer the arc method for a discrete move between two points and the point method for elasticity at a single point or from a function, because neither is always superior.

Chapter Five

THEORY OF PRODUCTION AND COST

Chapters Three and Four stood in front of the counter and watched a price form. This chapter walks behind the counter. A firm does not simply decide to supply; it hires land, labour, capital and enterprise, combines them under a technique that is fixed for the moment, and discovers that the second machine adds more than the first while the tenth worker adds almost nothing. Out of that technical fact comes every cost curve you will ever draw, and out of the cost curves, set against revenue, comes the one output at which the firm makes the most money it can. Work through this chapter and the supply curve stops being a line somebody drew and becomes something you can derive.

Production, Utility and the Firm

Every sack of flour in a Mbeya shop began as maize standing in a field, and something had to happen in between. That something is production, and it is not the making of matter but the making of usefulness. This section fixes what a producer actually creates, who does the creating, and how a firm turns inputs into outputs. Get this foundation exact and the whole chapter, from product curves to profit, stands on solid ground.

BINDER Question 1

A miller in Mbeya pours in ninety kilogrammes of maize and takes out ninety kilogrammes of flour. Nothing was added, nothing was lost, yet the sack is now worth far more.

Define production and, with the aid of a diagram, explain the production process.

Model Answer

Production is the creation of utility, that is, the creation of the power to satisfy a human want, by transforming inputs into goods and services.

A producer never creates matter. The maize that enters the mill and the flour that leaves it contain exactly the same substance. What the miller has created is usefulness, because flour can be cooked into ugali and whole grain cannot. Production is therefore measured by want satisfying power, not by weight.

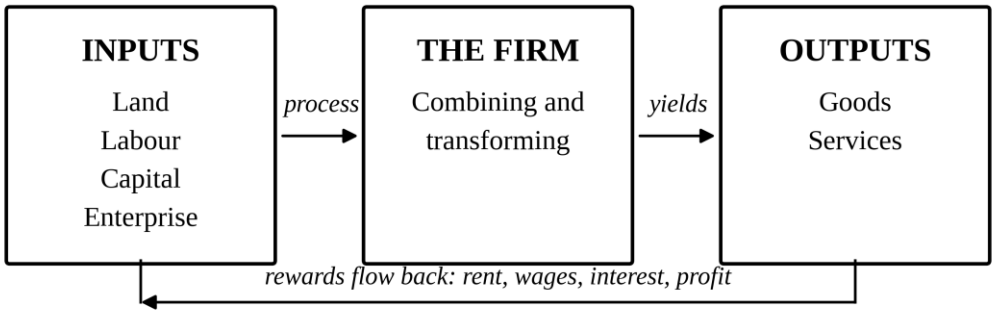


Figure 5.1: The production process

Inputs: the resources drawn into the process, namely land, labour, capital and entrepreneurship. In the mill these are the plot the building stands on, the miller and his workers, the grinding machine and the shillings tied up in it, and the owner who put the whole arrangement together.

The firm: the unit that combines those inputs and organises the transformation. It decides how much maize to buy, how many hands to hire and how long to run the machine each day.

Outputs: the goods and services that come out at the far end, here sacks of sembe. Output may be a physical good or a pure service, because a doctor who treats a patient and a bus that carries a passenger are both producing.

The rewards: each input is paid for what it contributes, so rent flows back to land, wages to labour, interest to capital and profit to the entrepreneur. The flow of resources into the firm is matched by a flow of income out of it.

So production is a transformation with two sides. Physically, inputs become outputs. In money terms, the value of what comes out must cover the rewards of everything that went in, or the producer will not repeat the process tomorrow.

The Master Key: *Production creates utility, never matter; the firm is where inputs are transformed and the rewards flow back.*

BINDER Question 2

A tomato rotting in an Iringa field and the same tomato on a Dar es Salaam plate are the same fruit. Only one of them is useful, and four different kinds of work explain the difference.

Explain the four forms of utility created by production, giving a Tanzanian example of each.

Model Answer

Production creates four forms of utility, namely form utility, place utility, time utility and possession utility, and a good becomes fully useful only when all four have been supplied.

Form utility: usefulness created by changing the physical shape of a thing. A Singida press crushes sunflower seed into cooking oil, so a seed that no household could cook with becomes a litre of alizeti oil that every household wants.

Place utility: usefulness created by moving a good to where it is wanted. Dagaa dried on the shore of Lake Victoria are worth little at Kirumba because everyone there has them, and worth a great deal in Dodoma because nobody there does. The lorry that carries them creates real value.

Time utility: usefulness created by holding a good until it is wanted. Maize harvested in June is stored by the National Food Reserve Agency and released in February, when the granaries of ordinary households are empty. Storage moves the grain from a month of plenty to a month of hunger.

Possession utility: usefulness created by transferring a good into the hands of the person who wants it. A Kariakoo trader who sells a bicycle to a farmer creates value because the bicycle is worth more to the farmer who will ride it to his shamba than to the trader who was only holding it.

Because all four are creations of usefulness, all four are production. The transporter, the storekeeper and the trader are producers just as truly as the miller is, even though none of them changes the physical shape of anything.

The Master Key: *Form, place, time and possession: four ways of making a thing useful, and all four are production.*

BINDER Question 3

A Hadzabe hunter near Lake Eyasi eats what he himself kills. A Dar es Salaam accountant eats fish he has never seen caught. Between those two meals lies the whole story of a modern economy.

Distinguish between direct production and indirect production.

Model Answer

Direct production is producing for one's own use, while indirect production is producing for exchange, so that the producer obtains what he needs by trading what he has made.

Direct production: the producer is also the consumer. A family in a remote village that grows its own mahindi, builds its own house and fetches its own water is producing directly. Nothing passes through a market, so no money changes hands.

Indirect production: the producer makes one thing and buys everything else. A Mtwara cashew farmer grows only cashew, sells the whole crop, and uses the proceeds to buy flour, cloth, soap and school fees. He eats no cashew at all.

Specialisation: indirect production rests on specialisation, because a producer can concentrate on the one activity he does best only if he is sure of buying the rest. This is why indirect production needs a reliable market and a trusted money.

Output: indirect production yields far more. The Hadzabe hunter is limited to what one pair of hands can do, while the cashew farmer uses land suited to cashew, tools made in a factory and knowledge gathered by others, so total output is many times larger.

Risk: indirect production carries a risk the direct producer does not face. If the world cashew price collapses, the farmer who grew nothing else has neither cash nor food, whereas the subsistence family still eats.

Tanzania contains both. A smallholder who eats most of his maize and sells the surplus is producing partly directly and partly indirectly, and the share that goes to the market rises as roads, storage and prices improve.

The Master Key: *Direct production feeds the producer; indirect production feeds the market, and the market then feeds the producer.*

BINDER Question 4

The word firm covers a woman frying vitumbua on a Tanga street corner and a sugar estate at Kilombero with two thousand workers. One idea has to stretch across both.

Define a firm, an input and an output, and explain the relationship between them.

Model Answer

A firm is the unit of production that hires and combines inputs in order to produce outputs, an input is any resource used up in that process, and an output is the good or service that results.

A firm: any organisation, of any size, that takes production decisions as one unit. The woman frying vitumbua decides alone how much flour to buy and how many hours to fry, so she is a firm. Kilombero Sugar Company decides through managers and a board, but it is still one decision taking unit.

An input: anything the firm uses up to produce. Inputs are grouped into the four factors of production, and each carries a price the firm must pay, which is why inputs are the source of cost.

An output: what the firm offers for sale, whether a physical good such as a sack of sugar or a service such as a bus journey. Output is the source of revenue.

The relationship: output depends on inputs in a definite technical way, and that dependence is the production function. Because inputs cost money and output earns money, the technical relationship between inputs and output becomes the money relationship between output and cost.

This is why a chapter on production must also be a chapter on cost. The moment you know how many workers a given output needs, you also know what that output will cost at the going wage.

The Master Key: *Inputs are what a firm pays for, output is what it sells, and the production function is the bridge between them.*

BINDER Question 5

Two Njombe farms each harvest one hundred sacks of maize this season. One used four hectares and eight workers; the other used two hectares and three. They produced the same; they did not perform the same.

Distinguish between production and productivity.

Model Answer

Production is the total quantity of output created, while productivity is output per unit of input, so production measures how much was made and productivity measures how well the resources were used.

Production is a total: it answers the question how much. Both Njombe farms produced one hundred sacks, so their production is identical.

Productivity is a ratio: it answers the question how much per unit of what was used. The first farm produced $100 \div 8 = 12.5$ sacks per worker; the second produced $100 \div 3 = 33.3$ sacks per worker, so the second farm is far more productive.

Different inputs give different measures: labour productivity is output per worker, land productivity is output per hectare, and capital productivity is output per machine. The first farm's land productivity is 25 sacks per hectare against the second farm's 50, so the second wins on that measure too.

Why the difference matters: production can be raised simply by using more resources, but productivity can only be raised by using resources better, through improved seed, better tools, training or organisation. A country grows rich by raising productivity, not merely production.

So a producer who tells you output has doubled has told you almost nothing until you know whether the inputs also doubled. If they did, productivity has not moved at all.

The Master Key: *Production is the size of the harvest; productivity is the harvest divided by what it took to get it.*

BINDER Question 6

A Mwanza fisherman lands the fish, a lorry driver carries it, a filleting plant packs it and an Arusha guide sells the story of the lake. All four are producing, and economists sort them into three groups.

Describe the three levels of production and show how a single Tanzanian product passes through all of them.

Model Answer

Production takes place at three levels, namely primary production which extracts from nature, secondary production which processes and manufactures, and tertiary production which provides services, and most goods pass through all three before reaching the consumer.

Primary production: the extraction of raw materials from nature. Fishing on Lake Victoria, mining Tanzanite at Mererani, growing cotton in Shinyanga and cutting timber all belong here. The output is a raw material, not a finished good.

Secondary production: the processing of raw materials into finished or semi finished goods. A ginnery turning seed cotton into lint, a Morogoro mill turning paddy into rice and a filleting plant turning fish into frozen fillets are all secondary producers.

Tertiary production: the provision of services that carry the good to the consumer or serve people directly. Transport, wholesaling, retailing, banking, insurance, teaching and nursing are tertiary. They create place, time and possession utility rather than form utility.

Follow one Nile perch. It is caught at Mwanza, which is primary production. It is filleted and frozen at a lakeside plant, which is secondary production. It is trucked to the port, financed by a bank, insured on the voyage and sold in a shop, all of which is tertiary production. The fish on the plate carries the work of all three levels inside its price.

Why the balance matters: an economy that stops at the primary level exports raw value and imports it back at a much higher price. This is why the drive to fillet the fish, mill the paddy and cut the Tanzanite inside the country is a drive to keep secondary production at home.

The Master Key: *Primary takes it from nature, secondary changes its form, tertiary puts it in your hands.*

REAL Question 7

Follow one bag of maize out of a Mbeya shamba in July and into a Dar es Salaam kitchen in December. Its price rises five times on the journey, and not one grain is added.

Read the account below and identify the form of utility created at each stage, then explain why the trader's margin is not simply a deduction from the farmer's income.

A farmer at Mbozi harvests maize in July and sells it at the farm gate for TShs 500 a kilogramme.
A trader buys it, dries it properly and stores it in a warehouse at Mbeya town until December.
A miller grinds it into sembe and packs it in ten kilogramme bags.
A lorry carries the bags to Dar es Salaam, where a shop sells them at TShs 2,500 a kilogramme.

Model Answer

Each stage of the journey creates a different form of utility, and the price rises because at every stage the maize becomes more useful than it was before.

Drying and storing at Mbeya: this creates time utility. Maize in July is abundant and cheap because every farmer is selling at once; maize in December is scarce because household stores are empty. Holding the grain moves it from the month of plenty to the month of need, and the trader carries the cost of the warehouse and the risk of spoilage while he waits.

Milling into sembe: this creates form utility. Whole grain cannot be cooked into ugali, so the grinding changes the physical form into the one the household actually wants, and the packing into ten kilogramme bags makes it convenient to buy.

Carrying to Dar es Salaam: this creates place utility. The flour is worth more in a city that grows no maize than in a region that grows a surplus, and the lorry, the fuel and the driver are the resources that close that distance.

Selling in the shop: this creates possession utility. The shopkeeper breaks bulk, holds stock and stays open in the evening, so the flour reaches the exact household that wants it at the moment it is wanted.

The rise from TShs 500 to TShs 2,500 is therefore not a transfer taken out of the farmer's pocket. It is payment for four separate acts of production, each of which used up real resources. The trader who stores maize pays for a warehouse, ties up his capital for five months and bears the risk that the price falls.

The honest test is whether the margin is larger than the cost of the service. If storage, milling and haulage together cost TShs 1,600 a kilogramme, then the chain is earning about TShs 400 for the risk and the enterprise. If a shortage of lorries or of licences lets one operator charge far more than his costs, that excess is not a reward for production but a rent extracted from scarcity.

The Master Key: *A middleman who creates place, time or possession utility is producing; only a middleman protected from competition is merely charging.*

REAL Question 8

Two Kariakoo tailors sit side by side. One sews eleven school shirts a day, the other sews four. They work the same hours on the same street, and one of them will soon close.

Using the information in the box, calculate the labour productivity of each workshop, explain the difference, and advise the second tailor.

Workshop A: three tailors, three electric machines, output 33 school shirts a day.
Workshop B: three tailors, one electric machine and two treadle machines, output 12 school shirts a day.
Both workshops pay each tailor TShs 15,000 a day and sell shirts at TShs 9,000.

Model Answer

Workshop A produces eleven shirts per tailor a day against Workshop B's four, so A is nearly three times as productive, and the difference lies in the capital each worker has to work with rather than in the workers themselves.

Labour productivity is output per worker, so divide the daily output of each workshop by the number of tailors.

$$\mathrm{AP_L(A)} = \frac{33}{3} = 11 \text{ shirts per tailor}$$

$$\mathrm{AP_L(B)} = \frac{12}{3} = 4 \text{ shirts per tailor}$$

The cause is capital per worker: in A every tailor has an electric machine, while in B two of the three are treadling by foot. The tailors are equally skilled and equally willing, but one pair of hands joined to a powered machine simply sews more than the same pair of hands joined to a pedal.

The consequence shows up at once in labour cost per shirt. Workshop A pays $3 \times 15{,}000 = 45{,}000$ shillings a day for 33 shirts, and Workshop B pays the same TShs 45,000 for 12 shirts.

$$\text{Labour cost per shirt (A)} = \frac{45{,}000}{33} \approx 1{,}364$$

$$\text{Labour cost per shirt (B)} = \frac{45{,}000}{12} = 3{,}750$$

The advice: B should replace the two treadle machines rather than press the tailors to work harder. At TShs 9,000 a shirt, moving from four to eleven shirts a tailor adds seven shirts, worth TShs 63,000 of revenue a day for each converted worker, so a machine costing a few hundred thousand shillings pays for itself within weeks.

Notice what this does not say. It does not say the tailors in B are lazy. Productivity is a property of the combination of factors, not a verdict on the worker, and the surest way to raise it here is to change what the worker has in front of him.

The Master Key: *When output per worker differs sharply, look first at the capital in the worker's hands, not at the worker.*

HOT Question 9

A Kariakoo wholesaler buys a carton of soap in the morning and sells it in the afternoon for more. A neighbour calls this cheating. An economist reaches for a different word.

Assess the claim that a trader who merely moves goods from one hand to another produces nothing.

Model Answer

The claim is false as a general statement, because moving goods creates place, time and possession utility, which is genuine production, although it becomes true in the narrow case where a trader is shielded from competition and charges far more than the service costs.

The case for the claim: the trader adds nothing physical. The carton of soap that leaves the shop is the same carton that entered it, so on a purely material view nothing has been produced and the margin looks like a pure transfer from buyer to seller.

Why the material view is wrong: usefulness, not matter, is what production creates. Soap sitting in a warehouse at Ubungo satisfies nobody. The same soap on a shelf in a village shop in Sumbawanga, in single bars a household can afford, satisfies a want directly. The trader has changed the place, the timing and the quantity in which the good is available.

The trader uses up real resources: he pays for transport, rent, storage, security and the interest on money tied up in stock, and he carries the risk that the goods are stolen, spoiled or unsold. These are the costs of producing a service, and they have to be covered exactly as a miller's costs do.

The test of the claim: compare the margin with the cost of the service. Where many traders compete, the margin is driven down towards the cost of the service and the trader earns only a normal return. Where one operator controls the only lorry on a rural route, or a licence keeps rivals out, the margin can far exceed the cost, and that excess is not a reward for production.

The remedy points the same way: if the complaint were true in general, the remedy would be to abolish traders. Every attempt to do so has produced empty shelves, because somebody still has to move, store and break bulk. Where the complaint is true in the narrow case, the remedy is more competition and better roads, not fewer traders.

So the verdict turns on the market the trader operates in, not on the act of trading itself. Trading is production; an unearned margin is a monopoly rent, and only the second deserves the neighbour's word.

The Master Key: *Judge the trader by the gap between his margin and his costs, not by the fact that he changes nothing physical.*

HOT Question 10

A Kilombero manager announces that output rose by a fifth this year and calls it progress. The accountant, looking at the wage bill and the fuel invoices, is not celebrating.

To what extent does a rise in a firm's output show that the firm has become more efficient?

Model Answer

A rise in output shows nothing about efficiency by itself, because output can be raised simply by using more inputs, and efficiency has improved only if output has risen faster than the inputs used to obtain it.

Output is a total, efficiency is a ratio: if Kilombero raised cane output by a fifth while also raising land, labour and fuel by a fifth, productivity is exactly where it was. Every hectare, every worker and every litre of diesel is producing what it produced last year.

The test is output per unit of input: efficiency has genuinely improved only if output per worker, per hectare or per shilling of cost has risen. If output rose by a fifth while the workforce rose by a twentieth, then output per worker has clearly risen and the claim of progress stands.

Cost per unit is the sharpest test: a firm that has become more efficient produces each unit for less. If average total cost per tonne of sugar has fallen, real efficiency has improved, because that single figure captures every input at once and weighs each by its price.

The case for the manager: not every extra input is a proportional one. Fixed costs such as the factory, the boiler and the management are spread over more tonnes as output grows, so average total cost can fall even when nothing about the technique has changed. Growth into spare capacity is a real gain and the manager is entitled to claim it.

The case against: beyond a point extra output requires more than proportional inputs, because the fixed plant is crowded and diminishing returns set in. Output then rises while cost per tonne rises with it, which is the opposite of efficiency even though the headline figure looks fine.

Technical and economic efficiency differ: a firm is technically efficient when it cannot get more output from the same physical inputs, and economically efficient when it produces that output at the lowest cost given input prices. A plant can be technically excellent and still economically wasteful if it uses expensive imported machinery where cheap local labour would do the same job.

So the extent is limited and conditional. A rise in output is evidence of growth, not of efficiency, and it becomes evidence of efficiency only when set beside the inputs consumed. Ask the manager one question: what did a tonne of sugar cost to make this year compared with last?

The Master Key: *More output is growth; more output per unit of input is efficiency, and only the second is progress.*

Land as a Factor of Production

Ask a Tanzanian what land is and he will point at a field. Ask an economist and he will include the rain above it, the Tanzanite beneath it and the perch swimming in the lake beyond it. Land is every free gift of nature that helps to produce, and because nobody made it and nobody can make more of it, it behaves unlike any other factor. This section fixes what land is, how it behaves, what it earns and why it earns it.

BINDER Question 11

A fisherman at Kigoma casts into Lake Tanganyika; a miner at Mererani cuts rock a kilometre down. Neither stands on a farm, yet both are working land.

Define land as a factor of production, explain why the economist's meaning is wider than the everyday one, and name the reward it earns.

Model Answer

In economics land means all the free gifts of nature used in production, whether above the surface, on it, below it or in the water, and the reward paid for its use is rent.

The free gift test: land is whatever nature supplied with no human effort behind it. Nobody made the soil of the Kilombero valley, the rain on it or the Tanzanite seam under Mererani; they enter production already made. That is what separates land from capital, which had to be built first.

Above the surface: the climate, the sunshine, the rainfall and the wind. A coffee farmer on Kilimanjaro relies on the cool altitude and dependable rain as much as on the soil; move his trees to Dodoma and the crop fails, because part of the land is left behind.

On the surface and below it: the soil, the forests and the pasture, and everything underneath: Tanzanite at Mererani, gold at Geita, coal at Mchuchuma, gas at Mnazi Bay. A mining company may buy no farmland at all, yet every shilling it spends on a licence is spent on land.

In the water: the rivers, the lakes and the sea, with the fish, the seaweed and the water itself. The Nile perch of Lake Victoria and the seaweed farmed off Paje are land, because nature and not a factory produced them.

The reward is rent: rent is the payment made to the owner for the use of land, whether TShs 120,000 a season for a hectare of cashew at Newala or the fee a quarry pays to cut stone. Because the owner did nothing to create it, rent buys permission to use, not a cost of making.

In ordinary speech land is ground you can fence; in economics it is defined by where it came from, not by where it lies. The test is simply whether nature supplied it free.

The Master Key: *Land is not the soil; it is everything nature gave free, and rent is what we pay to use it.*

BINDER Question 12

Nobody made the Kilombero valley, nobody can make another, and by itself it has never grown a single grain of rice. That combination of facts is what gives land its peculiar character.

Explain seven features of land as a factor of production.

Model Answer

Land differs from every other factor in seven ways: it is a primary factor, fixed in total supply, variable in quality, passive, geographically immobile but occupationally mobile, demanded only for what it produces, and subject to diminishing returns.

A primary or original factor: it is a free gift of nature, not produced by man: the plains of Shinyanga were there before any producer arrived. Land has no cost of production and none can be ordered.

The total supply is fixed: the surface of the earth cannot be enlarged, so no price raises the quantity available to the economy. To a single farmer the position differs, since land can always be bought or hired.

Land differs in quality: fertility, rainfall, slope and mineral content vary from place to place. Kilimanjaro's volcanic soils carry coffee, Singida's drier soils carry millet, a rocky hillside carries only a quarry, so two hectares repay the same effort differently.

Land is a passive factor: it produces nothing until labour and capital act on it. An uncleared hectare in the Rufiji floodplain grows reeds; cleared, levelled and sown with improved seed it grows paddy.

Geographically immobile, occupationally mobile: a hectare at Sumbawanga cannot be carried to Dar es Salaam, yet a plot at Kibaha passes easily from paddy to maize to a building plot. Land changes its job without changing its address.

Demand for land is derived: nobody wants land for its own sake, only for what can be produced on it. When the auction price of cashew rises the demand for land at Newala rises with it, and when it collapses the demand collapses too.

Diminishing returns apply: because a piece of land is fixed in size, adding more labour and fertiliser to it must eventually raise output by less and less. The tenth bag of fertiliser on one hectare adds less than the first.

The Master Key: *Nature gave it, nobody can make more of it, it cannot move, and it does nothing until labour and capital touch it.*

BINDER Question 13

Rent on a plot at Kigamboni doubles in three years and not one extra hectare appears. A price has risen without calling forth any more of the thing.

Explain why land is described as a stock rather than a flow, distinguish the total supply of land from its supply to a single use, and show what the fixed supply means for rent.

Model Answer

Land is a stock, not a flow: no production adds to it, so its total supply to the economy is perfectly inelastic while its supply to any single use is elastic, and rent is settled by demand alone.

A stock, not a flow: a flow is a quantity produced per period, like the sembe a Mbeya mill turns out each week, and can be enlarged by producing more. A stock simply exists: the hectares of the Rufiji floodplain were never produced at all.

What flows is the service: a tenant hires not the stock but its use for a season, which is why rent is quoted per hectare per season: the price of a flow coming out of a stock that never grows.

The supply to the economy is fixed: for the country as a whole the supply of land is a vertical line: however high the rent rises not one extra hectare appears, and however far it falls none is withdrawn, since land will be used for something whatever it earns.

The supply to a single use is elastic: to one grower more land is always obtainable at a price: a rice grower at Mngeta can hire ten more hectares by outbidding whoever holds them. Supply to any one use slopes upward; only supply to all uses together is vertical.

What this does to rent: when supply cannot answer, the whole of rent is settled by demand. If demand for building plots at Kigamboni rises, rent rises until enough bidders drop out to match the hectares that exist. Rent is price determined, not price determining.

A rise in rent is a transfer, not an incentive: when maize prices rise farmers plant more maize, but when rent rises nobody produces more land, and the extra shillings pass from tenant to owner. Land put to one use is land taken from another.

The Master Key: *The stock never changes, so demand alone decides rent, and a higher rent buys not one extra hectare.*

BINDER Question 14

A tourist pays for a view of Ngorongoro, a jeweller for a crystal from Mererani, a miller for maize from Mbeya. Three different trades, three prices, one factor underneath all of them.

Explain the importance of land to the Tanzanian economy, naming regions and their products.

Model Answer

Land is the foundation of the Tanzanian economy: it supplies the country's food, its export earnings, its minerals, its fisheries, its industrial raw materials and its tourist attractions, and most of the working population earns its living directly from it.

It feeds the nation: maize from Mbeya and Ruvuma, paddy from Kilombero and bananas from Kilimanjaro come off particular soils under particular rain, which is why a poor season in the southern highlands raises the price of sembe in Dar es Salaam.

It earns foreign exchange: cashew from Mtwara, coffee from Kilimanjaro, sisal from Tanga, cotton from Shinyanga and cloves from Zanzibar each grow where the soil, altitude and rain suit them, so the export list is largely a map of land quality.

It supplies minerals: Tanzanite at Mererani, gold at Geita, coal at Mchuchuma and gas at Mnazi Bay are land below the surface, free gifts whose whole cost is the labour and capital spent in reaching them.

It supplies fisheries and water: the Nile perch and dagaa of Lake Victoria and the seaweed of Zanzibar are land in the water, and the rivers count twice, since water that irrigates Kilombero also drives the turbines that light the factories.

It supplies the raw materials of industry: cotton from Shinyanga feeds the ginneries, sunflower from Singida the oil presses, cane from Mtibwa the sugar factories and sisal from Tanga the twine works. Secondary production cannot begin until something has been drawn out of the land.

It carries tourism: the Serengeti, the Ngorongoro crater and the reefs off Zanzibar cost nothing to create. An Arusha operator sells the use of them for foreign currency, so land can earn heavily without anything being taken out of it.

Since new land cannot be manufactured, national income can only rise by raising the output of each hectare, through irrigation, improved seed and secure title.

The Master Key: *Food, exports, minerals, fish, factory raw materials and the view from the crater rim are all of them land.*

BINDER Question 15

A farmer on Kilimanjaro walks forty minutes between the first of his five plots and the last, and each is smaller than a football pitch. His grandfather farmed one field.

Explain five problems that reduce the productiveness of land in Tanzania, and state a remedy for each.

Model Answer

Tanzanian land yields less than it could because of fragmentation of holdings, soil degradation and erosion, insecure title, overgrazing with conflict between users, and the loss of farmland to competing uses, and each has a known remedy.

Fragmentation of holdings: inheritance divides a farm among sons every generation until each man holds several tiny scattered pieces: time is lost walking between them and no piece is large enough for a tractor or a pump. The remedy is consolidation, block farming and shared machinery.

Soil degradation and erosion: cropping without rotation or manure removes what the crop takes out, and rain carries the topsoil off the slopes of Kondoa, so yields fall season after season. The remedy is terracing, contour ploughing, manure and trees on the steep ground.

Insecure title: much land is held under customary right without a certificate. A farmer without secure title will not plant a coffee tree that yields only in its fourth year, and cannot use the plot as security for a loan. The remedy is surveyed certificates of customary right of occupancy.

Overgrazing and conflict between users: herds concentrated on communal pasture in Shinyanga strip the grass and harden the soil until rain runs off instead of soaking in, and grazing and water are contested between pastoralists and cultivators. The remedy is village land use planning, stocking limits and watering points.

Competition from other uses: as Dar es Salaam spreads outwards, fertile land passes into building plots and roads, and since the total supply is fixed every hectare built on stops producing food. The remedy is planning and building upwards rather than outwards over good soil.

Dependence on the rains: only a small share of irrigable land is irrigated, so most output rests on rainfall that arrives late or fails, and one bad season wipes out a year's income. The remedy is irrigation in the Usangu valley, water harvesting and drought resistant varieties.

The Master Key: *Tanzania's land problem is not a shortage of hectares but the low yield of the hectares it already has.*

REAL Question 16

Follow Bi Halima's cashew at Newala from the tree to the auction floor. Two of her hectares carry grafted seedlings planted five years ago; four carry her grandfather's old trees.

Using the record in the box, calculate the total output of the holding, the average yield a hectare and the revenue at the auction, then advise Bi Halima whether to hire the three extra hectares she has been offered.

Bi Halima farms 6 hectares of cashew at Newala in Mtwara Region.

Four hectares carry old trees inherited from her grandfather and yield 450 kilogrammes of raw cashew a hectare.

Two hectares were replanted with grafted seedlings and yield 900 kilogrammes a hectare.

Raw cashew sold through the warehouse receipt auction fetches TShs 2,400 a kilogramme.

Weeding, spraying, harvesting and transport cost her TShs 700,000 a hectare a season.

A neighbour offers her three hectares of old cashew, of the same quality as her four, at a rent of TShs 120,000 a hectare a season.

Model Answer

The holding produces 3,600 kilogrammes worth TShs 8,640,000, an average of 600 kilogrammes a hectare that hides a twofold difference between her two blocks, and she should hire the three extra hectares, since each leaves her TShs 260,000 after every cost.

Take the two blocks separately: yield a hectare times hectares, then add.

$$\text{Output of the old trees} = 4 \times 450 = 1{,}800 \text{ kg}$$

$$\text{Output of the grafted trees} = 2 \times 900 = 1{,}800 \text{ kg}$$

$$\text{Total output} = 1{,}800 + 1{,}800 = 3{,}600 \text{ kg}$$

$$\text{Average yield} = \frac{3{,}600}{6} = 600 \text{ kg a hectare}$$

The average is true and misleading at once: not one hectare yields 600 kilogrammes: four yield 450 and two yield 900, and the grafted third of the area produces half the crop. An average for a holding of mixed quality has to be opened up before it is trusted.

$$\text{TR} = 3{,}600 \times 2{,}400 = 8{,}640{,}000$$

The crop is worth TShs 8,640,000 against working costs of TShs 700,000 on each of six hectares, or TShs 4,200,000 in all. The neighbour's three hectares are old cashew and will yield 450 kilogrammes each.

$$\text{Revenue of a rented hectare} = 450 \times 2{,}400 = 1{,}080{,}000$$

$$\text{Cost of a rented hectare} = 700{,}000 + 120{,}000 = 820{,}000$$

$$\text{Surplus a hectare} = 1{,}080{,}000 - 820{,}000 = 260{,}000$$

$$\text{Surplus on three hectares} = 3 \times 260{,}000 = 780{,}000$$

The advice is to hire, with one condition: each rented hectare returns TShs 260,000 more than it costs, so the three add TShs 780,000 to her season. The condition is labour: if taking them means her grafted trees are sprayed late, she may lose more on the good land than she gains on the poor.

$$\text{Break even auction price} = \frac{820{,}000}{450} \approx 1{,}822$$

The margin is thinner than it looks: a rented hectare pays its way only while cashew fetches about TShs 1,822 a kilogramme. At TShs 2,400 she has room, but a fall of a quarter would wipe the surplus out while the rent still fell due. Rent is a contract; the price of cashew is not.

What the two blocks prove: the grafted hectares sit on the same soil, under the same rain, yet yield twice as much. Nothing about the gift of nature differs between them: what doubled the output was capital, the grafted seedlings and the spraying, applied by labour, which is what calling land a passive factor means.

The rent of TShs 120,000 is one ninth of what a rented hectare produces, so the owner takes about eleven shillings in every hundred for doing nothing this season, and the other eighty nine go to the labour, capital and enterprise that made the land produce.

The Master Key: *Hire the extra hectare while its output covers both its rent and its working costs, and remember that the yield is made by what you put on the land.*

REAL Question 17

Follow the rent of one irrigated hectare at Mkula in Kilombero from 2019 to 2024. The canal never lengthened, the valley never widened, and the rent rose by three fifths.

Using the record in the box, calculate the excess demand for land at the old rent, the percentage rise in rent, the change in the total rent paid by the scheme and the share of a hectare's revenue that now goes in rent, then explain why the higher rent brought no extra land into cultivation.

> The irrigation scheme at Mkula in Kilombero District commands 500 hectares of paddy land, and no further land can be brought under the canal.
>
> In the 2019 season growers wished to hire exactly 500 hectares at the going rent of TShs 250,000 a hectare.
>
> In 2024, after a new rice mill opened at Ifakara, growers wished to hire 800 hectares at that same rent of TShs 250,000.
>
> The rent then settled at TShs 400,000 a hectare, at which growers again wished to hire exactly 500 hectares.
>
> An irrigated hectare yields 65 sacks of paddy of 100 kilogrammes each, and a sack fetches TShs 90,000 at the mill gate.

Model Answer

At the old rent 300 hectares of demand had nowhere to go, so the rent rose by 60 per cent to TShs 400,000, the scheme's rent bill rose by TShs 75,000,000, the owners' share of a hectare's revenue rose from about 4.3 to about 6.8 per cent, and not one extra hectare came into cultivation because none exists.

At the old rent growers wished to hire 800 hectares while the canal commands 500.

$$\text{Excess demand} = 800 - 500 = 300 \text{ hectares}$$

The shortage clears through price alone: in an ordinary market excess demand raises price and the higher price draws out extra supply. Here the second half cannot happen, so the whole adjustment falls on the rent, which rises until the demand for 300 hectares is priced out of the valley.

$$\text{Rise in rent} = 400{,}000 - 250{,}000 = 150{,}000$$

$$\text{Percentage rise} = \frac{150{,}000}{250{,}000} \times 100 = 60$$

The rent is 60 per cent higher for a factor that has not changed in any way. Put that beside the total the scheme pays over.

$$\text{Total rent in } 2019 = 500 \times 250{,}000 = 125{,}000{,}000$$

$$\text{Total rent in } 2024 = 500 \times 400{,}000 = 200{,}000{,}000$$

$$\text{Increase} = 200{,}000{,}000 - 125{,}000{,}000 = 75{,}000{,}000$$

Where the extra 75 million shillings goes: straight to the owners of the same 500 hectares in return for nothing new. The land is identical, worked in the identical way; what changed is only the division of the harvest between the man who owns the ground and the man who works it, which is what calling rent a surplus means.

$$\text{Revenue of a hectare} = 65 \times 90{,}000 = 5{,}850{,}000$$

$$\text{Rent share in } 2019 = \frac{250{,}000}{5{,}850{,}000} \times 100 \approx 4.3$$

$$\text{Rent share in } 2024 = \frac{400{,}000}{5{,}850{,}000} \times 100 \approx 6.8$$

Reading the two shares: the tenant now keeps TShs 5,450,000 a hectare where he kept TShs 5,600,000, so he is TShs 150,000 poorer before his other costs, yet the hectare still produces its 65 sacks. The rise changed how the crop is divided, not how large it is.

Why the mill was the cause: the demand for land is derived. The Ifakara mill raised the demand for paddy, and paddy from this valley can only come off land under the canal, so the extra value of the rice was pushed back into the price of the ground. Rent rose because paddy became more valuable, not the other way about.

The lesson for the district is blunt. If it wants more rice from Mkula, letting the rent rise will not deliver it, because supply cannot answer a price signal. More rice can only come from lifting the yield of each hectare or from extending the canal.

The Master Key: *When supply cannot move, the whole of an increase in demand lands on the rent and none of it lands on the harvest.*

HOT Question 18

The engineer at Kilombero says he has made new land out of a swamp. The economist says the swamp was always there. Both of them are looking at the same drained hectare.

To what extent is it true that the supply of land is fixed?

Model Answer

It is true that the physical surface of the earth cannot be enlarged, so the total supply of land is fixed in the strict sense, but it is false that the supply of usable land is fixed, because drainage, irrigation, reclamation and soil husbandry all enlarge the supply of land measured by what it can produce.

The stock of surface is genuinely fixed: no producer can manufacture a hectare. The area of the country is settled by geography and no price adds to it, which is why the supply of land to the economy is perfectly inelastic and why land alone has no cost of production.

Every use competes with every other: because the total cannot grow, land taken for one purpose must be taken from another. Every hectare at Kigamboni that becomes a housing plot stops growing cassava. If the total could be enlarged there would be no such contest.

But reclamation adds land in the economic sense: a swamp drained in the Kilombero valley and a hillside terraced at Lushoto bring into production ground that produced nothing before. The hectares existed as geography, but as economic land, a natural agent capable of yielding output, they are new. What is fixed is the surface, not the usable part of it.

Irrigation and husbandry add efficiency units: a hectare at Mbarali under a canal produces what two rain fed hectares produce. Measured in acres nothing has changed; measured in productive capacity the supply has doubled, and since it is capacity and not acreage that feeds people, the second measure is the one that matters.

The fixity never binds a single producer: to one grower or one builder, more land is always available at a price, taken from whoever values it less. The Kilombero Sugar Company can obtain another hundred hectares tomorrow. Fixity is a fact about the economy as a whole, never about any one firm.

The traffic also runs the other way: usable land can be lost as well as gained. Erosion strips the hills of Kondoa, salt accumulates in badly drained irrigated fields, and buildings spread over the best soils around Arusha. A quantity that can fall is not a constant.

The claim is therefore true of surface and false of capacity, and the difference is not academic. Because acreage is fixed, competition for land will not go away and rent will keep rising with demand; because effective supply is not fixed, no country is condemned to the harvest its acreage happens to give. Over a single season the supply is fixed absolutely; over a generation it is whatever drainage, water and soil husbandry make it.

The Master Key: *Hectares are fixed; usable land is not, and every extra sack of food has to come from the second.*

HOT Question 19

A farmer at Kondoa blames the soil for four bad seasons. His neighbour, working the same slope under the same rain, has terraced and manured and just harvested twice as much.

Assess the claim that when a farm gives a poor harvest the fault lies with the land.

Model Answer

The claim is usually false, because land is a passive factor that yields only what the labour and capital applied to it make it yield, though there is limited truth in it where the natural quality is genuinely poor or the capacity permanently destroyed.

Land really does differ in quality: a hectare on the volcanic slopes of Kilimanjaro will out-yield light sandy soil at Singida whatever either farmer does, so where nature has been mean the ceiling on output is genuinely lower and part of the blame belongs to the ground.

Weather is part of land: rainfall is a free gift of nature and belongs to land. When the rains fail at flowering the maize at Dodoma is cut whatever the farmer does, and the harvest is no verdict on him at all.

Some damage really is permanent: where the topsoil of a Kondoa hillside has washed into the river, the loss cannot be made good in one season, and the farmer on that plot faces a real constraint.

Against the claim, land is passive: an uncleared hectare in the Rufiji floodplain grows reeds; cleared, levelled and sown with improved seed, the same hectare grows paddy. The land was identical, so the whole difference came from what was applied to it, and a factor that cannot act cannot be blamed for failing to act.

The neighbouring plot settles the argument: two hectares side by side share the same soil, slope and rain and still yield differently: one is weeded at three weeks and fertilised, the other at seven and never. When the land is held constant and output still differs, the land cannot be the cause.

Diminishing returns is mistaken for tired soil: when the sixth worker on one hectare adds less than the fifth, a farmer says the land is exhausted. It is not: the land was fixed while the labour on it grew, so the fault is the proportion between the factors.

Most soil poverty is man made and reversible: cropping without rotation or manure takes out what the crop takes out and puts nothing back, and ploughing up and down a slope invites the rain to carry the rest away. That is husbandry written into the soil, not a fault of the land.

The honest test is whether the gap survives good practice: give the plot correct seed, timely weeding and restored nutrients for three seasons. If it still fails the constraint is natural and the crop should change; if it does not, the fault was never in the ground. The claim therefore stands only where nature set a low ceiling or the damage is beyond repair.

The Master Key: *Land is passive: hold it constant and any difference in the harvest must be the work of what was put on it.*

Labour, Division of Labour and Mobility

Of the four factors, only one can refuse to work, fall ill, take offence or learn a new trade. Labour is human, and every feature that makes it awkward for a producer flows from that single fact. This section fixes what labour is, what it is paid, why an unworked hour is lost for ever, how splitting a job multiplies output, and why a worker who cannot move keeps a whole economy short of hands.

BINDER Question 20

A Dar es Salaam clerk plays football on Saturday until he can hardly stand, and sits at a desk on Monday until his eyes ache. Only one of those days is labour.

Define labour as a factor of production and explain the forms in which the reward to labour is paid.

Model Answer

Labour is all human effort, whether physical or mental, applied to the production of goods and services in return for a reward, and that reward is paid as a wage, a salary, a fee or a commission.

Human effort of every kind: muscle and mind both count. The kibarua (casual labourer) carrying cement at Kigamboni and the engineer who drew the building are both supplying labour.

Applied to production: the effort must serve somebody else's want. A doctor at Muhimbili, a teacher in Songea and a bodaboda rider are all labour, though none makes a physical object.

Offered for a reward: the effort must be sold. The clerk who plays football all Saturday tires himself more than Monday does, but he sells nothing, so a hobby is not labour.

Labour is the service, not the population: only those able, willing and actually offering themselves for hire form the supply of labour; a rising population does not by itself raise the labour force.

Wages: payment by time worked or by piece, usually to manual and casual workers. The kibarua takes his TShs 15,000 at the gate each evening.

Salaries: a fixed monthly payment to permanent staff whose work cannot be counted piece by piece, such as a teacher or an accountant, and it does not fall because the month was quiet.

Fees: a payment for one completed professional service rather than for time spent, such as what an advocate charges for one case. The client buys a result, not an afternoon.

Commissions: a share of the value of the business the worker brings in, like the percentage an Arusha insurance agent earns on each policy. It ties reward to result, so it suits work that is hard to supervise.

All four are one name for the price of labour, and in most Tanzanian firms that price is the largest single item of cost.

The Master Key: *Labour is effort, of hand or of head, sold for a reward; the reward wears four names, wage, salary, fee and commission.*

BINDER Question 21

A machine left idle overnight is worth at dawn exactly what it was worth at dusk. A Tanga cutter's unworked Tuesday is gone, and nobody can put it back on the shelf.

Explain the features of labour which distinguish it from the other factors of production.

Model Answer

Labour differs from land and capital in nine ways, and every one follows from one fact: the factor is a living person, not a thing to be stored, shipped or shelved.

Labour is perishable: an hour not worked is lost for ever. A cutter idled by a broken machine cannot store those hours and sell them tomorrow.

Labour is inseparable from the labourer: the seller must go with the service. A landlord lets his land and stays at home; a welder must stand in the workshop throughout.

Labour has a human element: output depends on how the worker is treated. The same filleter works faster in a cool hall than in a hot shed, as no machine ever does.

Labour has weak individual bargaining power: one worker facing one employer is the weaker party, since he cannot store his labour and cannot wait long without eating. That is why workers combine.

Labour is heterogeneous: no two workers are identical. Two tailors trained in the same SIDO workshop sew different numbers of shirts, so labour cannot be counted like sacks of cement.

Labour is the active factor: land and capital stay passive until labour sets them going. A Mbeya grinding mill is iron and belts until a miller switches it on.

The supply of labour changes only slowly: numbers and skills rest on population, education and health, none alterable in a season. A shortage of nurses cannot be met this year, since training one takes four years.

Labour is mobile but imperfectly so: a worker can change trade and district, which land cannot, but he moves far less freely than capital, since skill, the fare, the rent and the family hold him.

Labour is both a means and an end: the worker is an input inside the firm and a consumer outside it, so cutting wages to cut costs quietly cuts the market as well.

The Master Key: *Every feature of labour follows from one fact: the factor is a person, so it perishes, it must attend in person, and it works well only if treated well.*

BINDER Question 22

Two filleters on the same Mwanza bench, the same age, the same training, the same knife. One clears ninety kilogrammes a shift and the other sixty. The knife is not the difference.

Explain what is meant by the efficiency of labour and outline the factors that determine it.

Model Answer

The efficiency of labour is the amount and quality of work a worker produces in a given time, so labour is more efficient when the same hour, at the same cost, yields more output or better output.

Efficiency is not effort. A cutter sweating with a blunt panga (bush knife) may work harder than one with a sharp panga and still cut half as much, so what counts is output per worker per hour.

Education and training: schooling gives the ability to read a measure and follow instructions; training gives the skill. A VETA welder makes a sound joint first time where an untrained man makes three.

Health and nutrition: a hungry worker, or one carrying malaria, cannot last the shift. Clean water, nets and a midday meal buy output, and the extra kilogrammes cost less than the meal.

Tools and capital per worker: efficiency belongs to the combination, not the man. A tailor at an electric machine outsews the same tailor at a treadle, so better capital raises output without more effort.

Working conditions: light, air, safety, hours and rest breaks all tell on output, which falls steeply in the last hours of an over long shift, where accidents also cluster.

Wages and incentives: a wage that rises with what a worker produces lifts effort, while a wage so low that the best hands leave destroys the experience the firm has paid to build.

Management and organisation: what looks like the efficiency of the worker is often the efficiency of the arrangement around him. Waiting for materials, unclear instructions and a locked store waste hours he cannot control.

Attitude to work and morale: willingness, discipline and pride decide how much is done when nobody is watching. Where workers are dealt with fairly, supervision costs less and waste falls.

Six of these seven lie in the producer's own hands: a firm too poor for a bigger factory can still raise output by training, feeding, equipping and organising the people it has.

The Master Key: *Efficiency is output per worker per hour; raise it by changing what the worker knows, what he holds, what he eats and how he is treated.*

BINDER Question 23

Watch a chapati stall at Mwenge. One woman rolls, one fries, one wraps and takes the money. Nobody ever taught them Adam Smith, and the queue still moves three times faster.

Explain the meaning of the division of labour and state, with explanation, its advantages to a producer.

Model Answer

The division of labour is the breaking up of a whole job into separate operations, each performed continuously by a different worker, so that no single worker makes the finished article from beginning to end.

A village fundi (craftsman) once took a customer's timber and made the whole chair himself, sawing, joining, sanding and varnishing in turn. In a Dodoma workshop today one man saws, a second joins, a third sands and varnishes, and the chair travels between them. Only the sharing has changed.

The forms it takes: in its simple form whole trades separate, so one person farms and another mills. In its complex form one trade is broken into operations inside a workshop, which lifts output most. Territorially, Mbeya takes maize and Mtwara cashew.

Greater skill through repetition: one operation performed all day is performed hundreds of times, and repetition breeds speed and accuracy together. The joiner who has fitted two thousand chair legs fits the next faster, truer and with less waste.

Saving of time: no time goes in moving between tasks, laying down one tool and taking up another, or waiting for glue to dry. Each worker stays at one bench, and the article moves instead of the man.

Machinery becomes possible: once a job is broken into simple repeated operations, a machine can be built for each one. A machine can cut cloth to one pattern all day; none can do everything a whole tailor does.

The right person in the right task: workers differ, so each is placed where his strength lies. A steady hand goes to finishing, a strong back to loading and a quick head to costing, and nobody spends the day at the thing he does worst.

Training becomes shorter and cheaper: teaching one operation takes days where teaching a whole trade takes years, so a new hand is at useful work within a week. That matters where many leave school and few finish a craft.

Greater output and lower cost per unit: the gains act together, so the same workers in the same hours turn out far more. The wage bill now spreads over more units, so labour cost per unit falls and the producer may cut his price.

Nothing has been added to the workshop but a decision about who does what, which is why a growing firm reorganises the work it has before it buys new machines.

The Master Key: *Divide the job, not the effort: repetition brings skill, skill brings speed, and speed brings an output the same hands could never reach alone.*

BINDER Question 24

The fastest button sewer in Kariakoo can sew nothing else at all. When the shirt orders dry up, the slowest all round tailor on the same street still eats.

Outline the disadvantages of the division of labour and explain what limits how far it can be carried.

Model Answer

The division of labour buys its extra output at a price: monotony, the loss of craft pride, narrow skills that die when demand shifts, and dependence so complete that one broken link halts everything; and it can go no further than the extent of the market allows.

Monotony and loss of interest: one small operation from morning until evening is dull, and dull work brings carelessness, absence and a wish to leave. Output per hour then sags, eating the gain the division was made to obtain.

Loss of craft pride: the worker no longer sees a finished article that is his. A man who made a whole chair could point to it in a customer's house; a man who only sands cannot.

Risk of unemployment when one skill dies: a narrow skill is worth nothing outside its one operation. When a Mwanza plant installs a skinning machine, the men who only skinned have no trade to fall back on, while an all round worker moves to another bench.

Over dependence and interruption: the work of each depends on the work of all. If the one packer is absent, everything before him piles up and everything after him stops, so a divided firm must keep spare trained hands.

Fewer complete craftsmen: young workers no longer learn a whole trade, so the stock of people who can make an article from start to finish falls, and a country short of craftsmen finds it hard to start new small firms.

The extent of the market is the binding limit: the work can be divided only if everything it produces can be sold. A tailor on the Kilombero road selling six shirts a week cannot keep a cutter, a machinist and a finisher busy; the same tailor in Kariakoo, selling three hundred, can.

The product must also be uniform: the article must be capable of being broken into repeated operations. One wedding gown to a customer's own design cannot be divided at all, while five hundred identical school shirts can be divided six ways.

The market limit is real today but not fixed for ever. A tarmac road, a cold store and mobile money widen the market, a wider market permits deeper specialisation, and deeper specialisation lowers cost and widens the market again.

The Master Key: *Divide the work as deeply as the market is wide and no deeper, for beyond that point the specialist stands idle and the gain turns into a cost.*

BINDER Question 25

A Songea teacher can become a Songea shopkeeper more easily than a Songea teacher can become a Dar es Salaam teacher. Distance and skill are two quite different walls.

Distinguish between the occupational and the geographical mobility of labour and explain the obstacles to each.

Model Answer

Occupational mobility is the ease with which a worker moves from one job or trade to another, geographical mobility the ease with which he moves from one place to another; labour is mobile in both senses, but far less freely than capital.

Occupational mobility: movement between occupations. It may be horizontal, as when a Moshi bank clerk becomes an insurance clerk at the same level, or vertical, as when a site foreman is promoted to manager.

Geographical mobility: movement between places, internal as when a nurse transfers from Sumbawanga to Dar es Salaam, external as when an engineer takes a contract in Dubai. A worker may be mobile in one sense and stuck in the other.

Skill and training block occupational movement: this is the largest wall. A sisal cutter cannot become a laboratory technician next week, because that job rests on years the first never gave him, and the narrower the training the higher the wall.

Professional entry rules block it further: many trades are closed by law or by the profession itself. Nobody may practise as a pharmacist, an advocate or a licensed electrician without registration, and the fees and qualifying courses keep numbers down even when posts stand empty.

The cost of moving and of housing blocks geographical movement: a move must be paid for before the first wage arrives. The fare from Kigoma, six months rent demanded in advance and food while the search goes on may exceed a labourer's whole savings, and where rooms are scarce there is nowhere to live at the far end.

Family, language and social ties: a worker who moves leaves parents, a plot of land and a school his children attend. Where the new district speaks another first language, the cost of the move is felt long after the fare is paid.

Lack of information: nobody applies for a post he has never heard of. A welder in Mpanda may not know that a Mtwara site is hiring at twice his rate, because hiring runs by word of mouth and by notices at the gate.

Age and accumulated rights: seniority, pension rights and long service payments are often lost on moving, so an older worker will not surrender them for a small gain in wages. Mobility falls with age even where no other barrier stands.

Labour is therefore mobile in principle and sticky in practice, which is how a shortage of welders in one town survives alongside idle school leavers in another. Trade schools, hostels, an employment service and better roads do more than any appeal to workers to move.

The Master Key: *Occupational mobility is blocked by skill and by rules; geographical mobility is blocked by money, housing and ties; and both blockages raise the cost of production.*

REAL Question 26

Follow three tailors in one Kariakoo workroom through a single change. No new machine arrives, nobody works longer, and by Friday the shop is turning out twelve more shirts a day.

Calculate the output per tailor and the labour cost per shirt before and after the change, state the gain to the workroom, and explain what would limit any further division of the work.

> Mama Zawadi's workroom at Kariakoo employs three tailors, Amina, Juma and Neema, each paid TShs 15,000 for an eight hour day.
>
> Until March each tailor took a school shirt right through from cloth to finished garment, and the workroom completed 18 shirts a day.
>
> From April the work was split: Amina cuts, Juma runs the seams on the machine, and Neema fixes collars and buttons and presses. The workroom now completes 30 shirts a day.
>
> Cloth and trimmings cost TShs 4,500 a shirt, and each finished shirt sells for TShs 9,000. Nothing else changed.

Model Answer

Splitting one job into three raised output per tailor from 6 shirts a day to 10 and cut the labour cost of a shirt from TShs 2,500 to TShs 1,500, leaving the workroom TShs 54,000 a day better off on the same wage bill.

Output per worker is total output divided by the number of workers.

$$\text{AP}_\text{L}(\text{before}) = \frac{18}{3} = 6 \text{ shirts per tailor}$$

$$\text{AP}_\text{L}(\text{after}) = \frac{30}{3} = 10 \text{ shirts per tailor}$$

Reading the rise: each tailor now finishes four more shirts a day, a rise of $4 \div 6$, that is two thirds, with no extra hour worked. The gain came from repetition, from tools that stay in one pair of hands, and from minutes no longer lost in changing tasks.

The wage bill did not move: three tailors at TShs 15,000 cost TShs 45,000 a day whether they make 18 shirts or 30.

$$\text{Labour cost per shirt (before)} = \frac{45{,}000}{18} = 2{,}500$$

$$\text{Labour cost per shirt (after)} = \frac{45{,}000}{30} = 1{,}500$$

What the saving is worth: TShs 1,000 has come off every shirt. Mama Zawadi may keep it as margin or cut her price to take custom from the workroom next door, and in Kariakoo she will do a little of each.

Each shirt sells for TShs 9,000 and carries TShs 4,500 of cloth and trimmings, so it leaves TShs 4,500 towards wages and profit.

$$\text{Before: } 18 \times (9{,}000 - 4{,}500) - 45{,}000 = 81{,}000 - 45{,}000 = 36{,}000$$

$$\text{After: } 30 \times (9{,}000 - 4{,}500) - 45{,}000 = 135{,}000 - 45{,}000 = 90{,}000$$

The gain to the workroom: TShs 90,000 a day against TShs 36,000, so the surplus covering rent, power and the owner's own return has risen by TShs 54,000, two and a half times what it was, or TShs 324,000 over a six day week.

What limits any further division: the extent of the market. Splitting the work six ways needs six tailors and sales of about 60 shirts a day. If Kariakoo takes only 30, three stand idle, the wage bill doubles to TShs 90,000 while output does not move, and labour cost per shirt climbs to $90{,}000 \div 30 = 3{,}000$.

Two cautions belong in the account. The line is only as fast as its slowest station, so if Juma is absent the cutting and the finishing stop within the hour; and none of the three can now make a whole shirt alone, a real loss should the workroom close.

The Master Key: *The same hands, the same hours, the same wage bill: divide the job and the labour cost of every unit falls, so long as the market can take what the division produces.*

REAL Question 27

Follow a Nile perch down the line at a Mwanza filleting plant. Four stations, ten workers, and the whole shift's output decided by the slowest single one of them.

Calculate output per worker before and after the change, explain why the plant produces 840 kg and not 960 kg, and work out what would happen to output and to output per worker if one more packer were hired.

A filleting plant on the lake shore at Mwanza works one shift of eight hours.

Until last year each of its 10 workers took a fish through every operation himself, and the plant produced 480 kg of fillet a shift.

The work has now been split into four stations, and the plant produces 840 kg a shift.

Station capacities per shift are: gutting and skinning, 3 workers, 960 kg; filleting, 4 workers, 900 kg; trimming, 2 workers, 880 kg; weighing and packing, 1 worker, 840 kg.

Model Answer

Specialisation lifted output per worker from 48 kg to 84 kg a shift, a rise of 75 per cent, but a line can move no faster than its narrowest station, so the plant is held down to the 840 kg that its single packer can handle.

Output per worker is total output divided by the number of workers, which is 10 in both periods.

$$\mathrm{AP_L(before)} = \frac{480}{10} = 48 \text{ kg per worker}$$

$$\mathrm{AP_L(after)} = \frac{840}{10} = 84 \text{ kg per worker}$$

$$\text{Rise} = \frac{84 - 48}{48} \times 100 = 75 \text{ per cent}$$

Where the 36 extra kilogrammes came from: under the old method every worker changed knife, station and rhythm for each fish and had to be competent at four operations. Now each hand repeats one movement and the fish moves instead of the worker, so 36 kg more per worker costs no extra hour and no extra shilling.

Why output stops at 840 kg: a line produces at the rate of its slowest station. Gutting could deal with 960 kg and filleting with 900 kg, but nothing leaves the plant until it is weighed and packed, and one packer packs only 840 kg in eight hours.

Station	Workers	Capacity per shift (kg)	Actually used (kg)	Idle capacity (kg)
Gutting and skinning	3	960	840	120
Filleting	4	900	840	60
Trimming	2	880	840	40
Weighing and packing	1	840	840	0

Station capacities set against the 840 kg the line actually moves.

Reading the table: every station but packing works below what it could do, so the plant pays nine people to keep pace with one. The 120 kg, 60 kg and 40 kg of idle capacity are output already paid for in wages and never received.

Now add a second packer, making 11 workers. Packing capacity doubles to 1,680 kg, so the line runs up instead against trimming at 880 kg.

$$\mathrm{Q_{11}} = 880 \text{ kg} \quad \text{(now limited by trimming)}$$

$$\mathrm{MP_{11}} = 880 - 840 = 40 \text{ kg}$$

$$\mathrm{AP_L}(11) = \frac{880}{11} = 80 \text{ kg per worker}$$

Interpreting the result: the eleventh worker adds only 40 kg, because the next narrowest station caps his gain at once. That marginal product lies far below the average product of 84 kg, so the average is dragged down to 80 kg, and he is worth hiring only if 40 kg of fillet sells for more than his wage.

Where the extra hand must be placed: he earns that 40 kg only at packing. Put him at trimming or at gutting and the line still stops at packing, output stays at 840 kg and his marginal product is zero. An extra worker is worth nothing unless he is placed where the line is narrowest.

The risk the division has created: one packer now stands between the whole plant and the market. If she does not report for work, 840 kg of fillet has nowhere to go and the shift is lost, which is why such plants train a reserve hand for every station.

The Master Key: *A divided line runs at the speed of its slowest station, so count capacity station by station before you count workers.*

REAL Question 28

A Kigamboni contractor needs thirty steel fixers next Monday. Dar es Salaam has twenty. Mwanza has plenty, and a thousand kilometres of road stand between the shortage and the surplus.

Work out the cost per worker per day of the Mwanza fixers, compare the contract's wage bill with what it would have been had labour been perfectly mobile, and advise the contractor.

> A contractor building flats at Kigamboni needs 30 steel fixers for 100 working days.
>
> Dar es Salaam can supply only 20, and because they are scarce the rate has risen from the normal TShs 28,000 to TShs 40,000 a day.
>
> Ten fixers can be brought from Mwanza. They ask TShs 30,000 a day each, one return bus fare of TShs 120,000 each, and lodging of TShs 7,000 a day each.
>
> A VETA course can train a general labourer, now earning TShs 15,000 a day, into a steel fixer in 40 days at a fee of TShs 500,000 a trainee.

Model Answer

The Mwanza fixers cost TShs 38,200 per worker per day once fare and lodging are counted, barely below the TShs 40,000 ruling in Dar es Salaam, and immobility adds TShs 34,200,000 to a bill that would otherwise have been TShs 84,000,000, an increase of about 41 per cent.

Take the Mwanza group first: ten workers for 100 days is 1,000 worker days, and three costs must be added. Figures are in shillings.

$$\text{Wages} = 10 \times 30{,}000 \times 100 = 30{,}000{,}000$$

$$\text{Lodging} = 10 \times 7{,}000 \times 100 = 7{,}000{,}000$$

$$\text{Fares} = 10 \times 120{,}000 = 1{,}200{,}000$$

$$\text{Total for the ten} = 30{,}000{,}000 + 7{,}000{,}000 + 1{,}200{,}000 = 38{,}200{,}000$$

$$\text{Cost per worker per day} = \frac{38{,}200{,}000}{10 \times 100} = 38{,}200$$

Reading the figure: the Mwanza men look cheap at TShs 30,000 against TShs 40,000, but once carried and housed they cost TShs 38,200 a day, so the real saving is only TShs 1,800 a worker a day, or TShs 1,800,000 across the contract. Moving has swallowed four fifths of the wage difference.

Now the whole wage bill. The 20 local fixers must be paid the scarcity rate for 100 days.

$$\text{The local twenty} = 20 \times 40{,}000 \times 100 = 80{,}000{,}000$$

$$\text{Whole wage bill} = 80{,}000{,}000 + 38{,}200{,}000 = 118{,}200{,}000$$

Had labour been perfectly mobile, fixers would have come from wherever they were idle, no scarcity would have arisen, and the rate would have stayed at its normal TShs 28,000 for all thirty.

$$\text{Bill with free mobility} = 30 \times 28{,}000 \times 100 = 84{,}000{,}000$$

$$\text{Extra cost of immobility} = 118{,}200{,}000 - 84{,}000{,}000 = 34{,}200{,}000$$

$$\frac{34{,}200{,}000}{84{,}000{,}000} \times 100 \approx 40.7 \text{ per cent}$$

What the extra 34 million buys: nothing whatever. Not one extra beam is fixed for it. It is the price of the men who could do the work being in the wrong place and the wrong trade, and it reappears in the price of every flat.

Why training cannot rescue this contract: the VETA course runs 40 days at TShs 500,000 a head, so ten trained labourers cost TShs 5,000,000 and would not be ready until two fifths of the contract had gone. Occupational immobility is a wall of time as much as of money.

The advice for this contract: take the Mwanza ten, since TShs 38,200 is still below TShs 40,000, but write the fares and the lodging into the tender price. Then negotiate a hostel rate: lodging alone is TShs 7,000,000, nearly a fifth of what the group costs, and it is the one item open to bargaining.

The advice for the next contract: start training now. Ten labourers through the course cost TShs 5,000,000 once and thereafter work at TShs 28,000 rather than the scarcity rate of TShs 40,000, a saving of TShs 12,000 a worker a day, or TShs 12,000,000 on the next hundred day contract.

The two mobilities divide the problem between them. Geographical immobility explains why the surplus in Mwanza did not walk to Kigamboni; occupational immobility explains why the labourers already at the gate could not pick up the rods. Only the second is a wall the contractor can pull down.

The Master Key: *Cheap labour a thousand kilometres away is not cheap; add the fare, the lodging and the waiting, and immobility shows up in the wage bill as plainly as any tax.*

REAL Question 29

The machine at a Tanga sisal estate stood idle four hours on Tuesday and lost nothing. Sixty cutters stood idle the same four hours, and those hours will never come back.

Calculate the worker hours lost, the fibre not cut and its value, and the labour cost per hour actually worked, then explain what the case shows about the perishability of labour.

> A sisal estate at Hale in Tanga employs 60 cutters on an eight hour day at TShs 12,000 a day each.
>
> A cutter cuts 240 leaves an hour, 30 leaves yield one kilogramme of dry fibre, and the estate sells fibre at TShs 2,500 a kilogramme.
>
> On Tuesday the decorticator, the machine that strips the fibre from the leaf, broke down after four hours and cutting was stopped for the rest of the shift.
>
> The estate may cut on Saturday to make up the loss, but Saturday hours are paid at one and a half times the ordinary rate.

Model Answer

The four hour breakdown destroyed 240 worker hours that can never be worked again, cost the estate 1,920 kg of fibre worth TShs 4,800,000, and doubled the labour cost of every hour actually worked from TShs 1,500 to TShs 3,000.

Work through the shift in steps, keeping hours and kilogrammes separate. All money figures are in shillings.

$$\text{Worker hours in a full shift} = 60 \times 8 = 480$$

$$\text{Worker hours actually worked} = 60 \times 4 = 240$$

$$\text{Worker hours lost} = 480 - 240 = 240$$

$$\text{Leaves not cut} = 240 \times 240 = 57{,}600$$

$$\text{Fibre not cut} = \frac{57{,}600}{30} = 1{,}920 \text{ kg}$$

$$\text{Value of that fibre} = 1{,}920 \times 2{,}500 = 4{,}800{,}000$$

Reading the loss: the estate failed to receive TShs 4,800,000 of fibre, exactly half a normal day's crop, since a full shift yields $\frac{115{,}200}{30} = 3{,}840$ kg worth TShs 9,600,000. The leaves are not lost, since they still stand in the field. The day is what has been lost.

The cutters are on a daily rate, so the estate pays each the full TShs 12,000 whether the machine runs or not.

$$\text{Wage bill for Tuesday} = 60 \times 12{,}000 = 720{,}000$$

$$\text{Normal labour cost per hour worked} = \frac{720{,}000}{480} = 1{,}500$$

$$\text{Tuesday labour cost per hour worked} = \frac{720{,}000}{240} = 3{,}000$$

What the doubling means: every hour of cutting actually obtained on Tuesday cost twice what such an hour normally costs, and the doubling passes straight into unit cost. Labour cost per kilogramme rises from $720{,}000 \div 3{,}840 = 187.50$ to $720{,}000 \div 1{,}920 = 375$.

Why the lost hours cannot simply be made up: the estate may cut on Saturday, but it must then buy fresh hours at a premium. Tuesday's idle hours cannot be taken off a shelf and used.

$$\text{Ordinary hourly rate} = \frac{12{,}000}{8} = 1{,}500$$

$$\text{Saturday hourly rate} = 1.5 \times 1{,}500 = 2{,}250$$

$$\text{Cost of buying back 240 hours} = 240 \times 2{,}250 = 540{,}000$$

The decision, and what it hides: TShs 540,000 to recover fibre worth TShs 4,800,000 is plainly worth paying, so the estate should cut on Saturday. But Tuesday's hours have not been recovered; new hours have been bought at a premium of TShs 750 each, and the estate is TShs 540,000 poorer than if the machine had never stopped.

The contrast with the machine: the decorticator also stood idle for four hours and lost nothing. It can run four extra hours on Saturday for the price of the fuel, and demands no weekend premium. Capital can be stored and used later; labour cannot.

Two lessons follow. The whole risk of a stoppage falls on whoever has hired the perishable factor, which is why a firm paying daily rates guards its machines so jealously. And the same perishability weakens the worker in a bargain, since he cannot store this morning and offer it again tomorrow.

The Master Key: *A machine that stands idle merely waits; a worker who stands idle loses the hour for ever, and the firm pays for that hour either way.*

HOT Question 30

A Kariakoo workroom keeps six specialists busy all week. The same trade in a Kilombero village cannot keep one. The tailors are equally skilled; the market is not equally wide.

Discuss the claim that the division of labour is limited by the extent of the market, and consider what this means for small producers in Tanzania.

Model Answer

The claim is sound, because a specialist can be kept fully employed only if everything he produces can be sold, but it describes the market at one moment rather than for ever, since roads, storage and a growing town can widen a market until specialisation that was impossible last year pays this year.

Why the limit is real: a specialist must be employed full time or he is a cost without a product. A village fundi selling six shirts a week cannot pay a full time cutter, who would finish by Tuesday and draw wages for standing still.

The rule works in the other direction too: where the market is wide, specialisation goes deep. A Dar es Salaam bakery selling half a million loaves a month keeps separate mixers, ovenmen, wrappers and drivers, and justifies a machine at every stage.

It explains the map of Tanzanian industry: divided production clusters in Dar es Salaam, Mwanza and Arusha and thins with distance from them. It is not that workers upcountry are less able; the sales within reach cannot keep a divided line at work.

But the market is not a wall, it is a frontier: market size is not fixed by nature. A tarmac road to Sumbawanga, mobile money that lets a Kigoma customer pay a Dodoma workshop, and one export order all widen it at a stroke, and specialisation follows within months.

Other limits often bind before the market does: the work must first be capable of being split into repeated operations, so one wedding gown to a customer's own design cannot be divided however wide the market. Capital, power and skilled supervision may also bind first.

Small producers can borrow market size from each other: the limit applies to the volume the divided operation serves, not to the size of one firm. Where twenty workshops in a SIDO cluster share one cutting service, labour is divided across firms instead of inside one.

The causation runs both ways: a wider market permits deeper specialisation, which lowers cost, lowers price and widens the market again. Small markets keep productivity low and low productivity keeps incomes and markets small, which is why opening a market is a development policy.

The counsel to a small producer is therefore not to abandon specialisation but to divide the work only as deeply as this month's sales justify, to keep workers who can cover two stations, and to spend real effort on widening the market, since every extra customer loosens the limit itself.

The Master Key: *The market sets the depth of specialisation today; widen the market and the limit itself moves, which is why a road can raise productivity as surely as a machine.*

HOT Question 31

A Mtwara site advertises for welders for six months and finds none. Ten kilometres away, hundreds of young men sit idle. Both of those facts are true on the same morning.

To what extent is the immobility of labour responsible for unemployment and unfilled vacancies existing side by side in Tanzania?

Model Answer

Immobility is a large part of the explanation, and much the largest part a country can directly remove, because idle workers and empty posts can survive together only if the idle cannot reach the posts; but weak demand, poor information, the seasons and the wage offered also keep the two apart.

How immobility produces the paradox: if labour were perfectly mobile the two would cancel out. The unemployed would move into the vacancies, wages would adjust, and neither surplus nor shortage could last a season.

Occupational immobility is the sharper barrier: most unfilled posts call for a definite skill and most idle workers have none, so no fall in the wage will turn one into the other; what separates them is knowledge, not price.

Geographical immobility keeps the surplus in the wrong district: work concentrates in a few towns while people are spread across a large country, and the fare, a rent deposit demanded in advance and family left behind keep a worker where there is no work.

Immobility also destroys posts, not merely leaves them empty: where a scarce trade can charge a scarcity rate, building and repair grow dearer, projects are postponed and the jobs that would have followed are never advertised at all.

But poor information is a separate cause: a worker with the skill, and willing to move, cannot apply for a post he never hears of, since hiring runs by word of mouth and by a notice at the gate. That is cured by an employment service, not by training.

Weak demand and the seasons are separate causes too: when construction slows or the crop fails, unemployment rises in every district while vacancies are few in every trade; and much rural work is idle for months by the nature of the crop. Neither is cured by moving anybody, and counting either as immobility points policy at the wrong target.

The wage offered may simply be too low: some posts stay open because the wage is below what a worker can earn elsewhere, or below what will feed him where rent must be paid. The remedy then lies with the employer, not the worker.

How the question can be settled: where training places are opened in the trade that is short, vacancies fill and unemployment falls together, which shows immobility was binding; where posts stand empty even after training, the fault lay in demand, in information or in the wage.

To a large extent, then, but not entirely. Occupational immobility above all is why the two figures can be printed on the same page on the same day, and it is the one most worth acting on, since it yields to trade schools, hostels, transport and a working employment service. What remains belongs to the level of demand.

The Master Key: *Idle hands and empty posts can only coexist behind a wall; find out first whether the wall is skill, distance, information or the wage, then prescribe.*

HOT Question 32

Two Mbeya millers boast at the same counter. One pays the lowest wage in town and the other the highest, and it is the second who is winning the flour trade.

Assess the view that a firm which pays the lowest wage in its trade will always have the lowest labour cost.

Model Answer

The view is false as a general rule, because a firm buys not an hour but the output of an hour, so what decides its cost is the wage divided by the efficiency of labour, and a low wage that buys low efficiency can leave labour cost per unit higher than a high wage that buys high efficiency.

The wage is the price of an hour; labour cost per unit is the wage bill divided by output. A miller paying TShs 10,000 a day for 20 sacks carries $10{,}000 \div 20 = 500$ shillings of labour in every sack, while one paying TShs 18,000 for 45 sacks carries $18{,}000 \div 45 = 400$. The better paid worker is the cheaper worker.

Why a higher wage can buy more than it costs: pay works upon health, effort and attention. A worker who eats properly and knows that care is rewarded works faster and spoils less, so part of the wage comes back as output.

Low wages raise the costs that never appear as wages: a firm known for the worst pay loses its best hands first, then pays again in recruiting, in training replacements, in spoilage and in the supervision needed when nobody stays long enough to be trusted.

At the bottom of the market the worker is different: labour is heterogeneous, so the lowest rate does not buy the same worker more cheaply; it buys a slower or less reliable one. A miller whose flour is coarse loses customers no wage saving will bring back.

The case for the low paying firm, first argument: where the work is simple, quickly learned, closely supervised and paced by a machine, the difference in efficiency is genuinely small, and there the lower wage does give the lower cost per unit.

The case for the low paying firm, second argument: in a district with a large labour surplus a firm may hire willing people at the local rate, since their alternative is no work at all. What depresses the wage there is that labour market, not the employer's meanness.

A wage can also be too high: efficiency does not rise without limit as pay rises. Beyond the point where the extra output bought by one more shilling of wage is worth less than that shilling, the firm loses on the bargain.

How a producer should actually decide: the honest figure is labour cost per unit. Raise the rate, wait a month and measure sacks per worker again; if output has risen by a larger proportion than the wage, the rise has paid for itself.

So the view holds only for simple, machine paced, closely watched work, and fails in general. The verdict turns on how much of the output depends on the worker's own skill and care, which is to say on the human element in labour, and it is cost per sack that decides which miller is still trading next year.

The Master Key: *Divide the wage by the output it buys before calling it cheap; the lowest paying firm is very often the highest cost firm.*

Capital, Wealth and Capital Formation

A lorry standing outside a house in Mbeya is worth twenty million shillings whether it moves or not, yet only one of those two states makes it a factor of production. Capital is the odd factor: the one a producer must first create before he can use it, and the only one a poor country can deliberately build for itself. This section separates capital from wealth and from money, sorts it into its types, and shows how a nation adds to its stock.

BINDER Question 33

The soil of Kilimanjaro was there before anyone was born. The coffee pulping machine standing on it was not; somebody had to go without something so that it could exist.

Define capital as a factor of production, state its reward, and explain why capital is described as a produced means of production.

Model Answer

Capital is any man made asset used to produce further goods and services, its reward is interest, and it is called a produced means of production because it must itself be produced before it can produce anything else.

Capital is man made: every item of capital was manufactured by somebody. The pulping machine began as ore a miner dug, timber a sawyer cut and hours a fundi, that is a skilled craftsman, put in. Nature supplies land and raw materials; nature supplies no machine.

It is not a free gift of nature: this separates capital from land. The Rufiji river is a gift of nature; the canal cut from it is not. Because capital must be made, it always carries an opportunity cost, namely the consumer goods the same resources could have produced.

It is produced in order to produce: capital satisfies no want directly; nobody eats a maize mill. It is wanted only for the output it makes possible, which is why the demand for capital is derived from the demand for the goods it helps to make.

Interest is its reward: the owner is paid interest, whether he lends his capital out or uses it himself and counts the interest forgone. Interest is the price of waiting, because capital exists only where somebody postponed consumption.

It must be saved into existence: the resources that build a pulping machine cannot at the same time be making sugar or shirts. Withdrawing them from consumer goods is saving; using them to build the machine is investment.

It is a stock, not a flow: capital is what a producer owns at a moment in time, while output, income and investment are flows measured over a period. Investment is the flow that adds to the stock, which is what makes capital formation measurable.

The economist's capital is therefore never the shillings in an account but the physical apparatus of production: the machines, buildings, tools, vehicles and stocks of materials.

The Master Key: *Capital is produced before it produces: land is a gift, capital is a debt owed to past saving.*

BINDER Question 34

A Mbeya trader's lorry stands under a mango tree all Sunday, then leaves at four on Monday morning loaded with maize. The same steel; two entirely different economic things.

With the aid of a diagram, explain the relationship between capital and wealth.

Model Answer

All capital is wealth, but not all wealth is capital, because wealth becomes capital only when it is put to work producing further wealth.

Wealth is the stock of assets a person or a country owns which have utility, are scarce, are transferable and can be held apart from the owner's own person. Capital is the part of wealth being used in production, a subset of wealth and never the whole of it.

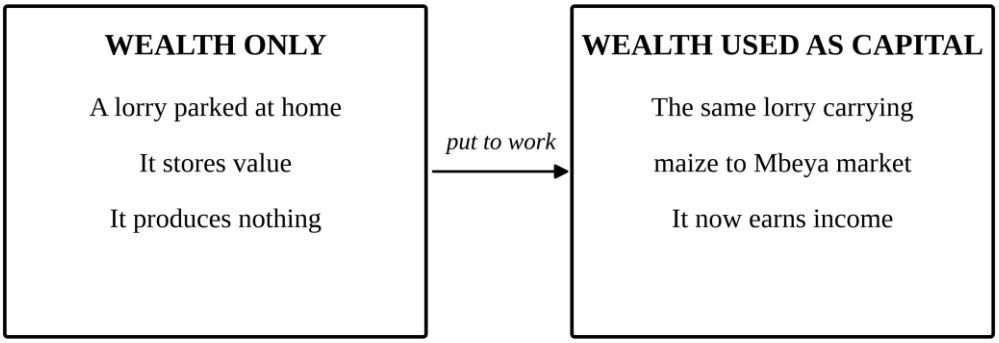


Figure 5.2: The same asset as wealth and as capital

The left hand panel, wealth only: the lorry parked at its owner's home stores value and can be sold or inherited, but while it stands it produces nothing. It is wealth and nothing more.

The right hand panel, the same lorry as capital: loaded with maize for Mbeya market it creates place utility and earns a freight charge. It has become a produced asset used to produce further goods and services, and it now earns interest for its owner.

What changed was the use, not the thing: not a bolt was altered between the panels. Capital is not a class of objects but a class of uses: a house becomes capital the day it is let, a sewing machine becomes mere wealth the day it is pushed under a bed.

Why all capital is wealth: anything used as capital has utility, is scarce and is transferable, so it passes every test of wealth. The converse fails: a plot bought and left idle, or a car used only for family journeys, is wealth that produces nothing.

Why the distinction matters to a country: a nation's wealth may be large while its capital is small, because so much of it sits in houses, in idle land, in cattle kept for prestige and in jewellery. Development means moving wealth from the parked column into the working one, the service a bank performs when it lends idle savings to producers.

So capital is wealth at work. Ask of any asset only whether it is producing further goods and services; if it is not, it is wealth that may still become capital tomorrow without changing physically.

The Master Key: *Wealth is what you own; capital is what your wealth is doing.*

BINDER Question 35

The Bank of Tanzania could double every shilling in the country tonight. By morning there would not be one extra mill, one extra lorry or one extra metre of road.

Explain why money is not in itself capital, and state the circumstances in which money becomes capital.

Model Answer

Money is not capital in itself because money is a claim on goods while capital is a productive asset, and money becomes capital only when it is exchanged for assets that produce further goods and services.

Money is a claim, capital is a thing: a ten thousand shilling note produces nothing. It is an order on goods that other people have already produced, whereas capital is the mill, the plough and the store itself, and it is these that do the producing.

The test at the level of the nation: double the notes in circulation overnight and not one extra machine exists in the morning. Prices would rise and nothing else would change, because real capital is created in workshops and never in printing presses.

Money becomes capital when it buys productive assets: shillings that buy a maize mill become fixed capital; shillings that buy raw cashew for a Mtwara processor become working capital; a loan becomes start up capital the moment it is spent on plant and stock. Until then it is purchasing power waiting to be used.

Money capital is still a real category for the firm: to a single producer money is capital because it commands capital goods. A workshop counts the cash held for wages, fuel and materials as working capital, since those shillings are committed to production and the process would stop without them.

Lending moves capital, it does not create it: a lender at Kariakoo who advances five million shillings calls the loan his capital; the welder who receives it calls the same five million his. Only one welding plant exists, so the country has gained capital once, however often the money is lent on.

Money is the ticket; capital is the machine bought with it. A producer who keeps his savings in cash owns wealth and liquidity, but no capital until his shillings have bought something that works.

The Master Key: *Money commands capital; it is not capital until it has bought something that produces.*

BINDER Question 36

A hoe bought at Kariakoo in January is blunt by August, and its owner never once counted that as a cost. It wears out whether anyone counts it or not.

State and explain the characteristics of capital as a factor of production.

Model Answer

Capital differs from the other factors in seven ways: it is man made, it is no free gift of nature, it depreciates, it is highly mobile, its demand is derived, it is productive, and its supply grows only as fast as saving.

Capital is man made: a secondary or artificial factor made by combining land and labour: a plough is iron ore that a miner dug and a fundi shaped. Unlike land, it can be added to without limit.

It is not a free gift of nature: so it always carries a social cost. Every hour and every tonne of steel spent on capital goods is not spent on consumer goods, so the country that builds most machines this year eats least.

It depreciates with use and with time: capital wears out as it works, decays when idle and falls out of date when better methods appear. A Morogoro rice huller loses value every season, so part of the takings is not profit but the fund for replacing it.

It is highly mobile: more mobile than land, which cannot move, and than labour, which moves unwillingly: a lorry carrying maize this week can carry cement next, a generator can be lifted from Dodoma to Mtwara, and capital crosses borders as foreign investment. A sugar factory at Kilombero, fixed once installed, is the exception.

Its demand is a derived demand: nobody wants a milling machine for its own sake. The demand for mills comes from the demand for sembe, so when a crop price collapses the demand for its machines collapses too.

It is a productive factor: the same field and the same pair of hands yield far more with a plough than with a hoe, which is why output per worker differs between countries largely as capital per worker does.

Its supply is elastic in the long run but depends on saving: unlike land, the stock of capital can be multiplied indefinitely, but only as fast as the community saves, so the poorest community finds it hardest to obtain the very thing that would lift it out of poverty.

Depreciation is the characteristic a producer forgets first: he must earn enough to replace his capital before he may call anything profit.

The Master Key: *Man made, wearing out, mobile, derived in demand, productive, and never available faster than a country can save.*

BINDER Question 37

The Mtibwa sugar estate owns a factory that will stand for twenty years and a heap of cane that will be gone by Friday. Both are capital, for different reasons.

Describe the main types of capital, giving a Tanzanian example of each.

Model Answer

Capital is classified as fixed, working or circulating, money, real and social, according to whether the asset survives many rounds of production, is used up in one, exists as purchasing power, exists as a physical asset, or is owned by the community.

Fixed capital: durable assets used over and over without being consumed in any one round of production: the Mtibwa factory buildings, a Morogoro rice huller, a bodaboda rider's motorcycle. Fixed capital is not used up, but it depreciates and must eventually be replaced.

Working or circulating capital: assets consumed in a single round and needing continuous replacement: the cane in the Mtibwa yard, fuel, work in progress, stocks awaiting sale and the cash held for wages. It circulates from cash into materials, into goods and back into cash.

Money capital: also called liquid capital, this is the purchasing power a firm holds for buying capital goods, materials and labour. The five million shillings a SIDO trainee borrows to set up on his own is his start up capital.

Real capital: the physical assets themselves as against the money that bought them: machines, buildings, tools, vehicles and stocks. A bank can create money capital in a morning; real capital must be produced by land and labour, and it alone is a country's true capital.

Social or infrastructural capital: assets owned by the community rather than by any one firm, serving production in general: trunk and feeder roads, TANESCO's power lines, a village water scheme, ports and railways. No single producer would build them, yet every producer's costs depend on them.

A producer needs the right mixture, not the largest amount of any one: a Dodoma press with an excellent machine and no money for seed stands silent, and the finest plant cannot deliver output over a road nobody has built.

The Master Key: *Fixed capital lasts through many rounds, working capital is used up in one, money capital buys both, and social capital carries them all.*

BINDER Question 38

A Singida farmer sells his sesame and, instead of the new roof, buys an ox plough. That one choice, repeated by a million households, is how a country grows rich.

Explain what is meant by capital formation and distinguish between gross investment and net investment.

Model Answer

Capital formation is the process of adding to a country's stock of capital by devoting part of current resources to capital goods instead of consumer goods, and it requires saving, the mobilisation of that saving, and investment in real assets.

Saving: income that is not consumed, and the point at which the real sacrifice is made, since resources are released to build machines only by being withheld from what people want now.

Mobilisation: saving kept in a tin under a bed helps no producer. Banks, credit societies, pension funds and the capital market gather scattered savings and place them with those who will build, so a shallow financial system slows a country even where thrift is high.

Investment: the actual buying or building of capital goods: the press, the store, the boat, the road. Only investment adds to the stock; saving merely makes the addition possible.

Replacement of worn out capital: part of every year's investment only makes good what depreciation has destroyed. This part, called capital consumption, must be met in full before a country has added anything at all.

Gross investment and net investment: gross investment is the whole amount spent on capital goods in a year, whether it replaces or adds. Net investment is what is left after capital consumption, and it alone measures the growth of the stock.

$$\text{Net investment} = \text{Gross investment} - \text{Capital consumption}$$

A bus company buys three buses while two of its old ones reach the end of their lives: gross investment is three buses, net investment one. If the three cost TShs 300,000,000 while TShs 200,000,000 of the fleet is used up:

$$\text{Net investment} = 300{,}000{,}000 - 200{,}000{,}000 = \text{TShs } 100{,}000{,}000$$

The three possible outcomes: positive net investment means the stock is growing and output can rise; zero means it is merely maintained, so the economy stands still however busy it looks; negative means the country is consuming its capital and will be poorer next year.

Capital formation is therefore a decision about time: the shilling put into a plough is a shilling not put into a meal today, and the return arrives only in later harvests.

The Master Key: *Saving makes it possible, investment does it, and only the part above depreciation actually adds to the stock.*

REAL Question 39

Follow one day's trading at Kirumba market in Mwanza, from the boat at dawn to the four kilogrammes that nobody buys and nobody can keep.

Using the figures in the box, calculate the extra revenue the freezer would earn in a month, its payback period and the annual return on the capital invested, and advise Neema whether to buy it with borrowed money.

> Neema Charles buys 80 kilogrammes of fresh sangara, that is Nile perch, at Kirumba market in Mwanza on each of her 25 trading days a month, at TShs 4,500 a kilogramme, and sells at TShs 7,000 a kilogramme.
>
> Without cold storage, 4 kilogrammes are still unsold at nightfall each day and have to be thrown away.
>
> A chest freezer costs TShs 2,700,000, would end the spoilage completely, and is expected to last five years with no scrap value.
>
> Electricity and maintenance for the freezer would come to TShs 250,000 a month.
>
> A bank at Mwanza will lend her the whole sum at 18 per cent a year.

Model Answer

The freezer would add TShs 700,000 a month to Neema's sales, pay for itself in six months and return about 180 per cent a year on the money invested, so she should buy it even with borrowed money.

Begin with what the spoilage costs her: she has already paid for all 80 kilogrammes whether they sell or not, so the 4 kilogrammes thrown away each evening are sales she never makes.

$$\text{Sales lost each day} = 4 \times 7{,}000 = \text{TShs } 28{,}000$$

$$\text{Extra revenue a month} = 28{,}000 \times 25 = \text{TShs } 700{,}000$$

The freezer is not free to run, so take off its electricity and maintenance.

$$\text{Net cash gain a month} = 700{,}000 - 250{,}000 = \text{TShs } 450{,}000$$

$$\text{Payback period} = \frac{2{,}700{,}000}{450{,}000} = 6 \text{ months}$$

Reading the payback period: by the end of her sixth month Neema has recovered the whole purchase price out of fish she would otherwise have thrown away, and the freezer is expected to last sixty months. A project that repays itself in a tenth of its working life is a strong one.

Payback ignores depreciation, which is a real cost although no cash leaves the till. Spread the price evenly over the five year life.

$$\text{Annual depreciation} = \frac{2{,}700{,}000}{5} = \text{TShs } 540{,}000$$

$$\text{Monthly depreciation} = \frac{540{,}000}{12} = \text{TShs } 45{,}000$$

$$\text{Extra profit a month} = 450{,}000 - 45{,}000 = \text{TShs } 405{,}000$$

$$\text{Extra profit a year} = 405{,}000 \times 12 = \text{TShs } 4{,}860{,}000$$

$$\text{Return on capital} = \frac{4{,}860{,}000}{2{,}700{,}000} = 1.8$$

Reading the return: a ratio of 1.8 means the freezer earns 180 shillings a year for every 100 sunk in it, after both running costs and wear. It exists because the freezer creates time utility: fish that used to perish at dusk now keeps.

Interest is the price of the capital, not the test of it: the bank asks 18 per cent a year, so borrowing the whole sum costs a definite amount which must be set against what the asset earns.

$$\text{Interest for one year} = 0.18 \times 2{,}700{,}000 = \text{TShs } 486{,}000$$

The advice: the freezer earns TShs 4,860,000 a year while the loan costs TShs 486,000, a tenth of it, so she should borrow and buy at once. The general rule is to acquire capital whenever the return on the asset exceeds the interest on the money that buys it, and waiting to save the sum would cost her TShs 450,000 a month.

The gain is more than the arithmetic shows: the freezer also strengthens her as a seller. At present she must take whatever the last buyers offer at dusk, since her alternative is losing the fish; with storage she can sell in the morning instead, so her price should improve as well as her quantity.

One warning. Other traders can see the same arithmetic, and as freezers spread the evening glut will disappear and the extra earnings shrink. Her advantage lies in being early, and in a machine that works for five years regardless.

The Master Key: *Compare what the machine earns with what the machine costs to own and to finance, then buy whenever the return beats the interest.*

REAL Question 40

Four carpenters at a SIDO workshop in Iringa built twelve school desks last week with hand saws. This week the same four built thirty two, and nobody worked a minute longer.

From the workshop's records, calculate output per worker, labour hours per desk and the total cost of a desk before and after the machines arrived, and explain what the case shows about the advantages of capital.

Four fundi, that is trained craftsmen, work at a SIDO workshop in Iringa, each for 48 hours a week, and each is paid TShs 120,000 a week.

With hand tools only, the workshop produced 12 school desks a week.

A bench saw and a planer, costing TShs 4,800,000 together, were then installed. Output rose to 32 desks a week with the same four men and the same hours.

The machines are expected to last 8 years with no scrap value, and the workshop works 50 weeks a year. Electricity for them costs TShs 60,000 a week.

Each desk sells for TShs 65,000 and uses TShs 30,000 of timber, nails and varnish.

Model Answer

Output per fundi rises from 3 desks a week to 8, labour time per desk falls from 16 hours to 6, and cost per desk falls from TShs 70,000 to TShs 47,250, turning a workshop that was losing money at the going price into one earning TShs 568,000 a week.

Start with output per worker, since the men and their hours are the same in both cases.

$$\text{AP}_\text{L}(\text{hand tools}) = \frac{12}{4} = 3 \text{ desks per fundi a week}$$

$$\text{AP}_\text{L}(\text{machines}) = \frac{32}{4} = 8 \text{ desks per fundi a week}$$

Now measure the labour time buried in one desk: the workshop has $4 \times 48 = 192$ labour hours a week in both situations.

$$\text{Hours a desk (hand tools)} = \frac{192}{12} = 16$$

$$\text{Hours a desk (machines)} = \frac{192}{32} = 6$$

Next the cost per desk. The weekly wage bill of $4 \times 120{,}000 = 480{,}000$ shillings does not change, so the fall in labour cost comes entirely from spreading the same wages over more desks.

$$\text{Labour cost a desk (hand tools)} = \frac{480{,}000}{12} = \text{TShs } 40{,}000$$

$$\text{Labour cost a desk (machines)} = \frac{480{,}000}{32} = \text{TShs } 15{,}000$$

The machines are not free either: charge their depreciation and their electricity.

$$\text{Depreciation a year} = \frac{4{,}800{,}000}{8} = \text{TShs } 600{,}000$$

$$\text{Depreciation a week} = \frac{600{,}000}{50} = \text{TShs } 12{,}000$$

$$\text{Capital cost a desk} = \frac{12{,}000 + 60{,}000}{32} = \text{TShs } 2{,}250$$

Item	With hand tools	With the machines
Desks a week	12	32
Output per fundi a week	3	8
Labour hours a desk	16	6
Labour cost a desk (TShs)	40,000	15,000
Capital cost a desk (TShs)	-	2,250
Materials a desk (TShs)	30,000	30,000
Total cost a desk (TShs)	70,000	47,250

The Iringa workshop before and after the machines.

The decisive figure: with hand tools a desk cost TShs 70,000 and sold for TShs 65,000, a loss of TShs 5,000 on every desk. With the machines it costs TShs 47,250, giving TShs 17,750 a desk and $32 \times 17{,}750 = 568{,}000$ shillings a week. Capital is what makes this business possible at the going price.

Capital raises output per worker: the same four men, equally skilled and equally willing, now produce nearly three times as much. Output per worker measures the combination of factors, not the worker, and what changed here was capital per man.

Capital saves labour and time: a desk that once absorbed 16 labour hours now absorbs 6, and those 10 hours are released for other work, which is why capital moves employment rather than destroying it.

Capital makes new methods possible: a planer holds a thickness no hand plane can hold across two hundred pieces, so the workshop can now bid for a district council order of identical desks, work it could not have taken before at any price.

Capital allows production on a larger scale at a lower unit cost: the depreciation of TShs 12,000 a week is spread over 32 desks rather than 12, so it costs TShs 375 a desk. Fixed capital rewards the producer who keeps it busy.

Then ask why nobody had done it before. The four men were neither lazy nor unskilled; they had no machine because nobody in the workshop had TShs 4,800,000 to spare. Where capital is scarce the return to the first machine is enormous, and what blocks it is the saving needed to seize it.

The Master Key: *Capital does not replace the worker, it multiplies him, and where capital is scarcest the first machine earns the most.*

REAL Question 41

The miller at Mvomero counts his fuel, his wages and his profit each season. The one cost he never sees is the one quietly eating his huller from the inside.

From the mill's records, compute the annual depreciation on the huller, the mill's total capital consumption, its gross and net investment for the year and its closing capital stock, and interpret every figure for the miller.

Mbogo Rice Mill at Mvomero in Morogoro began the year owning a huller, a lorry and a store, valued together at TShs 60,000,000. The huller alone had cost TShs 30,000,000.

The huller is expected to work for 10 years and then to be sold for scrap at TShs 4,000,000. The mill uses the straight line method.

The lorry and the store lose a further TShs 1,400,000 of value during the year.

During the year the miller spent TShs 9,000,000 on a stone separator and a second drying floor.

The mill hulls 2,000 tonnes of mpunga, that is paddy, in the year, at a charge of TShs 70,000 a tonne.

Model Answer

The huller depreciates by TShs 2,600,000 a year, total capital consumption is TShs 4,000,000, gross investment is TShs 9,000,000 and net investment TShs 5,000,000, so the mill's capital stock has genuinely grown from TShs 60,000,000 to TShs 65,000,000.

The straight line method spreads the loss of value evenly over the asset's working life. Only the difference has to be written off, because TShs 4,000,000 comes back as scrap.

$$\text{Annual depreciation} = \frac{30{,}000{,}000 - 4{,}000{,}000}{10} = \text{TShs } 2{,}600{,}000$$

Capital consumption for the whole business is the depreciation on every asset it owns, so add the lorry and the store.

$$\text{Capital consumption} = 2{,}600{,}000 + 1{,}400{,}000 = \text{TShs } 4{,}000{,}000$$

What capital consumption tells the miller: no supplier bills him for TShs 4,000,000, yet that much of his plant has been used up producing this year's rice. It is a genuine cost of production, and a miller who treats all his takings as his to spend is eating the mill itself and will find in ten years that he has no huller and no fund to buy one.

Now spread that cost over the work actually done.

$$\text{Depreciation a tonne} = \frac{4{,}000{,}000}{2{,}000} = \text{TShs } 2{,}000$$

Reading the figure per tonne: out of the TShs 70,000 he charges for hulling a tonne, TShs 2,000 belongs to the machines and not to him. A milling charge that covers only fuel, wages and repairs looks profitable and is not, because it leaves out the largest asset in the yard.

Gross investment is everything spent on capital goods during the year, whatever its purpose; net investment is what survives after capital consumption.

$$\text{Gross investment} = \text{TShs } 9{,}000{,}000$$

$$\text{Net investment} = 9{,}000{,}000 - 4{,}000{,}000 = \text{TShs } 5{,}000{,}000$$

$$\text{Closing capital stock} = 60{,}000{,}000 - 4{,}000{,}000 + 9{,}000{,}000 = \text{TShs } 65{,}000{,}000$$

What the net figure means: the mill is genuinely larger than it was, by TShs 5,000,000 or about one twelfth. Only this part of the TShs 9,000,000 is capital formation; the other TShs 4,000,000 has stood still against wear, and a producer who confuses the two believes he is expanding when he is holding his ground.

The two other cases: had he spent exactly TShs 4,000,000, net investment would have been zero and the mill would enter next year no stronger than it began. Had he spent nothing, it would have been minus TShs 4,000,000 and the stock would have fallen to TShs 56,000,000, which is disinvestment.

Why the scrap value is deducted: depreciation measures value actually lost, not money originally paid. Deducting the TShs 4,000,000 the huller will fetch keeps the annual charge honest, since charging the full TShs 3,000,000 a year would understate his profit and make him fear an expansion he can afford.

Do this sum for every producer and you have the national account: Tanzania's capital stock grows only by the amount by which gross investment exceeds the wearing out of what the country already owns.

The Master Key: *Depreciation is a cost you must charge for although nobody bills you; only the investment above it makes you richer.*

HOT Question 42

A minister says the loan will give Tanzania in five years the roads it would take fifty years to save for. The lender says exactly the same thing, and smiles.

To what extent can a low income country borrow its way to a stock of capital?

Model Answer

Borrowing can bring capital forward in time but never replaces domestic saving, because a loan is a claim on future output: foreign capital leaves a country richer only where the assets it buys earn more than the debt costs to service.

Domestic saving cannot do the job by itself: a household spending nearly all it earns on food, rent and school fees saves nothing, so low income gives low saving, low saving little capital, little capital low productivity and low productivity low income again. What saving exists is often held as cash, cattle or an unfinished house far from any bank, and a fast growing population absorbs much of what is invested merely in equipping the new arrivals. Borrowing is an attempt to break this vicious circle from outside.

Some capital is lumpy and cannot be saved for piece by piece: a port, a railway or a national grid cannot be built a metre at a time out of one year's savings, and half a bridge yields nothing. Borrowing lets a country own the whole asset now and pay for it out of the output the asset itself makes possible.

Foreign capital brings more than money: direct investment carries technology, management, training and access to markets, and capital crosses a border as land never can. A country that refuses it denies itself the knowledge as well as the machines.

But a loan is not a gift; it is future output already spent: principal and interest come out of tomorrow's production, so borrowing does not create saving; it changes who saves and when. The lender saves now and the borrower's children save later, and the postponement has a price.

The asset must earn or save foreign exchange, and it must be an asset: the debt falls due in dollars while a rural road earns shillings, so a project can be excellent in itself and still leave the country unable to service the loan. Where loans finance salaries, fuel subsidies or plants idle for want of spare parts, the obligation matures on time with nothing produced to meet it.

Absorptive capacity sets a ceiling: machines need trained operators, spare parts, power and maintenance. A country can be handed more capital than it can install and keep running, and idle capital depreciates as fast as capital at work.

The obligation is fixed while the return is not: the repayment schedule does not move, but a drought or a collapse in the cashew price can halve the earnings meant to meet it. Debt turns a variable return into a fixed liability, which transfers risk from the lender to the borrower.

So the extent is real but conditional. Borrowing pays where the asset yields more than the loan costs, where it yields in a form that can service the debt, and where domestic saving is rising alongside, so that borrowed capital supplements it and does not replace it. Otherwise a country ends with the debt of an industrial nation and the capital stock of a poor one.

The Master Key: *Borrow to build an asset that earns more than the loan costs; never borrow to eat, because the debt outlives the meal.*

HOT Question 43

A Kariakoo wholesaler keeps eight million shillings in his strongbox and calls it his capital. His accountant agrees at once; an economist reaches for a distinction the accountant never needs.

Discuss the claim that the money a trader holds is his capital.

> Juma Mnyika trades in cement at Kariakoo. On the first day of the month his business holds TShs 8,000,000 in cash, TShs 14,000,000 of cement in the store and a delivery lorry worth TShs 40,000,000.
>
> He also owns a plot at Kigamboni worth TShs 25,000,000, bought as somewhere to build a family house one day.
>
> Of the cash, TShs 6,000,000 is due to his supplier this week and TShs 2,000,000 is held loose in case a bargain appears.

Model Answer

The claim is true from the trader's standpoint and false from the country's: money committed to a trade is capital to the firm that holds it, while the capital of a nation is only the real assets that money buys.

The case for the claim: to Juma the eight million shillings is as productive as the lorry: it buys the next load of cement, pays the driver and settles the supplier, and without it the lorry would stand idle. Every firm counts the cash it holds for trading as part of its working capital.

The case against: money is a claim on goods, not a good that produces. The notes in the strongbox produce nothing while they lie there; what produces is the cement they will buy and the lorry that carries it. Capital is a produced means of production, a bank note a produced means of exchange.

The test is commitment, not the form of the asset: of Juma's eight million, six million is already on its way to his supplier and is plainly circulating capital, turning from cash into cement and back into cash. The two million held loose against a bargain is idle purchasing power, which becomes capital on the day it is spent on something productive and not before.

Not all of his wealth is capital either: the Kigamboni plot is worth more than the cash, yet it is wealth and not capital, because it is held for a house he may build one day and produces nothing meanwhile. The strongbox is judged by the same rule as the plot.

Adding up private capital counts the same thing twice: if Juma lends five million to a fellow trader, the lender calls the loan his capital and the borrower calls the same five million his, yet only one lot of goods has been added to the country's stock. Real capital cannot stand in two shops at once.

The individual and social views answer different questions: the accountant asks what resources this business commands, and for that question cash is capital. The economist asks what productive assets the community owns, and the answer is the lorry, the store and the cement. Both are right within their own question.

Why the distinction is not a quibble: a government that believed money was capital would think it could enrich the country by lending more freely, and would find prices rising and no new mills built. Capital is created in workshops and on building sites; the banking system only decides who uses it.

So two senses of one word are at work. In the accounting sense Juma is right, and his money capital finances the working of his business from day to day; in the economic sense he is wrong, because shillings can be printed and lorries cannot.

The Master Key: *To the firm, money committed to the trade is capital; to the nation, capital is only what the money has actually bought.*

HOT Question 44

In Njombe a village cut and gravelled six kilometres of road in a single dry season. Not one shilling entered any account, and the district's investment figure never moved.

Assess whether a village that builds a road with its own unpaid labour has formed capital.

> The 340 households of Ihanga village in Njombe spent eleven weeks of the dry season cutting, levelling and gravelling six kilometres of road out to the district road. Nobody was paid.
>
> Before the road, lorries would not come to the village and a sack of maize had to be head loaded out at a charge of TShs 3,000. Lorries now load at the village itself and charge TShs 1,200 a sack.
>
> The village markets about 4,000 sacks a year.
>
> A contractor had quoted TShs 96,000,000 for the same work.

Model Answer

Yes, the village has formed capital, because capital formation is the creation of a produced asset that yields a stream of future services, and it is financed by real saving, which need not take the form of money.

The road passes every test of capital: it is man made, durable, and satisfies no want directly, since nobody eats a road, yet it raises the productivity of every other factor in the village. That it is social capital rather than a private machine does not change its nature.

The saving was real although no shilling moved: saving is the diversion of resources from present consumption, and money is only its usual measure. The villagers gave up eleven weeks of whatever else those hands might have done, and that sacrifice financed the road.

The yield should be measured, because a claim to have formed capital is empty unless the asset earns something. The whole fall in the freight charge stays with the village.

$$\text{Saving on each sack} = 3{,}000 - 1{,}200 = \text{TShs } 1{,}800$$

$$\text{Saving each year} = 1{,}800 \times 4{,}000 = \text{TShs } 7{,}200{,}000$$

$$\text{Yield on the contractor's price} = \frac{7{,}200{,}000}{96{,}000{,}000} = 0.075$$

Reading the yield: the road returns about seven shillings and fifty cents a year for every hundred it would have cost to buy, and it returns them every year without further payment. An asset throwing off TShs 7,200,000 a year is capital by any test.

It is social capital, which is why nobody else built it: the road belongs to no single farmer, so no single farmer could recover its cost, and its benefits spill over on to all 340 households and the traders as well. Social capital is the base on which private capital works, since a lorry is useless where there is no road.

Against the claim: it does not appear in the figures: investment statistics record what is spent, so work done without payment is invisible to them. That is a weakness of the measure rather than of the road, and it means the recorded rate of capital formation understates what a poor economy achieves.

Against the claim: unmaintained capital disappears: the first heavy rains will cut gullies in an unmaintained camber, for depreciation applies to a village road as it does to a rice huller. Unless the village sets aside labour every year for repair, the asset will be gone in three seasons.

Against the claim: the return would not satisfy a lender: at seven and a half per cent the road could not repay a bank loan at eighteen, which is why no contractor and no bank was ever going to build it. The village could build it because its dry season labour had almost no alternative employment.

Against the claim: do not value it at the contractor's price: self built work is likely to be narrower and less well drained, so TShs 96,000,000 overstates what has been created. The honest value of new capital is what the asset yields over its life, not what somebody else would have charged.

So the verdict is yes, with one condition: capital has been formed, paid for by genuine saving in the only currency the village possessed, and it stays capital only for as long as it is maintained. The wider lesson matters more, for where labour is abundant and idle for part of the year while capital is scarce, turning that labour into roads, wells and terraces is the cheapest capital formation a poor country has.

The Master Key: *Capital is formed wherever present effort is turned into a lasting productive asset, whether or not a shilling changes hands.*

Entrepreneurship and the Reward of Enterprise

Land lies still, capital rusts and labour waits for orders until somebody decides to bring the three together and answer for the result. That somebody is the entrepreneur, and the answering is what makes enterprise a factor of production at all. This section fixes what entrepreneurship is, why its reward is a residual rather than a price, what qualities the work demands, and why the entrepreneur alone can be paid a negative amount.

BINDER Question 45

At Kariakoo a welder owns the machine, rents the shed and hires two hands. Land, labour and capital were all sitting idle until somebody decided to put them together.

Define entrepreneurship and explain the roles performed by the entrepreneur in the production process.

Model Answer

Entrepreneurship is the factor of production that brings land, labour and capital together into a working firm, takes the decisions on what and how to produce, and bears the risk that can be shifted onto nobody else; its reward is profit.

A plot at Kariakoo, a welding machine and a pair of trained hands produce nothing until somebody rents, buys, hires and decides what they shall make.

Coordinating the other factors: he hires land, labour and capital and fixes the proportions in which they are combined, deciding how large the workshop shall be, how many hands it needs and how much money goes into machinery rather than stock.

Bearing uninsurable risk: he commits money today for a price he will not see until tomorrow. A Mtwara buyer pays farmers in October for cashew he will sell in January, and no insurer will cover a fall in the price. That burden separates enterprise from management.

Innovating: he introduces new products, new methods and new sources of supply. A Singida press that begins refining its alizeti, that is, sunflower oil, instead of selling it cloudy is doing this part of the work.

Seeking out sales opportunities: he must find the market as well as make the product, studying what customers want, advertising and choosing where to expand. Output nobody has been found to buy is production left unfinished.

Deciding promptly: delay is itself a cost. An Iringa trader who takes three days to decide whether to sell fresh has lost part of his crop to rot, so a fair decision now beats the right decision late.

The entrepreneur is the only factor nobody else hires. Rent, wages and interest are prices he agrees to pay; profit is whatever the market leaves him, and it may leave him nothing.

The Master Key: *Enterprise is the deciding and the risk bearing; remove those two and what is left is a manager, not an entrepreneur*.

BINDER Question 46

A casual hand at a Mtwara cashew warehouse is paid every Friday, whatever happens next. The man who hired him will not know his own reward for three more months.

Explain why profit differs from rent, wages and interest as a reward to a factor of production.

Model Answer

Profit differs from rent, wages and interest because it is a residual rather than a contracted price, because it stays uncertain until the last sale is made, and because alone among the four it can be negative.

The other three are agreed in advance: a landlord fixes the rent before the shop opens, a kibarua, that is, a casual labourer, agrees his daily wage, and a bank fixes its interest, each of them while the output is still unsold.

Profit is a residual, and is paid last: it is agreed with nobody, being whatever remains once every other factor has been paid in full, so it is discovered by subtraction rather than promised in advance. The shortfall of a bad season therefore lands on him, which is why the decisions are his.

Profit is uncertain: it rests on a price that has not yet appeared. The Mtwara buyer knew the TShs 2,000 he promised farmers exactly, and nothing of the figure he would be offered three months later.

Profit can be negative: no worker pays his employer after a bad week and no bank accepts negative interest, yet an entrepreneur can end a season poorer than he began: loss is profit with a minus in front.

Profit has no rate per unit: wages are so much an hour and rent so much an acre a year, but profit is not the price of a measured quantity of anything.

Normal profit behaves like a cost: the minimum return that keeps his own labour and money in this business rather than the next best is a genuine opportunity cost, so part of what an accountant calls profit an economist counts as cost.

Who bears a failure depends on the form of the firm. A sole trader's loss runs from his savings to his house and land, while shareholders lose only what they subscribed and the rest falls on unpaid suppliers, the bank and workers. Limited liability moves the loss; it does not abolish it.

The Master Key: *Rent, wages and interest are promised; profit is only discovered, and it is the one reward that can arrive as a minus.*

BINDER Question 47

Two women open shops on the same Dodoma street with the same money on the same day. Within a year one has three shops and the other has none.

State and explain the qualities of a good entrepreneur.

Model Answer

A good entrepreneur needs willingness to bear risk, foresight in judging a market, initiative and innovation, organising and leadership ability, knowledge of his trade and its customers, and self discipline in handling money.

Willingness to bear risk: he must commit money to an outcome he cannot know, though a measured risk is not recklessness: every shilling put into one lorry load at the height of the Iringa tomato glut is not brave but foolish.

Foresight and prompt judgement of a market: he must read where demand is going and act before it arrives, as the Njombe farmers did who planted avocado while their neighbours planted maize. A week's delay can cost more than a slightly wrong decision.

Initiative and innovation: he must do what the trade has not yet done. A Mwanza fish trader who buys a chest freezer can hold dagaa until the price recovers, and has changed the method of his business.

Organising and leadership ability: he must put the right hand to the right task and be obeyed without being feared. Three fundi, that is, skilled craftsmen, sitting idle for want of materials is the organiser's fault and not theirs.

Knowledge of the trade and its customers: a Kariakoo cloth trader who knows which pattern sells before Idd and which when schools reopen buys the right stock at the right moment; the one who does not locks his money up in the wrong colour.

Self discipline and honesty in money matters: he must keep the business purse separate from the household purse and a written record of both. A stall quietly eaten by household spending shows a healthy profit in the owner's head and an empty box when the supplier calls.

Only the first of these six is about courage; the rest are knowledge, method and habit, and can be taught.

The Master Key: *Courage opens a business; foresight, organisation and clean records are what keep it open.*

BINDER Question 48

An Arusha tour operator can insure the Land Cruiser that rolls on the Ngorongoro road. Nobody will sell him cover for a season when the tourists simply stay away.

Distinguish between insurable risk and uninsurable uncertainty, and explain which of the two the entrepreneur's profit rewards.

Model Answer

An insurable risk is one whose chance can be calculated and pooled, so it can be shifted onto an insurer for a premium and becomes an ordinary cost, while uninsurable uncertainty cannot be shifted at all; profit rewards the second and not the first.

Insurable risk: an event that happens often enough across many similar firms for its frequency to be known: fire, theft of stock, a lorry overturning on the Ngorongoro road. An insurer covering thousands of vehicles knows how many will crash in a year, though not which ones.

The premium converts the risk into a cost: once the Arusha operator has paid it the loss no longer falls on him, and the premium enters the price of a safari exactly as fuel and a driver's wage do.

Uninsurable uncertainty: an event that is one of a kind, so that no frequency can be worked out and no pool of similar cases exists. A fall in the world cashew price, a bigger workshop across the street and a shift in policy are all of this kind. No insurer could price such a policy, and all his clients would claim in the same week.

Why the distinction decides the reward: an insurable risk has been turned into a cost any firm can pay, so it cannot be the source of anybody's profit; what is left is carried by the entrepreneur alone, and it is for carrying that residue that he is paid.

The boundary is not fixed: a forward contract sheds part of a price uncertainty and two crops instead of one spread it, so the frontier moves as markets improve. Where warehouse receipts and honest price information exist, less uncertainty is left to bear, and the profit that rewards it falls.

The Master Key: *If you can buy cover for it, it is a cost; if nobody will sell you cover, that is what profit is paid for.*

REAL Question 49

Follow the shillings through Mama Neema's frying pan on a Tanga street. The till fills every evening, yet three of her real costs never pass through it at all.

Calculate Mama Neema's accounting profit and her economic profit, explain what the difference between the two figures tells her, and state the constraints that will limit her expansion.

Mama Neema fries vitumbua at a stall in Ngamiani, Tanga, and trades 26 days a month.

She makes 200 vitumbua a day and sells every one of them at TShs 200.

Each month she buys rice flour and sugar for TShs 330,000, coconut milk and cooking oil for TShs 120,000, and charcoal for TShs 78,000.

A girl helps her wash and serve for TShs 5,000 a day, and the municipal council collects a stall fee of TShs 1,000 a day.

To start the stall she turned down a job as a cook at a guest house paying TShs 200,000 a month.

Her savings of TShs 900,000 are tied up in the heavy pan she bought from the SIDO workshop, the charcoal stove, the buckets and the stock. A savings account would have paid her 12 per cent a year.

She prepares and stores in the front room of her house. A neighbour lets a room of the same size for TShs 40,000 a month.

Model Answer

Mama Neema's accounting profit is TShs 356,000 a month but her economic profit is only TShs 107,000, and the gap of TShs 249,000 is the reward the three factors she owns herself could have earned somewhere else.

She sells 200 vitumbua a day at TShs 200 and trades 26 days in the month.

$$\text{Total revenue} = 200 \times 200 \times 26 = 1{,}040{,}000$$

Now the explicit costs, the payments that leave her hand: labour is $5{,}000 \times 26 = 130{,}000$ and the council fee $1{,}000 \times 26 = 26{,}000$.

$$\text{Total explicit cost} = 330{,}000 + 120{,}000 + 78{,}000 + 130{,}000 + 26{,}000 = 684{,}000$$

$$\text{Accounting profit} = 1{,}040{,}000 - 684{,}000 = 356{,}000$$

That is the figure she carries in her head, but three of the factors she uses were never paid at all. She supplied them herself.

Her own labour: she gave up a cook's post at TShs 200,000 a month to stand at the pan, and that forgone wage is a real cost though no money changes hands.

Her own capital: TShs 900,000 is locked in the pan, the stove, the buckets and the stock instead of earning 12 per cent a year.

$$\text{Forgone interest} = 900{,}000 \times \frac{12}{100} \times \frac{1}{12} = 9{,}000 \text{ a month}$$

Her own land: the front room she uses could be let for TShs 40,000 a month, so the stall consumes rent she pays herself in kind.

$$\text{Total implicit cost} = 200{,}000 + 9{,}000 + 40{,}000 = 249{,}000$$

$$\text{Economic profit} = 356{,}000 - 249{,}000 = 107{,}000$$

Reading the two figures: the TShs 107,000 is the true reward of her enterprise, since land, labour and capital have each now been paid what they could have earned elsewhere. Being positive, it says she should stay; a negative figure would have meant working hard to grow poorer, however healthy the TShs 356,000 looked.

How thin the reward is: she sells $200 \times 26 = 5{,}200$ vitumbua a month, so the enterprise earns her about TShs 21 on each one.

$$\frac{107{,}000}{5{,}200} \approx 20.6 \text{ shillings a bun}$$

A rise of TShs 20 in the cost of each bun costs her $5{,}200 \times 20 = 104{,}000$ a month and wipes out almost the whole of it, while her accounting profit would still read TShs 252,000. That is the trap the implicit costs exist to expose.

Finance: no bank will lend against a stall with no title, licence or written accounts, so she grows only out of savings or what an upatu, a rotating savings group among neighbours, releases to her.

Skills: she keeps no record separating till from household purse, so she cannot tell which cost is rising, cost a larger order or show a lender anything.

Licensing and formality: a licence, a health inspection, a taxpayer number and a fixed address are each affordable alone, but together they can cost more than the TShs 107,000 the stall earns, which is why so much Tanzanian enterprise stays informal.

Market information: she cannot know what flour will cost next week or lock in a supplier at a fixed price, so she carries that uncertainty herself.

The Master Key: *The till shows the accounting profit; only after her own labour, room and savings are priced does the true reward of her enterprise appear.*

REAL Question 50

Sit with a trader at Ilula market with fifty crates of tomatoes and one week to decide. Sell them fresh in Dar es Salaam, or dry them and wait three weeks.

Work out the economic profit of each route, advise Baraka which to take, and identify the uncertainty that the route you recommend leaves him carrying.

Baraka Mgeni buys 50 crates of tomatoes at Ilula market on the Iringa road at TShs 30,000 a crate.

Selling fresh: a place on a lorry to Dar es Salaam costs TShs 200,000 for the load, offloading and market fees at Mabibo cost TShs 100,000, and his own fare and three nights away cost TShs 90,000. One crate in five arrives unsaleable, and the rest fetch TShs 65,000 a crate.

Drying: hire of a solar drier and shed near Ilula for three weeks costs TShs 150,000, trays, salt and packing cost TShs 90,000, two women slice and turn the fruit for 8 days at TShs 8,000 a day each, carriage of the dried tomato to Dar es Salaam costs TShs 60,000 and handling there costs TShs 40,000.

Each crate holds 60 kilogrammes of fresh tomato and yields 4 kilogrammes of dried tomato, which a supermarket buyer takes on contract at TShs 12,000 a kilogramme.

Selling fresh takes one week; drying takes three. Baraka can earn TShs 100,000 a week broking for another trader, and his TShs 1,500,000 would earn 2 per cent a month in a savings account.

Model Answer

On the prices given, the fresh route yields an economic profit of TShs 602,500 against TShs 109,500 for drying, so Baraka should sell fresh, but only because the Mabibo price is high this week, and that price is the very thing he cannot insure.

The tomatoes cost the same whichever route he takes, so begin there.

$$\text{Cost of the crop} = 50 \times 30{,}000 = 1{,}500{,}000$$

Route one, selling fresh: one crate in five spoils on the road, so only four fifths of the load reaches a buyer in saleable condition.

$$\text{Crates sold} = 50 \times \frac{4}{5} = 40$$

$$\text{Revenue} = 40 \times 65{,}000 = 2{,}600{,}000$$

$$\text{Explicit cost} = 1{,}500{,}000 + 200{,}000 + 100{,}000 + 90{,}000 = 1{,}890{,}000$$

Now the two factors Baraka supplies himself: one week of his own labour, worth TShs 100,000 broking, and his TShs 1,500,000 tied up for a quarter of a month at 2 per cent.

$$\text{Forgone interest} = 1{,}500{,}000 \times \frac{2}{100} \times \frac{1}{4} = 7{,}500$$

$$\text{Implicit cost} = 100{,}000 + 7{,}500 = 107{,}500$$

$$\text{Economic profit (fresh)} = 2{,}600{,}000 - 1{,}890{,}000 - 107{,}500 = 602{,}500$$

Route two, drying: nothing is lost to spoilage, since the fruit is sliced as soon as it is bought, but each crate of 60 kilogrammes yields only 4 kilogrammes dried.

$$\text{Dried output} = 50 \times 4 = 200 \text{ kg}$$

$$\text{Revenue} = 200 \times 12{,}000 = 2{,}400{,}000$$

The slicing labour costs $2 \times 8 \times 8{,}000 = 128{,}000$; the other drying costs are given directly.

$$\text{Explicit cost} = 1{,}500{,}000 + 150{,}000 + 90{,}000 + 128{,}000 + 60{,}000 + 40{,}000 = 1{,}968{,}000$$

Drying holds him three weeks instead of one, so both of his own factors are consumed three times over.

$$\text{Implicit cost} = (3 \times 100{,}000) + \left(1{,}500{,}000 \times \frac{2}{100} \times \frac{3}{4}\right) = 300{,}000 + 22{,}500 = 322{,}500$$

$$\text{Economic profit (dried)} = 2{,}400{,}000 - 1{,}968{,}000 - 322{,}500 = 109{,}500$$

The advice: sell fresh. It earns TShs 602,500 against TShs 109,500 and frees his money after one week instead of three. Only TShs 200,000 of that gap is a difference in revenue; TShs 78,000 is the extra cash cost of drying and TShs 215,000 the extra two weeks of his own labour and money.

The uncertainty he keeps: the whole recommendation rests on a Mabibo price of TShs 65,000 a crate, which nobody has promised him. How far can it fall before the route stops paying?

$$\text{Break even price} = \frac{1{,}890{,}000 + 107{,}500}{40} = \frac{1{,}997{,}500}{40} \approx 49{,}938$$

So the fresh route covers every cost, his own labour included, above about TShs 50,000 a crate. It beats drying only above a higher figure.

$$\text{Indifference price} = \frac{1{,}997{,}500 + 109{,}500}{40} = \frac{2{,}107{,}000}{40} \approx 52{,}675$$

Between TShs 50,000 and TShs 52,700 the fresh route pays its way but drying pays better; only above TShs 52,700 is selling fresh genuinely right. At TShs 65,000 he stands well clear of both, which makes the advice sound rather than lucky.

What a glut would do: in a heavy Iringa season the Mabibo price has fallen to TShs 35,000 a crate. Revenue would then be $40 \times 35{,}000 = 1{,}400{,}000$ against explicit costs of TShs 1,890,000, a cash loss of TShs 490,000 and a week worked for nothing, while the lorry owner, the market attendant and the farmer are all paid in full.

That is risk against uncertainty at work. Insurers cover many lorries and know how often they crash, so he can insure the load; nobody will insure the Mabibo price, because there is only one and every trader would claim on the same morning. Drying is his own hedge, and the TShs 493,000 he gives up is what the supermarket's fixed price costs him.

The Master Key: *Compare routes on economic profit, not on revenue, and then ask which of the two prices in front of you is actually promised.*

REAL Question 51

Follow twenty five tonnes of raw cashew from a Tandahimba farmer to an exporter's lorry. Everybody in the chain was paid. Work out what was left for the buyer.

Calculate Hamisi's accounting profit or loss and his economic profit or loss at the price he actually received, find the price he needed, and explain who bore the shortfall.

Hamisi Nandonde buys korosho, that is, raw cashew nut, from farmers at Tandahimba in Mtwara Region. The season runs four months.

He puts in TShs 20,000,000 of his own savings and borrows TShs 40,000,000 from a bank at 18 per cent a year.

He buys 25,000 kilogrammes at TShs 2,000 a kilogramme.

Bags, weighing, loading and haulage cost TShs 100 a kilogramme. Warehouse rent and fumigation cost TShs 1,500,000. Two vibarua, that is, casual labourers, sort the nuts for 20 days at TShs 12,000 a day each. The buyer's licence and the district cess together come to TShs 2,700,000.

Instead of buying cashew he could have managed a shop at Newala for TShs 450,000 a month, and the store he uses as an office would let for TShs 100,000 a month.

He expected the exporter to pay TShs 2,700 a kilogramme. When the auction closed the exporter would pay only TShs 2,250.

Model Answer

At TShs 2,250 a kilogramme Hamisi makes an accounting loss of TShs 3,330,000 and an economic loss of TShs 6,730,000, and because every other factor was paid in full the whole of that shortfall came out of his own savings.

Set out the explicit costs first. Handling is $25{,}000 \times 100 = 2{,}500{,}000$, sorting is $2 \times 20 \times 12{,}000 = 480{,}000$, and the interest runs for four months only.

$$\text{Bank interest} = 40{,}000{,}000 \times \frac{18}{100} \times \frac{4}{12} = 2{,}400{,}000$$

Item	Working	Cost (TShs)
Raw cashew bought	25,000 kg at TShs 2,000	50,000,000
Bags, weighing and haulage	25,000 kg at TShs 100	2,500,000
Warehouse rent and fumigation	for the season	1,500,000
Sorting labour	2 workers, 20 days, TShs 12,000	480,000
Licence and district cess	for the season	2,700,000
Bank interest	TShs 40,000,000 at 18 per cent, 4 months	2,400,000
Total explicit cost		59,580,000

The explicit costs of one season's cashew buying at Tandahimba.

Now the factors he supplied himself, for which no cheque was written: his own TShs 20,000,000 locked up for the same four months at 18 per cent, his labour worth TShs 450,000 a month elsewhere and his store TShs 100,000 a month in rent.

$$\text{Forgone interest} = 20{,}000{,}000 \times \frac{18}{100} \times \frac{4}{12} = 1{,}200{,}000$$

$$\text{Total implicit cost} = 1{,}200{,}000 + (450{,}000 \times 4) + (100{,}000 \times 4)$$
$$= 1{,}200{,}000 + 1{,}800{,}000 + 400{,}000 = 3{,}400{,}000$$

$$\text{Total economic cost} = 59{,}580{,}000 + 3{,}400{,}000 = 62{,}980{,}000$$

Against those costs put what the exporter actually paid.

$$\text{Revenue} = 25{,}000 \times 2{,}250 = 56{,}250{,}000$$

$$\text{Accounting profit} = 56{,}250{,}000 - 59{,}580{,}000 = -3{,}330{,}000$$

$$\text{Economic profit} = 56{,}250{,}000 - 62{,}980{,}000 = -6{,}730{,}000$$

What the two losses mean: the TShs 3,330,000 is cash he will never see again. The TShs 6,730,000 also charges him for four months of his own work, his own store and the interest his TShs 20,000,000 would have earned in the bank.

The price he needed: divide each total cost by the 25,000 kilogrammes.

$$\frac{59{,}580{,}000}{25{,}000} = 2{,}383.2 \quad \text{and} \quad \frac{62{,}980{,}000}{25{,}000} = 2{,}519.2$$

He needed about TShs 2,384 a kilogramme to recover his cash and TShs 2,520 to earn a normal return on everything he put in; he was offered TShs 2,250. Had the exporter paid the TShs 2,700 he expected, revenue would have been TShs 67,500,000, an accounting profit of TShs 7,920,000 and an economic profit of TShs 4,520,000. The whole swing turned on a price he did not set.

Who bore the shortfall: nobody but Hamisi. The farmers took their TShs 2,000 at the scale, the two vibarua their TShs 12,000 at the end of each day, and the warehouse, the district, the lorry owner and the bank were all paid in full, every payment fixed before the price was known.

The arithmetic of the residual: he began with TShs 20,000,000 and, after repaying the bank and settling every bill, is left with TShs 16,670,000, exactly the TShs 3,330,000 loss. Being paid last means being paid only what the others have not taken.

Hamisi's real work was not the sorting or the fumigating, both of which he hired, but the judgement made in October, on imperfect information about a market thousands of kilometres away, that a January price above TShs 2,520 was likely enough to be worth his savings. He judged wrongly, and the whole penalty was his.

The Master Key: *Every other factor is paid by contract before the price is known; the entrepreneur takes what is left, and what is left can be less than nothing.*

HOT Question 52

The manager of a state company at Ubungo hires, fires, plans and signs the orders. His salary arrives on the twenty eighth whether the company made money or lost it.

Assess the claim that the salaried manager of a state owned company is an entrepreneur.

Model Answer

The claim is only half true, because the manager performs the organising, deciding and innovating half of the entrepreneurial function in full, but he does not bear the uninsurable risk, and it is that half which the reward of enterprise pays for.

He does coordinate the factors: he hires and dismisses labour, decides how much capital goes into which plant, chooses the technique and fixes the level of output, which in a large firm is harder work than a sole trader ever faces.

He can innovate: he can introduce a new method, a new product or a new source of materials, and many public firms have been turned round by a manager who did precisely that.

He decides under genuine uncertainty: committing the company to a new plant, he knows the outcome no better than a Mtwara cashew buyer does, even though the consequence of being wrong does not land on him.

He carries a personal risk of a kind: a manager who loses money is dismissed and his reputation goes with him, so he is not indifferent to the outcome, and the claim is therefore not absurd.

But his reward has the shape of a wage: his salary is agreed in advance, fixed per month and paid before any profit is calculated, arriving in a losing year exactly as in a winning one. Every feature that distinguishes profit, being residual, uncertain and able to turn negative, is absent from it.

He cannot be paid a negative amount: if the company loses two billion shillings he does not write a cheque for two billion. In a state company the Treasury does, which is to say the taxpayer, so the residual claimant and bearer of the uninsurable risk is the public.

His decisions may not even be his: a state company often cannot set its own price, choose its own board or refuse an unprofitable obligation. A manager at TANESCO does not fix the tariff he charges, because a regulator approves it, so the decision that most affects revenue is taken outside the firm.

The entrepreneurial function, undivided at Mama Neema's stall, is split in two in the modern firm: the organising and innovating half is salaried, while the risk bearing half belongs to whoever owns the residual, the shareholder in a private company and the taxpayer in a state one. So call him an entrepreneur if you mean the organiser and the innovator, and deny it if you mean the bearer of uninsurable risk. Performance contracts and share schemes exist precisely to hand him a slice of the residual, and so restore the missing half.

The Master Key: *Ask who is poorer when the firm loses money; that person, and not the person who signed the orders, is the entrepreneur.*

HOT Question 53

A Mtwara buyer who held cashew through a rising market calls his gain a reward for courage. The farmer who sold to him calls it luck, and asks what was earned.

Is it true that profit is a reward for nothing, being merely what happens to be left over? Justify your answer.

Model Answer

Profit is a residual in its arithmetic, but it does not follow that it rewards nothing, because somebody must bear the uninsurable uncertainty that production for a future price involves, although part of what is called profit is a windfall or a monopoly rent for which nothing was done.

The case for the claim, profit is defined by subtraction: unlike every other reward it is not the price of a measured service; nobody agrees it and nobody works an hour of it.

Much of it is plainly luck: two Mtwara buyers of equal skill bought at the same price in the same week; one sold into a rising world market and one into a falling one, and the difference between eight million gained and three million lost was a decision taken in Vietnam.

Some of it is rent or transfer rather than reward: where a licence keeps rivals off a rural route, or one buyer faces farmers with nowhere else to sell, the margin measures the absence of competition and not any service performed; and a firm paying its workers below what they could earn elsewhere merely moves value from one pocket to another.

The case against the claim, somebody must carry the unknown: every act of production for sale commits resources today for a price discovered later. If nobody would carry that burden, nothing would be produced except to order, and Mama Neema would not light the stove before knowing who would buy.

Normal profit is a real cost, not a leftover: the minimum return that keeps an entrepreneur's own labour and money in this line rather than the next is an opportunity cost as solid as the wage of a hired manager, and Hamisi's forgone salary and interest were real sacrifices.

The residual form is what makes it work: because he takes what is left, he has a reason to hunt every avoidable shilling of cost and every extra shilling of revenue, which a fixed reward would remove. The same variation makes profit a signal: high returns draw new driers into Iringa, and losses drive resources out of a trade.

The two sides reconcile. Where entry is open, any return above the normal level attracts imitators whose competition drives it back down, so what survives is payment for organising and for bearing uncertainty. Where entry is blocked by a licence, a monopoly or a bad road, the surplus is not competed away and is a

rent, exactly as the critic says. So judge any profit by asking whether anybody else was free to enter and compete it away; where they were not, the remedy is not to abolish profit but to open the trade.

The Master Key: *Profit is a residual in form and a payment for uncertainty in function; ask whether anyone was free to compete it away.*

Determinants of Production and the Efficiency of Factors

Two farmers in the same district, with the same seed and the same hands, can end the season with harvests that differ threefold. The difference lies in conditions no seed catalogue mentions: a road, a transformer, a licence, a rainfall pattern, a market large enough to be worth serving. This section sets out what determines how much an economy can produce, what makes one unit of a factor more efficient than another, and how easily factors move from a poor use to a better one.

BINDER Question 54

A Kariakoo trader can have a container from Guangzhou in his shop in three weeks. A farmer forty kilometres from Mbeya cannot get his tomatoes into town. Neither difference is about effort.

State and explain the determinants of production, giving a Tanzanian example of each.

Model Answer

The determinants of production are the conditions that fix how much can be produced: the quantity and quality of the factors, technology, infrastructure, government policy, factor prices, entrepreneurial ability, natural conditions and the size of the market.

Quantity and quality of the factors: output cannot exceed what the factors on hand will yield, and quality counts as much as quantity: Shinyanga has hands but few trained ginnery technicians.

The state of technology: the technique settles what a given bundle yields, so a Njombe hectare gives a tonne of maize under a hand hoe and several times that under improved seed.

Infrastructure: roads, power, water and storage carry production, and a road that holds through the rains turns a distant field into a supplying farm.

Government policy and public order: taxes, licences and the security of property decide whether producing is worth the trouble, so a produce cess at every district boundary lowers the crop and insecure title stops investment altogether.

The prices of the factors: a producer uses more of whichever factor is cheap, so at TShs 12,000 a day Kilombero cane is cut by hand rather than by harvester.

Entrepreneurial ability: somebody must see the opening, combine the factors and decide in time, so two Morogoro workshops with identical lathes differ chiefly in their owners.

Natural conditions and climate: rainfall, soil and pests set the outer limit of a place, for cloves grow at Zanzibar and not at Manyoni.

The size of the market: no producer builds a plant larger than the market he can sell into, and the scale in turn settles the technique, since a hundred tonne mill beside eight hundred households would idle six days in seven, so the miller buys small.

The determinants act together and the weakest binds the rest, since fertiliser poured onto a field no lorry can reach adds nothing. Four of the eight lie outside the firm.

The Master Key: *Output is fixed by what the factors are, what technique combines them, what surrounds the firm, and how large a market is waiting.*

BINDER Question 55

A hoe on a Singida farm turns one hectare in twelve days. The same farmer behind a hired tractor turns four hectares before dusk. The pair of hands never changed.

Explain what is meant by the efficiency of a factor of production, and state what raises the efficiency of land, of labour, of capital and of enterprise.

Model Answer

The efficiency of a factor is the output obtained from one unit of it in a given period, so it rises only when the same unit yields more, never because more units are employed.

Efficiency is a ratio, not a total.

$$\text{Efficiency of a factor} = \frac{\text{Total output}}{\text{Units of that factor employed}}$$

One harvest yields as many efficiency figures as there are factors in it. A Mbozi farm reaping 2,400 kilogrammes of beans from 2 hectares worked by 4 people has two.

$$\text{Efficiency of the land} = \frac{2{,}400}{2} = 1{,}200 \text{ kg a hectare}$$

$$\text{Efficiency of the labour} = \frac{2{,}400}{4} = 600 \text{ kg a worker}$$

Neither contradicts the other: the first asks what the land is doing, the second what the workers are doing.

The efficiency of land: raised by fertiliser and manure, improved seed, irrigation, drainage, terracing, rotation and fallow, control of weeds and pests, and above all by putting land to the use its soil and rainfall suit.

The efficiency of labour: raised by education and training, health and nourishment, experience, the capital placed in the worker's hands, sound organisation, and pay that makes the effort worth giving: an apprenticed SIDO welder lays a joint in half the time.

The efficiency of capital: raised by better technology built into the machine, by maintenance and spare parts, by skilled operators, by reliable power and by high utilisation, since a machine standing still earns nothing.

The efficiency of enterprise: raised by knowledge of the market, honest records and costing, willingness to bear a calculated risk rather than every risk, promptness, and competition, which removes the organiser who cannot cover his costs.

Two warnings. Output per worker can always be lifted by handing every worker a machine, yet if the machine costs more than the extra output is worth the firm is less efficient in money terms. And the four are not independent, so a low figure usually indicts the combination.

The Master Key: *Efficiency is output per unit of a factor, and it rises when the unit is improved or better combined, never when the count is simply increased.*

BINDER Question 56

A Mwanza fisherman can sell his boat by Friday and be trading in Kariakoo by Monday. His lake cannot follow him, and neither can the ice plant on the shore.

Distinguish between the occupational and the geographical mobility of a factor of production, and rank the four factors according to their mobility, giving reasons.

Model Answer

Occupational mobility is the ease with which a factor moves from one use to another, geographical mobility the ease with which it moves from one place to another; enterprise and money capital are the most mobile, labour next, land and installed capital least.

Occupational mobility: a factor switched to a different employment without going anywhere, as when a Kariakoo tailor leaves school shirts for curtains at the same machine.

Geographical mobility: a factor moved to a different place while doing the same work, as when a mason leaves Songea for a Dar es Salaam site. A factor may be mobile in one sense and immobile in the other.

Land, the least mobile: geographically it cannot move at all, so what travels to it is the demand for what it grows; occupationally one plot may carry maize, then beans, then a warehouse, though soil narrows the choice.

Labour, mobile but slowly: occupational mobility falls as skill grows specialised, since a surgeon cannot become an engineer in a season while an unskilled kibarua, that is a casual labourer, moves from site to farm in a morning. Family, housing and the fare check movement between places.

Capital, most mobile and least at once: money capital is the freest of factors, since shillings leaving a Kariakoo shop on Monday can finance a Mwanza fishing boat on Wednesday, but capital sunk into a particular form and place stops moving: a ginnery cannot be lifted to Mtwara, nor will a cotton gin ever shell cashew.

Enterprise, the most mobile: organising ability and the willingness to bear risk fit many trades and many towns, so a trader moves from soap to secondhand clothes in a week; what ties him is local knowledge, built slowly and left behind.

Mobility is above all a matter of time: a worker cannot be retrained by Friday but can be by the next dry season. That is the real content of the short run and the long run.

The Master Key: *Occupational mobility changes the job, geographical mobility changes the place; money and enterprise move easily, labour with difficulty, land and sunk capital hardly at all.*

BINDER Question 57

Mtwara advertises for welders and finds none. Two hundred kilometres away, young men in Lindi sit idle all day. The jobs and the hands are in the same country.

Outline the obstacles to the mobility of factors of production and explain why the immobility of factors reduces a country's total output.

Model Answer

Factors are held in place by barriers of skill, aptitude, law, asset specificity, cost and attachment, and every barrier lowers total output by stranding resources in uses worth less than those they could have moved to.

The cost and time of a skill: a Kigoma fisherman cannot become a welder without a course he must pay for and months earning nothing.

Aptitude, age and health: a man of fifty will not begin a five year training, and some occupations demand a talent that no course supplies.

Legal and institutional barriers: licences, professional registration, work permits, and customary tenure a family forfeits if it leaves; each wall is built by people and can be lowered by them.

The specificity of the asset itself: a cotton gin does one thing and nothing else, so the immobility is technical until the asset wears out.

The cost of moving and of living there: a young man may know Dar es Salaam pays double what Lindi pays and still not afford the fare and the rent.

Ties and ignorance: family, land and belonging hold people where they were born, and many do not know what is on offer elsewhere.

Resources sit in low value uses: Rufiji floodplain that could carry irrigated rice grows thin maize, and a young man trained in accounts rides a bodaboda.

Shortage and surplus survive side by side: Mtwara advertises for welders and finds none while young men in Lindi are idle, and a mobile economy would close that gap.

Adjustment to change becomes slow and costly: when sisal collapsed, the estates and their workers could not turn to another crop, so the output was lost outright rather than transferred.

The country therefore works inside its production possibility frontier instead of on it, and training, information, roads, portable pensions and secure titles each move a resource to a use worth more.

The Master Key: *Immobility does not destroy a resource; it strands it, and the loss is the gap between what it produces and what it could have produced.*

REAL Question 58

Follow one harvest of Irish potatoes out of a Njombe village where the feeder road dissolves each March. Count the sacks that reach a buyer, not the sacks that leave the soil.

Study the account below, then compute the farmer's cost for each sack sold and her profit under the present road and under an all weather road, and explain why a road counts as a determinant of production.

> Neema Mgaya farms two hectares of Irish potatoes at Ikuna village in Njombe and harvests 240 sacks.
>
> Her growing costs for the season, that is seed, fertiliser, hired labour and bags, come to TShs 4,320,000.
>
> The feeder road breaks up in the rains and no lorry reaches the village. One quarter of the harvest rots or is spoiled while she waits, and she sells what is left at the farm gate to a passing middleman at TShs 30,000 a sack.
>
> If the road held all year, losses would fall to one tenth of the harvest, a lorry would carry her sacks to Makambako at TShs 4,000 a sack, and the Makambako price is TShs 45,000 a sack.

Model Answer

Under the present road Neema sells 180 sacks and clears TShs 1,080,000, while an all weather road would let her sell 216 sacks and clear TShs 4,536,000, so a road she neither owns nor could build multiplies her income 4.2 times.

Begin with the sacks that reach a buyer: a quarter of the 240 is lost now, a tenth with a good road.

$$\text{Sacks sold now} = 240 - \left(\frac{1}{4} \times 240\right) = 240 - 60 = 180$$

$$\text{Sacks sold with the road} = 240 - \left(\frac{1}{10} \times 240\right) = 240 - 24 = 216$$

Now set the growing cost against the sacks that survive, since those that rot must be paid for by those that do not.

$$\text{Growing cost a sack sold, now} = \frac{4{,}320{,}000}{180} = \text{TShs } 24{,}000$$

$$\text{Growing cost a sack sold, with the road} = \frac{4{,}320{,}000}{216} = \text{TShs } 20{,}000$$

The first gain is fewer sacks wasted: the same TShs 4,320,000 is recovered from 216 sacks instead of 180, so the cost carried by each sack sold falls by TShs 4,000. Nothing was added to the field; the leak was stopped.

With the road she must also pay TShs 4,000 a sack for haulage.

$$\text{Delivered cost a sack} = 20{,}000 + 4{,}000 = \text{TShs } 24{,}000$$

Delivered at Makambako a sack costs the same as today: TShs 24,000 either way, because the saving on spoilage and the new haulage bill cancel to the shilling, so the whole gain must appear on the price side.

Take the margin next, that is price received less the cost of getting the sack there.

$$\text{Margin now} = 30{,}000 - 24{,}000 = \text{TShs } 6{,}000 \text{ a sack}$$

$$\text{Margin with the road} = 45{,}000 - 24{,}000 = \text{TShs } 21{,}000 \text{ a sack}$$

$$\text{Profit now} = 180 \times 6{,}000 = \text{TShs } 1{,}080{,}000$$

$$\text{Profit with the road} = 216 \times 21{,}000 = \text{TShs } 4{,}536{,}000$$

Reading the two profits: the margin on a sack rises three and a half times while the sacks sold rise by a fifth. Marketed output per hectare rises from 90 sacks to 108, so the efficiency of her land, measured at the buyer, rises by a fifth too.

Where the missing TShs 15,000 was going: not the middleman's greed: he sends a vehicle over a road that ruins it and risks finding the crop spoiled, so he offers only what the journey leaves him. At TShs 4,000 a sack several traders can compete, and competition hands most of the gap back.

Why a road is a determinant of production: the farm does not own the road, yet the road fixes how much output reaches a buyer, at what price, and on what scale producing is worth doing at all, so a farmer who trusts it plants more.

It also enlarges her market, for without the road she faces one buyer who sets his own price, and with it she reaches Makambako and beyond. Market size is itself a determinant, so one investment moves two at once.

The Master Key: *Count the sacks that reach a buyer, not the sacks that leave the soil, and a road is what turns the second number into the first.*

REAL Question 59

Kilombero can buy the same cane harvester that cuts for Brazil. It has looked at the price twice and gone back to a thousand men with cane knives. Follow the arithmetic.

Using the figures in the box, calculate the cost of cutting one tonne of cane by hand and by machine, find the daily wage at which the estate would be indifferent between the two methods, and advise the estate.

A block at Kilombero carries 30,000 tonnes of cane, and the estate must cut all of it this season.

A cane cutter cuts 2 tonnes a day and is paid TShs 12,000 a day.

A mechanical harvester cuts 200 tonnes a day. It costs TShs 1,200,000,000 and will work eight seasons of 150 cutting days each.

The harvester burns 150 litres of diesel a day at TShs 3,000 a litre and needs a crew of three paid TShs 50,000 each a day.

Model Answer

Hand cutting costs the estate TShs 6,000 a tonne against TShs 8,000 a tonne by machine, so at today's wage the knife is the cheaper tool and saves TShs 60,000,000 over the block, and the estate should mechanise only once the daily wage of a cutter reaches TShs 16,000.

Take the hand method first: the cost of a tonne is the daily wage divided by the daily output.

$$\text{Cost a tonne by hand} = \frac{12{,}000}{2} = \text{TShs } 6{,}000$$

The machine must carry its purchase price, its fuel and its crew, the price spread over eight seasons of 150 days.

$$\text{Working days in its life} = 8 \times 150 = 1{,}200$$

$$\text{Ownership cost a day} = \frac{1{,}200{,}000{,}000}{1{,}200} = \text{TShs } 1{,}000{,}000$$

$$\text{Fuel a day} = 150 \times 3{,}000 = \text{TShs } 450{,}000$$

$$\text{Crew a day} = 3 \times 50{,}000 = \text{TShs } 150{,}000$$

$$\text{Total cost a day} = 1{,}000{,}000 + 450{,}000 + 150{,}000 = \text{TShs } 1{,}600{,}000$$

$$\text{Cost a tonne by machine} = \frac{1{,}600{,}000}{200} = \text{TShs } 8{,}000$$

The knife wins at today's wage: the difference is TShs 2,000 on every tonne, so over the block of 30,000 tonnes the estate pays TShs 180,000,000 by hand against TShs 240,000,000 by machine.

Now find the wage at which the two would cost the same, with w the daily wage and hand cutting therefore costing $\frac{w}{2}$ a tonne.

$$\frac{w}{2} = 8{,}000$$

$$w = 2 \times 8{,}000 = \text{TShs } 16{,}000 \text{ a day}$$

Reading the switching wage: the wage must rise by a third before the harvester becomes cheaper, and the hundred cutters it replaces lose the work when it does.

High productivity is not low cost: the crew of three turns out about 67 tonnes a worker against a cutter's 2, yet the machine is dearer, because the TShs 1,450,000 a day of steel and diesel behind it must be paid as surely as any wage. A technique is chosen on the cost of all its factors, never on the output of one.

The advice: keep cutting by hand this season, but watch the daily wage, the shilling price of a harvester and any duty on imported machinery, since each can reverse the ranking. A second hand machine at half the price would cost TShs 6,000 a tonne and equal the knife at once.

Why one estate cuts by hand and another by machine: both know the same technique, but one faces a wage of TShs 12,000 a day and the other many times that, so each leans on whichever factor is cheap where it stands.

One caution. The machine cuts to a timetable no rain disturbs and removes heavy, dangerous work, but the wages of a thousand cutters are spent in Kilombero itself, while the instalments on an imported machine leave the district.

The Master Key: *The cheapest technique is not the most advanced one; it is the one that leans on whichever factor is cheap where the producer stands.*

REAL Question 60

The ginnery at Shinyanga was built to run sixteen hours a day, and its machines are as good as any in the trade. Last season they turned for eleven. Follow what the idle hours cost.

Read the ginnery's record below, then calculate the season's output and the fixed cost a tonne with and without the power failures, evaluate the proposal to hire a standby generator, and state which determinant of production is at fault.

A ginnery at Shinyanga gins 5 tonnes of seed cotton an hour and is staffed to run 16 hours a day for the 100 days of the buying season.

The public supply fails for an average of 4 hours a day. There are two interruptions daily, and each costs a further half hour in clearing the machines and starting again.

The season's fixed costs, that is depreciation, the licence, salaried staff and security, come to TShs 1,320,000,000.

A standby generator can be hired for the whole season for TShs 90,000,000 and burns TShs 300,000 of diesel for every hour it runs.

After paying for seed cotton and every other running cost, each tonne ginned leaves the ginnery a contribution of TShs 220,000.

Model Answer

The failures cut output from 8,000 tonnes to 5,500 and raise the fixed cost on every tonne from TShs 165,000 to TShs 240,000, and since the generator wins back the 2,500 lost tonnes at TShs 96,000 a tonne against a contribution of TShs 220,000, the ginnery should hire it and gain TShs 310,000,000.

Start with the hours: the plant is staffed for 16, loses 4 to failures and one more to the two restarts.

$$\text{Hours lost a day} = 4 + \left(2 \times \frac{1}{2}\right) = 5$$

$$\text{Hours actually run a day} = 16 - 5 = 11$$

$$\text{Utilisation} = \frac{11}{16} = 0.6875$$

Reading the utilisation figure: the plant works barely more than two thirds of the hours it was built and staffed for, though its machines gin their 5 tonnes whenever they turn. What has fallen is the number of hours, not the efficiency of the capital, and a machine standing still earns nothing while its cost runs on.

Now the season's output on each footing, at 5 tonnes an hour across 100 days.

$$\text{Planned output} = 5 \times 16 \times 100 = 8{,}000 \text{ tonnes}$$

$$\text{Actual output} = 5 \times 11 \times 100 = 5{,}500 \text{ tonnes}$$

The fixed costs do not fall when the current does, since depreciation, the licence and the staff are paid whether the machines turn or not.

$$\text{Fixed cost a tonne, planned} = \frac{1{,}320{,}000{,}000}{8{,}000} = \text{TShs } 165{,}000$$

$$\text{Fixed cost a tonne, actual} = \frac{1{,}320{,}000{,}000}{5{,}500} = \text{TShs } 240{,}000$$

What the failures cost each tonne: every tonne now carries TShs 75,000 more of fixed cost than it was meant to, and the farmer feels it too, since a ginnery with costs this high offers less at the buying post.

Now judge the generator, which must restore 5 hours on each of the 100 days.

$$\text{Generator hours} = 5 \times 100 = 500$$

$$\text{Diesel} = 500 \times 300{,}000 = \text{TShs } 150{,}000{,}000$$

$$\text{Total generator cost} = 90{,}000{,}000 + 150{,}000{,}000 = \text{TShs } 240{,}000{,}000$$

$$\text{Extra output} = 8{,}000 - 5{,}500 = 2{,}500 \text{ tonnes}$$

$$\text{Extra cost a tonne} = \frac{240{,}000{,}000}{2{,}500} = \text{TShs } 96{,}000$$

The generator pays, and comfortably: each tonne won back costs TShs 96,000 and leaves a contribution of TShs 220,000, a gain of TShs 124,000 on every one of the 2,500 tonnes.

$$\text{Net gain} = 2{,}500 \times (220{,}000 - 96{,}000) = \text{TShs } 310{,}000{,}000$$

It improves every other tonne too: with output restored the fixed cost a tonne falls back to TShs 165,000, an unchanged burden spread over more units, so one payment buys the extra tonnes and a lower cost on all the rest.

The determinant at fault is infrastructure: not technology, since the machines gin whenever current reaches them, and not labour, since the crews are paid for all 16 hours; the constraint sits on a line the ginnery does not own and cannot repair.

The generator is a second best answer, since TShs 240,000,000 buys back capacity already paid for once, and every producer in the district buys the same insurance separately when one line would serve them all.

The Master Key: *A machine that cannot run is a cost without an output, and the fixed cost it carries lands on every unit the plant does manage to make.*

HOT Question 61

The agronomist blames the seed. The engineer blames the road. Both are standing in the same Iringa field, looking at the same thin harvest, and only one of them can be the greater culprit.

It is argued that poor infrastructure, rather than poor technology, is the greater brake on Tanzanian output. Assess this claim.

Model Answer

The claim is broadly correct at Tanzania's present stage, because a technique that already exists cannot be used, moved or paid for where roads, power and storage fail, but the ranking is neither permanent nor uniform, and inside the field the yield gap is a gap in knowledge no road will close.

Infrastructure decides whether output ever becomes income: a Njombe farmer may hold improved seed and still watch a quarter of his crop rot for want of a road: the technology is present, paid for, and defeated by what surrounds it.

It sets the return on adopting technology: a farmer takes up an improved variety because it pays him, so where haulage swallows the extra yield the better technique is rationally refused. Poor infrastructure does not sit beside backward technique; it produces it.

Infrastructure creates the market, and the market fixes the scale: a road widens the area a producer can sell into, and only a wide market justifies a large plant, a specialised staff and the division of labour that lowers cost per unit.

Technology can be bought and infrastructure cannot: any producer with money can import a machine or a hybrid seed, but none can import a road network or a grid, and the constraint an individual cannot relieve is the one that binds.

Yet some gaps are unmistakably technical: maize yields of one to two tonnes a hectare, where the same soil elsewhere yields five or six, cannot be blamed on a road, because the shortfall happens before anything is carried anywhere.

A road to nothing carries nothing: infrastructure raises output only where there is output to raise, so tarmac laid to a district with no marketable surplus produces traffic rather than production.

The two are complements and not rivals: the return on a road rises with the yield it carries and the return on seed with the road that moves it, so the question is one of sequence.

Neither is the deepest constraint: behind both stand the supply of capital, the level of skill and the security of property, since a road built badly and never maintained is not infrastructure for long.

The claim therefore stands as a statement about sequence rather than importance. Infrastructure binds first, since it raises the return on every technology adopted afterwards, so a shilling on a feeder road usually earns more today than one on a demonstration plot. But that ordering expires, and a country that mends its roads and stops there meets its ceiling a little later and a little higher.

The Master Key: *Infrastructure binds first because it decides whether the technology a producer already owns can be used at all; technology binds next, so the answer is a sequence and not a winner.*

HOT Question 62

Tanzania has more good land than it plants and more willing hands than it employs. On the old arithmetic of wealth it should be rich already. It is not, and the reason is instructive.

A commentator writes that a country with abundant land and abundant labour has no business being poor. Discuss this claim with reference to Tanzania.

Model Answer

The claim is false, because production depends on the combination and efficiency of all four factors rather than on the abundance of two, and what Tanzania lacks is precisely what makes land and labour productive: capital, skill, technique, infrastructure and organisation. Yet abundant land and a young workforce are a genuine advantage.

The abundance is real and an advantage: Tanzania has far more arable land than it plants, with water, a long coast, minerals and a workforce whose median age is under twenty, while countries holding a fraction of these have built high incomes.

It also shows the poverty is not natural: if the binding constraint were land or hands, poverty would be a sentence passed by geography; since it is neither, poverty is a result of how resources are combined, and a result can be altered.

But production needs all four factors together: a worker with a hoe cultivates one hectare in a season while the same worker with a tractor and improved seed cultivates many times that, so the factors are complements long before they are substitutes.

Abundance is counted in quantity, output depends on quality: most of the land is unimproved, unirrigated and untitled, and much of the labour is untrained, so two abundant factors of low efficiency give a large quantity of low output, which is not wealth.

The determinants that are scarce are the other ones: technology, infrastructure, entrepreneurial ability and the size of the paying market are all thin, and it is the scarce determinant that sets the level of output.

Immobility strands much of the abundance: land under customary tenure cannot easily be sold or consolidated, a worker cannot afford the training that would carry him to a better use, and sunk capital stays where it is, so much of the abundance is real and idle at once.

Cheap plentiful factors can slow the search for productivity: where labour is cheap and land plentiful the cheapest way to raise output is to use more of both, so producers clear another hectare instead of raising the yield of the one they hold. That is extensive growth, and a country grows rich by intensive growth.

Abundance therefore sets a ceiling and never a floor, and output per head, not resources per head, separates two countries working the same hectare. But the commentator is right about one thing: land and people are the hardest endowments to acquire and the easiest to make productive once capital is saved, skill taught and roads built. The abundance is not the cause of the poverty; it is the reason it need not last.

The Master Key: *Abundant land and labour set the ceiling; capital, skill, technique and infrastructure decide how near to it a country ever gets.*

The Production Function and the Time Periods

A producer's real question is never how much he would like to make; it is how much this plot, this machine and these hands can be made to yield. The production function is that answer written as a rule, and the time period decides which parts of the rule he is free to touch today. This section fixes the function, the three forms it wears, and the four periods that run from a single morning to a change of technique itself.

BINDER Question 63

Ask a Mtwara cashew farmer how much his plot can yield and he answers with a shrug and a number. Written properly, that same answer is three symbols long.

Define a production function and explain the meaning of every symbol in its general form and in its two factor form.

Model Answer

A production function is the technical relationship between inputs and output, showing the maximum output obtainable from each combination of factor inputs, given the state of technology.

It is a technical relationship: it records what inputs can physically do, not what anything costs; prices enter afterwards, when each input quantity is multiplied by its price.

It states a maximum, not an average: it gives the greatest output a combination can yield when used properly; a Mtwara farmer who falls short of it has not disproved the function, only failed to reach it.

The general form allows any number of inputs:

$$Q = f(X_1, X_2, X_3 \ \ldots \ X_n)$$

Q, the output: the quantity produced in a stated period, in physical units: litres of oil or sacks of sembe a day. Output is a flow, so the period must be named.

f, the functional operator: the rule of transformation, not a number to be multiplied by anything: it says output depends on the inputs, and carries inside it the whole technique in use.

The factor inputs: each symbol stands for the quantity of one input, land, machine, hours of labour, fuel; the three dots mean the list runs on for as many inputs as the firm uses.

Such a list is awkward, so inputs are gathered into two groups: labour for every human input except entrepreneurship, capital for every non-human input.

$$Q = f(K, L)$$

K, capital: the quantity of capital in units, the machine, the shed and the land beneath, counted in units of the thing itself, one press, ten hectares, never in shillings.

L, labour: the quantity of labour in units, workers, worker days or hours: the input a firm can alter fastest, which is why so much theory hangs on this one letter.

It is therefore a promise of a limited kind: the most you can get from the inputs you name, never what that output is worth.

The Master Key: *A production function is the rule that turns quantities of inputs into the maximum quantity of output, for a given technique.*

BINDER Question 64

The same trees, the same hands, the same hours at a Mbinga coffee farm. A borrowed pulping machine arrives and the day's clean beans double. Every old figure is now wrong.

Explain why a production function is stated for a given state of technology, and state what happens to the function when technology improves.

Model Answer

A production function is stated for a given state of technology because the function is simply one technique written down, so when the technique improves the old function is not bent but replaced by a new one.

The function is a technique written down: its numbers are what this seed and this method can deliver. A hand pulper and a powered pulper working the same Mbinga cherry are two different rules, each needing a function of its own.

Why the assumption is necessary: without it two causes of a rise in output could not be told apart; holding technology constant is what allows a larger harvest to be attributed to the quantity of inputs alone.

Set the old rule and the new rule side by side for the same capital and the same labour.

$$\text{Old technique:} \quad Q_1 = f_1(K, L)$$

$$\text{New technique:} \quad Q_2 = f_2(K, L), \quad Q_2 > Q_1$$

The whole schedule is rewritten upward: every row of the old table now understates the farm. Two workers on the powered pulper turn out what five turned out by hand, so the new function lies wholly above the old at every quantity of labour.

A shift, not a movement: taking on another worker moves the firm along the function it already has; a better pulper moves it on to a different function altogether. Both show up as more output, which is why they are so often confused.

Where the change belongs in time: technology is held constant in the short run and the long run alike, so a change of technique belongs to a period of its own, the very long run, where the firm changes the rule its inputs obey.

So the strongest step open to a Tanzanian producer is often not more inputs but a new rule: certified seed, a powered pulper, a tarpaulin for drying instead of bare ground. Better technique yields more from the inputs he holds.

The Master Key: *Technology is the rule and inputs are what you feed into it, so better technology is never more input, it is a new rule.*

BINDER Question 65

At a Singida press the owner keeps his figures in his head, the clerk keeps them in a ruled book, a line on the wall keeps them too. One fact, three faces.

Describe the three forms in which a production function can be presented, taking a Singida sunflower press as your example.

Model Answer

A production function can be presented in three forms, the functional or algebraic, the schedule or tabular and the graphical, and all three carry the same information about the same firm.

The functional or algebraic form: the relationship written as an equation. The general dress, $Q = f(K, L)$, names the inputs but not the rule; a firm's own function is explicit and states the rule itself. The Singida press works one expeller machine and can vary only the workers pressing alizeti, the sunflower seed:

$$Q = 9L^2 - L^3 \quad \text{with capital fixed at } \overline{K} = 1$$

The form is compact and it can be worked: feed in any number of workers and it returns the day's litres of oil. With three workers:

$$Q = 9(3)^2 - (3)^3 = 81 - 27 = 54 \text{ litres a day}$$

The schedule or tabular form: the same rule set out row by row, one row for each quantity of the variable input, the fixed input repeated down the first column to show that it never moves.

Units of capital (K), fixed	Units of labour (L)	Output (Q), litres a day
1	1	8
1	2	28
1	3	54
1	4	80
1	5	100
1	6	108

The daily production schedule of a Singida sunflower press working one expeller machine.

The graphical form: the pairs in the table plotted with output on the vertical axis and labour on the horizontal, joined into a smooth total product curve. The table already shows its shape: the second worker adds 20 litres, the third 26 and the fourth 26, but the fifth only 20 and the sixth 8, so the curve leaves the origin steepening and flattens from the fourth worker while still climbing.

Which form to use: the equation is best for calculation, since it answers for a quantity of labour nobody has yet tried; the schedule is read at a glance; the graph shows the shape whole. A producer who keeps a table of hands and output is holding a production function, whether he calls it one or not.

Every line holds capital at one machine, so this is a short run function, whose shape belongs entirely to the fact that the press cannot grow while the queue of workers can.

The Master Key: *Equation, table and curve are one function in three dresses; choose the dress the question needs.*

BINDER Question 66

A Shinyanga ginnery takes on a tenth kibarua, a casual hand, and the day's lint hardly moves. Nobody is idle. The one gin that must swallow every boll has not grown.

With the aid of a diagram, explain production in the short run.

Model Answer

The short run is the period in which at least one factor cannot be varied, so a firm can change output only by changing its variable factors, chiefly labour.

The fixed factor: a factor whose quantity cannot be altered within the period. At a Shinyanga ginnery the gin and its shed cannot be added to once the cotton arrives, since a second gin must be ordered and installed.

The plant: the capital and land a firm works with. The short run's defining feature is that the plant is fixed: it can be worked harder or longer, but not made bigger.

The variable factor: labour, since hands can be taken on and released within days. The exception is skilled labour too scarce to replace within the period, which behaves as a fixed factor.

With capital constant and labour alone varying, the short run function is:

$$Q = f(L, \overline{K})$$

Reading the notation: Q is output, f the functional operator, L the labour the firm varies, and the bar over K records capital held fixed, so everything the firm can decide sits in one letter.

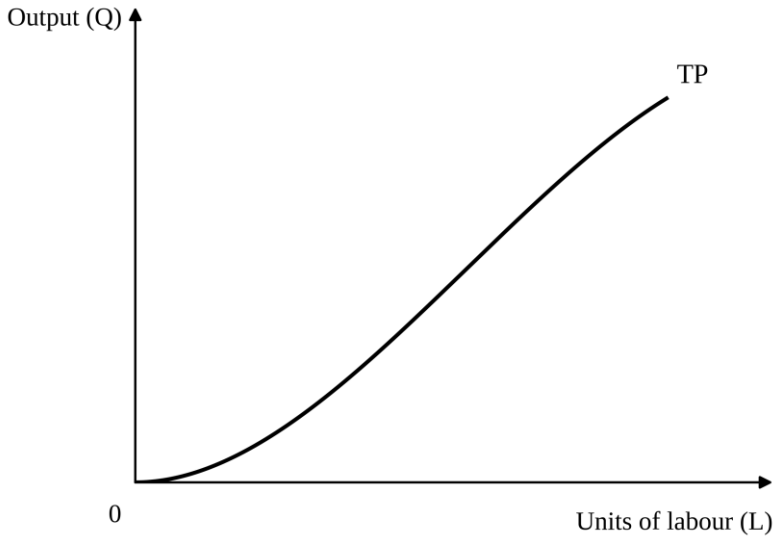


Figure 5.3: A total product curve

The curve begins at the origin: with no labour the ginnery produces nothing, however new the gin: capital is passive and yields nothing until labour joins it.

It first rises at an increasing rate: each extra hand adds more than the one before, because a gin worked by two people is badly under used and more hands let feeding, sorting and baling be divided.

Then it rises at a decreasing rate: beyond the point of inflection the curve flattens while still rising, each worker adding less than the one before, because the fixed gin swallows only so many bolls an hour and workers must wait upon it.

The shape follows from one fact, that something is fixed. Install a second gin and this curve no longer describes the ginnery, which has left the short run behind.

The Master Key: *In the short run the plant is fixed, so* $Q = f(L, \overline{K})$ *and output rides on the variable factor alone.*

BINDER Question 67

By six in the morning the whole day's catch is lying on the Mwanza fish market floor. No price on earth will add one more dagaa before the sun goes down.

Distinguish between the market period, the short run, the long run and the very long run, and explain why the long run cannot be stated as a fixed number of months.

Model Answer

The four periods are distinguished not by their length but by what the firm can vary: nothing in the market period, some factors in the short run, every factor in the long run, and the technique itself in the very long run.

The market period, or very short run: so brief that even output cannot be altered. The dagaa, the small dried sardine, landed at Mwanza is the whole supply for that morning: supply is perfectly inelastic and only price can move, for no rise brings another fish before tomorrow's boats.

The short run: output can be altered, but only by varying some factors while at least one, usually the plant, stays fixed: a miller can hire another shift, but cannot install a second mill.

The long run: every factor can be varied, the plant included: buy, sell or scrap machinery, take more land, move site, enter or leave an industry. There are no fixed factors, and therefore no fixed costs.

The very long run: the state of technology itself changes, so the production function is replaced rather than travelled along. New seed varieties, new machines and new ways of organising work belong here.

The long run is a planning horizon: not a stretch of calendar the firm waits through but the position from which it decides today what plant to operate later. Such decisions are hard to reverse, a resold plant fetching far less than it cost.

It differs from industry to industry: how long it lasts depends on how fast the plant can be changed: weeks for a bodaboda rider whose whole plant is one motorcycle, years for a cement works whose kiln must be designed, financed, imported and commissioned.

The periods are defined by what can be varied, never by the calendar. Ask which factors are still locked, and the answer names the period.

The Master Key: *Market period: only price moves. Short run: some factors move. Long run: all factors move. Very long run: the technique itself moves.*

BINDER Question 68

The Kariakoo tailor's rented room is immovable for the eleven months left on his lease and free as air on the day it ends. The same room, two different economics.

Distinguish between a fixed factor and a variable factor, explain why the same factor may be fixed in one period and variable in another, and show why the distinction matters for the study of cost.

Model Answer

A fixed factor is one whose quantity cannot be varied within the period under consideration and a variable factor is one whose quantity can, so the same factor may be fixed this season and variable the next.

A fixed factor: its quantity stays the same whatever the output, and is paid for even when the firm produces nothing. Buildings, machinery and land, the firm's plant, are the usual fixed factors.

A variable factor: its quantity rises and falls with output: casual labour, raw material, fuel, packaging and electricity, all of which a firm stops buying when it stops producing.

The classification belongs to the period, not the thing: nothing about a sewing machine or a hectare makes it eternally fixed: a factor is fixed because the firm is locked into it by a lease, a delivery time, a loan, or the want of a quick sale.

The same factor in two periods: the Kariakoo tailor's room is fixed for the eleven months left on his lease, the rent falling due whether he sews one shirt or a thousand. The day it expires the room becomes fully variable: nothing changed but the period.

Even labour can be fixed: three years of training make a skilled operator impossible to replace within a season, so his services behave as a fixed factor, while the vibarua, casual hands hired by the day, stay fully variable.

Why the distinction matters: every fixed factor gives rise to a cost that must be met whatever the output, every variable factor to a cost that moves with output: that is the division between fixed and variable cost, and why the short run carries two cost families while the long run has one.

So settle the period before writing down a single cost figure: what the firm is locked into decides which costs are unavoidable.

The Master Key: *A factor is fixed because the firm is locked into it, not because of what it is made of, and fixed factors are the parents of fixed costs.*

REAL Question 69

Follow the paddy of Morogoro, the mpunga, into the mill: one machine, one door, and a line of workers of whom each new one adds less than the last.

Using the records below, name the fixed and the variable factor and write the mill's short run production function, calculate the output added by each successive worker, and advise Mama Halima how many workers to employ.

Mama Halima runs a rice mill at Mkundi in Morogoro. The mill has one milling machine, already fully paid for, and no second machine can be obtained this season.

The number of workers she engages varies from day to day. Her daily records of milled rice are: 1 worker, 12 bags; 2 workers, 30 bags; 3 workers, 54 bags; 4 workers, 72 bags; 5 workers, 84 bags; 6 workers, 90 bags; 7 workers, 90 bags.

She is paid a milling fee of TShs 1,500 for every bag milled, and each worker is paid TShs 12,000 a day.

Model Answer

The milling machine is the fixed factor and labour the variable factor, so the mill is producing in the short run under $Q = f(L, \overline{K})$, and on these figures Mama Halima should engage five workers and no more.

The fixed factor: the milling machine, with the shed and plot it stands on, the mill's plant. It cannot be added to this season however long the queue of paddy grows, and it costs the same whether the machine runs or stands silent.

The variable factor: labour. The workers are engaged by the day, so their number is the one thing Mama Halima can change between now and the end of the season.

Since capital is fixed at one machine and only labour varies, the mill's function is the short run form, the bar recording capital held constant:

$$Q = f(L, \overline{K})$$

Each worker's addition is found by subtracting each day's total from the total in the line below.

Workers (L)	Bags milled a day (Q)	Bags added by the last worker
1	12	12
2	30	18
3	54	24
4	72	18
5	84	12
6	90	6
7	90	0

Daily milling record at Mkundi, Morogoro, with one milling machine held fixed.

The pattern in the third column: the additions climb to the third worker and fall away after him, so total output rises at an increasing rate to the third and at a decreasing rate from the fourth. That is the ordinary shape when one factor is fixed, and the seventh worker adds nothing at all, because the machine already runs without a pause.

The advice needs the money as well as the output: each bag earns TShs 1,500, so a worker is worth engaging only while the bags he adds, valued at 1,500 each, exceed his wage of TShs 12,000 a day.

$$\text{Fifth worker: } 12 \times 1{,}500 = 18{,}000 \text{ against a wage of } 12{,}000$$

$$\text{Sixth worker: } 6 \times 1{,}500 = 9{,}000 \text{ against a wage of } 12{,}000$$

$$\text{Seventh worker: } 0 \times 1{,}500 = 0 \text{ against a wage of } 12{,}000$$

The advice: engage five workers. The fifth brings in TShs 6,000 more than he costs, the sixth loses TShs 3,000 a day and the seventh his whole wage. Five workers mill 84 bags, earning TShs 126,000 against a wage bill of TShs 60,000, which leaves TShs 66,000 a day towards the machine, the shed and Mama Halima's own reward; six leave TShs 63,000 and seven TShs 51,000.

The ceiling is the machine, not the workers: nothing said to a seventh pair of hands will produce one bag more. To pass 90 bags a day she must leave the short run and buy a second machine, a decision belonging to another period.

The Master Key: *When one factor is fixed, how many workers to engage is settled by what the last worker adds, not by how many the owner could afford to pay.*

REAL Question 70

The Mbeya manager wants a second shift and a second mill, and he wants both working when the maize comes down in June. The calendar will grant him only one.

Read the two proposals below, then classify each as a short run or a long run decision, calculate the gain from the proposal that can be carried out this season, and advise the manager.

> It is January. A maize milling plant at Mbeya runs one hammer mill on a single eight hour shift, employing 10 workers and turning out 150 sacks of sembe a day. The milling season runs for 120 working days from June.
>
> Proposal A: run a second shift on the same mill, engaging 10 more workers at TShs 14,000 each a day. Output would rise to 280 sacks a day.
>
> Proposal B: install a second hammer mill at a cost of TShs 96,000,000. The supplier quotes 14 months from order to commissioning. The second mill would add 200 sacks a day.
>
> The plant earns a milling margin of TShs 1,800 on every sack, after electricity and packing are paid for.

Model Answer

Proposal A is a short run decision and Proposal B a long run one, and since the mill cannot arrive before the season opens, the manager should run the second shift now, which adds TShs 11,280,000 over the season, and order the mill at the same time.

Proposal A is a short run decision: it changes only the variable factor: the plant stays as it is and more labour is applied to the same fixed capital for more hours of the day, which is production in the short run, $Q = f(L, \overline{K})$.

Proposal B is a long run decision: it changes the plant itself. Once a second mill is commissioned capital is no longer fixed at one machine and the whole production function is rewritten. The decision cannot easily be undone, since a mill resold second hand fetches far less than the 96,000,000 paid for it.

The calendar settles which one is available: the season opens in June, five months away. A shift can be recruited and trained in a fortnight, so Proposal A is open this season, while the mill takes 14 months from order to commissioning and cannot serve it. For the coming season the plant is fixed whether the manager wishes it or not.

Now the arithmetic of Proposal A.

$$\text{Extra output} = 280 - 150 = 130 \text{ sacks a day}$$
$$\text{Extra margin} = 130 \times 1{,}800 = 234{,}000 \text{ shillings a day}$$
$$\text{Extra wages} = 10 \times 14{,}000 = 140{,}000 \text{ shillings a day}$$
$$\text{Daily gain} = 234{,}000 - 140{,}000 = 94{,}000 \text{ shillings}$$
$$\text{Gain for the season} = 94{,}000 \times 120 = 11{,}280{,}000 \text{ shillings}$$

What the figure means: the second shift earns TShs 11,280,000 over the 120 day season without one shilling of new capital, by working an asset already paid for through more hours of the day. Output does not double to 300 sacks, because the mill must still be stopped for cleaning, and that shortfall is the fixed factor speaking.

Proposal B must be judged over a longer horizon, since its return begins only in the season after next. At the same margin over the same 120 days:

$$\text{Season margin from the new mill} = 200 \times 1{,}800 \times 120 = 43{,}200{,}000 \text{ shillings}$$
$$\frac{96{,}000{,}000}{43{,}200{,}000} \approx 2.2 \text{ seasons to recover the outlay}$$

The advice: take both, in the right order. Engage the second shift now, the only lever the coming season leaves open, returning TShs 11,280,000 for no capital at all. Order the mill now as well, since a wait of 14

months means the long run must be bought long before it is wanted, and a machine that repays itself in two seasons is worth having.

The short run tells the manager what he can do with the plant he has, the long run what plant he ought to have; confuse them and he will buy a machine that arrives after the maize has gone elsewhere.

The Master Key: *Ask what the firm can still change before the decision must be taken; the answer names the period, and the period names the choice.*

HOT Question 71

Every season the manager tells the Kilombero board that the new plant belongs to the long run. Every season the long run is still one season away.

Assess the claim that the long run never actually arrives, so that a firm is always in the short run.

Model Answer

The claim is true of what a firm experiences and false of how a firm decides: at every moment some factor is locked, so the firm always operates in the short run, but long run choices are made in the present and are the choices that change the plant.

The case for the claim: something is always fixed: at any moment a firm has a lease running, a loan outstanding, a machine it cannot sell at anything like its worth, or an order undelivered. Name any date and something cannot be varied on it.

New plant brings new fixity: the manager who commissions his new mill has not escaped into a world where everything is variable: he has entered a fresh short run, the new mill being now the fixed factor for years. The horizon recedes as fast as he walks towards it.

Firms behave as though it never comes: the reward of a long run decision is distant while its cost falls at once, so a manager under pressure reaches for the short run remedy: one more shift, one more patch on a roof that ought to be rebuilt. The claim describes real conduct.

Against the claim: the period is set by the decision: the long run is a planning position, not a station the firm pulls into. A manager comparing two sizes of plant reasons in the long run this very morning, while this morning's sugar is made with the plant he already owns.

The long run does arrive, factor by factor: contracts fall due one at a time: a lease ends, a machine wears out, a loan is repaid, and at each moment a fixed factor becomes variable. Over a few years every element of a plant passes through one.

The distinction earns its keep either way: even with no instant at which everything is variable, the long run is needed to ask what size of plant a firm ought to have: a theory confined to the short run could say how hard a mill is worked, never why it is that size.

The verdict divides. As a description of experience the claim is sound, and it warns usefully: a manager who waits for the long run before attending to his plant never attends to it, since a plant fourteen months in delivery must be ordered while the firm is deep in the short run. As an objection to the theory it fails, for the long run was never a date but a horizon, planned against today.

The Master Key: *A firm always produces in the short run and always plans in the long run; the long run is a horizon to aim at, not a date to wait for.*

HOT Question 72

A Kariakoo fundi cherehani, a tailor, has never written an equation, yet he stops hiring at exactly the worker the equation would have named. Which of the two understands production?

Discuss whether a production function tells a producer anything he can actually use.

Model Answer

A production function is genuinely useful to a producer, but as a framework that forces the right questions rather than a formula that hands over the answers, so its value is real, indirect and easily overstated.

It names the constraint that actually binds: the first thing it makes a producer settle is which factor is fixed, which tells him which lever is in his hand and saves him pressing one that will not move.

It supplies a standard of performance: because it states the maximum obtainable, actual output can be held against it: if one mill and five workers should yield 84 bags and only 70 appear, the fault lies in supervision or maintenance, not in the machine.

It converts straight into cost: multiply the input quantities by their prices and the physical relationship becomes a money one. Every cost estimate rests on a belief about how much input an output requires, which is a production function under another name.

It tells him when to stop: read down a schedule and the point where extra hands add very little is plain. That is a hiring rule, the very rule the Kariakoo tailor obeys when he turns away a fourth apprentice for three machines.

Against it: no producer possesses the equation: a real firm does not hold $Q = f(K, L)$ in explicit form, only a memory of past seasons and at best a notebook. Treating an invented equation as measured is worse than having none.

Against it: it assumes away the commonest problem: stating the maximum presumes the firm already extracts all a combination can give, yet that is exactly where weak firms fail, so the tool is silent about the disease it is most often asked to cure.

Against it: the symbols hide untidy inputs: one unit of labour covers a kibarua on his first morning and a foreman of ten years, one unit of capital a new mill and a worn one, while rain, breakdowns and power cuts never enter the function, yet all enter the yard.

Against it: it is silent on demand: the function tells a producer what he can make, never what he can sell. Obeying it alone he will mill a record tonnage of sembe into a town already supplied, so physical efficiency carries him into a loss.

So the value is real but bounded. As a formula it misleads, its precision borrowed and its assumptions heroic. As a way of thinking it is hard to do without, because it carries a producer's instinct into cases where instinct has nothing to draw on, such as a machine nobody has ever run.

The Master Key: *Treat the production function as a discipline for questions, not a machine for answers: it tells a producer what binds him, never what the market will buy.*

Total, Average and Marginal Product

One field, one machine, one shed: the fixed part of a firm stays as it is while hands are added to it, and the output that results wears three faces. Total product is the whole heap, average product is that heap shared among the workers, and marginal product is what the last hand added. A producer who confuses the three will hire the wrong number of workers. This section defines them, computes them from a schedule and traces the relationships that bind them.

BINDER Question 73

A Mbinga coffee farmer counts 900 kilogrammes off his plot and is pleased. His neighbour asks a second question: how much did your last picker bring in? The pleasure fades.

Define total product, average product and marginal product, and state the formula for each.

Model Answer

Total product is the whole output a firm obtains from a given quantity of the variable factor working with a fixed factor, average product is that output per unit of the variable factor, and marginal product is the addition made by one more unit.

Total product: given the state of technology, it is the maximum output obtainable from the fixed factor combined with the variable factor: on a fixed two hectare Mbinga plot, every kilogramme of cherry the six pickers bring in together. Since the two hectares are unchanged all season, it is written as a function of labour alone, TP or simply Q.

Average product: the output per unit of the variable input, that is, total output divided by the labour employed. It is what a producer means by output per worker.

$$\mathrm{AP_L} = \frac{\mathrm{TP}}{\mathrm{L}} = \frac{\mathrm{Q}}{\mathrm{L}}$$

If the six pickers bring in 108 kilogrammes between them:

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = \frac{108}{6} = 18$$

Reading that figure: each picker accounts on the average for 18 kilogrammes a day, so a picker whose wage exceeds the value of 18 kilogrammes cannot be covered by the plot as it stands.

Marginal product: the additional output produced by one additional unit of the variable factor, every other factor unchanged. It answers what the last picker brought in, as distinct from what the whole gang brought in.

$$\mathrm{MP_L} = \frac{\Delta\,\mathrm{TP}}{\Delta\,\mathrm{L}} = \frac{\mathrm{TP_2} - \mathrm{TP_1}}{\mathrm{L_2} - \mathrm{L_1}}$$

where Δ TP is the change in total product and Δ L the change in labour. Where total product is continuous, marginal product is the partial derivative:

$$\mathrm{MP_L} = \frac{\partial\,\mathrm{TP}}{\partial\,\mathrm{L}}$$

The marginal product of capital: the same idea belongs to any factor being varied. When capital is the factor changed, its marginal product is the increase in output from one more unit of capital.

$$\mathrm{MP_K} = \frac{\Delta\,\mathrm{Q}}{\Delta\,\mathrm{K}}$$

A producer who knows only the heap knows the least useful of the three, because the heap goes on growing after his newest worker has stopped earning his wage.

The Master Key: *Total is the whole output, average is that output divided by the workers, marginal is what the last worker added.*

BINDER Question 74

An Iringa packing shed has three benches and no room for a fourth. The manager keeps hiring, the crates keep coming, and one morning the seventh hand makes the pile smaller.

Copy the schedule below and complete the average product and marginal product columns, then state what the completed schedule shows about the behaviour of output.

Chiwoda Tomato Packers of Iringa works with three packing benches which cannot be added to this season.

Crates of tomatoes packed in a day: 1 hand, 9 crates; 2 hands, 24; 3 hands, 42; 4 hands, 56; 5 hands, 65; 6 hands, 66; 7 hands, 63.

With nobody at work the shed packs nothing.

Model Answer

Completed, the schedule shows average product rising to a maximum of 14 crates a hand and then falling, marginal product rising to 18 crates and then falling through the average, through zero and into negative figures at the seventh hand, and total product peaking at 66 crates.

Average product is each day's total divided by the hands employed; marginal product is the difference between one total and the one above it, each extra hand being one unit of labour.

Hands (L)	Total product (crates)	Average product	Marginal product
0	0	-	-
1	9	9	9
2	24	12	15
3	42	14	18
4	56	14	14
5	65	13	9
6	66	11	1
7	63	9	-3

Daily packing record at Chiwoda Tomato Packers, Iringa, with three benches held fixed.

Two rows worked in full: at three hands the average is $42 \div 3 = 14$ crates and the third hand's marginal product is $42 - 24 = 18$ crates; at six hands the average is 11 crates and the sixth hand adds 1 crate.

Total product: rises to a peak of 66 crates at the sixth hand and then falls. It rises at an increasing rate to the third hand, the additions being 9, 15 and 18, and at a decreasing rate thereafter, at 14, 9 and 1.

Average product: climbs from 9 crates to a maximum of 14, held at the third and fourth hands, then falls to 13, 11 and 9. It never turns negative, because a positive total divided by a positive number cannot be.

Marginal product: climbs to 18 crates at the third hand, falls away thereafter and turns negative at the seventh, whose arrival costs the shed 3 crates. It crosses zero between the sixth hand and the seventh, exactly where total product turns from rising to falling.

Marginal meets average at the peak: the fourth hand adds 14 crates when the average is already 14, so she neither lifts nor lowers it and it stands at its highest. Before her the marginal lay above the average; after her it lies below.

Read down the last column: additions that grow, then additions that shrink, then an addition that is negative. Only the number of hands changed.

The Master Key: *Fill in the marginal column first, because every movement in the other two columns is explained by it.*

BINDER Question 75

Two curves sit one above the other in a Njombe mill's notebook. The upper one flattens at the very moment the lower one touches the ground. The timing is no accident.

With the aid of a diagram, show the relationship between the total product curve and the curves of average and marginal product.

Model Answer

The three curves are one relationship drawn twice: marginal product is the slope of total product, so it peaks where total product stops steepening, cuts average product from above at the maximum of average product, and reaches zero exactly where total product reaches its own maximum.

Draw two panels on the same horizontal scale of labour, total product above and average and marginal product below, so a vertical line dropped from the upper panel meets the lower at the same labour.

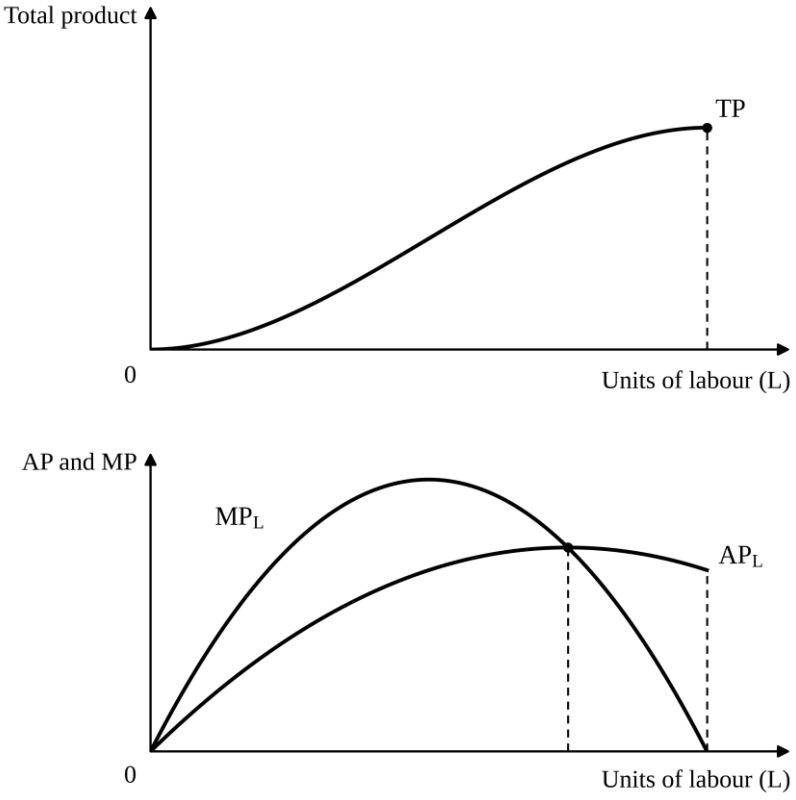


Figure 5.4: Total, average and marginal product

Total product in the upper panel: begins at the origin, since a fixed factor with no labour yields nothing, rises first at an increasing rate, then at a decreasing rate, and reaches a maximum at the dot before turning down.

Marginal product rises and then falls: its peak lies directly beneath the point where total product stops bending upwards, that being where the curve is steepest, and steepness is what marginal product measures.

Marginal product cuts average product from above: the two lower curves meet at the highest point of AP_L. While MP_L lies above AP_L the average is pulled up; once it falls below, the average is dragged down; so the labour at which they are equal is the turning point of the average.

Marginal product is zero beneath the peak of total product: the dashed line dropped from the maximum of TP meets the axis of the lower panel exactly where MP_L crosses it, because total product stops rising only when the last worker adds nothing.

Beyond that point: MP_L becomes negative and total product falls, while AP_L declines but stays positive and never touches the axis, since a positive total shared among a positive number of workers is always positive.

The three peaks come in order: marginal first, average next where the marginal cuts it, total last. A producer watching the upper panel alone is always late in seeing that his additions are shrinking.

The Master Key: *MP peaks first, AP peaks next where MP cuts it from above, and TP peaks last where MP reaches zero.*

BINDER Question 76

Nobody at a Mtwara shed ever measures a slope. Yet the steepness of the output curve at the last worker taken on is the whole of what that worker is worth.

Explain why marginal product is the slope of the total product curve, and show how the quantity of labour at which marginal product and average product each reach a maximum can be found from the behaviour of total product alone.

Model Answer

Marginal product is the slope of the total product curve, since slope is $\Delta\,\mathrm{TP} / \Delta\,\mathrm{L}$; and since average product is the slope of a line from the origin to a point on that curve, both maxima can be found on the curve itself.

Take two levels of labour, L_1 and L_2, with their outputs. The line joining the two points rises by $TP_2 - TP_1$ and runs by $L_2 - L_1$, so its slope is:

$$\text{slope} = \frac{TP_2 - TP_1}{L_2 - L_1} = \frac{\Delta\,TP}{\Delta\,L} = MP_L$$

which is marginal product itself. Bring the two points together and the line becomes the tangent, whose slope is marginal product at a point:

$$MP_L = \frac{\partial\,TP}{\partial\,L}$$

Steep curve, large marginal product: where the curve climbs steeply each extra worker adds a great deal, where it flattens he adds little, and at the flat top the tangent is horizontal and $MP_L = 0$, which is why the peak of total product and the zero of marginal product fall together.

Where marginal product is greatest: at the point of inflection, where the curve stops rising at an increasing rate and begins to rise at a decreasing rate: before it the slope grows, after it the slope shrinks.

Where average product is greatest: average product is $TP \div L$, the slope of the line drawn from the origin to the corresponding point on the curve, so it is greatest where that line is steepest, and the steepest such line just touches the curve instead of cutting it.

Why the two are equal there: where the line from the origin just touches the curve it is also the tangent, so its slope is at once the average and the marginal product: that is the geometric proof that $MP_L = AP_L$ at the maximum of average product.

A producer with nothing but the curve of his own output can therefore find all three maxima with a ruler.

The Master Key: *Marginal product is the slope of the tangent, average product the slope of the line from the origin, and where those two lines are one the average is at its peak.*

BINDER Question 77

A Kilombero foreman insists his gang is improving, because the day's tonnage keeps rising. Output per man has been falling for a week. Both statements are true.

State and prove the relationship between marginal product and average product, and state the relationship between marginal product and total product.

Model Answer

Average product rises while marginal product lies above it, peaks where the two are equal and falls once marginal product lies below it; total product rises while marginal product is positive, peaks where it is zero and falls once it is negative.

Let a firm employ L workers for a total product TP, and engage one more whose marginal product is MP: the new average is $(\mathrm{TP} + \mathrm{MP}) \div (\mathrm{L} + 1)$, so the change is:

$$\mathrm{AP}_2 - \mathrm{AP}_1 = \frac{\mathrm{TP} + \mathrm{MP}}{\mathrm{L} + 1} - \frac{\mathrm{TP}}{\mathrm{L}}$$

$$\mathrm{AP}_2 - \mathrm{AP}_1 = \frac{\mathrm{L}(\mathrm{TP} + \mathrm{MP}) - \mathrm{TP}(\mathrm{L} + 1)}{\mathrm{L}(\mathrm{L} + 1)}$$

$$\mathrm{AP}_2 - \mathrm{AP}_1 = \frac{\mathrm{L} \times \mathrm{MP} - \mathrm{TP}}{\mathrm{L}(\mathrm{L} + 1)}$$

$$\mathrm{AP}_2 - \mathrm{AP}_1 = \frac{\mathrm{MP} - \frac{\mathrm{TP}}{\mathrm{L}}}{\mathrm{L} + 1} = \frac{\mathrm{MP} - \mathrm{AP}}{\mathrm{L} + 1}$$

What the result says: the change in average product carries the sign of $\mathrm{MP} - \mathrm{AP}$, since $\mathrm{L} + 1$ is positive: the average rises when the marginal stands above it and falls when the marginal lies below, so $\mathrm{MP} = \mathrm{AP}$ marks the turning point, and since the marginal is falling as it passes through, that point is a maximum.

The same result in continuous form, the derivative of total product being marginal product:

$$\frac{\partial\, \mathrm{AP}_\mathrm{L}}{\partial\, \mathrm{L}} = \frac{\mathrm{L} \times \mathrm{MP}_\mathrm{L} - \mathrm{TP}}{\mathrm{L}^2} = \frac{\mathrm{MP}_\mathrm{L} - \mathrm{AP}_\mathrm{L}}{\mathrm{L}}$$

which is zero only where $\mathrm{MP}_\mathrm{L} = \mathrm{AP}_\mathrm{L}$, positive above it and negative below.

A check against real figures: a shed packing 42 crates with three hands and 56 with four has an average of 14 and a fourth hand adding 14, so the predicted change is zero and the average holds at 14; the fifth adds 9 and the average falls to 13.

Marginal product and total product: marginal product is the change in total product, so the total rises while marginal product is positive, stops when it reaches zero and falls once it is negative. While marginal product is itself rising the total rises at an increasing rate; once it falls but stays positive the total rises at a decreasing rate, so output climbs fastest long before it climbs highest.

The foreman and his critic are therefore both right: tonnage rises while output per man falls in any gang whose marginal product has fallen below its average but is not yet zero.

The Master Key: *The change in average product equals the marginal minus the average, divided by the new number of workers; that one line contains every rule.*

BINDER Question 78

A striker at Simba goes into a match with two goals a game to his name. He scores again, the crowd roars, and his average comes down.

Using the record of a Simba striker's goals, explain in everyday terms why the marginal pulls the average, and apply the same reasoning to a firm's product curves.

Model Answer

Any new figure drags an average towards itself, so a marginal figure above the average pulls it up, one below drags it down, and one equal to it leaves the average at its highest; a worker's product moves output per worker in the same way.

Follow one striker through five matches, keeping a running total and his goals a match.

Match	Goals in that match (the marginal)	Goals in all (the total)	Goals a match (the average)
1	2	2	2.0
2	4	6	3.0
3	3	9	3.0
4	1	10	2.5
5	0	10	2.0

A striker's record over five matches, the marginal pulling the average after every game.

Above the average, the average rises: in the second match he scores 4 goals against a standing average of 2, and the average climbs to 3. The newest figure is better than his record, so his record improves.

Equal to the average, it stands still: in the third match he scores 3 goals when his average is exactly 3, and the average does not move. A figure that has stopped rising and has not begun to fall is at its maximum.

Below the average, the average falls: in the fourth match he scores 1 goal against an average of 3, and the average slips to 2.5. He did score: a falling average never means the last contribution was nothing, only that it was smaller.

Zero at the margin, the total stands still: in the fifth match he scores nothing, so his total stays at 10 goals while the average falls to 2.0. A total stops growing only when the marginal figure is zero, exactly as total product does.

The same arithmetic in the shed: put workers for matches and crates for goals and nothing changes. Output per worker rises while the newest worker adds more than it, peaks when he adds exactly it, and falls when he adds less, though the shed is still packing more crates than yesterday.

One difference deserves naming. A striker cannot score a negative goal, so his total can level off but never fall of itself. A worker can be a negative addition: crowd enough hands round one bench and output drops.

The Master Key: *The marginal always drags the average towards itself, and when the marginal is level with the average the average is at its peak.*

REAL Question 79

Follow the mpunga, the paddy, on four hectares at Kilombero as the kibarua arrive. The eighth casual hand will be paid a full day's wage for making the heap smaller.

Complete the product schedule for the plot, state the quantity of labour at which average product and total product are each greatest, and work out what the eighth hand costs the tenant.

Mzee Chande rents four hectares of paddy at Mngeta in the Kilombero valley. The land, the water and the tools are fixed for the season.

He engages kibarua, casual hands, by the day to cut, thresh and winnow, and measures output in debe, the twenty litre tins in which threshed paddy is carried.

Debe threshed in a day: 1 hand, 14; 2 hands, 32; 3 hands, 54; 4 hands, 72; 5 hands, 80; 6 hands, 84; 7 hands, 84; 8 hands, 80.

A kibarua is paid TShs 10,000 for the day, and Mzee Chande sells threshed paddy at TShs 2,000 the debe.

Model Answer

Average product is greatest at 18 debe a hand, reached with the third hand and held by the fourth, total product is greatest at 84 debe, reached with the sixth hand and held by the seventh, and the eighth hand costs Mzee Chande TShs 18,000 for the privilege of losing four debe.

Average product is each day's total divided by the hands employed. Marginal product is the addition each hand makes, so it is the difference between one row and the row above it.

Kibarua (L)	Total product (debe)	Average product	Marginal product
0	0	-	-
1	14	14	14
2	32	16	18
3	54	18	22
4	72	18	18
5	80	16	8
6	84	14	4
7	84	12	0
8	80	10	-4

Threshing record on four hectares at Mngeta, Kilombero, with land, water and tools held fixed.

Two rows worked in full: at three hands, $\text{AP}_\text{L} = 54 \div 3 = 18$ debe and $\text{MP}_\text{L} = 54 - 32 = 22$ debe; at seven hands, $\text{AP}_\text{L} = 84 \div 7 = 12$ debe and $\text{MP}_\text{L} = 0$, the seventh hand having added nothing although he worked all day.

Average product is greatest at three and four hands: output a hand climbs 14, 16, 18, stops at 18 and then falls to 16, 14, 12 and 10 debe. At the fourth hand marginal product equals average product at 18 debe: before her the marginal stood above the average and pulled it up, after her it lies below and drags it down.

Total product is greatest at six hands: the heap grows to 84 debe with the sixth hand, whose own contribution is 4 debe. The seventh adds nothing, so his marginal product is zero, the sign that total product has reached its ceiling on these four hectares.

The eighth hand is paid the same TShs 10,000, and with him on the plot the threshing falls from 84 debe to 80. Four debe are lost, and at TShs 2,000 the debe that is a further TShs 8,000 of paddy gone.

$$\text{Wage paid to the eighth hand} = 10{,}000$$

$$\text{Value of output lost} = 4 \times 2{,}000 = 8{,}000$$

$$\text{Total cost of the eighth hand} = 10{,}000 + 8{,}000 = 18{,}000$$

What the figure means: the eighth kibarua costs the tenant TShs 18,000 a day and returns nothing, because four hectares can only be worked by so many people before they are treading on one another's heaps. No producer knowingly employs in this range, and the schedule shows where it begins: at the first hand whose marginal product is no longer positive.

The loss has nothing to do with the eighth man himself. Send him out first and leave the seventh at home, and the day's output would still be 80 debe, because what changed is the proportion of hands to hectares, not the quality of any pair of arms.

The Master Key: *Read the marginal column: the last positive entry names the biggest heap, and the first negative one names the hand who should have stayed at home.*

REAL Question 80

The tally book at a Mwanza fillet bench counts hands only in twos. The manager wants to know what one more pair of hands is worth, and the page will not say.

From the record below, calculate the average product at each entry and the marginal product per worker over each interval, state where output per worker and total output are each greatest, and explain why the manager cannot read the marginal product of a single worker from this record.

Nyanza Fillet Bench at Mwanza works six filleting tables, and no more can be installed this year.

The tally book is written up only when the shift changes, so it records output at every second worker.

Trays of fillet packed in a shift, each tray holding ten kilogrammes: 2 workers, 24 trays; 4 workers, 52; 6 workers, 66; 8 workers, 72; 10 workers, 70.

Model Answer

Output per worker is greatest at four workers, where it reaches 13 trays a worker, total output is greatest at eight workers, where it reaches 72 trays, and beyond eight workers the bench goes backwards at the rate of one tray for every worker added.

Average product is each entry divided by the workers at that entry. Marginal product over an interval is the change in total product divided by the change in labour, and here $\Delta L = 2$, so each figure is output added per worker over that interval.

$$AP_L = \frac{TP}{L} \quad MP_L = \frac{TP_2 - TP_1}{L_2 - L_1}$$

Workers (L)	Total product (trays)	Average product	Marginal product a worker over the interval
2	24	12	-
4	52	13	14
6	66	11	7
8	72	9	3
10	70	7	-1

Shift record at the Nyanza fillet bench, Mwanza, with six filleting tables held fixed.

One interval worked in full: between four workers and six the total rises from 52 trays to 66, so $\Delta TP = 14$ trays while $\Delta L = 2$ workers, and $14 \div 2 = 7$ trays a worker, which is what the fifth and sixth added each on the average.

Output per worker is greatest at four workers: the average climbs from 12 trays to 13, then falls to 11, 9 and 7. It falls from the sixth worker because the marginal figure over that interval, 7 trays, has dropped below the standing average of 13.

Total output is greatest at eight workers: the bench reaches 72 trays and then loses ground. Marginal product is 3 trays a worker over the interval from six to eight and one tray a worker lost from eight to ten, so it crosses zero between the eighth worker and the tenth, and there total product stands at its maximum.

Why a single worker cannot be read off this record: every marginal figure here is an average over two workers and not the product of either one. The ninth may have added 2 trays while the tenth cost the bench 4, and this record cannot tell those two apart; to read one worker, ΔL must equal 1.

The manager can see that six tables worked by more than eight people are past their best. What he cannot see is the exact hand at which to stop, and that is a fault in his tally book rather than in the arithmetic.

What the finer record would buy him: kept worker by worker, he could set the trays each new hand adds against that hand's wage and stop at the last one whose addition is worth more. As it is he must choose between seven, eight and nine workers on a guess.

The Master Key: *Marginal product over an interval is the output added per worker across that interval, and only a record kept one worker at a time can name the worker.*

REAL Question 81

At a Mtwara sorting shed the day's total keeps climbing while output per sorter keeps falling, and the owner cannot decide which of the two figures is telling him to stop hiring.

Using the shed's record, calculate the average and marginal product at each level of labour, and advise the owner how many sorters to engage, giving your reason in shillings.

Korosho Sorters of Mtwara clean and sort raw cashew, korosho, for the auction, working with four sorting tables which cannot be added to before the season ends.

Bags sorted in a day: 4 sorters, 48 bags; 5 sorters, 60; 6 sorters, 66; 7 sorters, 70; 8 sorters, 72.

The shed is paid TShs 2,500 for every bag it sorts, and a sorter is paid TShs 12,000 for the day.

Model Answer

The sixth sorter is the last one worth engaging, because he adds 6 bags a day worth TShs 15,000 against a wage of TShs 12,000, whereas the seventh would add only 4 bags worth TShs 10,000 and would therefore cost the shed TShs 2,000 a day.

Average product is bags divided by sorters, marginal product the addition each new sorter makes. The record opens at four sorters, so the marginal product of the fourth cannot be obtained and is left blank.

Sorters (L)	Bags sorted (TP)	Average product	Marginal product
4	48	12	-
5	60	12	12
6	66	11	6
7	70	10	4
8	72	9	2

Daily sorting record at Korosho Sorters, Mtwara, with four sorting tables held fixed.

Average product is at its maximum at five sorters: the fifth adds exactly 12 bags when the standing average is exactly 12, so the average neither rises nor falls and stands at its highest. From the sixth onwards the marginal lies below the average and output a sorter falls to 11 bags, then 10, then 9.

That falling average is not the figure the decision turns on. What matters is the money each extra sorter brings in against the money he costs, and every bag earns the shed TShs 2,500:

$$\text{Sixth sorter: } 6 \times 2{,}500 = 15{,}000 \text{ against a wage of } 12{,}000$$

$$\text{Seventh sorter: } 4 \times 2{,}500 = 10{,}000 \text{ against a wage of } 12{,}000$$

$$\text{Eighth sorter: } 2 \times 2{,}500 = 5{,}000 \text{ against a wage of } 12{,}000$$

The advice: engage six sorters. The sixth brings in TShs 3,000 more than he costs, while the seventh would lose the shed TShs 2,000 a day and the eighth TShs 7,000, though each is still adding bags to the total. Adding to output and adding to the owner's pocket are two different things.

The daily account confirms the choice. With six sorters the shed earns $66 \times 2{,}500 = 165{,}000$ shillings and pays $6 \times 12{,}000 = 72{,}000$ in wages, leaving TShs 93,000; with five the surplus is TShs 90,000, with seven TShs 91,000 and with eight TShs 84,000.

The mistake the owner was about to make: he was ready to stop at five sorters because output a sorter had begun to fall. That would have cost him TShs 3,000 a day, since a falling average is perfectly consistent with a marginal product still worth more than a wage. The average tells him how the shed is faring; the marginal tells him what to do next.

The answer holds only at these two prices. At TShs 1,500 a bag the sixth sorter would bring in only TShs 9,000 and should not be engaged; if casual wages fell to TShs 8,000 the seventh would become worth engaging.

The Master Key: *Engage a worker while the value of what he adds exceeds his wage, not while output per worker is still rising.*

HOT Question 82

A Mwanza accountant watches output per worker and says the bench is slipping. The foreman watches the last worker's trays and says hire another. Both are looking at the same shift.

Assess the view that marginal product, and not average product, is the figure a producer should watch.

Model Answer

The view is largely right for the decision at the margin, since only marginal product tells a producer what one more worker will add, but wrong as a general rule, because average product tells him whether the operation is worth running at all.

The case for the marginal: a decision about one more worker is a question about one more worker, and only marginal product answers it. Output per worker at a Mwanza fillet bench may stand at 13 trays while the next hand would add 7, and it is the 7, set against his wage, that decides.

The marginal locates the limits of production: the labour at which marginal product falls to zero is the labour at which total product is greatest, and beyond it extra hands take output away. A producer watching the average alone never sees it arrive, because average product is still positive when marginal product has gone below zero.

The marginal also explains the average: the change in average product is the marginal minus the average divided by the new number of workers, so a producer who knows the marginal can predict the average, while one who knows only the average cannot recover the marginal.

The case for the average: average product decides whether the enterprise pays at all. If a sorter produces on the average 9 bags a day and each bag earns TShs 2,500, the shed takes TShs 22,500 for each worker; if the wage is TShs 25,000 it loses money at every level of output, and no attention to the margin can save it.

The average is the honest measure for comparison: comparing this season with last, or one shed with a rival, means comparing like with like, and output per worker does that. Marginal product cannot be compared across firms of different sizes, since it depends on where each stands on its own curve.

The average is often the only figure available: the marginal needs a record kept one worker at a time with everything else held still, and most small producers keep no such record. They know the day's output and the number of hands, so they know only the average.

The verdict is a division of labour. Average product against the wage answers whether to produce at all; marginal product against the wage answers how much to produce. For the question at hand, whether to take on one more worker, the marginal is decisive and the average a trap, since output per worker may be falling while the last worker still earns more than he costs.

The Master Key: *Marginal product decides the next worker; average product decides whether there should be a business at all.*

HOT Question 83

A Tanga sisal foreman says his fifth cutter brought in less leaf than his fourth, and asks for stronger men. The office sends the same men in a different order.

A producer observes that marginal product falls as he engages more workers and concludes that the workers engaged later are less able than those engaged first. Discuss this conclusion.

Model Answer

The conclusion is in general false, because marginal product falls even when every worker is identical in strength and skill, the true cause being the changing proportion between the workers and the fixed factor they share, though for a producer who takes his best hands first a part of the fall may be real.

The test that settles it: send the men out in a different order. If the fall were caused by the men, the day's leaf would depend on which man came fifth. It does not: whichever is engaged fifth adds less than the fourth did.

The reasoning assumes identical units: every unit of the variable factor is taken to be the same in efficiency and quality when marginal product is worked out, so the falling column is a statement about proportions and not about persons.

The fixed factor is the real cause: a sisal estate has so many rows, so many knives, so much lorry space and one decorticator. As more cutters work an unchanged plant, each has less of it, waits longer for the lorry and is sent to rows further off, so each adds less than the one before him.

The same men can show a rising marginal product: over the early range each extra worker adds more than the last, because a plant built for a full gang is badly under used by two or three people and extra hands let the work be divided. The same men produce a rising marginal product at the start and a falling one later.

The case for the foreman: a producer with his pick of the labour market engages his best hands first, so the later hands may genuinely be slower or less practised, and where labour is scarce at harvest part of the fall is a real fall in the quality of the units employed.

How to tell the two causes apart: if five hands known to be equally strong are engaged and the fifth still adds less than the fourth, the cause is the fixed factor; if he cuts less even when sent out alone on the same rows, the cause is the man.

Why the difference matters: the two diagnoses call for opposite remedies. If the men are the trouble, the answer is better selection, training and supervision; if the proportion is the trouble, no supervision will help and the answer must be more of the fixed factor: more rows, another lorry, a larger plant.

So the foreman's conclusion should be turned round. A falling marginal product is the ordinary result of adding a variable factor to a fixed one, and it is a message about his estate rather than a report on his cutters.

The Master Key: *Marginal product falls because the fixed factor is being shared out more thinly, not because the last man hired is the weakest.*

The Law of Diminishing Returns

One hectare at Morogoro will not yield more rice forever, however many hands are set to work on it. That stubborn fact is the law of diminishing returns, the most useful single idea in the theory of production and the one on which every cost curve later in this chapter rests. This section states the law exactly, sets out its four assumptions, traces its three phases through a schedule and a curve, and asks what a producer should actually do when the marginal product starts to fall.

BINDER Question 84

Add a second weeder to a Morogoro rice plot and the harvest jumps. Add a ninth and almost nothing moves. Nobody grew lazy, and the plot has not shrunk.

State the law of diminishing returns and explain why it is also known as the law of variable proportions.

Model Answer

The law of diminishing returns states that as *successive units of a variable factor are applied to a fixed factor, the marginal product of the variable factor must beyond a certain point begin to fall;* it is called the law of variable proportions because what changes as those units are added is the ratio in which the two factors are combined.

Stated in full: given the state of technology, total output first rises at an increasing rate, then at a diminishing rate, and finally falls.

The two factors: the fixed factor cannot be altered within the period, such as a Dakawa farmer's two hectares this season. The variable factor is what he can change at will: usually labour, but equally fertiliser, diesel or machine hours.

Beyond a certain point: the fall does not begin with the first unit, since output per extra unit rises while the fixed factor still stands partly idle. A producer who expects the law to bite from the first worker stops hiring far too early.

Marginal product falls first: total product goes on rising after the marginal product has begun to fall, because a smaller addition is still an addition. A harvest that is still growing is no proof that the law is not already operating.

Why the law of variable proportions: one worker on two hectares has two hectares behind him; three have two thirds of a hectare each; nine have less than a quarter. Nobody has grown clumsy and no land has been lost: the fixed factor is simply shared among more users.

A technical law, not a money one: it describes what the land, the machine and the labour will physically yield, not what they are worth. Money enters only afterwards, when the producer asks whether the shrinking extra output still exceeds what the extra unit costs him.

The Master Key: *Hold one factor still and vary the other: the ratio does the work, and beyond a point each extra unit must add less than the last.*

BINDER Question 85

Plot a Mbeya mill's daily output against the men fed into it and the line does something strange. It climbs, leans over, and finally turns down, while the building never changes.

With the aid of a diagram, explain the three phases through which total product passes as successive units of a variable factor are applied to a fixed factor.

Model Answer

As successive units of a variable factor are applied to a fixed factor, total product passes through three phases: it rises first at an increasing rate, then at a diminishing rate, and finally it falls.

Take a maize mill at Mbeya with one hammer mill and one loading bay, both fixed for the season, and add workers one at a time.

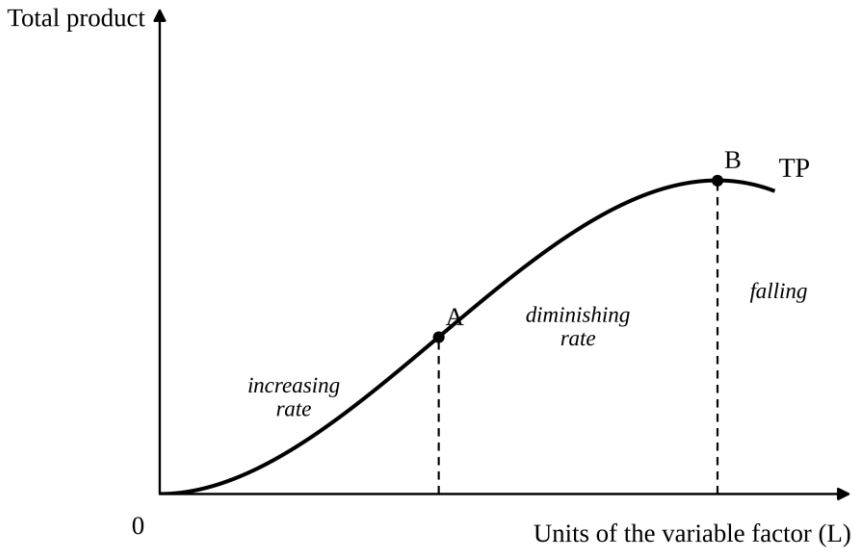


Figure 5.5: Total product rising at an increasing rate, then at a diminishing rate, then falling

Phase one, from the origin to A: total product rises at an increasing rate, each extra worker adding more than the man before him, so the marginal product rises and the curve steepens. A is the point of inflection, where the marginal product is greatest and from which the law operates.

Phase two, from A to B: total product still rises, but at a diminishing rate: every extra worker adds less than the man before him, so the marginal product is positive and falling and the curve flattens. Average product rises a little past A and peaks only where the falling marginal product meets it.

Point B, the top of the curve: total product is at its maximum and the last unit has added nothing, so the marginal product is zero and the curve is flat. With this fixed factor and this technique no further worker can raise output.

Phase three, beyond B: total product falls and the marginal product is negative: the extra men queue for the same machine, tread on the work of others and interrupt those already busy, so each destroys more than he performs. Average product falls too but stays positive.

The shape follows from the fixed factor: up to A it is brought into fuller use, from A to B it is spread thinner, and beyond B another pair of hands is a nuisance. No sensible producer works beyond B, and most stop well before it.

The Master Key: *Up to A the curve steepens, from A to B it flattens, past B it falls: increasing returns, diminishing returns and negative returns in one line.*

BINDER Question 86

Give a Singida farmer a new drought resistant seed and his yield a hectare doubles. An economist watching says the law of diminishing returns has not been broken, only postponed.

State and explain the four assumptions on which the law of diminishing returns rests, showing in each case what would follow if the assumption did not hold.

Model Answer

The law of diminishing returns rests on four assumptions: constant technology, only one factor varied while the others stay fixed, identical units of the variable factor, and a short run period.

The state of technology is constant: the same seed, machine and method are in use throughout. If it did not hold, a drought resistant seed would lift the output of every unit of labour at once and marginal product could rise where the law predicts a fall; but the new schedule has a falling section of its own, so a better technique postpones the law and never repeals it.

Only one factor is varied and the others are held fixed: there must be a genuinely fixed factor for the variable one to be spread over. If land, labour and capital all rose together we should be watching the scale of the whole plant change, which is returns to scale and belongs to the long run.

All units of the variable factor are identical: every worker is equally strong, skilled and willing, and every bag of fertiliser equally rich. If it did not hold, a falling marginal product would prove nothing, since the later workers might merely be weaker men. The blame falls on the proportion and not on the man, so no producer escapes the law by hiring better hands.

The law operates in the short run only: the period must be too short for the fixed factor to be altered. If it were not, the farmer would answer a falling marginal product by renting a third hectare and the welder by buying a fourth machine. In the long run nothing is fixed and the law has nothing to bite on.

These four are not fine print: each is a door by which a producer might hope to escape the law, and each is shut for a stated reason.

The Master Key: *Constant technique, one factor varied, identical units, short run: break any one of the four and the law is not being tested at all.*

BINDER Question 87

Two men share one Kariakoo welding machine and both are busy. Six men share it and four are standing about. Nobody has changed; there is simply less machine to go round.

Explain the causes of the law of diminishing returns.

Model Answer

The law operates because the fixed factor grows ever scarcer relative to the variable factor, while its indivisibility explains the early rising phase and the imperfect substitutability of factors explains why the eventual fall cannot be avoided.

The fixed factor grows scarce relative to the variable one: this is the root cause. Two hectares shared among three workers give each two thirds of a hectare; among nine, barely a fifth. The land has not shrunk by a furrow, but the amount standing behind each pair of hands has collapsed.

Indivisibility of the fixed factor: a pulping machine or a hectare of land cannot be bought in slivers to match the labour available, so at low employment it stands partly idle. Each early worker brings more of it into use, which is why output at first rises at an increasing rate.

The gains from the division of labour are soon exhausted: a second and a third worker let the tasks be split, one feeding the machine, one washing, one spreading the crop to dry. Once every task has a man of its own there is nothing left to specialise in.

Imperfect substitutability between factors: labour cannot take the place of land, nor fertiliser of sunshine. Were factors perfect substitutes, a shortage of the fixed one could be made good by pouring in more of the variable and output would rise in proportion for ever.

Crowding in the last phase: beyond the maximum the extra units do positive harm: they queue at the same machine, trample the young crop, mislay tools and interrupt those already working, so the marginal product passes below zero.

Agriculture feels this most sharply, which is why the law was first noticed on the land: a hectare cannot be stacked or moved and the season cannot be lengthened, whereas a Kariakoo workshop can at least run a night shift.

The Master Key: *One cause wearing three faces: the fixed factor runs short, it was lumpy to begin with, and nothing else can stand in its place.*

BINDER Question 88

One pulping machine stands in a Mbinga shed. The second worker through the door adds 140 kilogrammes to the day's work; the eighth takes 30 away.

Construct a product schedule for a Mbinga coffee pulping shed and use it to show the law of diminishing returns in operation, grouping the rows into the three phases.

Model Answer

A product schedule shows the law in three clear phases: total product first rises at an increasing rate while marginal product is rising, then rises at a diminishing rate while marginal product falls, and finally falls once marginal product has turned negative.

Take a coffee pulping shed at Mbinga with one pulping machine and one washing channel, both fixed. Average product is total product divided by the number of workers; marginal product is the addition made by the last worker engaged.

Workers (L)	Total product (kg)	Average product (kg)	Marginal product (kg)	The phase
0	0	-	-	-
1	100	100	100	Increasing returns
2	240	120	140	Increasing returns
3	420	140	180	Increasing returns
4	640	160	220	Increasing returns
5	800	160	160	Diminishing returns
6	900	150	100	Diminishing returns
7	910	130	10	Diminishing returns
8	880	110	-30	Negative returns

The law of diminishing returns operating in a Mbinga coffee pulping shed with one pulping machine.

Increasing returns, up to the fourth worker: total product climbs from 100 to 640 kilogrammes while the marginal product rises from 100 to 140, then 180, then 220. One man alone left the machine half idle; each new hand brings more of it into use and can specialise.

Diminishing returns, from the fifth to the seventh worker: the marginal product turns down, from 220 to 160, then 100, then only 10 kilogrammes, yet total product still rises from 640 to 910 because a smaller addition is still an addition. The law sets in with the fifth worker, not the eighth.

Negative returns, at the eighth worker: his marginal product is -30 kilogrammes and total product falls from 910 to 880. Eight men round one machine and one channel queue, jostle and spill cherry, so he takes away more work than he brings and should not be engaged at any wage.

What the average product is doing meanwhile: average product rises to 160 kilogrammes at the fourth worker and is still 160 at the fifth, whose marginal product exactly equals it, so the average peaks there and falls from the sixth worker onward. Average product is the slower signal.

The turning points are what a producer must know: the law sets in at the fifth worker, output is greatest at the seventh, and past the seventh the shed is worse off than before.

The Master Key: *Marginal product rises, then falls, then goes negative; that one column tells you which phase the producer is standing in.*

REAL Question 89

Follow two hectares of mpunga at Dakawa in Morogoro through one whole season, and count what each extra kibarua actually puts into the sacks.

Complete the average and marginal product columns for the plot, identify the worker with whom diminishing returns set in, name the phase each worker belongs to, and explain why the seventh worker reduces the harvest.

> Mzee Kajembe farms a fixed plot of two hectares of mpunga (paddy) in the Dakawa irrigation scheme, Morogoro. The plot, the water allocation and the tools cannot be added to this season.
>
> He engages kibarua (casual labourers) for the whole season on identical terms, and every one of them is equally fit and equally experienced.
>
> The season's harvest, in bags of paddy, has been: one worker 11 bags; two workers 26; three workers 45; four workers 60; five workers 70; six workers 72; seven workers 70.

Model Answer

Diminishing returns set in with the fourth kibarua, whose marginal product of 15 bags is the first to fall below that of the man before him, and the seventh worker reduces the harvest because on a fixed plot of two hectares he takes more work away than he brings to it.

Average product is the harvest divided by the number of kibarua engaged, and marginal product is the change in the harvest caused by the last man engaged. The plot, the water and the tools are fixed, so labour is the only variable factor.

Kibarua (L)	Total product (bags)	Average product (bags)	Marginal product (bags)	The phase
0	0	-	-	-
1	11	11	11	Increasing returns
2	26	13	15	Increasing returns
3	45	15	19	Increasing returns
4	60	15	15	Diminishing returns
5	70	14	10	Diminishing returns
6	72	12	2	Diminishing returns
7	70	10	-2	Negative returns

Paddy from a fixed two hectare plot at Dakawa, by number of kibarua engaged.

Two of the cells worked in full put the method beyond doubt.

$$\mathrm{AP_L} = \frac{\mathrm{TP}}{\mathrm{L}} = \frac{45}{3} = 15 \text{ bags a worker}$$

$$\mathrm{MP_L} = \frac{\Delta \mathrm{TP}}{\Delta \mathrm{L}} = \frac{60 - 45}{4 - 3} = 15 \text{ bags}$$

$$\mathrm{MP_L} = \frac{70 - 72}{7 - 6} = -2 \text{ bags}$$

Increasing returns, the first three workers: the marginal product rises from 11 to 15 and then to 19 bags. One man alone cannot weed two hectares before the grass takes hold nor scare the birds off at the right moment, so much of what he plants is lost; the second and third let the work be divided and finished inside the season.

Diminishing returns, the fourth to the sixth worker: the marginal product falls from 19 to 15, then to 10 and then to 2 bags, while the harvest still grows from 45 bags to 72, since every extra man now has less than half a hectare to himself. The fourth worker is where the law sets in, even though nothing about the harvest looks wrong at that point.

Negative returns, the seventh worker: his marginal product is -2 bags and the harvest falls from 72 to 70. Seven men on two hectares tread the young rice, crowd the bunds, break the water channels and weed ground already weeded, so his presence costs two bags of paddy on top of his wage.

Why it happens: nothing has changed in the men, who are hired on the same terms and are equally experienced. What has changed is the land standing behind each pair of hands: three workers had two thirds of a hectare each, seven have less than a third.

The way out is not a harder working kibarua. A third and a fourth hectare would restore the proportion and lift the whole schedule onto a higher line, but that is a long run decision and cannot be taken in mid season. On two hectares this plot will not yield more than 72 bags.

The Master Key: *Diminishing returns begin where the marginal product first turns down, not where the harvest finally stops rising.*

REAL Question 90

One hectare of alizeti at Ikungi, and a farmer with money enough for six bags of fertiliser. Watch the hectare itself decide how many of them are worth buying.

Work out the marginal product of each bag of fertiliser and the value of that marginal product, state after which bag diminishing returns set in, and advise Neema how many bags she should apply.

> Neema Mkumbo grows alizeti (sunflower) on one hectare at Ikungi in Singida. The land, the seed and the ploughing are the same every season; only the top dressing fertiliser is varied.
>
> Her yields in kilogrammes of seed, by the number of 50 kilogramme bags applied, are: no bag 400 kg; one bag 700; two bags 1,120; three bags 1,440; four bags 1,600; five bags 1,650; six bags 1,620.
>
> Sunflower seed sells at the Ikungi press for TShs 1,200 a kilogramme. A bag of fertiliser costs her TShs 100,000 delivered to the plot.

Model Answer

Diminishing returns set in after the second bag, yet Neema should still apply four bags, because the third and the fourth each add seed worth far more than the TShs 100,000 they cost, while the fifth adds only TShs 60,000 of seed and the sixth destroys seed instead of adding it.

The hectare, the seed and the ploughing are fixed and only the fertiliser varies, so the law bites on fertiliser exactly as it bites on labour. The value of a bag's marginal product is the extra seed it brings multiplied by TShs 1,200 a kilogramme.

Bags of fertiliser	Total yield (kg)	Marginal product (kg)	Value of that marginal product (TShs)	Worth buying?
0	400	-	-	-
1	700	300	360,000	Yes
2	1,120	420	504,000	Yes
3	1,440	320	384,000	Yes
4	1,600	160	192,000	Yes
5	1,650	50	60,000	No
6	1,620	-30	-36,000	No

Sunflower seed from one fixed hectare at Ikungi, by bags of fertiliser applied.

Take the second bag and the fifth in full, since those two settle the question.

$$\text{MP(second bag)} = 1{,}120 - 700 = 420 \text{ kg}$$
$$\text{Value of the second bag} = 420 \times 1{,}200 = \text{TShs } 504{,}000$$
$$\text{MP(fifth bag)} = 1{,}650 - 1{,}600 = 50 \text{ kg}$$
$$\text{Value of the fifth bag} = 50 \times 1{,}200 = \text{TShs } 60{,}000$$

Where the law sets in: the marginal product rises from 300 kilogrammes for the first bag to 420 for the second, and then falls away to 320, 160, 50 and at last to -30. From the third bag onward this hectare is in diminishing returns: the soil now has more nitrogen than it can use.

Why she should nevertheless buy the third and the fourth: a falling marginal product is not the same thing as an unprofitable one. The third bag adds 320 kilogrammes worth TShs 384,000 against a cost of TShs 100,000, and the fourth adds 160 kilogrammes worth TShs 192,000 against the same cost.

Where she must stop: the fifth bag adds seed worth only TShs 60,000, which is TShs 40,000 less than it costs her. The sixth is worse: it scorches the crop and destroys TShs 36,000 of seed on top of its own price. Buy while the extra seed is worth more than the bag, and stop the moment it is not.

Set the four bag plan against no fertiliser at all.

$$\text{Extra seed} = 1{,}600 - 400 = 1{,}200 \text{ kg}$$
$$\text{Extra revenue} = 1{,}200 \times 1{,}200 = \text{TShs } 1{,}440{,}000$$
$$\text{Cost of the fertiliser} = 4 \times 100{,}000 = \text{TShs } 400{,}000$$
$$\text{Net gain} = 1{,}440{,}000 - 400{,}000 = \text{TShs } 1{,}040{,}000$$

What the hectare will not do: however many bags are poured onto it, this hectare will not yield much beyond 1,650 kilogrammes, and past that point the yield actually falls. Fertiliser can lift the schedule, but it cannot abolish the fixed factor lying underneath it.

The Master Key: *Buy the bag while the seed it adds is worth more than the bag; diminishing returns tell you when to start counting, not when to stop buying.*

REAL Question 91

A Kariakoo workshop owner keeps three welding machines and seven welders, and complains that his men have grown lazy. His own record book says something else entirely.

Complete the workshop's product schedule, calculate the labour cost of a grille at each level of employment, and use your figures to answer the owner's charge that his welders have grown lazy.

Mzee Rajabu runs a welding workshop off Msimbazi Street in Kariakoo, making steel window grilles. He owns three welding machines and one work bench, and these cannot be added to.

He has taken on welders one at a time. Grilles finished in a week: one welder 6; two welders 18; three 36; four 56; five 70; six 72; seven 63.

Every welder is equally trained, is paid TShs 21,000 a day and works six days, so each costs the workshop TShs 126,000 a week.

Model Answer

The record book clears the welders: the fall in output per man is the law of diminishing returns operating on three fixed machines, since the fifth welder is the first whose marginal product falls, the seventh actually destroys nine grilles a week, and the very same men produced both the best figure and the worst.

Average product is grilles a week divided by the number of welders, marginal product is the extra grilles brought by the last welder, and the labour cost of a grille is the week's wage bill divided by the grilles finished.

Welders (L)	Grilles a week	Average product	Marginal product	Labour cost a grille (TShs)
1	6	6	6	21,000
2	18	9	12	14,000
3	36	12	18	10,500
4	56	14	20	9,000
5	70	14	14	9,000
6	72	12	2	10,500
7	63	9	-9	14,000

Output and labour cost at a Kariakoo welding workshop with three machines.

Two of the cost figures worked in full show how the last column is built.

$$\text{Labour cost a grille at four welders} = \frac{4 \times 126{,}000}{56} = \frac{504{,}000}{56} = \text{TShs } 9{,}000$$

$$\text{Labour cost a grille at seven welders} = \frac{7 \times 126{,}000}{63} = \frac{882{,}000}{63} = \text{TShs } 14{,}000$$

The law sets in at the fifth welder: the marginal product rises from 6 to 12, then to 18 and then to 20 grilles, before falling to 14, to 2 and finally to -9. From the fifth man onward the workshop is in diminishing returns, even though output climbs to its peak of 72 grilles at the sixth.

The seventh welder is in the negative phase: he does not merely add little; he subtracts. Output falls from 72 grilles to 63, so his marginal product is -9 a week. Seven men working three machines and one bench means four are idle at any moment, tools go missing and cutting is done twice.

The charge of laziness does not fit the record: every welder is equally trained and equally paid, and no man worked harder as the fourth than as the seventh. Output per welder rose from 6 grilles to 14 as the workshop filled and then fell back to 9, and the same men produced all three figures. What changed was the machines behind them, from three for one man to three shared by seven.

Labour cost a grille is the mirror of output per welder: because every welder costs the same, the labour cost of a grille is the weekly wage divided by average product, so the cost column is the average product column turned upside down.

$$\text{Labour cost a grille} = \frac{\text{w}}{\text{AP}_\text{L}} = \frac{126{,}000}{14} = \text{TShs } 9{,}000$$

Cost is therefore lowest exactly where output per welder is highest, at four and five welders, and climbs back to TShs 14,000 at seven: falling productivity and rising cost are one event seen from two sides. Let the seventh welder go, keep four or five, and for more than 72 grilles a week buy a fourth machine rather than lecture the men.

The Master Key: *When output per worker falls in a shop whose plant has not grown, suspect the machines before you suspect the men.*

HOT Question 92

A newspaper column argues that Tanzania has hungry people and idle hands, so the answer is obvious: put the hands on the land. The law of diminishing returns is less confident.

Discuss the claim that Tanzania could end its food shortages simply by putting more people to work on the land it already farms.

Model Answer

The claim is right about holdings that are still under worked and wrong as a general remedy, because on land that is already fully worked the law of diminishing returns has driven the marginal product of an extra pair of hands towards zero, so more people on the same hectares will divide the harvest rather than enlarge it.

There is real truth in it where land is under worked: many holdings are weeded once when they should be weeded twice and harvested late, so grain is lost. Such a plot is still in the early phase of the law, where an extra worker adds a great deal.

Land is not everywhere the binding factor: the fixed factor is fixed for a given farm in a given season, not for the country for ever. Where cultivable land lies unused for want of a road or a borehole, moving labour onto it increases the fixed factor alongside the labour.

But on crowded holdings the extra hands add almost nothing: where a family of nine already works one hectare the marginal product of the tenth worker is near zero. He is employed in name only, which is disguised unemployment: the harvest is unchanged and merely shared among one more mouth, so output a head falls.

Land, water and season fix a ceiling: a hectare of a given soil, under a given rainfall and a given seed, will yield only so much, and labour can neither lengthen the rains nor deepen the soil. Neema's hectare at Ikungi refused to give more than about 1,650 kilogrammes.

Some of the shortage is not a production problem at all: a large share of what the country grows never reaches a plate, being lost to poor drying, weevils, rats, bad roads and thin storage. Extra hands in the field do nothing about a loss that happens after the field.

What does work is enlarging the fixed factor: a scheme that allows two crops a year from the same hectare has in effect doubled the land available to that household, and land cleared, titled and served by a road adds to the fixed factor directly.

And changing the technique: improved seed, fertiliser, better tillage, tractor power and safe storage lift the whole schedule onto a higher line, so the same land and the same labour give more than before.

Yet technique postpones the law and does not repeal it: the new schedule has a falling section of its own. The Singida hectare given a fifth and a sixth bag of fertiliser gave back almost nothing and then less than nothing, so a better technique moves the ceiling upward without removing it.

The verdict therefore turns on which phase the land is in, and the country contains both kinds of holding. Where plots are under worked, more labour will raise output. Where they are crowded, more labour shares hunger rather than ends it, and the remedies that reach the whole country are irrigation and new land, better seed and fertiliser, better storage and roads, and work outside farming for the hands the land can no longer use.

The Master Key: *More hands raise a harvest only where the land is under worked; elsewhere they merely share it, and the cure is more land, better technique and less waste.*

HOT Question 93

Output per worker at a Mwanza fillet plant has fallen for three months running. The manager blames the law of diminishing returns. The store keeper blames a freezer that broke in April.

A manager whose output per worker has fallen concludes that his firm is suffering from diminishing returns. Assess this diagnosis.

Model Answer

The diagnosis is possible but quite unproved, because the law of diminishing returns holds only under four strict conditions which the manager has not shown to be satisfied, and falling output per worker has several ordinary causes that have nothing to do with proportions.

What would have to be true for the diagnosis to stand: the plant would have to be genuinely fixed, the labour force increased against it, the new workers as good as those already there, and the technique unchanged. Those four assumptions are factual claims he can check in his own records.

The law speaks about marginal product, not average product: the law asserts that the addition made by each extra worker falls. Output per worker is a different figure and turns down only later, once the marginal product has dropped below it, so a falling average is consistent with the law without being evidence of it.

The raw material may simply be short: a fillet plant receiving fewer fish from the lake will show falling output per worker with no change whatever in the ratio of labour to plant. The remedy then lies with boats and landings rather than with the size of the workforce.

A failure of capital produces the same symptom: a freezer broken since April, or an evening of load shedding from TANESCO, cuts output while the labour force stands unchanged. The producer has altered no proportion by any choice of his own, so a repair is in question and not the law.

The workers may not be identical: if untrained hands have been taken on, or experienced filleters have left, the third assumption is broken. Output per worker falls because the later units are poorer units, and to call that diminishing returns confuses the quality of a factor with its proportion.

Organisation, morale and simple loss: poor supervision, wages paid late, absenteeism, an untidy line and theft from the cold store all drag output per worker down. These are failures of management, and unlike the law they can be put right inside the same season.

The decisive test: ask whether the labour force actually rose while the plant stayed the same. If the number employed has not changed, no proportion has changed and the law cannot be the cause; if it did rise and each new hand added less than the one before, with fish, power and training steady, the diagnosis holds and the answer is more plant.

Why the wrong diagnosis is so attractive: the law is a technical necessity for which no manager can be blamed, while a broken freezer and a badly run shift are matters he must answer for. A diagnosis that excuses the person making it should be looked at twice.

So the truth of it is small until the figures are produced. The manager should set out, month by month, the labour employed against the fish received and the fillets packed, and work out the addition made by each extra worker. If that addition is falling while everything else holds steady he is right, and his firm needs a larger plant rather than fewer men.

The Master Key: *Falling output per worker is a symptom with many causes; the law is only one of them, and it is proved by the marginal product, never by the average.*

HOT Question 94

A Mtwara cashew buyer hears that his last picker gathered less than the one before, and sends the man home. He has just thrown away sixty five thousand shillings a day.

To what extent should a producer stop hiring as soon as the marginal product of the variable factor begins to fall?

Model Answer

He should not stop merely because the marginal product has begun to fall, since a falling marginal product is the ordinary condition of almost all production; the correct rule is to go on hiring while the value of what the extra unit adds exceeds what that unit costs, and to stop only when it does not.

A falling marginal product is normal, not a warning: beyond a certain point every producer's marginal product falls, so one who stopped there would stop almost as soon as he began. Nearly every firm in Tanzania that is making money is on the falling part of its schedule.

The proper test is money, not slope: compare the value of the marginal product with the price of the factor. A Mtwara cashew buyer finds that his seventh picker gathers only 40 kilogrammes a day against the sixth man's 60, while nuts fetch TShs 2,000 a kilogramme and a picker is paid TShs 15,000.

$$\text{Value added by the seventh picker} = 40 \times 2{,}000 = \text{TShs } 80{,}000$$

$$\text{Gain from engaging him} = 80{,}000 - 15{,}000 = \text{TShs } 65{,}000 \text{ a day}$$

So the falling unit may still be highly profitable: the seventh picker is worth TShs 65,000 a day although his marginal product has fallen by a third, and sending him home throws that sum away on every day of the season.

Total product is still rising in that stretch: between the point where the marginal product turns down and the point where it reaches zero, every extra unit still adds output. Refusing all of it leaves nuts on the ground that cost less to gather than they fetch.

Where he must certainly stop: once the marginal product reaches zero the extra unit cannot cover any wage whatever, and once it is negative the producer is paying a wage for damage done. No unit should ever be engaged in the negative phase.

There are honest reasons for stopping earlier: working capital is the commonest. A farmer who pays wages every week but is paid for his crop once, at harvest, may be unable to finance hands who would pay for themselves twice over, so his stopping point is set by his cash box and not by his schedule.

Both sides of the comparison must be valued properly: if his extra output pushes the price down, the right figure is what that output adds to revenue, not the quantity at today's price. And the true cost of the marginal worker is everything he brings with him, since supervision, tools, transport and careless picking that bruises the nut are as real as the wage.

A steeply falling schedule is a message about the plant: if the marginal product is collapsing quickly, the useful response is another machine, another hectare or another shift rather than a finer argument about the last worker. That is a long run decision, and it removes the cause.

So the extent is small. A falling marginal product is a signal to begin calculating, not a signal to stop hiring, and a producer who treats the two as the same will operate far below the output that pays him best.

The Master Key: *Stop where the extra unit earns less than it costs, not where it merely earns less than the unit before it.*

The Three Stages of Production

Add workers one at a time to a fixed plot and the harvest does three quite different things, in three quite different worlds. Economists cut the short run into three stages, defined not by how the total product curve looks to the eye but by what average and marginal product are doing, and they insist that a sensible producer works in the middle one. This section fixes the boundaries exactly, reads the diagram, and then asks how far real Tanzanian producers obey it.

BINDER Question 95

Put one worker on a hectare of Kilombero cane and output leaps. Put the twentieth on the same hectare and output falls. Between those two workers lie three different worlds.

With the aid of a diagram, explain the three stages of production.

Model Answer

Short run production falls into three stages: Stage I runs to the labour at which average product is greatest, Stage II from there to where marginal product is zero, and Stage III beyond, where marginal product is negative and total product falls.

One factor varies, usually labour, while the others stay fixed. The stages are defined not by the steepness of the total product curve but by what average and marginal product are doing.

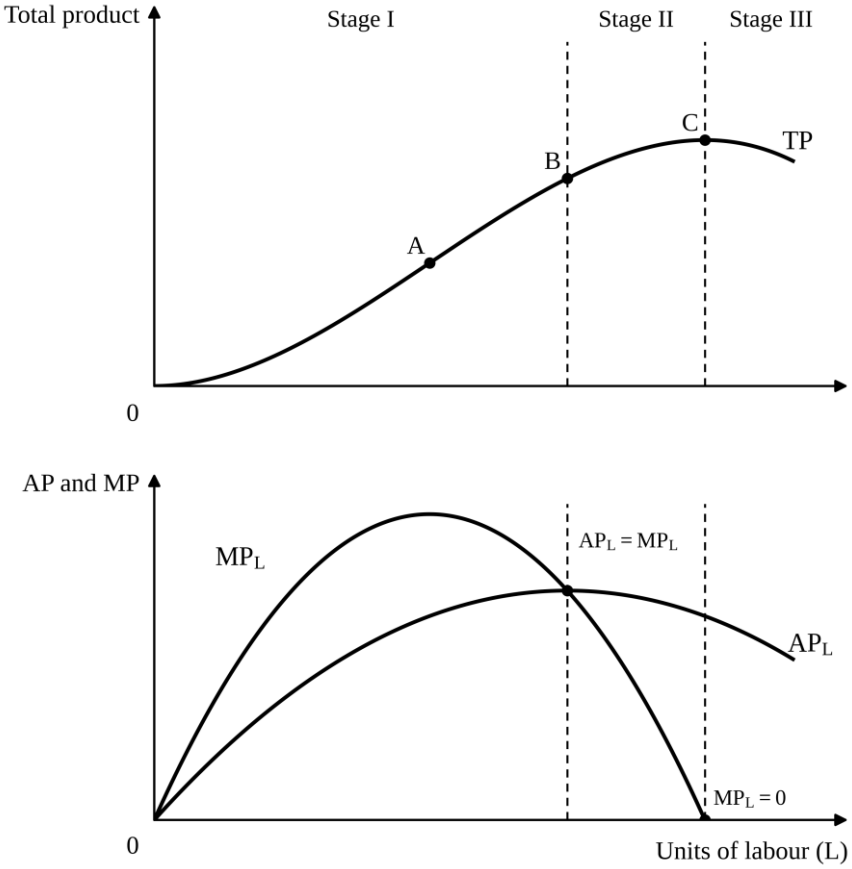


Figure 5.6: The three stages of production

Three points to find first: A is the point of inflection, where total product stops rising at an increasing rate and MP_L below it is at its maximum. B is where AP_L is greatest and MP_L cuts it from above. C is where total product is greatest and MP_L crosses the axis.

Stage I, from the origin to B: total product rises throughout and AP_L rises to its maximum at B. MP_L peaks at A and then falls, but stays above AP_L all the way, which is why the average is pulled up. The fixed factor is underused.

Stage II, from B to C: total product still rises, but at a decreasing rate, to its maximum at C. AP_L falls yet stays positive; MP_L falls too, stays positive and lies below AP_L, which drags the average down. A producer settles in this region.

Stage III, beyond C: MP_L is negative, so total product falls as more of the variable factor is added. AP_L goes on falling but never reaches zero, since a positive total over a positive number of workers cannot be nothing. This is the stage of negative returns.

A is not a boundary: diminishing returns set in there, but AP_L is still rising and the producer is still in Stage I. Only two lines divide the diagram, at $MP_L = AP_L$ and $MP_L = 0$.

The Master Key: *Two lines cut the short run in three: one where* MP_L *meets* AP_L *at its peak, one where* MP_L *reaches zero at the top of total product.*

BINDER Question 96

A Njombe potato grower says his crop is doing well because output is still rising. His brother, hoeing beside him, says output per worker is falling. Both are telling the truth.

Set out in a table what total product, average product and marginal product each do in the three stages of production, and give the name by which each stage is known.

Model Answer

Each stage has its own signature in the three products, so that any schedule or curve can be placed in a stage simply by asking what total, average and marginal product are doing at that level of the variable factor.

Three landmark points anchor the table. A is the point of inflection of the total product curve, where MP_L is at its maximum; B is where AP_L is at its maximum; C is where total product is at its maximum. Only B and C are stage boundaries.

Stage	Total product	Average product	Marginal product	Name
I, origin to the maximum of AP_L	rises, at an increasing rate to A, then at a decreasing rate	rises to its maximum at B	rises to its maximum at A, then falls, but stays above AP_L	Take off stage
II, maximum of AP_L to $MP_L = 0$	rises at a decreasing rate to its maximum at C	falls, but remains positive	falls, remains positive, and lies below AP_L	Rational or economic region
III, beyond $MP_L = 0$	falls	falls, but never reaches zero	negative	Stage of negative returns

The behaviour of the three products in each of the three stages.

The signature of Stage I: the marginal product lies above the average product, $MP_L > AP_L$. This single test is enough, because whenever the marginal lies above the average it must be pulling the average up, so average product cannot yet have peaked.

The signature of Stage II: the marginal product is positive but lies below the average product, $0 < MP_L < AP_L$. Total product is still climbing while output per worker is already falling, which is exactly the disagreement between the two brothers at Njombe, and both of their statements fit this one stage.

The signature of Stage III: the marginal product is negative, $MP_L < 0$. Total product turns down, and this is the only stage in which it does, so a falling total is proof at once that the producer has gone too far.

The common error is to look only at total product. A rising total is true of Stage I and of Stage II alike, so it separates nothing. Always look at the marginal, and compare it first with the average and then with zero.

The Master Key: *Marginal above average is Stage I; marginal below average but positive is Stage II; marginal below zero is Stage III.*

BINDER Question 97

The owner of a Mbeya maize mill wants a number, not a picture. At exactly which worker does one stage end and the next begin? Two derivatives answer him in whole workers.

State precisely where each stage of production begins and ends, then, for a Mbeya maize mill whose short run production function is $Q = 18L^2 - 1.5L^3$, find the labour at which Stage I ends and the labour at which Stage II ends.

Model Answer

Stage I ends where average product is at its maximum, so that $MP_L = AP_L$, and Stage II ends where marginal product is zero and total product at its maximum, which for this mill are six workers and eight workers.

The first boundary: it lies where AP_L reaches its maximum. At that labour, and only there, marginal product equals average product, because a marginal above the average is still lifting it and a marginal below is already pulling it down.

The second boundary: it lies where $MP_L = 0$. Total product is at its maximum there, because the total stops rising exactly when the last unit adds nothing. One step further and the marginal is negative and the total falls.

For the mill, whose output Q is sacks of sembe, that is, maize flour, ground in a day:

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = \frac{18\mathrm{L}^2 - 1.5\mathrm{L}^3}{\mathrm{L}} = 18\mathrm{L} - 1.5\mathrm{L}^2$$

$$\mathrm{MP_L} = \frac{\partial\,\mathrm{Q}}{\partial\,\mathrm{L}} = 36\mathrm{L} - 4.5\mathrm{L}^2$$

Stage I ends where average product is greatest, so set its derivative to zero.

$$\frac{\partial\,\mathrm{AP_L}}{\partial\,\mathrm{L}} = 18 - 3\mathrm{L} = 0$$

$$3\mathrm{L} = 18 \quad \text{so} \quad \mathrm{L} = 6$$

Check the boundary condition by putting $\mathrm{L} = 6$ into both functions.

$$\mathrm{AP_L} = 18(6) - 1.5(6)^2 = 108 - 54 = 54$$

$$\mathrm{MP_L} = 36(6) - 4.5(6)^2 = 216 - 162 = 54$$

Both stand at 54 sacks per worker, so the sixth worker is exactly on the line. Stage II then ends where marginal product is zero.

$$36\mathrm{L} - 4.5\mathrm{L}^2 = 0$$

$$\mathrm{L}(36 - 4.5\mathrm{L}) = 0 \quad \text{so} \quad \mathrm{L} = 8$$

$$\mathrm{Q} = 18(8)^2 - 1.5(8)^3 = 1{,}152 - 768 = 384$$

Reading the answers back: Stage I runs to six workers, Stage II from six to eight, Stage III from the ninth. At eight the mill grinds its greatest output, 384 sacks a day, but each worker averages 48 sacks against the 54 that six averaged. Extra output costs output per worker.

The economic region is only two workers wide. The stages tell the owner that a fifth worker is too few and a ninth ruinous, but not whether to run with six, seven or eight; for that he needs the price of sembe and the daily wage.

The Master Key: *Set the derivative of* $\mathrm{AP_L}$ *to zero for the first boundary and* $\mathrm{MP_L}$ *to zero for the second.*

BINDER Question 98

A Dodoma sunflower press stops hiring while output per worker is still climbing. A rival hires until the oil itself starts to fall. Both owners have made the same kind of mistake.

Explain why Stage II is described as the rational or economic region of production, and show why a rational producer will neither stop within Stage I nor enter Stage III.

Model Answer

Stage II is the rational or economic region because it is the only range in which both factors are used sensibly: in Stage I the fixed factor is still underused, while in Stage III the variable factor destroys the output it is paid to create.

Why the producer will not stop in Stage I: average product is still rising, so one more worker raises output per worker; and total output rises against an unchanged fixed factor, so output per hectare rises too. Both factors gain at once.

The stronger form of the same point: if it pays to produce at all, it pays to pass the end of Stage I. The greatest revenue per worker is price times the highest average product, reached exactly there, so if that peak will not cover the wage the producer shuts down rather than retreat.

What the fixed factor does in Stage I: the last unit of the fixed factor contributes nothing and could be given up without loss. Stage I for the variable factor is the third stage of the fixed factor: a plot worked by two when it could feed six is partly wasted.

Why the producer will never enter Stage III: marginal product is negative, so the extra worker reduces total output while drawing a full wage. The firm could have that same output with fewer workers and a smaller wage bill, whatever the price.

Stage III is inefficient even if labour were free: even if the workers cost nothing, as family labour appears to, entering Stage III would be foolish, since sending one home would raise the harvest. Stage I is merely wasteful; Stage III is absurd.

The argument is one of elimination: Stage I goes because output per factor is still climbing, Stage III because output itself is falling, and Stage II is what is left.

The Master Key: *Stage I wastes the fixed factor and Stage III wastes the variable one, so the rational producer lives in Stage II.*

BINDER Question 99

Two Iringa tomato growers with identical plots hire different numbers of pickers, and neither of them is being foolish. The price of tomatoes and the daily wage settle the difference between them.

Stage II is a range and not a point. Explain what fixes the exact quantity of the variable factor a producer employs within Stage II, and state what the boundaries of this region are called when they are drawn on a map of isoquants.

Model Answer

The stages come from the production function alone and can only narrow the choice to a range; the point inside it is settled by the price of the product and of the factor, the producer hiring until the value of the marginal product equals the wage.

Why the stages cannot fix a point: the analysis is purely technical: total, average and marginal product are quantities of output, and a relationship containing no prices cannot answer a question that turns on prices.

The rule that does fix it: the producer compares what the last unit of labour adds in money with what it costs. The addition to revenue is price times marginal product, the value of the marginal product; the cost is the wage.

$$P \times MP_L = w$$

The rule at work at Iringa: if tomatoes fetch TShs 800 a kilogramme and a picker costs TShs 12,000 a day, he is worth hiring while he brings in $12{,}000 \div 800 = 15$ kilogrammes. The grower stops at the first who does not, a definite point inside Stage II.

A higher product price pushes deeper into Stage II: the same marginal product is worth more shillings, so a worker not worth hiring becomes worth hiring and the point slides towards C, but never past C, where marginal product turns negative.

A higher wage pulls it back towards B: a dearer worker must clear more output, so the point moves back towards B. If the wage rises above the value of the greatest average product the producer closes down rather than slip into Stage I, since no level of employment would cover the wage bill.

The same boundaries on an isoquant map: when both factors vary, the edges of the economic region appear as two lines from the origin through the points where the isoquants turn back on themselves. These are the ridge lines, and every efficient combination lies between them.

The Master Key: *Technology gives you Stage II; prices give you the point inside it, where* $P \times MP_L = w$.

REAL Question 100

Follow one hectare of paddy at Ikwiriri in Rufiji as the sons and daughters of the household come home from town, one by one, and each takes up a hoe.

Complete the average and marginal product columns for the plot, identify the range of labour that falls in each stage of production, and state how far the household should go.

Mzee Chande farms one hectare of mpunga (paddy) at Ikwiriri in Rufiji. The plot, the hoes and the seed do not change from one season to the next.

Only the number of family members working the plot changes.

Output for the season, in sacks of paddy of 50 kilogrammes each, against the number of workers:

Workers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Sacks: 0, 5, 14, 24, 34, 42, 46, 48, 48, 45

Model Answer

The hectare is in Stage I to the fourth worker, Stage II from the fourth to the eighth, Stage III from the ninth, so the household should never send a ninth person and, if it pays wages, should stop before the eighth.

Average product is the total divided by the workers; marginal product is the change in the total from one more worker. For the fourth and fifth:

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = \frac{34}{4} = 8.5$$

$$\mathrm{MP_L} = \frac{\Delta\,\mathrm{Q}}{\Delta\,\mathrm{L}} = \frac{42 - 34}{5 - 4} = 8$$

Workers (L)	Total product (sacks)	Average product	Marginal product	Stage
0	0	-	-	-
1	5	5.00	5	I
2	14	7.00	9	I
3	24	8.00	10	I
4	34	8.50	10	End of I
5	42	8.40	8	II
6	46	7.67	4	II
7	48	6.86	2	II
8	48	6.00	0	End of II
9	45	5.00	-3	III

One season on one fixed hectare of Rufiji paddy, with the stages read off.

Stage I, the first worker to the fourth: average product climbs from 5.00 to 8.50 sacks and peaks at the fourth, with marginal product above it throughout, 10 against 8.50 at the fourth. One person cannot weed, guard and harvest a whole hectare, so the land is underused.

The first boundary: the fourth worker ends Stage I: average product is highest there at 8.50 sacks and the fifth worker's marginal product of 8 has fallen below it. In whole workers the crossing shows as the last row before the average turns down.

Stage II, the fourth worker to the eighth: average product falls from 8.50 to 6.00 sacks but stays positive, and marginal product falls from 8 to 0 while staying below it. Total product climbs throughout, from 34 sacks to 48, so each of these workers still adds something.

Stage III, the ninth worker: the harvest falls from 48 sacks to 45, so the ninth worker's marginal product is a loss of 3 sacks. Nine people on one hectare trample seedlings, wait for the same hoes and get in one another's way.

How far the household should go: never as far as the ninth, since at TShs 60,000 a sack that person removes 3 sacks worth TShs 180,000. The eighth adds nothing, so if he can earn even a small wage elsewhere he should take it.

The sixth and seventh add 4 and 2 sacks, so an unpaid household member is worth keeping in either place. A hired kibarua, that is, a casual labourer, at TShs 150,000 a season is another matter: the sixth's 4 sacks fetch TShs 240,000 and cover the wage, the seventh's 2 sacks only TShs 120,000.

The Master Key: *Read down the marginal column: above the average is Stage I, below it but positive is Stage II, below zero is Stage III.*

REAL Question 101

A boat at Kirumba beach takes on one more crewman each night and watches the catch climb, then level, then fall. The net never changed size, and neither did the lake.

Identify the three stages of production from the boat's record, then calculate how many crew Juma should carry at the prices given, and say what happens to that number if the price of dagaa rises to TShs 1,500 a kilogramme.

Juma owns one boat, one lift net and two pressure lamps at Kirumba in Mwanza. Nothing about the boat or the net changes from night to night.

Only the size of the crew changes. The figures are the average catch of dagaa (freshwater sardine) for one night, in kilogrammes.

Crew: 1, 2, 3, 4, 5, 6, 7, 8, 9

Catch: 50, 110, 168, 220, 264, 294, 308, 308, 288

Each crewman is paid TShs 20,000 a night. Fresh dagaa sells at the beach for TShs 700 a kilogramme.

Model Answer

The boat is in Stage I up to the third crewman, in Stage II from the third to the eighth and in Stage III from the ninth, and Juma should carry six crew, rising to seven if dagaa reaches TShs 1,500 a kilogramme.

Work out the average catch per crewman and the extra catch each brings, then value it at TShs 700 a kilogramme.

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = \frac{168}{3} = 56$$

$$\mathrm{MP_L} = \frac{\Delta\,\mathrm{Q}}{\Delta\,\mathrm{L}} = \frac{294 - 264}{6 - 5} = 30$$

Crew (L)	Catch (kg)	Average product (kg)	Marginal product (kg)	Value of $\mathrm{MP_L}$ (TShs)
1	50	50.0	50	35,000
2	110	55.0	60	42,000
3	168	56.0	58	40,600
4	220	55.0	52	36,400
5	264	52.8	44	30,800
6	294	49.0	30	21,000
7	308	44.0	14	9,800
8	308	38.5	0	0
9	288	32.0	-20	-14,000

One night's dagaa from one fixed boat and net at Kirumba, valued at TShs 700 a kilogramme.

Stage I, the first crewman to the third: average product rises from 50.0 to 56.0 kilogrammes and peaks at the third crewman, with marginal product above it throughout, 58 against 56.0 at the third. Two men cannot shoot, hold and haul a lift net, so the gear is underused.

Stage II, the third crewman to the eighth: average product falls from 56.0 to 38.5 kilogrammes but stays positive, and marginal product falls to 0 while remaining positive and below the average. The catch still rises, to its greatest value of 308 kilogrammes.

Stage III, the ninth crewman: the catch falls from 308 to 288 kilogrammes, a marginal product of minus 20. The boat is so crowded that the net cannot be worked cleanly, and Juma would pay TShs 20,000 to lose TShs 14,000 of fish.

Stage II is five crewmen wide, so Juma takes on a crewman while the value of what that man adds is at least what he costs.

$$\text{Hire while} \quad P \times MP_L \geq w$$

$$700 \times 30 = 21{,}000 \geq 20{,}000 \quad \text{(the sixth)}$$

$$700 \times 14 = 9{,}800 < 20{,}000 \quad \text{(the seventh)}$$

The answer is six crew: the sixth man brings in TShs 21,000 of dagaa for a wage of TShs 20,000; the seventh brings in TShs 9,800 and loses TShs 10,200 a night. Six crew land 294 kilogrammes worth TShs 205,800 against TShs 120,000 of wages, leaving TShs 85,800 for the boat, net and fuel.

Check it against the seventh: with seven crew the catch is worth TShs 215,600 and wages TShs 140,000, leaving TShs 75,600, so the extra 14 kilogrammes did not pay for the extra man.

If dagaa reaches TShs 1,500 a kilogramme: the seventh man's 14 kilogrammes are now worth $1{,}500 \times 14 = 21{,}000$ shillings, which clears the wage, so Juma takes him on: TShs 322,000 left against TShs 321,000 with six. The eighth adds nothing and the ninth destroys 20 kilogrammes, so no price brings either aboard.

The price of fish moved Juma deeper into Stage II and a higher wage would move him back, but nothing carries him past the eighth crewman into Stage III.

The Master Key: *The stages say which crew are possible; the price of the catch and the wage say which crew is best.*

HOT Question 102

A visitor to a Rufiji village counts eleven people weeding one hectare and calls it hidden unemployment. The household counts eleven people who will eat that evening, and calls it survival.

A commentator argues that the many family members working a small plot in rural Tanzania are producing in Stage III, and that this is what disguised unemployment really means. Assess this argument.

Model Answer

The commentator is right that crowded family plots are where disguised unemployment lives, but wrong to place them in Stage III: the household is more likely deep in Stage II, where the last worker's marginal product is small but still positive.

What the argument gets right: a fixed hectare worked by a growing family is the setting of the law of variable proportions: as members are added with no more land, marginal product falls towards zero, so the last worker could be withdrawn and the harvest scarcely change.

Stage III is touched, not inhabited: at the weeding and harvest peaks a plot can be overcrowded, seedlings trampled and tools shared, and marginal product really is negative. But if the eleventh person cut the harvest all season the household would feel it in the granary and send him to fetch water or mind the goats.

The household is not a wage paying firm: a firm stops where the value of the marginal product equals the wage, well inside Stage II. The household shares the harvest instead, and for a member with nowhere else to go the alternative is no income, so it keeps him while he adds anything and rests near $MP_L = 0$.

The seasonal reading is the honest one: rural labour is not needed evenly through the year: at transplanting and harvest almost every pair of hands has a large positive product, and for many weeks between they have nothing to do. The label is a yearly average, not a permanent state.

Where the argument still bites: if the last workers really do have a marginal product near zero, moving them off the land costs almost no food: that is the case for off farm work, for SIDO workshops and for the towns, and two young people can go to Dar es Salaam with no harvest lost.

The other remedy is to move the curve: the crowding exists only because the fixed factor is fixed. Irrigation in the Rufiji basin, better seed or a power tiller lifts the total product curve and carries the peak of average product to the right, so the same eleven people are back inside Stage II.

He is right in spirit and wrong in detail: the diagnosis should read late Stage II, with marginal product near zero, though the policy he wants still follows. Stage III claims the plot would yield more if somebody stopped working, which the evidence rarely supports.

The Master Key: *Disguised unemployment is a marginal product near zero, not below it: the end of Stage II, not Stage III.*

HOT Question 103

Theory says every surviving producer sits in Stage II. Walk through an industrial estate at Ubungo and count the hands standing idle beside a machine nobody can afford to feed.

Discuss the view that Stage II describes where firms actually produce, rather than merely where economists say they ought to produce.

Model Answer

Stage II is a prediction about producers who pay full price for every input and face competition, so it holds well for the commercial firm in an open market and badly for the household farm, the sheltered monopoly and the credit starved firm.

The case for it, since cost presses continuously: a firm that hires into Stage III pays wages to reduce its own output, while a firm stranded in Stage I leaves output on the table that its rivals collect. Neither survives long where producers compete for the same customers.

Producers obey the rule without knowing it: no fundi in Kariakoo computes a derivative. He notices that the fourth tailor waits half the day for the machine, and he stops hiring. The theory describes what he does rather than instructing him, as a good positive theory should.

Against it, unpaid labour changes the rule: the family farm pays no wage, so it does not stop where the value of the marginal product equals the wage but pushes to the very end of Stage II and sometimes past it. Since much Tanzanian production is household production, that is a large exception.

Credit can strand a firm inside Stage I: a Singida oil press that cannot buy enough sunflower seed sits in Stage I with the machine idle half the day, not by choice but because working capital is dear. It would move tomorrow if a bank lent at a sensible rate.

Obligations can hold a firm in Stage III: a state owned enterprise told to keep employment up, or a firm for which dismissal is slow and costly, may carry more workers than the plant can use, so the extra hands get in the way and output falls. The firm is not free to obey the rule.

Nobody can see the boundaries: marginal product is not printed on any invoice. A producer cannot know that the peak of average product falls at 6.3 workers, and labour comes in whole people, so even a firm that wants Stage II can only be near it.

Stage II is a tendency rather than a law of observation, earning its keep as a prediction about survivors. The sharper the competition and the more fully the producer pays for his inputs, the better it fits; elsewhere, look for the reason producers are outside it.

The Master Key: *Stage II describes the firm that pays for all its inputs and faces rivals; everywhere else it is advice, not description.*

HOT Question 104

A Mtwara cashew processor hires up to the point where marginal product falls to zero. He has the largest output on the street, and he loses money every day.

Advise a producer who intends to employ labour up to the end of Stage II, where marginal product is zero and total product is at its maximum, on whether this is the right rule to follow.

Model Answer

It is the wrong rule in nearly every case: the end of Stage II gives the greatest output, not the greatest profit, and a producer who pays for labour should stop at the last worker whose value of marginal product still covers the wage.

The greatest output is not the greatest profit: the last worker in Stage II has a marginal product of zero, adding nothing to the sacks leaving the shed and a full day's wage to the cost. Hiring him is a pure loss, as is hiring the man before him whose output is worth less than a day's pay.

The rule the producer should use instead: take on labour while the value of the marginal product is at least the wage, and stop at the first worker for whom it is not.

$$P \times MP_L \geq w$$

What that means at Mtwara: if shelled cashew sells at TShs 2,500 a kilogramme and a shelling hand costs TShs 15,000 a day, he is worth taking on only while he adds $15{,}000 \div 2{,}500 = 6$ kilogrammes. The processor stops at the last worker who clears that much, in the middle of Stage II, not at its end.

The rule moves with the market: a higher price or a lower wage lowers the output a worker must clear, so the stopping point slides towards the end of Stage II, and a price collapse pulls it back. His employment is not a fixed technical number but changes with prices.

When the producer is right after all: if labour genuinely costs nothing at the margin his rule becomes correct. A household using its own labour when there is no other work has an opportunity cost of zero and should go to $MP_L = 0$, as should a producer under contract to deliver the greatest quantity.

One part of his instinct is sound: he is right never to go beyond it: the end of Stage II is a ceiling no price can lift, since past it marginal product is negative and extra workers cost money to destroy output.

One refinement if he is large: the rule assumes he can sell all he produces at the going price. If selling more cashew pushes the price down, he should compare the wage with marginal revenue times marginal product, which stops him earlier.

Treat the end of Stage II as a fence, not a destination: work out what a day's wage is worth in kilogrammes at today's price, hire while the last worker clears that much, and recalculate whenever either moves.

The Master Key: *Maximum output is a fence at the end of Stage II; maximum profit is wherever the last worker's output just pays his wage.*

Product Curves by Calculus

A schedule gives the average and the marginal product only at the points somebody happened to write down. A function gives them everywhere, and a derivative finds the exact worker at which each curve turns. This section takes total product functions from six Tanzanian producers, divides to obtain average product, differentiates to obtain marginal product, and locates the three levels of the variable factor every producer needs: where marginal product peaks, where average product peaks, and where output itself stops rising.

BINDER Question 105

The owner of a Makambako mill can feel that his tenth worker adds nothing. He cannot say where the nothing begins. A derivative can, and to the exact worker.

A maize mill at Makambako has the total product function $Q = 12L^2 - 0.8L^3$, where Q is sacks of sembe (maize flour) milled in a day and L is the number of workers employed in the day. Derive the average product and the marginal product of labour, find the number of workers that maximises total output, and state the output produced there.

Model Answer

Dividing the function by L gives $AP_L = 12L - 0.8L^2$, differentiating it gives $MP_L = 24L - 2.4L^2$, and setting marginal product to zero gives ten workers, at which the mill turns out 400 sacks a day.

Average product is a ratio, found by division; marginal product is a rate of change, found by differentiation. Confusing the two is the commonest fault here.

$$Q = 12L^2 - 0.8L^3$$

Average product by division: divide the total product function by the units of labour employed, since average product is output per worker.

$$AP_L = \frac{Q}{L} = \frac{12L^2 - 0.8L^3}{L}$$

$$AP_L = 12L - 0.8L^2$$

Marginal product by differentiation: differentiate total product with respect to labour: marginal product is the addition made by one more worker, which is the slope of the total product curve, and a slope is a derivative.

$$MP_L = \frac{\partial Q}{\partial L} = 24L - 2.4L^2$$

Total output is greatest where its slope is zero, and the slope is the marginal product, so the condition is $MP_L = 0$.

$$24L - 2.4L^2 = 0$$

$$L(24 - 2.4L) = 0$$

$$24 - 2.4L = 0$$

$$2.4L = 24$$

$$L = \frac{24}{2.4} = 10 \text{ workers}$$

Testing that ten is a peak, not a trough: a zero first derivative says only that the curve is flat, and a curve is flat at the bottom of a valley as well as the top of a hill. For a maximum the second derivative must be negative.

$$\frac{\partial MP_L}{\partial L} = 24 - 4.8L$$

$$24 - 4.8(10) = 24 - 48 = -24$$

The second derivative is negative, so ten workers is the top of the hill. Substituting ten into the original function gives the output there.

$$Q = 12(10)^2 - 0.8(10)^3 = 1{,}200 - 800 = 400 \text{ sacks}$$

Reading ten workers back to the miller: it is a ceiling, not a target. The tenth worker adds nothing, since $MP_L = 240 - 240 = 0$, yet draws a full wage, so output per worker slips to $400 \div 10 = 40$ sacks.

What lies beyond ten: an eleventh worker pushes output down to 387.2 sacks, since marginal product at eleven is $264 - 290.4 = -26.4$. The mill would pay a wage to mill 12.8 sacks fewer.

The Master Key: *Divide for the average, differentiate for the marginal, and set the marginal to zero for the top of the total.*

BINDER Question 106

A Makambako miller wants the most flour from each pair of hands, not the most flour altogether. Those are different numbers of workers, and one of them is not a whole number.

For the same mill, whose total product function is $Q = 12L^2 - 0.8L^3$, find the number of workers at which average product is greatest, show that marginal product equals average product at that number, and explain what the miller does when the answer is not a whole number.

Model Answer

Average product is greatest at seven and a half workers, where average and marginal product are both 45 sacks, and since half a worker cannot be hired the miller takes eight, who deliver 44.8 sacks each.

Average product is itself a function of labour, so maximise it as total product was maximised: differentiate and set the derivative to zero.

$$\mathrm{AP_L} = 12\mathrm{L} - 0.8\mathrm{L}^2$$

$$\frac{\partial\, \mathrm{AP_L}}{\partial\, \mathrm{L}} = 12 - 1.6\mathrm{L}$$

$$12 - 1.6\mathrm{L} = 0$$

$$1.6\mathrm{L} = 12$$

$$\mathrm{L} = \frac{12}{1.6} = 7.5 \text{ workers}$$

The second order condition: differentiating $12 - 1.6\mathrm{L}$ again gives -1.6, negative for every L, so 7.5 workers is certainly a maximum. Negative means a peak, positive a trough.

Now substitute 7.5 into both the average and the marginal product functions.

$$\mathrm{AP_L} = 12(7.5) - 0.8(7.5)^2 = 90 - 45 = 45 \text{ sacks}$$

$$\mathrm{MP_L} = 24(7.5) - 2.4(7.5)^2 = 180 - 135 = 45 \text{ sacks}$$

The two are equal, and that is no accident: average product peaks precisely where marginal product equals it, so the crossing is an algebraic necessity and a free check: if your answer does not make $\mathrm{MP_L} = \mathrm{AP_L}$, there is a slip somewhere.

The total product at that labour confirms the average from the other direction.

$$\mathrm{Q} = 12(7.5)^2 - 0.8(7.5)^3 = 675 - 337.5 = 337.5 \text{ sacks}$$

$$\mathrm{AP_L} = \frac{337.5}{7.5} = 45 \text{ sacks}$$

Labour is lumpy, so round to a hiring decision: nobody hires half a worker. Either side gives $\mathrm{AP_L} = 44.8$ sacks, identical because 7.5 sits halfway between, so the miller takes eight, who mill 358.4 sacks against the 313.6 that seven mill.

What the rounding costs him: at TShs 12,000 a day a sack costs TShs 266.67 in labour at 7.5 workers against TShs 267.86 at eight, so rounding costs about TShs 1.20 a sack, TShs 400 a day, which he can close by keeping seven and hiring a kibarua, a casual labourer, for half a day.

Why 7.5 is the number that matters: at seven and a half each pair of hands produces more flour than at any other manning level, so the wage bill buys the most sacks it can. Below it the mill is underworked; above it the grinders are crowded.

The Master Key: *Average product peaks where marginal product is equal to it, and a fractional answer is rounded to whichever whole number the producer can actually hire.*

BINDER Question 107

A Mwanza fisherman's average catch rises only on a day when he beats his own average. Average and marginal product obey the very same rule, and one line of calculus proves it.

Prove by differentiation that average product is at a maximum where marginal product equals average product, and state the rule that follows about when average product rises and when it falls.

Model Answer

Differentiating $\mathrm{AP_L} = \mathrm{Q}/\mathrm{L}$ **as a quotient gives** $(\mathrm{MP_L} - \mathrm{AP_L}) \div \mathrm{L}$**, so average product rises while marginal product is above it, falls while it is below, and is stationary only where the two are equal.**

Differentiate $\mathrm{AP_L} = \mathrm{Q/L}$ as a quotient, remembering that Q is a function of L whose derivative is the marginal product.

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}}$$

$$\frac{\partial\, \mathrm{AP_L}}{\partial\, \mathrm{L}} = \frac{\mathrm{L} \times \mathrm{MP_L} - \mathrm{Q}}{\mathrm{L}^2}$$

$$\frac{\partial\, \mathrm{AP_L}}{\partial\, \mathrm{L}} = \frac{1}{\mathrm{L}}\left(\mathrm{MP_L} - \frac{\mathrm{Q}}{\mathrm{L}}\right)$$

$$\frac{\partial\, \mathrm{AP_L}}{\partial\, \mathrm{L}} = \frac{\mathrm{MP_L} - \mathrm{AP_L}}{\mathrm{L}}$$

The condition for the maximum: a maximum requires the first derivative to be zero. Labour is positive whenever anybody works, so the fraction vanishes only if its numerator does, which means $\mathrm{MP_L} = \mathrm{AP_L}$.

When average product is rising: if $\mathrm{MP_L} > \mathrm{AP_L}$ the numerator is positive, so average product climbs: the worker just added produces more than the others average and pulls it up behind him.

When average product is falling: if $\mathrm{MP_L} < \mathrm{AP_L}$ the numerator is negative, so average product slides: the newcomer produces less than the existing average and drags it down, though he still adds to the total.

Check it on the Makambako mill, where $\mathrm{AP_L} = 12\mathrm{L} - 0.8\mathrm{L}^2$ and $\mathrm{MP_L} = 24\mathrm{L} - 2.4\mathrm{L}^2$. At five workers the marginal is far above.

$$\mathrm{MP_L}(5) = 120 - 60 = 60 \quad \mathrm{AP_L}(5) = 60 - 20 = 40$$

At nine workers it has fallen well below.

$$\mathrm{MP_L}(9) = 216 - 194.4 = 21.6 \quad \mathrm{AP_L}(9) = 108 - 64.8 = 43.2$$

Between a rise and a fall there must be a point doing neither, and that is 7.5 workers, where both stand at 45 sacks.

Why the fisherman is the right picture: a Mwanza fisherman averaging 40 kilogrammes lands 60 today and his average rises; tomorrow he lands 21.6 and it falls. Any average and its margin behave alike, which is why the shape returns for marginal and average cost.

What the rule is worth in practice: a producer need not compute the whole curve to know which way it heads, only compare what the last worker added with what the others average. Beat the house average and the house average rises.

The Master Key: *Marginal product pulls average product towards itself: above it the average rises, below it the average falls, equal to it the average is at its peak.*

BINDER Question 108

At a Kirumba dagaa yard the work gets easier and easier to add hands to, until one morning it does not. That morning sits at an exact number of workers.

A dagaa drying yard at Kirumba in Mwanza has the total product function $\mathrm{Q} = 15\mathrm{L}^2 - 0.5\mathrm{L}^3$, where Q is kilogrammes of dagaa (small dried lake sardines) spread, turned and bagged in a day and L is the number of workers. Find the number of workers at which marginal product is greatest, state the marginal product there, and explain what is happening to total product at that number.

Model Answer

Marginal product is greatest at ten workers, where it stands at 150 kilogrammes, and ten is the point of inflection of the total product curve, where output stops rising at an increasing rate and begins to rise at a decreasing rate.

Differentiate marginal product and set the derivative to zero. Since it is already the first derivative of total product, its own derivative is the second, which speaks of shape, not height.

$$\mathrm{Q} = 15\mathrm{L}^2 - 0.5\mathrm{L}^3$$

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = 15\mathrm{L} - 0.5\mathrm{L}^2$$

$$\mathrm{MP_L} = \frac{\partial\,\mathrm{Q}}{\partial\,\mathrm{L}} = 30\mathrm{L} - 1.5\mathrm{L}^2$$

$$\frac{\partial\,\mathrm{MP_L}}{\partial\,\mathrm{L}} = 30 - 3\mathrm{L}$$

$$30 - 3\mathrm{L} = 0$$

$$3\mathrm{L} = 30$$

$$\mathrm{L} = 10 \text{ workers}$$

The second order condition: differentiating $30 - 3\mathrm{L}$ again gives -3, negative, so ten workers is where marginal product is greatest and not least.

$$\mathrm{MP_L} = 30(10) - 1.5(10)^2 = 300 - 150 = 150 \text{ kg}$$

What is happening to total product at ten workers: output is still climbing, faster than at any other manning level. What ends at ten is not growth but acceleration: the tenth worker is the last to add more than the one before.

$$\mathrm{Q} = 15(10)^2 - 0.5(10)^3 = 1{,}500 - 500 = 1{,}000 \text{ kg}$$

The point of inflection in plain words: up to ten the curve rises at an increasing rate, each hand more useful than the last because the racks are still empty. From the eleventh it rises at a decreasing rate, marginal product slipping to 148.5 against 150, where diminishing returns take hold.

The other two turning points follow. Average product is greatest where its own derivative vanishes.

$$\frac{\partial\,\mathrm{AP_L}}{\partial\,\mathrm{L}} = 15 - \mathrm{L} = 0 \quad \mathrm{L} = 15 \text{ workers}$$

$$\mathrm{AP_L}(15) = 225 - 112.5 = 112.5 \quad \mathrm{MP_L}(15) = 450 - 337.5 = 112.5$$

Total product is greatest where marginal product itself vanishes.

$$30\mathrm{L} - 1.5\mathrm{L}^2 = 0 \quad \mathrm{L}(30 - 1.5\mathrm{L}) = 0 \quad \mathrm{L} = 20 \text{ workers}$$

$$\mathrm{Q} = 15(20)^2 - 0.5(20)^3 = 6{,}000 - 4{,}000 = 2{,}000 \text{ kg}$$

Which of the three numbers matters most: not ten and not twenty. Ten is where the good news slows; twenty is a ceiling, since the twentieth worker adds nothing and is paid in full. The working range is fifteen to twenty, and the wage picks the point inside it.

Why diminishing returns start before any trouble shows: the yard is not in difficulty at ten; it is at its most vigorous. Diminishing returns mean not that output is falling but that its climb has slackened, because the racks and drying space are fixed and each worker gets a smaller share.

The Master Key: *Marginal product peaks at the point of inflection of total product, which is where diminishing returns begin, not where output begins to fall.*

BINDER Question 109

An Iringa packing shed, a Dodoma press and a Kilombero cane block run on three different cubic functions. Their three turning points still fall in the same proportion, two to three to four.

Take the general total product function $\mathrm{Q} = \mathrm{aL}^2 - \mathrm{bL}^3$, in which a and b are positive constants. Show that the labour at which marginal product is greatest, the labour at which average product is greatest and the labour at which total product is greatest always stand in the ratio 2 to 3 to 4, then check the result on the function $\mathrm{Q} = 6\mathrm{L}^2 - \mathrm{L}^3$ of a tomato packing shed at Iringa, where Q is crates packed in a day and L is the number of packers.

Model Answer

The three turning points fall at $\mathrm{L} = \frac{\mathrm{a}}{3\mathrm{b}}$, $\mathrm{L} = \frac{\mathrm{a}}{2\mathrm{b}}$ and $\mathrm{L} = \frac{2\mathrm{a}}{3\mathrm{b}}$, which are in the ratio 2 to 3 to 4, so at the Iringa shed they are two packers, three packers and four packers.

Work the general function once and every particular case follows by two divisions. Begin by deriving the two product curves.

$$\mathrm{Q} = \mathrm{aL}^2 - \mathrm{bL}^3$$

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = \mathrm{aL} - \mathrm{bL}^2$$

$$\mathrm{MP_L} = \frac{\partial\,\mathrm{Q}}{\partial\,\mathrm{L}} = 2\mathrm{aL} - 3\mathrm{bL}^2$$

Where marginal product is greatest: differentiate marginal product and set the derivative to zero. The second derivative is $-6\mathrm{b}$, negative because b is positive, so this is a maximum.

$$\frac{\partial\,\mathrm{MP_L}}{\partial\,\mathrm{L}} = 2\mathrm{a} - 6\mathrm{bL} = 0$$

$$\mathrm{L} = \frac{2\mathrm{a}}{6\mathrm{b}} = \frac{\mathrm{a}}{3\mathrm{b}}$$

Where average product is greatest: differentiate average product and set the derivative to zero. The second derivative is $-2\mathrm{b}$, again negative, so again a maximum.

$$\frac{\partial\,\mathrm{AP_L}}{\partial\,\mathrm{L}} = \mathrm{a} - 2\mathrm{bL} = 0$$

$$\mathrm{L} = \frac{\mathrm{a}}{2\mathrm{b}}$$

Where total product is greatest: set marginal product itself to zero, since the total product curve is flat at its summit.

$$2\mathrm{aL} - 3\mathrm{bL}^2 = 0 \quad \mathrm{L}(\,2\mathrm{a} - 3\mathrm{bL}\,) = 0$$

$$\mathrm{L} = \frac{2\mathrm{a}}{3\mathrm{b}}$$

Divide all three by $\frac{\mathrm{a}}{6\mathrm{b}}$, a positive quantity, which changes the scale without disturbing the order.

$$\frac{\mathrm{a}}{3\mathrm{b}} : \frac{\mathrm{a}}{2\mathrm{b}} : \frac{2\mathrm{a}}{3\mathrm{b}} = 2 : 3 : 4$$

The check on the Iringa shed: here $\mathrm{a} = 6$ and $\mathrm{b} = 1$, so the three come out at two, three and four packers. The long way agrees: $\mathrm{MP_L}$ peaks at two packers at 12 crates, $\mathrm{AP_L}$ at three at 9 crates where marginal product has also fallen to 9, and total product at four with 32 crates.

$$\frac{\partial\,\mathrm{MP_L}}{\partial\,\mathrm{L}} = 12 - 6\mathrm{L} = 0 \quad \mathrm{L} = 2 \text{ packers}$$

$$\frac{\partial\,\mathrm{AP_L}}{\partial\,\mathrm{L}} = 6 - 2\mathrm{L} = 0 \quad \mathrm{L} = 3 \text{ packers}$$

$$12\mathrm{L} - 3\mathrm{L}^2 = 0 \quad \mathrm{L} = 4 \text{ packers}$$

a	b	L where MP peaks	L where AP peaks	L where TP peaks
6	1	2	3	4
9	1	3	4.5	6
12	0.8	5	7.5	10
24	2	4	6	8
15	0.5	10	15	20

Five pairs of constants, and in every one of them the three turning points stand in the ratio 2 to 3 to 4.

The heights are as tidy as the positions: substituting each turning point back gives marginal product peaking at $\frac{\mathrm{a}^2}{3\mathrm{b}}$, average product at $\frac{\mathrm{a}^2}{4\mathrm{b}}$ and total product at $\frac{4\mathrm{a}^3}{27\mathrm{b}^2}$. For the Iringa shed those are 12, 9 and 32 crates.

Why the rule is worth carrying: it turns a page of differentiation into three divisions and gives an instant check, since the average product peak always sits three quarters of the way to the output peak, making the good stretch the last quarter of the journey.

The Master Key: *For any* $Q = aL^2 - bL^3$ *the peaks of marginal, average and total product sit at* $a/3b$, $a/2b$ *and* $2a/3b$, *always in the ratio two to three to four.*

REAL Question 110

Follow one cane block at Kilombero through a single morning. Add cutters and the tonnage climbs, then crawls, then falls, and the manager wants to know exactly where each turn happens.

Using the record in the box, derive the average and marginal product of a cutter, find the number of cutters at which each of the three product curves reaches its peak, calculate the labour cost of a tonne at the two numbers that matter, and advise the block manager.

A cane block at Kilombero is cut by hand. The land, the tractor and the trailer serving the block are fixed for the season.

Last season's records give the total product function $Q = 1.5L^2 - 0.125L^3$, where Q is tonnes of cane cut and stacked in a day and L is the number of cutters in the gang.

Every cutter is paid TShs 14,000 for the day, whatever the gang cuts.

Cut cane must reach the mill within a day, and the block must be cleared before the rains.

Model Answer

The gang's marginal product peaks at four cutters, average product at six and the total cut at eight, so never more than eight, and if he is judged on cost he sends six, where a tonne costs TShs 3,111 in wages against TShs 3,500 at eight.

Take the function as the record gives it, dividing for the average and differentiating for the marginal.

$$Q = 1.5L^2 - 0.125L^3$$

$$AP_L = \frac{Q}{L} = 1.5L - 0.125L^2$$

$$MP_L = \frac{\partial Q}{\partial L} = 3L - 0.375L^2$$

Where marginal product peaks: differentiate marginal product and set it to zero. The second derivative is -0.75, negative, so this is a peak.

$$\frac{\partial MP_L}{\partial L} = 3 - 0.75L = 0$$

$$L = \frac{3}{0.75} = 4 \text{ cutters}$$

$$MP_L(4) = 12 - 6 = 6 \text{ tonnes}$$

Where average product peaks: differentiate average product and set it to zero. At six cutters marginal product has fallen to the same figure, as it must at the peak of an average.

$$\frac{\partial AP_L}{\partial L} = 1.5 - 0.25L = 0$$

$$L = \frac{1.5}{0.25} = 6 \text{ cutters}$$

$$AP_L(6) = 9 - 4.5 = 4.5 \quad MP_L(6) = 18 - 13.5 = 4.5 \text{ tonnes}$$

Where the day's cut peaks: set marginal product to zero. Eight cutters take 32 tonnes off the block, and the eighth adds nothing at all for his TShs 14,000.

$$3L - 0.375L^2 = 0 \quad L(3 - 0.375L) = 0$$

$$L = \frac{3}{0.375} = 8 \text{ cutters}$$

$$Q(8) = 1.5(64) - 0.125(512) = 96 - 64 = 32 \text{ tonnes}$$

$$Q(6) = 1.5(36) - 0.125(216) = 54 - 27 = 27 \text{ tonnes}$$

Labour cost a tonne is the wage bill over the tonnes cut, that is the wage over average product, so it is lowest where average product is highest.

$$\text{Cost a tonne at } L = 6\text{: } \frac{6 \times 14{,}000}{27} = \frac{84{,}000}{27} \approx 3{,}111$$

$$\text{Cost a tonne at } L = 8\text{: } \frac{8 \times 14{,}000}{32} = \frac{112{,}000}{32} = 3{,}500$$

The first piece of advice is a prohibition: never send more than eight cutters. A ninth costs a further TShs 14,000 and cuts the day's tonnage to 30.375, because nine men on one block tread the standing rows and wait on one another.

The second is a genuine choice between six and eight: six cutters give the cheapest tonne, TShs 3,111, and take 27 tonnes off the block; eight give the biggest day, 32 tonnes, at TShs 3,500 a tonne. The five extra tonnes cost TShs 389 more a tonne.

How the manager should decide: if the mill can take the cane whenever it comes and cost is his only worry, he sends six and clears the block over more days. If the crusher waits or the rains are near, five extra tonnes a day are worth far more than TShs 389 a tonne and he sends eight.

He must not judge the gang by tonnes per cutter. Output per cutter is best at six, but insisting on six for the look of that average buys a smaller day, and a block standing over into a second cutting day loses more in burnt cane than was saved in wages.

The Master Key: *Calculus gives the boundaries, six cutters and eight; the price of the cane and the nearness of the rains decide which point between them to stand on.*

REAL Question 111

The press at Dodoma has been running since six in the morning and the oil is still flowing. The question is not whether it flows but whether the hour pays for itself.

Using the record in the box, derive the average and marginal product of an hour of pressing, find the hour at which output per hour is greatest and the hour beyond which the day's output falls, then work out hour by hour how long the press should run and advise the owner.

A sunflower press at Dodoma works one expeller in one shed with one seed store. All three are fixed.

Seed is fed steadily all day, but as the machine heats and the screw wears, less oil is squeezed from each kilogramme, so the litres won in an hour fall as the day goes on.

The day's output follows $Q = 18L^2 - L^3$, where Q is litres of alizeti (sunflower) oil pressed in the day and L is the number of hours the press is run.

A litre sells for TShs 5,000 and the seed it took, after the seed cake has been sold back, cost TShs 3,500, so each litre carries TShs 1,500 towards the running of the press and the profit.

Power, the operator's crew and machine wear cost TShs 12,000 for every hour the press runs.

Model Answer

Output per hour is greatest at nine hours and the day's output stops rising at twelve, and since every hour up to the twelfth adds litres worth more than the TShs 12,000 it costs, the owner should run for twelve hours and stop.

The variable factor here is machine time, not people, but the mathematics does not care. Divide for the average, differentiate for the marginal.

$$Q = 18L^2 - L^3$$

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} = 18\mathrm{L} - \mathrm{L}^2$$

$$\mathrm{MP_L} = \frac{\partial\,\mathrm{Q}}{\partial\,\mathrm{L}} = 36\mathrm{L} - 3\mathrm{L}^2$$

The hour at which output per hour is greatest: set the derivative of average product to zero. At nine hours the press yields 81 litres an hour and marginal product has fallen to the same 81, as it must at an average's peak.

$$\frac{\partial\,\mathrm{AP_L}}{\partial\,\mathrm{L}} = 18 - 2\mathrm{L} = 0 \quad \mathrm{L} = 9 \text{ hours}$$

$$\mathrm{AP_L}(9) = 162 - 81 = 81 \quad \mathrm{MP_L}(9) = 324 - 243 = 81 \text{ litres an hour}$$

The hour beyond which the day's output falls: set marginal product to zero. The second derivative $36 - 6\mathrm{L}$ is -36 at twelve hours, and being negative confirms a maximum.

$$36\mathrm{L} - 3\mathrm{L}^2 = 0 \quad \mathrm{L}(\,36 - 3\mathrm{L}\,) = 0 \quad \mathrm{L} = 12 \text{ hours}$$

$$\mathrm{Q}(12) = 18(144) - 1{,}728 = 2{,}592 - 1{,}728 = 864 \text{ litres}$$

Nine hours and twelve are the ends of the sensible range; the point inside is settled by shillings. Set the litres each further hour brings against the TShs 12,000 it costs.

Hours run	Litres in the day	Litres added by that hour	Value of those litres (TShs)	Cost of that hour (TShs)
9	729	89	133,500	12,000
10	800	71	106,500	12,000
11	847	47	70,500	12,000
12	864	17	25,500	12,000
13	845	-19	-28,500	12,000

The Dodoma press hour by hour, with every litre valued at the TShs 1,500 it carries over and above its seed.

Reading the table: every hour up to the twelfth adds litres worth more than TShs 12,000, so every one earns its keep. The twelfth is narrowest: 17 litres worth TShs 25,500 against TShs 12,000, leaving TShs 13,500.

The thirteenth hour is a loss twice over: it costs TShs 12,000 in power and wages and destroys 19 litres worth TShs 28,500, leaving the owner TShs 40,500 poorer. Negative marginal product in money is an actual subtraction, paid for at full price.

Why output per hour is not the target: at nine hours a litre costs about TShs 148 to press, at twelve about TShs 167, output per hour having fallen to 72 litres. But the 135 extra litres are worth TShs 202,500 and cost only TShs 36,000: chasing the lowest cost a litre would leave him TShs 166,500 poorer.

A divisible factor makes the rounding problem vanish: hours can be cut as fine as the owner likes, so unlike a fractional worker a fractional answer is literal: 11.6 hours means stopping at eleven hours thirty six minutes.

So run for twelve hours and stop. Do not creep past twelve because the oil is still flowing: from there the day's total goes backwards, and paying to destroy one's own output is the worst bargain there is.

The Master Key: *Nine hours gives the cheapest litre and twelve hours gives the most litres; the price of the oil chooses between them, and past twelve nothing can choose, because output itself is falling.*

REAL Question 112

The shed at Mtwara has benches for twenty, and the calculus says hire thirteen and a third. Nobody has yet seen a third of a sheller report for work.

Using the record in the box, derive the average and marginal product of a sheller, find the number of shellers that maximises the day's output and the number that maximises output per sheller, deal with the fractional answer, and advise the shed how many shellers to put on the benches.

A cashew shelling shed at Mtwara has twenty hand cracking benches, one sorting table and one drying floor. All of these are fixed.

The shed's output follows $Q = 20L^2 - L^3$, where Q is kilogrammes of raw nuts cracked, sorted and bagged in a day and L is the number of shellers at the benches.

Every sheller is paid TShs 12,000 for the day.

The shed is paid TShs 300 for every kilogramme it cracks, sorts and delivers.

Model Answer

The day's output is greatest at thirteen and a third shellers, which no shed can hire, and output per sheller at ten, but the owner should put twelve on the benches, because the thirteenth brings in less than her wage.

Derive the two product curves, dividing for the average and differentiating for the marginal.

$$Q = 20L^2 - L^3$$

$$AP_L = \frac{Q}{L} = 20L - L^2$$

$$MP_L = \frac{\partial Q}{\partial L} = 40L - 3L^2$$

The output maximising number of shellers: set marginal product to zero and solve.

$$40L - 3L^2 = 0$$

$$L(40 - 3L) = 0$$

$$3L = 40$$

$$L = \frac{40}{3} = 13.33 \text{ shellers}$$

The second order condition: the derivative of marginal product is $40 - 6L$, which at 13.33 shellers is -40. Being negative, this is a maximum.

The output there is 1,185.19 kilogrammes, but no such day is ever worked, since a third of a sheller cannot be hired.

What the shed does about the fraction: test the whole numbers on either side. Thirteen shellers crack 1,183 kilogrammes and fourteen 1,176, so thirteen is the best the shed can reach; the two kilogrammes lost are the price of a worker's indivisibility.

$$Q(13) = 20(169) - 2{,}197 = 3{,}380 - 2{,}197 = 1{,}183 \text{ kg}$$

$$Q(14) = 20(196) - 2{,}744 = 3{,}920 - 2{,}744 = 1{,}176 \text{ kg}$$

The number that maximises output per sheller: set the derivative of average product to zero. At ten shellers each cracks 100 kilogrammes, marginal product has fallen to the same 100, and the shed handles 1,000 kilogrammes.

$$\frac{\partial AP_L}{\partial L} = 20 - 2L = 0 \quad L = 10 \text{ shellers}$$

$$\mathrm{AP_L}(10) = 200 - 100 = 100 \quad \mathrm{MP_L}(10) = 400 - 300 = 100 \text{ kg}$$

$$\mathrm{Q}(10) = 2{,}000 - 1{,}000 = 1{,}000 \text{ kg}$$

Neither is yet an answer. Labour cost a kilogramme is the wage bill divided by the kilogrammes cracked.

$$\text{At L} = 10\text{: } \frac{10 \times 12{,}000}{1{,}000} = 120 \text{ a kg}$$

$$\text{At L} = 13\text{: } \frac{13 \times 12{,}000}{1{,}183} = \frac{156{,}000}{1{,}183} \approx 131.87 \text{ a kg}$$

Why the cheapest kilogramme is not the answer: ten to thirteen adds 183 kilogrammes for TShs 36,000 in wages, about TShs 197 a kilogramme against the TShs 300 the shed is paid, so as a block it pays. But an average over three shellers hides a bad step at the end.

Taking the shellers one at a time: set each sheller against what she adds. The eleventh adds 89 kilogrammes worth TShs 26,700 against a wage of TShs 12,000, the twelfth 63 worth TShs 18,900, the thirteenth only 31 worth TShs 9,300, the first who does not pay.

$$\text{11th sheller: } 1{,}089 - 1{,}000 = 89 \text{ kg} \quad 89 \times 300 = 26{,}700$$

$$\text{12th sheller: } 1{,}152 - 1{,}089 = 63 \text{ kg} \quad 63 \times 300 = 18{,}900$$

$$\text{13th sheller: } 1{,}183 - 1{,}152 = 31 \text{ kg} \quad 31 \times 300 = 9{,}300$$

The same answer from the calculus: keep hiring while $300 \times \mathrm{MP_L}$ exceeds TShs 12,000, that is while marginal product is above 40 kilogrammes. At twelve $\mathrm{MP_L} = 48$, comfortably above; at thirteen it is 13, far below.

$$300 \times \mathrm{MP_L} = 12{,}000 \quad \mathrm{MP_L} = 40 \text{ kg}$$

What the three numbers mean to the owner: ten is the floor of the sensible range and 13.33 its ceiling; between them the wage and the cracking rate pick twelve. Ten leaves money on the drying floor, thirteen pays TShs 12,000 for TShs 9,300.

The Master Key: *Calculus finds the floor at ten shellers and the ceiling at thirteen and a third; the wage and the cracking rate pick twelve, and the thirteenth is the one who does not pay for herself.*

HOT Question 113

A Shinyanga ginnery manager has a fitted cubic on one printed sheet and a foreman of twenty seasons at his elbow. When the two disagree, which of them should he believe?

It is argued that once a producer has fitted a total product function, judgement is no longer needed, because the calculus tells him exactly how much of the variable factor to employ. Assess this claim.

A ginnery at Shinyanga has fitted last season's daily records to the total product function $\mathrm{Q} = 6\mathrm{L}^2 - 0.1\mathrm{L}^3$, where Q is kilogrammes of lint ginned in a day and L is the number of workers feeding, sorting and baling.

Its manager says: I need not argue with the foreman any more. The function tells me how many workers to put on the floor.

Model Answer

The claim is half true: the calculus fixes the boundaries of the sensible range more precisely than any experience can, yet cannot choose the point inside them, cannot be trusted beyond the stretch it was fitted to, and rests on assumptions a ginnery breaks each season.

Take the manager's own function. Dividing gives average product, differentiating gives marginal product, and the turning points follow.

$$\mathrm{AP_L} = 6\mathrm{L} - 0.1\mathrm{L}^2 \quad \mathrm{MP_L} = 12\mathrm{L} - 0.3\mathrm{L}^2$$

$$\frac{\partial \, \mathrm{AP_L}}{\partial \, \mathrm{L}} = 6 - 0.2\mathrm{L} = 0 \quad \mathrm{L} = 30 \text{ workers}$$

$$12\mathrm{L} - 0.3\mathrm{L}^2 = 0 \quad \mathrm{L}(12 - 0.3\mathrm{L}) = 0 \quad \mathrm{L} = 40 \text{ workers}$$

What the calculus settles beyond argument: no foreman, however long his service, can say that output per worker peaks at exactly thirty and the fortieth worker adds precisely nothing; a schedule in fives would miss both. Between thirty and forty lies the only region a rational ginnery should occupy.

What it cannot do, the important half: between thirty and forty the function is silent, because the choice depends on prices nowhere inside it. The deciding rule needs the price of lint and the daily wage, which no derivative supplies.

$$\mathrm{P} \times \mathrm{MP_L} = \mathrm{w}$$

The function is an estimate, not a law of nature: the cubic was fitted to one season's records. Better rain, new saw cylinders or a reorganised feeding line shifts both coefficients and all three turning points. Rerunning it without asking whether conditions hold automates the error.

The algebra runs on long past the sense: beyond sixty workers the fitted function turns negative, predicting $-4{,}900$ kilogrammes at seventy. Negative lint cannot happen: a cubic describes one stretch of a real curve and is nonsense outside it, and only judgement knows where that stretch ends.

$$\mathrm{Q}(70) = 29{,}400 - 34{,}300 = -4{,}900 \text{ kg}$$

The smooth curve rests on assumptions the floor breaks: the derivation assumes every unit of labour identical and technology unchanged. One fast baler is worth two slow ones, so the curve is an average hiding who reported that morning; and a second gin changes the fixed factor, forcing a refit.

The answer may not come in buyable units: the arithmetic will happily return 12.24 workers. Machine time can be cut to the minute, but people cannot, so the producer must round and then test which whole number serves him better.

The case for the manager, stated fairly: the foreman's alternative is worse: experience settles on last year's manning level and cannot say whether the thirty first worker is worth his wage. The function turns a vague sense into two exact numbers.

The calculus fences the field more accurately than memory could: under thirty wastes the plant, over forty destroys output. But it cannot choose the spot inside, nor warn him the function has gone stale. Steady conditions let him lean on it; changing ones leave the rest to judgement.

The Master Key: *Calculus fences the field and prices choose the spot inside it, and a derivative is only ever as honest as the function it is taken of.*

Returns to Scale

A miller who cannot enlarge his shed can only crowd more workers into it, and the tenth worker adds almost nothing. Give him three years and the shed itself becomes a decision. This section asks what happens to output when every input rises together in the same proportion: whether output runs ahead of the inputs, keeps step with them, or falls behind. The answer decides how large a firm ought to become, and where growth stops paying.

BINDER Question 114

The shed at a Mbeya mill is the one thing the miller cannot change this season. Give him three years and even the shed becomes a decision, and a different law takes over.

Define the long run and returns to scale, state the law of returns to scale, and use a schedule to show its three phases.

Model Answer

The long run is the period in which every factor input can be varied, and returns to scale describe how output responds when all inputs rise in the same proportion: more than proportionally, exactly proportionally or less.

The long run: the planning period in which no factor is fixed, so the firm changes the scale of the whole plant rather than crowding one factor onto a fixed one. A miller does not hire a sixth worker; he builds a second shed, buys a second mill and staffs it.

Returns to scale: the response of output when every input is increased in the same proportion. Two conditions hide there: every input must change, and each by the same percentage, so the ratio of capital to labour is unchanged.

The law of returns to scale: when all factor inputs rise in the same proportion, output may rise by a greater, the same or a smaller proportion. These are increasing, constant and decreasing returns to scale, and a growing firm commonly meets them in that order.

Carry a single number for the comparison. Let s be the proportional rise in output divided by the proportional rise in every input.

$$s = \frac{\text{proportional change in output}}{\text{proportional change in all inputs}}$$

Reading the coefficient: $s > 1$ is increasing returns to scale, $s = 1$ constant and $s < 1$ decreasing. The denominator is the same at every step, so only output is doing the talking.

Labour (workers)	Capital (presses)	Output (litres a day)	Inputs multiplied by	Output multiplied by	Phase
3	1	40	-	-	-
6	2	120	2	3.0	Increasing
12	4	300	2	2.5	Increasing
24	8	600	2	2.0	Constant
48	16	900	2	1.5	Decreasing
96	32	1,080	2	1.2	Decreasing

A long run planning schedule for a sunflower press at Singida, with every input doubled at each step.

Inputs rise 100 per cent every step, so only output varies. Output runs 40, 120, 300, 600, 900, 1,080, rising 200, 150, 100, 50 and 20 per cent, so s is 2, 1.5, 1, 0.5 and 0.2: increasing, then constant at the doubling to 600, then decreasing.

This can only be a long run law. In the short run one factor at least is fixed, so all inputs cannot rise in the same proportion. Scale arises only when shed, presses and workers can all be enlarged together.

The Master Key: *All inputs up by the same proportion: if output runs ahead the returns are increasing, if it keeps step they are constant, if it lags they are decreasing.*

BINDER Question 115

Three maps of the same press, each drawn for outputs of 100, 200 and 300 litres. Not a word on any of them mentions scale, yet the spacing of the lines gives the whole answer away.

With the aid of a diagram, illustrate how the spacing of a firm's isoquants reveals increasing, constant and decreasing returns to scale.

Model Answer

Returns to scale are read off an isoquant map along a ray from the origin, where the ratio of capital to labour never changes, by measuring how far apart the isoquants for equal steps of output lie.

An isoquant joins every combination of labour and capital yielding one level of output. A map drawn for 100, 200 and 300 units shows what each further hundred costs in inputs. Along a ray from the origin the ratio of capital to labour is held constant, exactly what returns to scale require.

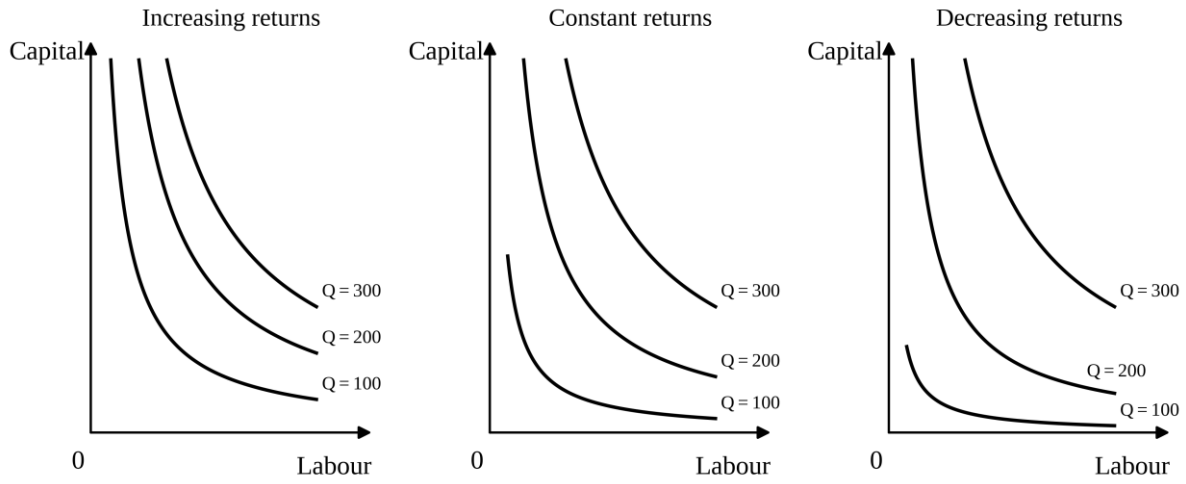


Figure 5.7: Increasing, constant and decreasing returns to scale

Increasing returns to scale: in the left panel the isoquants crowd closer together. The jump from 100 to 200 needs a large addition of both factors, from 200 to 300 a smaller one, so equal steps of output are bought with shrinking steps of input.

Constant returns to scale: in the middle panel the isoquants are evenly spaced along the ray. Each further hundred units costs exactly the same addition of labour and capital as the hundred before it.

Decreasing returns to scale: in the right panel the isoquants spread further and further apart. The third hundred units of output demands a bigger addition of both factors than the second did, so inputs are now outrunning output.

Why the ray matters: off the ray the factor proportion changes, so any change in output mixes returns to scale with the effect of substituting one factor for the other. Along the ray that mixture is impossible and the spacing measures scale alone.

The map also predicts costs. At given factor prices the input distance between two isoquants is the extra money spent to reach the higher output. Crowded isoquants mean a falling cost a litre, evenly spaced a constant one and widening a rising one.

The Master Key: *Walk out along a ray: isoquants closing up mean increasing returns, evenly spaced mean constant, spreading apart mean decreasing.*

BINDER Question 116

The 10,000 litre tank at a Dodoma fuel station stands beside a 1,250 litre one and is only twice as wide and twice as tall. It did not swallow eight times the steel.

Explain the causes of increasing returns to scale.

Model Answer

Increasing returns to scale arise because a larger plant can do what a small one cannot: indivisible large equipment, deeper specialisation, the geometry relating a container's surface to its volume, and the profitable use of by products.

Indivisibility of large machines: the best machines come in lumps and cannot be bought in halves. A largest size sunflower expeller is one indivisible unit, so a small firm does without it or leaves it half idle. Doubling the plant works that lump fully, so output outruns inputs.

Greater specialisation: in a small mill one worker cleans, grinds, weighs and sews the sacks, losing time at each change and never becoming expert. Double the plant and each operation goes to a worker of its own, quicker and more accurate. Management divides too: a separate buyer, engineer and accountant.

Surface against volume: a container is paid for by its surface but earns by its volume, and the two do not grow at the same rate. Double every dimension of a tank and the steel rises fourfold while the fuel it holds rises eightfold.

$$\text{Volume rises by } 2 \times 2 \times 2 = 8 \text{ times}$$

$$\text{Surface rises by } 2 \times 2 = 4 \text{ times}$$

So a tank twice as wide and twice as tall stores eight times the fuel for four times the steel. The same geometry governs a pipe, a boiler and a ship, which is why large plant fills the trades that hold, heat or carry liquids and gases.

Better use of by products: at a small scale leftovers are thrown away: the quantity will not pay for a machine to treat them. At a large scale that waste becomes a product, a fillet plant collecting skins, frames and swim bladders in quantities that justify a drier and a fishmeal press.

All four causes share a shape: each becomes available only at size, so it cannot show in a small plant however well run. Increasing returns therefore do not last: once the machine is fully used, the tasks divided and the waste worked up, nothing remains to unlock.

The Master Key: *Lumpy machines, deeper division of labour, the geometry of surface against volume, and waste turned into product: four gifts that only arrive with size.*

BINDER Question 117

A baker at Ilala opens a second bakery that copies the first oven for oven and hand for hand. Arithmetic seems to promise exactly twice the bread. Firms that try it often find otherwise.

Explain why a firm that simply duplicates an existing plant tends to experience constant returns to scale, and state the causes of decreasing returns to scale.

Model Answer

Exact duplication gives constant returns to scale: a faithful copy does what the original does and no more, so output doubles when inputs double; decreasing returns set in later because the direction of the firm cannot be copied.

The duplication argument: copy every input exactly: the same ovens, bakers of the same skill, floor space and technique. Nothing is missing and nothing is shared, so the copy matches the original and two plants produce twice the output.

Why constant returns is the benchmark: duplication is always available, so output can never rise less than in proportion on technical grounds. Any departure needs an explanation: the firm found something a copy could not, or lost control of something a copy would have kept.

The strain on management: the first and greatest cause of decreasing returns. Direction cannot be duplicated as an oven can: two plants still have one owner deciding, and his time spreads thinner as sheds, shifts and depots multiply, so decisions are delayed and stocks misjudged.

The breakdown of communication: in a small workshop an instruction passes straight from owner to worker. In a large one it goes down through supervisors and back up through reports, delayed and distorted, while meetings multiply and more labour runs the firm than produces.

Loss of control and morale: the owner can no longer see every worker, so effort is watched by rules and supervisors instead of his own eye. Waste and pilferage rise, and the willingness a small firm gets free must be bought.

Inputs drawn from further away: a doubled plant must be fed, and the nearest supplies are already taken. Cane, maize, cotton or fish come from further off, at more cost in fuel and time and more loss on the way.

If inputs rise a fifth and output only a tenth, more inputs stand behind each unit, so at unchanged factor prices unit cost rises: decreasing returns to scale mean increasing cost to scale.

The Master Key: *A copied plant must double the output; what cannot be copied is the head that directs it, and that is where decreasing returns begin.*

BINDER Question 118

Two coffee curing works above Moshi write down production functions that look almost identical. The exponents differ by a tenth, and that tenth decides which of them should build a second plant.

Show that the returns to scale of the production function $Q = AL^aK^b$ **depend on the sum** $a + b$**, and use the result to classify** $Q = 10L^{0.6}K^{0.5}$ **and** $Q = 5L^{0.3}K^{0.7}$**.**

Model Answer

Multiplying both inputs of $Q = AL^aK^b$ **by** λ **multiplies output by** λ^{a+b}**, so the function is homogeneous of degree** $a + b$**, and returns are increasing, constant or decreasing as** $a + b$ **exceeds, equals or falls below one.**

Call the original output Q_1, multiply each input by λ, where $\lambda > 1$, and call the new output Q_2.

$$Q_1 = AL^aK^b$$

$$Q_2 = A(\lambda L)^a(\lambda K)^b$$

$$Q_2 = A\lambda^aL^a\lambda^bK^b$$

$$Q_2 = \lambda^{a+b}AL^aK^b$$

$$Q_2 = \lambda^{a+b}Q_1$$

The degree of homogeneity: the power to which λ is raised is $a + b$, the degree of homogeneity. It is the whole answer, since it says by what multiple output moves when inputs are multiplied by λ.

The rule that follows: if $a + b > 1$ then $\lambda^{a+b} > \lambda$ and output rises more than in proportion: increasing returns. If $a + b = 1$ it rises exactly in proportion, and if $a + b < 1$ less.

The first works has $Q = 10L^{0.6}K^{0.5}$, so $a + b = 1.1$ and returns are increasing. Test by doubling from 100 units of each.

$$Q_1 = 10 \times 100^{0.6} \times 100^{0.5} = 10 \times 15.8489 \times 10 = 1{,}584.9$$

$$Q_2 = 10 \times 200^{0.6} \times 200^{0.5} = 10 \times 24.0225 \times 14.1421 = 3{,}397.3$$

$$\frac{Q_2}{Q_1} = \frac{3{,}397.3}{1{,}584.9} = 2.14 = 2^{1.1}$$

Reading the first result: inputs rose 100 per cent and output about 114 per cent, so $s = 1.14$. Doubling the plant gives more than double the cured coffee, and at unchanged factor prices the cost of curing a tonne falls.

The second works has $Q = 5L^{0.3}K^{0.7}$, so $a + b = 1$ and returns are constant. The doubling test confirms it exactly.

$$Q_1 = 5 \times 100^{0.3} \times 100^{0.7} = 5 \times 100 = 500$$

$$Q_2 = 5 \times 200^{0.3} \times 200^{0.7} = 5 \times 200 = 1{,}000$$

$$\frac{Q_2}{Q_1} = \frac{1{,}000}{500} = 2 = 2^1$$

Reading the second result: inputs and output both rose 100 per cent, so $s = 1$. This works gains nothing per unit of input by growing, and may as well build a second identical plant under its own manager.

A third case: if a plant's function were $Q = 4L^{0.4}K^{0.4}$ then $a + b = 0.8$, and doubling both inputs would multiply output by only $2^{0.8} = 1.74$, a rise of 74 per cent against inputs up 100, so $s = 0.74$.

The exponents describe one technique; change the technique and they change. A sum measured over one range of output need not hold over another, and a firm may show $a + b$ above one while small and below one when large.

The Master Key: *Add the exponents: above one is increasing, exactly one is constant, below one is decreasing returns to scale.*

REAL Question 119

Follow one maize mill at Iyunga in Mbeya through three expansions. Each time the owner doubles everything he owns, and each time the sacks at the end of the day answer him differently.

Using the mill's records below, calculate the proportional change in inputs and in output at each expansion, obtain the scale coefficient, name the phase of returns to scale reached, and advise the owner where to stop.

Stage 1: one grinding mill, 5 workers, one shed, 40 kW of power. Output 400 sacks of sembe a day.

Stage 2: everything doubled, so 2 mills, 10 workers, two sheds, 80 kW. Output 900 sacks a day.

Stage 3: doubled again, so 4 mills, 20 workers, four sheds, 160 kW. Output 1,800 sacks a day.

Stage 4: doubled again, so 8 mills, 40 workers, eight sheds, 320 kW. Output 2,700 sacks a day.

Every sack holds 25 kilogrammes of sembe.

Model Answer

Inputs rise 100 per cent at every expansion but output rises 125, then 100, then only 50 per cent, so s falls from 1.25 through 1 to 0.5, taking the mill from increasing through constant to decreasing returns; it should stop at stage 3.

Every input is doubled at each step, so the denominator of the scale coefficient is 100 per cent throughout and only the output response varies.

$$\text{Rise in output, stage 1 to 2} = \frac{900 - 400}{400} \times 100 = 125$$

$$s = \frac{125}{100} = 1.25$$

$$\text{Rise in output, stage 2 to 3} = \frac{1{,}800 - 900}{900} \times 100 = 100$$

$$s = \frac{100}{100} = 1$$

$$\text{Rise in output, stage 3 to 4} = \frac{2{,}700 - 1{,}800}{1{,}800} \times 100 = 50$$

$$s = \frac{50}{100} = 0.5$$

The three phases: the first doubling gives increasing returns: 125 per cent more sembe from 100 per cent more of everything. The second gives constant returns, output and inputs in step. The third gives decreasing returns: a whole second plant brought only half as much again.

Output per worker tells the same story in one column, and it is the figure the owner can check without any theory.

$$\frac{400}{5} = 80 \quad \frac{900}{10} = 90 \quad \frac{1{,}800}{20} = 90 \quad \frac{2{,}700}{40} = 67.5$$

Reading those figures: output a worker rises from 80 to 90 sacks, holds at 90, then falls to 67.5. Capital was doubled alongside labour each time, so the labour to capital ratio never changed: the rise and the fall are the doing of scale itself.

Why the first doubling gained: at 400 sacks a day no operation filled a worker's day, and every hand moved between cleaning, grinding, sifting, weighing and sewing, losing time at each change. At 900 sacks each operation fills a worker, and a bagging machine one mill could not keep busy is worth buying: specialisation and indivisibility at stage 2.

Why the third doubling lost: one owner now supervises eight sheds on four sites. Maize that came from Mbozi and Isongole must be drawn from further afield, so more arrives damp or broken and more time is lost at the intake. The organisation outgrew the man running it.

The advice: stop at stage 3. At 1,800 sacks a day, 45 tonnes of sembe, the mill gets 90 sacks from each worker and every doubling to that point has paid for itself. Stage 4 buys 900 more sacks with a plant that ought to have produced 1,800.

Two cautions. This is a long run measurement, every input having moved together, and says nothing about diminishing returns, which needs the shed to stay the same size. Nor is the physical answer the commercial one: what price will 1,800 sacks a day fetch in Mbeya?

The Master Key: *Double everything and watch the output ratio: 2.25, then 2, then 1.5 is the whole arc of returns to scale in one mill.*

REAL Question 120

Cane cut at Kilombero must reach the crusher within about a day, or the sugar begins leaving before the lorry arrives. Now push the fields forty kilometres further out and watch the arithmetic.

Using the estate's records below, calculate the percentage change in each input and in output at both expansions, state the phase of returns to scale in each case, and explain what the yield a hectare adds to the diagnosis.

Before: 8,000 hectares under cane, 2,400 field workers, 32 harvesters. Cane crushed 640,000 tonnes in the season.

First expansion: 10,000 hectares, 3,000 field workers, 40 harvesters. Cane crushed 800,000 tonnes.

Second expansion: 12,500 hectares, 3,750 field workers, 50 harvesters. Cane crushed 920,000 tonnes.

The fields opened in the second expansion lie up to 40 kilometres from the factory, which was not enlarged in either round.

Model Answer

Every input rises 25 per cent each time, but output rises 25 per cent the first time and only 15 per cent the second, so the estate moves from constant returns with $s = 1$ **into decreasing returns with** $s = 0.6$**.**

Confirm first that this is a change of scale, that all three inputs move in the same proportion.

$$\text{Land} = \frac{10{,}000 - 8{,}000}{8{,}000} \times 100 = 25$$

$$\text{Labour} = \frac{3{,}000 - 2{,}400}{2{,}400} \times 100 = 25$$

$$\text{Harvesters} = \frac{40 - 32}{32} \times 100 = 25$$

$$\text{Cane crushed} = \frac{800{,}000 - 640{,}000}{640{,}000} \times 100 = 25$$

$$s = \frac{25}{25} = 1$$

The first expansion: land, labour and machinery all rose by a quarter and the harvest by a quarter, so the estate shows constant returns to scale. It duplicated a quarter of itself, and the copy performed as the original did.

Now the second expansion. Land rises from 10,000 to 12,500 hectares, labour from 3,000 to 3,750 and harvesters from 40 to 50, each again 25 per cent. The cane does not keep up.

$$\text{Cane crushed} = \frac{920{,}000 - 800{,}000}{800{,}000} \times 100 = 15$$

$$s = \frac{15}{25} = 0.6$$

The second expansion: inputs up 25 per cent brought output up only 15 per cent, so $s = 0.6$ and the estate has entered decreasing returns. Every further hectare, worker and harvester buys less cane than the last.

The yield a hectare turns the same evidence into a figure any field manager will recognise.

$$\frac{640{,}000}{8{,}000} = 80 \quad \frac{800{,}000}{10{,}000} = 80 \quad \frac{920{,}000}{12{,}500} = 73.6$$

What the yield shows: 80 tonnes a hectare before and 80 after the first expansion is constant returns, output per unit of input unchanged. The fall to 73.6 tonnes, a loss of 6.4 a hectare, is decreasing returns seen from the land.

The cause is distance: cane loses sucrose once cut, so cane hauled 40 kilometres arrives with less sugar than cane hauled 5, and some is left standing when lorries are delayed. Inputs drawn from further away are a standard cause of decreasing returns, and at Kilombero the leading one.

A second cause and a caution: the factory was never enlarged, so capacity for 8,000 hectares now serves 12,500. Not every input rose by 25 per cent, so part of the shortfall is a crowded fixed factor. The new land may also be poorer, and returns to scale assume equal quality.

What the estate should do: not add a fourth block of distant fields. Either build a second crushing plant near the new fields, restoring the ratio of factory to field, or leave the far land to outgrowers with their own lorries. Both attack distance.

Paying 25 per cent more for everything and getting 15 per cent more cane, the cost of a tonne has risen about 9 per cent at unchanged factor prices, and every tonne of sugar carries that into the shop price.

The Master Key: *When inputs rise by a quarter and output by a sixth, the estate has not grown well; it has simply grown far.*

REAL Question 121

A fillet plant at Igoma builds a second line copying the first knife for knife. Duplication promises exactly twice the fillet. The weighbridge at the end of the day records rather more.

Using the plant's records below, calculate the percentage rise in labour, in lines and in output, decide whether the plant has shown constant returns to scale, and explain the four extra tonnes.

> Before: one filleting line, 50 workers, 2 chillers. Output 20 tonnes of fillet a day.
>
> After: two identical lines, 100 workers, 4 chillers. Output 44 tonnes of fillet a day.
>
> The ice plant, the effluent works and the general manager serve both lines and were not duplicated. Together they cost TShs 4,400,000 a day whether one line runs or two.

Model Answer

Labour, lines and chillers all rose 100 per cent while output rose 120 per cent, so the plant produced four tonnes more than exact duplication would give, from the indivisible ice plant now fully used and the deeper specialisation two lines allow.

Work the proportional changes first, because the whole diagnosis rests on comparing them.

$$\text{Labour} = \frac{100 - 50}{50} \times 100 = 100$$

$$\text{Lines and chillers} = \frac{2 - 1}{1} \times 100 = 100$$

$$\text{Output} = \frac{44 - 20}{20} \times 100 = 120$$

$$\text{s} = \frac{120}{100} = 1.2$$

The duplication benchmark: an exact copy does what the original does, so two lines should have yielded $2 \times 20 = 40$ tonnes a day, which is constant returns. The plant beat that by 4 tonnes, and a beaten benchmark needs an explanation.

Output per worker confirms it: before the change each worker accounted for $20 \div 50 = 0.40$ tonnes of fillet a day, after it $44 \div 100 = 0.44$ tonnes, up 10 per cent. Exact duplication would not have moved this figure.

Where two tonnes come from: the ice plant and cold store are indivisible: the smallest unit served two lines, so with one line it stood half idle and fish waited for chilling in the afternoon heat. With two lines it is fully worked and more fish leaves as fillet.

Where the other two come from: on a single line each worker moved between three cuts and skill was spread thin. With two lines a worker keeps to one cut, becomes faster and cleaner, and takes more fillet off the same fish: specialisation with size, as at the Mbeya mill.

The verdict: not a clean test, since the ice plant, the effluent works and the manager were held constant while the rest doubled. But had they doubled too, the second ice plant would have stood idle and output still 44 tonnes, so the technology shows increasing returns with $\text{s} = 1.2$.

The money side moves with the physical, though they are not the same thing. The undoubled overhead of TShs 4,400,000 a day now spreads over 44 tonnes instead of 20.

$$\frac{4{,}400{,}000}{20} = 220{,}000 \quad \text{against} \quad \frac{4{,}400{,}000}{44} = 100{,}000$$

Reading the shillings: the ice plant, the effluent works and the manager cost TShs 220,000 a tonne before the second line and TShs 100,000 after, saving TShs 120,000. On 44 tonnes a day that is TShs 5,280,000, enough to pay for the second line within a season.

The four extra tonnes came from filling a lump already there, and that lump fills only once. A third line would find the ice plant committed and must bring its own, so the next expansion should give constant returns at best.

The Master Key: *When a copy beats its original, look for the lump that was standing half idle before the copy arrived.*

HOT Question 122

The manager of a tomato paste works at Iringa says the fifth vat proved the law of diminishing returns. His engineer replies that nothing at all was held fixed, so the law never entered the room.

With the aid of a diagram, examine the manager's claim below, distinguishing carefully between returns to a variable factor and returns to scale, and identify what else could be raising his cost.

> The manager writes: 'We have expanded twice this year. Output is up, but the cost of a tin is up as well. This is simply the law of diminishing returns catching up with us.'

Model Answer

He is right only if he pressed extra labour onto a plant he did not enlarge, diminishing returns being a short run law. A firm that enlarged everything and still finds cost rising meets decreasing returns to scale; one whose input prices rose meets neither.

What diminishing returns says: a short run law: one factor varies while the plant stays fixed, so the factor proportion changes. Beyond a point each extra unit has less fixed factor to work with and its marginal product falls.

What returns to scale says: a long run law: every factor varies together and in the same proportion. The firm is not crowding a plant but building a larger one, and asks whether the larger plant is more productive.

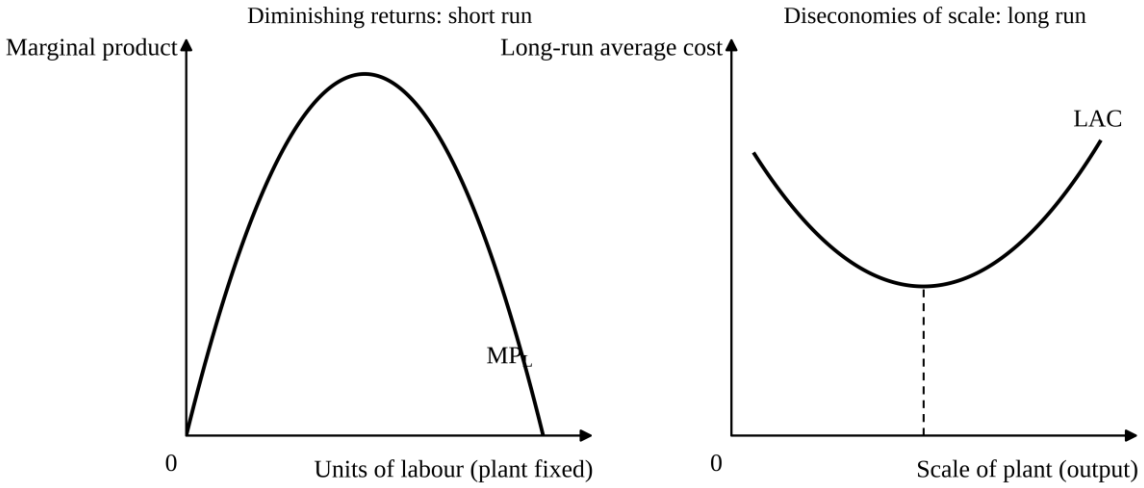


Figure 5.8: Diminishing returns in the short run and diseconomies of scale in the long run

The left panel: marginal product rises then falls as more labour is applied to a plant of unchanged size, every point the same plant. The fall is crowding of a fixed factor, cured by enlarging the plant, a long run decision.

The right panel: long run average cost falls, bottoms and turns upward, every point a different plant, each fully adjusted. The upward stretch is not crowding but the larger organisation producing less per unit of input: diseconomies of scale.

Three questions settle it: did the plant change? If the vats multiplied but the boiler, store and manager did not, he is in the short run. Did the factor ratio change? Labour rising faster than capital is variable proportions. Did output per unit fall, or only prices?

The case for him: most firms that say they expanded did not expand everything: two more vats, the same boiler, the same store, the same man signing every order. The plant is fixed in every sense that matters, and diminishing returns is the right name.

The case against him: if the works built a second line with its own boiler and supervisor, no factor was fixed and the law cannot apply. Rising cost then means decreasing returns to scale: strain on one management, delays in communication, bruised tomatoes from the Ruaha valley.

The possibility he missed: cost a tin can rise while returns are unchanged. If the firm's buying bid up tomatoes in the Iringa market, or wages rose, or the tinplate tariff went up, each unit uses the same inputs and pays more: a price effect, not a productivity effect.

Why it matters: each diagnosis carries a different remedy. Diminishing returns is cured by enlarging the plant; decreasing returns to scale by two moderate plants under separate managers; rising input prices by better buying, and worsened by any change in the factory.

Ask one question: when output rose, did the walls move? If not, he is suffering diminishing returns and should build. If they did, he must show output per unit fell before blaming scale.

The Master Key: *Diminishing returns crowds a fixed plant, decreasing returns to scale strains a bigger one, and a dearer input is neither*.

HOT Question 123

Tanzania has thousands of maize mills and a handful of cement works. Both sell something almost every household buys, so the difference between the two industries cannot lie in the demand.

Assess the claim that increasing returns to scale explain why some industries in Tanzania are left with only a few large firms.

Model Answer

Increasing returns explain much of it: where they run to a high output the smallest plant that produces cheaply is big relative to the national market and small rivals cannot survive. But market size, transport cost and legal barriers decide as much.

Where it clearly holds: cement: a rotary kiln is indivisible and obeys the geometry of surface against volume, so twice the capacity costs nothing like twice as much. A works a tenth the size of Wazo Hill or Tanga carries a higher cost a tonne and never gets built.

The same in other trades: sugar milling, brewing, cigarette making and float glass rest on a large indivisible vessel fed continuously. So do networks: a power grid or a mobile network is one indivisible system whose cost hardly rises with customers, so the first to build it is hard to undercut.

Why they push towards few firms: a firm that grows becomes cheaper, cuts its price, wins more output and becomes cheaper still. Where returns keep increasing over a wide range no small rival is safe at any size, so firms fall in number until survivors reach the scale the technique demands.

Where the claim fails: most Tanzanian industries do not. Maize milling, tailoring, carpentry, fish smoking, bakery and retail show constant returns beyond a modest size, which is why a second mill is a copy of the first rather than an enlargement, and thousands of firms coexist.

Transport fragments the market: sembe cannot travel far before haulage swallows the saving, so a mill serves its district and the country is a few hundred markets, not one. Size is limited by the market, not the technique: large firms in cement, which travels, not in bread, which does not.

Barriers unrelated to scale: concentration can also be manufactured. Licences and permits, tariff protection, bank credit only at a size established firms have, allocation of industrial land and long standing relations with government buyers can leave three firms where the technique would support thirty.

How to tell them apart: test whether cost a unit really falls with size. If the largest firm is also the cheapest and its lead widens with output, increasing returns are at work. If it is not the cheapest yet faces no rivals, the barrier is legal or financial.

True but conditional, turning on plant size against market size. Where the plant is large and the market national, as in cement, few firms is natural; where the plant is small or the market fragmented, few firms signals a barrier other than technique, and the remedy is roads and credit.

The Master Key: *Few firms is a technical result only where the cheapest plant is large against the market it can reach; otherwise look for the licence.*

HOT Question 124

A Kariakoo trader with one good shop is told that the road to wealth is a second shop, then a third. His neighbour followed that advice and now has nothing left to sell but the fittings.

An adviser tells a growing Tanzanian firm that a bigger firm is always a better firm. Discuss.

Model Answer

The advice is wrong as a general rule: growth pays only while returns to scale are increasing, only while the market will take the extra output at a price covering cost, and only if the firm finds the capital and management a larger scale demands.

The case for growing: while returns to scale are increasing, output rises faster than the inputs behind it, so at unchanged factor prices unit cost falls. A firm that refuses to grow chooses to be dearer than the rival who does, and will be undersold.

What only size can buy: the indivisible machine, the accountant, the laboratory, the drier that turns waste into a second product and the division of labour that keeps each worker to one task are beyond a small firm: not rewards for bigness but techniques usable only at a size.

The first limit is technical: beyond some size decreasing returns set in. One head can direct only so much, communication lengthens and distorts, control gives way to rules, and raw material comes from further away in worse condition, so output rises by less than inputs and unit cost rises.

The second limit is demand: a plant that can make 2,700 sacks a day is worth nothing if the district will buy 1,800. The surplus must be sold lower, which may not cover cost, or carried far, which adds the haulage the extra scale was meant to save.

The third limit is reversibility: long run decisions are hard to undo. A shed, a kiln or a filleting line resells for far less than it cost, so a firm that overbuilds cannot shrink back. Grow in steps, above all a family firm on a bank loan.

The fourth limit is management: in many Tanzanian firms the owner is buyer, supervisor, cashier and salesman at once. Doubling the plant without building the layer of managers it needs is the commonest way of turning increasing returns into decreasing ones, and why the second shop kills the first.

What to do instead: grow to the size at which output per unit of input stops rising, then duplicate rather than enlarge. A second plant of the proven size under its own manager gives constant returns, whereas piling capacity onto one site and one head invites decreasing returns.

The adviser has confused a phase with a rule. Bigger is better only while s exceeds one and the market can absorb the output, neutral at $s = 1$, harmful once s falls below one. Ask what a sack costs at each size and how many sell at that cost.

The Master Key: *Grow while output outruns inputs and the market still wants the difference; past that point a bigger firm is only a costlier one.*

Isoquants, Isocosts and the Least Cost Combination

A tailor at Kariakoo knows exactly how many shirts he must sew this week. What he does not know is whether the next shilling should buy another pair of hands or another machine. Nothing so far in this chapter can answer him, because the product curves hold capital still. This section supplies what is missing: the isoquant, which shows every combination that yields the same output, the isocost, which shows every combination he can afford, and the single point where the two touch.

BINDER Question 125

A Singida press makes a hundred tins of alizeti oil with two workers and eighteen machine hours, and the same hundred tins with six workers and six. Both recipes, one press.

Define an isoquant and, with the aid of a diagram, explain what an isoquant map shows.

Model Answer

An isoquant is a curve joining all combinations of two factors that yield the same output, and an isoquant map is a set of such curves, each standing for a different level of output.

Iso means equal and quant means quantity, so an isoquant is an equal quantity curve, also called an equal product curve. Unlike the product curves, which held capital still, it lets both factors move.

Take a small press at Singida turning sunflower seed into alizeti, the local cooking oil. It can run on many hands and few machine hours, or few hands and long hours, with the daily tins unchanged.

Labour (workers a day)	Capital (machine hours a day)	Output (tins of oil)
2	18	100
3	12	100
6	6	100
9	4	100

Four technically possible ways of pressing the same hundred tins at a Singida oil mill.

Every row of that table is one point on one isoquant. The press is technically indifferent between them, each yielding 100 tins, but not financially indifferent, and about that the isoquant says nothing.

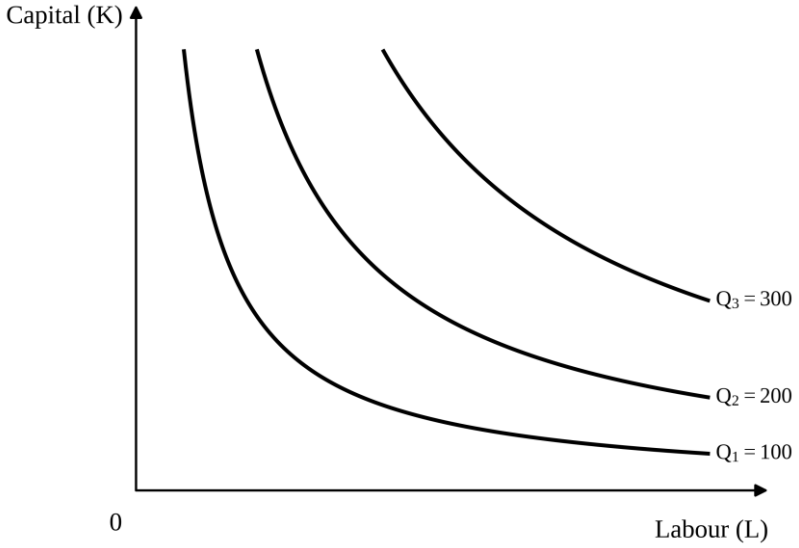


Figure 5.9: An isoquant map

Each curve is one level of output: the lowest curve is $Q_1 = 100$, and every point along it is a different recipe for a hundred tins. Slide along it and the factor mix changes while output stands still.

A curve further out is a higher output: $Q_2 = 200$ lies above and right of Q_1 because two hundred tins cannot be pressed with less of both factors than a hundred needs. Moving outward raises output; moving along one curve only changes technique.

The map is complete: an isoquant passes through every attainable combination of the two factors, so a curve could be drawn through any point the producer names. Only three are drawn because a page of a thousand curves teaches nothing.

The axes carry factors, not output: labour is measured along the horizontal axis and capital up the vertical. Output is on no axis at all; it is the label on each curve, which is why an isoquant map is drawn in factor space.

What the map cannot tell him: a purely technical statement, drawn by an engineer and not an accountant. It says which combinations are possible, never which is cheapest, because it holds no prices. The wage and the machine rental enter through the isocost line.

The isoquant map is the production function drawn out in full. Every technique the press could adopt lies on it, and this diagram alone cannot choose one for him.

The Master Key: *One curve, one output, many recipes; a higher curve, a higher output.*

BINDER Question 126

At a Mtwara shelling plant the manager sketches two equal product curves and lets them cross. An hour later he cannot say whether one combination shells four hundred bags or six hundred.

State and explain the properties of isoquants, giving the reason for each.

Model Answer

Isoquants slope downward, are convex to the origin, never intersect, stand for a higher output the further they lie from the origin, and in the usual case touch neither axis; every property follows from something real about production.

Take a cashew shelling plant at Mtwara, where kernels can be cut by hand or by machine, and hold its daily output of shelled bags constant while the properties are tested.

They slope downward: output is held constant, so one factor cannot be reduced unless the other rises. If the plant lets six shellers go, the kernels they cut must come from more machine hours. The negative slope is forced by the definition of the curve.

They are convex to the origin: the curve bows towards the corner because the marginal rate of technical substitution diminishes: the first machine hours given up are the most easily spared, and each further hour is harder to replace, so more labour is needed for each unit of capital released.

Two isoquants never intersect: suppose two crossed. The crossing point is one combination of labour and capital, yet it would lie on a curve labelled 400 bags and one labelled 600 at once. One combination worked with one technique cannot produce two outputs, so the sketch is wrong.

A higher isoquant is a higher output: a curve further from the origin can only be reached by using more of at least one factor, and more of a factor with nothing wasted yields more product. A firm that wants to grow must climb to a curve it is not on.

They do not touch either axis: a point on the capital axis would mean output with no labour, one on the labour axis output with no capital. Neither is possible: a shelling machine with nobody to feed it shells nothing, so each curve approaches the axes without reaching them.

Only the downward sloping stretch matters: a stretch turning upward would say that more of both factors gives the same output, so the extra factor produces nothing and is wasted. No producer minimising cost would work there, so the meaningful part falls from left to right.

Together the properties describe a family of smooth curves bowing towards the origin and never touching, each a different output. Their shape is not a convention but the diminishing rate of substitution, and behind it the fact that two factors are never perfect stand ins.

The Master Key: *Downward sloping because output is fixed, convex because substitution gets harder, never crossing because one combination gives one output.*

BINDER Question 127

A Shinyanga ginnery swaps a machine hour for a hand and the lint holds steady. It swaps again, and again, and the fourth hand cannot do what the first one did.

Define the marginal rate of technical substitution, derive $\mathrm{MRTS_{LK}} = \frac{\mathrm{MP_L}}{\mathrm{MP_K}}$**, and with the aid of a diagram explain why it diminishes.**

Model Answer

The marginal rate of technical substitution of labour for capital is the capital a firm can give up when it takes one more unit of labour at constant output. It equals the ratio of the marginal products and falls as labour replaces capital, which is why the isoquant is convex.

Output is held constant, so the firm never leaves the isoquant it started on, and the marginal rate of technical substitution is simply the slope of that curve without its sign.

$$\mathrm{MRTS_{LK}} = -\frac{\Delta \mathrm{K}}{\Delta \mathrm{L}}$$

Along a downward sloping curve $\Delta \mathrm{L}$ is positive while $\Delta \mathrm{K}$ is negative, so the raw ratio is negative; the minus sign turns it into a positive number of units of capital given up per unit of labour taken on.

Why it equals the ratio of marginal products: a firm moving along an isoquant does two things at once: extra labour adds output and surrendered capital destroys output, and since the total must not change the gain offsets the loss exactly.

$$\text{Output gained} = \mathrm{MP_L} \times \Delta \mathrm{L}$$

$$\text{Output lost} = \mathrm{MP_K} \times \Delta \mathrm{K}$$

$$\mathrm{MP_L} \times \Delta \mathrm{L} = \mathrm{MP_K} \times \Delta \mathrm{K}$$

$$\frac{\Delta \mathrm{K}}{\Delta \mathrm{L}} = \frac{\mathrm{MP_L}}{\mathrm{MP_K}}$$

$$\mathrm{MRTS_{LK}} = -\frac{\Delta \mathrm{K}}{\Delta \mathrm{L}} = \frac{\mathrm{MP_L}}{\mathrm{MP_K}}$$

A worked case at the ginnery: at one point on the curve an extra hand adds 12 bales of lint a day and an extra machine hour adds 3. The rate of substitution is 4: one more hand releases four machine hours.

$$\text{MRTS}_{\text{LK}} = \frac{\text{MP}_{\text{L}}}{\text{MP}_{\text{K}}} = \frac{12}{3} = 4$$

$$\text{Gained} = 1 \times 12 = 12 \text{ bales}$$

$$\text{Lost} = 4 \times 3 = 12 \text{ bales}$$

Reading the two lines together: the hand brings in 12 bales and the four machine hours would have brought in 12, so the ginnery ends the swap with the 100 bales it began with. That is what staying on one isoquant means.

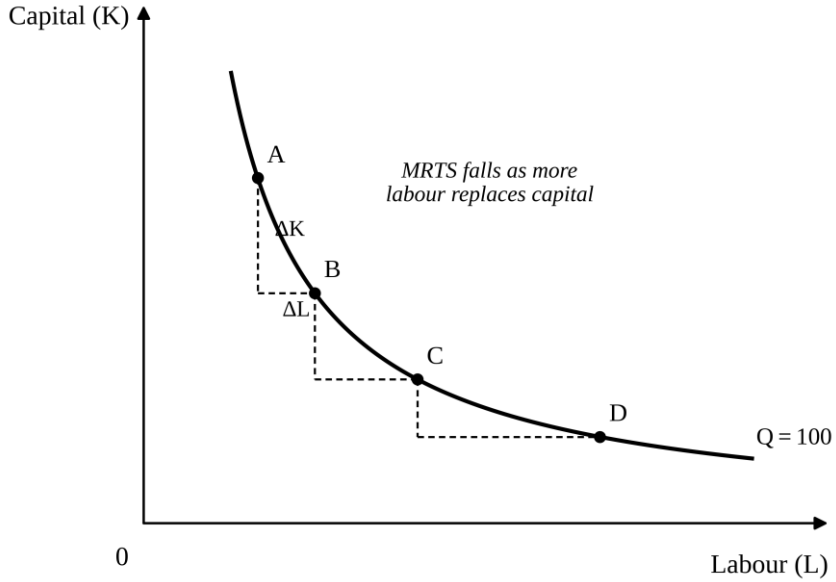


Figure 5.10: The marginal rate of technical substitution along an isoquant

Point	Labour (workers)	Capital (machine hours)	Change in L	Capital given up	MRTS
A	2	20	-	-	-
B	3	14	1	6	6
C	4	10	1	4	4
D	5	8	1	2	2

The marginal rate of technical substitution falling along one isoquant of 100 bales a day.

The rate falls at every step: from A to B one extra worker releases six machine hours, from B to C four, and from C to D only two. The same hand is worth less and less in machinery as the plant fills with hands.

Why it falls: the two factors are specialised, not interchangeable. Worked by two people and twenty machine hours, hands are scarce and one more is worth a great deal, so plenty of machine time can be surrendered. By five people crowding the same gins, an extra hand releases almost nothing.

What the falling rate says: substitution has limits. A firm cannot go on replacing capital with labour at the rate it managed at the start, and each further step buys less relief. That is why the curve bends, and why hiring without end cannot escape an expensive machine.

A straight line would mean the fourth hand replaces as much machinery as the first, that hands and gins are perfect stand ins. They are not, and the curve records that fact.

The Master Key: MRTS_{LK} *is the slope of the isoquant, it equals* MP_{L} / MP_{K}*, and it falls because factors are specialised.*

BINDER Question 128

A Morogoro mill fires its boiler with rice husk or firewood, and the steam gauge cannot tell which. Next door a second bodaboda stands idle for want of a second rider.

With the aid of a diagram, explain the shape of the isoquants when two factors are perfect substitutes and when they are perfect complements.

Model Answer

When two factors are perfect substitutes their isoquants are straight lines with a constant marginal rate of technical substitution; when they are perfect complements the isoquants are right angled, no substitution being possible at any rate.

The ordinary convex isoquant assumes the factors can be exchanged and that the exchange gets harder as it goes on. Drop either assumption and the curve changes shape.

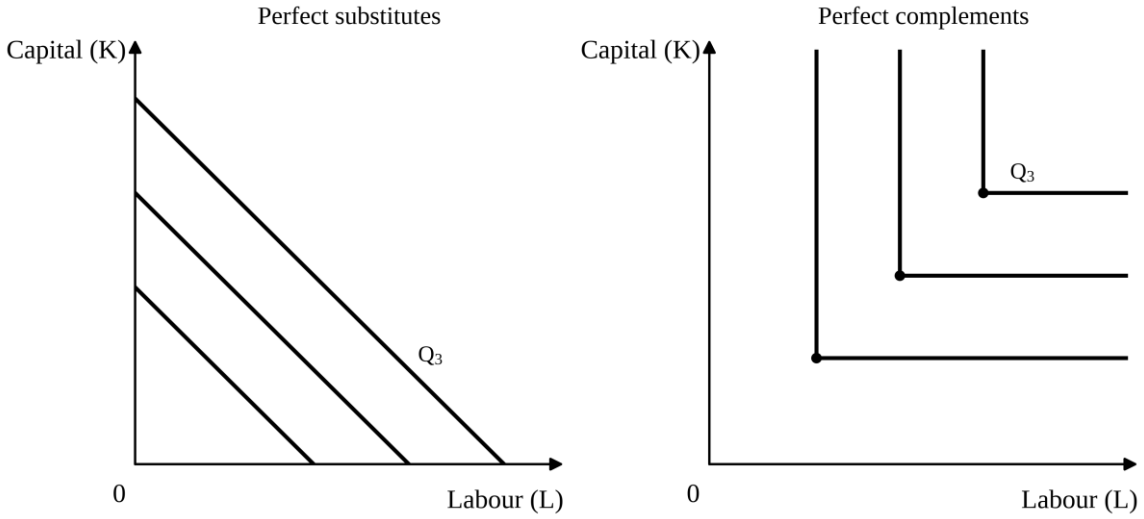


Figure 5.11: Isoquants for perfect substitutes and for perfect complements

Perfect substitutes: the shape: a straight line falling from the capital axis to the labour axis. Its slope never changes, so the rate of substitution is constant: the hundredth unit of one factor replaces as much of the other as the first did.

Perfect substitutes: a Tanzanian case: a rice mill at Morogoro raises steam by burning rice husk from its own milling or bought firewood. Two sacks of husk always give the heat of one bundle, whatever is in the furnace, so the rate stays at half a bundle per sack.

Perfect substitutes: a corner choice: one factor is cheaper over the whole range and the mill uses it alone. Two sacks of husk at TShs 1,000 cost TShs 2,000 and do the work of a firewood bundle costing TShs 2,500, so the mill buys husk and saves TShs 500 a bundle.

Perfect substitutes: the choice can swing: let firewood fall to TShs 1,800 and the arithmetic reverses: two sacks of husk cost TShs 2,000 against TShs 1,800 for the bundle they replace, and the mill switches its whole fuel. A small price change moves it right across the diagram.

Perfect complements: the shape: two straight arms meeting at a right angle, one horizontal and one vertical, the corner on a ray from the origin. Only the corner is worth occupying: every point along an arm uses more of one factor and produces no more.

Perfect complements: a Tanzanian case: a bodaboda, the motorcycle carrying passengers for hire, must be used one to one with its rider. Ten machines with five riders carry no more than five machines with five riders. So too a fundi cherehani at his sewing machine.

Perfect complements: the rates: along the horizontal arm extra labour adds nothing, so $MP_L = 0$ and the rate is zero; along the vertical arm extra capital adds nothing and the rate is infinite. At the corner there is no single slope, so no tangency applies.

Why the two cases matter: with perfect substitutes the factor prices decide everything and the firm sits at one corner. With perfect complements they decide nothing about the combination, which technology fixes, and change only its cost. Convex isoquants lie between, which is why the usual answer mixes the factors.

A large plant holds both cases. The Morogoro mill chooses fuel as pure substitution and drivers and lorries as pure complements, and only in the sorting hall does the convex curve appear.

The Master Key: *Straight isoquants mean perfect substitutes and a corner choice; right angled isoquants mean fixed proportions and no choice at all.*

BINDER Question 129

A Mwanza fillet plant is given three million shillings for a day's factors and not a shilling more. Every extra worker it hires costs it a quarter of a machine.

Define an isocost line, derive its equation, its two intercepts and its slope, and illustrate the effect of a fall in the wage.

Model Answer

An isocost line joins all combinations of two factors a firm can buy for one given total outlay, doing for the producer what the budget line does for the consumer: it carries the prices into the diagram.

Take a fish filleting plant at Mwanza with TShs 3,000,000 a day to lay out. A worker costs TShs 15,000 a day and a filleting machine TShs 60,000 to hire, power and service. The isocost line lists every mixture that spends the outlay exactly.

$$C = wL + rK$$

Reading the equation: C is the total outlay, w the wage per unit of labour, r the rental per unit of capital, L and K the quantities hired. The wage bill wL plus the capital bill rK uses up all of C, so every point spends the same.

To draw it, make capital the subject, since capital is measured up the vertical axis.

$$K = \frac{C}{r} - \frac{w}{r}L$$

The vertical intercept: put $L = 0$ and the whole outlay goes on capital, so the line meets the capital axis at C/r. For Mwanza that is fifty machines and no worker, the most capital the outlay can command.

$$\frac{C}{r} = \frac{3{,}000{,}000}{60{,}000} = 50 \text{ machines}$$

The horizontal intercept: put $K = 0$ and the whole outlay goes on labour, so the line meets the labour axis at C/w. Here that is two hundred workers and no machine at all, the largest workforce the same money can command.

$$\frac{C}{w} = \frac{3{,}000{,}000}{15{,}000} = 200 \text{ workers}$$

The slope: the line falls at the rate w/r, the price of labour in units of capital. At Mwanza that is one quarter, so surrendering one machine hires four more workers. It is the market's rate of exchange, against which the firm's own rate must be matched.

$$\text{Slope} = \frac{w}{r} = \frac{15{,}000}{60{,}000} = 0.25$$

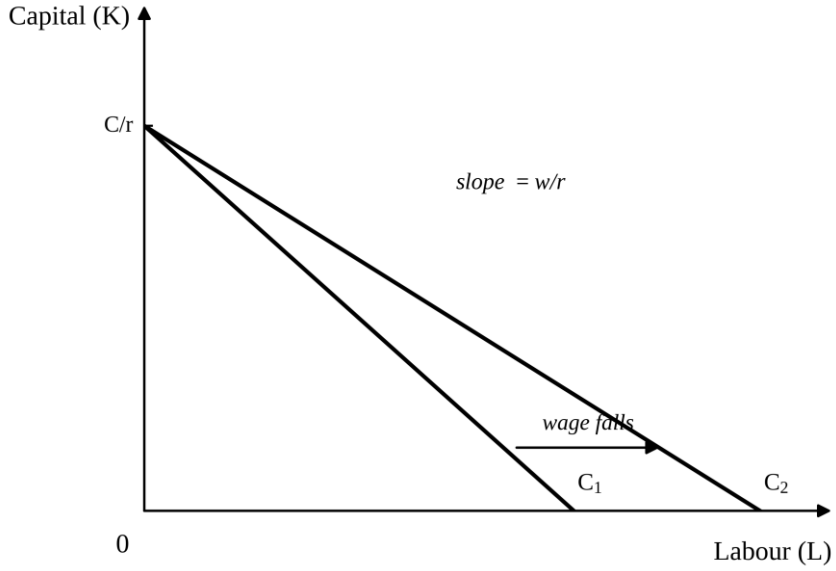


Figure 5.12: An isocost line and the effect of a fall in the wage

A change in outlay shifts the line: raise the money to TShs 3,600,000 with both prices unchanged and the intercepts become sixty machines and two hundred and forty workers, the slope still one quarter. The line moves outward parallel to itself: more money buys more of both without altering the rate of trade.

$$\frac{3{,}600{,}000}{60{,}000} = 60 \text{ machines} \quad \frac{3{,}600{,}000}{15{,}000} = 240 \text{ workers}$$

A price change rotates it: let the wage fall to TShs 10,000, the outlay and machine rental unchanged. The plant can still afford only fifty machines, so the vertical intercept does not move, but the same money now hires three hundred workers. The line swings out along the labour axis.

$$\frac{3{,}000{,}000}{10{,}000} = 300 \text{ workers}$$

$$\text{New slope} = \frac{10{,}000}{60{,}000} \approx 0.167$$

What the flatter line means: one machine surrendered now hires six workers instead of four, so labour has become cheap in terms of capital. Everything affordable before is still affordable, and a wedge of new labour intensive combinations has been added without one extra shilling.

The isoquant carries the technology and the isocost the prices, and neither alone can tell a firm what to do. Lay one on the other and the choice becomes geometry.

The Master Key: $C = wL + rK$*: intercepts* C/r *and* C/w*, slope* w/r*; the budget shifts it, a factor price rotates it.*

BINDER Question 130

A block yard at Dodoma spends the same twenty thousand shillings on two extra hands or on one extra day of the mixer. The hands make eighty blocks; the mixer makes sixty.

With the aid of a diagram, explain the least cost combination of factors, and show what a firm should do when it is not at that combination.

Model Answer

A firm reaches its least cost combination where its isocost line is tangent to the highest isoquant it can attain, that is, where the marginal rate of technical substitution equals the ratio of factor prices. Any firm not there can raise output without spending more.

The isoquant map gives every technically possible way of producing; the isocost line every combination he can afford. He must find the point on the line and on the highest curve it reaches.

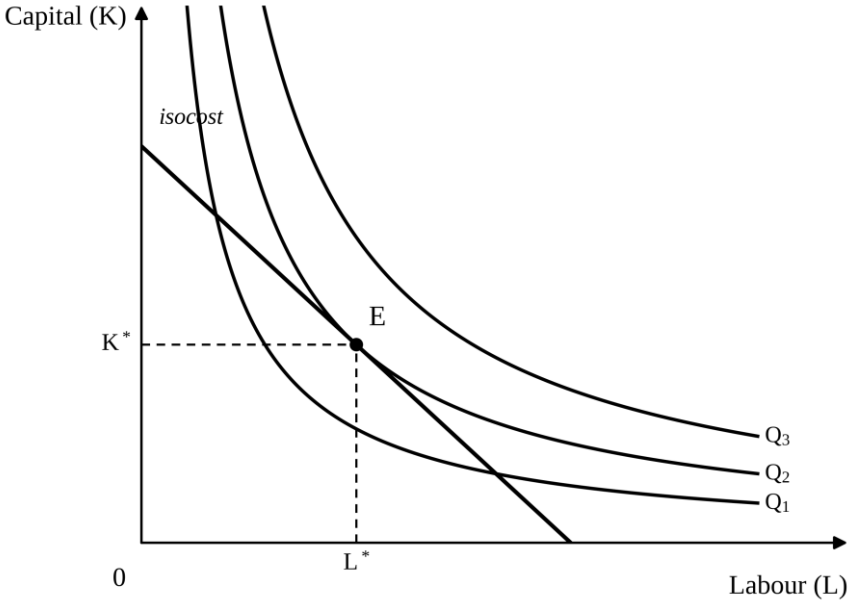


Figure 5.13: Producer equilibrium: the least cost combination of factors

Why Q_3 is refused: Q_3 lies wholly above the isocost line. Every combination on it costs more than the firm has, so however desirable that output, none of it is attainable with the present outlay.

Why Q_1 is wasteful: the isocost line cuts Q_1 at two points. Both are affordable and both spend the whole outlay, yet at each the firm produces only Q_1 when the same money laid out differently would produce more.

Why E is the answer: Q_2 is the highest curve the isocost can touch, and it touches at one point, E, where the firm hires L^* and K^* and gets the largest output the outlay can buy. Q_2 could not be produced for less.

The condition in slopes: at a tangency the two curves have the same slope. The isoquant's slope is the marginal rate of technical substitution, the isocost's the ratio of factor prices, so equilibrium equates them.

$$\text{MRTS}_{\text{LK}} = \frac{\text{MP}_\text{L}}{\text{MP}_\text{K}} = \frac{\text{w}}{\text{r}}$$

The same condition written per shilling: cross multiply the equality and it turns into a statement about what money buys. This is the equi marginal condition, and it is the form a producer can actually use.

$$\frac{\text{MP}_\text{L}}{\text{w}} = \frac{\text{MP}_\text{K}}{\text{r}}$$

The equi marginal logic in words: the last shilling on labour must add as much output as the last on capital. If it adds more, move money towards labour; if less, the other way. Only at equality is no shilling doing more good elsewhere.

Take the block yard at Dodoma. A hand costs TShs 10,000 a day and adds 40 blocks; a mixer day costs TShs 20,000 and adds 60. Divide each addition by its price.

$$\frac{\text{MP}_\text{L}}{\text{w}} = \frac{40}{10{,}000} = 0.004 \text{ blocks per shilling}$$

$$\frac{\text{MP}_\text{K}}{\text{r}} = \frac{60}{20{,}000} = 0.003 \text{ blocks per shilling}$$

The diagnosis: a shilling in labour brings back 0.004 of a block and a shilling in the mixer 0.003, so the yard is not in equilibrium. In whole units, TShs 20,000 buys two hands making 80 blocks or one mixer day making 60.

The remedy: release one mixer day and hire two more hands. The outlay stays at TShs 20,000, the yard loses 60 blocks and gains about 80, so output rises by roughly 20 a day for no extra money.

The same diagnosis in slopes: here $\text{MRTS}_{LK} = 40 \div 60 \approx 0.667$ while $w/r = 0.5$. The isoquant is steeper than the isocost, placing the yard left of the tangency, so it must take on labour and release capital.

Why the movement stops itself: as labour is added its marginal product falls, and as capital is withdrawn the marginal product of what remains rises, so MP_L / w falls while MP_K / r climbs. The firm stops at the tangency unprompted.

A firm is at least cost when no rearrangement of the money it already spends would buy more output. Everything else in the theory of the firm assumes that has been done.

The Master Key: *Tangency of isoquant and isocost:* $\text{MRTS}_{LK} = w/r$, *or equally* $\text{MP}_L / w = \text{MP}_K / r$.

BINDER Question 131

A Mbeya milling company wants to triple its output. It already knows the cheapest way to make four hundred sacks; it does not yet know the cheapest way to make twelve hundred.

Draw the expansion path of a firm and explain what it tells a producer who is planning to grow.

Model Answer

The expansion path is the line joining all the least cost combinations of factors as a firm expands its output while factor prices stay unchanged, so it is the cheapest route from a small firm to a large one.

One tangency answers one question, how best to produce one output. A firm that intends to grow needs the answer at every output, and the expansion path is those answers strung together.

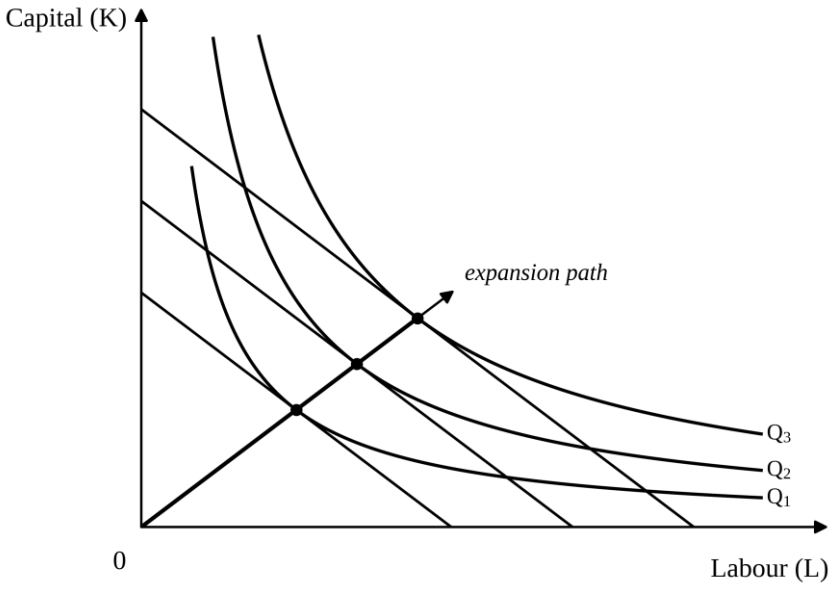


Figure 5.14: The expansion path of a firm

How the path is built: draw an isoquant for each output the firm might want. The wage and rental being unchanged, every isocost line has slope w/r and they run parallel. Mark where each isoquant touches the lowest line reaching it, and join the dots.

Why it runs out of the origin: a firm producing nothing hires nothing, so the origin is the least cost combination for zero output and the path starts there, running outward and upward as larger output needs more of some factor.

A straight path means one recipe: when the tangencies lie on one ray from the origin, the ratio of capital to labour is the same at every scale. The firm repeats its recipe larger, so the technique at twelve hundred sacks is that at four hundred.

Put figures on it. The Mbeya company pays TShs 15,000 a day for a worker and TShs 200,000 for a milling machine, and at those prices its least cost combinations run as follows.

Output (sacks a day)	Labour (workers)	Capital (machines)	Total cost (TShs)	Cost per sack (TShs)
400	4	2	460,000	1,150
800	8	4	920,000	1,150
1,200	12	6	1,380,000	1,150

Three points on the expansion path of a Mbeya maize milling company at a wage of TShs 15,000 and a machine rental of TShs 200,000.

$$400 \text{ sacks: } \; 4 \times 15{,}000 + 2 \times 200{,}000 = 460{,}000$$

$$1{,}200 \text{ sacks: } \; 12 \times 15{,}000 + 6 \times 200{,}000 = 1{,}380{,}000$$

Reading the table: machines to workers holds at one to two throughout, which is why the path is a straight ray. Cost per sack stands at TShs 1,150 at every output, so tripling the mill triples total cost: constant returns to scale. Falling cost per sack would mean economies of scale.

What the path gives the manager: a shopping list at every scale. Twelve hundred sacks a day needs twelve workers, six machines and TShs 1,380,000 a day, so he can order machines, plan recruiting and quote a price before committing a shilling.

The source of long run cost: every point on the path is the cheapest way of producing its own output, so reading total cost against output along the path traces the long run total cost curve, and dividing by output traces long run average cost.

What makes the path bend: if larger machines earn their keep only at large volumes, the tangencies drift towards the capital axis and the path bends upward, the bigger firm using more capital per worker. That is capital deepening; a path bending the other way says the firm grows by hiring.

A price change moves the whole path: the path is drawn for one pair of prices. Let the wage fall and every isocost becomes flatter, every tangency slides towards labour, and the whole path swings that way. A growth plan is only as stable as its prices.

A producer planning to grow should ask not how much more he can sell but what combination of hands and machines each larger output demands, because the expansion path decides what growth will cost.

The Master Key: *Join the tangencies at unchanged prices and you have the cheapest road from small to large.*

REAL Question 132

Stand in the sorting hall of a Morogoro rice mill. Twelve women pick stones from the rice by hand while three machines do the same work beside them. Both are paid for.

Using the figures in the box, test whether the mill is at its least cost combination, state which factor it should expand, and describe the combination it should move to.

A rice mill at Morogoro sorts milled rice before bagging it. It hires hand sorters at TShs 12,000 a day and rents optical sorting machines, complete with power and service, at TShs 96,000 a machine a day.

The mill at present works 12 sorters and 3 machines, and spends TShs 432,000 a day on the two together.

Its own records show that the twelfth sorter added 30 bags a day to output and that the third machine added 180 bags a day.

The mill earns a margin of TShs 500 on every bag it sorts, and works 300 days in the year.

Model Answer

The mill is not at its least cost combination: the last shilling on a sorter buys 0.0025 of a bag against 0.001875 on a machine, so it should hire more sorters and release a machine, moving to twenty sorters and two machines for the same TShs 432,000.

The test is the equi marginal condition: divide each factor’s marginal product by its price and see which returns more output for a shilling.

$$\frac{\mathrm{MP_L}}{\mathrm{w}} = \frac{30}{12{,}000} = 0.0025 \text{ bags per shilling}$$
$$\frac{\mathrm{MP_K}}{\mathrm{r}} = \frac{180}{96{,}000} = 0.001875 \text{ bags per shilling}$$

The two figures in money: a decimal with three noughts in front means nothing on a factory floor, so scale both to TShs 100,000. Spent on sorters that money brings in 250 bags a day; spent on machine hire, 187.5. The mill is buying the smaller.

The same verdict in slopes: the mill's rate of technical substitution stands above the price ratio, so the isoquant through its present position is steeper than its isocost, and it stands left of the tangency with too much capital and too little labour.

$$\mathrm{MRTS_{LK}} = \frac{\mathrm{MP_L}}{\mathrm{MP_K}} = \frac{30}{180} = \frac{1}{6} \approx 0.167$$
$$\frac{\mathrm{w}}{\mathrm{r}} = \frac{12{,}000}{96{,}000} = 0.125$$

Which factor to expand: labour. Giving back one optical sorter releases TShs 96,000 a day, and at TShs 12,000 a sorter that money hires eight more hands, so the mill can move from twelve sorters and three machines to twenty sorters and two.

$$\frac{96{,}000}{12{,}000} = 8 \text{ extra sorters}$$

Check that the new mixture still spends the same money, because if it did not, the comparison would be worthless.

$$20 \times 12{,}000 + 2 \times 96{,}000 = 240{,}000 + 192{,}000 = 432{,}000$$

What the move gains: the machine given back was producing 180 bags a day. The eight extra sorters produce less as they arrive, their marginal product falling from about 30 to 24, so on average they add about 27 bags each.

$$\frac{30 + 24}{2} = 27 \text{ bags each}$$
$$8 \times 27 = 216 \text{ bags gained}$$
$$216 - 180 = 36 \text{ extra bags a day}$$
$$36 \times 500 = 18{,}000 \text{ shillings a day}$$
$$18{,}000 \times 300 = 5{,}400{,}000 \text{ shillings a year}$$

What that figure means: the mill earns an extra TShs 5,400,000 a year without buying an asset, without borrowing and without raising its outlay by one shilling. The gain comes from rearranging money it was already spending, the most profitable change a firm can make.

Where the movement stops: at twenty sorters and two machines the last sorter adds 24 bags and the last machine 192, the first lower because labour has been crowded on and the second higher because the remaining machines are worked harder.

$$\frac{24}{12{,}000} = 0.002 \quad \frac{192}{96{,}000} = 0.002$$
$$\mathrm{MRTS_{LK}} = \frac{24}{192} = 0.125 = \frac{\mathrm{w}}{\mathrm{r}}$$

Reading that as a diagram: the two ratios are equal and the rate of substitution has fallen into line with the price ratio, so the mill is at the tangency, having travelled along one isocost line from a point where it cut an isoquant to where it touches a higher one.

What the calculation assumes: that the machines are rented and can be given back, that eight sorters can be found and trained, and above all that hand and machine sorting give rice a buyer treats as identical. If a contract demands machine uniformity, the cheapest way of making the wrong product is no bargain.

The Master Key: *Divide each marginal product by its price; expand the factor with the larger answer until the two are equal.*

REAL Question 133

Walk the cutting blocks at Kilombero in July. Three hundred men with cane knives bring in nine hundred tonnes a day, and three harvesters could bring in exactly the same.

Compare the cost of the two techniques in the box, advise the estate which to use, and calculate the daily wage at which that advice would change.

A section of the Kilombero cane estate must cut and load 900 tonnes of cane a day through a harvest of 150 working days.

Technique A, hand cutting: 300 cutters, each cutting 3 tonnes a day, paid TShs 9,000 a day each.

Technique B, mechanical cutting: 3 harvesters, each cutting 300 tonnes a day, hired complete with fuel, operator and maintenance at TShs 1,000,000 a machine a day.

Both techniques deliver the same 900 tonnes of cane to the mill each day.

Model Answer

Hand cutting is cheaper at the present wage, costing TShs 2,700,000 a day against TShs 3,000,000 for the harvesters, so the estate should cut by hand and save TShs 45,000,000 over the harvest; that advantage vanishes once the daily wage passes TShs 10,000.

Both techniques produce the same 900 tonnes, so both are points on the same isoquant. The question is which lies on the lower isocost line, and that is settled by multiplication.

$$\text{Cost of A} = 300 \times 9{,}000 = 2{,}700{,}000 \text{ shillings a day}$$

$$\text{Cost of B} = 3 \times 1{,}000{,}000 = 3{,}000{,}000 \text{ shillings a day}$$

The verdict: hand cutting is cheaper by TShs 300,000 every cutting day, which across a harvest of 150 days is TShs 45,000,000 the estate keeps for producing exactly the same tonnage.

$$3{,}000{,}000 - 2{,}700{,}000 = 300{,}000 \text{ shillings a day}$$

$$300{,}000 \times 150 = 45{,}000{,}000 \text{ shillings a harvest}$$

The same verdict per shilling: divide each factor's marginal product by its price. A cutter delivers 3 tonnes for TShs 9,000 and a harvester 300 tonnes for TShs 1,000,000, so a million shillings on men brings in 333 tonnes and on machinery 300.

$$\frac{\text{MP}_\text{L}}{\text{w}} = \frac{3}{9{,}000} \approx 0.000333 \text{ tonnes per shilling}$$

$$\frac{\text{MP}_\text{K}}{\text{r}} = \frac{300}{1{,}000{,}000} = 0.000300 \text{ tonnes per shilling}$$

And tested in slopes: the rate at which the technology lets machines be replaced by men stands above the rate at which the market prices them, so the estate belongs at the labour end of the isoquant. All three tests agree, being one condition in different clothes.

$$\text{MRTS}_\text{LK} = \frac{\text{MP}_\text{L}}{\text{MP}_\text{K}} = \frac{3}{300} = 0.01$$

$$\frac{\text{w}}{\text{r}} = \frac{9{,}000}{1{,}000{,}000} = 0.009$$

The wage at which the advice reverses: the estate would be indifferent between the two techniques at the wage that makes 300 cutters cost precisely what 3 harvesters cost. Solve for it.

$$300\text{w} = 3{,}000{,}000$$

$$\text{w} = \frac{3{,}000{,}000}{300} = 10{,}000 \text{ shillings a day}$$

What the switching wage means: below TShs 10,000 a day the estate cuts by hand; above it it mechanises and 300 cutting jobs end. The whole labour intensive technique rests on a gap of TShs 1,000 a day, about eleven per cent of the present wage: that is how narrow the ground is.

What it leaves out for the machine: a harvester cuts through the night and through rain, needs no housing, water or clinic, and delivers cane of an even length the mill prefers. Each is worth money and should come off the machine's effective rental, which lowers the switching wage below TShs 10,000.

And on labour's side: cutters work the wet and steep blocks a harvester cannot enter, leave less soil and trash in the load, and can be engaged for one harvest and released, while a machine hired by the day is paid for on a day the rain stops cutting. Price those in and the switching wage rises.

The advice stands, but notice on what it rests. The estate cuts by hand not because hand cutting is superior, nor because it is a duty to employ, but because at TShs 9,000 it is cheaper.

The Master Key: *Two techniques on one isoquant: cost them both, take the cheaper, then find the price at which the answer flips.*

REAL Question 134

A Kariakoo workshop has one million eight hundred thousand shillings a week for factors. Twenty tailors and five machines fill the room, and the owner is certain that is the right mix.

Write the workshop's isocost equation, state its intercepts and its slope, then find the least cost combination and the gain from moving to it.

A garment workshop at Kariakoo has TShs 1,800,000 a week to lay out on tailors and sewing machines.

A tailor is paid TShs 60,000 a week. A machine costs TShs 120,000 a week to hire, power and service.

The workshop now runs 20 tailors and 5 machines. At that combination the twentieth tailor adds 25 shirts a week and the fifth machine adds 60 shirts a week.

The workshop clears a margin of TShs 2,500 on every shirt, and trades 52 weeks in the year.

Model Answer

The isocost line is $1{,}800{,}000 = 60{,}000\text{L} + 120{,}000\text{K}$**, running from 15 machines on the capital axis to 30 tailors on the labour axis with a slope of 0.5. The present mixture is affordable but not least cost: two tailors swapped for a machine add ten shirts a week for nothing.**

Begin from the general form of the isocost and put the workshop's own figures into it.

$$\text{C} = \text{wL} + \text{rK}$$

$$1{,}800{,}000 = 60{,}000\text{L} + 120{,}000\text{K}$$

The present mixture lies on the line: twenty tailors and five machines cost exactly the money available, so the workshop is neither overspending nor holding back. Affordable is not the same as best, and the question is where along this line it should stand.

$$20 \times 60{,}000 + 5 \times 120{,}000 = 1{,}200{,}000 + 600{,}000 = 1{,}800{,}000$$

The vertical intercept: if every shilling went on machines the workshop could hire fifteen of them and employ nobody at all, so the line meets the capital axis at fifteen.

$$\frac{\text{C}}{\text{r}} = \frac{1{,}800{,}000}{120{,}000} = 15 \text{ machines}$$

The horizontal intercept: if every shilling went on tailors it could engage thirty of them and hire no machine, so the line meets the labour axis at thirty.

$$\frac{\text{C}}{\text{w}} = \frac{1{,}800{,}000}{60{,}000} = 30 \text{ tailors}$$

The slope: the line falls at one half, meaning one machine given up pays for two tailors, and two tailors let go pay for one machine. Every swap must respect that rate, because that is what the market charges.

$$\text{Slope} = \frac{\text{w}}{\text{r}} = \frac{60{,}000}{120{,}000} = 0.5$$

Now test the present position against the equi marginal condition, dividing each marginal product by the price of the factor that produced it.

$$\frac{\text{MP}_\text{L}}{\text{w}} = \frac{25}{60{,}000} \approx 0.000417 \text{ shirts per shilling}$$

$$\frac{\text{MP}_\text{K}}{\text{r}} = \frac{60}{120{,}000} = 0.000500 \text{ shirts per shilling}$$

The diagnosis: the machine returns more output per shilling than the tailor, so the workshop carries too much labour and too little capital. In slopes, the rate of substitution has fallen below the price ratio, putting the workshop right of the tangency.

$$\text{MRTS}_{LK} = \frac{25}{60} \approx 0.417 \quad \text{against} \quad \frac{w}{r} = 0.5$$

The swap in whole units: release two tailors and the workshop saves TShs 120,000 a week, precisely the hire of one machine. Two tailors produced 50 shirts between them and the machine produces 60, so the workshop is ten shirts a week better off.

$$\text{Output lost} = 2 \times 25 = 50 \text{ shirts}$$
$$\text{Output gained} = 1 \times 60 = 60 \text{ shirts}$$
$$\text{Net gain} = 60 - 50 = 10 \text{ shirts a week}$$
$$10 \times 2{,}500 = 25{,}000 \text{ shillings a week}$$
$$25{,}000 \times 52 = 1{,}300{,}000 \text{ shillings a year}$$

What that means to the workshop: an extra TShs 1,300,000 a year appears out of nothing but a rearrangement of the same weekly outlay. No loan is taken, no new order won and no tailor works harder. The money was being lost quietly every week.

Where the swapping stops: at eighteen tailors and six machines the outlay is unchanged, but the last tailor now adds 28 shirts, fewer of them sharing more machinery, while the last machine adds only 56, machines having become the crowded factor.

$$18 \times 60{,}000 + 6 \times 120{,}000 = 1{,}080{,}000 + 720{,}000 = 1{,}800{,}000$$
$$\frac{28}{60{,}000} \approx 0.000467 \quad \frac{56}{120{,}000} \approx 0.000467$$
$$\text{MRTS}_{LK} = \frac{28}{56} = 0.5 = \frac{w}{r}$$

The least cost combination: eighteen tailors and six machines. The two ratios are equal, the rate of substitution equals the price ratio, and the isocost is tangent to the highest isoquant the workshop can reach. No further swap would add a shirt.

Factors come in whole units, and nobody hires two thirds of a sewing machine, so a real workshop gets as near the tangency as whole numbers allow. The rule has still told the owner which way to move.

The Master Key: *Being on the isocost line only proves you can afford the mixture; only tangency proves it is the right one.*

HOT Question 135

A Mwanza fillet plant is offered an imported filleting line that will do the work of sixty women. The accountant wants it. The district officer counts sixty households.

Discuss whether a Tanzanian firm should adopt a labour intensive or a capital intensive technique of production.

Model Answer

Neither technique is right in itself: the least cost combination is settled by the ratio of the wage to the rental of capital set against the ratio of the marginal products, and in most Tanzanian manufacturing that comparison still points towards labour, though less firmly once quality and volume enter.

The rule that settles it: a technique is not modern or backward, but cheap or dear at the prices the firm faces. The firm should sit where $\text{MRTS}_{LK} = w/r$, which is why the answer can differ between two plants on one street.

Why the ratio usually favours labour: a day of unskilled labour costs between TShs 9,000 and TShs 15,000, while machinery is bought in foreign currency, shipped, cleared and financed near eighteen per cent. That makes w/r small and the tangency far along the labour axis.

The quoted rental understates: a machine idled by a power cut still carries its hire charge, a spare part may take six weeks from abroad, and one operator lost can stop a line. Each raises the effective r above the invoice and pushes the tangency towards labour.

Labour turns a fixed cost variable: a machine must be paid for whether orders come or not, so its cost is spread only by volume. A cashew plant working four months of the year buys a machine idle for the rest, whereas hands are engaged for the season and released.

For capital: hand work fails: fillets for export must be cut, chilled and packed within a controlled time and temperature, and a hand line fails the inspection however little it costs. There the isoquant is right angled and the machine must simply be bought.

For capital: the true cost of labour: sixty women filleting 4 tonnes a day at TShs 12,000 each cost TShs 720,000, or TShs 180,000 a tonne. A line hired at TShs 500,000 filleting 5 tonnes costs TShs 100,000 a tonne. Cheap hands on a low marginal product are dearest.

For capital: the prices may lie: if machinery enters free of duty while the wage is held above the market by statute, the isocost the firm faces is not the one the country faces. The firm mechanises rightly for itself and wrongly for the economy.

Employment is a national aim: the firm minimises cost; the country wants jobs. Ordering a firm to keep labour it does not need makes it dear, and a dear firm closes and takes every job with it. Change the prices it faces by training that raises MP_L.

The choice is not one choice: a plant is a chain of separate processes, each with its own isoquant. The Mwanza plant can fillet by machine where the standard is decided and receive, weigh, ice and pack by hand where it is not.

The decision turns on the loaded ratio of factor prices and on where the technology puts the rate of substitution, one process at a time. For most Tanzanian firms that means labour in handling, sorting and packing, and machinery where quality is decided.

The Master Key: *Neither technique is virtuous; the one that is cheapest at the prices you truly face is the right one, process by process.*

HOT Question 136

Ask a Kariakoo workshop owner for the marginal product of his fourth tailor and he will laugh. Ask him whether the fourth tailor earns his keep and he answers at once.

Assess the usefulness of the least cost rule to a manager who cannot measure the marginal product of a worker or a machine.

Model Answer

As a formula to be solved the rule is nearly useless on a factory floor, since no marginal product can be read off a ledger. As a question, in which direction does the last shilling do more good, it is among the most useful a manager can carry, and its discrete form is workable.

The measurement objection is real: a marginal product is the addition to output from one more unit of a factor with all else constant, and nothing in a working plant is constant. A rice mill cannot hold paddy quality, power, weather and the order mix still while it adds one sorter.

The records do not exist: most small firms keep one book, recording money in and money out. There is no daily series of output against labour, so nothing to take a difference of. The rule asks a rate of change from a firm that measures no levels.

Factors are not divisible: the rule speaks of moving a shilling between factors, but nobody buys a fifth of a sorting machine or engages a third of a tailor. Swaps come in whole units and overshoot, so exact equality is approached and rarely occupied.

The prices are not given: a firm hiring hard in a thin rural labour market bids the wage up as it hires, so w is not constant. The true cost of a machine includes downtime, spare parts and the operator nobody has costed, so r is not the invoice figure.

The firm may not be minimising cost: a family firm engages the nephew, a manager builds an empire, a public enterprise is told to hold its staff. Where those pressures rule, the tangency describes not what is done but what would be done if cost decided.

The rule needs a direction, not a number: it never asks the manager to compute anything. Two tailors cost what one machine costs; would two tailors add more shirts a week? Every workshop owner in Kariakoo can answer that from the floor.

A rough measurement is enough: engage one extra sorter for a fortnight and count the bags; hire one machine for a month and count again. What comes back is a rough marginal product, and rough is enough to know which way to move.

The discrete form uses his books: costing two whole techniques for the same output, as the Kilombero estate does with cutters and harvesters, needs nothing but wages, rentals and tonnages. That is the rule in the only clothes a working firm can wear.

What the rule protects him from: without it a manager reasons from the price of a factor alone, buys the cheap thing and believes he has saved. The rule divides price by what the factor produces, which is why a cheap worker without a machine can be dearest.

It explains behaviour nobody calculates: firms that never heard of a marginal product still drift towards the cheap factor, because the ones that do not make losses and close. The rule predicts the pattern of technique across the country though no owner has solved it.

As an algebraic condition, of little use to a manager with no data. As an accounting comparison between whole techniques, used every day. As a habit of mind, indispensable: ask what this shilling buys here against there.

The Master Key: *You need not measure a marginal product to obey the rule; you need only ask which way the last shilling does more good.*

HOT Question 137

Tanzania's low wage is called its edge in production. At Kilombero it holds three hundred cutting jobs, and one thousand shillings a day is all that stands between them and a harvester.

Is it true that cheap labour is Tanzania's great advantage in production? Assess the claim.

Model Answer

Cheap labour is a genuine advantage on a firm's cost sheet and a trap for the economy, because what a producer competes on is never the wage but the wage divided by the marginal product, and a wage low only because output per worker is low buys no advantage.

The tangency moves towards labour: a low wage means a low w/r, a flat isocost and a least cost combination far along the labour axis. A firm can reach a given isoquant with very little capital, and that matters most where capital is scarcest.

It suits an economy short of capital: machinery is imported and paid for in dollars, while labour is paid in shillings out of this week's takings. A labour intensive technique lets a firm begin with a room, a few tools and an order.

It creates the employment the country most needs: hundreds of thousands join the labour force each year. A labour intensive plant absorbs them where a capital intensive one, producing the same output, would take on a handful of operators and a maintenance fitter.

Against: unit labour cost is what actually competes: the buyer never sees the wage. He sees the price, and the labour in that price is the wage divided by the output the worker produces.

$$\text{Labour cost per unit} = \frac{w}{MP_L}$$

$$\frac{9{,}000}{3} = 3{,}000 \text{ shillings a tonne}$$

$$\frac{15{,}000}{6} = 2{,}500 \text{ shillings a tonne}$$

Read those two lines together: a cutter paid TShs 9,000 who cuts 3 tonnes costs TShs 3,000 a tonne. A cutter paid TShs 15,000 who cuts 6 tonnes, having a better knife and a trained gang, costs TShs 2,500. The higher wage is the cheaper labour.

Cheap labour removes the pressure to improve: when hands are cheap the tangency sits where it always sat, and no owner has reason to buy the machine, train the gang or redesign the flow. The economies that grew rich were pushed up their isoquant maps by labour that would not stay cheap.

The advantage is brittle: it amounts to the distance between the wage now paid and the wage at which the machine wins. At Kilombero that is TShs 1,000 a day, about eleven per cent. One wage award and three hundred jobs end.

A low wage is also a small market: a worker paid TShs 9,000 a day is a customer with TShs 9,000 a day. Firms selling at home are held down by the very wage that holds their costs down, and never reach the scale at which costs would fall.

What the claim gets right: the answer is not to legislate the wage upward. A wage pushed past the switching point does not enrich the cutter; it mechanises his job away or drives it into an informal yard. The wage must rise because the marginal product has.

True as a description of where Tanzania's least cost combinations lie, false as a plan. Cheap labour is the starting position, not the strategy: raise the marginal product through skill, tools, power and roads, so wages climb while unit labour cost falls.

The Master Key: *The wage is not the cost of labour; the wage divided by the marginal product is, and only that figure competes.*

The Concept of Cost and the Two Profits

A shop can fill its till every evening, pay every supplier and show a comfortable profit in its book, and still be the wrong business for its owner to be in. Cost in economics is not what leaves your hand but what you give up, so beside the profit the accountant strikes there stands a second and truer one. These questions take that second profit apart, shilling by shilling, and use it to decide when a producer should stay and when he should go.

BINDER Question 138

A Kariakoo trader pays no rent, because the shop is his own. He tells you his costs are low. The building tells a different story to anyone who offers to rent it.

Explain what an economist means by the cost of production, and distinguish explicit costs from implicit costs, giving Tanzanian examples of each.

Model Answer

To an economist the cost of a resource is its opportunity cost, the value of the best alternative given up, so economic cost is explicit cost, the payments made to outsiders, plus implicit cost, the earnings the producer's own factors forgo.

A resource serves one use at a time. The hour a fundi, that is, a skilled craftsman, spends welding a gate cannot also be spent fitting a door, and that sacrifice is the cost, receipt or no receipt.

Explicit costs: the payments the firm makes to outsiders for the factors it hires, wages, rent for a hired shed, raw materials, fuel, electricity from TANESCO, transport and interest on a bank loan. Money changes hands, so each leaves a receipt in the books.

Implicit costs: the opportunity cost of factors the producer owns and does not pay for. No cheque, no receipt, so not a shilling appears in the books, yet the sacrifice is real. The building could have been let to a tenant, the year in the shop sold to an employer.

The test that separates them: ask who receives the payment. If money leaves the firm for an outsider, the cost is explicit. If the factor belongs to the owner and no payment is made, the cost is implicit, measured by what it would have earned elsewhere.

$$\text{Economic cost} = \text{Explicit cost} + \text{Implicit cost}$$

Why implicit costs must be counted: a factor used inside the firm is denied to somebody outside who would have paid for it. The press on the owner's own plot at Singida uses that plot as surely as if he rented it, and the uncollected rent is a real sacrifice.

Both kinds are costs of production: the seed a miller buys and the wage he does not pay himself both measure something the community gives up for this output. To leave one out is not a simplification but an error.

Two questions, two answers. What did the business spend? The explicit costs. What did it truly cost? Everything given up to run it. Counting only what leaves your hand counts half the sacrifice.

The Master Key: *Cost is what you give up, not what you pay out; explicit costs leave the till, implicit costs never do.*

BINDER Question 139

The huller in a Morogoro rice mill loses value this morning while it stands idle, and the savings buried in it earn nothing. Nobody has sent the owner a bill for either.

Explain the four kinds of implicit cost that arise when a producer uses factors of production he owns himself, and show how each of them is measured.

Model Answer

The four implicit costs are depreciation on the capital the producer owns, the interest it could have earned elsewhere, the wage his own labour could have earned, and the rent his land or building would have fetched, each measured by its best alternative.

Depreciation of owned capital: capital wears out in use, so part of the machine is consumed each period, measured by the fall in its value. A huller costing TShs 36,000,000, with a nine year life and no scrap, eats TShs 4,000,000 a year.

$$\text{Annual depreciation} = \frac{36{,}000{,}000}{9} = 4{,}000{,}000$$

Interest forgone on owned capital: money locked into the firm could have earned a return elsewhere, in a bank deposit, a treasury bill, a bond or shares. TShs 25,000,000 of his savings in the mill, at a treasury bill rate of 8 per cent, costs him TShs 2,000,000 a year.

$$\text{Interest forgone} = 25{,}000{,}000 \times \frac{8}{100} = 2{,}000{,}000$$

Wage forgone by owned labour: his time has a price even unpaid, the best wage open to him elsewhere. Had a rice company at Ifakara hired him as plant manager at TShs 750,000 a month, that is TShs 9,000,000 a year. A salary actually paid to an owner is explicit.

Rent forgone on owned land or buildings: land or premises the owner supplies himself, measured by the highest rent it would fetch if let. A godown a trader would rent at TShs 350,000 a month costs the mill TShs 4,200,000 a year.

Measure each by an alternative that truly exists: the figure must be one somebody would really have paid. A forgone salary of TShs 750,000 counts only if such a post was genuinely open; where no employer is hiring, the forgone wage is small.

Never count the same sacrifice twice: charge a building either at the rent it would fetch or at depreciation plus interest on its value, never both, since the rent covers exactly that wear and interest. Double counting invents a loss.

Depreciation is the one implicit cost an accountant usually enters, as a provision for wear and tear, while forgone interest, wage and rent appear only in the owner's reasoning. That is why those three are forgotten.

The Master Key: *Four sacrifices nobody bills you for: the machine wearing out, the money lying idle, the wage unearned and the rent uncollected.*

BINDER Question 140

The accountant at a Mtwara cashew buyer's office and the economist beside him stare at one ledger. They read out two profits that differ by millions, and neither of them has erred.

Distinguish accounting cost from economic cost and accounting profit from economic profit, writing the equation for each profit.

Model Answer

Accounting cost is the money the firm actually spends, so accounting profit is total revenue less explicit cost, whereas economic cost is explicit cost plus implicit cost, so economic profit is total revenue less the whole sacrifice production required.

Accounting cost: the operating cost the accountant records, money actually spent plus any provision for depreciation. It serves three purposes, settling income tax, showing a bank how its loan was used, and giving shareholders a proper calculation of profit and dividend.

Economic cost: the whole opportunity cost of production, which adds to those money payments the earnings forgone by every factor the owner supplies himself. It answers what the community and the owner gave up so that this output could exist.

The two profits follow directly from the two costs.

$$\text{Accounting profit} = \text{Total revenue} - \text{Explicit cost}$$

$$\text{Economic profit} = \text{Total revenue} - (\text{Explicit cost} + \text{Implicit cost})$$

The second subtracts everything the first subtracts and the implicit costs besides, so a single further subtraction moves from one to the other.

$$\text{Economic profit} = \text{Accounting profit} - \text{Implicit cost}$$

Economic profit can never be the larger of the two: implicit cost cannot be negative, so the economist's figure is always the smaller, by exactly what the owner's factors could earn elsewhere. A firm may show a healthy book profit and an economic loss at once, and both are true.

Historic cost against replacement cost: the accountant records what was paid for an asset, its historic cost, because a receipt supports it. The economist asks what the same asset would cost today, its replacement cost, since that is the sacrifice. When prices rise, a mill setting aside only historic cost finds the money will not buy another huller.

Which figure for which purpose: use the accounting figures wherever a law or contract demands them, for the tax authority, the bank and the shareholders. Use the economic figures for the question the owner faces, whether these resources should stay in this business.

Neither man is wrong. The accountant answers what we spent, and answers it exactly. The economist answers what it cost to be here rather than somewhere else, and only that tells an owner whether to stay.

The Master Key: *Accounting profit subtracts what was paid out; economic profit subtracts everything that was given up.*

BINDER Question 141

A Sumbawanga miller is told his economic profit is exactly zero and takes it as bad news. His neighbour, thirty years in the trade, would sign for that figure this afternoon.

Define normal profit and supernormal profit, and explain why a firm whose economic profit is zero is not a firm in difficulty.

Model Answer

Normal profit is the minimum return that keeps an entrepreneur in this line of business, so it is an implicit cost removed before economic profit is struck, and zero economic profit means exactly normal profit, doing as well here as anywhere.

Normal profit defined: the least reward that keeps the entrepreneur where he is, the supply price of enterprise. Pay less and he takes his organising ability and his willingness to bear uncertainty somewhere else.

Why it is a cost and not a surplus: every factor must be paid enough to keep it in the firm, and enterprise is no different. This sum is exactly what retains the entrepreneur, so it sits inside implicit cost like any wage.

Where it sits in the arithmetic: economic cost already contains it. Once explicit and implicit cost are taken from revenue, the owner's forgone wage, interest, rent and normal profit have all been met, and what remains is pure surplus.

Zero economic profit is not zero income: a miller with zero economic profit has been paid a full wage for his labour, full interest on his capital, full rent on his building and the normal reward for bearing uncertainty. He has no reason to move.

Supernormal or abnormal profit: economic profit above zero, a return greater than the resources could earn elsewhere. It is a signal rather than a settled condition, drawing new firms in until extra output pushes the price down and the surplus is competed away.

Negative economic profit: a return below the best alternative. The owner may still show a book profit and pay every bill, yet he loses by staying, so the signal is to move out. This is why maize mills in a small town thin out after a poor season without one going bankrupt.

Positive economic profit says come in, zero says stay, negative says go. That is the whole allocating mechanism of a market economy.

So breaking even does not mean scraping by. It means covering every cost, the owner's opportunity cost included, the healthy condition of a competitive trade.

The Master Key: *Zero economic profit means normal profit, and normal profit means doing exactly as well here as anywhere else.*

BINDER Question 142

A borehole crew at Chamwino drills eighty metres, strikes rock and finds no water. That money is gone. The only question left is whether the next metre is worth drilling.

Define a sunk cost, distinguish it carefully from a fixed cost, and state the rule that governs a sunk cost when a fresh decision has to be taken.

Model Answer

A sunk cost is a cost already incurred which cannot be recovered whatever the firm now does, and because no choice now open to the firm can change it, a sunk cost is irrelevant to every fresh decision.

Sunk cost defined: spending gone beyond recall. A district licence fee already paid and not refundable, money spent digging a dry borehole, an advertisement already broadcast and a machine built to one customer's design that nobody else will buy are all sunk.

Fixed cost defined: a cost that does not vary with output in the short run, such as the rent of a shed, the salary of a watchman or an insurance premium. Fixed with respect to output is quite another thing from unrecoverable.

Where the two part company: a fixed cost is often escaped by closing. A shed rented month by month costs the same whether the workshop makes ten gates or a hundred, yet give the landlord notice and it stops. A sunk cost no action can escape.

A cost can be partly sunk: a welding plant bought for TShs 8,000,000 that would fetch TShs 5,000,000 today is sunk only to the extent of the TShs 3,000,000 that cannot be got back. The other TShs 5,000,000 is recoverable, so keeping the machine costs him that sum.

The rule for decisions: count only what differs between the courses open to you. A cost that is the same under every option, whether already paid or now unavoidable, drops out. Look forward at the extra revenue and extra cost each choice brings, never backward.

The error the rule prevents: the belief that money already spent must be justified by spending more, heard everywhere as we have come too far to stop now. Those shillings are lost whether the firm goes on or stops.

A fundi at Kariakoo who has paid a non refundable annual licence of TShs 1,200,000 should ask one question when trade turns slack. Does staying open bring in more than it costs from today onward?

The Master Key: *A sunk cost is gone whichever way you choose, so it can never help you choose.*

BINDER Question 143

A fillet plant on the Mwanza shore counts fuel, ice and wages, and its books balance to the shilling. The fishermen below the outfall pipe keep a different account entirely.

Distinguish private cost from social cost, explain what is meant by an external cost, and show why the two costs diverge.

Model Answer

Private cost is the cost a firm bears itself and therefore counts, external cost is the cost its production imposes on other people who are never compensated, and social cost is the two added together, so the divergence between them is exactly the external cost.

Private cost: everything the firm itself gives up in order to produce, explicit costs together with implicit costs. It is the only part of the sacrifice the producer actually feels, and so the only part he counts.

External cost: a cost falling on third parties who take no part in the transaction and receive nothing for bearing it. When a fish processing plant at Mwanza discharges untreated waste into Lake Victoria, the fishermen whose catch declines and the households who must boil their water pay part of that plant's cost.

$$\text{Social cost} = \text{Private cost} + \text{External cost}$$

Further Tanzanian cases: the smoke of a factory in the Dar es Salaam industrial area, which raises the cost of treating chest complaints around it; charcoal burning for the city market, which strips woodland farmers far away depend on; and heavy lorries that break a district road the council must repair.

Why the two diverge: a firm is charged only for what it must buy. Nobody invoices the plant for the lake, so the waste is free to the firm and costly to everyone else. He stops where his private cost is covered, and so produces more than social cost would justify.

What follows for policy: the remedy is to make private cost equal social cost. A levy equal to the damage, a requirement to treat the effluent before discharge, or an enforced standard all put the external cost back onto the producer, so his own arithmetic leads him to the right output.

The mirror case exists as well. A firm that trains fitters who later work elsewhere confers an external benefit, so its private benefit understates the social benefit and it trains too few. Benefits spill over the fence of the firm as costs do.

The Master Key: *Private cost is what the firm pays, social cost is what the country pays, and the gap is borne by somebody who never agreed to it.*

REAL Question 144

Follow one year of alizeti, that is, sunflower, through a small press at Ilongero in Singida. The cash book shows a fine profit. Four costs that matter never entered it.

Using the records in the box, calculate the press's total revenue, its accounting profit and its economic profit, and state what the second figure tells its owner that the first cannot.

Tumaini Oil Press at Ilongero in Singida Region is owned and run by Method Sanga. The figures below cover one full year.

The press bought 120,000 kilogrammes of sunflower seed from farmers at TShs 620 a kilogramme and sold 24,000 litres of cooking oil at TShs 5,200 a litre. The seed cake left over is returned to the farmers as part of the price.

Four workers were paid TShs 180,000 each a month. Power from TANESCO cost TShs 3,600,000, and repairs and spare parts cost TShs 1,700,000.

Bottles, caps and labels cost TShs 250 a litre. Transport of seed and oil cost TShs 2,400,000, and the licence, the levy and the district cess together came to TShs 1,260,000.

The expeller and filter cost Method TShs 24,000,000, have a working life of eight years and no scrap value. He keeps no provision for wear and tear in his cash book.

TShs 30,000,000 of his own savings is tied up in the press and the stock, and a treasury bill would have paid him 9 per cent a year.

He turned down a post as plant supervisor at a Singida ginnery paying TShs 900,000 a month, and the press stands in his own godown, which a trader would rent at TShs 400,000 a month.

Model Answer

The press takes TShs 124,800,000 in the year, shows an accounting profit of TShs 26,800,000 and earns an economic profit of TShs 5,500,000, so Method does better at Ilongero than in anything else open to him, but by far less than his cash book suggests.

Take the revenue first, since the press sold only oil and at one price.

$$\text{Total revenue} = 24{,}000 \times 5{,}200 = 124{,}800{,}000$$

The seed cost $120{,}000 \times 620 = 74{,}400{,}000$, the four workers $4 \times 180{,}000 \times 12 = 8{,}640{,}000$ and the bottling materials $24{,}000 \times 250 = 6{,}000{,}000$, the remaining lines being given directly.

$$\text{Total explicit cost} = 74{,}400{,}000 + 8{,}640{,}000 + 3{,}600{,}000 + 6{,}000{,}000 + 1{,}700{,}000 + 2{,}400{,}000 + 1{,}260{,}000$$

$$\text{Total explicit cost} = 98{,}000{,}000$$

$$\text{Accounting profit} = 124{,}800{,}000 - 98{,}000{,}000 = 26{,}800{,}000$$

TShs 26,800,000 is the figure a bank and the tax authority work from, and as an account of the money it is correct. Four sacrifices are missing, each a factor Method supplied himself.

Implicit cost	How it is measured	Amount (TShs)
Depreciation of the press	24,000,000 spread over 8 years	3,000,000
Interest forgone on own capital	30,000,000 at 9 per cent a year	2,700,000
Wage forgone by the owner	900,000 a month for 12 months	10,800,000
Rent forgone on the godown	400,000 a month for 12 months	4,800,000
Total implicit cost	-	21,300,000

The four sacrifices that never entered the cash book.

$$\text{Total implicit cost} = 3{,}000{,}000 + 2{,}700{,}000 + 10{,}800{,}000 + 4{,}800{,}000 = 21{,}300{,}000$$

$$\text{Economic cost} = 98{,}000{,}000 + 21{,}300{,}000 = 119{,}300{,}000$$

$$\text{Economic profit} = 124{,}800{,}000 - 119{,}300{,}000 = 5{,}500{,}000$$

The shorter road gives the same answer as a check: $26{,}800{,}000 - 21{,}300{,}000 = 5{,}500{,}000$.

What the second figure tells him: after meeting the salary, interest, rent and wear he gave up, he is still TShs 5,500,000 ahead of his best alternative. That surplus is supernormal profit, and it answers what the cash book cannot, whether he should be in this trade.

How thin the margin really is: spread over the year's output the surplus is a little under TShs 230 a litre against an economic cost of about TShs 4,971. His whole advantage over the ginnery lies in about four shillings in every hundred a customer pays.

$$\text{Economic cost a litre} = \frac{119{,}300{,}000}{24{,}000} \approx 4{,}970.83$$

$$\text{Surplus a litre} = \frac{5{,}500{,}000}{24{,}000} \approx 229.17$$

The price at which he would earn only normal profit: if oil fell from TShs 5,200 to about TShs 4,971 a litre, revenue would exactly cover economic cost and economic profit would be zero, that is, normal profit. He should still stay, since that price pays his full salary, interest and rent; only below it is the ginnery better.

What a rise in the seed price would do: seed alone is about three quarters of his explicit cost, so he is far more exposed to the farm gate price than to anything else. A rise of TShs 50 a kilogramme adds $120{,}000 \times 50 = 6{,}000{,}000$ and wipes out the entire surplus.

Both figures are true and answer different questions. TShs 26,800,000 is what the business made; TShs 5,500,000 is what being in it was worth rather than the next best use of the same year, savings and godown.

The Master Key: *Take the accounting profit, subtract everything your own factors could have earned elsewhere, and what is left is the real reason to stay.*

REAL Question 145

Follow a year at a guest house in Njiro, Arusha. The books close with sixty seven million shillings of profit, and the owner would still be richer if she locked the door.

Using the records in the box, calculate the guest house's accounting profit and its economic profit, find the room rate at which it would earn exactly normal profit, and advise the owner.

Zawadi Mushi owns and manages Kilele Guest House at Njiro in Arusha. The figures cover one year.

The house has fourteen rooms and let 3,600 room nights during the year at TShs 40,000 a room night.

Eight members of staff were paid TShs 260,000 each a month, and breakfast for guests cost TShs 3,000 a room night.

Electricity and water cost TShs 9,600,000; laundry, linen and repairs TShs 7,200,000; insurance, licence and the hotel levy TShs 6,400,000; advertising and agents' commission TShs 11,520,000.

Interest of 15 per cent a year was paid on a bank loan of TShs 40,000,000.

The furniture, beds and water pump cost TShs 96,000,000 and have a working life of eight years with no scrap value. No provision for wear and tear appears in the accounts.

Zawadi owns the building outright, and a tour company has offered to rent it from her at TShs 3,500,000 a month.

She gave up a post with an Arusha tour operator paying TShs 2,200,000 a month, and TShs 60,000,000 of her own savings is in the business, on which a bank would pay 10 per cent a year.

Model Answer

Kilele Guest House shows an accounting profit of TShs 67,520,000 for the year and an economic loss of TShs 18,880,000, so Zawadi is nearly nineteen million shillings a year worse off running the house than letting the building and taking the salary she refused.

Begin with what came in, every shilling a room night sold at one rate.

$$\text{Total revenue} = 3{,}600 \times 40{,}000 = 144{,}000{,}000$$

Wages come to $8 \times 260{,}000 \times 12 = 24{,}960{,}000$, breakfasts to $3{,}600 \times 3{,}000 = 10{,}800{,}000$ and bank interest to $40{,}000{,}000 \times \frac{15}{100} = 6{,}000{,}000$, while the other four lines stand as given.

$$\text{Total explicit cost} = 24{,}960{,}000 + 10{,}800{,}000 + 9{,}600{,}000 + 7{,}200{,}000 + 6{,}400{,}000 + 11{,}520{,}000 + 6{,}000{,}000$$

$$\text{Total explicit cost} = 76{,}480{,}000$$

$$\text{Accounting profit} = 144{,}000{,}000 - 76{,}480{,}000 = 67{,}520{,}000$$

A handsome figure, correct as an account of the money. Set beside it what she gives up to earn it.

Implicit cost	How it is measured	Amount (TShs)
Depreciation of furniture and fittings	96,000,000 spread over 8 years	12,000,000
Rent forgone on the building	3,500,000 a month for 12 months	42,000,000
Salary forgone by the owner	2,200,000 a month for 12 months	26,400,000
Interest forgone on own savings	60,000,000 at 10 per cent a year	6,000,000
Total implicit cost	-	86,400,000

What the owner of Kilele Guest House pays without ever writing a cheque.

$$\text{Total implicit cost} = 12{,}000{,}000 + 42{,}000{,}000 + 26{,}400{,}000 + 6{,}000{,}000 = 86{,}400{,}000$$

$$\text{Economic cost} = 76{,}480{,}000 + 86{,}400{,}000 = 162{,}880{,}000$$

$$\text{Economic profit} = 144{,}000{,}000 - 162{,}880{,}000 = -18{,}880{,}000$$

Reading the minus sign: the loss does not mean the house cannot pay its bills. Every supplier, every member of staff and the bank were paid and TShs 67,520,000 remained. The building, the savings and Zawadi's year would have earned TShs 18,880,000 more elsewhere.

The rate that would earn normal profit: divide the whole economic cost by the room nights she let. She needs about TShs 45,244 a room night against the TShs 40,000 she charges, a rise of TShs 5,244 or thirteen per cent, at which economic profit is zero.

$$\text{Rate for normal profit} = \frac{162{,}880{,}000}{3{,}600} \approx 45{,}244$$

The same answer through occupancy: an extra room night brings TShs 40,000 and costs only the TShs 3,000 breakfast, so it adds TShs 37,000 towards costs that do not move with occupancy, the TShs 65,680,000 of other explicit cost plus TShs 86,400,000 of implicit cost, TShs 152,080,000 in all.

$$\text{Room nights for normal profit} = \frac{152{,}080{,}000}{37{,}000} \approx 4{,}111$$

Fourteen rooms give her 5,110 room nights a year, so she is at about 70 per cent occupancy and needs 80. Either route closes the same gap.

The advice: lift the rate towards TShs 45,000, or fill eight rooms in ten, and the house covers its full cost. If neither can be done at Njiro, let the building to the tour company at TShs 3,500,000 a month, take the post offered and bank her savings, together worth TShs 18,880,000 a year.

One caution: an opportunity cost is only as large as the opportunity. If the tour company withdraws, or no employer will pay TShs 2,200,000 a month, her implicit cost falls and the loss disappears.

The books told Zawadi she was successful and nothing about whether to continue. The economic account tells her she has been paying nineteen million shillings a year to be her own employer.

The Master Key: *A business can pay every bill, keep every promise and still be the most expensive thing its owner does with a year.*

REAL Question 146

Two traders at Kibaigwa move the same four hundred tonnes of maize in the same season. One owns his lorry and store, the other hires everything, and their books tell opposite stories.

Using the records in the box, calculate the accounting profit and the economic profit of each trader, state which of the two is truly the better business, and explain why the books mislead.

Rajabu Ngasa and Salum Kagoma both buy maize at Kibaigwa market in Kongwa and sell it to millers in Dar es Salaam. In the season just closed each of them bought 400,000 kilogrammes at TShs 500 a kilogramme and sold the whole quantity at TShs 680 a kilogramme.

Each paid TShs 6,400,000 for bags, loading and casual labour, TShs 3,100,000 for the market cess and the licence, and TShs 1,300,000 for store power and fumigation.

Rajabu owns his lorry and his store. He paid TShs 9,200,000 for fuel and a driver, and he works in the business full time.

Salum owns nothing. He hired a lorry complete with its driver and fuel for TShs 25,000,000 for the season, rented a store for TShs 7,200,000 and employed a manager at TShs 800,000 a month.

Rajabu's store would be rented by another trader at TShs 600,000 a month. His lorry cost TShs 84,000,000 and has a working life of seven years with no scrap value. TShs 110,000,000 of his own money is tied up in the lorry and the stock, and a treasury bill pays 9 per cent a year. A grain company at Kibaigwa would engage him as a buyer at TShs 800,000 a month.

Salum has TShs 30,000,000 of his own money in the business at the same 9 per cent, and he writes up the accounts himself in the evenings, work for which a book keeper would charge TShs 200,000 a month.

Model Answer

Rajabu's books show TShs 52,000,000 against Salum's TShs 19,400,000, yet once the factors each man supplies himself are priced, Rajabu earns TShs 13,300,000 against Salum's TShs 14,300,000, so the trader who looks three times as successful is the weaker business.

Both men bought and sold identical quantities at identical prices, so revenue and the cost of the maize are the same.

$$\text{Revenue (each)} = 400{,}000 \times 680 = 272{,}000{,}000$$

$$\text{Maize purchased (each)} = 400{,}000 \times 500 = 200{,}000{,}000$$

Rajabu's other payments are bags and loading, cess and licence, store power and fumigation, and fuel and a driver for his lorry.

$$\text{Rajabu's explicit cost} = 200{,}000{,}000 + 6{,}400{,}000 + 3{,}100{,}000 + 1{,}300{,}000 + 9{,}200{,}000 = 220{,}000{,}000$$

$$\text{Rajabu's accounting profit} = 272{,}000{,}000 - 220{,}000{,}000 = 52{,}000{,}000$$

Salum pays the same three items, then outsiders for the lorry, the store and the management, his manager costing $800{,}000 \times 12 = 9{,}600{,}000$.

$$\text{Salum's explicit cost} = 200{,}000{,}000 + 6{,}400{,}000 + 3{,}100{,}000 + 1{,}300{,}000 + 25{,}000{,}000 + 7{,}200{,}000 + 9{,}600{,}000 = 252{,}600{,}000$$

$$\text{Salum's accounting profit} = 272{,}000{,}000 - 252{,}600{,}000 = 19{,}400{,}000$$

On money paid out Rajabu is far ahead, which is the comparison a bank manager would make and the wrong one, since the two men hold the same factors in different ways.

What Rajabu owns and never pays for: his lorry wears out, his own money earns nothing sitting in the lorry and the stock, his store could be let to another trader, and his labour sold to a grain company. Four sacrifices, not one receipt.

$$\text{Lorry depreciation} = \frac{84{,}000{,}000}{7} = 12{,}000{,}000$$

$$\text{Interest forgone} = 110{,}000{,}000 \times \frac{9}{100} = 9{,}900{,}000$$

$$\text{Rajabu's implicit cost} = 12{,}000{,}000 + 9{,}900{,}000 + 7{,}200{,}000 + 9{,}600{,}000 = 38{,}700{,}000$$

What Salum owns: only his working capital and the evenings over the books, since every other factor is hired and already in his accounts.

$$\text{Salum's implicit cost} = \left(30{,}000{,}000 \times \frac{9}{100}\right) + (200{,}000 \times 12) = 2{,}700{,}000 + 2{,}400{,}000 = 5{,}100{,}000$$

$$\text{Rajabu's economic profit} = 52{,}000{,}000 - 38{,}700{,}000 = 13{,}300{,}000$$

$$\text{Salum's economic profit} = 19{,}400{,}000 - 5{,}100{,}000 = 14{,}300{,}000$$

Item	Rajabu (TShs)	Salum (TShs)
Revenue	272,000,000	272,000,000
Explicit cost	220,000,000	252,600,000
Accounting profit	52,000,000	19,400,000
Implicit cost	38,700,000	5,100,000
Economic profit	13,300,000	14,300,000

The same trade, held two different ways.

Why the books mislead: Salum's lorry hire, store rent and manager's salary go to outsiders and depress his profit, while Rajabu's are paid in sacrifices no account records. The TShs 32,600,000 gap between their book profits is nearly the TShs 33,600,000 gap between their implicit costs.

Cost per kilogramme settles the ranking: Rajabu's economic cost is TShs 258,700,000 for 400,000 kilogrammes, that is, TShs 646.75 each, against Salum's TShs 257,700,000, or TShs 644.25. At TShs 680 Rajabu clears TShs 33.25 a kilogramme and Salum TShs 35.75, and that TShs 2.50 over 400,000 kilogrammes is the TShs 1,000,000 by which Salum is the better business.

What Rajabu should do about it: he is not making a loss and need not leave the trade, but he should stop believing his lorry is free. It costs TShs 12,000,000 of wear, $84{,}000{,}000 \times \frac{9}{100} = 7{,}560{,}000$ of interest and TShs 9,200,000 of fuel and a driver, TShs 28,760,000 against Salum's hired haulage at TShs 25,000,000.

$$\text{Saving from selling the lorry and hiring} = 28{,}760{,}000 - 25{,}000{,}000 = 3{,}760{,}000$$

If the lorry fetches what the books say, that change saves TShs 3,760,000 a season and puts him ahead of Salum.

When two firms are compared, ask which factors each owns, because the firm that owns more looks more profitable and may be poorer.

The Master Key: *The firm that owns its factors is not cheaper, only less billed; price everything, then compare.*

REAL Question 147

Trade at a Kariakoo welding shop dies for four months every year when the builders stop. This season the fundi must decide whether opening the door at all is worth it.

Using the records in the box, sort the costs into those that matter and those that do not, decide whether Emmanuel should work through the slack season or close, and show what treating his sunk costs as though they counted would cost him.

> Emmanuel Kibona runs Chuma Imara Welding Works at Kariakoo in Dar es Salaam. Building work stops for four months every year and he must decide what to do in that season.
>
> If he works, he expects sales of TShs 13,500,000 over the four months.
>
> Steel, rods, gas and electricity would cost TShs 3,900,000, and two welders engaged month by month would cost TShs 450,000 each a month.
>
> The shed is rented at TShs 500,000 a month. The landlord requires one month's notice, so closing now still costs one month's rent.
>
> The annual council licence of TShs 1,200,000 was paid in January and nothing is refunded if he closes.
>
> A jig built to the design of a customer who then cancelled cost TShs 3,400,000. It fits no other job and nobody will buy it.
>
> If he closes, Emmanuel can take fitting work on a Bagamoyo road contract worth TShs 600,000 a month.
>
> His welding plant cost TShs 8,000,000 three years ago, would fetch TShs 5,000,000 today and would cost TShs 11,000,000 to replace new. He would keep it in store either way.

Model Answer

Emmanuel should work through the slack season, because doing so brings in TShs 13,500,000 against only TShs 11,400,000 of cost that his decision can actually change, leaving him TShs 2,100,000 better off than if he closed the workshop.

Put one question to every line in the box. Does this sum differ according to what I decide?

The costs that working causes: the steel, rods, gas and electricity at TShs 3,900,000, the two welders at $2 \times 450{,}000 \times 4 = 3{,}600{,}000$, and three months' rent at $3 \times 500{,}000 = 1{,}500{,}000$, the fourth falling due under the notice either way.

$$\text{Avoidable explicit cost} = 3{,}900{,}000 + 3{,}600{,}000 + 1{,}500{,}000 = 9{,}000{,}000$$

The cost paid in his own time: if the workshop opens, Emmanuel cannot take the Bagamoyo contract, so $600{,}000 \times 4 = 2{,}400{,}000$ is given up. Not a shilling passes through the till, yet it is as real a cost as the steel.

$$\text{Relevant economic cost} = 9{,}000{,}000 + 2{,}400{,}000 = 11{,}400{,}000$$

$$\text{Gain from working the season} = 13{,}500{,}000 - 11{,}400{,}000 = 2{,}100{,}000$$

The licence is sunk: TShs 1,200,000 went to the council in January and nothing he decides now brings it back. It is the same whether he works or closes.

The jig is sunk as well: TShs 3,400,000 was spent on a jig that fits no other job and has no buyer, so its value is zero under both courses. The correct treatment is to leave it out.

The notice month is unavoidable, not sunk: that TShs 500,000 has not been paid, so it is unavoidable rather than sunk. Both drop out because they do not differ between the options. Relevance turns not on whether the money has gone, but on whether the choice can move it.

Item	Amount (TShs)	Does the decision move it?
Materials, gas and power	3,900,000	Yes, count it
Wages of the two welders	3,600,000	Yes, count it
Rent, the three later months	1,500,000	Yes, count it
Fitting work forgone	2,400,000	Yes, count it
Rent for the notice month	500,000	No, unavoidable
Council licence	1,200,000	No, already sunk
The cancelled jig	3,400,000	No, already sunk

Sorting a workshop's costs by the only question that decides anything.

What the error would cost him: suppose he charged the licence and the jig against the season. His cost would appear to be TShs 16,000,000 against sales of TShs 13,500,000, an apparent loss of TShs 2,500,000, and he would close.

$$\text{Cost wrongly reckoned} = 11{,}400{,}000 + 1{,}200{,}000 + 3{,}400{,}000 = 16{,}000{,}000$$

$$\text{Apparent result} = 13{,}500{,}000 - 16{,}000{,}000 = -2{,}500{,}000$$

Closing would not have recovered a shilling of the licence or the jig. It would only have added the TShs 2,100,000 he could have earned to the loss.

The plant and its three different prices: the TShs 8,000,000 paid three years ago is historic cost and settles nothing. The TShs 5,000,000 it would fetch today is what he gives up by keeping it, and belongs in any decision about leaving welding. The TShs 11,000,000 to replace it new is what he must set aside to go on.

Look forward, count only what your choice can change, and let money already spent lie where it fell.

The Master Key: *Ask of every shilling: does my decision move it? If not, strike it out, however much it hurt to spend.*

HOT Question 148

A shopkeeper at Buguruni shows you her book: a profit every month for six years. Her brother, who took a salaried job instead, quietly bought a plot in those same six years.

Assess the claim that a shop whose books show a profit every month is a profitable business.

Model Answer

The claim is only half true, because a profit in the books shows revenue exceeding the payments actually made, not that the owner's resources earn what they could earn elsewhere, and the error depends on how much of the business she supplies herself.

What a book profit does prove: that the business is solvent. Every supplier has been paid, the rent and licence met, and money still remains. A firm that cannot manage this much cannot survive, which is why the bank and the tax authority look first.

What it does not prove: that the shop is worth running. It says nothing about the wage the owner could have earned, the rent her premises would fetch, the interest her stock money would earn in a treasury bill, or the wear on her shelves.

The scale of the omission: the omitted items are the largest of all. Take a shop with a book profit of TShs 400,000 a month, in the owner's own front room, run by an owner who could earn TShs 350,000 in employment, on TShs 5,000,000 of her own stock. The room would let for TShs 80,000 a month and the money earn 12 per cent, or TShs 50,000 a month.

$$\text{Implicit cost a month} = 350{,}000 + 80{,}000 + 50{,}000 = 480{,}000$$

$$\text{Economic profit a month} = 400{,}000 - 480{,}000 = -80{,}000$$

Reading that result: the shop that has shown a profit every month for six years has been costing its owner TShs 80,000 a month, nearly a million a year, against letting the room, banking the money and taking a job. The brother with the plot is the proof.

The test that settles the claim: compare the whole return from the shop with the whole return from the best alternative, asking whether revenue exceeds explicit plus implicit cost. If not, the owner is subsidising her business out of wages and rent she never collects.

The case for the shopkeeper, however: an opportunity cost is only as large as the opportunity. If no employer in Buguruni will hire her, her forgone wage is nothing; if no tenant wants a front room, the forgone rent is nothing. Where such markets are thin, the book profit is nearly the true surplus.

And the return is not only money: she keeps her own hours, works beside her children, answers to nobody and cannot be dismissed. These are real returns no account records, and an owner may accept a smaller measured surplus for them.

So the verdict is conditional. The question is not whether money is left at the end of the month, but whether more would have been left elsewhere.

The Master Key: *A profit in the book proves the business survives; only economic profit proves it deserves to.*

HOT Question 149

A tailor at Mwanza prices a shirt by the cloth and the thread alone, since his own hands cost nothing. He is the cheapest in the street and the poorest.

Discuss whether the unpaid labour that an owner puts into his own business should be counted as a cost of that business.

Model Answer

It should be counted, because the owner's time has a price whether or not the business pays it, and a firm that leaves it out prices its work too low, judges itself wrongly and stays in a trade it ought to leave, provided the wage entered is real.

The time has an alternative use: an hour at the machine is an hour not spent on a road contract, in a factory or on a shamba. That forgone earning is the opportunity cost of his labour, and opportunity cost is what cost means.

Leaving it out corrupts the price: a tailor who counts only cloth and thread quotes a price covering his materials and nothing else. He wins every order and earns nothing, and pulls the whole street down to a level nobody can live on.

Leaving it out corrupts the comparison: a firm whose owner works free looks more profitable than an identical firm that pays a manager, though nothing real distinguishes them. Whole industries can appear to flourish when they simply do not pay their owners.

Leaving it out corrupts the decision: the only question worth asking is whether the business earns more than its resources would earn elsewhere. If the owner's labour is never priced, that question cannot be put, and people stay for years in work paying less than the employment they refuse.

The case against, no money leaves the firm: an unpaid hour need not be found in cash. For tax, for a bank and for keeping the doors open, the figure that matters is money actually spent, and a notional wage there is an invention with no receipt.

The case against, the wage may be almost nothing: the cost is what he could truly earn, not what he would like to earn. Where no employer in the district is hiring, or in a slack month, the forgone wage really is small, and hours with no other use are nearly free.

The case against, part of the return is not money: independence, the dignity of one's own trade, flexible hours and the chance to teach a child the work are genuine returns, and an owner may knowingly accept a smaller money surplus for them.

Count the owner's labour, but count it honestly, at the best wage actually open to him, and set beside it what he values in working for himself. The tailor who does this finds his real cost for each shirt.

The Master Key: *Your own hours are the one input you never invoice and always spend; price them, or the price you charge is fiction.*

HOT Question 150

The board has spent nine hundred million shillings on a half built plant and cannot bear to stop. Every shilling of that argument points backwards, and a factory only ever earns forwards.

Study the board's argument in the box, then advise the company, stating the principle on which your advice rests and the circumstances in which money already spent may legitimately affect a decision.

> A cashew processing company at Lindi has already spent TShs 900,000,000 on a factory that is half built.
>
> Completing it will cost a further TShs 500,000,000.
>
> On the best estimate now available, the finished factory would be worth TShs 380,000,000 to the company.
>
> The half built structure together with its land would fetch TShs 210,000,000 if sold today.
>
> The chairman tells the board: we have already put nine hundred million into this plant, so we cannot stop now, because stopping would waste everything we have spent.

Model Answer

The board should stop, because the TShs 900,000,000 already spent is sunk and is lost under either course, while looking only forward, completing the plant means paying TShs 500,000,000 to obtain something worth TShs 380,000,000, whereas stopping now realises TShs 210,000,000.

The chairman's argument turned round: the nine hundred million is the one figure in the box that no decision can touch. It is equally lost if the plant is finished and equally lost if the site is sold.

Set out only what each course changes from today onward.

$$\text{Completing} = 380{,}000{,}000 - 500{,}000{,}000 = -120{,}000{,}000$$

$$\text{Stopping and selling} = +210{,}000{,}000$$

$$\text{Advantage of stopping} = 210{,}000{,}000 - (-120{,}000{,}000) = 330{,}000{,}000$$

Reading the comparison: finishing the factory destroys a further TShs 120,000,000 of value, while selling the site recovers TShs 210,000,000. The company is TShs 330,000,000 better off stopping, and the nine hundred million never enters the sum.

Why the fallacy is so strong: stopping forces the loss to be admitted openly, while continuing buries it inside a working factory where nobody need name it. We have come too far to stop is a wish to postpone an admission.

When past spending does matter, first, as information: that the plant has swallowed nine hundred million and stands half finished tells the board its estimates were badly wrong, which is evidence about the remaining TShs 500,000,000. Past spending reshapes the forecast; it is never a cost.

Second, where the outlay is not fully sunk: the TShs 210,000,000 the structure and land would fetch is recoverable, and because it can still be recovered it belongs in the decision. Only the unrecoverable TShs 690,000,000 is truly sunk, and a board confusing the two will hold worthless assets and give away valuable ones.

Third, where stopping carries future costs: a contract may impose a penalty for abandonment, a lender may call in other loans, a licence may have been granted on condition of completion, and a company known for walking away may find contractors and banks dearer. Were these together to exceed TShs 330,000,000, the advice would change.

Fourth, the option of waiting: abandonment is not the only alternative. If a low cashew price is why the finished plant is worth so little, the board may mothball the site, pay a watchman and the rates, and keep the option alive.

So the advice is to stop, and the principle is that a decision can only be taken about the future. Recoverable value, remaining costs and future returns are the only quantities a choice can move.

The Master Key: *You cannot spend your way back to money already gone; decide only about the shillings still in front of you.*

Short Run Total Costs

A mill at Mbeya pays for its shed whether it grinds a thousand sacks or none at all, and pays for maize only when the machine is turning. That single difference splits every shilling a firm spends into two families, and the whole short run cost apparatus grows out of it. This section fixes the cost function, defines total fixed and total variable cost, adds them into total cost, and explains why each of the three curves takes the shape it does.

BINDER Question 151

Ask a Mbeya miller what a sack of sembe costs him to make and he answers at once. Ask what an hour of his machine costs and he stares at you.

Define a cost function, write it in its general form and explain every symbol in it, and explain why a firm's costs are shown against the quantity of output rather than against the quantity of a factor.

Model Answer

A cost function relates the cost of production to the quantity of output, written $C = f(q)$ for a given technique and given factor prices, and costs are shown against output because output is what the producer chooses, sells and must charge every shilling to.

$$C = f(q)$$

C: the total cost of producing the good or service, in shillings for a stated period, whether a day, a month or a season. It gathers every payment made for the factors used.

q: the quantity of output in that same period, counted in the unit the firm sells: sacks of sembe, litres of alizeti oil, kilogrammes of fillet, journeys carried.

f: a functional operator. It asserts that cost depends on output in some definite way without saying which. The particular form, $C = 2q + 5$ or $C = 4 + 2q + q^3$, is discovered from the firm's own records.

Two things are held still, the technique of production and the price of every factor. If the wage of a kibarua, that is, a casual labourer, rises, or a faster huller is installed, the whole function shifts; only a change in output moves the firm along it.

Output is what the producer decides: a miller does not begin by deciding to engage four workers. He begins by judging how many sacks he can sell, and labour, maize and diesel follow. The cost curve is drawn against the variable he settles first.

Revenue is earned per unit of output: the mill is paid so many shillings a sack, so cost must be measured in the same unit before profit can be found. Price a sack against cost a sack means something; against cost a worker it means nothing.

A firm uses many factors at once: the mill buys maize, diesel, electricity, labour, bags and the use of a building, measured in kilogrammes, litres, units, hours and square metres. No single factor axis holds them all, yet each can be charged to a sack.

The product curves and the cost curves are the same story in two currencies. One asks what a worker adds to output, the other what a sack adds to cost, and a worker must be paid.

The Master Key: *Cost is a function of output,* $C = f(q)$*, written for a given technique and given factor prices.*

BINDER Question 152

A Njombe miller can buy more maize this afternoon and hire two more hands by evening. He cannot make his shed longer before the season ends, and the rent falls due anyway.

Explain how the short run distinction between fixed and variable factors gives rise to the distinction between fixed and variable costs, and state what becomes of fixed costs in the long run.

Model Answer

Costs divide into fixed and variable because factors do: the payment for a factor whose quantity cannot be altered within the period is a fixed cost, the payment for one that can be altered is a variable cost, and in the long run no cost is fixed.

The short run is defined by the fixed factor: it is the period in which at least one factor cannot be varied. At the Njombe mill that factor is the shed, the grinding machine and the trading licence, all settled before the season opened.

Fixed factors give rise to fixed costs: since the quantity of the fixed factor is the same whether output is large or nothing, the payment is the same too. One shed's rent is one shed's rent at every output, and the sum of all such payments is total fixed cost.

Variable factors give rise to variable costs: maize, diesel, electricity and casual hands can all be increased or reduced within the day. The miller uses more as he grinds more and none when he grinds nothing, so the payment moves with output. The sum of these is total variable cost.

The period and the contract classify: a lorry hired for a single trip is variable, since no trip means no payment. The same lorry bought on a five year loan is fixed, since the instalment falls due in a month when it never leaves the yard. The arrangement changed, not the vehicle.

In the long run there are no fixed costs: the long run is long enough for every factor to be varied. The lease can be surrendered, the machine sold, the licence left unrenewed and the watchman released, so total fixed cost is zero and total cost is total variable cost.

This is a fixed cost is never a complete sentence until the period is stated. A cost is fixed for a length of time, not for ever, and short run cost analysis lives inside the window in which one factor cannot be moved.

The Master Key: *Fixed factors make fixed costs and variable factors make variable costs; stretch the period far enough and neither survives.*

BINDER Question 153

On the first day of the month a Mbeya miller pays the landlord, the insurer and the watchman before a single grain enters the machine. Maize he buys only when he grinds.

Define total fixed cost and total variable cost, giving Tanzanian examples of each, and distinguish a fixed cost from a sunk cost.

Model Answer

Total fixed cost is the total payment for the fixed factors, which does not change with output and falls due even at zero output, while total variable cost is the payment for the variable factors, zero at zero output and rising as output rises.

Total fixed cost: the cost of the fixed factors, the same figure at every level of output, so it is often called an overhead or supplementary cost. Because it is owed even when nothing is produced, total cost at zero output is exactly total fixed cost.

The fixed costs of a Mbeya mill: the rent of the mill building, the trading licence, the insurance on shed and machine, the salary of the watchman who guards the place whether it runs or not, the interest on the loan that bought the grinding machine, and the depreciation that comes with the passing of time.

Total variable cost: the cost of the variable factors, nothing at zero output because a factor not used is not paid for, and rising as output rises, which is why it is also called a prime, direct or operating cost.

The variable costs of the same mill: the maize bought for grinding, the diesel burned by the engine, the electricity the motor draws from TANESCO, the wages of the vibarua engaged by the day to carry and pour, and the bags and thread for packing. Grind nothing for a week and each is zero.

Fixed is not the same as sunk: a fixed cost does not vary with output but is still being incurred, and can be escaped by leaving the trade, since next year's lease unrenewed is next year's rent unpaid. A sunk cost is already paid and cannot be recovered, like the concrete floor poured to carry the machine.

Total fixed cost is a total, not a figure for each sack. The whole TShs 800,000 stands unmoved as output climbs, and it is the share carried by each sack that falls as the sacks multiply.

The Master Key: *Fixed cost is paid for having the plant, variable cost for using it, and a sunk cost is paid already and gone.*

BINDER Question 154

A Mbeya mill's costs rise gently as the first sacks come and steeply as the last ones do, though the maize is bought at the same price all day long.

State the relationship between total fixed cost, total variable cost and total cost, and, with the aid of a diagram, explain the shape of each of the three curves.

Model Answer

Total cost is the sum of total fixed and total variable cost, $TC = TFC + TVC$**; the TFC line is horizontal, the TVC curve rises from the origin in an S shape, and TC carries that S shape lifted vertically by the whole of TFC.**

$$TC = TFC + TVC$$

Every shilling belongs to one family or the other, so adding the two totals accounts for all of a firm's spending. At zero output the second term disappears.

$$TC = TFC + 0 = TFC \quad \text{when } q = 0$$

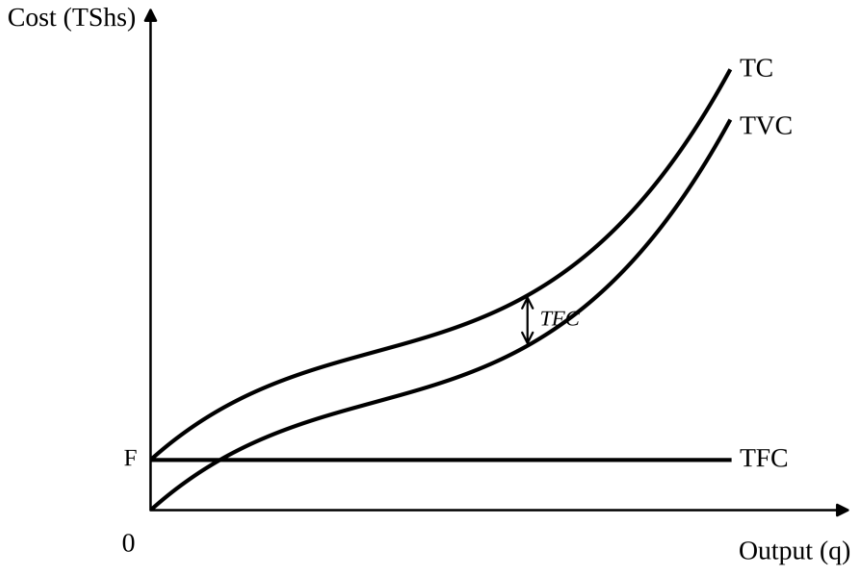


Figure 5.15: Total fixed cost, total variable cost and total cost

The TFC line: a horizontal straight line at the height F. At every output the rent, the licence and the interest add up to the same F, so the line runs parallel to the output axis across the whole diagram.

Why the TVC curve starts at the origin: at zero output no maize has been bought, no diesel burned and no kibarua engaged, so the payment for the variable factors is nothing. The curve leaves the corner of the diagram and rises as more sacks demand more of every variable factor.

Why the TVC curve is S shaped: its steepness is governed by the productivity of the variable factor. While marginal product is rising, each extra sack takes less extra labour and material than the one before, so total variable cost rises by a smaller amount each time and the curve bends flat. Once diminishing returns set in it steepens.

The point where it turns: the curve changes the direction of its bend at the output where marginal product is highest. Before that the mill is filling a shed too big for it; after it the shed is crowded and the same shilling buys less flour.

The TC curve: it begins on the vertical axis at F, not at the origin, because a mill producing nothing still owes its fixed costs. Above that it is TVC shifted bodily upward by F, since adding a constant raises height everywhere and changes slope nowhere.

The arrow between the two curves shows the vertical distance TC minus TVC. That distance is total fixed cost, the same at a large output as at a small one.

The Master Key: *TVC supplies the shape, TFC supplies the lift, and TC is the two of them together.*

BINDER Question 155

However many bales a Tanga sisal estate presses, its landlord never lowers the rent to nothing. That one fact holds two curves apart for the whole length of the diagram.

Explain why the vertical distance between the total cost curve and the total variable cost curve is constant, why the two curves can never meet or cross, and why the total cost curve begins on the vertical axis rather than at the origin.

Model Answer

The vertical distance between TC and TVC is total fixed cost, which takes the same value at every output, so the gap cannot narrow and cannot close while any factor is fixed, and TC must begin on the vertical axis at the height of TFC.

Make the gap itself the subject. Total cost is the sum of the two components, so subtracting one leaves the other.

$$\mathrm{TC} - \mathrm{TVC} = \mathrm{TFC}$$

The gap is constant because TFC is constant: total fixed cost is defined as the cost that does not respond to output. If the estate owes TShs 800,000 a month for its shed, its licence and its interest, that figure stands at 10 tonnes of fibre and at 500 alike.

The two curves can never meet: meeting would mean $\mathrm{TC} - \mathrm{TVC} = 0$, that is $\mathrm{TFC} = 0$. But the short run is a period in which at least one factor is fixed, and a fixed factor must be paid for, so TFC is positive.

They can never cross either: crossing would put TVC above TC, meaning a firm whose spending on variable factors alone exceeded its spending on everything. Total cost already contains total variable cost and adds a non negative amount to it.

Why TC leaves the vertical axis at F: at zero output the variable factors are not used, so TVC is zero and total cost is nothing but total fixed cost. TC starts at the height F while TVC starts at the origin, and that same gap separates them everywhere else.

The only escape is the long run: when every contract has expired the estate can give up the shed and sell the press, TFC becomes zero and the two curves collapse into one line. That is why the long run diagram has one total cost curve and the short run two.

The gap between the average curves does narrow as output rises, since a fixed sum spread over more sacks makes a smaller share for each. That narrowing belongs to the average diagram alone.

The Master Key: *TC minus TVC is TFC at every output, so in the short run the gap can never close.*

BINDER Question 156

A Njombe miller keeps two columns in an exercise book: what he pays whatever happens, and what he pays only when the machine turns. The third column he has never written.

Copy the schedule of the mill's costs from the information below, complete every cell for outputs of zero to six sacks a day, and state what the completed schedule shows.

The rent of the shed, the licence, the watchman's wage and the interest on the machine loan come to TShs 120,000 a day between them.

Total variable cost at outputs of 0, 1, 2, 3 and 4 sacks a day is TShs 0, TShs 95,000, TShs 175,000, TShs 245,000 and TShs 310,000.

Total cost at 5 sacks a day is TShs 510,000, and at 6 sacks a day it is TShs 620,000.

Rule four columns: output, total fixed cost, total variable cost and total cost.

Model Answer

The fixed cost column is TShs 120,000 in every row, total cost follows by addition in the first five rows and total variable cost by subtraction in the last two, and the schedule shows a constant fixed cost, a variable cost rising by falling and then rising amounts, and a constant gap.

Fill the fixed cost column first, since TShs 120,000 stands in the row for zero sacks and in the row for six alike. Then apply the identity in whichever direction the missing figure demands.

$$\text{TC} = \text{TFC} + \text{TVC}$$

$$120{,}000 + 0 = 120{,}000 \quad 120{,}000 + 95{,}000 = 215{,}000 \quad 120{,}000 + 175{,}000 = 295{,}000$$

$$120{,}000 + 245{,}000 = 365{,}000 \quad 120{,}000 + 310{,}000 = 430{,}000$$

For the last two rows the total is given and the variable cost missing, so make TVC the subject and subtract.

$$\text{TVC} = \text{TC} - \text{TFC} = 510{,}000 - 120{,}000 = 390{,}000$$

$$\text{TVC} = \text{TC} - \text{TFC} = 620{,}000 - 120{,}000 = 500{,}000$$

Output (sacks a day)	Total fixed cost (TShs)	Total variable cost (TShs)	Total cost (TShs)
0	120,000	0	120,000
1	120,000	95,000	215,000
2	120,000	175,000	295,000
3	120,000	245,000	365,000
4	120,000	310,000	430,000
5	120,000	390,000	510,000
6	120,000	500,000	620,000

The daily cost schedule of a small maize mill at Njombe.

The fixed cost column never moves: TShs 120,000 appears seven times, on the day he grinds six sacks and on the day he grinds none, so it is the height of the horizontal TFC line.

The variable cost column starts at zero: with no grinding there is no maize, no diesel and no kibarua to pay. It then climbs to TShs 500,000, and somewhere between one sack and two it overtakes the fixed cost, where TVC crosses the TFC line.

The total cost column starts at TShs 120,000: the zero output row reads TC equals TFC, which is the arithmetic behind the total cost curve leaving the vertical axis above the origin.

The gap is the same in every row: subtract the third column from the fourth at any output and TShs 120,000 remains: 215,000 less 95,000, 430,000 less 310,000, 620,000 less 500,000.

The two columns rise by identical steps: the variable cost rises by 95,000, then 80,000, 70,000, 65,000, 80,000 and 110,000, and the total cost rises by exactly the same six amounts, because the fixed component adds nothing to any change.

Those six steps carry the economics. Each extra sack costs less to add than the one before up to the fourth, the range in which the variable factor is becoming more productive. From the fifth onward each costs more, which is diminishing returns, and that fall then rise gives the S shape.

The Master Key: *Fill the fixed column down, add across for total cost, subtract for variable cost, and check that the gap in every row is TFC.*

REAL Question 157

Follow the shillings of a maize mill at Iyunga in Mbeya through one month, from the rent paid before the doors open to the diesel burned on the busiest day of the harvest.

Using the mill's records below, build a schedule of total fixed cost, total variable cost and total cost for monthly outputs of zero to six hundred sacks, and read the pattern the completed schedule shows.

Fixed charges each month: rent of the mill building TShs 300,000; trading licence and insurance TShs 90,000; the watchman's wage TShs 150,000; interest on the loan that bought the grinding machine TShs 260,000.

Maize is bought at TShs 380,000 for every hundred sacks of sembe milled.

Diesel, electricity, the wages of vibarua and the packing bags come together to TShs 240,000 at 100 sacks, TShs 420,000 at 200 sacks, TShs 570,000 at 300 sacks, TShs 710,000 at 400 sacks, TShs 920,000 at 500 sacks and TShs 1,300,000 at 600 sacks.

In the two months before the harvest the mill grinds nothing at all.

Model Answer

Total fixed cost is TShs 800,000 a month at every output, total variable cost climbs from nothing to TShs 3,580,000, and total cost runs from TShs 800,000 in an idle month to TShs 4,380,000 at six hundred sacks, rising by a falling amount to four hundred sacks and sharply thereafter.

Take the fixed charges first. All are payments for factors the miller cannot alter this season, the building, the licence, the insurance, the watchman and the machine bought with borrowed money, so they add to a single figure independent of output.

$$\text{TFC} = 300{,}000 + 90{,}000 + 150{,}000 + 260{,}000 = 800{,}000$$

The variable cost has two parts. Maize is strictly proportional at TShs 380,000 for each hundred sacks, while diesel, electricity, casual wages and bags are given directly. Take three hundred sacks as the worked case.

$$\text{Maize at 300 sacks} = 3 \times 380{,}000 = 1{,}140{,}000$$

$$\text{TVC} = 1{,}140{,}000 + 570{,}000 = 1{,}710{,}000$$

$$\text{TC} = \text{TFC} + \text{TVC} = 800{,}000 + 1{,}710{,}000 = 2{,}510{,}000$$

The busiest month is worked the same way.

$$\text{Maize at 600 sacks} = 6 \times 380{,}000 = 2{,}280{,}000$$

$$\text{TVC} = 2{,}280{,}000 + 1{,}300{,}000 = 3{,}580{,}000$$

$$\text{TC} = 800{,}000 + 3{,}580{,}000 = 4{,}380{,}000$$

Output (sacks a month)	TFC (TShs)	TVC (TShs)	TC (TShs)
0	800,000	0	800,000
100	800,000	620,000	1,420,000
200	800,000	1,180,000	1,980,000
300	800,000	1,710,000	2,510,000
400	800,000	2,230,000	3,030,000
500	800,000	2,820,000	3,620,000
600	800,000	3,580,000	4,380,000

The monthly cost schedule of the Iyunga maize mill at Mbeya.

An idle month is not a free month: the row for zero output reads TShs 800,000, because rent, licence, insurance, watchman and interest all fall due in a month when the machine never turns. The two months before harvest cost the miller TShs 1,600,000 before he has sold a sack.

The variable cost carries the whole of the movement: every shilling of difference between an idle month and a busy one is variable cost, TShs 3,580,000 of maize, diesel, power, casual wages and bags. This is the part he can switch off when a firm stops producing without closing down.

The gap between TC and TVC never changes: at 100 sacks the difference is 1,420,000 less 620,000, and at 600 sacks 4,380,000 less 3,580,000. Both come to TShs 800,000, the constant vertical distance between the two curves.

The steps tell the productivity story: each further hundred sacks adds TShs 620,000, then 560,000, 530,000, 520,000, 590,000 and 760,000. The falling steps to four hundred sacks are the mill filling a shed built for more; the rising steps after are diminishing returns, night running, overtime for the vibarua and more diesel.

$$4{,}380{,}000 - 3{,}620{,}000 = 760{,}000$$

Moving from five hundred to six hundred sacks adds TShs 760,000, or TShs 7,600 for each extra sack, so the sixth hundred is worth grinding only if it fetches more. The first hundred after the idle months added only TShs 6,200 a sack.

The Master Key: *Add the fixed charges once, build the variable cost output by output, and the difference between the two totals never moves.*

REAL Question 158

A sunflower press in a SIDO shed at Singida records only one figure each month: what it spent in total. Hidden inside those numbers is a rent the owner never listed separately.

Read the press's record below, state its total fixed cost and explain how you know, derive its total variable cost at every output, and explain what the pattern of the variable cost tells the owner about the productivity of his workers.

The press pays a monthly rent for the SIDO shed, a local government licence, a watchman and interest on the loan that bought the expeller. It buys sunflower seed, engages vibarua (casual labourers) to fill and carry, and pays for electricity and filter cloth.

Total cost in a month of no pressing at all: TShs 480,000.

Total cost at 100 litres of alizeti oil: TShs 790,000. At 200 litres: TShs 1,060,000. At 300 litres: TShs 1,300,000.

At 400 litres: TShs 1,530,000. At 500 litres: TShs 1,810,000. At 600 litres: TShs 2,190,000.

Model Answer

The press has a total fixed cost of TShs 480,000 a month, read from the row for zero output where total cost equals total fixed cost, and subtracting it from each total gives a variable cost rising by falling amounts to four hundred litres and by rising amounts after.

Sort the record first. Shed rent, licence, watchman and interest cannot be varied this month, so they are fixed. Seed, casual wages, electricity and filter cloth are used only when the expeller is running, so they are variable.

How the fixed cost is known: in the month of no pressing no seed was bought, no kibarua engaged and no current drawn, so total variable cost was zero. Total cost that month is therefore total fixed cost alone, TShs 480,000.

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC} \quad \text{so at } \mathrm{q} = 0, \quad \mathrm{TFC} = \mathrm{TC} = 480{,}000$$

Now make the variable cost the subject and take TShs 480,000 off every total.

$$\mathrm{TVC} = \mathrm{TC} - \mathrm{TFC}$$

$$790{,}000 - 480{,}000 = 310{,}000 \quad 1{,}060{,}000 - 480{,}000 = 580{,}000 \quad 1{,}300{,}000 - 480{,}000 = 820{,}000$$

$$1{,}530{,}000 - 480{,}000 = 1{,}050{,}000 \quad 1{,}810{,}000 - 480{,}000 = 1{,}330{,}000 \quad 2{,}190{,}000 - 480{,}000 = 1{,}710{,}000$$

Output (litres a month)	TC (TShs)	TFC (TShs)	TVC (TShs)
0	480,000	480,000	0
100	790,000	480,000	310,000
200	1,060,000	480,000	580,000
300	1,300,000	480,000	820,000
400	1,530,000	480,000	1,050,000
500	1,810,000	480,000	1,330,000
600	2,190,000	480,000	1,710,000

Total cost split into its fixed and variable parts at a Singida sunflower press.

The variable cost behaves as theory says: it is zero at zero output, since a factor not used is not paid for, and it rises without ever falling as output grows. Plotted, it would leave the origin and climb across the diagram.

The pattern of the steps: each further hundred litres adds TShs 310,000, then 270,000, 240,000, 230,000, 280,000, then 380,000. The additions fall for four steps and rise for two, so the curve flattens at first and steepens later, the S shape of the theory.

What the falling steps say about the workers: up to four hundred litres each extra hundred costs less than the hundred before, which is rising marginal product in money form. The shed, the expeller and the watchman were built for more, so as the press fills the same hands and the same current yield more oil.

What the rising steps say: beyond four hundred litres each extra hundred costs more than the last. The fixed expeller is now the constraint: the vibarua queue for the machine, seed must be pressed twice for the last of the oil, and the shed runs into the evening at overtime wages.

The cheapest extra oil he will press is the hundred litres between three hundred and four hundred, at TShs 2,300 a litre, while the hundred between five hundred and six hundred costs TShs 3,800. That is what a fixed expeller does to a rising output, and the cure is a second machine.

The Master Key: *The zero output row hands you the fixed cost, and every other row hands you the variable cost by subtraction.*

HOT Question 159

The miller and the bodaboda rider both call the machine's hire a cost. The miller pays for his whether he grinds or not; the rider pays only on the days he chooses to ride.

A cost is fixed or variable by its own nature, so the same item is a fixed cost in every firm. Assess this claim, with reference to a Mbeya miller and a bodaboda rider in Dodoma.

Model Answer

The claim is false, because whether a cost is fixed or variable is settled by the length of the period, by the contract the firm has signed and by whether the quantity of that factor moves with output in that firm, not by the name of the item.

The case for the claim: there is a rough regularity. Rent, licence fees, insurance premiums and loan interest are fixed in most firms, being charged for a period rather than for a unit, while raw material and casual wages are variable, being consumed unit by unit. That list is right nine times in ten.

But the period decides: the Mbeya miller's shed rent is fixed for the year of his lease, since no reduction in grinding will reduce it. Over five years it is variable, because he can move to a smaller shed, share one with a neighbouring huller or give up milling.

The contract decides: the miller's machine is on a loan, so the instalment falls due in a month when the mill never opens, a fixed cost. The Dodoma rider who hires a motorcycle for each day he rides pays nothing on the day he rests. A rider buying his on work and pay owes every week whether he carries passengers or not.

The role of the factor decides: the watchman's salary is fixed, since one watchman guards one shed whether output is high or nil, while the wage of a kibarua engaged by the day to pour maize is variable. Not the factor but its relation to output classifies the cost.

One bill can contain both: a TANESCO invoice at the mill shows a standing service charge, payable whether the motor ever started, and a charge for the units the motor drew. The first is fixed and the second variable, on the same piece of paper.

The strongest cases still fail in the long run: even the annual licence and the insurance premium are fixed only while the firm stays in the trade. A miller who leaves renews neither. In the long run every cost is variable, the final proof that fixed describes a situation and not a substance.

So the claim is a rule of thumb dressed as a law of nature. Before calling any cost fixed, ask how long the period is, what the contract says, and whether the quantity of this factor moves when output moves.

The Master Key: *Ask how long the period is and what the contract says; the name of the item never settles whether a cost is fixed.*

HOT Question 160

Between the harvests the Mbeya mill stands silent for two months. The owner grinds nothing, sells nothing and earns nothing, yet on the first of each month the landlord still knocks.

It is said that a firm which produces nothing incurs no cost. Discuss this claim, and explain what it implies for a maize mill that stands idle between harvests.

Model Answer

The claim is false in the short run, where a firm producing nothing still owes the whole of its fixed cost, so total cost at zero output equals total fixed cost, and it becomes true only in the long run, when every contract has run out.

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC} = \mathrm{TFC} + 0 = \mathrm{TFC} \quad \text{when } q = 0$$

Why the claim fails in the short run: the mill that grinds nothing in October still pays rent, licence, insurance, the watchman guarding an idle machine and interest on the loan. At TShs 800,000 a month, two silent months cost TShs 1,600,000 for zero sacks.

What is true inside the claim: the whole of the variable cost is indeed escaped. No maize is bought, no diesel burned and no kibarua engaged, so total variable cost is nothing. That is why a firm in difficulty halts the machines long before it surrenders the lease.

The claim is right about the long run: given a long enough period the lease expires, the machine can be sold, the licence left unrenewed and the watchman released, so total fixed cost is zero and a firm producing nothing truly pays nothing. That is a firm which has left the trade, not one resting between harvests.

What does not come back even then: money already spent and unrecoverable stays spent. The concrete plinth cast for the grinding machine and the wiring run to it cannot be sold, so leaving the trade does not refund them.

The first implication for the idle season: the fixed cost of the silent months is a cost of the year's flour. If the mill grinds in only ten months, those sacks must carry twelve months of rent, licence, watchman and interest.

The second implication: in a slack month it pays to run at any price that covers the variable cost and leaves something over, since the TShs 800,000 is paid whether the machine turns or not.

The third implication: the owner should attack the fixed cost rather than endure it. He can negotiate a shorter lease, share the shed with a neighbouring huller, hire the machine out for sunflower cake or cassava, or take in custom milling.

The danger in that advice: a manager who concludes that the rent costs him nothing because it is paid anyway is halfway to ruin. Fixed cost is ignored when the question is whether to grind today, decisive when the question is whether to stay in milling.

So the verdict turns on the period and the question asked. Within the season the mill cannot escape its fixed cost by standing still; across the seasons it can escape the whole of it by leaving the trade.

The Master Key: *At zero output cost is not zero but TFC: cover variable cost to keep grinding this season, cover fixed cost too or leave the trade.*

Average and Marginal Costs

Totals tell a producer what the whole day cost. They never tell him whether the next sack is worth grinding. For that he needs the cost of a single unit, and there are two of those: the average, which shares the whole bill among all the units, and the marginal, which counts only what the last unit added. This section builds average fixed, average variable, average total and marginal cost out of a schedule, gives each its shape, and ties the four together.

BINDER Question 161

The rent of a Mbeya mill shed is the same on a day it grinds one sack as on a day it grinds three hundred. Only one of those days feels expensive.

Define average fixed cost, and with the aid of a diagram explain why the average fixed cost curve falls continuously as output rises yet never touches the horizontal axis.

Model Answer

Average fixed cost is total fixed cost divided by the number of units produced, so it is the share of the firm's unchanging overhead that each single unit of output has to carry.

$$\mathrm{AFC} = \frac{\mathrm{TFC}}{\mathrm{q}}$$

The numerator does not move. The rent, the licence, the watchman's wage and the depreciation on the huller are settled before a single sack is ground. Only the denominator moves, and a fixed number divided by a growing one must shrink.

Spreading the overhead: picture the day's fixed bill of TShs 240,000 laid on the floor of the mill, every sack carrying an equal share. One sack carries the whole TShs 240,000, two sacks TShs 120,000 each, two hundred sacks TShs 1,200 each. Only the number of shoulders has changed.

Sacks a day (q)	Total fixed cost (TShs)	Average fixed cost (TShs)
1	240,000	240,000
2	240,000	120,000
4	240,000	60,000
10	240,000	24,000
40	240,000	6,000
200	240,000	1,200

The same fixed bill of TShs 240,000 a day shared among more and more sacks at a Mbeya maize mill.

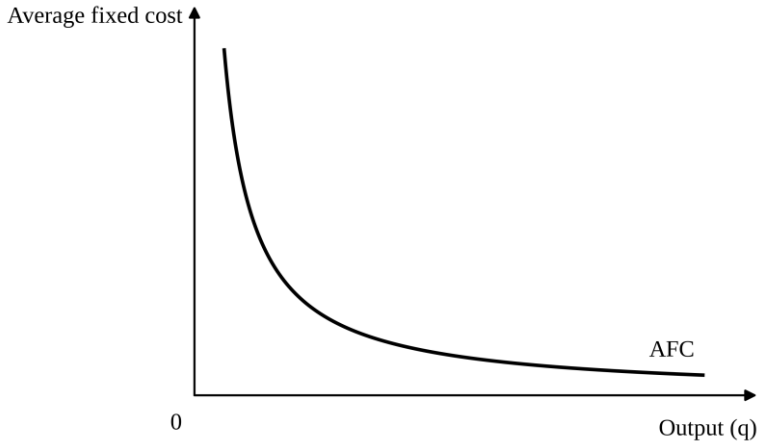


Figure 5.16: The average fixed cost curve

Why the curve is a rectangular hyperbola: multiply the two moving figures at any point and the answer never changes, since AFC $\times$ q $=$ TFC. Every point is the corner of a rectangle of the same TShs 240,000, tall and narrow at low output, long and flat at high. That curve is a rectangular hyperbola.

Why it never reaches zero: a positive number divided by any finite output leaves something positive. TShs 240,000 among a thousand sacks is still TShs 240 a sack, among ten thousand still TShs 24. The curve approaches the axis without touching it, the overhead thinned out but not abolished.

Why it never turns upward: unlike every other short run cost curve, average fixed cost has no minimum. Diminishing returns act on the variable factor crowding into a fixed plant, and here there is nothing to bite on, since the shed and the huller are what is held constant.

This is why a producer hates idle capacity. A mill working at a fifth of what its shed and huller could handle pays the whole rent and loads it onto very few sacks, each dear for a reason unconnected with the milling.

The Master Key: *AFC is the overhead shared out: TFC divided by q falls forever, never turns, and never quite reaches zero.*

BINDER Question 162

A Tanga soap works spends the same on its boiler whatever it makes, and more on oil the more it makes. Its cost per bar answers to both masters.

Define average variable cost and average total cost, derive the relationship between average total cost, average fixed cost and average variable cost, and explain why the average variable cost and average total cost curves are both U shaped.

Model Answer

Average variable cost is total variable cost per unit and average total cost is total cost per unit, and because total cost is the fixed bill plus the variable bill, average total cost is the sum of average fixed cost and average variable cost.

Average variable cost: the cost per unit of everything that exists only because production happens, the palm oil, the caustic soda, the firewood under the boiler and the casual wages. In symbols

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{q}}$$

Average total cost: the cost per unit of the whole bill, fixed and variable together, which is what the owner of the soap works means when he asks what a bar costs. In symbols

$$\mathrm{ATC} = \frac{\mathrm{TC}}{\mathrm{q}}$$

Take the identity that total cost is fixed cost plus variable cost, and divide the whole of it by output.

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC}$$

$$\frac{\mathrm{TC}}{\mathrm{q}} = \frac{\mathrm{TFC} + \mathrm{TVC}}{\mathrm{q}} = \frac{\mathrm{TFC}}{\mathrm{q}} + \frac{\mathrm{TVC}}{\mathrm{q}}$$

$$\mathrm{ATC} = \mathrm{AFC} + \mathrm{AVC}$$

The average total cost curve is no separate creature. It is AFC and AVC added vertically at every output, its shape a tug of war between the two.

Why average variable cost is U shaped: average variable cost is the mirror image of the average product of the variable factor. At low output few hands work a large plant, average product rises, each bar absorbs less labour and fuel, and AVC falls. Crowding brings diminishing returns and turns it up.

Why average total cost is U shaped: add a curve that always falls to one that falls and then rises. At low output both fall, so ATC falls steeply. When AVC turns up ATC does not, because the fall in AFC is for a while the larger, and ATC turns only when the rise outweighs it.

The two curves do not bottom out together: because ATC keeps falling after AVC has turned, its lowest point lies at a larger output. Variable cost per bar can be climbing while total cost per bar still falls.

Where each shape comes from: the left arm of AVC comes from increasing returns to the variable factor, the left arm of ATC mostly from spreading the overhead. The right arm of both comes from diminishing returns.

So the soap works can be told two things about the same day, and a producer who watches only one of them will read his business wrongly.

The Master Key: *AVC is TVC over q, ATC is TC over q and equals AFC plus AVC; both are U shaped, and ATC reaches its lowest point later than AVC.*

BINDER Question 163

Ask a Kariakoo welder what a gate costs and he names an average. Ask what one more gate would cost him tonight and the figure changes completely.

Define marginal cost, derive the forms in which it may be written, explain why it can be calculated from total variable cost alone, and account for the U shape of the marginal cost curve.

Model Answer

Marginal cost is the addition to total cost that results from producing one more unit of output, so it measures what the last unit by itself cost the firm, and not what all the units have cost on average.

Over a discrete step from one whole unit to the next, marginal cost is the change in total cost divided by the change in output.

$$\mathrm{MC} = \frac{\Delta\,\mathrm{TC}}{\Delta\,\mathrm{q}}$$

Put the total cost identity inside that expression: a change in total cost is a change in fixed cost plus a change in variable cost.

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC}$$

$$\text{MC} = \frac{\Delta\,\text{TFC} + \Delta\,\text{TVC}}{\Delta\,\text{q}} = \frac{\Delta\,\text{TFC}}{\Delta\,\text{q}} + \frac{\Delta\,\text{TVC}}{\Delta\,\text{q}}$$

Why the fixed term disappears: in the short run total fixed cost does not respond to output. The rent of the welding shed and the licence are the same whether the welder finishes six gates this week or seven, so the change is zero and the first term vanishes.

$$\frac{\Delta\,\text{TFC}}{\Delta\,\text{q}} = \frac{0}{\Delta\,\text{q}} = 0$$

$$\text{MC} = \frac{\Delta\,\text{TVC}}{\Delta\,\text{q}}$$

When the cost function is continuous the same idea is written as a derivative, and for the same reason it may be taken on the variable part alone.

$$\text{MC} = \frac{\partial\,\text{TC}}{\partial\,\text{q}} = \frac{\partial\,\text{TVC}}{\partial\,\text{q}}$$

What that result means in practice: the fixed bill is already committed and cannot be undone by making one gate fewer, so it has no place in the cost of the next gate. Only the extra steel, rods, electricity and hours belong there. A welder who loads rent onto one extra gate turns away work worth having.

Why marginal cost is U shaped: marginal cost is the mirror image of marginal product. Suppose labour is the only variable factor at a wage w. Extra output requires extra labour, and what that labour brings is its marginal product, so

$$\text{MC} = \frac{\text{w} \times \Delta\,\text{L}}{\Delta\,\text{q}} = \frac{\text{w}}{\text{MP}_\text{L}}$$

Reading that relationship: with the wage fixed, marginal cost moves inversely with marginal product. While the plant is lightly worked marginal product rises and MC falls, and marginal product is highest exactly where marginal cost is lowest. Once diminishing returns set in, marginal cost climbs steeply.

So the U is not a drawing convention. It is the law of diminishing returns seen from the money side of the business, turned upside down by the division.

The Master Key: *MC is what the last unit added, taken from variable cost alone because fixed cost cannot change, and its U is diminishing returns inverted.*

BINDER Question 164

A netball team at a Dodoma school admits one short player and the average height drops at once, though nobody already in the team shrank. Cost averages obey the same law.

State the relationship between marginal cost and average variable cost and between marginal cost and average total cost, and with the aid of a diagram explain why the marginal cost curve cuts both average curves at their lowest points and does so from below.

Model Answer

Whenever marginal cost lies below an average that average is pulled down, whenever it lies above the average is pushed up, and where the two are equal the average is momentarily still, which is why marginal cost passes through the lowest point of both average curves.

The rule is the plain arithmetic of averages. A member below the present average pulls it down, one above lifts it, one equal to it cannot move it.

When MC is less than AVC: the last unit cost less than the average of those before it, so it drags the running average down. The whole falling arm of the AVC curve is the marginal doing this.

When MC equals AVC: the last unit cost exactly what the earlier units averaged, so the average neither falls nor rises. A curve that falls, flattens and then rises is at its minimum there.

When MC is greater than AVC: the last unit cost more than the running average, so it lifts the average and AVC rises. The rule fixes the direction of movement, not the size of the gap.

The same three statements hold for ATC: if $\text{MC} < \text{ATC}$ average total cost is falling, if $\text{MC} = \text{ATC}$ it is at its minimum, and if $\text{MC} > \text{ATC}$ it is rising, ATC being a running average too.

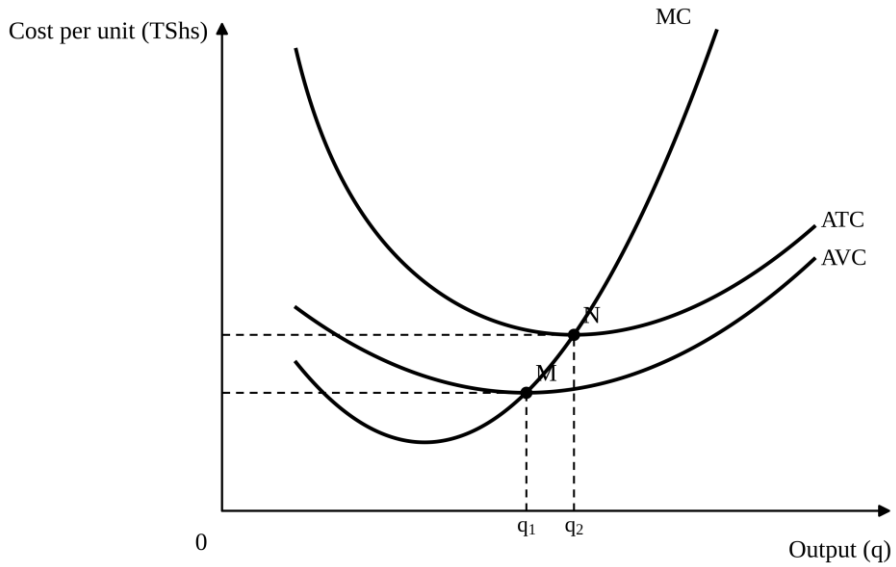


Figure 5.17: Marginal cost cuts average variable cost and average total cost at their minimum points

Reading the diagram: M is the lowest point of average variable cost, at q_1, and N the lowest point of average total cost, at q_2. Marginal cost passes through both, since an average is at its minimum where the marginal stops pulling it down.

Why the cut is from below: to the left of M the marginal lies below the average, which makes the average fall, and to the right it lies above. A curve below on one side and above on the other must be rising as it passes.

Why N lies to the right of M: at q_1 marginal cost equals average variable cost, but average total cost there is larger by the whole of average fixed cost, so ATC must still be falling. A curve still falling has not reached its minimum, so q_2 exceeds q_1.

Marginal cost cuts the averages at their minimum points, but its own minimum comes earlier, and nothing of importance happens where MC itself bottoms out.

The Master Key: *Below pulls the average down, above pushes it up, equal holds it still: MC cuts AVC and ATC upward through their lowest points, and ATC bottoms out later.*

BINDER Question 165

Watch the two average cost curves of a Mwanza ice plant lean towards each other as output grows. They come very close. They will never touch, and the reason has a name.

Draw, on one diagram, the average fixed cost, average variable cost, average total cost and marginal cost curves of a firm in the short run, and explain what happens to the vertical distance between the average total cost curve and the average variable cost curve as output expands.

Model Answer

The vertical distance between the average total cost curve and the average variable cost curve is average fixed cost itself, so that gap narrows continuously as output rises, becomes very small at high output, and never closes.

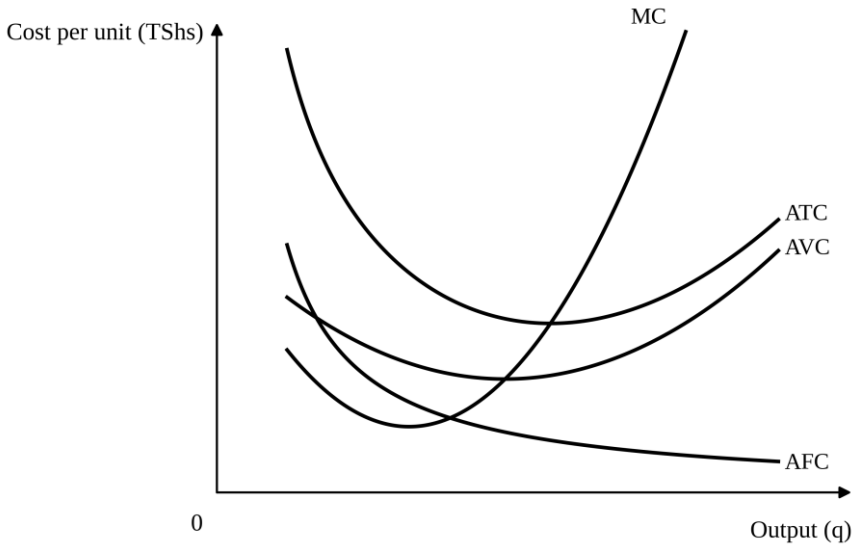


Figure 5.18: The short run average and marginal cost curves

Begin from the identity that holds at every output on the diagram.

$$\text{ATC} = \text{AFC} + \text{AVC}$$

Make average fixed cost the subject and the answer falls out in one line.

$$\text{ATC} - \text{AVC} = \text{AFC} = \frac{\text{TFC}}{\text{q}}$$

Why the gap narrows: the gap is the average fixed cost curve read off the same diagram. Average fixed cost falls at every output, so the distance between ATC and AVC shrinks at every output. At one unit the gap is the whole fixed bill; at a hundred units a hundredth of it.

Why the gap never closes: the gap vanishes only if average fixed cost becomes zero, and a positive fixed bill divided by a finite output is never zero. The two curves converge without ever meeting, exactly as the AFC curve approaches the horizontal axis without touching it.

Reading the rest of the family: average fixed cost falls alone and never turns. Average variable cost and average total cost are both U shaped, with ATC above AVC at every output. Marginal cost is U shaped too, reaches its minimum before either average and cuts both at their lowest points.

Why the ATC curve changes character along its length: at low output ATC is dominated by average fixed cost, which is why it begins so high above AVC and falls so steeply. At high output average fixed cost has almost gone, so ATC follows AVC upward. The left arm is the overhead, the right arm diminishing returns.

For the ice plant this is a working fact rather than geometry. Running at a quarter of what the cold room could handle, total cost per block stands far above variable cost per block, and the whole difference is idle plant being paid for.

The Master Key: *ATC minus AVC is AFC: the gap shrinks with every extra unit and would close only at an output no firm can reach.*

BINDER Question 166

A SIDO workshop at Moshi keeps one column of figures for the rent and another for the metal sheet. From those two columns, four different cost curves can be built.

Complete the workshop's short run cost schedule, and state the output at which marginal cost, average variable cost and average total cost each reach their minimum.

A SIDO workshop at Moshi makes metal buckets. Output q is measured in dozens of buckets a day. Its total fixed cost is TShs 84,000 a day: the rent of the shed, the licence and the depreciation on the rolling machine.

Its total variable cost, in shillings, is 0 at zero output, then 40,000 at one dozen, 60,000 at two, 72,000 at three, 88,000 at four, 120,000 at five, 180,000 at six, 280,000 at seven and 432,000 at eight.

Model Answer

Once total fixed and total variable cost are known at every output the whole family follows by division and subtraction, and the schedule shows marginal cost lowest at three dozen, average variable cost lowest at four dozen and average total cost lowest at five dozen.

Build the totals first. Total cost is the fixed and variable columns added at each output, and it begins at TShs 84,000 even when nothing is made.

Dozens a day (q)	TFC (TShs)	TVC (TShs)	TC (TShs)
0	84,000	0	84,000
1	84,000	40,000	124,000
2	84,000	60,000	144,000
3	84,000	72,000	156,000
4	84,000	88,000	172,000
5	84,000	120,000	204,000
6	84,000	180,000	264,000
7	84,000	280,000	364,000
8	84,000	432,000	516,000

Total fixed, total variable and total cost at the Moshi workshop.

Now the per unit figures. Average fixed cost is the fixed bill divided by output, average variable cost the variable bill divided by output, average total cost the total divided by output, and marginal cost the rise caused by the last dozen.

$$\text{AFC} = \frac{\text{TFC}}{\text{q}}, \quad \text{AVC} = \frac{\text{TVC}}{\text{q}}, \quad \text{ATC} = \frac{\text{TC}}{\text{q}}, \quad \text{MC} = \frac{\Delta\,\text{TC}}{\Delta\,\text{q}}$$

Dozens a day (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
0	-	-	-	-
1	84,000	40,000	124,000	40,000
2	42,000	30,000	72,000	20,000
3	28,000	24,000	52,000	12,000
4	21,000	22,000	43,000	16,000
5	16,800	24,000	40,800	32,000
6	14,000	30,000	44,000	60,000
7	12,000	40,000	52,000	100,000
8	10,500	54,000	64,500	152,000

The four per unit costs of the Moshi bucket workshop, derived from the totals above.

One row worked in full shows the method. Take five dozen, where total variable cost is TShs 120,000 and total cost TShs 204,000.

$$\text{AFC} = \frac{84{,}000}{5} = 16{,}800$$

$$\text{AVC} = \frac{120{,}000}{5} = 24{,}000$$

$$\text{ATC} = \frac{204{,}000}{5} = 40{,}800$$

$$\text{ATC} = \text{AFC} + \text{AVC} = 16{,}800 + 24{,}000 = 40{,}800$$

$$\text{MC} = \frac{204{,}000 - 172{,}000}{5 - 4} = 32{,}000$$

Where marginal cost is lowest: at three dozen a day, where it falls to TShs 12,000. Up to there every extra dozen was cheaper than the one before, as the shed and the rolling machine came into fuller use. After three dozen diminishing returns set in.

Where average variable cost is lowest: at four dozen a day, where it falls to TShs 22,000. Marginal cost at four dozen is TShs 16,000, below the TShs 24,000 the average stood at, so it is dragged down; at five dozen it is TShs 32,000, so the average is pushed back up.

Where average total cost is lowest: at five dozen a day, where it falls to TShs 40,800. Marginal cost at five dozen is TShs 32,000, below the TShs 43,000 average total cost at four dozen, so ATC is still pulled down; at six dozen it is TShs 60,000, so ATC turns and rises to 44,000.

The order in which the three minima arrive: they come in the order marginal, average variable, average total, at three, four and five dozen, and that order is no accident. Each average is dragged down after the marginal has begun to climb, ATC longest because it also carries the falling AFC.

Average fixed cost falls from TShs 84,000 at one dozen to TShs 10,500 at eight and never turns, while average total cost falls to 40,800 and climbs again to 64,500. The turn comes from the variable side, never the rent.

The Master Key: *Divide the totals for the averages and difference them for the margin, and the three minima appear in the order MC, AVC, ATC.*

BINDER Question 167

Half the cost schedule of a Mtwara cashew shed has been eaten by damp and only six figures remain. Every one of the missing entries can still be recovered exactly.

Using the surviving figures, reconstruct the shed's complete cost schedule for outputs of zero to five sacks, and state the route by which each missing total was recovered.

A shelling shed at Mtwara handles korosho, raw cashew nut. Output q is in sacks of shelled nut a day.

At zero output the shed's total cost is TShs 36,000.

At one sack its total variable cost is TShs 20,000.

At two sacks its total cost is TShs 68,000.

At three sacks its average variable cost is TShs 15,000.

At four sacks its marginal cost is TShs 26,000.

At five sacks its average total cost is TShs 28,000.

Model Answer

Every missing figure can be recovered because the seven columns are locked together by three identities, that total cost is fixed cost plus variable cost, that an average is a total divided by output, and that marginal cost is the change in total cost.

Start at zero output: when nothing is produced there is no variable cost, so the whole of total cost at zero output is fixed cost. The shed's total fixed cost is TShs 36,000 a day, and that figure stands in every row.

$$\text{At } q = 0, \ \text{TVC} = 0, \ \text{so TFC} = \text{TC} = 36{,}000$$

One sack: total variable cost is TShs 20,000, so total cost is 36,000 plus 20,000, TShs 56,000, and marginal cost of the first sack is the rise from 36,000 to 56,000, TShs 20,000.

Two sacks: total cost is TShs 68,000, so total variable cost is 68,000 less the fixed 36,000, TShs 32,000, and marginal cost of the second sack is 68,000 less 56,000, TShs 12,000.

Three sacks: average variable cost is TShs 15,000, so total variable cost is 15,000 times 3, TShs 45,000, and total cost TShs 81,000. Marginal cost of the third sack is 81,000 less 68,000, TShs 13,000.

$$\text{TVC} = \text{AVC} \times q = 15{,}000 \times 3 = 45{,}000$$

Four sacks: marginal cost is TShs 26,000, which is the amount total cost rose by, so total cost is 81,000 plus 26,000, TShs 107,000, and total variable cost is 107,000 less 36,000, TShs 71,000.

Five sacks: average total cost is TShs 28,000, so total cost is 28,000 times 5, TShs 140,000, total variable cost 140,000 less 36,000, TShs 104,000, and marginal cost of the fifth sack TShs 33,000.

$$\text{TC} = \text{ATC} \times q = 28{,}000 \times 5 = 140{,}000$$

With every total recovered, the remaining columns are simple division.

Sacks a day (q)	TFC (TShs)	TVC (TShs)	TC (TShs)
0	36,000	0	36,000
1	36,000	20,000	56,000
2	36,000	32,000	68,000
3	36,000	45,000	81,000
4	36,000	71,000	107,000
5	36,000	104,000	140,000

The recovered totals for the Mtwara shelling shed.

Sacks a day (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
0	-	-	-	-
1	36,000	20,000	56,000	20,000
2	18,000	16,000	34,000	12,000
3	12,000	15,000	27,000	13,000
4	9,000	17,750	26,750	26,000
5	7,200	20,800	28,000	33,000

The completed per unit schedule for the Mtwara shelling shed.

The check that the schedule is sound: at every output average total cost must equal average fixed cost plus average variable cost. At four sacks, 9,000 plus 17,750 is 26,750, exactly what 107,000 divided by 4 gives.

Average variable cost bottoms out at three sacks at TShs 15,000 and average total cost at four sacks at TShs 26,750, so the cheapest sack this shed can shell costs TShs 26,750.

The Master Key: *Total cost at zero output is the fixed cost, a total over q is an average, and a difference in total cost is the margin: three moves open any blank schedule.*

REAL Question 168

Follow the mpunga, the paddy, into a hulling mill at Morogoro. The mill charges by the tonne, and what a tonne costs it changes with every tonne it takes.

Derive the mill's average fixed cost, average variable cost, average total cost and marginal cost at each output, state the output at which each average reaches its minimum, and advise the miller on the lowest charge per tonne that would cover all his costs.

A hulling mill at Morogoro takes in mpunga, paddy, from farmers and returns milled rice for a charge per tonne.

Its total fixed cost is TShs 120,000 a day: the rent of the shed, the loan repayment on the huller, the watchman's wage and depreciation.

Its total variable cost, in shillings, is 0 at zero tonnes, then 50,000 at one tonne, 80,000 at two, 108,000 at three, 140,000 at four, 190,000 at five and 270,000 at six.

The mill cannot handle more than six tonnes a day with its present huller.

Model Answer

The mill's average variable cost is lowest at four tonnes a day at TShs 35,000 and its average total cost lowest at five tonnes at TShs 62,000, so TShs 62,000 a tonne is the lowest charge that covers every shilling the mill spends.

Add the two given columns for total cost, divide each total by output for the averages, and difference the total cost column for the margin.

Tonnes a day (q)	TFC (TShs)	TVC (TShs)	TC (TShs)
0	120,000	0	120,000
1	120,000	50,000	170,000
2	120,000	80,000	200,000
3	120,000	108,000	228,000
4	120,000	140,000	260,000
5	120,000	190,000	310,000
6	120,000	270,000	390,000

Total costs at the Morogoro hulling mill.

Tonnes a day (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
0	-	-	-	-
1	120,000	50,000	170,000	50,000
2	60,000	40,000	100,000	30,000
3	40,000	36,000	76,000	28,000
4	30,000	35,000	65,000	32,000
5	24,000	38,000	62,000	50,000
6	20,000	45,000	65,000	80,000

Average and marginal cost per tonne of milled rice at Morogoro.

The row at five tonnes shows how every other row was obtained.

$$\text{AFC} = \frac{120{,}000}{5} = 24{,}000$$

$$\text{AVC} = \frac{190{,}000}{5} = 38{,}000$$

$$\text{ATC} = \frac{310{,}000}{5} = 62{,}000 = 24{,}000 + 38{,}000$$

$$\text{MC} = \frac{310{,}000 - 260{,}000}{5 - 4} = 50{,}000$$

Average fixed cost: falls without interruption from TShs 120,000 a tonne at one tonne to TShs 20,000 at six, because the same TShs 120,000 of rent, loan and watchman is shared among more and more tonnes.

Average variable cost: falls to TShs 35,000 at four tonnes and rises after. Up to four tonnes the huller and the two hands are used more fully, so diesel, electricity, bags and wages spread better. Beyond four the machine is pushed past its speed, and repairs, spillage and overtime raise every tonne.

Average total cost: falls to TShs 62,000 at five tonnes and rises to TShs 65,000 at six. It falls for a whole tonne after average variable cost has turned, because between four and five tonnes the fall in AFC is larger than the rise in AVC.

$$\text{fall in AFC} = 30{,}000 - 24{,}000 = 6{,}000 \quad > \quad \text{rise in AVC} = 38{,}000 - 35{,}000 = 3{,}000$$

Marginal cost: falls to TShs 28,000 at three tonnes and then climbs to TShs 80,000 at six. It crosses average variable cost between four and five tonnes and average total cost between five and six, exactly where each average turns.

The advice on the charge: the lowest charge that covers everything is TShs 62,000 a tonne, and the mill must be milling five tonnes a day to reach it. At TShs 70,000 a tonne with five tonnes coming in, the mill takes TShs 350,000 against costs of TShs 310,000.

Two cautions belong with that advice. TShs 62,000 belongs to five tonnes alone, so if he quotes it and then mills three he loses, a tonne there costing TShs 76,000. And when custom is slack he should still open, since anything above TShs 35,000 a tonne contributes.

The Master Key: *Least cost at Morogoro is TShs 62,000 a tonne at five tonnes a day, but any charge above average variable cost still helps to pay for the shed.*

REAL Question 169

A buyer at the Mwanza plant offers a price comfortably above the plant's average cost. The manager is ready to sign. The fifth tonne will cost more than he thinks.

Work out the plant's full cost schedule from its total cost figures, calculate what the fifth tonne costs, and advise the manager whether to accept the offer.

A fillet plant on the lake shore at Mwanza buys Nile perch from the fishermen and packs frozen fillet for export.

Its total cost, in shillings a day, is 180,000 at zero tonnes, 300,000 at one tonne, 370,000 at two, 450,000 at three, 560,000 at four, 730,000 at five and 1,020,000 at six.

The plant already holds a standing contract for four tonnes a day at TShs 200,000 a tonne.

A new buyer now offers TShs 150,000 for one extra tonne, a single order that will not disturb the standing contract.

Model Answer

The manager should refuse the offer as it stands, because the fifth tonne adds TShs 170,000 to the plant's costs and only TShs 150,000 to its revenue, so accepting would cut the day's profit by TShs 20,000.

Take the fixed cost first. At zero output the plant produces nothing, so the whole TShs 180,000 it still spends must be fixed cost.

$$\text{At } q = 0, \quad \text{TVC} = 0, \quad \text{so TFC} = \text{TC} = 180{,}000$$

Tonnes a day (q)	TC (TShs)	TFC (TShs)	TVC (TShs)	MC (TShs)
0	180,000	180,000	0	-
1	300,000	180,000	120,000	120,000
2	370,000	180,000	190,000	70,000
3	450,000	180,000	270,000	80,000
4	560,000	180,000	380,000	110,000
5	730,000	180,000	550,000	170,000
6	1,020,000	180,000	840,000	290,000

Total and marginal cost at the Mwanza fillet plant.

Tonnes a day (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)
0	-	-	-
1	180,000	120,000	300,000
2	90,000	95,000	185,000
3	60,000	90,000	150,000
4	45,000	95,000	140,000
5	36,000	110,000	146,000
6	30,000	140,000	170,000

Average costs per tonne of fillet at the Mwanza plant.

The figure that settles it is the marginal cost of the fifth tonne, the rise in total cost from four tonnes to five.

$$\text{MC} = \frac{730{,}000 - 560{,}000}{5 - 4} = 170{,}000$$

The comparison that decides it: the order brings in TShs 150,000 and the tonne costs TShs 170,000, so the plant ends the day TShs 20,000 worse off. Four tonnes give TShs 800,000 against TShs 560,000, a profit of TShs 240,000; five give TShs 950,000 against TShs 730,000, a profit of TShs 220,000.

Why the average misleads here: average total cost at five tonnes is TShs 146,000, below the offered TShs 150,000, which makes the order look attractive. But that average shares all five tonnes evenly, and four were already being paid for at TShs 200,000 each. Only the fifth tonne, at TShs 170,000, is at stake.

The rule the case teaches: an addition to output must be judged against marginal cost and never against average cost. Average cost answers what production has cost so far; marginal cost answers what the next decision will cost.

Where the plant's costs turn: average variable cost is lowest at three tonnes at TShs 90,000 and average total cost at four tonnes at TShs 140,000, so the standing contract already has the plant at its least cost output. A fifth tonne moves it up the rising arm of both curves.

What would change the answer: any price above TShs 170,000 for that fifth tonne would be worth taking, so the manager should go back to the buyer asking TShs 175,000 rather than refuse outright, since a price a little above marginal cost still adds something to the day.

Notice how little the fixed cost mattered. The TShs 180,000 for cold store, licence and guards is the same at four tonnes as at five, so it cannot choose between them. Fixed cost decides whether to be in the fillet trade; marginal cost decides how much to pack.

The Master Key: *Judge an extra tonne by what it adds, not by what everything has averaged: TShs 150,000 against a marginal cost of TShs 170,000 is a refusal.*

REAL Question 170

The landlord of a Kariakoo bakery raises the rent. The flour, the yeast and the wages have not changed by a shilling, yet two of the four cost curves move.

Calculate the bakery's average fixed, average variable, average total and marginal cost before and after the rent increase, state which of the four are affected and which are not, and explain what happens to the bakery's least cost output.

A bakery at Kariakoo bakes mikate, bread loaves. Output q is measured in hundreds of loaves a day.

Its total fixed cost is TShs 60,000 a day, almost all of it rent.

Its total variable cost, in shillings, is 0 at zero output, then 45,000 at one hundred loaves, 80,000 at two hundred, 114,000 at three hundred, 160,000 at four hundred, 225,000 at five hundred and 324,000 at six hundred.

The landlord now doubles the rent, so that the bakery's total fixed cost rises to TShs 120,000 a day.

Model Answer

The rent increase raises average fixed cost and average total cost at every output but leaves average variable cost and marginal cost completely untouched, and it moves the bakery's least cost output from four hundred loaves a day to five hundred.

Set out the four per unit figures at the old fixed cost of TShs 60,000 a day.

Hundreds of loaves (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
1	60,000	45,000	105,000	45,000
2	30,000	40,000	70,000	35,000
3	20,000	38,000	58,000	34,000
4	15,000	40,000	55,000	46,000
5	12,000	45,000	57,000	65,000
6	10,000	54,000	64,000	99,000

The Kariakoo bakery with a fixed cost of TShs 60,000 a day.

Now double the fixed cost to TShs 120,000 a day and rebuild the same four columns.

Hundreds of loaves (q)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
1	120,000	45,000	165,000	45,000
2	60,000	40,000	100,000	35,000
3	40,000	38,000	78,000	34,000
4	30,000	40,000	70,000	46,000
5	24,000	45,000	69,000	65,000
6	20,000	54,000	74,000	99,000

The same bakery after the rent doubles the fixed cost to TShs 120,000 a day.

What does not move: average variable cost and marginal cost are identical in the two schedules, figure for figure. Nothing about the flour, the yeast, the charcoal or the baker's wage has changed, and rent is no part of the cost of one more loaf.

What does move: average fixed cost doubles at every output, from TShs 60,000 to TShs 120,000 at one hundred loaves and from TShs 10,000 to TShs 20,000 at six hundred, and since ATC is the sum of the two averages the whole curve shifts upward by that amount.

$$\Delta \text{ATC} = \Delta \text{AFC} = \frac{120{,}000 - 60{,}000}{\text{q}} = \frac{60{,}000}{\text{q}}$$

The shift is not a parallel one: at one hundred loaves average total cost rises by TShs 60,000, at three hundred by TShs 20,000 and at six hundred by only TShs 10,000. A heavier overhead punishes small output far more than large.

Why the least cost output moves to the right: before the rise, average total cost was lowest at four hundred loaves at TShs 55,000; after it, lowest at five hundred at TShs 69,000, since four hundred now costs TShs 70,000. A heavier fixed bill drags ATC down for longer, pushing the firm towards a larger output.

What the baker should not conclude: he should not simply add the rent increase to his price. He should bake more, since five hundred loaves at TShs 69,000 a hundred is cheaper per loaf than four hundred at TShs 70,000, and the extra loaves bring in revenue as well.

A change in fixed cost changes what the firm must cover but not what the next loaf costs, so it alters the price at which the bakery breaks even while leaving untouched the figure the baker uses to decide how much to bake.

The Master Key: *Fixed cost moves AFC and ATC alone; AVC and MC never feel it, and a heavier overhead pushes the least cost output further to the right.*

REAL Question 171

A clerk at a Dodoma alizeti press hands the manager a schedule and a recommendation. One figure in the schedule is impossible, and the recommendation rests on it.

Derive the press's correct cost schedule, identify the figure the clerk has got wrong, prove that it is wrong in two separate ways, and state the true least cost output.

A press at Dodoma crushes alizeti, sunflower seed, into cooking oil. Output q is measured in hundreds of litres a day.
The press has a total fixed cost of TShs 90,000 a day.
Its total variable cost, in shillings, is 70,000 at one hundred litres, 120,000 at two hundred, 168,000 at three hundred, 232,000 at four hundred, 330,000 at five hundred and 480,000 at six hundred.
The clerk's average total cost row reads, in shillings: 160,000 then 105,000 then 86,000 then 80,500 then 74,000 then 95,000.
On the strength of it he tells the manager that the cheapest output is five hundred litres a day.

Model Answer

The clerk's average total cost at five hundred litres is wrong: it should read TShs 84,000 and not TShs 74,000, so the press's true least cost output is four hundred litres a day at TShs 80,500 and not five hundred as he recommends.

Build the schedule honestly from the two totals the press actually has, and the error shows itself at once.

Hundred litres (q)	TFC (TShs)	TVC (TShs)	TC (TShs)	MC (TShs)
0	90,000	0	90,000	-
1	90,000	70,000	160,000	70,000
2	90,000	120,000	210,000	50,000
3	90,000	168,000	258,000	48,000
4	90,000	232,000	322,000	64,000
5	90,000	330,000	420,000	98,000
6	90,000	480,000	570,000	150,000

Total and marginal cost at the Dodoma sunflower press.

Hundred litres (q)	AFC (TShs)	AVC (TShs)	ATC correct (TShs)	ATC as written (TShs)
0	-	-	-	-
1	90,000	70,000	160,000	160,000
2	45,000	60,000	105,000	105,000
3	30,000	56,000	86,000	86,000
4	22,500	58,000	80,500	80,500
5	18,000	66,000	84,000	74,000
6	15,000	80,000	95,000	95,000

The correct average costs beside the clerk's row; the two disagree at five hundred litres.

The first proof: the averages do not add up: at every output average total cost must be the sum of average fixed cost and average variable cost. At five hundred litres average fixed cost is 90,000 over 5, that is TShs 18,000, and average variable cost 330,000 over 5, TShs 66,000.

$$\text{ATC} = \text{AFC} + \text{AVC} = 18{,}000 + 66{,}000 = 84{,}000$$

The direct division gives the same answer, and is the surer test because it uses the total cost column.

$$\text{ATC} = \frac{\text{TC}}{\text{q}} = \frac{420{,}000}{5} = 84{,}000$$

The second proof: the relationship rule forbids his figure: marginal cost at five hundred litres is the rise from TShs 322,000 to TShs 420,000, that is TShs 98,000. That lies far above the average total cost of TShs 80,500 at four hundred litres, and when marginal cost is above the average the average must rise, not fall to 74,000.

$$\text{MC}_5 = 98{,}000 \quad > \quad \text{ATC}_4 = 80{,}500 \quad \text{so ATC must rise}$$

The true least cost output: average total cost falls to TShs 80,500 at four hundred litres and then rises to 84,000 and 95,000, so four hundred litres is the least cost output. Marginal cost at four hundred is TShs 64,000, below the TShs 86,000 the average stood at; at five hundred it is TShs 98,000, above it.

What the error would have cost: acting on the clerk's figure, the manager would have pressed five hundred litres at a true cost of TShs 84,000 a hundred litres instead of TShs 80,500, that is TShs 3,500 more on every hundred, believing he was saving money.

The habit this teaches: a cost schedule audits itself. Two checks catch almost every slip: average total cost must equal average fixed cost plus average variable cost, and each average must move in the direction marginal cost dictates.

Notice what the clerk got right, because that is what makes the mistake dangerous. His TShs 80,500 at four hundred litres is correct, and so is every other entry. A single wrong figure in a sound schedule is the hardest error to see.

The Master Key: *Two checks audit any schedule: ATC must equal AFC plus AVC, and each average must move in the direction marginal cost dictates.*

HOT Question 172

The engineer at Mtibwa wants the lowest cost per tonne of sugar; the owner wants the largest profit. They are not asking for the same output.

Assess the claim that a producer should always aim to produce at the output where average total cost is lowest.

Model Answer

The claim is only partly true, because the lowest average total cost identifies the cheapest way of making a unit but not the most profitable quantity, and a producer whose object is profit should produce where marginal cost has risen to meet marginal revenue.

The case for the claim: the minimum of average total cost is the least cost output, where the firm gets most from the plant it has. No capacity stands idle and none is strained, and the inputs are in the cheapest proportion the plant allows.

The right standard for judging a manager: if a Mtibwa mill can make sugar at TShs 1,200 a kilogramme at its best output but is making it at TShs 1,500, the difference is waste and closing it is the manager's job.

But profit is a total, not a rate: a firm banks total profit, not profit per tonne. Selling 100 tonnes at TShs 40,000 a tonne yields TShs 4,000,000, while 160 tonnes at TShs 30,000 yields TShs 4,800,000, worse per tonne and better for the owner.

The correct rule lies at the margin: so long as one more tonne adds more to revenue than to cost it is worth making, so the firm expands until marginal cost equals marginal revenue. Beyond the minimum of ATC marginal cost is above it and rising, so a price above ATC leaves room to gain.

Demand may not permit it in any case: the least cost output is worked out entirely from the cost side and knows nothing of the market. A press that makes oil most cheaply at five hundred litres a day but can sell only three hundred cannot reach it, and storing the rest adds spoilage and risk.

The plant itself is a choice, not a fact: the minimum belongs to one shed and one machine. If the firm expects to sell far more for years to come, the answer is to build a larger plant whose cost curve sits lower, not to squeeze this one harder.

When the claim does hold exactly: where the firm has no influence over price and competition has driven price down to the lowest average cost itself, the profit maximising output and the least cost output coincide. That is a long run resting place.

So the verdict is divided. Aim to be able to produce at the minimum of average total cost, but do not aim to produce that quantity whatever happens; the quantity is settled by the cost of the next tonne against what it fetches.

The Master Key: *Minimum average cost is the test of a well run plant; marginal cost weighed against marginal revenue is the test of the right output.*

HOT Question 173

A Mbeya miller has squeezed every shilling out of his costs and sits exactly at the bottom of his average cost curve. The month still closes with a loss.

Explain how a producer operating at the minimum of his average cost curve can nevertheless be making a loss, and advise the miller what he should do.

A maize mill at Mbeya is producing 40 tonnes of sembe, maize flour, a month, which is the output at which its average total cost is lowest.

At that output average total cost is TShs 720 a kilogramme and average variable cost is TShs 500 a kilogramme.

Competition from imported flour and from other local mills has pushed the price down to TShs 650 a kilogramme.

Model Answer

Producing at the minimum of average cost guarantees only that no cheaper way exists of making that output with that plant, and this miller loses money because a price of TShs 650 a kilogramme lies below his lowest average cost of TShs 720.

The arithmetic of the loss: every kilogramme brings in TShs 650 and costs him TShs 720, so each loses TShs 70. On 40 tonnes, that is 40,000 kilogrammes, the loss comes to TShs 2,800,000 a month, and no rearrangement removes it.

$$\text{Loss} = (720 - 650) \times 40{,}000 = 2{,}800{,}000$$

Why cost minimisation is only half the story: average cost is settled by his technique, his plant and the prices of maize, diesel and labour; the price of sembe is settled by the market, the harvest, imports and the mills down the road.

Where the real trouble may lie: a lowest average cost of TShs 720 may itself be too high for the trade. The mill may carry a plant built for more throughput than the market gives, a heavy loan on the huller, or a generator because the grid fails.

What his fixed bill actually is: average fixed cost is average total cost less average variable cost, 720 less 500, that is TShs 220 a kilogramme, so over 40,000 kilogrammes the month's fixed bill is

$$\text{TFC} = \text{AFC} \times \text{q} = (720 - 500) \times 40{,}000 = 8{,}800{,}000$$

Why he should nevertheless keep milling: the price of TShs 650 is above his average variable cost of TShs 500, so every kilogramme pays for its own maize, diesel and wages and leaves TShs 150 towards the fixed bill, TShs 6,000,000 against TShs 8,800,000.

$$\text{Contribution} = (650 - 500) \times 40{,}000 = 6{,}000{,}000$$

What stopping would cost him: if he shuts the mill the rent, the loan and the watchman still fall due, so he loses the whole TShs 8,800,000. Closing makes him TShs 6,000,000 a month worse off, so he should keep milling while price exceeds TShs 500.

The advice for the longer run: a loss covered this way is a wound that has stopped bleeding, not a cure. He must either lift the price, by packing and branding his sembe, supplying schools and hospitals on contract, or milling for a fee; or pull the cost curve down, by renegotiating the rent and buying maize cheaply at harvest.

And the point at which he should leave: if the price still cannot be brought above his lowest average cost, then when the huller wears out and the lease falls due he should renew neither. The trade does not pay enough to justify replacing the plant.

So the verdict turns on two questions. Am I making this output as cheaply as it can be made is a question about the miller, and he has answered it well. Is it worth making at all is a question about the price.

The Master Key: *Minimum average cost defeats waste, not a low price: keep milling while price exceeds AVC, and change the plant or the product before the lease is renewed.*

Cost Functions and Cost Calculus

A cost schedule tells a producer what the few outputs on it cost. A cost function tells him what every output would cost, and a derivative then finds the exact quantity at which each curve turns. This section takes total cost functions from a Tanga dairy, a Morogoro rice mill, a Mwanza soap works and a Dodoma sunflower press, reads the fixed cost off at zero output, divides for the averages, differentiates for the margin, and finds the outputs at which marginal and average cost are least.

BINDER Question 174

A Kariakoo baker's book has two columns, what the day cost and how many loaves it baked. From one line of algebra fitted to those, six separate cost curves come out.

Define a cost function and set out, in order, the method by which the total fixed cost, the total variable cost, the average fixed cost, the average variable cost, the average total cost and the marginal cost of a firm are obtained from a total cost function $\text{C} = \text{f(q)}$**.**

Model Answer

A cost function relates the output a firm produces to the cost of producing it, and every other cost follows from it in order: put zero for the fixed cost, subtract that constant for the variable cost, divide by output for each average, and differentiate for the margin.

Total cost depends on the quantity produced, and the function states exactly how.

$$C = f(q)$$

Step one, the fixed cost at zero output: put zero in place of q, and every term carrying a q vanishes, so the constant is the fixed cost.

$$TFC = f(0)$$

Step two, subtract that constant: total cost is the fixed half plus the variable half, so the variable half is the function less its constant.

$$TC = TFC + TVC$$
$$TVC = TC - TFC = f(q) - f(0)$$

Step three, divide for the averages: an average is a total shared among the units that carry it, so each average is its own total divided by q.

$$AFC = \frac{TFC}{q} = \frac{f(0)}{q}$$
$$AVC = \frac{TVC}{q} = \frac{f(q) - f(0)}{q}$$
$$ATC = \frac{TC}{q} = \frac{f(q)}{q} = AFC + AVC$$

Step four, differentiate for the margin: marginal cost is what one more unit adds to total cost, and an addition per unit is a derivative.

$$MC = \frac{\partial TC}{\partial q}$$

Why the variable half suffices: the derivative of a constant is zero, so the fixed cost leaves no trace and the shorter function may be used.

$$MC = \frac{\partial (TFC + TVC)}{\partial q} = 0 + \frac{\partial TVC}{\partial q}$$

Set the method to work once on the general short run cost function.

$$C = F + aq - bq^2 + cq^3$$
$$TFC = F \quad TVC = aq - bq^2 + cq^3$$
$$AFC = \frac{F}{q} \quad AVC = a - bq + cq^2$$
$$ATC = \frac{F}{q} + a - bq + cq^2$$
$$MC = a - 2bq + 3cq^2$$

The commonest fault: dividing where the question calls for differentiation. The average asks what a unit has cost, the margin what the next will cost. On the cubic above, division gives $a - bq + cq^2$ and differentiation $a - 2bq + 3cq^2$.

Three checks worth running on every answer: average total cost less average variable cost must equal average fixed cost; average fixed cost must fall for ever; and marginal cost must pass through the lowest point of both average curves.

Four operations, taken in order, turn one line of algebra into the whole family of short run cost curves.

The Master Key: *Zero the output for the fixed cost, subtract it for the variable cost, divide for every average and differentiate for the margin.*

BINDER Question 175

A Kariakoo welder pays the same for every metre of rod, whether he makes one gate or forty. His marginal cost curve refuses to bend, and the famous U shapes quietly vanish.

A firm's total cost function is $C = 2q + 5$. Obtain its total fixed cost, total variable cost, average fixed cost, average variable cost, average total cost and marginal cost, and state what the behaviour of marginal cost in this firm implies about the technique of production that has been assumed.

Model Answer

The fixed cost is 5, the variable cost $2q$, average fixed cost $\frac{5}{q}$, average variable cost and marginal cost both a constant 2, and average total cost $2 + \frac{5}{q}$, so nothing here is U shaped and only the spreading of the fixed 5 moves.

Take the method in order, beginning at zero output.

$$C = 2q + 5$$

The fixed cost: substitute zero for q. The term $2q$ disappears and 5 remains, so the firm pays 5 before it produces anything.

$$TC = TFC = 2(0) + 5 = 5$$

The variable cost: subtract the fixed 5, and what is left rises with output and vanishes at zero output.

$$TVC = (2q + 5) - 5 = 2q$$

The averages, by division: divide each total by the output that carries it. The 2 in average variable cost is what one unit costs in materials and labour, and it does not move.

$$AFC = \frac{TFC}{q} = \frac{5}{q}$$

$$AVC = \frac{TVC}{q} = \frac{2q}{q} = 2$$

$$ATC = \frac{TC}{q} = \frac{2q + 5}{q} = 2 + \frac{5}{q}$$

$$AFC + AVC = \frac{5}{q} + 2 = ATC$$

The margin, by differentiation: the derivative of $2q$ is 2 and of the constant 5 is zero, so marginal cost is 2 at every output.

$$MC = \frac{\partial (2q + 5)}{\partial q} = 2 + 0 = 2$$

Output (q)	Total cost	AFC	AVC	ATC	MC
1	7	5	2	7	2
2	9	2.5	2	4.5	2
5	15	1	2	3	2
10	25	0.5	2	2.5	2
20	45	0.25	2	2.25	2

The whole schedule of a linear cost function: two columns never move, and the fall in average total cost is nothing but the fall in average fixed cost.

Marginal cost equals average variable cost: both stand at 2, at the first unit and at the thousandth. Where a margin equals its average, that average is neither pulled up nor dragged down, so it is flat.

Average total cost never turns up: the only moving part of $2 + \frac{5}{q}$ is the $\frac{5}{q}$. At 20 units it is 2.25, at 100 units 2.05 and at 1,000 units 2.005, closing on 2 without reaching it, so this firm has no least cost output.

What constant marginal cost assumes: every extra unit uses the same quantity of the variable factor as the one before, so marginal product never falls and diminishing returns have been assumed away. One fixed plant worked harder must eventually cost more.

Reading the figures in shillings: TShs 5 is what the firm pays before it opens and TShs 2 what one more unit costs, so it should take any order above TShs 2, yet over the period it must earn more than $2 + \frac{5}{q}$ a unit.

A linear cost function is narrow rather than wrong. It contains no diminishing returns, so it tells a producer, falsely, that his largest orders are as cheap as his smallest.

The Master Key: *A linear cost function makes marginal cost equal average variable cost at every output, so nothing is U shaped and only average fixed cost moves.*

BINDER Question 176

Add a third shift at a small SIDO workshop and the day's cost does not merely rise, it rises faster than the work does. One cubed term carries that whole story.

A firm faces the total cost function $C = 4 + 2q + q^3$. Find its fixed cost, its total variable cost, its average variable cost, its average total cost and its marginal cost, showing every step of the differentiation, then find the output at which average total cost is least and show that marginal cost is equal to average total cost at that output.

Model Answer

The fixed cost is 4, the variable cost $2q + q^3$, average variable cost $2 + q^2$, average total cost $\frac{4}{q} + 2 + q^2$ and marginal cost $2 + 3q^2$, and average total cost is least at about 1.26 units, where both stand at 6.76.

Work the four steps in order.

$$C = 4 + 2q + q^3$$

The fixed cost at zero output: put zero in place of q, and both the term in q and the term in q cubed vanish.

$$TC = TFC = 4 + 2(0) + (0)^3$$
$$TFC = 4$$

The variable cost is what remains: subtract the 4, and what is left is zero at zero output and grows with output.

$$TVC = TC - TFC$$
$$TVC = (4 + 2q + q^3) - 4$$
$$TVC = 2q + q^3$$

The averages, by division: divide the variable cost by q and the total cost by q; the two differ by exactly $\frac{4}{q}$.

$$AVC = \frac{TVC}{q} = \frac{2q + q^3}{q}$$
$$AVC = 2 + q^2$$
$$ATC = \frac{TC}{q} = \frac{4 + 2q + q^3}{q} = \frac{4}{q} + 2 + q^2$$

The margin, by differentiation: multiply each term by its power and then lower the power by one.

$$MC = \frac{\partial (4 + 2q + q^3)}{\partial q}$$
$$MC = 0 + 2 + 3q^2$$
$$MC = 2 + 3q^2$$

The same answer by the shorter road: differentiating the variable cost alone gives an identical result, the fixed 4 contributing nothing.

$$\text{MC} = \frac{\partial\,(2\text{q} + \text{q}^3)}{\partial\,\text{q}} = 2 + 3\text{q}^2$$

Average variable cost never falls here: at every positive output 3q^2 exceeds q^2, so marginal cost lies above average variable cost everywhere, and an average with its margin above it must rise. There is no negative middle term.

Within average total cost a falling term and a rising term pull against one another, $\frac{4}{\text{q}}$ dropping while q^2 climbs. Set its derivative to zero.

$$\text{ATC} = 4\text{q}^{-1} + 2 + \text{q}^2$$
$$\frac{\partial\,\text{ATC}}{\partial\,\text{q}} = -\frac{4}{\text{q}^2} + 2\text{q}$$
$$-\frac{4}{\text{q}^2} + 2\text{q} = 0$$
$$2\text{q}^3 = 4$$
$$\text{q}^3 = 2$$
$$\text{q} = 1.2599 \text{ units}$$

The second order condition: differentiating once more gives $\frac{8}{\text{q}^3} + 2$, positive everywhere, so 1.26 units is a trough.

Now value both curves there, where $\text{q} = 1.2599$, $\text{q}^2 = 1.5874$ and $\frac{4}{\text{q}} = 3.1748$.

$$\text{ATC} = 3.1748 + 2 + 1.5874 = 6.7622$$
$$\text{MC} = 2 + 3(1.5874) = 2 + 4.7622 = 6.7622$$

The two agree, and not by accident: marginal cost passes through the lowest point of average total cost, dragging it down below 1.26 units and pushing it up above. If the output found does not make $\text{MC} = \text{ATC}$, there is an error.

Reading the figures in shillings: at three units marginal cost is $2 + 3(9) = 29$, while the three units together have cost TShs 37, an average of TShs 12.33. The next unit costs more than twice the average so far.

The Master Key: *Read the constant for the fixed cost, divide for the average, differentiate for the margin, and marginal cost will always cut average total cost at its lowest point.*

BINDER Question 177

A Tanga dairy fills its first cans cheaply, its middle cans more cheaply still, and its last cans dearly. Three coefficients in one line of algebra decide where the turn comes.

A dairy plant at Tanga chills and packs milk. It works with a fixed cost of 200 and a total variable cost function $\text{TVC} = 100\text{q} - 5\text{q}^2 + 0.15\text{q}^3$**, where q is the number of hundred litre cans handled in a day and every cost figure is in thousands of shillings. Find the plant's total cost function, its average cost and average variable cost functions and its marginal cost function, then value all four at ten cans a day.**

Model Answer

Total cost is $200 + 100\text{q} - 5\text{q}^2 + 0.15\text{q}^3$**, average cost** $\frac{200}{\text{q}} + 100 - 5\text{q} + 0.15\text{q}^2$**, average variable cost** $100 - 5\text{q} + 0.15\text{q}^2$ **and marginal cost** $100 - 10\text{q} + 0.45\text{q}^2$**, so ten cans cost TShs 850,000, that is TShs 85,000 a can and TShs 45,000 for the tenth.**

Both halves of total cost are given, so the first step is addition.

$$\text{TC} = \text{TFC} + \text{TVC}$$
$$\text{TFC} = 200 \quad \text{TVC} = 100\text{q} - 5\text{q}^2 + 0.15\text{q}^3$$
$$\text{TC} = 200 + 100\text{q} - 5\text{q}^2 + 0.15\text{q}^3$$

Confirming the fixed cost: substituting zero for q leaves 200, so the plant pays TShs 200,000 a day for the cold room, the licence, the watchman and the wear on the tank.

$$\mathrm{TC}(0) = 200 + 100(0) - 5(0)^2 + 0.15(0)^3 = 200$$

Average cost, by division: each term is divided separately: the fixed term keeps its q underneath, the others lose one power of q.

$$\mathrm{AC} = \frac{\mathrm{TC}}{\mathrm{q}} = \frac{200}{\mathrm{q}} + \frac{100\mathrm{q}}{\mathrm{q}} - \frac{5\mathrm{q}^2}{\mathrm{q}} + \frac{0.15\mathrm{q}^3}{\mathrm{q}}$$

$$\mathrm{AC} = \frac{200}{\mathrm{q}} + 100 - 5\mathrm{q} + 0.15\mathrm{q}^2$$

Average variable cost, on the variable half only: the fixed term drops out, so average cost exceeds average variable cost by exactly $\frac{200}{\mathrm{q}}$ and the two curves close as output grows.

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{q}} = \frac{100\mathrm{q}}{\mathrm{q}} - \frac{5\mathrm{q}^2}{\mathrm{q}} + \frac{0.15\mathrm{q}^3}{\mathrm{q}}$$

$$\mathrm{AVC} = 100 - 5\mathrm{q} + 0.15\mathrm{q}^2$$

Marginal cost, by differentiation: the constant differentiates to zero, $100\mathrm{q}$ to 100, $-5\mathrm{q}^2$ to $-10\mathrm{q}$ and $0.15\mathrm{q}^3$ to $0.45\mathrm{q}^2$.

$$\mathrm{MC} = \frac{\partial\,\mathrm{TC}}{\partial\,\mathrm{q}} = 0 + 100 - 10\mathrm{q} + 0.45\mathrm{q}^2$$

$$\mathrm{MC} = 100 - 10\mathrm{q} + 0.45\mathrm{q}^2$$

Now put ten cans into each of the four functions.

$$\mathrm{TC} = 200 + 1{,}000 - 500 + 150 = 850$$

$$\mathrm{AC} = 20 + 100 - 50 + 15 = 85$$

$$\mathrm{AVC} = 100 - 50 + 15 = 65$$

$$\mathrm{MC} = 100 - 100 + 45 = 45$$

Check the figures against one another: average fixed cost is 20 and average variable cost 65, and $20 + 65 = 85$, the average cost already obtained. Dividing total cost by output gives 85 as well.

Reading the figures in shillings: a ten can day is a thousand litres costing TShs 850,000, that is TShs 850 a litre, of which TShs 650 is chilling, packing, power and cans. The tenth can cost only TShs 450 a litre.

Why the margin lies below the average: at ten cans marginal cost is 45 and average variable cost 65. An average with its margin below it must be falling, so turning milk away at ten cans turns away his own economies.

The negative middle term is what makes this function worth having. Without the $-5\mathrm{q}^2$ average variable cost could only rise; with it the curve falls while the plant fills and rises when the line is crowded.

The Master Key: *Add for the total, divide term by term for the averages, differentiate term by term for the margin, and check that average fixed cost plus average variable cost returns the average cost.*

BINDER Question 178

The Tanga manager knows his cheapest working day lies somewhere between a quiet one and a crowded one. Somewhere is not a number, and one derivative turns it into 16.67 cans.

For the same Tanga plant, whose average variable cost function is $\mathrm{AVC} = 100 - 5\mathrm{q} + 0.15\mathrm{q}^2$ **and whose marginal cost function is** $\mathrm{MC} = 100 - 10\mathrm{q} + 0.45\mathrm{q}^2$**, find by differentiation the output at which average variable cost is least and its value there, prove in general that marginal cost must equal average variable cost at that output, and confirm the proof on the plant's own figures.**

Model Answer

Average variable cost is least at 16.67 cans a day, where it stands at 58.33, and marginal cost at that very output is also 58.33, exactly as the general proof requires, since marginal cost always cuts average variable cost at its lowest point.

Minimise average variable cost in the ordinary way, by setting its derivative to zero.

$$\mathrm{AVC} = 100 - 5\mathrm{q} + 0.15\mathrm{q}^2$$

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = -5 + 0.3\mathrm{q}$$

$$-5 + 0.3\mathrm{q} = 0$$

$$0.3\mathrm{q} = 5$$

$$\mathrm{q} = \frac{5}{0.3} = 16.67 \text{ cans}$$

The second order condition: differentiating again gives 0.3, positive at every output, so 16.67 cans is a trough and not a peak.

Value average variable cost there, where $\mathrm{q}^2 = 277.78$.

$$\mathrm{AVC} = 100 - 5(16.67) + 0.15(277.78)$$

$$\mathrm{AVC} = 100 - 83.33 + 41.67 = 58.33$$

The check on this plant: put the same output into the marginal cost function, where the rule requires the two figures to be identical.

$$\mathrm{MC} = 100 - 10(16.67) + 0.45(277.78)$$

$$\mathrm{MC} = 100 - 166.67 + 125 = 58.33$$

The recurring decimal: the true output is $\frac{50}{3}$ cans, so carried as fractions the working stays exact.

$$5\mathrm{q} = \frac{250}{3} \quad 0.15\mathrm{q}^2 = \frac{125}{3}$$

$$\mathrm{AVC} = 100 - \frac{250}{3} + \frac{125}{3} = 100 - \frac{125}{3} = \frac{175}{3}$$

$$10\mathrm{q} = \frac{500}{3} \quad 0.45\mathrm{q}^2 = 125$$

$$\mathrm{MC} = 100 - \frac{500}{3} + 125 = 225 - \frac{500}{3} = \frac{175}{3}$$

Both come to $\frac{175}{3}$, so the equality is exact. Work in fractions and round only at the end.

They agree to the last figure: 58.33 against 58.33, and it happens for every total cost function there is.

Differentiate average variable cost as a quotient, the derivative of total variable cost being marginal cost.

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{q}}$$

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = \frac{\mathrm{q} \times \mathrm{MC} - \mathrm{TVC}}{\mathrm{q}^2}$$

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = \frac{1}{\mathrm{q}}\left(\mathrm{MC} - \frac{\mathrm{TVC}}{\mathrm{q}}\right)$$

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = \frac{\mathrm{MC} - \mathrm{AVC}}{\mathrm{q}}$$

Reading the general result: output is positive whenever anything is produced, so the fraction vanishes only where $\mathrm{MC} = \mathrm{AVC}$, and that is the proof. Below the average the numerator is negative and the average falls.

Test that direction on the plant's own numbers, below the turning point and above it.

$$\text{At } \mathrm{q} = 10\text{: } \mathrm{MC} = 45 \quad \mathrm{AVC} = 65$$

$$\text{At } \mathrm{q} = 25\text{: } \mathrm{MC} = 131.25 \quad \mathrm{AVC} = 68.75$$

The tests agree with the calculus: at ten cans marginal cost lies far below average variable cost, so the average is still falling; at twenty five it lies far above. Between them there is a lowest point.

What TShs 58,333 a can means: 16.67 cans is 1,667 litres, and no arrangement of the existing cold room, tank and crew can chill and pack a litre for less than TShs 583. Below that the plant is better idle.

Why the floor is not a target: 16.67 cans gives the cheapest can, not the most profitable day. If the price stands above 58.33, each further can still adds more to receipts than to cost. The floor is a landmark, not a destination.

The Master Key: *Average variable cost is least where marginal cost is equal to it, because the derivative of average variable cost is* $(\mathrm{MC} - \mathrm{AVC}) \div \mathrm{q}$.

BINDER Question 179

There is a moment in the Tanga plant's day when the next can is the cheapest it will ever add. After it, every further can costs a shade more than the last.

For the same Tanga plant, whose marginal cost function is $\mathrm{MC} = 100 - 10\mathrm{q} + 0.45\mathrm{q}^2$**, find the output at which marginal cost is least and its value there, explain what is happening to the total cost curve at that output, and show that for any total variable cost of the form** $\mathrm{TVC} = \mathrm{aq} - \mathrm{bq}^2 + \mathrm{cq}^3$ **the output at which marginal cost is least and the output at which average variable cost is least always stand in the ratio 2 to 3.**

Model Answer

Marginal cost is least at 11.11 cans a day, where it stands at 44.44, and that output is the point of inflection of the total cost curve; in general it lies at $\frac{\mathrm{b}}{3\mathrm{c}}$ **against the average variable cost minimum at** $\frac{\mathrm{b}}{2\mathrm{c}}$**, a ratio of 2 to 3.**

Marginal cost is the first derivative of total cost, so its own derivative is the second derivative, which speaks about the shape of the total cost curve.

$$\mathrm{MC} = 100 - 10\mathrm{q} + 0.45\mathrm{q}^2$$

$$\frac{\partial\,\mathrm{MC}}{\partial\,\mathrm{q}} = -10 + 0.9\mathrm{q}$$

$$-10 + 0.9\mathrm{q} = 0$$

$$0.9\mathrm{q} = 10$$

$$\mathrm{q} = \frac{10}{0.9} = 11.11 \text{ cans}$$

The second order condition: differentiating again gives 0.9, positive at every output, so 11.11 cans is genuinely a minimum.

Value marginal cost there, carrying 11.11 as the fraction $\frac{100}{9}$.

$$\mathrm{q} = \frac{100}{9} \quad \mathrm{q}^2 = \frac{10{,}000}{81}$$

$$\mathrm{MC} = 100 - \frac{1{,}000}{9} + 0.45\left(\frac{10{,}000}{81}\right)$$

$$\mathrm{MC} = 100 - \frac{1{,}000}{9} + \frac{500}{9}$$

$$\mathrm{MC} = 100 - \frac{500}{9} = \frac{400}{9} = 44.44$$

What happens to total cost there: total cost is still climbing, but at 11.11 cans more gently than anywhere else, each further can up to there adding less than the can before and each one beyond adding more.

The productivity mirror: marginal cost is least precisely where the marginal product of the variable factor is greatest, the two being inverses. So 11.11 cans is where diminishing returns take hold, average variable cost there being 62.96 and still falling.

Now take the general case, since the same two turning points are wanted for every cubic.

$$\mathrm{TVC} = \mathrm{aq} - \mathrm{bq}^2 + \mathrm{cq}^3$$

$$\text{AVC} = \frac{\text{TVC}}{\text{q}} = \text{a} - \text{bq} + \text{cq}^2$$

$$\text{MC} = \frac{\partial\,\text{TVC}}{\partial\,\text{q}} = \text{a} - 2\text{bq} + 3\text{cq}^2$$

Where marginal cost is least: differentiate marginal cost and set the derivative to zero; the second derivative 6c is positive.

$$\frac{\partial\,\text{MC}}{\partial\,\text{q}} = -2\text{b} + 6\text{cq} = 0$$

$$\text{q} = \frac{2\text{b}}{6\text{c}} = \frac{\text{b}}{3\text{c}}$$

Where average variable cost is least: differentiate average variable cost and set the derivative to zero; the second derivative is positive.

$$\frac{\partial\,\text{AVC}}{\partial\,\text{q}} = -\text{b} + 2\text{cq} = 0$$

$$\text{q} = \frac{\text{b}}{2\text{c}}$$

$$\frac{\text{b}}{3\text{c}} : \frac{\text{b}}{2\text{c}} = 2 : 3$$

The check on the Tanga plant: here $\text{b} = 5$ and $\text{c} = 0.15$, so marginal cost is least at $5 \div 0.45 = 11.11$ cans and average variable cost at $5 \div 0.30 = 16.67$, and dividing the first by the second gives 0.67, two thirds.

The heights come from the same algebra: substituting each turning point into its own function gives a least marginal cost of a $-\frac{\text{b}^2}{3\text{c}} = 100 - \frac{25}{0.45} = 44.44$ and a least average variable cost of a $-\frac{\text{b}^2}{4\text{c}} = 100 - \frac{25}{0.60} = 58.33$.

Why a manager carries both numbers: they fence the interesting stretch of the day. Below 11.11 cans expansion is getting cheaper at the margin; between 11.11 and 16.67 it is dearer at the margin yet still pulls the average down. The cheapest extra can costs TShs 44,444 and the cheapest can on running cost TShs 58,333.

The Master Key: *Differentiate marginal cost for the inflection of the total cost curve; for any cubic it sits at* $\frac{\text{b}}{3\text{c}}$*, two thirds of the way to the average variable cost minimum at* $\frac{\text{b}}{2\text{c}}$*.*

REAL Question 180

Follow one day's paddy through a Morogoro mill, from the intake hopper to the sacks on the lorry, and watch what each further tonne does to the cost of the rest.

Using the record in the box, write the mill's total cost function, derive its average fixed cost, average variable cost, average total cost and marginal cost functions, value every one of them at ten tonnes and at eighteen tonnes, find by differentiation the output at which average variable cost is least, and advise the miller how much paddy to take.

A rice mill at Morogoro hulls and polishes mpunga (paddy) brought in by farmers from the Kilombero valley.

Its fixed cost is TShs 300,000 a day: the rent of the shed, the licence, the watchman and the wear on the huller.

Its total variable cost follows $\text{TVC} = 42{,}000\text{q} - 1{,}800\text{q}^2 + 50\text{q}^3$, where q is tonnes of paddy milled in a day and every cost is in shillings.

The mill is paid TShs 45,000 for every tonne of paddy it mills.

The huller and the drying floor together cannot handle more than 25 tonnes in a day.

Model Answer

At ten tonnes a tonne costs TShs 59,000 against the TShs 45,000 the mill is paid; at eighteen tonnes, where average variable cost is least, it costs TShs 42,467 and the mill is in profit; and since marginal cost there is TShs 25,800 he should take paddy to about 24.8 tonnes.

Fixed and variable cost are given separately, so add them.

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC}$$

$$\mathrm{TC} = 300{,}000 + 42{,}000\mathrm{q} - 1{,}800\mathrm{q}^2 + 50\mathrm{q}^3$$

The averages, by division: the fixed term keeps its q underneath, while each variable term loses one power of q.

$$\mathrm{AFC} = \frac{300{,}000}{\mathrm{q}}$$

$$\mathrm{AVC} = \frac{42{,}000\mathrm{q} - 1{,}800\mathrm{q}^2 + 50\mathrm{q}^3}{\mathrm{q}} = 42{,}000 - 1{,}800\mathrm{q} + 50\mathrm{q}^2$$

$$\mathrm{ATC} = \frac{300{,}000}{\mathrm{q}} + 42{,}000 - 1{,}800\mathrm{q} + 50\mathrm{q}^2$$

The margin, by differentiation: the fixed TShs 300,000 differentiates to zero, which is why rent is no reason to mill a sack more or less.

$$\mathrm{MC} = \frac{\partial\,\mathrm{TC}}{\partial\,\mathrm{q}} = 42{,}000 - 3{,}600\mathrm{q} + 150\mathrm{q}^2$$

Now value the four functions at the two outputs asked for.

$$\mathrm{At\ q} = 10\text{: AVC} = 42{,}000 - 18{,}000 + 5{,}000 = 29{,}000$$

$$\mathrm{At\ q} = 10\text{: ATC} = 30{,}000 + 29{,}000 = 59{,}000$$

$$\mathrm{At\ q} = 10\text{: MC} = 42{,}000 - 36{,}000 + 15{,}000 = 21{,}000$$

$$\mathrm{At\ q} = 18\text{: AVC} = 42{,}000 - 32{,}400 + 16{,}200 = 25{,}800$$

$$\mathrm{At\ q} = 18\text{: ATC} = 16{,}667 + 25{,}800 = 42{,}467$$

$$\mathrm{At\ q} = 18\text{: MC} = 42{,}000 - 64{,}800 + 48{,}600 = 25{,}800$$

Output (tonnes)	AFC (TShs)	AVC (TShs)	ATC (TShs)	MC (TShs)
10	30,000	29,000	59,000	21,000
18	16,667	25,800	42,467	25,800
24.8	12,094	28,116	40,210	45,000

The Morogoro mill at three outputs: the tonne grows cheaper as the fixed TShs 300,000 is spread over more work, while the cost of the last tonne climbs steadily.

Where average variable cost is least: differentiate it and set the derivative to zero; the second derivative is 100, so eighteen tonnes is a minimum.

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = -1{,}800 + 100\mathrm{q} = 0$$

$$\mathrm{q} = \frac{1{,}800}{100} = 18\ \text{tonnes}$$

The compulsory check: marginal cost and average variable cost both come to TShs 25,800 at eighteen tonnes, as they must at the lowest point of an average.

What the ten tonne day tells him: ten tonnes bring TShs 450,000 against TShs 590,000, so he loses TShs 14,000 on every tonne and TShs 140,000 on the day. Average variable cost is only TShs 29,000; it is average fixed cost of TShs 30,000 a tonne that ruins him.

$$\mathrm{At\ q} = 10\text{: } 450{,}000 - 590{,}000 = -140{,}000$$

What the eighteen tonne day tells him: the same TShs 300,000 now falls on eighteen tonnes, so average fixed cost drops to TShs 16,667 and a tonne costs TShs 42,467. Eighteen tonnes bring TShs 810,000 against TShs 764,400, clearing TShs 45,600, about TShs 2,533 a tonne.

$$\text{At } q = 18\text{: } 810{,}000 - 764{,}400 = 45{,}600$$

But eighteen tonnes is not the stopping place: the nineteenth tonne costs $42{,}000 - 3{,}600(19) + 150(361)$, that is TShs 27,750, against the TShs 45,000 he is paid, and every tonne costing less than that adds to profit.

$$42{,}000 - 3{,}600q + 150q^2 = 45{,}000$$

$$150q^2 - 3{,}600q - 3{,}000 = 0$$

$$q^2 - 24q - 20 = 0$$

$$q = \frac{24 + \sqrt{576 + 80}}{2} = \frac{24 + 25.61}{2}$$

$$q = 24.81 \text{ tonnes}$$

The advice: take paddy up to capacity. At about 24.8 tonnes the last tonne costs the TShs 45,000 the mill is paid, and the huller manages 25, so the day clears about TShs 118,800 against TShs 45,600, and the miller who chased the cheapest tonne would be TShs 73,000 poorer daily.

The warning hidden in the figures: all this assumes the mill can find 25 tonnes of paddy a day. If farmers bring only ten, his problem is a buying one, and he must go out to the growers.

What does a tonne cost is answered by division, what does the next tonne cost by differentiation, and how many tonnes to mill by neither alone.

The Master Key: *The output that makes a tonne cheapest and the output that makes the day most profitable are different numbers: the first comes from setting a derivative to zero, the second from setting marginal cost against the price.*

REAL Question 181

The boiler at a Mwanza soap works is hot by seven, and the first cartons are the dearest it will make. Somewhere before noon the cost of one more starts climbing again.

Using the record in the box, derive the works' average variable cost and marginal cost functions, find by differentiation the output at which marginal cost is least and the output at which average variable cost is least, state the value of each, show that the two outputs stand in the ratio two to three, and explain to the manager what the least average variable cost tells him about the lowest price he can accept.

A soap works at Mwanza boils and frames laundry soap. A carton holds twelve bars of one kilogramme.

Its fixed cost is TShs 240,000 a day: the rent of the shed, the watchman, the licence and the wear on the boiler.

Its total variable cost follows $TVC = 9{,}000q - 120q^2 + q^3$, where q is cartons made in a day and every cost is in shillings.

Wholesalers in Mwanza pay the works TShs 12,000 a carton.

Model Answer

Marginal cost is least at 40 cartons a day, where it is TShs 4,200, average variable cost is least at 60 cartons, where it is TShs 5,400, the two standing in the ratio two to three as a cubic requires, and TShs 5,400 is the price below which he should not light the boiler.

Divide the variable cost for the average and differentiate it for the margin.

$$TVC = 9{,}000q - 120q^2 + q^3$$

$$AVC = \frac{TVC}{q} = 9{,}000 - 120q + q^2$$

$$\mathrm{MC} = \frac{\partial\,\mathrm{TVC}}{\partial\,\mathrm{q}} = 9{,}000 - 240\mathrm{q} + 3\mathrm{q}^2$$

Where marginal cost is least: differentiate marginal cost and set the derivative to zero; the second derivative is 6.

$$\frac{\partial\,\mathrm{MC}}{\partial\,\mathrm{q}} = -240 + 6\mathrm{q} = 0$$

$$\mathrm{q} = \frac{240}{6} = 40 \text{ cartons}$$

$$\mathrm{MC} = 9{,}000 - 240(40) + 3(1{,}600) = 9{,}000 - 9{,}600 + 4{,}800 = 4{,}200$$

Where average variable cost is least: differentiate average variable cost and set the derivative to zero; the second derivative is 2.

$$\frac{\partial\,\mathrm{AVC}}{\partial\,\mathrm{q}} = -120 + 2\mathrm{q} = 0$$

$$\mathrm{q} = \frac{120}{2} = 60 \text{ cartons}$$

$$\mathrm{AVC} = 9{,}000 - 120(60) + 3{,}600 = 9{,}000 - 7{,}200 + 3{,}600 = 5{,}400$$

The compulsory check: marginal cost at sixty cartons must equal average variable cost there, and it does, which shows both derivations were right.

$$\mathrm{MC}(60) = 9{,}000 - 14{,}400 + 10{,}800 = 5{,}400$$

The ratio of the two outputs: 40 to 60 is 2 to 3, a property of every cubic variable cost function, since with $\mathrm{TVC} = \mathrm{aq} - \mathrm{bq}^2 + \mathrm{cq}^3$ the margin is least at $\frac{\mathrm{b}}{3\mathrm{c}}$ and the average at $\frac{\mathrm{b}}{2\mathrm{c}}$. Here $\mathrm{b} = 120$ and $\mathrm{c} = 1$.

$$\frac{\mathrm{b}}{3\mathrm{c}} = \frac{120}{3} = 40 \quad \frac{\mathrm{b}}{2\mathrm{c}} = \frac{120}{2} = 60$$

What happens between the two: from 40 to 60 cartons the cost of an extra carton is rising while the average is still falling, because marginal cost remains below the average. At fifty cartons the margin is TShs 4,500 against an average of TShs 5,500.

$$\text{At } \mathrm{q} = 50\text{: } \mathrm{MC} = 4{,}500 \quad \mathrm{AVC} = 5{,}500$$

The lowest price he can accept: TShs 5,400 a carton is the least the works can spend on the oil, the caustic, the boiling, the wrapping and the wages of one carton, and only at sixty.

Between TShs 5,400 and TShs 9,400 he should run: at sixty cartons his full average cost is TShs 9,400, so any lower price loses money. But TShs 7,000 leaves TShs 1,600 a carton above running cost, TShs 96,000 towards the TShs 240,000 of rent and watchman, so the loss narrows to TShs 144,000.

$$\mathrm{AC}(60) = \frac{240{,}000}{60} + 5{,}400 = 4{,}000 + 5{,}400 = 9{,}400$$

$$(\,7{,}000 - 5{,}400\,) \times 60 = 96{,}000$$

At the price he is actually paid: the wholesalers give TShs 12,000, TShs 2,600 above his average cost, so the day clears TShs 156,000. Since marginal cost at sixty is only TShs 5,400, the sixty first carton is worth framing.

Forty cartons tells him where his boiler and benches stop getting easier to work harder; sixty tells him the least a carton can be made for, and so the price below which nothing pays.

The Master Key: *Marginal cost bottoms out at two thirds of the output at which average variable cost bottoms out, and it is the second of the two that fixes the lowest price worth accepting.*

REAL Question 182

The alizeti press at Dodoma has no cheap stretch at all: every litre costs a little more to squeeze than the last. Yet its cost per litre still falls, then rises.

Using the record in the box, state the press's total fixed cost and total variable cost, derive its average fixed cost, average variable cost, average total cost and marginal cost functions, find by

differentiation the output at which average total cost is least, prove that marginal cost equals average total cost at that output, and advise the owner how far to run the press.

A press at Dodoma crushes alizeti (sunflower) seed into cooking oil.

Its total cost follows $\mathrm{TC} = 162{,}000 + 2{,}000\mathrm{q} + 5\mathrm{q}^2$, where q is litres of oil pressed in a day and every cost is in shillings.

The seed cake is sold back to farmers as animal feed, and that receipt is already allowed for in the figures above.

The press sells its oil at TShs 5,000 a litre, and the expeller cannot manage more than 220 litres in a day.

Model Answer

The press's fixed cost is TShs 162,000 and its average total cost is least at 180 litres a day, where average total cost and marginal cost both stand at TShs 3,800 a litre; but a litre sells for TShs 5,000 and one more costs only TShs 4,200 at the limit, so he should press 220.

This function is a quadratic rather than a cubic, which makes a difference.

$$\mathrm{TC} = 162{,}000 + 2{,}000\mathrm{q} + 5\mathrm{q}^2$$

The fixed cost at zero output: both remaining terms carry a q, so TShs 162,000 is left: the shed, the licence, the wear on the expeller and the operator's wage.

$$\mathrm{TC}(0) = 162{,}000 + 2{,}000(0) + 5(0)^2 = 162{,}000$$

The variable cost is what remains: subtract the constant, and what remains is the seed, the power, the filtering and the bottles.

$$\mathrm{TVC} = \mathrm{TC} - \mathrm{TFC} = 2{,}000\mathrm{q} + 5\mathrm{q}^2$$

The averages, by division: each total is divided by the litres that carry it.

$$\mathrm{AFC} = \frac{162{,}000}{\mathrm{q}}$$

$$\mathrm{AVC} = \frac{2{,}000\mathrm{q} + 5\mathrm{q}^2}{\mathrm{q}} = 2{,}000 + 5\mathrm{q}$$

$$\mathrm{ATC} = \frac{162{,}000}{\mathrm{q}} + 2{,}000 + 5\mathrm{q}$$

The margin, by differentiation: the constant differentiates to zero, $2{,}000\mathrm{q}$ to 2,000 and $5\mathrm{q}^2$ to $10\mathrm{q}$.

$$\mathrm{MC} = \frac{\partial\,\mathrm{TC}}{\partial\,\mathrm{q}} = 2{,}000 + 10\mathrm{q}$$

Marginal cost rises twice as fast: both begin at TShs 2,000, but the average gains TShs 5 a litre while the margin gains TShs 10. With $\mathrm{TVC} = \mathrm{aq} + \mathrm{bq}^2$ the average is $\mathrm{a} + \mathrm{bq}$ and the margin $\mathrm{a} + 2\mathrm{bq}$.

Then where does the U come from: entirely from the fixed cost, since $\frac{162{,}000}{\mathrm{q}}$ falls steeply while $5\mathrm{q}$ rises gently.

Write the fixed term as a power and set the derivative to zero.

$$\mathrm{ATC} = 162{,}000\mathrm{q}^{-1} + 2{,}000 + 5\mathrm{q}$$

$$\frac{\partial\,\mathrm{ATC}}{\partial\,\mathrm{q}} = -\frac{162{,}000}{\mathrm{q}^2} + 5$$

$$-\frac{162{,}000}{\mathrm{q}^2} + 5 = 0$$

$$5\mathrm{q}^2 = 162{,}000$$

$$\mathrm{q}^2 = 32{,}400$$

$$\mathrm{q} = \sqrt{32{,}400} = 180 \text{ litres}$$

The second order condition: differentiating once more gives $\frac{324{,}000}{q^3}$, positive everywhere, so 180 litres is a trough.

Value both curves at 180 litres.

$$\text{ATC} = \frac{162{,}000}{180} + 2{,}000 + 5(180) = 900 + 2{,}000 + 900 = 3{,}800$$

$$\text{MC} = 2{,}000 + 10(180) = 2{,}000 + 1{,}800 = 3{,}800$$

Why the two had to be equal: differentiate average total cost as a quotient. Output is positive, so the derivative vanishes only where marginal cost equals average total cost.

$$\frac{\partial\,\text{ATC}}{\partial\,q} = \frac{q \times \text{MC} - \text{TC}}{q^2} = \frac{\text{MC} - \text{ATC}}{q}$$

What TShs 3,800 a litre means: no arrangement of this expeller, shed and crew can bottle a litre for less, and only at 180 litres a day, which at TShs 5,000 a litre clears TShs 216,000.

Why he should press 220 litres: the cheapest litre is not the best day. The 220th costs $2{,}000 + 10(220) = 4{,}200$ and earns TShs 5,000, so running to the limit lifts average total cost only to TShs 3,836 while profit rises to TShs 256,000.

$$\text{ATC}(220) = \frac{162{,}000}{220} + 2{,}000 + 1{,}100 \approx 736 + 2{,}000 + 1{,}100 = 3{,}836$$

$$\text{Profit at } 220 = 1{,}100{,}000 - (\,162{,}000 + 440{,}000 + 242{,}000\,) = 256{,}000$$

Where he would stop if he could: press while one more litre costs less than the TShs 5,000 it fetches. Setting marginal cost equal to the price gives 300 litres, so capacity and not cost is the constraint.

$$2{,}000 + 10q = 5{,}000 \quad 10q = 3{,}000 \quad q = 300 \text{ litres}$$

Where a cubic gives a falling stretch of running cost, a quadratic gives none, and the whole U of its average total cost is the fixed TShs 162,000 spread.

The Master Key: *Where variable cost per unit only rises, the whole of the U in average total cost is the falling average fixed cost, and its lowest point is exactly where marginal cost crosses it.*

HOT Question 183

The baker has last year's costs fitted to a straight line and quotes TShs 900 to anyone who asks. His flour supplier has changed his price twice since those records were closed.

Assess the claim that a cost function fitted to last year's records, and a linear one at that, can be trusted to guide this year's decisions.

A bakery at Kariakoo has fitted last year's daily records to the total cost function $\text{TC} = 400{,}000 + 900q$, where q is loaves baked in a day and every cost is in shillings.

The bakery has one oven, one mixer and one delivery pickup, and last year it baked between 800 and 1,200 loaves on almost every working day.

Its owner says: my marginal cost is TShs 900 a loaf, it will be TShs 900 at any output, and I shall quote TShs 900 on every order I take this year.

Model Answer

The fitted function is a useful servant and a dangerous master: it describes this bakery between 800 and 1,200 loaves at last year's prices, but its straight line assumes diminishing returns away, its coefficients are last year's shillings, and quoting TShs 900 confuses marginal cost with the cost of running a bakery.

Take the function seriously first, since much can be read off it.

$$\text{TC} = 400{,}000 + 900q$$

$$\text{TFC} = 400{,}000 \quad \text{TVC} = 900q$$

$$\text{AVC} = 900 \quad \text{MC} = 900 \quad \text{ATC} = \frac{400{,}000}{\text{q}} + 900$$

What the function gives him: it separates the TShs 400,000 a day of rent, licence, watchman and oven wear from the TShs 900 a loaf of flour, yeast, gas and wrapping, so a loaf costs TShs 1,400 at 800 loaves and TShs 1,233 at 1,200.

$$\text{ATC}(800) = 500 + 900 = 1{,}400 \quad \text{ATC}(1{,}200) = 333 + 900 = 1{,}233$$

A straight line fits a narrow stretch: any smooth curve looks straight over a short enough piece, and this bakery lived between 800 and 1,200 loaves last year.

But it assumes diminishing returns away: a constant marginal cost says the two thousandth loaf costs what the eight hundredth cost. With one oven and one mixer that cannot be so, since extra loaves need a second firing and overtime.

It hides the falling stretch too: the first loaves of a firing carry the gas that heated the oven, so marginal cost genuinely falls early in the day, where the line reports a flat TShs 900.

The algebra runs on past the bakery: put 5,000 loaves in and it answers that the day costs TShs 4,900,000 and a loaf TShs 980. One oven at Kariakoo cannot bake 5,000 loaves at any cost.

$$\text{TC}(5{,}000) = 400{,}000 + 4{,}500{,}000 = 4{,}900{,}000 \quad \text{ATC} = 980$$

The coefficients are last year's prices: the TShs 900 was last year's flour, gas and wage, and if flour has risen by a tenth the true figure is nearer TShs 960.

What is fixed depends on the period: the TShs 400,000 is fixed only while the oven, the shed and the pickup are fixed; for a decision about the coming year the lease can be surrendered.

The worst of it is the pricing plan: quoting TShs 900 covers the flour and nothing else, so the TShs 400,000 a day is never recovered and the bakery closes with a full order book and an empty till. The price list must start from average total cost, TShs 1,300.

The case for the owner, put fairly: the alternative to a stale function is usually no function at all. The owner with his line can say whether 300 extra loaves at TShs 1,100 are worth taking, since they would add TShs 60,000 to his day.

As a description of this bakery between 800 and 1,200 loaves at last year's prices the function is fit to use; as a general law of its costs it is worth nothing, having no rising branch and no upper limit.

The decision turns on two things, neither of them mathematical: how far output will stray from last year's, and how far prices have moved. Where flour moves month by month, a fitted line maps a road since rebuilt.

The Master Key: *A fitted cost function is last year's technique valued at last year's prices, honest only inside the range it was fitted to, and marginal cost prices one extra order, never the whole price list.*

From Product Curves to Cost Curves

A producer who watches his workers and a producer who watches his shillings are watching the same thing from two sides. When labour is the only variable factor and the wage is fixed, every product curve has a cost curve hidden inside it, upside down. This section derives that link, reads it off a Mbeya schedule, and shows why the cost curves of the short run bend upward for a reason that has nothing whatever to do with money.

BINDER Question 184

A Njombe miller keeps two notebooks. One counts sacks for every worker, the other shillings for every sack. He has never noticed that one is the other turned upside down.

Assuming that labour is the only variable factor and that its wage is constant, derive the relationship between average variable cost and average product, and between marginal cost and marginal product. State what follows for the lowest point of each cost curve.

Model Answer

With labour the only variable factor and the wage constant, average variable cost is the wage divided by average product and marginal cost is the wage divided by marginal product, so each cost curve is the product curve behind it turned upside down.

Begin with what the firm pays out. If it hires L workers at a constant wage w, and labour is the only factor that changes with output, total variable cost is simply the wage bill.

$$\mathrm{TVC} = \mathrm{w} \times \mathrm{L}$$

Average variable cost is that divided by output q, split so that output and labour stand together underneath.

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{q}} = \frac{\mathrm{wL}}{\mathrm{q}}$$

$$\mathrm{AVC} = \mathrm{w} \times \frac{\mathrm{L}}{\mathrm{q}} = \frac{\mathrm{w}}{\mathrm{q/L}}$$

But $\mathrm{q/L}$ is exactly the average product of labour.

$$\mathrm{AVC} = \frac{\mathrm{w}}{\mathrm{AP_L}}$$

Now the margin. Since the wage never moves, only extra workers can change the wage bill, so $\Delta\,\mathrm{TVC} = \mathrm{w}\,\Delta\,\mathrm{L}$.

$$\mathrm{MC} = \frac{\Delta\,\mathrm{TVC}}{\Delta\,\mathrm{q}} = \frac{\mathrm{w}\,\Delta\,\mathrm{L}}{\Delta\,\mathrm{q}}$$

$$\mathrm{MC} = \frac{\mathrm{w}}{\Delta\,\mathrm{q}\,/\,\Delta\,\mathrm{L}}$$

And $\Delta\,\mathrm{q}\,/\,\Delta\,\mathrm{L}$ is exactly the marginal product of labour.

$$\mathrm{MC} = \frac{\mathrm{w}}{\mathrm{MP_L}}$$

The wage sits alone on top: in both results the only money figure is w, and it is constant. Underneath sits a productivity figure that moves with output, so anything that happens to cost came from the product below it.

The two are inverse: a fraction with a fixed top falls when its bottom rises, so a rising average product means a falling average variable cost, and the same holds between marginal product and marginal cost.

Where the turning points must lie: average variable cost is lowest exactly where average product is highest, and marginal cost is lowest exactly where marginal product is highest. The turning points are one event read on two scales.

What this tells the producer: cost per unit is a technical fact wearing a money coat. A miller wanting a cheaper sack can touch only the wage he pays and the output his workers get, and the second is under his own roof.

Note the assumptions: labour is the single variable factor and its price is the same for the first worker and the twentieth. Loosen either and the tidy formulas go, though the inverse relation survives.

The Master Key: $\mathrm{AVC} = \mathrm{w/AP_L}$ *and* $\mathrm{MC} = \mathrm{w/MP_L}$*: hold the wage still and every cost curve is its product curve upside down.*

BINDER Question 185

At a Mbeya mill the sixth worker is the one who lifts output per head highest. Ask the accountant which sack was cheapest to grind and he names the very same afternoon.

With the aid of a diagram, explain why the average variable cost curve is the mirror image of the average product curve, and state where on the two curves a producer is using his variable factor most cheaply.

Model Answer

The average variable cost curve is the mirror image of the average product curve because $AVC = w/AP_L$, so with the wage constant every rise in average product is a fall in average variable cost, and the peak of the one stands opposite the trough of the other.

Draw the two curves side by side: average product against labour on the left, average variable cost against output on the right. The dashed lines carry the peak of the one to the trough of the other.

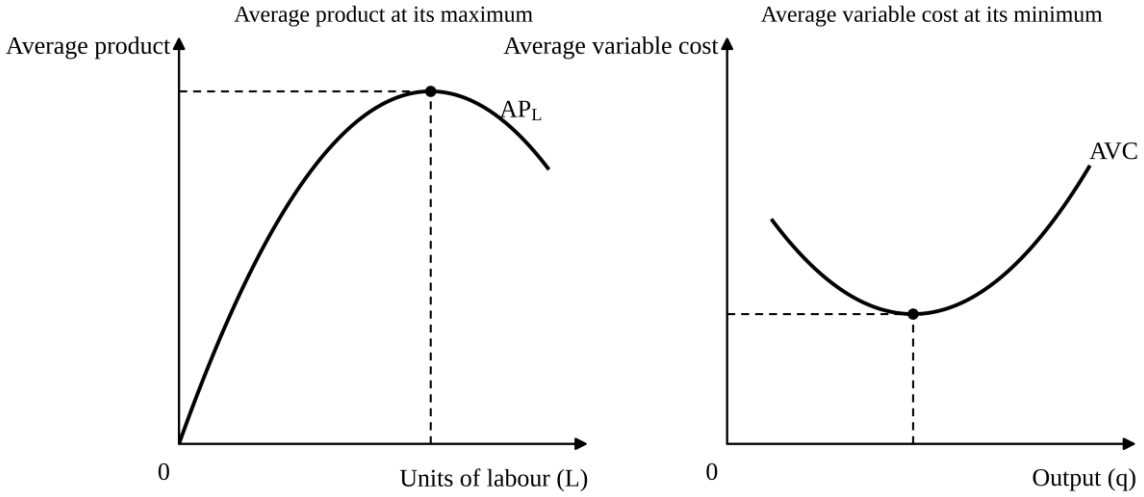


Figure 5.19: Average product and average variable cost as mirror images

The left panel: average product rises as the first workers are added, because a small force spread over a fixed plant allows a better division of the work. It peaks, then falls as the plant becomes crowded.

The right panel: average variable cost does the opposite, falling while average product rises, bottoming at the output the peak of average product produces, and rising thereafter. One curve is the reciprocal of the other times the wage.

Why the shapes must be opposite: at a wage of TShs 9,000 a day, if average product rises from 10 to 12 bags a worker, average variable cost falls from TShs 900 to TShs 750 a bag. Nothing changed but how much each worker got done.

The horizontal axes measure different things: the left panel counts workers, the right counts bags. A point crosses by asking how much output that number of workers produces, so the mirror runs through the schedule, not through the page.

The cheapest use of the variable factor: labour is used most cheaply where average product peaks, since that point is both the top of the left curve and the bottom of the right. Employ fewer and the plant is under used; employ more and workers get in each other's way.

One caution. Average variable cost does not bottom where average total cost does, because fixed cost per unit is still falling, so average total cost reaches its minimum at a larger output.

The Master Key: *Peak of average product, trough of average variable cost: one point, two panels, and the wage is the only thing joining them.*

BINDER Question 186

A Songea mill grinds its cheapest extra sack while its cost per sack is still falling. Two lowest points, two different mornings, and one schedule of workers explains both.

Illustrate the relationship between the marginal product of labour and marginal cost, and explain why marginal cost reaches its lowest point at a smaller output than average variable cost does.

Model Answer

Marginal cost is the wage divided by the marginal product of labour, so the marginal cost curve is the marginal product curve turned upside down, and because marginal product peaks before average product does, marginal cost bottoms at a smaller output than average variable cost.

Set the panels side by side once more: marginal product against labour on the left, marginal cost against output on the right.

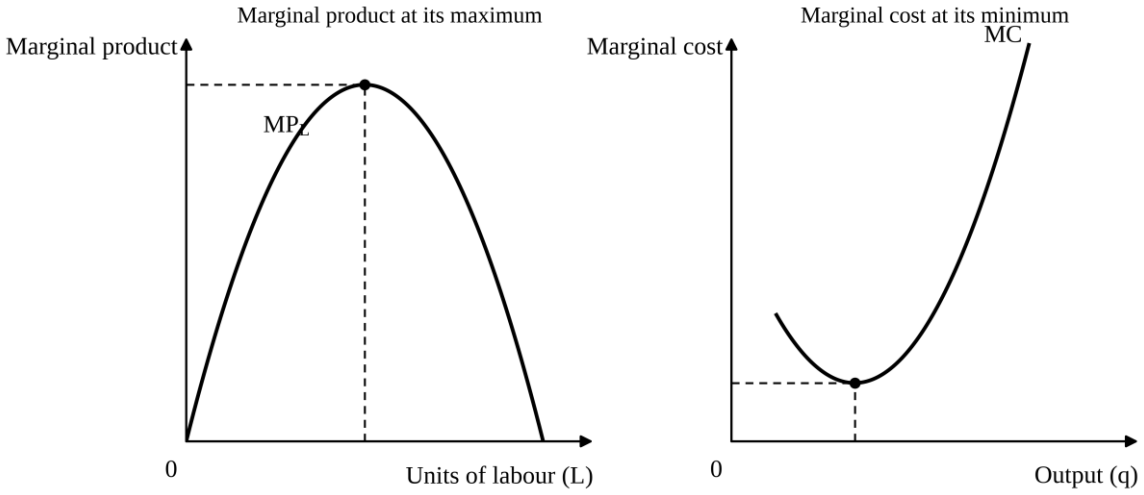


Figure 5.20: Marginal product and marginal cost as mirror images

The left panel: marginal product rises while extra workers fill out an under manned plant, peaks, then falls as diminishing returns take hold. That peak is the moment one extra worker adds more than any before or after him.

The right panel: marginal cost falls, bottoms at the output produced when marginal product peaks, and rises thereafter. Since $MC = w/MP_L$, the cheapest extra unit comes from the most productive extra worker.

Why marginal cost turns first: the marginal curve always turns before the average it feeds. Marginal product peaks and falls while still above average product, so average product rises a while longer and average variable cost bottoms later, by exactly the labour separating the two peaks.

The same algebra proves that marginal cost cuts average variable cost at its lowest point, because average product peaks where marginal product has fallen back to equal it.

$$\text{At the peak of } AP_L: \quad MP_L = AP_L$$

$$MC = \frac{w}{MP_L} = \frac{w}{AP_L} = AVC$$

Reading that result: where marginal product has come down to meet average product, marginal cost has come up to meet average variable cost, and that is its lowest point. The two crossings are one fact stated twice.

Before and after the crossing: while marginal product is above average product, marginal cost is below average variable cost and pulls it down; once below, it pushes the average up. That is why the average curve falls, flattens, then rises.

So a producer who knows his product schedule already knows the shape of his cost curves, and the reverse. Neither needs measuring twice.

The Master Key: *Marginal cost bottoms where marginal product peaks, and that comes first because the margin always turns before the average.*

BINDER Question 187

Nothing about money makes a cost curve bend upward. At the Mtibwa boiler house the cost of a tonne began to climb on the day the plant ran out of room.

Explain why the short run average variable cost and marginal cost curves are U shaped, and state which part of those curves corresponds to Stage II of production.

Model Answer

The short run cost curves are U shaped because the law of diminishing returns acts on the product curves behind them: increasing returns push product up and cost per unit down, and diminishing returns then push product down and cost per unit up.

Keep the two results in front of you: with the wage constant, $\mathrm{AVC} = \mathrm{w}/\mathrm{AP_L}$ and $\mathrm{MC} = \mathrm{w}/\mathrm{MP_L}$. A U shape in cost can only come from a hill shape in product.

Nothing in the money explains it: the wage is a constant, so it cannot bend anything. It fixes the height of the curves, not their shape. Double it and both sit twice as high and are still U shaped. The bend comes from the plant and the workers.

The falling arm comes from increasing returns: when the fixed plant is under used, each extra worker allows a finer division of the work and a fuller use of the machines, so product rises. With the wage fixed, rising product means falling cost per unit.

The turning points come from the law of diminishing returns: beyond a point the fixed factor is fully stretched and marginal product begins to fall, so marginal cost turns up. Average product turns later, so average variable cost turns later too.

The rising arm comes from diminishing returns: once each extra worker adds less than the one before, each extra unit costs more, and the average is dragged up behind the margin. As marginal product falls towards zero, marginal cost climbs without limit.

Stage II on the cost side: Stage II runs from the labour at which average product is greatest to that at which marginal product falls to zero. On the cost side that is the rising arm of average variable cost, with marginal cost above it and climbing.

Why a sensible producer always has rising marginal cost: marginal cost turns up before Stage II begins, since marginal product peaks inside Stage I, so any firm in the rational region has rising marginal cost by construction. It is normal, not a sign of trouble.

The U shape therefore belongs to the short run alone. In the long run every factor varies together and the long run average cost curve takes its shape from economies and diseconomies of scale instead.

The Master Key: *The cost curves are U shaped because the product curves are hill shaped, and the law of diminishing returns is what makes the hill.*

REAL Question 188

Follow the workers into a Mbeya grinding mill one at a time and watch two columns move against each other: bags per worker climbing, shillings per bag falling, until both of them turn.

Set out the mill's product schedule and its cost schedule in full, then state the output at which marginal cost is least and the output at which average variable cost is least, and show that each of them stands opposite a peak on the product side.

Mama Tumaini runs a grinding mill at Iyunga in Mbeya. The shed, the two machines and the licence are fixed for the season.

The mill grinds maize brought in by its customers and charges by the bag, so the grain itself is no cost to the mill. Take hired labour as the only variable factor.

Each worker is a kibarua (a casual labourer) paid TShs 9,000 for a day.

Total product, in 20 kilogramme bags of sembe (maize flour) ground in a day, is 4, 12, 24, 40, 60, 75, 84 and 90 as the first to the eighth worker is added.

The mill charges TShs 1,200 to grind a bag.

Model Answer

Marginal cost is least at 60 bags a day, exactly the output at which the marginal product of labour is greatest, and average variable cost is least at 75 bags a day, exactly the output at which average product is greatest.

Take the product side first. Average product is total product divided by the number of workers, and marginal product is the addition to total product made by the latest worker.

Workers (L)	Total product q (bags)	Average product (bags a worker)	Marginal product (bags)
1	4	4	4
2	12	6	8
3	24	8	12
4	40	10	16
5	60	12	20
6	75	12.5	15
7	84	12	9
8	90	11.25	6

The short run product schedule of the Iyunga mill.

Now carry the schedule across to cost. Total variable cost is the wage bill, TShs 9,000 times the number of workers; average variable cost is that divided by bags, and marginal cost is the extra wage bill divided by the extra bags.

Workers (L)	Output q (bags)	Total variable cost (TShs)	Average variable cost (TShs a bag)	Marginal cost (TShs a bag)
1	4	9,000	2,250	2,250
2	12	18,000	1,500	1,125
3	24	27,000	1,125	750
4	40	36,000	900	562.5
5	60	45,000	750	450
6	75	54,000	720	600
7	84	63,000	750	1,000
8	90	72,000	800	1,500

The same schedule carried through to cost at a wage of TShs 9,000 a worker a day.

Take the sixth worker as the specimen calculation, since that is where the average turns. First the product side.

$$\mathrm{AP_L} = \frac{\mathrm{q}}{\mathrm{L}} = \frac{75}{6} = 12.5 \text{ bags a worker}$$

$$\mathrm{MP_L} = 75 - 60 = 15 \text{ bags}$$

Then the cost side, computed from the wage bill and checked against the two formulas.

$$\mathrm{TVC} = 9{,}000 \times 6 = 54{,}000$$

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{q}} = \frac{54{,}000}{75} = 720$$

$$\mathrm{AVC} = \frac{\mathrm{w}}{\mathrm{AP_L}} = \frac{9{,}000}{12.5} = 720$$

$$\mathrm{MC} = \frac{\Delta\,\mathrm{TVC}}{\Delta\,\mathrm{q}} = \frac{54{,}000 - 45{,}000}{75 - 60} = \frac{9{,}000}{15} = 600$$

$$\mathrm{MC} = \frac{\mathrm{w}}{\mathrm{MP_L}} = \frac{9{,}000}{15} = 600$$

Marginal cost is least where marginal product is greatest: the fifth worker adds 20 bags, more than any other, and those bags cost TShs 450 each, less than at any other step. Both belong to the same worker and the same 60 bags, since 9,000 divided by 20 is 450.

Average variable cost is least where average product is greatest: at six workers each averages 12.5 bags, the highest in the column, and the mill grinds a bag for TShs 720, the lowest in its column, since 9,000 divided by 12.5 is 720.

The two lowest points are at different outputs: marginal cost bottoms at 60 bags and average variable cost at 75, a gap of one worker. That is the gap between the two product peaks, carried across unchanged.

Where the two cost curves cross: at six workers marginal cost is TShs 600 against an average of TShs 720, so the average is pulled down; at seven it is TShs 1,000 against TShs 750, so it is pushed up. The crossing falls between them.

What Mama Tumaini should do: she charges TShs 1,200 a bag, so she adds a worker while the extra bags cost less. The seventh worker's bags cost TShs 1,000 and are worth taking; the eighth's cost TShs 1,500 and are not. Seven workers, inside Stage II.

One trap. Six workers give the largest margin a bag, TShs 480, on 75 bags, contributing TShs 36,000. Seven give TShs 450 on 84 bags, which is TShs 37,800. The cheapest bag and the best day are not the same thing.

The Master Key: *Read the mill's two schedules side by side and the mirror is in the arithmetic: 9,000 over the best product is always the lowest cost.*

REAL Question 189

In one season a Kilombero cutting gang won a pay rise and took delivery of sharper knives. Both changed the cost of a tonne of cane, and not in the same way.

Work out average variable cost and marginal cost at each size of gang, then recompute both under each of the two proposed changes and explain why a change in the wage and a change in productivity move the cost curves differently.

A cane cutting gang works one block at Kilombero. The block, the tractor and the trailer are fixed; the cutters are the only variable factor.

Each cutter is paid TShs 12,000 for a day's work.

Cane cut in a day, in tonnes, is 4, 10, 18, 30, 40 and 45 as the first to the sixth cutter joins the gang.

Change (i): the daily wage rises by a quarter, the cutting method staying exactly as it is.

Change (ii): the wage stays at TShs 12,000, but sharpened knives and a new cutting drill raise every cutter's product by a quarter.

Model Answer

As things stand the gang's cheapest tonne costs TShs 1,500 at 40 tonnes; a quarter on the wage raises every cost figure by a quarter and leaves the cheapest output where it was, while a quarter on productivity lowers every cost figure by a fifth and moves the cheapest output out to 50 tonnes.

Start with the gang as it is. Average product is tonnes divided by cutters, marginal product the addition made by the newest cutter, and cost follows from $\mathrm{AVC} = \mathrm{w}/\mathrm{AP_L}$ and $\mathrm{MC} = \mathrm{w}/\mathrm{MP_L}$ at a wage of TShs 12,000.

Cutters (L)	Cane cut q (tonnes)	AP (tonnes a cutter)	MP (tonnes)	AVC (TShs a tonne)	MC (TShs a tonne)
1	4	4	4	3,000	3,000
2	10	5	6	2,400	2,000
3	18	6	8	2,000	1,500
4	30	7.5	12	1,600	1,000
5	40	8	10	1,500	1,200
6	45	7.5	5	1,600	2,400

The gang's product and cost schedule at a wage of TShs 12,000 a cutter a day.

Two checks on the arithmetic. At five cutters the wage bill is TShs 60,000 for 40 tonnes, and the fourth cutter adds 12 tonnes for TShs 12,000.

$$\text{AVC} = \frac{12{,}000 \times 5}{40} = \frac{60{,}000}{40} = 1{,}500$$

$$\text{MC} = \frac{12{,}000}{12} = 1{,}000$$

So marginal cost is least at 30 tonnes, where marginal product peaks at 12, and average variable cost is least at 40 tonnes, where average product peaks at 8. Now take the two changes in turn.

Change (i) raises the wage by a quarter, to TShs 15,000, and touches nothing else. The product columns are untouched, so put the new wage over the same denominators.

$$\text{AVC}_{\text{new}} = \frac{1.25\text{w}}{\text{AP}_\text{L}} = 1.25 \times \frac{\text{w}}{\text{AP}_\text{L}} = 1.25 \times \text{AVC}$$

$$\text{AVC}_{\text{new}} = \frac{15{,}000}{8} = 1{,}875 \text{ at its lowest}$$

$$\text{MC}_{\text{new}} = \frac{15{,}000}{12} = 1{,}250 \text{ at its lowest}$$

Change (ii) leaves the wage at TShs 12,000 and raises every product figure by a quarter, so total product becomes 5, 12.5, 22.5, 37.5, 50 and 56.25 tonnes, average product peaks at 10 and marginal product at 15.

$$\text{AVC}_{\text{new}} = \frac{\text{w}}{1.25\ \text{AP}_\text{L}} = 0.8 \times \frac{\text{w}}{\text{AP}_\text{L}} = 0.8 \times \text{AVC}$$

$$\text{AVC}_{\text{new}} = \frac{12{,}000}{10} = 1{,}200 \text{ at its lowest}$$

$$\text{MC}_{\text{new}} = \frac{12{,}000}{15} = 800 \text{ at its lowest}$$

Figure at the turning point	As things stand	Wage up a quarter	Product up a quarter
Wage a cutter a day (TShs)	12,000	15,000	12,000
Highest average product (tonnes a cutter)	8	8	10
Lowest average variable cost (TShs a tonne)	1,500	1,875	1,200
Output at which AVC is lowest (tonnes)	40	40	50
Highest marginal product (tonnes)	12	12	15
Lowest marginal cost (TShs a tonne)	1,000	1,250	800
Output at which MC is lowest (tonnes)	30	30	37.5

A change in the wage against a change in productivity, compared at the turning points.

A wage change only stretches the curves upward: the wage is the numerator, so multiplying it by 1.25 multiplies every cost figure by 1.25 and nothing else. The product columns never move, so the lowest average variable cost stays at 40 tonnes and merely sits higher.

A productivity change moves the curves down and sideways: here the denominator grows, so each cost figure is multiplied by $1 \div 1.25 = 0.8$. But the output any gang produces also grows by a quarter, so every point slides right as well as down: TShs 1,200 at 50 tonnes.

Why the two percentages differ: a quarter on the wage adds a full quarter to cost because it sits on top of the fraction; a quarter on productivity takes only a fifth off because it sits underneath. Worth remembering when weighing a pay claim against an improvement.

The test of an affordable pay rise: if both happen together the cheapest tonne costs $1.25 \times 0.8 = 1$ times what it did, TShs 1,500, exactly where it started. A quarter on pay is paid for exactly by a quarter on output per cutter.

What the estate should read into this: the two look alike on a cost sheet and are not. The wage rise buys nothing physical, so the gang still cuts 40 tonnes and the estate pays more. The sharper knives buy 50 tonnes, and the extra cane can be sold.

One qualification. The two are often connected: cutters paid better may stay longer, learn the block and cut more, so a wage rise partly pays for itself through the very product columns it was assumed not to touch.

The Master Key: *A wage change lifts the cost curves without moving them; a productivity change lowers them and slides them outward as well.*

HOT Question 190

The accountant at a Shinyanga ginnery wants the wage cut; the engineer wants the rollers reset. Both promise a cheaper bale of lint, and only one of them is looking in the right place.

A consultant advises the manager of a Shinyanga ginnery that the quickest way to cut his cost per bale is to attack his wage bill rather than his production line. Discuss.

Model Answer

The consultant is right that the wage is one of only two things in the formula and wrong to treat it as the better of the two, because $\mathrm{AVC} = \mathrm{w}/\mathrm{AP_L}$ shows that a lower wage cuts cost without adding a single bale, while a higher average product cuts cost and adds bales at once.

Everything sits inside one expression. With labour the only variable factor, average variable cost is the wage divided by average product, so there are exactly two routes to a cheaper bale.

$$\mathrm{AVC} = \frac{\mathrm{w}}{\mathrm{AP_L}}$$

The case for the consultant: the wage is the numerator, so a cut of a tenth cuts average variable cost by a tenth at every output, immediately, with no capital and no waiting. Where a ginnery genuinely pays well above the district rate, this is a real saving.

The wage is rarely the manager's to choose: the ginnery buys labour in a market it does not control. Cut below what neighbouring ginneries pay and the experienced sorters and machine minders leave with their speed. It keeps the saving one season and loses the output for several.

A wage cut usually cuts the denominator too: pay less and you often get less. If the wage falls a tenth and average product falls with it, the new figure is $0.9\mathrm{w} \div 0.9\,\mathrm{AP_L}$, exactly the old one. The saving is swallowed and the ginnery has bought a grievance for nothing.

The production line route lowers cost and raises output: raising average product moves the whole curve down and its lowest point outward, so the ginnery gets more bales as well as cheaper ones. A wage cut leaves the physical schedule where it stood, so the extra bales never appear.

But the arithmetic does favour the wage on cost alone: cutting the wage a quarter cuts cost a bale a full quarter, while raising average product a quarter cuts it only a fifth, since $1 \div 1.25 = 0.8$. On cost alone the consultant's lever is stronger, which is why it is so often reached for.

The right question is a diagnostic one: ask why cost a bale is high. If the ginnery pays far above the district rate for the same work, the wage is the answer. If the cotton queues at the gate, the rollers are worn or the workers were never trained, no wage cut will fix it.

So the advice is defensible as arithmetic and poor as management. A firm paying above the market for ordinary work has a wage problem; one paying the market rate for badly organised work has a productivity problem. Only the second remedy leaves more cotton at the end of the season.

The Master Key: *Two ways to cut cost per unit, and only one of them also leaves you with more to sell.*

HOT Question 191

The proof was written for one variable factor and one wage. A Mwanza fillet plant buys labour, ice and diesel, and all three vary with the day's catch. Does the mirror survive?

Assess the claim that the relationship between the product curves and the cost curves holds only where labour is the single variable factor.

Model Answer

The claim is right about the formulas and wrong about the principle, because $\mathrm{AVC} = \mathrm{w}/\mathrm{AP_L}$ **and** $\mathrm{MC} = \mathrm{w}/\mathrm{MP_L}$ **do need a single variable factor at a constant price, but the inverse relation between productivity and cost survives any number of variable factors bought at given prices and combined at least cost.**

Why the simple formulas need one factor: let a Mwanza fillet plant hire L units of labour at wage w and M units of ice and fuel at price r. Total variable cost is now $\mathrm{wL} + \mathrm{rM}$, and dividing by output leaves no single wage over a single average product to invert.

$$\mathrm{TVC} = \mathrm{wL} + \mathrm{rM} \quad \text{so} \quad \mathrm{AVC} = \frac{\mathrm{wL} + \mathrm{rM}}{\mathrm{q}}$$

What takes the place of the formula: suppose the plant always buys the cheapest bundle that will produce a given output. Each output then has one variable cost, and average variable cost is that divided by the output. The ratio still falls when the bundle becomes more productive.

The law behind the shape does not care how many factors vary: the U shape came from the law of variable proportions, which applies whenever any variable input is pressed against a fixed one. Whether one factor varies or five, output per shilling first rises as the plant fills up and then falls as it is crowded.

One thing genuinely does break: with several variable factors the lowest average variable cost need not coincide with the peak of labour's own average product, because the plant can use more ice and fewer hands. The neat one to one reading of the diagram is lost.

A price change no longer scales the curve exactly: under one factor a wage rise lifts every cost figure in exact proportion. With two, the firm substitutes towards ice and fuel, so variable cost rises by less than the wage and the shape alters slightly. The proportional result is a special case.

The practical defence of the simple version: in many Tanzanian firms labour really is the dominant variable cost in the short run. For a cane cutting gang, a tailoring workshop or a hand ginnery the single factor formula is close enough to be worth using.

So the claim is true of the two equations and false of the economics they express. Cost per unit is the price of the variable input divided by its productivity, and that generalises: replace one price by the cost of the least cost bundle. The mirror becomes harder to draw and does not stop being true.

The Master Key: *The formulas need one factor; the principle that cost per unit is price divided by productivity needs none.*

HOT Question 192

A Dodoma sunflower press finds that every extra tin of oil costs more than the last, and the owner suspects that somebody is mismanaging his plant. His economist congratulates him instead.

To what extent is a firm whose marginal cost is rising doing something wrong?

Model Answer

Hardly at all, because rising marginal cost is the normal condition of any firm producing in the rational region, and a firm still on the falling arm of its marginal cost curve is producing too little rather than producing well.

Rising marginal cost is falling marginal product in disguise: since $\mathrm{MC} = \mathrm{w}/\mathrm{MP_L}$, marginal cost rises for one reason only, that the latest unit of the variable factor adds less than the one before. That begins the moment the fixed plant stops being under used.

The rational region guarantees it: Stage II runs from the peak of average product to the point where marginal product falls to zero, and marginal product falls throughout, so marginal cost rises throughout. A firm producing sensibly has rising marginal cost by construction.

The profit rule actually requires it: a firm produces where the price of the last unit equals the cost of making it, and that is a maximum only if marginal cost is rising through it. Falling marginal cost is an instruction to expand, not a state to rest in.

A worked reading of the point: a Dodoma press selling a tin of alizeti (sunflower) oil should press one more while marginal cost is below the price and stop once it climbs past. Without a rising marginal cost there would be no stopping point at all.

When rising marginal cost is a symptom: the number matters as well as the direction. If marginal cost rises at a very small output, the plant is too small for the trade. If this season's exceeds last season's at the same output, the curve has shifted up, and worn screws, power cuts, poor seed or a badly arranged yard are the likely causes.

How to tell the two apart: moving up a given curve as output grows is ordinary. A curve sitting higher than it did, or higher than a comparable press down the road, is the real complaint. The first is a movement along the curve, the second a shift of it.

So the extent is very limited. He should ask not whether marginal cost is rising, which it must be, but at what output it began to rise and how high it stands against last season and against his rivals. If the answers are unflattering the fault lies in the plant or the organisation.

The Master Key: *Rising marginal cost is where sensible production happens; ask how high the curve sits, not which way it slopes.*

Long Run Costs, the Planning Curve and the Optimum Size of the Firm

In the short run a producer is a prisoner of the plant he already owns. In the long run he is free: he may build any shed, buy any machine, choose any size at all. This section works out what costs look like when nothing is fixed, how the long run curves are built out of the short run ones, which plant a firm should build for the output it expects, and how large a Tanzanian firm ought to be.

BINDER Question 193

A fundi cherehani, a tailor in Kariakoo, can double his workshop in a fortnight. The cement works at Tanga needs four years. Both are speaking of the same long run.

Define the long run in cost terms, and explain why no long run average fixed cost curve can be drawn.

Model Answer

The long run is the planning period in which a firm can vary every factor, the plant included, so every cost is variable, none is fixed, and no long run average fixed cost curve can be drawn.

Every factor is variable: the long run is planning time, not a count of months: labour, materials, buildings, machines and land all vary. A Kariakoo tailor reaches it in a fortnight, a second cherehani arriving by bodaboda; a cement works waits three or four years for a kiln.

No factor is fixed, so no cost is fixed: a cost is fixed only because its factor cannot be altered: rent by a signed lease, a repayment by a mill already bought. In the long run the firm may take another lease, buy another mill or build nothing.

Total cost equals variable cost: since $\text{TFC} = 0$, long run total cost equals long run variable cost and $\text{LAC} = \frac{\text{LTC}}{\text{q}}$ holds no fixed cost term. The seven short run curves, TFC, TVC, TC, AFC, AVC, ATC and MC, collapse into three: LTC, LAC and LMC.

No long run average fixed cost curve: average fixed cost is $\text{AFC} = \frac{\text{TFC}}{\text{q}}$, and with $\text{TFC} = 0$ it is zero at every output, so there is nothing to plot and nothing to spread.

The long run total cost curve starts at the origin: every short run total cost curve cuts the vertical axis at that plant's fixed cost, paid even at zero output. The long run curve begins at zero: a firm producing nothing has bought nothing.

The long run is a position a firm plans from, not a date it arrives at. A producer always works in some short run; the long run is the family of plants open to him when the machinery is replaced.

The Master Key: *In the long run nothing is fixed, so nothing is a fixed cost, and only three curves survive: LTC, LAC and LMC.*

BINDER Question 194

Three millers at Uyole build three different sheds. Ask which shed is the cheapest and the only honest answer is a question back: how much maize will you have?

With the aid of a diagram, show how a firm's long run total cost curve is derived from its short run total cost curves, and explain why the long run curve can never lie above them.

Model Answer

The long run total cost curve is the envelope from below of the short run total cost curves, because at every output the firm may pick the plant that makes it most cheaply, so long run total cost is the lowest short run cost available.

A miller at Uyole may build a small, a medium or a large shed, each fixing one curve: STC_1, STC_2, STC_3. Each starts on the vertical axis at its own fixed cost and turns up steeply past its comfortable rate.

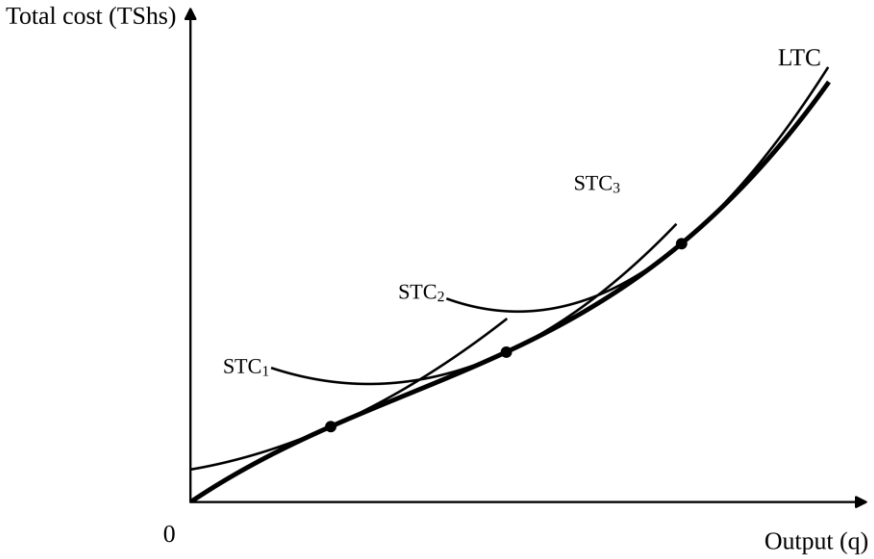


Figure 5.21: Short run total cost curves and the long run total cost curve

Reading the diagram: at every output three costs are on offer, one from each plant, and the firm takes the least. Trace the underside of the three curves and you have the long run total cost curve.

Each plant is cheapest over one stretch: the small shed wins at low outputs, having little fixed cost to spread. The large shed wins at high outputs, where a low running cost a sack repays a heavy fixed cost. The medium shed wins between.

One point of contact each: each short run curve touches the long run curve at one output and lies strictly above it elsewhere. That output is the plant's design output, where the long run choice and the short run position agree.

The long run curve can never lie above: the long run set of choices contains every short run choice, so extra freedom cannot make the firm worse off: $\mathrm{LTC}(q) \leq \mathrm{STC}(q)$, with equality only at that plant's design output.

The curve rises from the origin: with no plant yet bought, long run total cost at zero output is zero. LTC starts at the origin while every STC starts above it, the gap being that plant's fixed cost.

The envelope is drawn from below, not threaded through the lowest points of the short run curves. The miller reads off not the cheapest shed in general but the cheapest shed for the output he expects.

The Master Key: *At each output take the least of all the short run total costs; that lower boundary, rising from the origin, is the long run total cost curve.*

BINDER Question 195

Before a brick is laid, the owner of a new sunflower press at Singida must choose his size. His guide is a curve drawn for plants that do not yet exist.

With the aid of a diagram, derive the long run average cost curve from a firm's short run average cost curves, and explain why it is called the planning curve.

Model Answer

The long run average cost curve is the envelope of the short run average cost curves, giving the lowest average cost at which each output can be made when any plant may be built. It is the planning curve because a firm consults it before building.

Two routes give the same curve: divide long run total cost by output, $\text{LAC} = \frac{\text{LTC}}{\text{q}}$, or take the short run curves, one for each possible plant, and pick the lowest figure at every output.

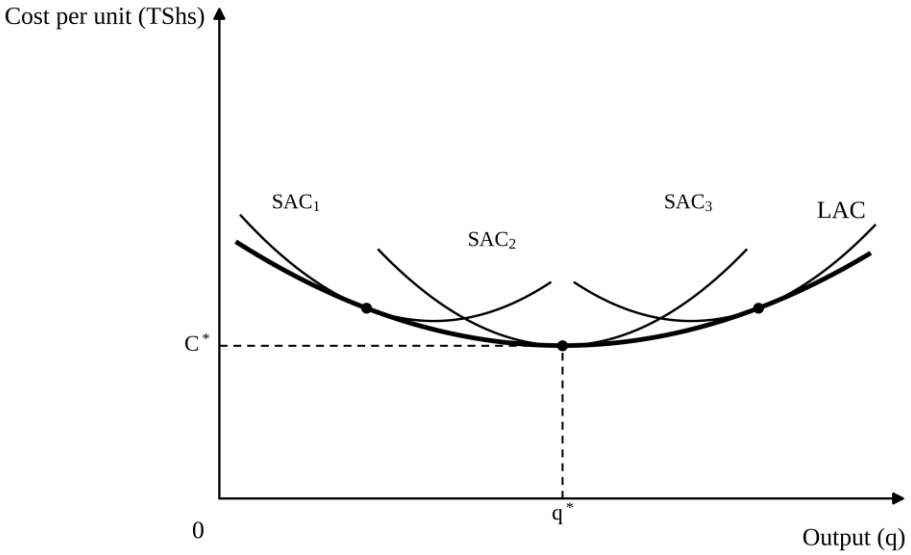


Figure 5.22: The long run average cost curve as an envelope of short run curves

One short run curve for every plant: each possible plant has its own U shaped short run curve. The diagram shows SAC_1 for a small press, SAC_2 for a medium and SAC_3 for a large one, and a firm that has built is tied to its curve.

The envelope: the LAC is the lower boundary of that family, touching each short run curve at one output and lying below it elsewhere, where some other plant is cheaper, so $\text{LAC}(\text{q}) \leq \text{SAC}(\text{q})$ always.

Why it is called the planning curve: the manager enters from the horizontal axis: from the output he expects to sell, up to the LAC, then across to the short run curve tangent there. That is the plant to build, and the LAC's height is his cost a unit.

A curve of positions, not a path: a firm never slides along the LAC, since each point belongs to a different plant. Once built it moves along its own short run curve, returning only when the plant can be changed.

What the minimum means: at q^* the envelope is lowest and cost a unit is C^*: the cheapest this technology can make a unit, and the plant tangent there is the one every other is measured against.

For the Singida press this is real money. A press built for 400 litres a day but selling 1,200 is driven far past its rate; one built for 1,200 and selling 400 is idle steel.

The Master Key: *The long run average cost curve is the floor beneath all the short run curves, and a firm reads it upward from the output it expects, never downward from a cost it likes.*

BINDER Question 196

The plant a firm builds for a small output is never worked to its limit; the plant it builds for a large one is always worked past it. Exactly one plant escapes.

Explain precisely where the long run average cost curve touches each short run average cost curve, and why the point of contact lies on the falling section of the short run curve at outputs below the optimum and on its rising section at outputs above it.

Model Answer

The long run average cost curve touches each short run curve at one output and lies below it elsewhere; since tangency requires equal slopes, contact falls on a falling section below the optimum, a rising section above, and a curve's own minimum only at the optimum.

What tangency means: two curves are tangent when they meet and share the same slope there. The equality of slopes does all the work here.

The long run curve is flat only once: the LAC is U shaped: falling to the left of its minimum, rising to the right, flat only at q^*.

A short run curve is flat only at its minimum: each SAC is U shaped for its own reason, diminishing returns inside a plant of given size, and it is flat at the output that plant was designed for.

Below the optimum: below q^* the LAC still falls, so the SAC touching it shares that negative slope. A SAC falls only left of its own minimum, so that plant's cheapest output lies to the right: it is built a little large and underused.

Why an underused plant is accepted: the larger plant is cheaper at q even unfilled, its economies of scale outweighing the loss: a bigger sunflower press at three quarters of its rate beats a small press flat out.

Above the optimum: above q^* the LAC rises, so the SAC touching it rises too. A SAC rises only right of its own minimum, so that plant's cheapest output lies to the left: a plant a little too small, overworked.

At the optimum, and only there: at q^* the LAC is flat, so the SAC touching it has zero slope, which happens only at its own minimum. There alone do the curves meet at a plant's own lowest point.

Do not thread the long run curve through the short run minima. If one plant is cheapest at 200 sacks at TShs 900 and the next at 400 sacks at TShs 800, that line prices 300 sacks near TShs 850, though the second plant may charge TShs 820.

The Master Key: *Tangency is about slopes: below the optimum a firm underuses a plant a little too big, above it a firm overworks a plant a little too small, and only at the optimum does the plant run at its own best rate.*

BINDER Question 197

A Mbeya miller adds one more sack to the day's run. That single sack, and not the hundreds before it, decides whether his average cost goes up or down.

Draw the long run average cost curve together with the long run marginal cost curve, and explain the relationship between them and what holds at the optimum output.

Model Answer

Long run marginal cost is the addition to long run total cost from one more unit when the plant too may be altered. It lies below long run average cost while that falls, above it while it rises, and cuts it from below at its minimum: $\mathrm{LMC} = \mathrm{LAC} = \mathrm{SMC} = \mathrm{SAC}$**.**
It is defined as short run marginal cost is, except that the plant may change too.

$$\mathrm{LMC} = \frac{\Delta\,\mathrm{LTC}}{\Delta\,\mathrm{q}}$$

$$\mathrm{LMC} = \frac{\partial\,\mathrm{LTC}}{\partial\,\mathrm{q}}$$

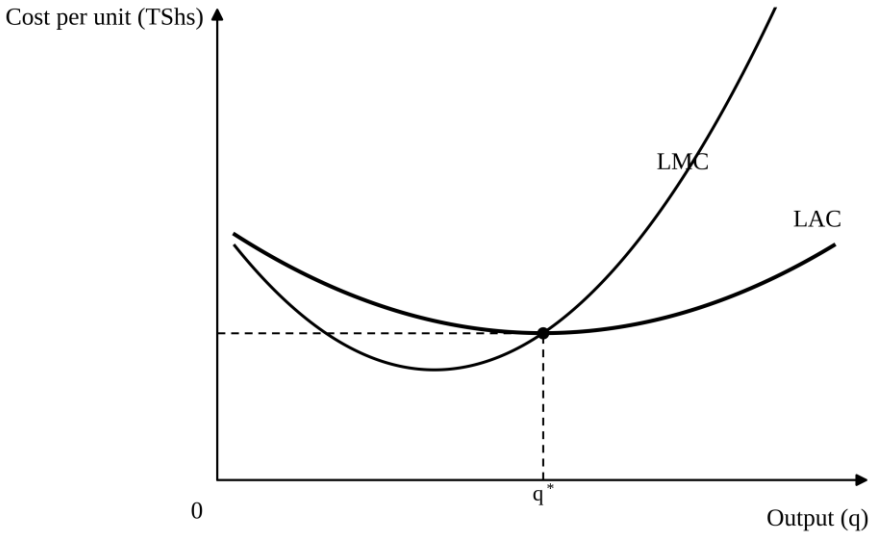


Figure 5.23: Long run average cost and long run marginal cost

Why the marginal drags the average: an average falls when the newcomer is below it and rises when it is above. If the extra sack costs less than the average sack so far, the average is pulled down; if dearer, pushed up.

LMC below LAC while LAC falls: over the whole falling stretch each extra unit costs less than the running average, which is why the average keeps falling. LMC lies under LAC wherever economies of scale are still being gathered.

LMC above LAC while LAC rises: once diseconomies set in, each extra unit costs more than the average unit, so the average is dragged up and LMC lies above LAC. The gap widens as they bite harder.

The crossing point: at the minimum of LAC the average is neither falling nor rising, so the extra unit costs exactly what the average unit costs. Hence $\text{LMC} = \text{LAC}$ at q^*, and being below before and above after, LMC cuts from below.

What holds at the optimum: at q^* four figures coincide. The plant in use is tangent to the LAC at its own minimum, where $\text{SMC} = \text{SAC}$; the envelope touches, so $\text{LAC} = \text{SAC}$; the long run marginal cuts, so $\text{LMC} = \text{LAC}$. Hence $\text{LMC} = \text{LAC} = \text{SMC} = \text{SAC}$.

One precision: the LMC is not the lower envelope of the short run marginal curves: at each output it equals the SMC of the plant right for that output, so it lies above some and below others.

For the Mbeya miller this is a working rule. While the last sack costs less than his average sack, growing makes him cheaper; once it costs more, growth makes him dearer.

The Master Key: *The marginal pulls the average: LMC under LAC means costs are still falling, LMC over LAC means they are rising, and the point where they meet is the optimum size.*

BINDER Question 198

A sugar mill at Mtibwa is at its technical best at one exact output. The manager may be perfectly right to produce a different amount, and the accountant will explain why.

Define the optimum size of a firm and, with the aid of a diagram, explain why the long run average cost curve is U shaped, making clear why the law of diminishing returns is not the reason.

Model Answer

The optimum size of a firm is the plant and output at which long run average cost is lowest, and that curve is U shaped because economies of scale pull cost down as the firm grows and diseconomies push it up: neither is diminishing returns, which needs a fixed factor.

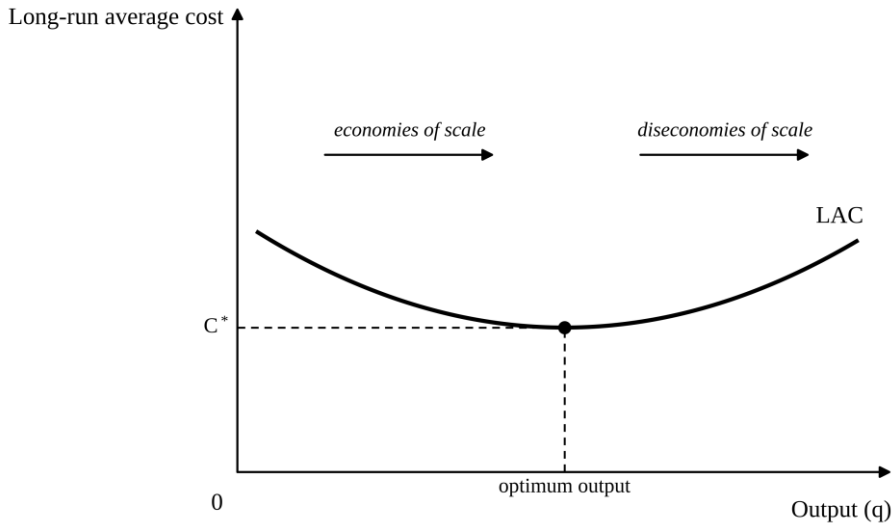


Figure 5.24: Economies of scale, diseconomies of scale and the optimum size of the firm

The definition: a firm is of optimum size when it has built the plant of least attainable average cost and runs it at the bottom of that plant's own curve: the output at the bottom of the LAC, where cost a unit is C^*. It is also the optimum firm.

The falling branch is economies of scale: Technical: a sifting line no small mill could fill. Managerial: a specialist buyer, engineer and accountant for one overworked owner. Financial: cheaper borrowing from a bank seeing a larger borrower. Marketing: maize by the lorry load, one advertisement over more sacks. Risk bearing: several products in several markets.

The rising branch is diseconomies of scale: beyond a point the firm is hard to run: decisions cross more layers, so head office learns late that a machine has stopped; power passes to managers whose interest is not the owner's; cane comes from further afield, older and dearer; and the firm's own demand lifts local prices.

Why this is not diminishing returns: diminishing returns needs a fixed factor: pile a variable factor on and each worker has less land or machine. Along the long run curve nothing is fixed and every factor grows together, so the short run U is diminishing returns, the long run U economies and diseconomies of scale.

The optimum is technical, not commercial: the definition rests on cost and says nothing of revenue. The most profitable output, where marginal revenue equals marginal cost, may lie either side of the optimum, so a Mtibwa mill whose market takes half the optimum output should not build the optimum plant.

The optimum size is an engineer's answer to a manager's question: the cheapest scale the technology permits. Whether Morogoro holds enough buyers at a price worth having settles how large the mill is built.

The Master Key: *The optimum size is where long run average cost is least: the cheapest size, which is not always the most profitable one.*

REAL Question 199

Three sheds stand side by side at Uyole outside Mbeya: a small mill, a medium one and a large one. Follow the day's maize and let the shillings choose the shed.

Using the miller's estimates below, construct the long run average cost schedule, state which plant should be built at each level of output, identify the optimum size of the firm, and calculate what the owner would lose by building the largest plant if demand settles at 300 sacks a day.

Mr Mwakalinga is planning a sembe mill at Uyole, outside Mbeya, and an engineer has costed three possible plants.

Plant A is one grinding mill in a rented shed. Plant B is two mills with a sifting line. Plant C is four mills with sifting, bagging and its own transformer.

Plant A, at outputs of 100, 200, 300, 400, 500 and 600 sacks a day, has an average cost a sack of TShs 1,150, 950, 900, 1,000, 1,300 and 1,800.

Plant B, at the same six outputs, has an average cost of TShs 1,600, 1,150, 880, 800, 860 and 1,020.

Plant C, at the same six outputs, has an average cost of TShs 2,500, 1,850, 1,350, 990, 840 and 900.

A sack holds 25 kilogrammes of sembe and the mill works 300 days a year.

Model Answer

The schedule is TShs 1,150, 950, 880, 800, 840 and 900 a sack, so Plant A suits 100 or 200 sacks a day, Plant B 300 or 400 and Plant C 500 or 600; the optimum size is Plant B at 400 sacks at TShs 800 a sack, and Plant C built for a market of 300 sacks costs an extra TShs 141,000 a day.

Long run average cost at any output is the lowest of the three short run figures there, since Mr Mwakalinga may still pick any plant.

Output (sacks a day)	Plant A	Plant B	Plant C	LAC	Plant to build
100	1,150	1,600	2,500	1,150	A
200	950	1,150	1,850	950	A
300	900	880	1,350	880	B
400	1,000	800	990	800	B
500	1,300	860	840	840	C
600	1,800	1,020	900	900	C

Short run average cost a sack for three plants at Uyole, with the long run average cost read off as the lowest of the three.

The envelope: the LAC column is no new curve. It is the floor of the three short run curves, each plant contributing the stretch over which it is cheapest.

The optimum size of the firm: the column falls 1,150, 950, 880, 800, then turns up to 840 and 900. Its lowest value is TShs 800 a sack at 400 sacks a day with Plant B: the optimum size of this firm.

$$\text{LTC} = 400 \times 800 = \text{TShs } 320{,}000 \text{ a day}$$

The cost of building too large: if he builds C and the Mbeya market takes only 300 sacks a day, he pays TShs 1,350 a sack where Plant B would have charged TShs 880.

$$1{,}350 - 880 = 470 \text{ shillings a sack}$$

$$470 \times 300 = \text{TShs } 141{,}000 \text{ a day}$$

$$141{,}000 \times 300 = \text{TShs } 42{,}300{,}000 \text{ a year}$$

Reading that figure: TShs 42.3 million a year is roughly the price of a second grinding mill, thrown away yearly for building too big. Nothing is wrong with Plant C; it is asked to do a job it was never built for.

The mirror mistake costs more: building too small hurts harder if the market grows. Put up Plant A, let demand reach 500 sacks a day, and he pays TShs 1,300 a sack against Plant C's TShs 840.

$$(1{,}300 - 840) \times 500 = 460 \times 500 = \text{TShs } 230{,}000 \text{ a day}$$

Where the choice hardly matters: at 300 sacks A and B differ by only $900 - 880 = 20$ shillings a sack, TShs 6,000 a day, so something else may decide, such as which shed is easier to enlarge. At 500 sacks the gap is TShs 460.

A plant's best is not the best available: Plant A at its own cheapest output, 300 sacks, costs TShs 900 a sack, TShs 100 above the optimum: a miller running the small plant perfectly is still dearer than one who chose right.

Two cautions. Only three plants are on offer, not the endless family a smooth envelope assumes; with a plant for every output, switching would be gradual and each plant below the optimum run short of its best rate. And whether 400 sacks can be sold above TShs 800 is a question about demand.

The Master Key: *Take the lowest cost in each column and the row you have written is the planning curve; its smallest entry is the optimum size of the firm.*

REAL Question 200

The kilns at Tanga run day and night for a reason. Follow the cost of a tonne of cement as the works grows larger, and watch the fall suddenly stop.

Using the engineer's estimates below, calculate the percentage fall in average cost from the smallest plant to the 750,000 tonne plant and from there to the largest, identify the minimum efficient scale, and explain what it implies for the number of cement firms the country can support.

A cement works at Tanga is being designed, and long run average cost a tonne has been estimated for six possible annual capacities.

At 100,000 tonnes a year the cost is TShs 280,000 a tonne; at 250,000 tonnes, TShs 210,000; at 500,000 tonnes, TShs 180,000.

At 750,000 tonnes it is TShs 168,000 a tonne; at 1,000,000 tonnes, TShs 165,000; at 1,250,000 tonnes, TShs 164,000.

Cement leaves the works at TShs 200,000 a tonne, and the country uses about 6 million tonnes a year.

Model Answer

Average cost falls 40 per cent from the smallest plant to the 750,000 tonne plant but only about 2.4 per cent over the rest, so the minimum efficient scale is about 750,000 tonnes a year, an eighth of national demand, and the country can support only a handful of large cement firms.

Set the six estimates in order and see what each step down in cost is worth: enormous at the start, trivial at the end.

Capacity (tonnes a year)	LAC (TShs a tonne)	Fall from the row above
100,000	280,000	-
250,000	210,000	70,000
500,000	180,000	30,000
750,000	168,000	12,000
1,000,000	165,000	3,000
1,250,000	164,000	1,000

Long run average cost of a cement works at six possible annual capacities.

Now put the two stretches into percentages, since TShs 12,000 saved means one thing on a cost of 280,000 and another on 168,000.

$$\text{Fall up to the flat} = \frac{280{,}000 - 168{,}000}{280{,}000} \times 100 = 40$$

$$\text{Fall beyond the flat} = \frac{168{,}000 - 164{,}000}{168{,}000} \times 100 \approx 2.4$$

This curve is not a U: it falls steeply, flattens and never turns up over any capacity an engineer would consider. That is the L shaped curve found in most heavy industry: the firm keeps every economy gathered and stops finding new ones.

The minimum efficient scale: the smallest output at which a firm reaches the lowest average cost available in its industry. Here it is about 750,000 tonnes, since beyond it two thirds more size buys only TShs 4,000 a tonne.

What that does to a small plant: at an ex works price of TShs 200,000 a tonne, set the works of efficient size beside the smallest plant on the list, under a seventh of its capacity.

$$\text{Gain at the efficient scale} = (200{,}000 - 168{,}000) \times 750{,}000 = \text{TShs } 24{,}000{,}000{,}000$$

$$\text{Loss at the small scale} = (280{,}000 - 200{,}000) \times 100{,}000 = \text{TShs } 8{,}000{,}000{,}000$$

Reading those two figures: the large works earns about TShs 24 billion a year while the small one loses about TShs 8 billion. A small cement plant cannot cover its costs at the going price: the efficient scale is a wall.

How many firms the market can hold: national use is about 6 million tonnes a year and one works of efficient size makes 750,000 of them.

$$\frac{6{,}000{,}000}{750{,}000} = 8$$

Reading that answer: there is room for about eight works of efficient size, which is why cement is made by a few large firms, at Tanga, Wazo Hill outside Dar es Salaam, Mbeya and Mtwara, never in a village workshop. In sembe milling the efficient scale is thirty sacks a day.

One caution about the eight. It counts plants of least cost size the market could hold, not firms. Cement is dear to move, so a works at Mtwara does not compete for the Mwanza trade.

The Master Key: *Find where the fall in average cost stops and you have found the minimum efficient scale; divide it into the market and you have found how many firms the industry can hold.*

REAL Question 201

Follow one season's cane at Kilombero to the last bag of sugar. The cost of a tonne falls and then climbs, and the cheapest season is not the most profitable one.

From the estate's long run total cost schedule below, calculate long run average cost and long run marginal cost at each output, state the optimum size of the estate, show that long run marginal cost cuts long run average cost at its minimum, and advise the estate on the output it should plan for.

Kilombero Sugar Company is planning the scale of a new milling season, and its engineers have costed six possible outputs of white sugar.

At 40,000 tonnes the long run total cost is TShs 76 billion; at 60,000 tonnes, TShs 105 billion; at 80,000 tonnes, TShs 132 billion.

At 100,000 tonnes it is TShs 160 billion; at 120,000 tonnes, TShs 198 billion; at 140,000 tonnes, TShs 245 billion.

A plant is available for every one of these outputs, so all the figures are long run figures.

Sugar leaves the estate at TShs 2,000,000 a tonne.

Model Answer

Long run average cost falls from TShs 1,900,000 a tonne to a lowest TShs 1,600,000 at 100,000 tonnes and then rises, so the optimum size is 100,000 tonnes a season; long run marginal cost is TShs 1,400,000 just below and TShs 1,900,000 just above, cutting the average at its minimum, yet the estate should plan for 120,000 tonnes.

Average cost is total cost divided by output; marginal cost is the change in total cost over the change in output. Every step here is 20,000 tonnes.

$$\text{LAC} = \frac{\text{LTC}}{\text{q}} \quad \text{LMC} = \frac{\Delta\,\text{LTC}}{\Delta\,\text{q}}$$

Take the averages first, working in shillings a tonne.

$$\frac{76{,}000{,}000{,}000}{40{,}000} = 1{,}900{,}000$$
$$\frac{105{,}000{,}000{,}000}{60{,}000} = 1{,}750{,}000$$
$$\frac{132{,}000{,}000{,}000}{80{,}000} = 1{,}650{,}000$$
$$\frac{160{,}000{,}000{,}000}{100{,}000} = 1{,}600{,}000$$
$$\frac{198{,}000{,}000{,}000}{120{,}000} = 1{,}650{,}000$$
$$\frac{245{,}000{,}000{,}000}{140{,}000} = 1{,}750{,}000$$

Now the marginals. Total cost rises by 29, 27, 28, 38 and 47 billion across the five steps; divide each by the 20,000 tonnes it bought.

$$\frac{29{,}000{,}000{,}000}{20{,}000} = 1{,}450{,}000$$
$$\frac{27{,}000{,}000{,}000}{20{,}000} = 1{,}350{,}000$$
$$\frac{28{,}000{,}000{,}000}{20{,}000} = 1{,}400{,}000$$
$$\frac{38{,}000{,}000{,}000}{20{,}000} = 1{,}900{,}000$$
$$\frac{47{,}000{,}000{,}000}{20{,}000} = 2{,}350{,}000$$

Output (tonnes)	LTC (TShs billion)	LAC (TShs a tonne)	LMC (TShs a tonne)
40,000	76	1,900,000	-
60,000	105	1,750,000	1,450,000
80,000	132	1,650,000	1,350,000
100,000	160	1,600,000	1,400,000
120,000	198	1,650,000	1,900,000
140,000	245	1,750,000	2,350,000

Long run total, average and marginal cost for one season at Kilombero.

The optimum size of the estate: the average column falls 1,900,000, 1,750,000, 1,650,000, 1,600,000, then turns up to 1,650,000 and 1,750,000. Its lowest value is TShs 1,600,000 a tonne at 100,000 tonnes: the optimum size.

Marginal below the average, then above: while the average falls, the marginals of 1,450,000, 1,350,000 and 1,400,000 sit below it. As the average turns up at 120,000 tonnes the marginal has jumped to 1,900,000, so the curves cross in between.

Why the crossing must be there: an average is at rest only when the next unit costs what the average unit costs. Below the optimum extra sugar is cheaper and drags it down; above it extra sugar is dearer and pushes it up.

The cheapest size is not the most profitable: at TShs 2,000,000 a tonne, revenue is 160 billion at 80,000 tonnes, 200 at 100,000, 240 at 120,000 and 280 at 140,000. Take total cost from each.

$$\text{Profit at 80 thousand tonnes} = 160 - 132 = \text{TShs } 28 \text{ billion}$$

$$\text{Profit at 100 thousand tonnes} = 200 - 160 = \text{TShs } 40 \text{ billion}$$

$$\text{Profit at 120 thousand tonnes} = 240 - 198 = \text{TShs } 42 \text{ billion}$$

$$\text{Profit at 140 thousand tonnes} = 280 - 245 = \text{TShs } 35 \text{ billion}$$

Reading those figures: profit is greatest at 120,000 tonnes, not at the optimum 100,000, though average cost there is TShs 50,000 a tonne higher. That block of 20,000 tonnes costs TShs 1,900,000 a tonne and sells at TShs 2,000,000, adding TShs 100,000 each while lifting the average. The next would cost TShs 2,350,000.

The advice: plan for 120,000 tonnes, build the plant tangent to the LAC there, accept TShs 1,650,000 a tonne and expect about TShs 42 billion of profit. But that depends on a high price: at TShs 1,700,000, profit would be $204 - 198 = 6$ billion against $170 - 160 = 10$ billion at 100,000.

The optimum size is a statement about cost alone. The output worth producing is settled where the last tonne stops paying for itself, and that point shifts with the price of sugar.

The Master Key: *The optimum size is where average cost is least; the output worth producing is where the last tonne still covers its own cost, and the two are rarely the same.*

HOT Question 202

The engineer says build the plant with the lowest cost per tonne. The sales manager asks who in Tanzania is going to buy all that. Both men are right about something.

Advise a Tanzanian firm on whether it should always build the plant that gives the lowest long run average cost.

Model Answer

No. The lowest point of the long run average cost curve names the cheapest size, not the most profitable one, so the right plant is the one tangent to that curve at the output the firm can actually sell, though a market large enough to fill it makes the least cost plant right.

The case for it: a repeated saving: every unit is made at the lowest cost the technology allows, and the saving returns for the life of the machinery: TShs 100 a sack on 400 sacks a day is TShs 12 million a year.

The only defensible size in competition: where price is driven towards average cost, a firm above the bottom of the long run curve is driven out. In cement, brewing and cigarette making a firm below the efficient size cannot cover its costs.

Room to survive a bad year: a firm at the bottom of its curve has the widest gap between price and cost, so it survives a season that closes dearer rivals. Low cost is insurance as well as profit.

The case against: demand may be absent: the optimum plant is cheapest only if run at its optimum output. A Singida press built for 5,000 litres a day but selling 1,500 charges what its own short run curve charges, above a smaller press.

Profit, not cost, is the objective: the most profitable output is where marginal revenue equals marginal cost, either side of the optimum. A firm facing a high price can profitably pass it, as at Kilombero; one facing a thin market stops short.

The capital must be serviced: a bigger plant needs far more money down, and borrowing at eighteen per cent is a charge the engineer's cost a tonne may not carry, so a smaller plant financed from savings can be sounder.

The future is not known: demand may grow, so a plant too small today is right in three years. Where a second line is cheap, build below the optimum and expand later; where expansion is costly, as with a kiln, build ahead.

Some markets are local: a maize mill at Ludewa cannot draw customers from Mbeya, because carting grain over those roads costs more than the milling saving. Its market is fixed by geography.

Build the plant tangent to the long run curve at the output you honestly expect to sell, not the one at the bottom. In cement or brewing the two coincide; where the market is small or uncertain, least cost turns a paper advantage into idle steel.

The Master Key: *Build for the output you can sell; the bottom of the long run curve is the cheapest size, and only a market large enough to fill it makes it the right one.*

HOT Question 203

The mill in a Ludewa village grinds thirty sacks a day at nearly twice the cost a sack of the Mbeya works. A visiting economist calls it inefficient; the village calls it dinner.

Discuss whether a small maize mill serving one village is an inefficient firm or simply a firm of the right size for the market it serves.

Model Answer

The village mill is not inefficient in any useful sense: its market is the village, not the nation, and once carriage is counted a small mill is the cheapest way to serve it. It becomes inefficient only if better roads or larger demand make a bigger mill viable and the owner refuses to grow.

The case for inefficiency: on the long run curve of maize milling the mill sits high on the falling branch, grinding thirty sacks a day where a plant of least cost size grinds four hundred. It forgoes every economy of scale: no sifting line, maize near retail prices, an idle motor.

Its capital is idle: a machine running three hours a day carries its whole purchase price on very few sacks, and thousands of such mills tie up a great deal of scarce capital.

It survives on an obstacle: if transport cost nothing, most village mills would close within a year. Their survival is a symptom of bad roads, and a symptom is not an achievement.

The market sets the scale: a firm can be the wrong size only against a demand it could serve. The village buys thirty sacks a day and no more, and nobody carries maize eighty kilometres to Mbeya and back to save a few hundred shillings.

Transport is part of milling cost: the honest comparison is milling plus carriage both ways. If the Mbeya mill charges TShs 800 a sack and transport TShs 500 each way, the delivered cost is TShs 1,800 against the village mill's TShs 1,500.

It supplies what a large mill cannot: the village mill lets a household grind one debe of maize, a four gallon tin, on the morning the flour is needed, instead of a month's supply that spoils: place utility and time utility together.

A small plant suits a seasonal demand: village demand peaks after harvest and falls away before the next. A small plant with a light fixed cost rides that swing; a large plant with heavy fixed charges would be crushed by three slack months.

What settles it is not cost a sack but whether a larger mill could serve the same customers more cheaply, delivered. Three checks: unmet demand within reach a bigger mill could supply below present prices; roads good enough to widen the market; four villages able to support one better plant.

The distinction to carry away is between a firm too small for its market and a firm whose market is small. The remedy for the first lies inside it, in investment and management; for the second it is a road or a power line, not advice to the miller.

The Master Key: *A firm is the wrong size only in relation to a market it could actually serve; the village mill is small because its market is small, and the road, not the miller, is what needs mending.*

HOT Question 204

Every diagram in the room shows the long run average cost curve turning upwards. Ask a Tanzanian brewer when his costs last rose because he grew, and he will look at you strangely.

With the aid of a diagram, assess whether the U shaped or the L shaped long run average cost curve better describes Tanzanian industry, and explain what your answer implies for the number and the size of firms.

Model Answer

The L shaped curve fits most Tanzanian industry better than the U, because average cost falls steeply and then flattens instead of turning up. What matters is where it stops falling: that point, the minimum efficient scale, decides whether an industry holds a few giant firms or thousands of small ones.

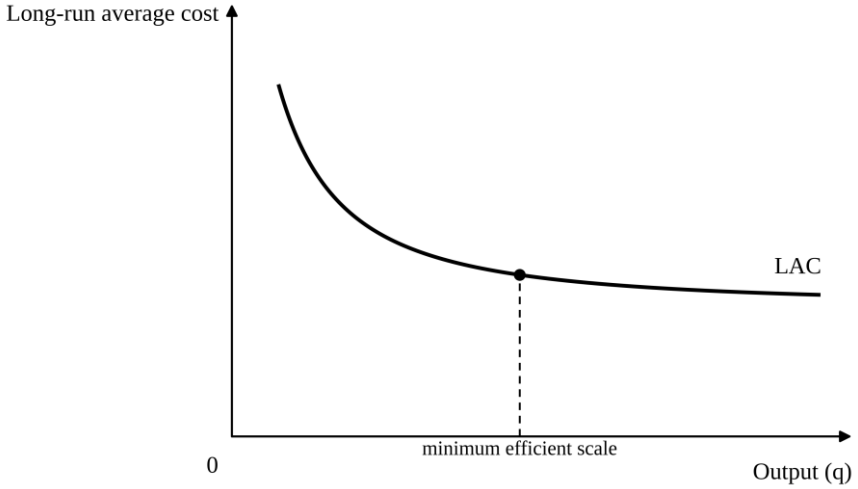


Figure 5.25: The L shaped long run average cost curve and minimum efficient scale

What the L shape says: average cost falls steeply while the firm is small: the first proper machine, the first specialist manager and the first bulk purchase each bring a large saving. The curve then flattens, and where it reaches its floor is the minimum efficient scale.

The evidence for the L: engineers costing a plant almost never find a size beyond which cost a unit clearly rises. Managerial diseconomies, the classic reason for a rising branch, prove avoidable: a firm outgrowing one manager can be split into departments or run as several efficient plants under one head office.

Where the U still holds: where the owner's judgement is the key input and cannot be delegated, cost climbs with size: a tour operator at Arusha whose reputation is personal, a farm depending on the owner's eye. Agriculture also rises because expansion draws in poorer, more distant land, so extra cane at Kilombero or cotton in Shinyanga is dearer.

A high efficient scale means few, large firms: cement is the plainest case: a works of efficient size makes about an eighth of all the country uses, so a handful supply the market and a small one cannot survive. Brewing and cigarette making run the same way.

A low efficient scale means many, small firms: a fundi cherehani reaches his lowest cost with two machines and a helper; a sembe mill at a few dozen sacks a day; a woman selling chipsi mayai, chips cooked in egg, with one stove and one jiko. Each scale is a fraction of national demand.

What it does not mean: it does not mean small firms are as productive as large ones, only that in that trade the cost curve is flat over a wide range of sizes. Tailoring has a low efficient scale and a low income because the whole curve sits high.

The policy that follows: turning thousands of small millers into a few large ones would fail, because their smallness answers a low efficient scale and dear transport. Breaking a cement works into small local plants would raise the price of cement for every builder.

For teaching the envelope the U is convenient, since a clear minimum gives the optimum size a definite meaning. For Tanzanian industry the L is nearer the truth in manufacturing and processing, while the U survives where the key input is the owner himself.

The Master Key: *Ask not where the curve turns up but where it stops falling; the minimum efficient scale set beside the size of the market tells you how many firms the industry will hold.*

Internal Economies of Scale

A big mill and a small mill buy the same maize at the same price and pay the same wage, yet the big one turns out a cheaper sack. The advantage is not luck and it is not sharp practice; it is scale. This section defines economies of scale, separates the internal ones a firm earns by its own growth from the external ones the industry hands it, works through every internal economy in turn, and prices them in shillings.

BINDER Question 205

Two sembe mills face each other across the Uyole road. They buy the same maize, pay the same wage and sell at the same price, yet one sack always leaves the bigger shed cheaper.

Define economies of scale and distinguish between internal and external economies of scale, making clear what each does to the firm's long run average cost curve.

Model Answer

Economies of scale are the cost advantages of large scale production, the fall in long run average cost as a firm raises its scale; they are internal when they come from the firm's own growth and external when they come from the industry's.

Economies of scale defined: economies means cost advantages: the advantages of large scale production, enjoyed whenever long run average cost falls as output rises, reversed as diseconomies when it climbs. The idea is long run: a larger plant, not an old one worked harder.

$$\mathrm{LAC} = \frac{\mathrm{LTC}}{\mathrm{q}}$$

Internal economies: cost advantages accruing to one firm because it expanded its own scale. It earns them itself and keeps them, a rival who stays small getting nothing, and it moves down its own long run average cost curve while the curve stays put.

External economies: cost advantages accruing to every firm because the industry has grown: trained fundis pool in the district, banks open branches, spare parts dealers appear, the road is tarmacked. The whole curve shifts down, the small firms included.

The test that separates them: ask whose growth caused the saving. A Mwanza fillet plant discounted for ordering fifteen thousand cartons grew itself, so its economy is internal; the same plant paying less because the lake fish trade grew is handed an external one.

Not short run fixed cost spreading: when a Morogoro rice mill works its plant harder, average fixed cost falls because one fixed cost is divided among more tonnes: the short run, inside an unchanged plant. An economy of scale needs a larger plant.

Why the distinction decides policy: internal economies reward a firm for growing, external economies reward a place, which is why some trades end in a few large firms and others in clusters. Cheaper cement needs one firm at efficient size; cheaper furniture a college and a road.

This section takes the internal economies one by one and prices each; the external ones belong to the section that follows.

The Master Key: *Internal economies move the firm down its own long run average cost curve; external economies move the curve itself down.*

BINDER Question 206

A Njombe fabricator doubles every dimension of a milk tank. He needs four times the sheet metal, and the tank holds eight times the milk. Somewhere in that gap a fortune is hiding.

Explain the technical economies of scale open to a large firm, treating separately the indivisibility of large machines, the superiority of specialised machines, the linking of processes and the principle of increased dimensions.

Model Answer

Technical economies are the cost advantages a firm gains from machines and methods that only a large output makes worth using, in four forms: the indivisibility of large machines, the superiority of specialised machines, the linking of processes and increased dimensions.

The indivisibility of large machines: a large machine is sold whole or not at all: a sixty horsepower huller with a sifting line exists, half of one does not. Costing the same at five tonnes a week or fifty, it is cheaper to use, not to buy.

An oil expeller at Singida costs TShs 7,200,000 a year to own, counting depreciation, interest and its shed, whatever the press does.

$$\frac{7{,}200{,}000}{1{,}200} = \text{TShs } 6{,}000 \text{ a tonne of seed}$$

$$\frac{7{,}200{,}000}{9{,}000} = \text{TShs } 800 \text{ a tonne of seed}$$

Reading those two lines: the same machine, doing the same work, carries TShs 6,000 a tonne at the small output and TShs 800 at the large. Only the tonnes sharing the cost have changed, worth TShs 5,200 a tonne.

The superiority of specialised machines: a large output justifies a machine that does one job supremely well rather than a general one doing many adequately. A fundi cherehani sews seams, hems, buttonholes and edges on one machine; a large uniform workshop keeps a seamer, a buttonholer and an overlocker.

The linking of processes: a large plant sets its stages in one line, each feeding the next with no stopping, cooling or re-handling. At a Mwanza fillet plant fish passes from gutting bench to filleting line to blast freezer in one flow; a small operator carts crates across a yard.

The principle of increased dimensions: also called the container principle. Cost depends on surface area, the sheet metal bought, usefulness on volume. Area rises with the square of the dimensions and volume with the cube, so capacity outruns cost.

$$\text{Surface area} = 6L^2 \quad \text{Volume} = L^3$$

A Njombe fabricator builds a square milk tank in stainless sheet at TShs 90,000 the square metre, one metre each way against two.

$$A_1 = 6 \times 1^2 = 6 \text{ square metres} \quad V_1 = 1^3 = 1 \text{ cubic metre} = 1{,}000 \text{ litres}$$

$$A_2 = 6 \times 2^2 = 24 \text{ square metres} \quad V_2 = 2^3 = 8 \text{ cubic metres} = 8{,}000 \text{ litres}$$

$$6 \times 90{,}000 = \text{TShs } 540{,}000 \quad \text{so} \quad \frac{540{,}000}{1{,}000} = \text{TShs } 540 \text{ a litre of capacity}$$

$$24 \times 90{,}000 = \text{TShs } 2{,}160{,}000 \quad \text{so} \quad \frac{2{,}160{,}000}{8{,}000} = \text{TShs } 270 \text{ a litre of capacity}$$

Reading the tank arithmetic: doubling every dimension multiplies the sheet metal by four and the capacity by eight, so the cost of steel a litre of capacity is halved, from TShs 540 to TShs 270.

$$\frac{\text{Metal}}{\text{Capacity}} = \frac{6L^2}{L^3} = \frac{6}{L}$$

How far the container principle reaches: it governs anything that holds or carries: a chilling tank, a fermentation vat, a grain silo, a warehouse, a lorry body, a fuel tanker, a ship, a pipeline. Hence bulk carriers as large as the port allows.

None of the four is open to a firm producing little: the indivisible machine stands idle, the specialised machine lacks its job, the line has nothing to link, the tank is never filled.

The Master Key: *A big machine is not cheaper to buy but cheaper to use, and the container principle gives eight times the space for four times the steel.*

BINDER Question 207

The owner of a small Iringa tomato cannery buys the tins, hires the women, sells the crop and keeps the books himself. He is four people, and none of the four is very good.

Explain the managerial, labour, welfare and research economies enjoyed by a large firm, giving a Tanzanian illustration of each.

Model Answer

These four economies all arise because a large output lets a firm buy specialised people and specialised knowledge, then spread their cost over so many units that each carries very little of it.

Managerial economies: the division of labour applied to management: a purchasing manager, a production manager, a sales manager and an accountant, each better at one job than an owner doing all four. At Kilombero a specialist buyer at TShs 60,000,000 a year is an extravagance on 6,000 tonnes of sugar and a bargain on 60,000.

Labour economies: a large workforce permits a far finer division of labour. Two tailors making school uniforms must each cut, sew, finish and press a whole shirt; at a scale of forty, one cuts, another sews seams, a third makes buttonholes, a fourth presses.

Welfare economies: a large firm can provide housing, a dispensary, a canteen, clean water, a nursery and a training school, which raise productivity and hold workers. A Tanga sisal estate with a dispensary loses fewer days to malaria, and one clinic serves fifty workers or two thousand.

Research economies: only a large firm can keep a laboratory, a trial plot or a design office: a tea or sugar company with a nursery of new varieties, a cashew factory with a chemist. The cost hardly changes with size, so the small processor waits for others.

Each buys something indivisible: a manager, a specialised post, a clinic, a laboratory. None can be bought in a tenth, so each is crushing on a small output and light on a large.

The Master Key: *A specialist is an indivisible input: you cannot hire a fifth of an accountant, so only a large output can afford one.*

BINDER Question 208

A Kariakoo trader and a national brewery walk into the same bank on the same morning. They ask for money on the same terms and walk out with completely different answers.

Explain the financial, risk bearing, purchasing and marketing economies of scale, and state in each case why the advantage is closed to a small firm.

Model Answer

These four economies arise in the markets a firm deals in rather than in its factory: a large firm borrows more cheaply, survives shocks better, buys inputs at a discount and spreads its selling cost over more units, and every advantage turns on size itself.

Financial economies: a large firm is a lower risk, better secured borrower, with land, machinery, audited accounts and a known name, so it gets a lower rate, a longer term and a larger sum, and may issue shares or debentures. A Kariakoo trader borrowing TShs 5,000,000 against stock may pay twenty two per cent, a brewery billions at far less.

Why it is closed to small firms: the bank's cost of appraising, documenting and watching a loan hardly changes with its size, so it presses far harder on a small one, and the small borrower usually has no title deed to pledge.

Risk bearing economies: a large firm spreads risk across several products, markets and suppliers, so no single failure destroys it. A Singida oil company pressing alizeti, milling maize and packing sesame, buying from four regions, loses only part of a year's profit when the sunflower fails.

Purchasing economies: buying in bulk earns discounts, better terms and priority when supply is short, since the seller's cost of one sale hardly rises with its size. A Mwanza fillet plant ordering fifteen thousand cartons is quoted a fifth less a carton than one ordering three thousand.

Marketing economies: the cost of a selling effort is largely independent of the quantity sold: one radio campaign, one stand at the Sabasaba fair, one sales team, one export office cost what they cost, so each falls per unit as the units multiply.

In two of them, the sales office and the campaign, the cost is indivisible and the saving comes from division; in the other two, the interest rate and the bulk discount, each input costs less.

The Master Key: *Away from the machines, size still pays: cheaper money, spread risk, bulk discounts and a selling cost divided among many more units.*

BINDER Question 209

A Mtwara cashew factory pays its chemist the same salary in a poor season and a bumper one. In the poor season the salary is a burden; in the bumper season it is nearly invisible.

Explain why every internal economy of scale shows itself as a fall in the firm's long run average cost, and show by arithmetic how the cost of an indivisible item is spread as output rises.

Model Answer

Every internal economy works in one of two ways, either by spreading an indivisible cost over more units or by lowering the price paid for each unit of input, and both arrive at a lower long run average cost.

Long run average cost is total cost divided by output, so it falls only if total cost rises more slowly than output. Every internal economy is a reason why it does.

$$\text{LAC} = \frac{\text{LTC}}{\text{q}}$$

The first route, spreading an indivisible cost: some costs do not rise with output at all, because the thing bought cannot be divided: a laboratory, a general manager, an advertising campaign, a sifting line, a chilling tank, a sales office. Call it F, and each unit carries F divided by output, a figure falling without limit.

$$\text{Cost a unit of the indivisible item} = \frac{\text{F}}{\text{q}}$$

Set the Mtwara chemist and his laboratory at TShs 24,000,000 a year and read what happens as the factory grows.

Output (tonnes a year)	Laboratory cost a tonne (TShs)	Fall from the row above (TShs)
1,000	24,000	-
2,000	12,000	12,000
4,000	6,000	6,000
8,000	3,000	3,000
12,000	2,000	1,000
24,000	1,000	1,000

The cost a tonne of one indivisible laboratory costing TShs 24,000,000 a year at a Mtwara cashew factory.

Reading the table: the laboratory is a burden of TShs 24,000 a tonne at a thousand tonnes and a trifle of TShs 1,000 at twenty four thousand. Doubling output from 1,000 to 2,000 saves TShs 12,000 a tonne, from 12,000 to 24,000 only TShs 1,000.

The second route, a lower price for each input: the bulk discount, the lower interest rate, the machine burning less fuel, the worker sewing more shirts an hour: all cut what the firm pays for each unit. TShs 360 off fifteen thousand cartons is TShs 5,400,000 a month, and it does not fade.

Why the two routes must be kept apart: spreading runs out of strength: once the laboratory is down to TShs 1,000 a tonne little is left to save. The second route does not fade but is capped, since a discount stops at some order size and a bank's rate cannot go below its funding cost.

So the long list is one piece of arithmetic in nine forms: divide what cannot be divided among more units, or pay less for each unit you use.

The Master Key: *Spread what cannot be divided, or buy each unit cheaper; every internal economy does one or the other, and both land on long run average cost.*

REAL Question 210

Follow one year of maize through a Mbeya milling shed, first with a small huller and then with a large one, and let the shillings a sack decide which machine belongs there.

Using the record in the box, calculate the average cost a sack under each huller at 12,000 sacks a year and at 48,000 sacks a year, find the output at which the two machines cost the same, state exactly the fall in average cost the large huller delivers at the larger output, and advise Mama Sanga which machine to buy.

Mama Sanga runs a maize milling shed at Iyunga, on the edge of Mbeya town, and is choosing between two hullers.

Huller A is a single 25 horsepower machine rated at 2 tonnes an hour. It costs TShs 2,400,000 a year to own, counting depreciation, interest and the shed, and TShs 1,000 a sack to run, counting power, labour, sacks and repairs.

Huller B is a 60 horsepower machine with its own sifting and bagging line, rated at 6 tonnes an hour. It costs TShs 9,600,000 a year to own and only TShs 640 a sack to run, because one operator feeds the whole line, the hand sifting stage disappears, and the larger motor uses less power a tonne.

A sack holds 100 kilogrammes of sembe. The shed can work 300 days a year and 8 hours a day.

Neither machine is sold in parts, and the second hand market for either is thin.

Model Answer

At 12,000 sacks a year Huller A costs TShs 1,200 a sack against Huller B's TShs 1,440; at 48,000 sacks A costs TShs 1,050 against B's TShs 840; the two cost the same at 20,000 sacks, so Mama Sanga should buy the small huller below that figure and the large one above it.

Average cost a sack is the annual cost of owning the machine divided among the sacks, plus the running cost each sack carries.

$$\mathrm{AC_A} = \frac{2{,}400{,}000}{\mathrm{q}} + 1{,}000$$

$$\mathrm{AC_B} = \frac{9{,}600{,}000}{\mathrm{q}} + 640$$

Take the smaller trade first, 12,000 sacks a year, which is 1,200 tonnes of maize or about 40 sacks a working day.

$$\mathrm{AC_A}(12{,}000) = \frac{2{,}400{,}000}{12{,}000} + 1{,}000 = 200 + 1{,}000 = \text{TShs } 1{,}200$$

$$\mathrm{AC_B}(12{,}000) = \frac{9{,}600{,}000}{12{,}000} + 640 = 800 + 640 = \text{TShs } 1{,}440$$

The small machine wins at 12,000 sacks: Huller B costs TShs 240 a sack more, TShs 2,880,000 a year on 12,000 sacks. At 6 tonnes an hour, 1,200 tonnes takes 200 of the shed's 2,400 hours: silent eleven hours in twelve.

Now take the larger trade, 48,000 sacks a year, which is 4,800 tonnes.

$$\mathrm{AC_A}(48{,}000) = \frac{2{,}400{,}000}{48{,}000} + 1{,}000 = 50 + 1{,}000 = \text{TShs } 1{,}050$$

$$\mathrm{AC_B}(48{,}000) = \frac{9{,}600{,}000}{48{,}000} + 640 = 200 + 640 = \text{TShs } 840$$

The large machine wins at 48,000 sacks: Huller B is now TShs 210 a sack cheaper, on 48,000 sacks TShs 10,080,000 a year, more than the whole cost of owning Huller A. Neither machine has altered.

The economy of scale stated exactly: average cost falls from TShs 1,200 a sack to TShs 840, a fall of TShs 360 or thirty per cent, earned by this firm's growth and not by any change in maize prices, wages or weather.

Where the 360 shillings come from: owning costs TShs 200 a sack at both outputs, four times the machine over four times the sacks. The whole saving is in running cost, TShs 1,000 down to TShs 640: one operator instead of three, no hand sifting, less power.

The switching output is found by setting the two average cost functions equal.

$$\frac{2{,}400{,}000}{q} + 1{,}000 = \frac{9{,}600{,}000}{q} + 640$$

$$1{,}000 - 640 = \frac{9{,}600{,}000 - 2{,}400{,}000}{q}$$

$$360 = \frac{7{,}200{,}000}{q}$$

$$q = \frac{7{,}200{,}000}{360} = 20{,}000 \text{ sacks a year}$$

$$AC_A(20{,}000) = 120 + 1{,}000 = 1{,}120 \quad AC_B(20{,}000) = 480 + 640 = 1{,}120$$

Reading the switching output: 20,000 sacks a year is 2,000 tonnes, about 67 sacks a working day. The question is not which huller is better, since B plainly is, but whether Iyunga and the villages feeding it will bring 2,000 tonnes.

Why she cannot compromise: nothing is sold between the two hullers and she cannot buy two thirds of B. Her only intermediate route is a second Huller A, worth pricing, since at 48,000 sacks one would run all 2,400 hours.

$$AC_{2A}(48{,}000) = \frac{4{,}800{,}000}{48{,}000} + 1{,}000 = 100 + 1{,}000 = \text{TShs } 1{,}100$$

What that last line teaches: two small hullers give her capacity but not economy: she still pays TShs 1,000 a sack to run them, TShs 260 above Huller B. Replicating a small machine buys output, not a lower cost.

Two things could still overturn this. Whether 4,800 tonnes of maize can be found and 48,000 sacks of sembe sold around Mbeya is a question about the market. And a 60 horsepower motor needs three phase power, which the Iyunga line may not hold.

The Master Key: *A big machine is not better because it is big; it is cheaper only where there is enough work to keep it fed.*

REAL Question 211

Follow the cartons, not the fish, through the filleting plants at Nyegezi outside Mwanza. The same box that costs one plant TShs 1,800 costs its bigger neighbour TShs 1,440.

Using the record in the box, calculate the packaging cost and the selling cost a tonne of fillet at each of the two scales, state the exact fall in cost a tonne, express that fall as a share of the export price, and name the internal economies at work.

Two Nile perch filleting plants stand on the lake shore at Nyegezi, outside Mwanza, and both export chilled fillet by air.

The smaller plant handles 30 tonnes of fillet a month. The larger handles 150 tonnes.

Fillet is packed in waxed cartons holding 10 kilogrammes each. The carton maker in Dar es Salaam quotes TShs 1,800 a carton on orders below 10,000 and TShs 1,440 a carton on orders of 10,000 and above.

On the smaller orders the buyer must fetch the cartons himself, which costs TShs 600,000 a month. On orders of 10,000 and above the maker delivers to Mwanza free of charge.

Each plant keeps one export sales office in Mwanza, with a manager, a quality officer and a clerk, at TShs 6,000,000 a month.

Fillet is sold to European buyers at TShs 12,000 a kilogramme.

Model Answer

Packaging and selling cost the small plant TShs 400,000 a tonne of fillet and the large plant TShs 184,000, a fall of TShs 216,000 or fifty four per cent, and it is the work of two internal economies: purchasing on the cartons, marketing on the sales office.

Begin with the cartons. Each holds 10 kilogrammes, so every tonne of fillet needs 100 cartons and the order follows from the tonnage.

$$30 \times 100 = 3{,}000 \text{ cartons a month} \quad 150 \times 100 = 15{,}000 \text{ cartons a month}$$

The small plant's order of 3,000 falls below the maker's threshold of 10,000, so it pays full price and fetches the cartons itself.

$$3{,}000 \times 1{,}800 = \text{TShs } 5{,}400{,}000$$

$$5{,}400{,}000 + 600{,}000 = \text{TShs } 6{,}000{,}000 \text{ a month}$$

$$\frac{6{,}000{,}000}{30} = \text{TShs } 200{,}000 \text{ a tonne of fillet}$$

The large plant's order of 15,000 passes the threshold, so it takes the discount and pays nothing for delivery.

$$15{,}000 \times 1{,}440 = \text{TShs } 21{,}600{,}000 \text{ a month}$$

$$\frac{21{,}600{,}000}{150} = \text{TShs } 144{,}000 \text{ a tonne of fillet}$$

The purchasing economy: packaging falls from TShs 200,000 to TShs 144,000 a tonne, a saving of TShs 56,000, or twenty eight per cent of the small plant's bill, from a discount of TShs 360 a carton and a fetching cost of TShs 600,000 a month now gone.

Now the sales office. It costs the same TShs 6,000,000 a month at either plant, since one manager, one quality officer and one clerk place 150 tonnes as easily as 30.

$$\frac{6{,}000{,}000}{30} = \text{TShs } 200{,}000 \text{ a tonne}$$

$$\frac{6{,}000{,}000}{150} = \text{TShs } 40{,}000 \text{ a tonne}$$

The marketing economy: selling falls from TShs 200,000 to TShs 40,000 a tonne, a fall of eighty per cent, and the office does nothing differently: the same three people at the same desks, with more tonnes to divide their salaries among.

Item	Small plant, 30 t (TShs a tonne)	Large plant, 150 t (TShs a tonne)	Fall a tonne (TShs)
Cartons and their delivery	200,000	144,000	56,000
Export sales office	200,000	40,000	160,000
Total	400,000	184,000	216,000

Packaging and selling cost a tonne of Nile perch fillet at two scales at Nyegezi, Mwanza.

The fall stated exactly: TShs 216,000 a tonne is fifty four per cent of what the small plant pays. At 150 tonnes a month the large plant keeps TShs 32,400,000 a month, or TShs 388,800,000 a year, for the same work.

Setting the saving against the price: a tonne of fillet earns TShs 12,000,000 at TShs 12,000 the kilogramme, so TShs 216,000 is 1.8 per cent of turnover. But a processor's margin may be five to ten per cent, so against the margin it is a fifth of profit.

Two cautions. The discount is genuinely internal, coming from this plant's own order size; had the carton maker cut his price because the lake fish trade had grown, the small plant would share it. And the fish itself is not cheaper.

The Master Key: *One sales office and one bulk order: the work does not change, only the number of tonnes the bill is divided among.*

REAL Question 212

A Kilombero estate has one man who buys the fertiliser, times the harvest, argues with the bank and rules the books. Ten times the cane later, he is still one man.

Using the record in the box, calculate the management cost a tonne of sugar at each scale, find the output at which the specialist buyer begins to pay for himself, calculate what the estate's cheaper borrowing is worth a tonne, and state the total saving a tonne that the estate's growth has produced.

An estate in the Kilombero valley produced 6,000 tonnes of sugar a year when it began. It now produces 60,000 tonnes.

At 6,000 tonnes the whole business was run by one general manager at TShs 60,000,000 a year, who bought the inputs, ran the factory, sold the sugar and kept the books.

At 60,000 tonnes the estate employs five specialist managers, for the fields, the factory, purchasing, sales and accounts, at a total of TShs 300,000,000 a year.

The purchasing manager's contracts for cane, fertiliser and spares cut the estate's input cost by TShs 3,000 on every tonne of sugar.

The estate has borrowed TShs 4,000,000,000 for a new boiler at 13 per cent a year. A small miller with no land title to pledge is quoted 22 per cent for the same money.

Sugar leaves the factory at TShs 2,200,000 a tonne.

Model Answer

Management costs TShs 10,000 a tonne at 6,000 tonnes and TShs 5,000 at 60,000, the specialist buyer pays for himself at 20,000 tonnes a year, cheaper borrowing is worth TShs 6,000 a tonne, and the three together have taken TShs 14,000 a tonne out of average cost.

Management cost a tonne is the salary bill divided by the tonnes that bill manages, so take the two scales in turn.

$$\frac{60{,}000{,}000}{6{,}000} = \text{TShs } 10{,}000 \text{ a tonne}$$

$$\frac{300{,}000{,}000}{60{,}000} = \text{TShs } 5{,}000 \text{ a tonne}$$

The managerial economy stated exactly: the salary bill has risen five times while output rose ten, so management cost has halved, from TShs 10,000 to TShs 5,000 a tonne. On 60,000 tonnes that saving is TShs 300,000,000 a year, the whole new salary bill.

The second half of the managerial economy: specialisation does not only spread a cost, it improves the work. The general manager who did four jobs did none all day, and buying always waited. The purchasing manager works every morning on prices and contracts, cutting input cost by TShs 3,000 a tonne.

That gain can be tested against his salary. He costs TShs 60,000,000 a year and saves TShs 3,000 a tonne, so he pays for himself where the saving equals the salary.

$$3{,}000q = 60{,}000{,}000$$

$$q = \frac{60{,}000{,}000}{3{,}000} = 20{,}000 \text{ tonnes a year}$$

Reading that threshold: below 20,000 tonnes the buyer is a loss. At 6,000 tonnes he would have saved TShs 18,000,000 against a salary of TShs 60,000,000, a net loss of TShs 42,000,000; at 60,000 tonnes he saves TShs 180,000,000, a net gain of TShs 120,000,000.

The financial economy is measured the same way, by asking what the estate would have paid at the small firm's rate: 22 against 13 per cent is 9 per cent on the whole borrowing.

$$4{,}000{,}000{,}000 \times 0.09 = \text{TShs } 360{,}000{,}000 \text{ a year}$$

$$\frac{360{,}000{,}000}{60{,}000} = \text{TShs } 6{,}000 \text{ a tonne}$$

The financial economy stated exactly: TShs 6,000 a tonne, more than the whole specialist management bill of TShs 5,000. It owns land the bank can take, keeps audited books, and is large enough for the bank's cost of appraisal to be spread over billions.

Source of the saving	Saving a tonne (TShs)	Saving a year at 60,000 tonnes (TShs)
Management spread over more tonnes	5,000	300,000,000
The specialist buyer's contracts	3,000	180,000,000
The lower rate of interest	6,000	360,000,000
Total	14,000	840,000,000

Three internal economies at a Kilombero sugar estate, valued at an output of 60,000 tonnes a year.

What the total means: TShs 14,000 a tonne on 60,000 tonnes is TShs 840,000,000 a year. Against a factory gate price of TShs 2,200,000 a tonne that is only 0.6 per cent, yet it is the price of a boiler.

Two qualifications. Part of the financial saving is a transfer rather than a true economy, since the small miller's 22 per cent is partly the bank's real cost of lending to a borrower it cannot judge. And beyond some size management becomes a diseconomy.

The Master Key: *A specialist earns his keep only above a threshold output; find that output and you have found where managerial economies begin.*

HOT Question 213

Nine internal economies are listed in every account of the theory. A welder in a Kariakoo shed can reach perhaps three of them, and one of the nine he could not use if you handed it to him.

Assess which of the internal economies of scale matter most to a Tanzanian firm and which are barely available to it.

Model Answer

The economies that bite hardest here are the purchasing, technical and financial ones, since they turn on quantities a growing firm can assemble, while research and large scale marketing are near unreachable, and what binds them all is the size of the market.

Purchasing economies are the most available: any trader, miller or processor can place a larger order, needing no technology, no licence and no engineer, only working capital and a dry store. Hence Kariakoo traders club together to fill one container.

Technical economies are hostage to power: a larger huller, a larger chilling tank and a linked line behave as the theory says, but machines arrive in a few imported sizes, and an unreliable supply turns a large motor into a liability.

Financial economies reward formality more than size: the gap between what a titled estate pays and an untitled workshop pays is wide, but most of the reward arrives in one jump, when a firm becomes formal, registered, titled and audited.

Risk bearing is worth more here: one rainfall pattern, one crop, one buyer and one road are the ordinary shape of Tanzanian business, with little insurance to buy, so a second product or buying district protects more here than in a rich economy.

Specialists are scarce outside the capital: dividing a salary among more units is as valid at Njombe as anywhere, but a firm at Mtwara or Sumbawanga wanting a food technologist or a cost accountant may find none within a day's travel, and must hold him against the pull of Dar es Salaam.

Welfare economies are strong where labour is remote: on a sisal, tea or sugar estate far from a town, housing, water, a dispensary and a school are the only way to hold a workforce. In an urban workshop the same spending buys less.

Research economies are almost unreachable: very few firms can keep a laboratory or a trial programme. Public research stands in its place, TARI for seed trials, TBS for standards, TIRDO for industrial technology, so in practice it is external.

Marketing economies are capped by the market: the cost of a national campaign is spread over the sales it produces, and household incomes limit those sales. A brewery, a cement works, a telephone company and a cooking oil brand can carry one; a workshop cannot.

Ranked by what a firm can remove by reaching the next size open to it, the order runs purchasing, technical, financial, risk bearing, then managerial and labour, then welfare, with marketing and research last. Volume is the reward, and volume is limited by the market and the roads.

The Master Key: *The economies a Tanzanian firm can reach are the ones that need only volume; the ones it cannot reach are the ones that need a market bigger than it has.*

HOT Question 214

Cement in Tanzania is made by a handful of giants and nobody else. Chapati is made by ten thousand women and no giant at all. One theory has to explain both.

Discuss whether internal economies of scale explain why large firms drive small ones out of some trades but not others.

Model Answer

Internal economies explain the pattern better than any rival account, since a trade falls into few hands wherever the output at which economies are exhausted is large against the market; but transport cost, personal service, perishability and informality keep small producers alive elsewhere.

The case for economies of scale: compare the output at which average cost stops falling with the size of the market. In cement, sugar refining, brewing, cigarettes, glass, fertiliser and steel rolling it is a large share of national consumption, so few firms fill the market; in tailoring, welding, food selling, village milling and bodaboda transport it stops at once.

A price the small firm cannot meet: where economies run deep, the large firm can hold a price above its own cost and below the small firm's, so the small firm loses on every sale, not from bad management but from being the wrong size.

The Tanzanian evidence agrees: cement, edible oil refining, beer, cigarettes, sugar and telecommunications are concentrated in few hands, all resting on heavy indivisible plant; maize milling, tailoring, carpentry, fish trading and vegetable retail stay in thousands of hands, all using light equipment.

Transport protects the small firm: a large mill at Mbeya may turn out a sack for TShs 840 against a village mill's TShs 1,400, yet if carriage fifty kilometres costs TShs 700 the village mill is safe: for a bulky good, the market is the parish.

Personal service cannot be scaled: a fundi cherehani makes a uniform to one child's measurements and alters it the same afternoon, which a garment factory cannot do however cheap its shirts. Where a product must be fitted or fresh, the small firm sells something else.

Perishability and tiny orders: vegetables at Iringa, milk on a village round and dagaa at a lakeside market must move within hours and in lots of a kilogramme or two, and no cold chain is worth building for a two kilogramme sale.

Part of the survival is not efficiency: a workshop that pays no tax, keeps no accounts, holds no licence and meets no safety standard carries costs a formal firm cannot match, so some of that resilience is really the burden of formality.

Scale sometimes stops delivering: economies do not run for ever. Beyond the minimum efficient scale come diseconomies of communication and delegation, and if the curve is L shaped further growth wins nothing, so the largest firm need not be the cheapest.

Internal economies are the right first question, not the whole answer. The test is a comparison: how large is the minimum efficient scale against the market a firm can reach? Where the ratio is large, as in cement, the trade ends in few hands; where it is small, as in village milling, the small firm is the efficient answer.

The Master Key: *Ask not how large the firm is but how large the minimum efficient scale is against the market it can reach; that ratio decides who survives.*

HOT Question 215

A Njombe farmer with six cows will never own a chilling tank. One hundred and fifty such farmers own one between them, and their milk now leaves the village cold.

Advise a small Tanzanian firm on whether, and how far, it can obtain the internal economies of a large firm without itself becoming large.

Model Answer

A small firm can obtain much of what large firms enjoy by joining with others, so that the group becomes the large firm: purchasing, technical, marketing and financial economies transfer well, managerial and risk bearing only partly, and every device carries a coordination cost that decides whether it lives.

The principle behind every device: an internal economy belongs to whoever is large. If a hundred small producers form one body that buys, owns or sells for them, the economies become internal to that body and are shared among the members.

Shared machinery is the clearest case: a milk chilling tank in the Njombe highlands costs TShs 9,000,000 a year to own and run, and the society buys milk on 300 days. One farmer with six cows delivers about 40 litres a day, the members together 2,000.

$$40 \times 300 = 12{,}000 \text{ litres} \quad \text{so} \quad \frac{9{,}000{,}000}{12{,}000} = \text{TShs } 750 \text{ a litre}$$

$$2{,}000 \times 300 = 600{,}000 \text{ litres} \quad \text{so} \quad \frac{9{,}000{,}000}{600{,}000} = \text{TShs } 15 \text{ a litre}$$

Reading those two lines: at TShs 750 a litre, against a farm gate price of about TShs 900, the tank is unthinkable for one farmer; at TShs 15 it is a rounding error, and the milk leaves the village cold.

Group purchasing transfers almost perfectly: an AMCOS or a traders' association placing one order for fertiliser, seed, cartons, fuel or spares gets the bulk price and free delivery no member could get alone. Only the order need be joint.

Contract farming borrows several economies at once: a processor contracting with out growers supplies seed, agro chemicals, advice and credit, and buys the crop at a stated price, so the grower gets research he could never fund, inputs at bulk price and a guaranteed buyer. The cane growers at Kilombero and Mtibwa, the tobacco schemes and the tea growers of Njombe and Mufindi work this way.

Hiring is often better than owning: a small miller need not own a lorry to enjoy the economies of haulage; he buys it from a transporter whose lorries run full. So too with cold storage, tractor hire, mobile hulling and contract packing.

The public route: a SIDO industrial estate offers a shed, three phase power, common machinery and training no single workshop could afford; TARI, TBS and TIRDO supply research a small firm cannot generate; the warehouse receipt system supplies storage and collateral.

What does not transfer well: managerial economies transfer only if the group hires a real manager and lets him manage, which many societies cannot. Risk bearing transfers only partly, since maize growers in one district face one drought. And a linked process cannot be shared: share a tank, not a flow.

The costs of the arrangement must be counted: a cooperative has meetings, elections, a secretariat, audits and disputes, and decides in a season what one owner decides in an afternoon. Members side sell whenever a passing trader pays a shilling more.

So the advice is yes, beginning with the cheapest transfers. Buy jointly before you own jointly, since a joint order needs only an agreement while a joint machine needs a government. Own a shared asset only when the volume is proved and the membership disciplined.

The Master Key: *You cannot become large, but you can be part of something large: buy jointly, hire what others have already built, and own together only what you can govern.*

External Economies and the Diseconomies of Scale

A workshop can grow cheaper without growing at all. When an industry gathers in one place, trained hands, banks, roads, spare parts and specialist firms appear around every member of it, and each one produces more cheaply than before. Push the same process too far and the crowd turns costly: land, labour and lorries all cost more. This section works out the external economies, the internal and external diseconomies, and the one distinction on which everything here turns.

BINDER Question 216

The gem cutters of Mererani each own one small workshop. Not one of them has grown, yet every one of them now cuts stones more cheaply than he did five years ago.

Define external economies of scale and, with the aid of a diagram, distinguish them from internal economies of scale.

Model Answer

External economies of scale are cost advantages that reach every firm in an industry because the industry as a whole has expanded, whereas internal economies of scale reach one firm alone because that firm itself has expanded.

Ask of any saving: did it come from the growth of this firm, or of the industry around it? A Mererani cutter's larger saw cuts his cost alone; a technical college at Mererani gives every workshop on the hill cheaper cutters.

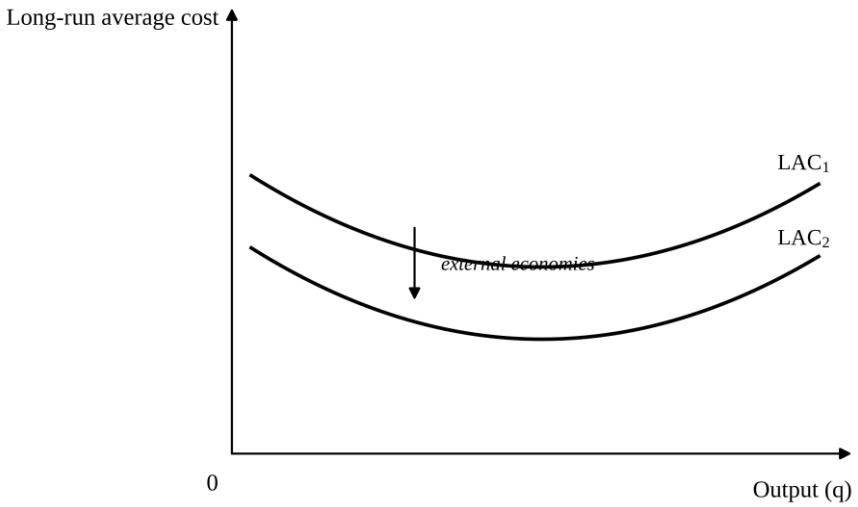


Figure 5.26: External economies shifting the long run average cost curve downward

An internal economy moves the firm along its curve: an internal economy belongs to the firm's own scale, so it is built into the shape of the long run average cost curve. Expanding, the firm slides down the falling branch of LAC_1; the curve never moves.

An external economy shifts the whole curve downward: an external economy lowers the cost of every quantity alike, whatever the firm's own output. The planning curve drops bodily from LAC_1 to LAC_2, and a workshop that has not grown by one stone finds its old output cheaper.

Who receives them: internal economies are private, kept by the firm that expands. External economies are shared: a labour pool, a tarred road or a bank branch cannot be withheld from the workshop next door. That matters in Tanzania, where most firms are too small for large internal economies.

What causes them: internal economies come from the firm's own decisions, to buy a bigger machine, divide labour further, borrow in bulk or advertise over a larger output. External economies come from the size and concentration of the industry, which no firm controls.

What they do to the industry: reaching everybody, an external economy makes no firm stronger than another. It makes the whole industry cheaper, so the industry supplies more at every price and a place that has gathered a trade keeps it. A cutter who left Mererani would leave every external economy behind.

The Master Key: *Internal economies move the firm down its own long run average cost curve; external economies move the curve itself down underneath the firm.*

BINDER Question 217

Ask a Kariakoo trader why he does not move his shop to a quiet street where the rent is half. He will tell you that quiet is exactly what he cannot afford.

Explain the forms in which external economies of scale reach a firm, giving a Tanzanian example of each.

Model Answer

External economies reach a firm in six forms, namely economies of concentration, economies of information, economies of disintegration, cheaper raw materials and capital equipment, technological economies and the growth of ancillary industries, none of which need the firm to grow.

Economies of concentration or localisation: many firms of one trade in one place gain in common: a pool of trained labour, bank and insurance branches, roads, power lines and masts, repair workshops. In Kariakoo a tailor finds machinist, lender, lorry and mechanic in one street, unthinkable when the stalls numbered ten and not two thousand.

Economies of information: as an industry grows it pays to gather what every member needs: associations form, prices are published, buyers and standards become known, firms train jointly. The Moshi coffee auction tells every grower in Mbinga and Kilimanjaro this week's value.

Economies of disintegration or specialisation: once an industry is large enough, production splits into stages, each handed to a firm that does nothing else. As the Shinyanga cotton crop grew, separate ginners, spinners and garment makers appeared, each working its equipment all day and charging less.

Cheaper raw materials and capital equipment: a growing industry raises demand for the materials and machines it uses, so its suppliers reach a cheap scale and pass part of the saving on. When sunflower spread across Singida and Dodoma, workshops built expellers in batches and the price of a press fell.

Technological external economies: new technical knowledge and better machinery do not stay inside the firm that found them. A better solar dryer tried in one Mtwara cashew factory is in the factory down the road within a season.

The growth of ancillary and supporting industries: around a large industry grows a ring of firms that live off it. The Mwanza fish plants brought makers of cartons, sacks and labels, hauliers, an ice plant, insulated lorries, a freezer workshop and buyers of the waste.

One test sorts these from internal economies: could a single firm, acting alone, have arranged the saving? It can buy its own bigger machine; it cannot conjure up a college, a bank branch or a specialist cutting shop.

The Master Key: *Concentration, information, disintegration, cheaper inputs, technology and ancillary industries: six gifts the industry gives to a firm that did nothing but stay where it was.*

BINDER Question 218

A Mtwara cashew factory hires a second manager to watch over the first. Output does not rise by a single kernel, but the cost of every kernel does.

Define diseconomies of scale and explain the internal diseconomies that turn a firm's long run average cost curve upwards.

Model Answer

Diseconomies of scale are the disadvantages a firm meets when it expands beyond a certain size, and they show as a rise in long run average cost; the internal ones arise inside the firm, out of the difficulty of running a large organisation.

They give the long run average cost curve its rising branch. No machine has failed, no worker has grown lazy and no price has changed; what has grown too heavy is holding one organisation together.

Communication diseconomies: layers multiply between the floor and the office, and a message loses time and accuracy at every step. A Tanga sisal owner walking his fields hears of a broken decorticator within the hour; six estates run from a head office hear next week, when the leaf has spoiled.

Diseconomies of the delegation of power: one person cannot take every decision, so power passes to appointed managers, and two things go wrong: the manager knows less than the owner, and the shillings he saves are not his. A storekeeper who does not own the maize will not cross the yard to save a sack.

Managerial diseconomies: the top of a firm is the one thing it cannot easily buy more of. The same few minds must supervise more departments, more sites and more decisions, so each gets less attention, coordination slips and committees multiply. Control has become the scarce factor.

Industrial relations diseconomies: in a small workshop the owner knows every worker by name and settles a grievance over tea. In a plant of two thousand the worker deals with a form and a rule. Motivation weakens, absence, turnover and disputes rise, and every stoppage adds to cost.

They are internal because the firm's own size generates them, so the firm can escape them: divide into smaller self contained units, make each answer for its own profit, cut the layers. That is why the rising branch can be pushed far to the right.

The Master Key: *Diseconomies of scale are the price of complexity: nothing about the machines has changed, only the difficulty of running what you now own.*

BINDER Question 219

Every welder in Dar es Salaam wants a plot at Vingunguti, and that is precisely why a plot at Vingunguti now costs more than the workshop that will stand on it.

Explain the external diseconomies of scale, giving a Tanzanian example of each, and state why they can raise a firm's costs even when that firm has not expanded.

Model Answer

External diseconomies of scale are disadvantages that fall on every firm in an industry because the industry as a whole has grown too large or too crowded, and they take four forms: rising factor prices, transport and congestion costs, marketing costs and the cost of controlling pollution.

A rise in factor prices: all the firms bid for the same land, skills and materials, so anything scarce rises in price. Twelve fish plants on the Mwanza shore chasing a catch that has not grown raise the beach price of Nile perch, the rent of a Vingunguti plot and the welder's wage.

Higher transport costs and congestion: an area thick with firms makes more traffic than its roads were built for, so lorries queue, deliveries arrive late and hauliers raise their rates. Four hours in the Kariakoo streets for one delivery earns a lorry nothing, and the charge lands on every carton.

Higher marketing costs: when many firms chase the same buyers each must shout to be heard, and radio, television and newspapers raise their rates as demand for airtime rises. A firm may spend far more and hold exactly the share it held before.

The rising cost of controlling pollution and waste: one tannery discharging into a river passes unnoticed; twenty in the same valley cannot. Waste concentrates with the industry, the authorities require treatment, and each firm must build effluent plants and buy filters. Fish waste at Mwanza and sawdust at a furniture cluster tell the same story.

The firm need not have grown at all: its scale, machines and methods may be last year's, and yet fish, land, haulage and airtime all cost more. The curve has shifted bodily upward, the mirror of an external economy.

How a firm can respond: since the cause lies outside, so does the cure. A firm may move to a less crowded place, losing the external economies it leaves behind, or join others to press for the road, power line or waste plant. It must not hunt in its own accounts for a fault that lies outside them.

The Master Key: *External diseconomies push the whole curve up, so a firm can find its costs rising in a year when it changed nothing whatever.*

BINDER Question 220

A Njombe miller's cost a sack is rising. The cure may be to send two workers home, or to pull down half the mill, and in the accounts the two cases look identical.

Distinguish between the law of diminishing returns and the diseconomies of scale, using a Tanzanian example of each.

Model Answer

The law of diminishing returns is a short run law about adding one variable factor to a fixed factor, and it lifts marginal cost and average variable cost; diseconomies of scale are a long run matter of increasing all factors together, and they lift long run average cost.

Both end in a rising cost a unit, which is why they are confused, but they belong to different time periods, they have different causes and they call for opposite remedies.

Basis	Law of diminishing returns	Diseconomies of scale
Time period	The short run	The long run
Factors varied	One variable factor, with at least one factor fixed	All factors together, so the scale itself changes
What changes	The proportion in which factors are combined	The size of the whole firm
Cause	The fixed factor becomes crowded	Communication, delegation, management and industrial relations
Cost affected	MC, AVC and short run ATC	LAC, the long run average cost curve
Remedy	Change the proportions: fewer workers, or a bigger plant	Change the size: split the firm, or stop expanding

A short run law and a long run idea, set side by side.

Diminishing returns, illustrated at Kilombero: a grower holds two hectares of paddy, fixed this season, and puts on more vibarua, casual labourers, to weed and harvest. The fourth worker adds a good deal, the seventh little, the ninth gets in the way. Output a worker falls, so average variable cost climbs.

Diseconomies of scale, illustrated at Tanga: a sisal company that ran one estate acquires five more, builds a head office in town and appoints managers, supervisors and clerks. Nothing is fixed: land, labour, decorticators and buildings all rose. Yet a tonne of fibre costs more: instructions pass through three hands, and managers who own no crop take the easy decision.

The test that never fails: ask what was fixed while costs were rising. If anything was fixed, the plant, the land, the building, you are in the short run and looking at diminishing returns. If nothing was fixed, you are in the long run and looking at diseconomies of scale.

Why the distinction is not a quibble: the two call for opposite action. Diminishing returns says the proportions are wrong, so change the mix. Diseconomies of scale says the size is wrong, so shrink or reorganise into smaller units. Apply the first cure to the second disease and you hire and fire for ever.

Diminishing returns gives every short run average cost curve its U shape; diseconomies of scale give the long run curve its own. They are the rising branches of two curves drawn for two lengths of time.

The Master Key: *Something fixed means diminishing returns in the short run; nothing fixed means diseconomies of scale in the long run.*

REAL Question 221

Follow one day's Nile perch through a filleting plant at Nyegezi on the Mwanza shore, first when the plant stood almost alone and then when eleven neighbours had joined it.

Using the plant's two daily accounts below, calculate the average cost a kilogramme of fillet in each year, name the external economy behind each saving, identify the one item that is an external

diseconomy, and explain why this is a shift of the plant's cost curve rather than a movement along it.

Ziwa Fillets works on the Mwanza shore at Nyegezi and freezes 4,000 kilogrammes of Nile perch fillet a day.

In its first year only three other processors worked the lakeshore. Its daily costs were: fresh fish TShs 20,000,000; ice trucked up from Dar es Salaam TShs 3,600,000; diesel for its own generator TShs 2,400,000; labour TShs 2,000,000; bank charges and the cost of travelling to a Dar es Salaam bank TShs 1,200,000; repairs and spare parts TShs 800,000.

Twelve processors now work the same shore. An ice plant has opened at Kirumba, a power line has been laid to the industrial area, a college in Mwanza trains filleters, a bank has opened a branch in the town and a workshop repairs freezing equipment.

Its daily costs this year are: fresh fish TShs 21,000,000; ice TShs 1,200,000; power TShs 900,000; labour TShs 1,600,000; bank charges TShs 600,000; repairs and spare parts TShs 700,000.

Output is unchanged at 4,000 kilogrammes of fillet a day and the plant has not bought a single new machine.

Model Answer

Average cost falls from TShs 7,500 to TShs 6,500 a kilogramme, a fall of TShs 1,000 or about 13.3 per cent, and since output is unchanged at 4,000 kilogrammes the whole of it is a downward shift of the plant's cost curve.

Add each column first, then divide by the day's output, which is the same in both years.

$$\text{Total cost, first year} = 20{,}000{,}000 + 3{,}600{,}000 + 2{,}400{,}000 + 2{,}000{,}000 + 1{,}200{,}000 + 800{,}000$$
$$= \text{TShs } 30{,}000{,}000$$
$$\text{Average cost, first year} = \frac{30{,}000{,}000}{4{,}000} = \text{TShs } 7{,}500 \text{ a kilogramme}$$

$$\text{Total cost, this year} = 21{,}000{,}000 + 1{,}200{,}000 + 900{,}000 + 1{,}600{,}000 + 600{,}000 + 700{,}000$$
$$= \text{TShs } 26{,}000{,}000$$
$$\text{Average cost, this year} = \frac{26{,}000{,}000}{4{,}000} = \text{TShs } 6{,}500 \text{ a kilogramme}$$
$$\text{Fall} = \frac{7{,}500 - 6{,}500}{7{,}500} \times 100 \approx 13.3 \text{ per cent}$$

Now compare the two accounts item by item, to see where each shilling came from.

Item	First year (TShs)	This year (TShs)	Change (TShs)
Fresh fish	20,000,000	21,000,000	up 1,000,000
Ice	3,600,000	1,200,000	down 2,400,000
Diesel, then power	2,400,000	900,000	down 1,500,000
Labour	2,000,000	1,600,000	down 400,000
Bank charges	1,200,000	600,000	down 600,000
Repairs and spares	800,000	700,000	down 100,000
Total	30,000,000	26,000,000	down 4,000,000

One day at a Mwanza filleting plant, before and after the lakeshore filled with processors.

Ice, a saving of TShs 2,400,000 a day: an economy of concentration and of ancillary growth. Four processors could not keep an ice plant busy; twelve can. Ice is now made at Kirumba beside the fish, not hauled a thousand kilometres.

Power, a saving of TShs 1,500,000 a day: the transport, power and communication that concentration brings. No line was worth running to a lonely shed; one is worth running to an area with twelve customers, and grid power beats a generator.

Labour, a saving of TShs 400,000 a day: the pool of trained labour. A college trains filleters because twelve employers now wait to hire them, so the plant no longer trains raw hands and loses less fillet to bad knife work.

Bank charges, a saving of TShs 600,000 a day: banks and insurers open branches where an industry has gathered, since twelve firms will support a branch and one will not. Credit is arranged in Mwanza now, not by aeroplane.

Repairs and spares, a saving of TShs 100,000 a day: an ancillary workshop that services freezing equipment now stands nearby, so a breakdown is mended in hours rather than days. The fish that no longer spoils while a compressor waits is worth more than the figure shows.

The one external diseconomy in the accounts: fresh fish, up TShs 1,000,000 a day. Twelve processors now bid for a catch that has not grown, so the beach price of Nile perch has risen: the classic external diseconomy of a rise in factor prices.

$$\text{Rise in the fish bill a kilogramme} = \frac{1{,}000{,}000}{4{,}000} = \text{TShs } 250$$

$$\text{Net saving} = 5{,}000{,}000 - 1{,}000{,}000 = \text{TShs } 4{,}000{,}000 \text{ a day}$$

Why this is a shift and not a movement: the plant freezes 4,000 kilogrammes a day in both years and has bought no new machine, so its scale has not changed and it cannot have slid along its long run average cost curve. The curve itself came down to meet it, large processors and small alike.

$$4{,}000{,}000 \times 300 = \text{TShs } 1{,}200{,}000{,}000 \text{ a year}$$

Over three hundred working days that is about TShs 1.2 billion a year on a plant that did not grow by one freezer. But the lake is the industry's fixed factor: if the catch does not grow, the beach price can swallow every saving.

The Master Key: *When output has not changed and cost a unit has fallen, the saving came from outside the firm, not from inside it.*

REAL Question 222

Mama Zena's stall on Congo Street is the same size it was ten years ago, and she now finishes thirty school shirts a day instead of twelve. She bought no new machine.

From the tailor's records below, calculate her cost a shirt and her daily profit before and after, name the external economy at work, and explain why no single tailor could have arranged it alone.

Mama Zena rents a stall on Congo Street in Kariakoo and sews school shirts.

When she began, she cut the cloth, sewed, worked the buttonholes, embroidered the school badge and pressed, helped by one hired hand. Twelve shirts a day was the most the two of them could ever finish.

Her daily charges then were stall rent TShs 12,000, power and machine maintenance TShs 9,000, and the hired hand TShs 15,000. Cloth, thread and buttons cost TShs 4,000 a shirt.

The street now holds more than two hundred tailoring stalls. A cutting shop with a band knife cuts a whole bundle at one stroke for TShs 300 a shirt, an embroidery shop with a computerised machine works the badge and the buttonholes for TShs 500 a shirt, and a presser finishes a shirt for TShs 200.

Mama Zena now only sews. She and the hired hand finish 30 shirts a day. Her daily charges and the cost of her cloth are unchanged.

A school shirt sells at TShs 9,000.

Model Answer

Her cost a shirt falls from TShs 7,000 to TShs 6,200 and her daily profit rises from TShs 24,000 to TShs 84,000, and the whole gain is an economy of disintegration, which came from the growth of the street and not of the stall.

Her daily charges are the same in both accounts, so begin there and add what each shirt costs on top.

$$\text{Daily charges} = 12{,}000 + 9{,}000 + 15{,}000 = \text{TShs } 36{,}000$$

$$\text{Cost a shirt before} = \frac{36{,}000}{12} + 4{,}000 = 3{,}000 + 4{,}000 = \text{TShs } 7{,}000$$

$$\text{Paid out on each shirt now} = 4{,}000 + 300 + 500 + 200 = \text{TShs } 5{,}000$$

$$\text{Cost a shirt after} = \frac{36{,}000}{30} + 5{,}000 = 1{,}200 + 5{,}000 = \text{TShs } 6{,}200$$

$$\text{Profit before} = (9{,}000 - 7{,}000) \times 12 = \text{TShs } 24{,}000 \text{ a day}$$

$$\text{Profit after} = (9{,}000 - 6{,}200) \times 30 = \text{TShs } 84{,}000 \text{ a day}$$

The name of the economy: the economy of disintegration, also called specialisation. Once an industry is large enough, production splits into separate processes, each handed to a firm that does nothing else and does it all day.

Why she pays out more yet pays less: she now hands TShs 1,000 a shirt to outsiders. But cutting, embroidering and pressing ate most of her day: freed of all three she sews thirty shirts instead of twelve, so the fixed TShs 36,000 falls from TShs 3,000 to TShs 1,200. That TShs 1,800 beats the TShs 1,000 paid out.

Why the economy is external and not internal: could one tailor have arranged this alone? A band knife that cuts forty layers must run all day to pay for itself, and a computerised embroidery machine costs more than Mama Zena's stall. Neither specialist could live on her trade, and both live on two hundred stalls.

What a lone tailor cannot copy: a tailor in a quiet suburb with the same skill, the same machine and the same rent will still cut and embroider with her own hands, still finish twelve shirts a day and still pay TShs 7,000 for each. The difference is the industry each woman sits inside.

Across three hundred working days her profit rises from about TShs 7.2 million to about TShs 25.2 million, and she bought nothing. But the crowding that brought the cutter and the embroiderer has pushed Congo Street rents far above suburban ones.

The Master Key: *Ask whether one firm on its own could have arranged the saving; if it could not, the industry arranged it, and the economy is external.*

REAL Question 223

Mr Mwaikambo's mill at Iyunga outside Mbeya has grown twice in five years, and twice his cost a sack has gone up. The two rises have nothing in common but the direction.

From the mill's records below, calculate the average cost a sack in each of the three years, state the marginal cost of the extra output in year three, and diagnose each of the two rises, stating clearly which is a case of diminishing returns and which is a case of diseconomies of scale.

Mr Mwaikambo mills mahindi, that is, maize, into sembe, that is, maize flour, at Iyunga outside Mbeya. The figures below are milling costs only and exclude the grain itself.

Year one: one shed, two grinding mills and six workers. Output 300 sacks a day. Shed rent and machine depreciation TShs 30,000 a day, wages TShs 90,000, power and packing TShs 120,000.

Year three: the same shed and the same two mills, but ten workers. Output 360 sacks a day. Shed rent and depreciation TShs 30,000, wages TShs 150,000, power and packing TShs 144,000.

Year five: three sheds, six grinding mills and eighteen workers, together with two supervisors at TShs 30,000 a day each, a manager at TShs 60,000, a storekeeper at TShs 25,000 and a clerk at TShs 20,000. Output 750 sacks a day. Shed rent and depreciation TShs 90,000, wages TShs 270,000, power and packing TShs 300,000.

Power and packing have cost TShs 400 a sack throughout, and every mill worker is paid TShs 15,000 a day.

Model Answer

Average cost rises from TShs 800 to TShs 900 and then to TShs 1,100 a sack. The first rise is diminishing returns in the short run, only labour having been added to a fixed plant; the second is diseconomies of scale in the long run, every factor having risen together.

Total the three accounts and divide each by that year's output.

$$\text{Total cost, year one} = 30{,}000 + 90{,}000 + 120{,}000 = \text{TShs } 240{,}000$$

$$\text{Cost a sack, year one} = \frac{240{,}000}{300} = \text{TShs } 800$$

$$\text{Total cost, year three} = 30{,}000 + 150{,}000 + 144{,}000 = \text{TShs } 324{,}000$$

$$\text{Cost a sack, year three} = \frac{324{,}000}{360} = \text{TShs } 900$$

$$\text{Total cost, year five} = 90{,}000 + 270{,}000 + 300{,}000 + 165{,}000 = \text{TShs } 825{,}000$$

$$\text{Cost a sack, year five} = \frac{825{,}000}{750} = \text{TShs } 1{,}100$$

Year	Plant	Workers	Sacks a day	Total cost (TShs)	Cost a sack (TShs)
One	1 shed, 2 mills	6	300	240,000	800
Three	1 shed, 2 mills	10	360	324,000	900
Five	3 sheds, 6 mills	18 plus 5 staff	750	825,000	1,100

Five years at a sembe mill outside Mbeya.

The first rise is a short run rise: between year one and year three the shed and the two mills did not change; only labour changed, from six workers to ten. That is the setting the law of diminishing returns describes, a variable factor added to a fixed factor.

Read it in the product figures first: output a worker collapses, and the marginal product of the newcomers is a fraction of what the original hands produced.

$$\text{Output a worker, year one} = \frac{300}{6} = 50 \quad \text{year three} = \frac{360}{10} = 36$$

$$\text{Marginal product of the four extra workers} = \frac{360 - 300}{4} = 15 \text{ sacks each}$$

Now read it in the cost figures: the four extra hands cannot grind faster than two mills will grind, so they queue, they fetch and carry and they get in each other's way. Their sacks are dear ones.

$$\text{Marginal cost of the extra sacks} = \frac{324{,}000 - 240{,}000}{360 - 300} = \frac{84{,}000}{60} = \text{TShs } 1{,}400$$

What that TShs 1,400 means: the sixty extra sacks cost TShs 1,400 each, well above the TShs 800 the mill had been averaging, so they drag the average up. Diminishing returns reaches the accounts this way, cured by sending four workers home or buying a third mill.

The second rise is a long run rise: sheds went from one to three, mills from two to six and mill workers from six to eighteen. Every physical factor was multiplied by three, so nothing was fixed and diminishing returns has nothing to say.

Test the returns to scale: constant returns to scale would have tripled output from 300 to 900 sacks a day. The mill reached only 750, and that shortfall of 150 sacks is decreasing returns to scale.

$$\text{Cost a sack had output tripled too} = \frac{90{,}000 + 270{,}000 + 360{,}000}{900} = \frac{720{,}000}{900} = \text{TShs } 800$$

$$\text{Cost a sack at 750 sacks, before the office staff} = \frac{660{,}000}{750} = \text{TShs } 880$$

$$\text{Supervision and office staff a sack} = \frac{165{,}000}{750} = \text{TShs } 220$$

$$800 + 80 + 220 = \text{TShs } 1{,}100$$

Where the extra TShs 300 a sack went: at 900 sacks the tripled mill would have cost TShs 800 a sack, as in year one. Producing only 750 lifts that to TShs 880, so TShs 80 of the rise is the output shortfall. The remaining TShs 220 is the supervision and office staff the little mill never needed.

Naming the diseconomies behind those figures: the TShs 220 is managerial diseconomy: one owner who cannot see three floors pays others to look for him, with communication diseconomy beside it, an instruction now passing through a supervisor. The 150 sack shortfall adds delegated power, mills idle for grain a storekeeper has not released.

The two rises call for opposite remedies. Year three is wrong proportions, cured by changing the mix. Year five is wrong size: the mill has grown past what one man can run, so the cure is three separate mills under three owners.

The Master Key: *Ask what was fixed while cost was rising: something fixed means diminishing returns, nothing fixed means a diseconomy of scale.*

HOT Question 224

A planner wants every furniture maker in Dar es Salaam moved onto one estate at Vingunguti. The carpenters say they will be ruined; the economist says they will be cheaper. Somebody is wrong.

To what extent should Tanzania encourage its firms to concentrate in industrial clusters?

Model Answer

Tanzania should encourage clustering, but only while the external economies a cluster creates still outweigh the external diseconomies, which means several clusters rather than one, each where an industry has a real reason to be, with roads, power and waste treatment ahead of the crowd.

A cluster creates a pool of skilled labour: where two hundred tailors work one street, a machinist is hired the same morning and no firm trains raw hands. Mererani has cutters, Kariakoo machinists, Mwanza filleters.

It makes specialist and ancillary firms possible: the best equipment is indivisible: a band knife, an ice plant, a cold store, an embroidery machine. Each must work all day to pay for itself, and only a cluster keeps it busy.

It makes public investment worth making: a tarred road, a power line, a water main and an effluent plant carry heavy fixed costs, ruinous over one firm and small over a hundred. Hence the SIDO estates and the export processing zones.

Information and standards travel faster inside a cluster: a better drying method tried in one Mtwara factory is next door within a season, and a buyer will inspect twenty suppliers in a morning where he would not travel four days for one.

It lets small firms reach a scale they cannot reach alone: the typical firm here is very small, and a cluster hands it cheap credit, skills, transport and specialist services that only a large firm could otherwise obtain.

Against this, the diseconomies arrive with the economies: the same crowd bids up the wage of scarce skills and the rent of land, jams the road, raises advertising rates and concentrates the waste until somebody must treat it. A cluster's cost curve falls, then rises.

A cluster policy deepens regional imbalance: investment, skilled people and public money flow to the few places chosen, and the districts left out fall further behind. Concentration in Dar es Salaam and Arusha is efficient for those firms and hard on Kigoma and Rukwa.

A town that lives on one industry falls with it: the links that spread a gain also spread a shock. If the perch stock of Lake Victoria collapses, the processors, the ice plant, the carton maker, the hauliers and the bank branch fail together.

Clusters cannot simply be decreed: an industry gathers where there is a genuine reason: a lake, a port, a mine, a crop or a road. An estate built where none exists stays half empty, and watering a cluster that has begun is cheaper than planting one.

So yes, on three conditions: the site must have a real reason to hold that industry; roads, power and waste treatment must go in ahead of the crowding; and there must be several clusters, so no town carries all the risk.

The Master Key: *A cluster is worth encouraging while its external economies still exceed its external diseconomies, and public spending on roads, power and waste is what keeps that inequality true.*

HOT Question 225

A Kilombero manager is told by a visiting consultant that his estate has grown too big to be efficient. The estate has been growing for sixty years and has never yet shrunk.

Assess the claim that a firm which grows large is bound in the end to become inefficient.

Model Answer

The claim is a half truth: the internal diseconomies it rests on are real and every large Tanzanian firm meets them, but they are organisational faults that good management can postpone almost indefinitely, so a large firm risks inefficiency and is not condemned to it.

Communication really does deteriorate with size: delay and inaccuracy grow with every layer. A village miller knows in minutes that his sifter has jammed; a company running fourteen mills from a head office may not know for a week.

Delegation dilutes both information and incentive: the owner hands decisions to managers who know less about the whole firm and keep none of the shillings they save. Some pursue their own department instead, and the loss shows only as costs quietly too high.

Judgement at the top cannot be multiplied: a firm can buy more land, machines and workers, but not more of the judgement that made it successful. Adding managers adds coordination, not judgement, and the entrepreneur behaves rather like a fixed factor against which everything else is increased, though the long run fixes nothing.

Industrial relations worsen as the workforce grows impersonal: a plant of two thousand cannot run on the personal loyalty that carries a workshop of ten. Rules replace conversation, effort slackens where nobody watches, and disputes cost more because each stops more output.

The measured evidence is L shaped, not U shaped: when engineers cost real plants of different sizes, the curve falls, then flattens, and rarely turns up over any capacity anybody would build. Cement, brewing, milling and telecommunications all show it.

A firm can also buy management on the market: the claim assumes the owner is stuck with the ability he was born with. A growing firm can hire accountants, engineers and trained managers because it can now afford them, an internal economy in reverse.

Diseconomies can be cured; a fixed factor cannot: a firm can redraw its own organisation chart: divisions answering for their own profit, a manager's pay tied to what he controls, fewer layers, distant plants run as subsidiaries. Kilombero can make each estate answerable for its own tonnes.

Improving communications keep pushing the ceiling outward: firms became unwieldy because information travelled slowly, carried by people. When a manager at Mtibwa reads the day's crushing figures on a telephone, the clerks who carried them are not needed and the turning point moves right.

In Tanzania the market bites long before diseconomies do: most firms here stop growing because they ran out of buyers, not because they became clumsy. A sembe mill, a furniture workshop, a bus company on one route: each is limited by its market.

The claim confuses a tendency with a fate. Complexity costs, and the cost rises with size, so a firm that grows without paying it in managers, systems and incentives will become inefficient. Ask not how big a firm is but whether it redesigned itself.

The Master Key: *Large firms are not condemned to inefficiency; they are billed for complexity, and they become inefficient only when they refuse to pay the bill.*

HOT Question 226

The owner of a Mtwara cashew factory doubled his shelling floor and now says the size is killing him. His accountant has three other explanations, and one of them is not about cost at all.

A Mtwara cashew processing firm doubled its capacity last year and finds that its cost a tonne of kernel has risen. Advise the owner on whether he is suffering diseconomies of scale, and explain how he should establish the true cause.

Korosho Bora Limited shells and dries raw cashew into kernel at Mtwara.

Last year it doubled its capacity, taking a second building, twice the machinery and twice the workers.

Its cost a tonne of kernel has risen from TShs 4,200,000 to TShs 5,100,000.

In the same year the auction price of raw cashew rose sharply, the minimum wage was raised, a second shift was put on the old shelling machines for six months before the new building opened, and the export price of kernel fell from TShs 6,000,000 to TShs 5,400,000 a tonne.

Model Answer

The owner should not yet blame his size: at least three other causes are present in the same year, and only one of the four would call for the firm to shrink, so he must first strip out the causes that have nothing to do with scale.

Begin by separating what happened to cost from what happened to profit, which the owner has run together.

$$\text{Profit a tonne last year} = 6{,}000{,}000 - 4{,}200{,}000 = \text{TShs } 1{,}800{,}000$$

$$\text{Profit a tonne this year} = 5{,}400{,}000 - 5{,}100{,}000 = \text{TShs } 300{,}000$$

$$\text{Loss a tonne} = 900{,}000 + 600{,}000 = \text{TShs } 1{,}500{,}000$$

First, TShs 600,000 is not a cost rise at all: of the TShs 1,500,000 lost on every tonne, only TShs 900,000 is a rise in cost. The other TShs 600,000 is the fall in the export price of kernel, which squeezes the margin without touching cost.

Second, factor prices are not his fault: the auction price of raw cashew and the higher wage lift the cost a tonne of every processor in Mtwara. The whole curve has shifted up, and shrinking will not lower it; if more processors now bid for the same crop, it is an external diseconomy.

Third, the second shift is diminishing returns: for six months he ran extra workers on the old shelling machines while the new building was being fitted, a variable factor added to a fixed factor. That is short run crowding, cured when the new machines take the load.

Fourth, bad management is not a diseconomy of scale: a firm that doubles without training supervisors, without a stores system and without anybody costing the output will waste kernel and idle machines at any size. Diseconomy of scale compares well run firms, this size against half.

What a genuine diseconomy of scale would look like: all factors increased together, factor prices unchanged, technique unchanged, the plant fully loaded, no mismanagement, and the cost a tonne still higher while rivals of the old size produce more cheaply. Only then is the remedy two separate firms, or the sale of one.

The two tests he should actually run: first, re-cost this year's output at last year's nut price and wage and see how much of the TShs 900,000 survives; whatever vanishes was factor prices. Second, ask a processor of the old size in the same town what his cost did.

One more figure worth watching: compare tonnes of kernel a worker before and after. If output a worker held up while cost a tonne rose, the trouble is prices or overhead; if it fell while every factor doubled, the case against his size is serious.

So do not shrink yet. Most of the damage is a price fall and a factor price rise, and part of the rest is short run crowding that has passed. Everything turns on whether the rise survives with factor prices held constant and the building fully loaded.

The Master Key: *Before blaming the size of a firm, hold its factor prices constant and look at a rival of the old size; if the rise survives both tests, it is a diseconomy of scale.*

Total, Average and Marginal Revenue

Money comes into a firm the way output comes out of it, in three different measures. Total revenue is the whole takings, average revenue is those takings shared over the units sold, and marginal revenue is what the last unit brought in. Whether the three move together or pull apart depends on one thing only: whether the firm may set its price or must accept it. This section defines all three, tabulates them, draws them, and connects marginal revenue to elasticity.

BINDER Question 227

A Kariakoo shopkeeper counts TShs 800,000 in the till and calls it a good day. He cannot say what his last shirt brought in, and that is the figure that decides.

Define total revenue, average revenue and marginal revenue, state the formula for each, and show that average revenue is the price of the product.

Model Answer

Total revenue is the whole sum a firm receives from selling its output, average revenue is that sum divided by the units sold, which works out to be the price itself, and marginal revenue is the addition to total revenue made by selling one more unit.

Total revenue: the whole money receipt from selling a firm's output over a period, price multiplied by quantity sold. A Kariakoo shop selling 40 school shirts a day at TShs 20,000 each takes in TShs 800,000.

$$\mathrm{TR} = \mathrm{P} \times \mathrm{q}$$

where P is the price per unit and q the quantity sold. Total revenue is not profit and not income: nothing has yet been paid for the shirts, the stall or the hand who sold them.

Average revenue: the revenue per unit of output sold, total revenue divided by the quantity sold. It is what a trader means when he says what a shirt fetched him.

$$\mathrm{AR} = \frac{\mathrm{TR}}{\mathrm{q}} = \frac{\mathrm{P} \times \mathrm{q}}{\mathrm{q}} = \mathrm{P}$$

So average revenue is the price: the quantity cancels out and leaves the price standing alone. This is no approximation and no special case: it holds at every output and in every market, because dividing by quantity undoes the multiplication that formed total revenue.

Therefore the average revenue curve is the firm's demand curve: a demand curve shows the quantity buyers will take at each price; the average revenue curve shows the revenue per unit at each quantity. Since revenue per unit is the price, both are drawn from the same figures and are one line.

Marginal revenue: the addition made to total revenue by the sale of one more unit, everything else unchanged. It answers what the last shirt brought in, as distinct from what the whole day's selling brought in.

$$\mathrm{MR} = \frac{\Delta\,\mathrm{TR}}{\Delta\,\mathrm{q}}$$

where Δ TR is the change in total revenue and Δ q the change in quantity. Where total revenue is continuous, marginal revenue is its derivative:

$$\mathrm{MR} = \frac{\partial\,\mathrm{TR}}{\partial\,\mathrm{q}}$$

One line worked in full: suppose 40 shirts sell at TShs 20,000 but 41 need a price of TShs 19,800. Total revenue rises from TShs 800,000 to TShs 811,800, so the forty-first shirt's marginal revenue is TShs 11,800 while average revenue is TShs 19,800, the price.

A producer who watches only the heap will go on selling long after his last unit has stopped adding to it.

The Master Key: *Total revenue is price times quantity, average revenue is the price itself, and marginal revenue is what the last unit added.*

BINDER Question 228

A Morogoro carpenter drops the price of a bed by fifty thousand shillings and sells one more. His delight lasts until he counts the beds he had already sold.

Copy the demand schedule below and complete the total revenue, average revenue and marginal revenue columns, then state what the completed schedule shows about the behaviour of the three.

Kazi Njema Furniture is a small workshop on the SIDO estate at Morogoro, making metal framed beds to its own design.

The workshop has its own customers, so it must lower its price if it is to sell more beds in a week.

Beds it can sell in a week: 1 at TShs 350,000; 2 at TShs 300,000; 3 at TShs 250,000; 4 at TShs 200,000; 5 at TShs 150,000; 6 at TShs 100,000.

Every bed sold in a given week is sold at the same price.

Model Answer

Completed, the schedule shows average revenue falling by TShs 50,000 a step and marginal revenue by TShs 100,000, twice as fast, so marginal revenue lies below average revenue throughout, gives its last positive figure at the fourth bed where total revenue peaks at TShs 800,000, and turns negative at the fifth.

Total revenue is the price times the beds sold at it, average revenue is total revenue divided by those beds, and marginal revenue is the difference between one row and the row above.

Beds a week (q)	Price a bed (TShs)	Total revenue (TShs)	Average revenue (TShs)	Marginal revenue (TShs)
1	350,000	350,000	350,000	350,000
2	300,000	600,000	300,000	250,000
3	250,000	750,000	250,000	150,000
4	200,000	800,000	200,000	50,000
5	150,000	750,000	150,000	-50,000
6	100,000	600,000	100,000	-150,000

Weekly revenue schedule of Kazi Njema Furniture, Morogoro, a workshop that must cut its price to sell more.

Two rows worked in full: at three beds, $\text{TR} = 250{,}000 \times 3 = 750{,}000$ and $\text{MR} = 750{,}000 - 600{,}000 = 150{,}000$ shillings. At five beds $\text{TR} = 150{,}000 \times 5 = 750{,}000$ and $\text{MR} = -50{,}000$ shillings, so the fifth bed takes TShs 50,000 out of the week.

The average revenue column repeats the price column: every entry in the fourth column repeats the entry in the second, since $\text{AR} = (\text{P} \times \text{q}) \div \text{q} = \text{P}$. Read as a curve, the first two columns are the workshop's demand curve and its average revenue curve.

Marginal revenue falls twice as fast: average revenue steps down 350, 300, 250, 200, 150 and 100 thousand shillings; marginal revenue steps down 350, 250, 150, 50, minus 50 and minus 150 thousand. The schedule is the straight line $\text{P} = 400{,}000 - 50{,}000\text{q}$.

Why marginal revenue is below average revenue: take the move from three beds to four. The workshop gains the price of the fourth bed, TShs 200,000, but must now accept TShs 50,000 less on each of the three it was already selling:

$$\text{Gain on the extra bed} = 200{,}000$$

$$\text{Loss on the beds already being sold} = 3 \times 50{,}000 = 150{,}000$$

$$\text{MR} = 200{,}000 - 150{,}000 = 50{,}000$$

which is the figure the table gives. The more units already being sold, the heavier that loss, so marginal revenue sinks away from the price faster as output grows.

Total revenue rises, peaks and falls: it climbs from TShs 350,000 to a maximum of TShs 800,000 at four beds, then falls to TShs 750,000 and TShs 600,000. The peak stands at the last bed whose marginal revenue is still positive.

Whatever a bed costs to make, the workshop should never make the fifth: it brings in less than the four before it while using steel, paint and a day of the fundi's time.

The Master Key: *Average revenue is the price column written twice; marginal revenue falls twice as fast and its last positive entry names the peak of total revenue.*

BINDER Question 229

A Shinyanga cotton grower asks the ginnery for a better price and is refused. He asks how much they will take at the going price, and the answer is: all of it.

Complete the revenue schedule of the grower below and, with the aid of a diagram, draw his average, marginal and total revenue curves, explaining the shape of each.

> Bwana Shija grows seed cotton at Kishapu in Shinyanga and sells it to the ginneries at the ruling price of TShs 1,200 a kilogramme.
>
> He is one of many thousands of growers and his cotton is the same seed cotton as everybody else's, so he can sell every kilogramme he picks at TShs 1,200 and not one kilogramme above that price.
>
> Complete the schedule for 0, 500, 1,000, 1,500, 2,000 and 2,500 kilogrammes.

Model Answer

Because the price is the same at every quantity he offers, his average revenue and his marginal revenue are both equal to that price of TShs 1,200 at every output, and total revenue rises in equal steps, so its curve is a straight line through the origin.

Total revenue is the ruling price multiplied by the kilogrammes sold, average revenue is total revenue divided by those kilogrammes, and marginal revenue is the change in total revenue across each step of 500 kilogrammes.

Kilogrammes sold (q)	Price (TShs a kg)	Total revenue (TShs)	Average revenue (TShs a kg)	Marginal revenue (TShs a kg)
0	1,200	0	-	-
500	1,200	600,000	1,200	1,200
1,000	1,200	1,200,000	1,200	1,200
1,500	1,200	1,800,000	1,200	1,200
2,000	1,200	2,400,000	1,200	1,200
2,500	1,200	3,000,000	1,200	1,200

Revenue schedule of a Kishapu cotton grower who sells at the ruling price of TShs 1,200 a kilogramme.

One row worked in full: at 1,500 kilogrammes, $\text{TR} = 1{,}200 \times 1{,}500 = 1{,}800{,}000$ shillings, $\text{AR} = 1{,}200$ and $\text{MR} = 1{,}200$ shillings a kilogramme. The three have collapsed into one figure, and that figure is the price.

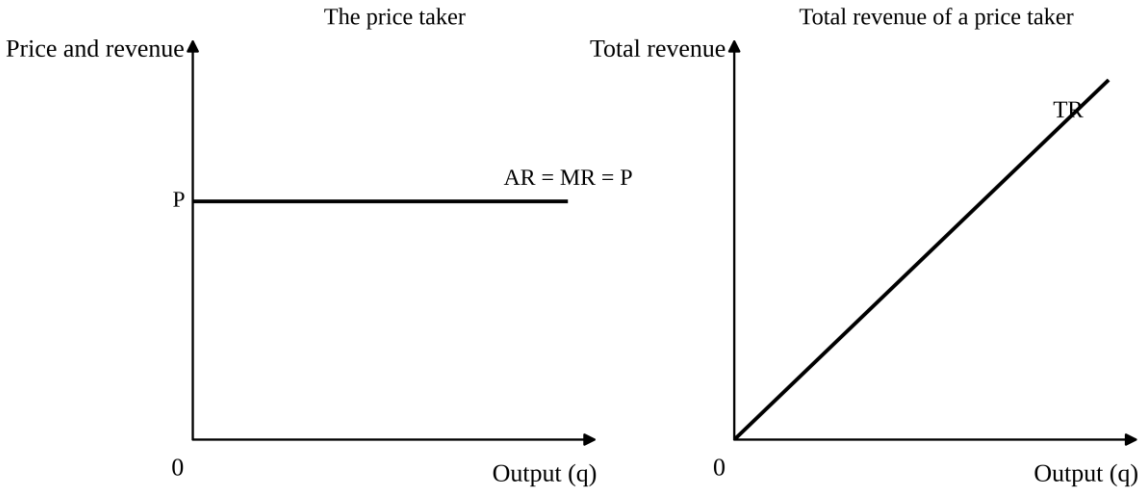


Figure 5.27: Average, marginal and total revenue for a price taker

The left panel, average and marginal revenue: a single horizontal line at the ruling price, labelled AR = MR = P. The price does not move whatever quantity Bwana Shija brings: at TShs 1,200 the ginneries take everything, a shilling above it nothing.

A distinction that must be kept: the demand curve for Tanzanian seed cotton slopes downwards, and a large crop would push the price down. What is horizontal is the curve facing one grower, whose crop is a trivial fraction of the whole.

The right panel, total revenue: a straight line rising from the origin, because nothing sold earns nothing and every extra kilogramme adds the same TShs 1,200. Its slope, the same at every point, is that price.

$$\mathrm{TR} = 1{,}200 \times \mathrm{q}$$

$$\mathrm{MR} = \frac{\partial\,\mathrm{TR}}{\partial\,\mathrm{q}} = 1{,}200 = \mathrm{AR} = \mathrm{P}$$

Why the three are equal here: selling one more kilogramme he receives its full price of TShs 1,200 and loses nothing on those already sold. There is no price cut to pay for, so marginal revenue is the price entire.

There is no revenue peak on this curve: total revenue never stops climbing, since every kilogramme adds TShs 1,200 and none adds less. His limit is his acres, his pickers and what an extra kilogramme costs to grow, never his demand curve.

All this holds only while he can sell whatever he brings at the ruling price. Should the ginneries cap him at 2,000 kilogrammes, or his crop grow large enough to move the market, the line would bend.

The Master Key: *For a price taker AR = MR = P, and total revenue is a straight line through the origin whose slope is that price.*

BINDER Question 230

A Tanga trader cuts the price of a khanga by two hundred shillings to catch one more buyer. Every other buyer that morning pays two hundred shillings less as well.

With the aid of a diagram, show the total, average and marginal revenue curves of a firm that must lower its price in order to sell more, and explain why marginal revenue lies below average revenue.

Model Answer

For a firm facing a downward sloping demand curve, marginal revenue lies below average revenue at every positive output and falls twice as steeply, because the price cut that wins the extra sale must be granted on every unit already sold; total revenue peaks where marginal revenue is zero.

Draw two panels on one horizontal scale of output, total revenue above and revenue per unit below, so a vertical line joins the same quantity in both.

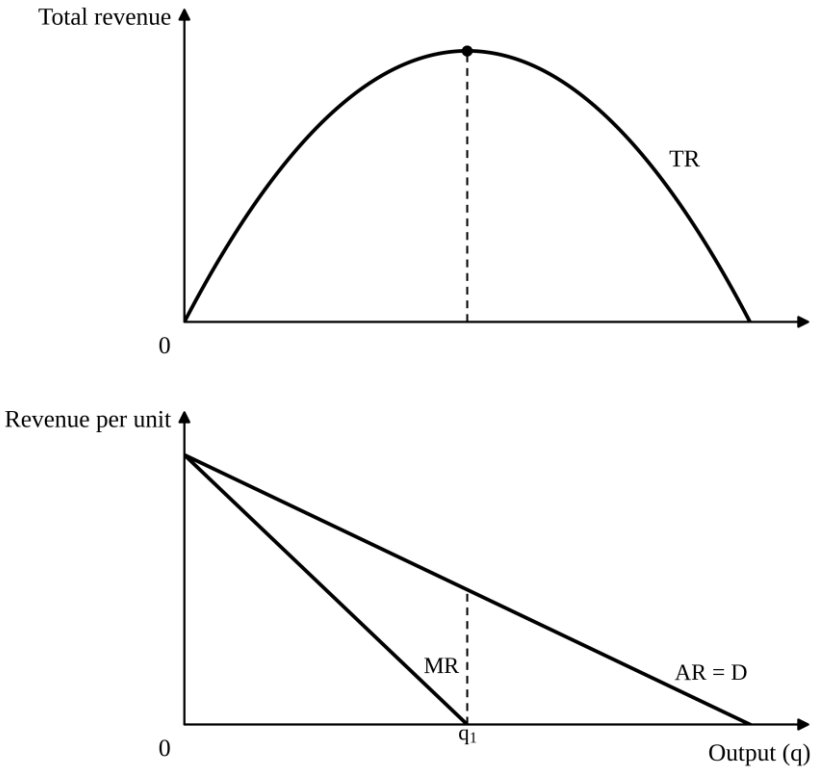


Figure 5.28: Total, average and marginal revenue for a price maker

The average revenue curve in the lower panel: the flatter downward sloping line, labelled AR = D. Its height is the price that output fetches, and it falls because a larger quantity needs a lower price.

The marginal revenue curve lies below it: the steeper line, from the same intercept, falling twice as fast. They start together because the first unit has no earlier units to spoil. From the second unit a gap opens and widens.

Why the gap exists: follow the Tanga trader. He sells 30 khanga at TShs 14,000 each and must drop the price to TShs 13,800 to sell 31, and the drop applies to every khanga sold.

$$\text{TR at } 30 = 30 \times 14{,}000 = 420{,}000$$

$$\text{TR at } 31 = 31 \times 13{,}800 = 427{,}800$$

$$\text{MR} = 427{,}800 - 420{,}000 = 7{,}800$$

The other way round explains it: he gains TShs 13,800 on the thirty-first khanga and loses TShs 200 on each of the 30 already sold, TShs 6,000 in all:

$$\text{MR} = 13{,}800 - (30 \times 200) = 13{,}800 - 6{,}000 = 7{,}800$$

The rule the arithmetic gives: marginal revenue is the price of the extra unit minus the revenue given away on the earlier ones. That term is positive whenever demand slopes downwards, so marginal revenue is below the price.

The total revenue curve in the upper panel: it leaves the origin, rises at a decreasing rate, reaches a dome shaped maximum, then falls. It rises while marginal revenue is positive, peaks where it is zero and falls where it is negative.

What the dashed line says: it drops from the peak of total revenue to q_1, where the marginal revenue line cuts the axis. Marginal revenue is the slope of total revenue, and a curve peaks where its slope is zero.

One warning the diagram carries: at q_1 the average revenue curve is still well above the axis, so the firm is charging a healthy price. A good price and a worthless last unit sit together, so no producer can judge output by price.

The output q_1 is a ceiling, never a target. Every unit up to it used real steel, real cloth and real hours, and the last added nothing to the takings while adding to the bill.

The Master Key: *MR lies below AR because the price cut that wins the extra sale must be granted on every unit already being sold.*

BINDER Question 231

Two Mwanza sellers stand a hundred metres apart at Kirumba. One posts his own price and holds it; the other takes whatever the shed shouts. Their revenue curves share nothing.

Distinguish between a price taker and a price maker, and explain how the difference shows itself in the firm's total, average and marginal revenue.

Model Answer

A price taker sells any quantity at the ruling price, facing a horizontal demand curve on which average revenue, marginal revenue and price are one figure; a price maker must lower its price to sell more, so marginal revenue lies below average revenue and falls twice as fast.

Why a price taker's demand curve is horizontal: three conditions: his output is a negligible fraction of the trade, his product is indistinguishable from rivals', and buyers know the going price and move freely between sellers. Ask a shilling more and he sells nothing; ask less and he gains nothing.

The taker's three revenue figures: average revenue equals the ruling price and does not move; marginal revenue equals it too, because an extra sale costs him nothing on the units already sold; and total revenue is a straight line from the origin.

Why a price maker's demand curve slopes downwards: he possesses something of his own: a design, a corner location, a name buyers trust, credit for regulars, a stretch of road no rival serves. So he keeps custom after asking more, and sells more only by asking less.

The maker's three revenue figures: average revenue falls as output rises; marginal revenue falls twice as fast; and total revenue peaks where marginal revenue is zero. The line $P = a - bq$ gives $TR = aq - bq^2$ and $MR = a - 2bq$.

The whole difference in one sentence: the price maker must cut the price on all the units he was already selling, so his gain on the extra unit is reduced by the loss on the rest. The taker suffers no such loss.

A consequence for the taker: he has no revenue maximising output at all. Total revenue climbs without limit as he sells more, so nothing on the revenue side tells him to stop; capacity and costs alone do that.

A consequence for the maker: he has a definite revenue maximising output, where marginal revenue reaches zero, and would never sell beyond it whatever his costs, because those units reduce his takings while adding to his bill.

The two are ends of a range, not boxes: the Kirumba dagaa trader is nearly a pure taker, a workshop with its own design a modest maker, the only cement plant in a region a strong one. Ask always how much custom stays after a small rise.

The Master Key: *One firm takes the price and keeps AR = MR = P; the other makes the price and pays for every extra sale with a cut on all the rest.*

BINDER Question 232

A Singida press writes its demand on one line of a notebook: five shillings off the price for every extra bottle. Two lines of algebra then say where its takings stop climbing.

For a firm whose demand curve is the straight line $P = a - bq$, derive the total revenue and marginal revenue functions and state how the marginal revenue line is related to the demand curve. Then apply your result to the press described below.

Alizeti Oil Press at Singida bottles sunflower oil, alizeti, in five litre bottles.

The monthly demand for its oil is $P = 35{,}000 - 5q$, where P is the price of a bottle in shillings and q is the number of bottles sold in the month.

Find the total revenue and marginal revenue functions, the quantity and price at which total revenue is greatest, and the amount of that revenue.

Model Answer

For $P = a - bq$**,** $TR = aq - bq^2$ **and** $MR = a - 2bq$**, so the marginal revenue line has the demand curve's intercept and twice its slope. For the press,** $TR = 35{,}000q - 5q^2$ **and** $MR = 35{,}000 - 10q$**, and revenue is greatest at 3,500 bottles priced at TShs 17,500, or TShs 61,250,000 in the month.**

Total revenue is price times quantity, so put the demand curve in place of the price and multiply out.

$$TR = P \times q = (a - bq)q = aq - bq^2$$

Marginal revenue is the rate at which total revenue changes, the derivative of total revenue with respect to output.

$$MR = \frac{\partial TR}{\partial q} = a - 2bq$$

Same intercept, twice the slope: at $q = 0$ both lines stand at the height a. Average revenue then falls by b a unit and marginal revenue by 2b, so the marginal line is twice as steep and cuts the axis halfway along the demand line.

$$AR = a - bq = 0 \quad \text{at} \quad q = \frac{a}{b}$$

$$MR = a - 2bq = 0 \quad \text{at} \quad q = \frac{a}{2b}$$

Where total revenue is greatest: a curve turns where its slope is zero, and that slope is marginal revenue, so total revenue turns where $MR = 0$, that is at $q = a \div 2b$. The second derivative is negative at every output, so the turn is a peak:

$$\frac{\partial^2 TR}{\partial q^2} = -2b < 0$$

Now the press at Singida, where $P = 35{,}000 - 5q$, so $a = 35{,}000$ and $b = 5$. Multiply by output for total revenue.

$$TR = (35{,}000 - 5q)q = 35{,}000q - 5q^2$$

$$MR = \frac{\partial TR}{\partial q} = 35{,}000 - 10q$$

Set marginal revenue equal to zero to find where the takings stop climbing.

$$35{,}000 - 10q = 0$$

$$10q = 35{,}000$$

$$q = 3{,}500 \text{ bottles}$$

Put that quantity back into the demand curve for the price.

$$P = 35{,}000 - 5(3{,}500) = 35{,}000 - 17{,}500 = 17{,}500$$

And into the total revenue function for the revenue itself.

$$TR = 35{,}000(3{,}500) - 5(3{,}500)^2$$

$$TR = 122{,}500{,}000 - 61{,}250{,}000 = 61{,}250{,}000$$

Reading the answer: selling 3,500 five litre bottles at TShs 17,500 each brings the press TShs 61,250,000 in the month. At 3,400 and again at 3,600 bottles it is TShs 61,200,000, only TShs 50,000 less, so the top of the hill is flat.

A check on the halving rule: average revenue falls to zero at $q = 35{,}000 \div 5 = 7{,}000$ bottles, and marginal revenue reaches zero at 3,500, exactly half of that. The halving follows from the doubled slope, and it draws the marginal revenue line without any computing.

3,500 bottles is where revenue is greatest, not profit. The last bottle adds nothing to the takings while costing seed, bottles, power and labour, so the press will stop short of it.

The Master Key: *For* $P = a - bq$ *the marginal revenue line has the same intercept and twice the slope, so revenue peaks at half the output at which the price would fall to zero.*

REAL Question 233

Follow the Nile perch from an Igoma filleting bench to a buyer overseas. The exporter chooses how many kilogrammes to send and has no say whatever in what they fetch.

Work out the exporter's total, average and marginal revenue at each level of output, write down his total revenue function, and advise him on the broker's proposal.

Bwana Masalu runs a small filleting bench at Igoma in Mwanza and sells chilled Nile perch fillet to an overseas buyer.

The export price is settled in the world market at TShs 12,000 a kilogramme. The buyer will take every kilogramme Bwana Masalu can supply at that price, and nothing at all above it.

His bench can handle up to 800 kilogrammes a day and he works 26 days in the month.

A broker advises him to offer his fillet at TShs 11,400 a kilogramme so as to win more orders.

Model Answer

At every output his average revenue and marginal revenue are both TShs 12,000, the world price, so $\mathrm{TR} = 12{,}000\mathrm{q}$**; and the broker's proposal should be refused, because it would cost him TShs 480,000 a day, TShs 12,480,000 in the month, and buy nothing.**

Total revenue is the price multiplied by the quantity, and here the price does not move, so one number fixes the whole function.

$$\mathrm{TR} = 12{,}000 \times \mathrm{q}$$

$$\text{At } 200 \text{ kg} \quad \mathrm{TR} = 12{,}000 \times 200 = 2{,}400{,}000$$

$$\text{At } 400 \text{ kg} \quad \mathrm{TR} = 12{,}000 \times 400 = 4{,}800{,}000$$

$$\text{At } 600 \text{ kg} \quad \mathrm{TR} = 12{,}000 \times 600 = 7{,}200{,}000$$

$$\text{At } 800 \text{ kg} \quad \mathrm{TR} = 12{,}000 \times 800 = 9{,}600{,}000$$

Average revenue at every one of them: divide each total by the quantity that produced it and the world price comes back every time:

$$\mathrm{AR} = \frac{\mathrm{TR}}{\mathrm{q}} = \frac{9{,}600{,}000}{800} = 12{,}000$$

Marginal revenue from the schedule: between 600 and 800 kilogrammes total revenue rises by TShs 2,400,000 for 200 kilogrammes, so each of them added TShs 12,000:

$$\mathrm{MR} = \frac{\Delta\,\mathrm{TR}}{\Delta\,\mathrm{q}} = \frac{9{,}600{,}000 - 7{,}200{,}000}{800 - 600} = \frac{2{,}400{,}000}{200} = 12{,}000$$

Marginal revenue from the function: the same answer follows in one line, since the slope of a straight line through the origin is the same at every point:

$$\mathrm{MR} = \frac{\partial\,\mathrm{TR}}{\partial\,\mathrm{q}} = 12{,}000 = \mathrm{AR} = \mathrm{P}$$

Why the three collapse into one: selling one more kilogramme, Bwana Masalu receives the whole TShs 12,000 and gives up nothing on those already sold, which still fetch TShs 12,000. There is no price cut to pay for, so marginal revenue is the price itself.

Now the broker's proposal, tested at the bench's full output of 800 kilogrammes a day.

$$\text{Revenue at the world price} = 800 \times 12{,}000 = 9{,}600{,}000$$

$$\text{Revenue at the broker's price} = 800 \times 11{,}400 = 9{,}120{,}000$$

$$\text{Loss a day} = 9{,}600{,}000 - 9{,}120{,}000 = 480{,}000$$

$$\text{Loss in a month of 26 days} = 480{,}000 \times 26 = 12{,}480{,}000$$

The advice: refuse it. He can already sell everything the bench produces at TShs 12,000, so there is no order he is failing to win. The cut simply hands the buyer TShs 600 on every kilogramme he would have sold anyway.

The opposite error would be worse: ask TShs 12,600 and the buyer turns to the next bench along the lake, so he sells nothing at all. Demand is perfectly elastic as it faces him, although world demand for Nile perch is nothing like it.

Where his true limit lies: his revenue curve has no peak, so nothing here tells him when to stop. His limit is the 800 kilogrammes his bench can handle, the ice and the cold room, and the point where one more kilogramme costs more than the TShs 12,000 it brings.

He is a price taker because he is small and his fillet is like everybody else's. Should his supply grow enough to move the world price, or the overseas buyer be his only buyer, that line would tilt.

The Master Key: *A price taker gains the whole price on every extra unit, so cutting his price is a gift to the buyer and never a strategy.*

REAL Question 234

Mama Rehema knows her Kariakoo customers by name, which is why she can charge more than the stall opposite, and exactly why one more sale costs her something on all the rest.

Derive the shop's total revenue and marginal revenue functions, find the quantity and price at which its revenue is greatest, and show that selling twenty pairs fewer or twenty pairs more brings in less.

Mama Rehema keeps a shoe shop on Msimbazi Street in Kariakoo, selling black school shoes to parents who come back to her year after year.

The weekly demand at her shop is $q = 160 - \frac{P}{300}$, where q is the number of pairs she sells in the week and P is the price of a pair in shillings.

Every pair sold in a given week is sold at the same price.

Model Answer

Her total revenue function is $TR = 48{,}000q - 300q^2$ **and her marginal revenue is** $MR = 48{,}000 - 600q$**, so revenue is greatest at 80 pairs a week priced at TShs 24,000, bringing in TShs 1,920,000, while both 60 and 100 pairs bring only TShs 1,800,000.**

The demand relation is given with quantity as the subject, but revenue is price times quantity, so make price the subject first.

$$q = 160 - \frac{P}{300}$$

$$\frac{P}{300} = 160 - q$$

$$P = 300(160 - q) = 48{,}000 - 300q$$

This line is her average revenue curve: average revenue is the price, so $AR = 48{,}000 - 300q$ is her demand curve and her average revenue curve at once. At 40 pairs a week the price is TShs 36,000, and every pair sold that week fetches it.

Multiply the price by the quantity for total revenue, then differentiate for marginal revenue.

$$TR = P \times q = (48{,}000 - 300q)q = 48{,}000q - 300q^2$$

$$MR = \frac{\partial TR}{\partial q} = 48{,}000 - 600q$$

The marginal revenue line has the same intercept of 48,000 and twice the slope, 600 against 300, as the rule requires. Now set marginal revenue equal to zero:

$$48{,}000 - 600q = 0$$

$$600q = 48{,}000$$

$$q = 80 \text{ pairs a week}$$

$$P = 48{,}000 - 300(80) = 48{,}000 - 24{,}000 = 24{,}000$$

$$TR = 24{,}000 \times 80 = 1{,}920{,}000$$

Confirming that it is a peak: the second derivative of total revenue is negative at every output, so the turning point is a maximum:

$$\frac{\partial^2 \text{TR}}{\partial \text{q}^2} = -600 < 0$$

Now test the answer by moving twenty pairs each way along her demand curve.

$$\text{At q} = 60 \quad \text{P} = 48{,}000 - 18{,}000 = 30{,}000 \quad \text{TR} = 1{,}800{,}000$$

$$\text{At q} = 100 \quad \text{P} = 48{,}000 - 30{,}000 = 18{,}000 \quad \text{TR} = 1{,}800{,}000$$

Reading the test: either way she is TShs 120,000 a week worse off, the two figures identical because total revenue is a parabola peaking at 80. At 60 pairs marginal revenue is still positive at TShs 12,000; at 100 it is minus TShs 12,000.

Where the elastic part of her demand curve ends: marginal revenue is positive below 80 pairs and negative above, so her demand is elastic while she prices above TShs 24,000 and inelastic below. She should never let her price fall under TShs 24,000 a pair, because below it a cut loses her money twice over.

What she gains from her regular customers: the stall opposite, selling shoes nobody can tell apart, has a nearly flat demand curve. Mama Rehema's customers come back, so her curve slopes; that slope is worth money, and it costs her a cut on the pairs her regulars already buy.

Eighty pairs is where her takings are greatest, not her earnings. Each pair costs something from the wholesaler, and at 80 the last pair adds nothing while adding its full cost, so her best output lies to the left.

The Master Key: *Rearrange the demand relation into* $\text{P} = \text{a} - \text{bq}$, *differentiate the total revenue, and the output where marginal revenue dies is the top of the revenue hill.*

REAL Question 235

An Arusha operator cuts his safari price twice. The first cut fills the vehicles and the bank account. The second fills the vehicles and empties the bank account.

Complete the revenue schedule below, use it to classify the elasticity of demand over each interval, and advise the operator how far he should cut his price.

> Kilima Safaris of Arusha sells seats on a four day northern circuit tour.
>
> Bookings a month at each price: TShs 900,000 a head, 40 bookings; TShs 800,000, 50 bookings; TShs 700,000, 60 bookings; TShs 600,000, 70 bookings; TShs 500,000, 75 bookings.
>
> Judge elasticity over an interval as the proportionate change in bookings divided by the proportionate change in price, each proportion taken on the average of the two ends of the interval, and ignore the sign.

Model Answer

Total revenue climbs from TShs 36,000,000 to a peak of TShs 42,000,000 and then falls, so demand is elastic above TShs 600,000, unit elastic over the step from TShs 700,000 to TShs 600,000 where marginal revenue is zero, and inelastic below; the operator should never cut his price under TShs 600,000 a head.

Total revenue is the price times the bookings taken at it, average revenue is the price itself, and marginal revenue is the change in total revenue divided by the change in bookings.

Price a head (TShs)	Bookings (q)	Total revenue (TShs)	Marginal revenue a head (TShs)	Elasticity over the interval
900,000	40	36,000,000	-	-
800,000	50	40,000,000	400,000	1.89, elastic
700,000	60	42,000,000	200,000	1.36, elastic
600,000	70	42,000,000	0	1.00, unit elastic
500,000	75	37,500,000	-900,000	0.38, inelastic

Monthly revenue schedule of Kilima Safaris, Arusha, as the price of a northern circuit seat is cut in steps.

One row worked in full: at TShs 800,000 with 50 bookings, TR = 40,000,000 shillings. From 40 bookings to 50 the takings rose by TShs 4,000,000 for 10 tourists, so MR = 400,000 a head, the TShs 100,000 cut being granted on the 40 bookings already held.

The total outlay test: watch what a price cut does to the third column. Where a cut raises total revenue, demand is elastic over that range; where it leaves total revenue unchanged, unit elastic; where it lowers it, inelastic.

The elasticity arithmetic on the crucial interval: from TShs 700,000 and 60 bookings to TShs 600,000 and 70, the bookings change by 10 on an average of 65 and the price by TShs 100,000 on an average of TShs 650,000:

$$\text{e} = \frac{10 \div 65}{100{,}000 \div 650{,}000} = \frac{0.1538}{0.1538} = 1$$

And marginal revenue says the same thing: total revenue does not move over that interval, standing at TShs 42,000,000 at both ends, so marginal revenue is zero. Unit elasticity, an unchanged total outlay and a zero marginal revenue are three descriptions of one event.

Below that price the ground falls away: cutting from TShs 600,000 to TShs 500,000 brings only five extra bookings, 70 to 75, so elasticity is 0.38 and demand is inelastic. Total revenue falls to TShs 37,500,000, a loss of TShs 4,500,000:

$$\text{MR} = \frac{37{,}500{,}000 - 42{,}000{,}000}{75 - 70} = \frac{-4{,}500{,}000}{5} = -900{,}000$$

The general rule the table demonstrates: marginal revenue is positive wherever demand is elastic, zero where it is unit elastic and negative where inelastic. So no firm sells in the inelastic stretch: raising the price brings more money from fewer tourists.

The advice: he must not go below TShs 600,000 a head, and should stop above it. Each extra tourist costs fuel, park fees, meals and guide's time. Over the step to 60 bookings marginal revenue is TShs 200,000, so if those costs exceed it, TShs 800,000 is better.

The total outlay test tells him which side of the hill he stands on; marginal revenue tells him how steep the ground is and what the next step down will cost. That is the figure to set against his fuel bill.

The Master Key: *Marginal revenue is positive while demand is elastic, zero at unit elasticity and negative when inelastic, so no firm sells where its own demand is inelastic.*

HOT Question 236

The trader says he sets his own price. The customer says every shop on Congo Street asks the same. Only one of them has made a claim that can be tested.

A Kariakoo trader insists that he fixes his own prices. Discuss whether he is a price taker or a price maker, and state what evidence would settle the question.

Model Answer

He is neither purely one nor the other: close to a price taker in the standard lines that make most of his turnover, a weak price maker in the differentiated part, and the question is settled by how much custom survives a small price rise.

The case that he is a price taker: in rice, soap, cement and a familiar imported charger, dozens of indistinguishable sellers stand within a hundred metres. Ask more than the street and the customer walks three doors down: what he calls fixing a price is matching one.

The case that he is a price maker: if he had no power, no two Kariakoo shops would quote different figures, and they plainly do. He has customers who trust him, credit for regulars, a corner position, Sunday opening, a reputation for taking returns.

The evidence that settles it: raise one price by five per cent for a fortnight, hold everything else steady and count what is sold. If sales go to nothing he is a taker; if he keeps most he is a maker; if he loses almost nothing he was pricing too low.

A second test, the goods themselves: cement, sugar and airtime are the same everywhere, so in those lines he takes the price. A shirt he has altered, a repair he has done, a delivery to the ward, a guarantee he stands behind: there he makes it.

A third test, what he does when a rival cuts: a price taker must follow within the hour or sell nothing; a maker holds his figure for days and loses only part of his custom. The speed at which he must follow measures how nearly horizontal his curve is.

A fourth test, the haggling itself: a posted figure in Kariakoo begins a conversation, evidence that no seller there is a pure taker, since nobody bargains over a price the market handed him. A grower selling seed cotton has nothing to bargain about.

Why the answer changes what he should do: if he is a taker, every extra sale brings the whole price, a cut is pure loss, and his energy belongs in buying cheaper. If he is a maker, he must reckon what a cut gives away on the customers he has.

His insistence is half true. He writes the figures on the tags, and within a narrow band he really is choosing; what he cannot do is price much above his neighbour and keep his buyers. The width of that band is a question of fact.

The Master Key: *Put the price up by five per cent and count what is left: a taker loses everybody, a maker loses only some.*

HOT Question 237

The manager announces record turnover and the workshop applauds. The owner, holding the invoices for the last two beds, does not join in.

Assess the view that a firm should aim to maximise its total revenue.

Kazi Njema Furniture of Morogoro can sell 1 bed a week at TShs 350,000, 2 at TShs 300,000, 3 at TShs 250,000, 4 at TShs 200,000 and 5 at TShs 150,000.

Every bed costs the workshop TShs 120,000 in steel, paint, power and the fundi's time.

Model Answer

The view is wrong as a general objective, since the revenue maximising output always exceeds the profit maximising output whenever an extra unit costs anything to make, though it can be defended where a firm buys market share, where managers are paid on turnover, or where the extra unit is nearly free.

The case for it, the manager's own interest: salaries, standing, security and the size of an office follow the size of a firm rather than its surplus, so a manager who is not the owner has reason to chase turnover, which happens where ownership is separated from control.

The case for it, growth and market share: a young firm may sell cheaply to build a name and regular customers, taking a thin return now for a larger trade later. Volume may also bring economies of scale, and banks look at turnover when they extend credit.

The case for it, where the extra unit is nearly free: an empty seat on a bus, a hotel room on a quiet night, a tray of mandazi stale by morning: one more sale costs almost nothing, so the revenue and profit maximising outputs nearly coincide.

The case against it, in figures: the Morogoro workshop's takings peak at four beds a week, at TShs 800,000. But every bed costs TShs 120,000 to make, so set the surplus at four beds against the surplus at three:

$$\text{At 4 beds: } 800{,}000 - (4 \times 120{,}000) = 800{,}000 - 480{,}000 = 320{,}000$$

$$\text{At 3 beds: } 750{,}000 - (3 \times 120{,}000) = 750{,}000 - 360{,}000 = 390{,}000$$

Reading those two lines: the revenue maximising output is four beds, the profit maximising output three. Chasing the record turnover costs the owner TShs 70,000 every week, about TShs 3,640,000 in a year.

The reason, in one line: the fourth bed adds TShs 50,000 to revenue and TShs 120,000 to cost, so it subtracts TShs 70,000 from profit. Revenue is greatest where marginal revenue is zero, profit where marginal revenue equals marginal cost.

$$\text{MR of the fourth bed} = 50{,}000 \quad \text{MC} = 120{,}000$$

A further cost the revenue chaser overlooks: four beds instead of three tie up more working capital and leave more stock to be stolen, damaged or unsold. Revenue counts what comes in and is silent about what goes out, including risk.

What revenue analysis does settle for certain: no firm should produce where marginal revenue is negative, taking in less money while using more materials and hours. The revenue maximising output is not a target but a ceiling, and for positive cost the best output lies below it.

Revenue is a means, profit the end, and they coincide only where the last unit is free. The rule joins both halves of the account: produce while the extra unit brings in more than it costs, and stop where they are equal.

The Master Key: *Maximum revenue sits where MR = 0, maximum profit where MR = MC, and since marginal cost is positive the profitable output is always the smaller one.*

Profit Maximisation

Every shilling of cost in this chapter has been counted for the sake of a single decision: how much to produce. Make too little and the shed stands half idle; make too much and the last unit costs more than it fetches. This section fixes the output that leaves the widest gap between what comes in and what goes out, first with two total curves, then with two marginal ones, and then in shillings on Tanzanian firms.

BINDER Question 238

A Mbeya miller grinds more sacks than ever and carries home less money than ever. Both his revenue and his cost have risen; what has quietly closed is the distance between them.

Define profit, write the profit equation, and with the aid of a diagram explain the total revenue and total cost approach to profit maximisation, showing the break even points and the profit maximising output.

Model Answer

Profit is the excess of total revenue over total cost, and a firm maximises it at the output where the vertical gap between total revenue and total cost is widest, with revenue standing above cost.

$$\pi = \text{TR} - \text{TC}$$

All three are measured at the same output. Profit here means economic profit: revenue less the full opportunity cost of every resource, so the owner's own money and labour already sit inside TC, which the accounting figure leaves out.

Put both totals on one pair of axes and the best output can be read with a ruler.

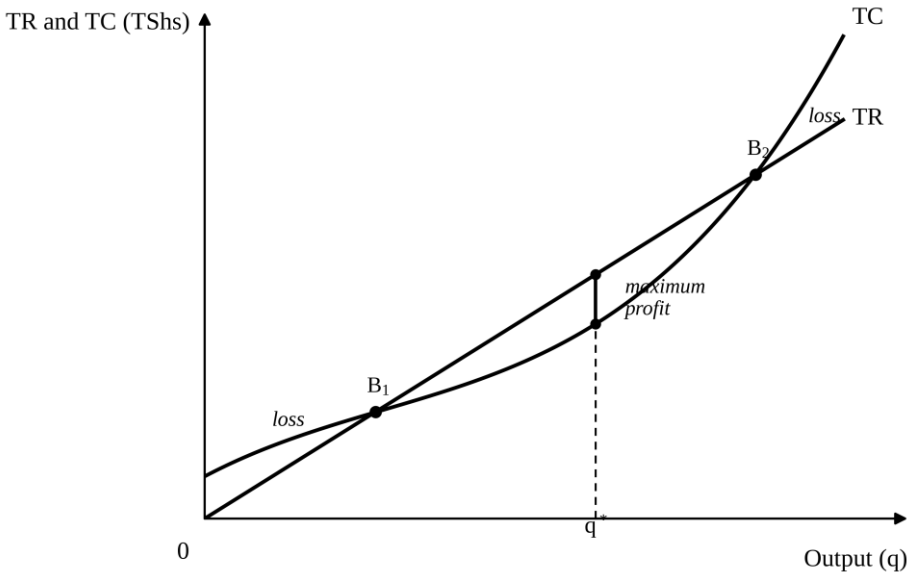


Figure 5.29: Profit maximisation by the total revenue and total cost approach

The total revenue line: it starts at the origin, since nothing produced is nothing sold, and rises in a straight line because every sack fetches the same price. Its slope is that price, marginal revenue.

The total cost curve: it begins on the vertical axis, not the origin, because shed rent, the licence and the watchman are paid even when the mill is silent. It rises gently while the variable factor gains, steeply once diminishing returns crowd the fixed plant.

The first break even point: at small outputs cost lies above revenue and the gap is a loss: too few sacks to carry the fixed cost. At B_1 the curves meet, $TR = TC$ and profit is zero, the smallest output that pays its way.

The profit region: between B_1 and B_2 revenue lies above cost, and the vertical gap at any output is the profit there, read off in shillings. Every output here earns something, but not the same something.

The profit maximising output: the widest gap is at q^*; drop a vertical to the axis for the number of sacks the miller should grind. That gap is his maximum profit, and no other output gives a wider one.

Why the curves run parallel at the best output: the gap stops widening where both climb at the same rate, so a tangent to TC at q^* is parallel to TR. One slope is marginal revenue, the other marginal cost, so $MR = MC$.

The second break even point and the loss beyond: past q^* cost climbs faster than revenue: overtime is paid, machines are hired, the plant is cramped. The gap closes at B_2, where $TR = TC$ again, and beyond it the firm loses while busier than ever.

A producer should never ask whether revenue is rising. Between q^* and B_2 revenue rises at every output while profit falls, the trap the busy Mbeya miller has walked into. Ask whether the gap is rising.

The Master Key: *Profit is the vertical gap between TR and TC: zero at* B_1 *and at* B_2*, widest at* q^**, where the two curves run parallel.*

BINDER Question 239

A Kariakoo welder decides one gate at a time: what will this gate fetch, what will this gate cost. He has never opened a mathematics book, and he is doing calculus.

Derive the first order condition for profit maximisation from the profit equation, and state the same rule in words that a producer with no mathematics could act on.

Model Answer

Profit is greatest where one more unit changes profit not at all, and since the change in profit is the change in revenue less the change in cost, that output is where marginal revenue equals marginal cost.

Write profit as a function of output and differentiate. At the top of the profit hill the ground is flat, so that derivative must be zero.

$$\pi = TR - TC$$

$$\frac{\partial \pi}{\partial q} = \frac{\partial TR}{\partial q} - \frac{\partial TC}{\partial q}$$

$$\frac{\partial \pi}{\partial q} = 0$$

$$\frac{\partial TR}{\partial q} = \frac{\partial TC}{\partial q}$$

$\frac{\partial TR}{\partial q}$ is the addition to revenue made by one more unit, marginal revenue, and $\frac{\partial TC}{\partial q}$ is the addition to cost, marginal cost. So the condition reads:

$$MR = MC$$

What the condition is and is not: it is the first order or necessary condition, from the first derivative. It locates every output where profit has stopped changing, valley bottoms as well as hill tops, so it is necessary but never sufficient alone.

Why a firm expands while marginal revenue exceeds marginal cost: each extra unit adds more to takings than to costs, so profit rises. If the welder's next gate fetches TShs 90,000 and costs TShs 62,000 in steel, rods and hours, it adds TShs 28,000 to his profit.

Why a firm contracts while marginal cost exceeds marginal revenue: the extra unit adds more to cost than to revenue, so profit falls. If a later gate still fetches TShs 90,000 but costs TShs 95,000, a second machine hired and the work done by lamplight, making it destroys TShs 5,000.

The plain rule to fall back on: while one more adds more to takings than to costs, make it; stop where the two are equal. A producer who knows what the next unit fetches and costs applies the condition without mathematics.

One warning belongs with the rule: it speaks of the last unit, never the average. A producer who stops where profit per unit is greatest stops too early, giving up units that still add to total profit.

The Master Key: *Weigh the addition to revenue against the addition to cost, and expand while the first is larger; MR = MC is simply the flatness of the top of the hill written down.*

BINDER Question 240

A Morogoro rice miller can see his profit as a rectangle long before he sees it as cash. Its width is easy to find; its height is not the price he charges.

With the aid of a diagram, show how the profit maximising output and the total profit of a firm are read from its marginal cost, marginal revenue and average total cost curves.

Model Answer

The profit maximising output is read where marginal cost cuts the marginal revenue line from below, and the profit there is the rectangle whose height is price less average total cost and whose width is that output.

Take a mill that can sell as much rice as it wishes at the going price. Then price, average revenue and marginal revenue are one figure, drawn as a single horizontal line.

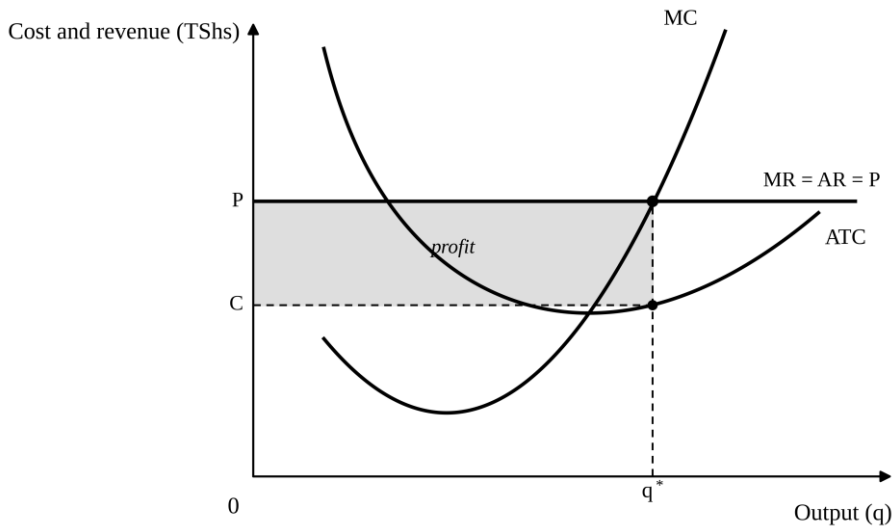


Figure 5.30: Profit maximisation where marginal cost cuts marginal revenue from below

Step one, find the output: follow marginal cost up to where it cuts the horizontal MR = AR = P line from below and drop a vertical to q^*. Left of it each further kilogramme adds more than it costs; right of it, pull back.

Step two, find the price: read up from q^* to the horizontal line and across to the axis at P. That is what each kilogramme fetches, fixed by the market and not by the mill.

Step three, find the average cost: read up from q^* to the average total cost curve and across to the axis at C. That is the average cost of a kilogramme at that output, the shed and the licence already spread into it.

Step four, close the rectangle: the height $P - C$ is the profit on one kilogramme and the width q^* the number of kilogrammes, so the shaded rectangle is the whole profit.

$$\pi = TR - TC = (AR \times q^*) - (ATC \times q^*)$$

$$\pi = (P - C) \times q^*$$

The same rectangle in shillings: suppose the best output is 500 kilogrammes a day, the price TShs 2,000 a kilogramme and average total cost TShs 1,600. Each kilogramme then carries TShs 400 of profit and the day TShs 200,000 for the owner to draw.

$$\pi = (2{,}000 - 1{,}600) \times 500 = 200{,}000$$

Why output is not where average cost is least: average total cost is lowest where marginal cost cuts it, which is short of q^* whenever price exceeds least average cost, since past that bottom every kilogramme still fetches more than it costs. Average cost decides the profit, marginal cost the output.

If the price line lay below average total cost everywhere, the same four steps would apply, but C would stand above P and the rectangle would measure a loss. The rule finds the best result available, not a good one.

The Master Key: *Marginal cost and marginal revenue fix the output; price and average total cost fix the profit on each unit; multiply the two and you have the rectangle.*

BINDER Question 241

At an Njombe potato shed two different outputs satisfy marginal cost equals marginal revenue. At one of them the shed does as well as it possibly can; at the other, as badly.

State the second order condition for profit maximisation, explain why marginal cost must cut marginal revenue from below, and explain what is wrong with the smaller output at which marginal cost cuts marginal revenue from above.

Model Answer

Profit is at a maximum only if the second derivative of the profit function is negative, that is if $\frac{\partial^2 TR}{\partial q^2} < \frac{\partial^2 TC}{\partial q^2}$, so marginal cost must be rising as it meets marginal revenue and must cut it from below.

A marginal cost curve that falls and then rises meets a horizontal marginal revenue line twice, once falling and once rising. Both satisfy $MR = MC$, so a second test is needed.

$$\frac{\partial^2 \pi}{\partial q^2} = \frac{\partial^2 TR}{\partial q^2} - \frac{\partial^2 TC}{\partial q^2} < 0$$

$$\frac{\partial^2 TR}{\partial q^2} < \frac{\partial^2 TC}{\partial q^2}$$

What the condition says in words: marginal revenue must be changing more slowly than marginal cost. Where price does not vary with output the marginal revenue line is flat, so the condition reduces to marginal cost rising through the meeting point.

Why the smaller crossing is a profit minimum: just below it marginal cost is above marginal revenue, so each unit costs more than it earns and profit falls; just above, marginal cost is below and profit rises. The flat point is a valley bottom.

What a firm at that output should do: since profit rises whichever way it moves, it should not stay. Normally it expands to the larger crossing, every unit between adding more to revenue than to cost. If even the best output is worse than standing idle, it should stop.

A worked check: a sorting shed at Njombe buys, washes and bags Irish potatoes. Its total cost is $TC = q^3 - 12q^2 + 60q + 20$, with q sacks a day and money in thousands of shillings, and traders pay TShs 39,000 a sack, so marginal revenue is 39.

$$MC = \frac{\partial TC}{\partial q} = 3q^2 - 24q + 60$$

$$3q^2 - 24q + 60 = 39$$
$$3q^2 - 24q + 21 = 0$$
$$q^2 - 8q + 7 = 0$$
$$(q - 1)(q - 7) = 0 \quad q = 1 \text{ or } q = 7$$

Which of the two is the maximum: differentiate marginal cost. At one sack the slope is negative, so marginal cost falls and cuts from above; at seven it is positive, so marginal cost rises and cuts from below. Only seven satisfies the second order condition.

$$\frac{\partial \text{MC}}{\partial q} = 6q - 24$$
$$6(1) - 24 = -18 \quad 6(7) - 24 = 18$$

The profits settle the matter: at one sack the shed loses TShs 30,000 a day, worse than the TShs 20,000 it loses shut; at seven it earns TShs 78,000. One sack is the shed's worst day, and it satisfies MR = MC as faithfully as seven.

$$\pi = 39q - (q^3 - 12q^2 + 60q + 20) = -q^3 + 12q^2 - 21q - 20$$
$$\pi(1) = -30 \quad \pi(7) = 78 \quad \pi(0) = -20$$

So MR = MC points at two outputs at once, and the second order condition says which to read. In practice the producer rarely doubts: he wants the crowded end of the marginal cost curve.

The Master Key: *MR = MC finds the flat points; only where marginal cost is rising through marginal revenue is the flat point the top of the hill.*

BINDER Question 242

At an Ikungi press every tin fetches the same forty thousand shillings, so the price never falls. What changes, tin by tin, is what the next tin costs to squeeze.

Using the record in the box, complete the marginal revenue, marginal cost and profit columns, find the profit maximising output by comparing marginal revenue with marginal cost row by row, confirm it from the profit column, and state the two outputs at which the press exactly breaks even.

A small press at Ikungi in Singida crushes alizeti (sunflower) seed into tins of cooking oil.

Traders take every tin the press can make at TShs 40,000 a tin, so it never has to lower its price to sell more.

Its total cost for a day's run, in shillings, is 28,000 with the press idle, and then 58,000; 80,000; 98,000; 120,000; 148,000; 182,000; 226,000; 282,000 and 360,000 for one to nine tins.

Model Answer

The press should crush six tins a day: the sixth costs TShs 34,000 and brings in TShs 40,000, while a seventh would cost TShs 44,000 and still bring TShs 40,000, and the profit column peaks at TShs 58,000 at six tins.

Build the missing columns. Total revenue is TShs 40,000 times the tins, so marginal revenue is TShs 40,000 at every row; marginal cost is the addition to total cost; profit is revenue less cost.

$$\text{MR} = \frac{\Delta \text{TR}}{\Delta q} \quad \text{MC} = \frac{\Delta \text{TC}}{\Delta q} \quad \pi = \text{TR} - \text{TC}$$

Tins a day	Total revenue	Total cost	Marginal revenue	Marginal cost	Profit
0	0	28,000	-	-	-28,000
1	40,000	58,000	40,000	30,000	-18,000
2	80,000	80,000	40,000	22,000	0
3	120,000	98,000	40,000	18,000	22,000
4	160,000	120,000	40,000	22,000	40,000
5	200,000	148,000	40,000	28,000	52,000
6	240,000	182,000	40,000	34,000	58,000
7	280,000	226,000	40,000	44,000	54,000
8	320,000	282,000	40,000	56,000	38,000
9	360,000	360,000	40,000	78,000	0

A day's oil pressing at Ikungi, all figures in shillings.

Reading the schedule row by row: from the first tin to the sixth marginal cost stays below marginal revenue of TShs 40,000, so each is worth crushing. The sixth adds TShs 6,000, lifting profit to TShs 58,000; the seventh would take TShs 4,000 off.

$$\pi(6) - \pi(5) = 40{,}000 - 34{,}000 = 6{,}000$$

$$\pi(7) - \pi(6) = 40{,}000 - 44{,}000 = -4{,}000$$

Confirming it from the profit column: the largest entry is TShs 58,000, at six tins, the same answer. The two tests must agree, because the profit column changes from row to row by marginal revenue less marginal cost, rising while $\text{MC} < \text{MR}$ and falling after.

$$\pi(6) = 240{,}000 - 182{,}000 = 58{,}000$$

The two break even outputs: revenue and cost are both TShs 80,000 at two tins and both TShs 360,000 at nine, so profit is zero at each: these are where the revenue line crosses the cost curve, and outside them the press loses.

Why marginal cost falls then rises: the first tins are dear because a full day's press is used for an hour. By the third the plant is properly loaded and marginal cost is lowest at TShs 18,000; from the fourth the machine is at its limit, seed comes from further off and the run pushes late.

The trap of profit per tin: at five tins the press earns TShs 10,400 a tin, at six about TShs 9,667. The sixth lowers profit per tin and still raises total profit by TShs 6,000, because the owner banks shillings, not an average.

$$\frac{52{,}000}{5} = 10{,}400 \quad \frac{58{,}000}{6} \approx 9{,}667$$

If traders raised the price to TShs 44,000 a tin, the seventh would add exactly what it costs and six tins and seven would both give TShs 82,000. The best output depends on the press and the price together.

The Master Key: *Add a unit whenever its marginal cost is below marginal revenue; the profit column and the marginal columns must point at the same output.*

REAL Question 243

The freezer at a Mwanza fillet plant never sleeps, and every extra crate must be sold a little cheaper than the last. Somewhere in that fall sits the crate to stop at.

Using the plant's functions in the box, find the profit maximising output, the price at that output and the profit in shillings, verify that the output is a maximum, and show what the plant would earn if it aimed instead at the greatest possible revenue.

A filleting plant on the Mwanza lakeshore freezes Nile perch fillet in crates of 25 kilogrammes.

All money below is in thousands of shillings a day, and q is crates a day.

Total revenue: $\mathrm{TR} = 640\mathrm{q} - 4\mathrm{q}^2$, so the price the plant receives is $\mathrm{P} = 640 - 4\mathrm{q}$, because it must shade its price to move more crates in one day.

Total cost: $\mathrm{TC} = 3{,}600 + 100\mathrm{q} + 6\mathrm{q}^2$, where the 3,600 is the day's fixed cost of the cold store, the ice plant, the generator and the salaried staff.

Model Answer

The plant maximises profit at 27 crates a day, priced at TShs 532,000 a crate, earning TShs 3,690,000 a day; chasing the greatest revenue instead would mean freezing 80 crates and a loss of TShs 24,400,000 a day.

Differentiate each total once and set marginal revenue equal to marginal cost.

$$\mathrm{MR} = \frac{\partial\,\mathrm{TR}}{\partial\,\mathrm{q}} = 640 - 8\mathrm{q}$$

$$\mathrm{MC} = \frac{\partial\,\mathrm{TC}}{\partial\,\mathrm{q}} = 100 + 12\mathrm{q}$$

$$640 - 8\mathrm{q} = 100 + 12\mathrm{q}$$

$$640 - 100 = 12\mathrm{q} + 8\mathrm{q}$$

$$540 = 20\mathrm{q}$$

$$\mathrm{q} = 27 \text{ crates a day}$$

The price at that output: put 27 crates into the price function. TShs 532,000 a crate of 25 kilogrammes is TShs 21,280 a kilogramme of frozen fillet, the figure to quote the traders and agents who lift its crates.

$$\mathrm{P} = 640 - 4\,(\,27\,) = 640 - 108 = 532$$

The day's revenue, cost and profit: work each total at 27 crates and subtract. The plant takes TShs 14,364,000, spends TShs 10,674,000 on fish, ice, wages, power and its share of fixed charges, and keeps TShs 3,690,000.

$$\mathrm{TR} = 640\,(\,27\,) - 4\,(\,729\,) = 17{,}280 - 2{,}916 = 14{,}364$$

$$\mathrm{TC} = 3{,}600 + 100\,(\,27\,) + 6\,(\,729\,) = 3{,}600 + 2{,}700 + 4{,}374 = 10{,}674$$

$$\pi = 14{,}364 - 10{,}674 = 3{,}690$$

Verifying that 27 crates is a maximum: subtract cost from revenue and differentiate twice. The second derivative is negative at every output, so the turning point is a peak; equivalently -8 for revenue is smaller than 12 for cost.

$$\pi = 540\mathrm{q} - 10\mathrm{q}^2 - 3{,}600$$

$$\frac{\partial\,\pi}{\partial\,\mathrm{q}} = 540 - 20\mathrm{q} = 0 \quad \mathrm{q} = 27$$

$$\frac{\partial^2\,\pi}{\partial\,\mathrm{q}^2} = -20 < 0$$

The check a careful producer makes: test the crates on either side. At 26 and at 28 crates profit is TShs 3,680,000, so 27 stands TShs 10,000 above both neighbours. The peak is real, and gentle: one crate out costs little.

What chasing revenue would do: revenue is greatest where marginal revenue falls to zero, since past that another crate reduces takings. That happens at 80 crates and TShs 320,000, giving TShs 25,600,000 a day, far above the TShs 14,364,000 the profit maximiser collects.

$$640 - 8\mathrm{q} = 0$$

$$\mathrm{q} = 80 \quad \mathrm{P} = 640 - 320 = 320$$

$$\mathrm{TR} = 640\,(\,80\,) - 4\,(\,6{,}400\,) = 51{,}200 - 25{,}600 = 25{,}600$$

$$\mathrm{TC} = 3{,}600 + 8{,}000 + 38{,}400 = 50{,}000$$

$$\pi = 25{,}600 - 50{,}000 = -24{,}400$$

Reading the comparison in shillings: moving from 27 crates to 80 adds TShs 11,236,000 to revenue and TShs 39,326,000 to cost, since the plant buys nearly three times the fish, runs a second shift, hires freezing space and takes a lower price throughout. Record takings would destroy TShs 28,090,000.

$$\Delta\,\mathrm{TR} = 25{,}600 - 14{,}364 = 11{,}236 \quad \Delta\,\mathrm{TC} = 50{,}000 - 10{,}674 = 39{,}326$$

So the target is 27 crates at TShs 532,000, and the figure the manager should watch is not the day's takings but the cost of the next crate.

The Master Key: *Differentiate, equate, then check the sign of the second derivative; and remember that the biggest takings and the biggest profit sit at very different outputs.*

REAL Question 244

Cane burns at Kilombero from June to December and the mill runs day and night. Yet there is a tonnage beyond which every further tonne of sugar leaves the estate poorer.

Using the estate's functions in the box, derive marginal revenue and marginal cost, find the profit maximising tonnage, the price and the daily profit, verify the second order condition, and find the two tonnages at which the estate exactly breaks even.

The Kilombero sugar estate mills its own cane into white sugar. Take q as tonnes of sugar milled in a day.

All money below is in thousands of shillings a day.

Total revenue: $\mathrm{TR} = 2{,}600\mathrm{q} - 2\mathrm{q}^2$, so the price the estate receives is $\mathrm{P} = 2{,}600 - 2\mathrm{q}$, since it must accept a little less a tonne to place a larger tonnage with the wholesalers.

Total cost: $\mathrm{TC} = 150{,}000 + 600\mathrm{q} + 3\mathrm{q}^2$, the first term being what the day costs whether cane is crushed or not: the mill, the boilers, the haulage fleet and the salaried staff.

Model Answer

The estate maximises profit at 200 tonnes of sugar a day at TShs 2,200,000 a tonne, which is TShs 2,200 a kilogramme, keeping TShs 50,000,000 a day, and it breaks even at 100 tonnes and again at 300.

Differentiate each total once and set the two derivatives equal.

$$\mathrm{MR} = \frac{\partial\,\mathrm{TR}}{\partial\,\mathrm{q}} = 2{,}600 - 4\mathrm{q}$$

$$\mathrm{MC} = \frac{\partial\,\mathrm{TC}}{\partial\,\mathrm{q}} = 600 + 6\mathrm{q}$$

$$2{,}600 - 4\mathrm{q} = 600 + 6\mathrm{q}$$

$$2{,}600 - 600 = 6\mathrm{q} + 4\mathrm{q}$$

$$2{,}000 = 10\mathrm{q}$$

$$\mathrm{q} = 200 \text{ tonnes a day}$$

Checking the two margins meet: at 200 tonnes marginal revenue and marginal cost are both 1,800, so the two hundredth tonne brings in TShs 1,800,000 and costs TShs 1,800,000. It just pays for itself; everything beyond costs more than it fetches.

$$\mathrm{MR} = 2{,}600 - 4\,(\,200\,) = 1{,}800 \quad \mathrm{MC} = 600 + 6\,(\,200\,) = 1{,}800$$

The price the estate should hold: TShs 2,200,000 a tonne is TShs 2,200 a kilogramme at the mill gate; the higher figure a shopper pays in Morogoro or Dar es Salaam adds the lorry, the wholesaler and the retailer, each producing a service of place, time or possession.

$$\mathrm{P} = 2{,}600 - 2\,(\,200\,) = 2{,}200$$

The day's profit: revenue of TShs 440,000,000 against cost of TShs 390,000,000 leaves TShs 50,000,000. The cost divides into TShs 150,000,000 the day would cost with the boilers cold, TShs 120,000,000 of wages, cane cutting and haulage, and TShs 120,000,000 more from pushing the mill hard.

$$\mathrm{TR} = 2{,}200 \times 200 = 440{,}000$$

$$\mathrm{TC} = 150{,}000 + 600\,(200) + 3\,(40{,}000) = 150{,}000 + 120{,}000 + 120{,}000 = 390{,}000$$

$$\pi = 440{,}000 - 390{,}000 = 50{,}000$$

The second order condition: collect profit into one expression and differentiate twice. The second derivative is -10, negative at every tonnage, so 200 tonnes is a maximum; equally, -4 for revenue is less than 6 for cost, so marginal cost is rising through marginal revenue.

$$\pi = 2{,}000q - 5q^2 - 150{,}000$$

$$\frac{\partial^2 \pi}{\partial q^2} = -10 < 0$$

The two break even tonnages: set profit to zero and solve the quadratic. The estate covers its costs exactly at 100 tonnes and again at 300, and 200 lies precisely halfway between, as a quadratic profit function must always give.

$$2{,}000q - 5q^2 - 150{,}000 = 0$$

$$q^2 - 400q + 30{,}000 = 0$$

$$\sqrt{160{,}000 - 120{,}000} = \sqrt{40{,}000} = 200$$

$$q = \frac{400 - 200}{2} = 100 \quad q = \frac{400 + 200}{2} = 300$$

What the two tonnages mean: below 100 tonnes the takings cannot carry the TShs 150,000,000 the mill costs whether it turns or not. Above 300 the estate hauls cane from far away, runs overtime and drops its price, so cost has caught revenue again.

The profit as a rectangle: average total cost at 200 tonnes is TShs 1,950,000 against a price of TShs 2,200,000, so the estate keeps TShs 250,000 a tonne, and 200 tonnes at TShs 250,000 is the same TShs 50,000,000.

$$\mathrm{ATC} = \frac{390{,}000}{200} = 1{,}950 \quad (2{,}200 - 1{,}950) \times 200 = 50{,}000$$

So the instruction is exact: mill 200 tonnes a day at TShs 2,200 a kilogramme. An order pushing the mill to 300 tonnes wipes out the whole TShs 50,000,000.

The Master Key: *Equate the margins for the best tonnage, equate the totals for the break even tonnages, and check that the best one sits between them.*

REAL Question 245

To sell his sixth tray the Kariakoo baker must drop the price on the five he was already selling. That sixth tray brings in far less than its own price.

Using the bakery's record in the box, build the revenue and the cost schedules, find the profit maximising number of trays and the price to charge, state the profit in shillings, and explain why the output that maximises revenue is not the output that maximises profit.

A bakery off Msimbazi Street in Kariakoo bakes bread in trays of forty loaves.

The more trays it puts out in a day, the lower the price the traders will pay: the price a tray is TShs 63,000 less TShs 3,000 for every tray baked, so one tray fetches TShs 60,000, two fetch TShs 57,000 each, and so on.

Total cost for the day is TShs 50,000 with the oven cold, and then 80,000; 106,000; 130,000; 156,000; 188,000; 228,000; 280,000 and 348,000 shillings for one to eight trays.

Model Answer

The bakery should bake five trays a day at TShs 48,000 a tray, leaving TShs 52,000 of profit, whereas the eight trays that bring the largest revenue of TShs 312,000 would leave it TShs 36,000 out of pocket.

Take the revenue side first. Total revenue is price times trays; marginal revenue is the addition to total revenue made by one more tray, which is not the price of that tray.

Trays a day	Price a tray	Total revenue	Marginal revenue
0	-	0	-
1	60,000	60,000	60,000
2	57,000	114,000	54,000
3	54,000	162,000	48,000
4	51,000	204,000	42,000
5	48,000	240,000	36,000
6	45,000	270,000	30,000
7	42,000	294,000	24,000
8	39,000	312,000	18,000

The revenue side of a Kariakoo bakery's day, in shillings.

Why marginal revenue falls below the price: the fifth tray fetches TShs 48,000, but selling five instead of four means cutting TShs 3,000 from each of the four already sold, losing TShs 12,000. The fifth adds only TShs 36,000, and that figure must meet cost.

$$\mathrm{MR}_5 = 48{,}000 - (4 \times 3{,}000) = 48{,}000 - 12{,}000 = 36{,}000$$

Now the cost side: marginal cost is the addition to total cost made by one more tray, and profit is revenue less cost.

Trays a day	Total cost	Marginal cost	Profit
0	50,000	-	-50,000
1	80,000	30,000	-20,000
2	106,000	26,000	8,000
3	130,000	24,000	32,000
4	156,000	26,000	48,000
5	188,000	32,000	52,000
6	228,000	40,000	42,000
7	280,000	52,000	14,000
8	348,000	68,000	-36,000

The cost and profit side of the same day, in shillings.

Where the two margins cross: the fifth tray adds TShs 36,000 to revenue and TShs 32,000 to cost, lifting profit by TShs 4,000. The sixth adds TShs 30,000 while costing TShs 40,000, stripping TShs 10,000 away. Five trays it is, and the profit column agrees.

$$\pi(5) - \pi(4) = 36{,}000 - 32{,}000 = 4{,}000$$

$$\pi(6) - \pi(5) = 30{,}000 - 40{,}000 = -10{,}000$$

The price to charge: the schedule fixes output at five trays, and demand then fixes the price at TShs 48,000 a tray, or TShs 1,200 a loaf. Having chosen the trays, he lets the traders set the price.

The profit read as a rectangle: average total cost at five trays is TShs 37,600, so each tray carries TShs 10,400 and five carry TShs 52,000, the same figure the profit column gives.

$$\text{ATC} = \frac{188{,}000}{5} = 37{,}600 \quad (48{,}000 - 37{,}600) \times 5 = 52{,}000$$

Why revenue peaks elsewhere: total revenue climbs to TShs 312,000 at eight trays, because marginal revenue, though shrinking, stays positive. But the eighth tray costs TShs 68,000 and adds only TShs 18,000, so the day loses TShs 36,000: chasing takings costs TShs 88,000 a day.

The reason the two targets differ: revenue maximisation looks only at what comes in and stops where marginal revenue reaches zero; profit maximisation looks at both sides and stops where marginal revenue has fallen only to marginal cost, which is always the smaller output.

A busier oven, a fuller yard and a longer queue all point towards eight trays, and every one of those signs is a sign of a losing day. Only the next tray's cost against its takings tells the truth.

The Master Key: *For a firm that must cut its price to sell more, marginal revenue lies below price; set that lower figure, not the price, against marginal cost.*

REAL Question 246

In April the road from Arusha to Tarangire is empty and the agents' price collapses. The operator's best possible week still ends in a loss, and taking that week is the right decision.

Using the operator's figures in the box, find the number of vehicle days that maximises profit in the low season, calculate the profit or loss, compare it with closing for the season, and explain why total revenue never reaches total cost at this price.

An Arusha tour operator runs safaris to Tarangire and the Serengeti in its own Land Cruisers. Take q as vehicle days sold in a week, that is, one vehicle with its driver guide out for one day.

All money below is in thousands of shillings a week.

Total cost: $\text{TC} = 12{,}000 + 1{,}200\text{q} + 30\text{q}^2$. The 12,000 is what the week costs whether a vehicle moves or not: the loans on the fleet, the office off Boma Road, the licences and the retainers of the permanent guides.

In the low season the agents will take as many vehicle days as the operator can supply, but only at TShs 1,800,000 each.

Model Answer

The operator should sell ten vehicle days a week, which still ends the week TShs 9,000,000 down, but closing would lose TShs 12,000,000, so ten vehicle days is both the profit maximising and the loss minimising choice.

The agents pay the same rate for every vehicle day, so the operator cannot move the price and marginal revenue is that price. Differentiate the cost function and set the two equal.

$$\text{MR} = \text{P} = 1{,}800$$

$$\text{MC} = \frac{\partial\,\text{TC}}{\partial\,\text{q}} = 1{,}200 + 60\text{q}$$

$$1{,}200 + 60\text{q} = 1{,}800$$

$$60\text{q} = 600$$

$$\text{q} = 10 \text{ vehicle days a week}$$

The week's result: ten vehicle days bring in TShs 18,000,000 and cost TShs 27,000,000, so the week closes TShs 9,000,000 down. The second derivative of profit is -60, and the neighbours prove it: at eight and at twelve the loss is TShs 9,120,000.

$$\text{TR} = 1{,}800 \times 10 = 18{,}000$$

$$\text{TC} = 12{,}000 + 1{,}200\,(10) + 30\,(100) = 12{,}000 + 12{,}000 + 3{,}000 = 27{,}000$$

$$\pi = 18{,}000 - 27{,}000 = -9{,}000$$

$$\pi = 600\text{q} - 30\text{q}^2 - 12{,}000 \quad \frac{\partial^2 \pi}{\partial\, \text{q}^2} = -60 < 0$$

The comparison that matters: the choice is not between a loss and nothing. Park every vehicle and he still pays the loans, the office, the licences and the retainers, losing the whole TShs 12,000,000 for nothing. Running loses TShs 9,000,000, so working the season is TShs 3,000,000 a week better.

Where the three million comes from: variable cost at ten vehicle days is TShs 15,000,000, so each costs TShs 1,500,000 to run and brings in TShs 1,800,000. Each leaves TShs 300,000 over its running cost, and ten leave TShs 3,000,000 towards the fixed charges.

$$\text{TVC} = 1{,}200\,(10) + 30\,(100) = 15{,}000 \quad \text{AVC} = \frac{15{,}000}{10} = 1{,}500$$

$$(1{,}800 - 1{,}500) \times 10 = 3{,}000$$

Why there is no break even: average total cost is least at twenty vehicle days, where it is TShs 2,400,000, while the agents pay TShs 1,800,000. The lowest cost reachable is a third above the price, so the revenue line never crosses the cost curve.

$$\text{ATC} = \frac{12{,}000}{\text{q}} + 1{,}200 + 30\text{q}$$

$$\frac{\partial\, \text{ATC}}{\partial\, \text{q}} = -\frac{12{,}000}{\text{q}^2} + 30 = 0$$

$$\text{q}^2 = 400 \quad \text{q} = 20$$

$$\text{ATC}\,(20) = 600 + 1{,}200 + 600 = 2{,}400$$

When the season turns: in July the agents pay TShs 3,000,000 a vehicle day. The same working gives thirty vehicle days, revenue of TShs 90,000,000, cost of TShs 75,000,000 and a profit of TShs 15,000,000 a week. Only the price has changed.

$$1{,}200 + 60\text{q} = 3{,}000 \quad \text{q} = 30 \quad \pi = 90{,}000 - 75{,}000 = 15{,}000$$

The rule never promised a profit; it promised the best available result, and in April that is a loss of TShs 9,000,000 rather than TShs 12,000,000. Whether to continue at that price for good turns on whether takings cover moving the vehicles.

The Master Key: *When every output loses money, MR = MC finds the smallest loss, and the smallest loss is measured against the fixed cost that closing would not save.*

HOT Question 247

Ask a Kariakoo hardware trader how he prices barbed wire and he says cost plus thirty. Ask him what marginal cost means and he laughs. He is nearer the rule than he knows.

Assess the claim that the rule that marginal cost should equal marginal revenue is of no use in Tanzania, because firms in fact set their prices by adding a percentage to cost.

Model Answer

The claim is largely false, because a cost plus price is usually the rule applied in working clothes rather than a rival to it, but it carries real force against a firm whose percentage is fixed by habit and never revised.

The case for the claim: it describes what people do: a Kariakoo trader adds a percentage to his buying price, a fundi cherehani quotes cloth plus thread plus labour plus something for himself, a bakery works from a cost a loaf. Full cost pricing works from average, not marginal, cost.

Why a small firm may not know marginal cost: it keeps one cash book and no split between fixed and variable cost, and needs the cost of the forty first sack, not the average of forty; finding that takes clerical work, itself a cost.

A cost plus price can be exactly right: marginal revenue can be written in terms of price and elasticity of demand, and setting it equal to marginal cost turns the rule into a percentage above cost: the more elastic the demand, the thinner the percentage.

$$\mathrm{MR} = \mathrm{P}\left(1 - \frac{1}{\mathrm{e}}\right)$$

$$\mathrm{P}\left(1 - \frac{1}{\mathrm{e}}\right) = \mathrm{MC}$$

$$\mathrm{P} = \mathrm{MC} \times \frac{\mathrm{e}}{\mathrm{e} - 1}$$

What the formula gives in practice: if the trader's wire has an elasticity of 4, the rule says charge four thirds of marginal cost, cost plus about 33 per cent, almost exactly the thirty he quotes; at an elasticity of 2 he could double it.

$$\mathrm{e} = 4: \quad \mathrm{P} = \frac{4}{3}\,\mathrm{MC} \qquad \mathrm{e} = 2: \quad \mathrm{P} = 2\,\mathrm{MC}$$

The percentage is not chosen at random: the same trader charges far more on a fitting nobody else stocks, far less on cement every shop sells, cuts his percentage when a rival opens and lifts it when the lorries fail. Each move approaches $\mathrm{MR} = \mathrm{MC}$.

Survival does the arithmetic nobody performs: a firm pricing far from the rule earns less, expands more slowly and closes first in a bad year, so the firms still trading price near it. The bakery's TShs 48,000 against a marginal cost of TShs 32,000 is cost plus fifty per cent.

Where the claim genuinely bites: a fixed percentage ignores how demand differs between lines, underprices in a shortage, and refuses good business: a Mbeya miller whose average cost is TShs 60,000 a sack turns down TShs 55,000, though two hundred sacks costing TShs 45,000 would add TShs 2,000,000.

$$200 \times (\,55{,}000 - 45{,}000\,) = 2{,}000{,}000$$

The rule as a standard, not a description: even where no producer works it out, it shows a lender, an adviser or the owner where money is being left behind, and settles what a percentage cannot: a lower priced contract, a night shift, the last machine.

The verdict turns on whether the percentage moves. If it answers competition, scarcity and the demand for each line, cost plus is the rule in working clothes; if habit or a price control has frozen it, the firm is not maximising, and the dismissed rule measures the loss.

The Master Key: *Cost plus is not the opposite of MR = MC; it is what MR = MC looks like when a busy trader does it in his head.*

HOT Question 248

The board of a Mwanza fish plant votes to keep two hundred filleters through a bad season. The accountant calls it waste; the manager calls it next year's supply of skilled hands.

Discuss whether a firm should always aim at the greatest possible profit, or may sensibly pursue growth, survival, market share or the welfare of its workers.

Model Answer

Profit maximisation is the right first assumption, because a firm that abandons it for long does not survive to pursue anything else; but firms aim at long run profit, and growth, market share, survival and the treatment of workers are usually means to it rather than rivals.

The case for profit as the objective: profit rewards the entrepreneur for bearing uncertainty and is the one claim nobody guarantees, since wages, rent and interest are paid first. It is also the main finance for expansion where lending is dear: TShs 50,000,000 a day builds the estate's second mill unaided.

Survival comes before maximisation: in a bad season the objective is staying open. A firm that squeezes this month's largest profit by selling its lorry, running down stock and postponing repairs may have no business next month: taking less now applies the rule over a longer period.

Growth and market share: managers may aim at the largest sales revenue consistent with a satisfactory profit, called sales revenue maximisation, since salary, standing and power over suppliers follow size. A larger share may also bring economies of scale and better terms, raising profit later.

What the pursuit of share actually costs: it should be priced, not assumed free. Six trays at TShs 45,000 rather than five at TShs 48,000 would hold the Kariakoo bakery's traders and drop profit from TShs 52,000 to TShs 42,000, defensible only if the custom is worth more than TShs 10,000.

Workers, and why the plant kept its filleters: a skilled filleter takes months to train, so a plant laying off two hundred pays to find and train two hundred more when the fish return. Keeping them is an investment in its own future costs; keeping them beyond that, out of obligation, trades profit for something else.

Ownership, control and satisficing: in a large company owners and managers differ, and a salaried manager may settle for a satisfactory profit and a quieter life, which is satisficing. In most Tanzanian firms, from the fundi to the family wholesaler, owner and manager are one.

Firms not meant to maximise: a public utility such as TANESCO must extend a rural line that will never pay, its objective being service, not surplus, and a cooperative buying members' coffee at Mbinga exists to raise what members receive. For these the rule prices decisions without setting them.

The limits of the alternatives: growth financed by losses is borrowed time, and a firm expanding into loss meets a creditor who cares nothing for market share. Every objective other than profit is paid for out of profit, which is why profit stays the benchmark.

The answer turns on the horizon and on who owns the firm. Over a season or two firms will trade profit for stability, custom and skilled hands, often wisely; over the long run only outputs near $\mathrm{MR} = \mathrm{MC}$ survive, so every departure should be priced.

The Master Key: *Treat profit maximisation as the long run rule and every other objective as a purchase made out of profit, whose price should be known before it is paid.*

HOT Question 249

A Tanga sisal estate shows a loss in every month of the year, and the manager who closes it tomorrow hands the owners a larger loss than the one he stopped.

Examine the claim that an output at which a firm makes a loss cannot possibly be its profit maximising output.

Model Answer

The claim is false in the short run: when every output yields a loss, the output where marginal cost equals marginal revenue makes that loss as small as it can be, and the smallest available loss is the best available result.

Why the claim looks obvious: profit and loss are opposites in ordinary speech, so a rule called profit maximisation ought to end in a profit; red ink suggests the rule or the firm has failed. The instinct is honest and mistaken.

The rule maximises a difference, whatever its sign: the rule finds the output at which total revenue less total cost is greatest. Where revenue exceeds cost that is the largest profit; where cost exceeds revenue it is the smallest loss, the same rule beyond zero.

$$\pi = \mathrm{TR} - \mathrm{TC}$$

The comparison is between two losses: fixed cost is paid whether the plant runs or stands: the lease, the loan, the watchman, the licence. Closing takes the firm not to zero but to a loss equal to the whole fixed cost, so the question is which loss is smaller.

The sisal estate in figures: the Tanga estate's fixed cost is TShs 40,000,000 a month. At its best output it takes TShs 180,000,000 and spends TShs 205,000,000, losing TShs 25,000,000; closed, it takes nothing

and still pays TShs 40,000,000. Cutting the sisal is TShs 15,000,000 a month better, so closing enlarges the loss.

Where the fifteen million comes from: variable cost is TShs 165,000,000, so the crop earns TShs 15,000,000 more than it costs to cut, strip, dry and bale, and that surplus goes towards fixed charges the estate cannot escape. Test price against average variable cost.

When the claim is right: if revenue will not cover even variable cost, every hour worked deepens the loss and the estate should stop. In the long run there are no fixed costs: the lease ends, machines can be sold, the land can carry another crop, so a firm that cannot cover its costs should leave.

The abuse the argument invites: the same reasoning can excuse a loss for ever, since next year is always said to be better. The comparison must be made afresh each period, and a firm minimising a loss for years is no longer in the short run.

So the claim confuses the sign of the answer with the soundness of the rule. A loss making output can be the profit maximising one, and in a bad season usually is; everything turns on whether takings still cover what production costs.

The Master Key: *Maximising profit and minimising loss are one rule; when both outcomes are losses, choose the smaller and remember that closing does not cost nothing.*

Break Even and the Shut Down Decision

Every producer meets two numbers that decide whether the day was worth opening for: the output at which the takings finally cover the costs, and the price below which it is better to switch the machine off than to run it. This section builds the break even point out of contribution rather than quoting a formula, then works carefully through the shut down decision, where a firm making a loss can still be perfectly right to keep producing.

BINDER Question 250

A Mbeya miller sells his first ten sacks of the month and is still poorer than when he opened the door. Somewhere later in the month, one sack changes that.

Define the break even point and, with the aid of a diagram, explain how it is found on a break even chart.

Model Answer

The break even point is the level of output at which total revenue exactly equals total cost, so that the firm makes neither a profit nor a loss.

A firm's costs do not begin at zero. Before a sack is sold, the rent, the licence, the watchman and the loan interest are running, so the month opens with a loss.

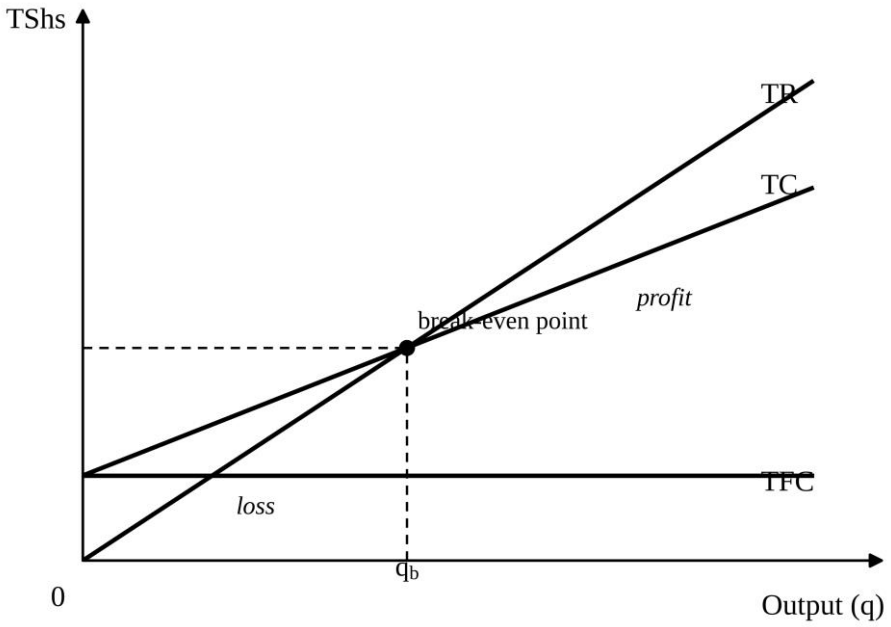


Figure 5.31: The break even chart

The total fixed cost line: a horizontal line at the same height at every output: these costs do not move when output does. The firm bears them at zero output, which is why the total cost line does not start at the origin.

The total cost line: it starts on the vertical axis at total fixed cost and rises with output, because every extra unit adds its variable cost. Its height is fixed plus variable cost, so the gap above the fixed cost line is total variable cost.

The total revenue line: it starts at the origin, because a firm that sells nothing earns nothing, and rises with output at a rate set by the price. Its slope is the price, so a higher price tilts the line upward.

The break even point: the crossing where the total revenue line cuts the total cost line. The output beneath it is the break even output q_b, and the height of the crossing is break even revenue, the takings the firm must reach before it earns anything.

The loss region and the profit region: left of q_b the cost line lies above the revenue line and the vertical gap is the loss; right of it the revenue line lies above and the gap is the profit. Both gaps widen with distance from the crossing.

One caution about the word profit. The cost drawn here is economic cost, already containing the normal profit that keeps the owner in this line of business, so a firm at break even earns no supernormal profit yet is paid enough to stay.

Notice what the chart assumes. Both lines are straight, which holds only while price and variable cost a unit are the same at every output. Where marginal cost rises the cost line curves, and a second crossing may lie to the right.

The Master Key: *The break even point is where the revenue line, starting from nothing, finally overtakes the cost line, which started at the fixed cost.*

BINDER Question 251

A Kariakoo tailor pays TShs 4,000 for the cloth of a shirt and sells it for TShs 9,000. The other TShs 5,000 is not his profit, and he knows it.

Define contribution per unit and derive, from first principles, the formula for the break even output.

Model Answer

Contribution is the excess of price over average variable cost, the amount every unit hands over towards fixed costs once its own variable cost is paid, and the break even output is built directly out of it.

Contribution defined: the tailor's shirt sells at TShs 9,000 and uses TShs 4,000 of cloth, thread and power, so it contributes TShs 5,000. That is not profit, because the stall rent and the machine instalment have not been touched; it is the shirt's share of paying them.

$$\text{Contribution per unit} = \text{P} - \text{AVC}$$

Total contribution: contribution per unit multiplied by output, $\text{q}(\text{P} - \text{AVC})$. Profit is total contribution less total fixed cost, so profit appears only after contribution has climbed past the fixed cost.

$$\pi = \text{q}(\text{P} - \text{AVC}) - \text{TFC}$$

Now impose the break even condition: total revenue equals total cost, and total cost is fixed cost plus variable cost a unit times output.

$$\text{TR} = \text{TC}$$
$$\text{P} \times \text{q} = \text{TFC} + (\text{AVC} \times \text{q})$$
$$(\text{P} \times \text{q}) - (\text{AVC} \times \text{q}) = \text{TFC}$$
$$\text{q}(\text{P} - \text{AVC}) = \text{TFC}$$
$$\text{q}_\text{b} = \frac{\text{TFC}}{\text{P} - \text{AVC}}$$

Reading the formula: break even output is the fixed cost divided by the contribution each unit makes towards it: at this much a unit towards the rent, how many units before the rent is paid? A producer who can rebuild $q(P - AVC) = TFC$ never doubts which quantity goes on top.

When the formula means nothing: it requires $P > AVC$. If price is below average variable cost the contribution is negative, no output ever covers the fixed cost, and selling more deepens the loss. The formula returns a negative output, the arithmetic warning not to produce.

Break even revenue: the takings at the break even output, that output valued at the selling price. A producer who thinks in money rather than units watches this figure, because below it the month ends in a loss.

$$TR_b = P \times q_b = \frac{TFC \times P}{P - AVC}$$

Price and variable cost are usually two large numbers and contribution is the gap between them; because the gap is small it moves violently when either number shifts, which is why a producer guards it more jealously than his rent.

The Master Key: *Contribution is what a unit leaves behind after paying for itself, and break even output is fixed cost divided by contribution.*

BINDER Question 252

A Singida press covers every shilling of its costs at a thousand litres of alizeti oil and presses 1,250. The owner still sleeps badly, and he is right to.

Define break even revenue and the margin of safety, and show, using the record below, how each of them is found for this press.

> A sunflower press at Singida pays TShs 1,200,000 a month in rent, licence, the operator's salary and loan interest, whether it runs or not.
>
> Seed, filtering, bottles and power cost TShs 3,300 for every litre of alizeti (sunflower) oil it produces.
>
> The oil sells at TShs 4,500 a litre, and last month the press sold 1,250 litres.

Model Answer

Break even revenue is the break even output valued at the selling price, here TShs 4,500,000, and the margin of safety is the amount by which actual output exceeds it, here 250 litres or 20 per cent of sales.

Begin with the contribution. Each litre sells for TShs 4,500 and swallows TShs 3,300 in seed, bottles and power.

$$\text{Contribution} = 4{,}500 - 3{,}300 = 1{,}200$$

So every litre hands TShs 1,200 towards fixed costs of TShs 1,200,000 a month, and break even output is the number of such handovers required.

$$q_b = \frac{TFC}{P - AVC} = \frac{1{,}200{,}000}{1{,}200} = 1{,}000 \text{ litres}$$

$$TR_b = 1{,}000 \times 4{,}500 = 4{,}500{,}000$$

What those two figures say: the press must sell 1,000 litres, worth TShs 4,500,000, before it earns a shilling for its owner. Every litre up to the thousandth pays the rent, the salary and the bank; only later litres enrich anybody.

The margin of safety compares that threshold with what the press actually sold, as a quantity and as a share of output; the share is more useful because it compares across firms of different sizes.

$$\text{Margin of safety} = 1{,}250 - 1{,}000 = 250 \text{ litres}$$

$$\text{Margin of safety} = \frac{250}{1{,}250} \times 100 = 20 \text{ per cent}$$

Reading the margin: sales could fall by 250 litres, a fifth of the present total, before the press slipped into loss. That is a thin cushion for a business whose seed comes from one harvest a year, which is why the owner watches the sunflower crop more anxiously than his machine.

Profit at the actual output: the fixed costs are covered by the thousandth litre, so the 250 litres above break even each carry their whole contribution into profit.

$$\pi = 250 \times 1{,}200 = 300{,}000$$

Confirm it by the long road. Revenue is 1,250 times TShs 4,500, or TShs 5,625,000, and total cost is TShs 1,200,000 plus 1,250 times TShs 3,300, or TShs 5,325,000. The difference is again TShs 300,000.

Why a producer watches this figure: the margin of safety turns profit into a measure of risk. Two presses may each earn TShs 300,000 a month, but one with a margin of 40 per cent survives a bad season where one with 5 per cent cannot.

The Master Key: *The margin of safety is the distance between what you sell and what you must sell; the wider it is, the more bad luck the firm can absorb.*

BINDER Question 253

An Iringa workshop is struck by two cost rises of exactly the same size, one in its rent and one in its steel. One of them hurts more than twice as hard.

Explain, working each case numerically, what happens to a firm's break even output when the price of its product rises, when its fixed cost rises, and when its variable cost per unit rises.

A SIDO workshop at Iringa makes steel window frames.

Its fixed costs are TShs 960,000 a month; steel, welding rods, power and casual labour cost TShs 36,000 a frame; and a frame sells at TShs 60,000.

Consider three separate shocks. The selling price rises by a tenth, to TShs 66,000; or the rent rises so that fixed costs rise by a quarter, to TShs 1,200,000; or the steel price rises so that variable cost a frame rises by a quarter, to TShs 45,000.

Model Answer

A rise in price lowers the break even output, while a rise in fixed or variable cost raises it, and the variable cost rise is the most dangerous because it attacks the contribution itself rather than enlarging the sum to be covered.

Start with the workshop as it stands. Contribution is TShs 60,000 less TShs 36,000, so each frame hands TShs 24,000 towards the month's fixed costs.

$$q_b = \frac{960{,}000}{60{,}000 - 36{,}000} = \frac{960{,}000}{24{,}000} = 40 \text{ frames}$$

A rise in the price: price sits in the denominator, so a higher price means a larger contribution and a smaller break even output. At TShs 66,000 contribution rises to TShs 30,000 a frame, the whole extra TShs 6,000 falling into the gap.

$$q_b = \frac{960{,}000}{66{,}000 - 36{,}000} = \frac{960{,}000}{30{,}000} = 32 \text{ frames}$$

A price rise of a tenth cuts break even output by a fifth, from 40 frames to 32, because a tenth on the price is a quarter on the contribution.

A rise in fixed cost: fixed cost sits in the numerator, so break even output rises in exact proportion. A quarter more rent needs a quarter more frames: contribution is still TShs 24,000, so the workshop walks further at the same pace.

$$q_b = \frac{1{,}200{,}000}{24{,}000} = 50 \text{ frames}$$

A rise in variable cost a unit: this is the shock to fear. It does not enlarge the sum to be covered; it shrinks the contribution that does the covering. At TShs 45,000 contribution collapses from TShs 24,000 to TShs 15,000 and break even output leaps.

$$q_b = \frac{960{,}000}{60{,}000 - 45{,}000} = \frac{960{,}000}{15{,}000} = 64 \text{ frames}$$

Shock	Contribution a frame (TShs)	Break even output (frames)	Change from 40
None, as things stand	24,000	40	-
Price up a tenth, to TShs 66,000	30,000	32	down 20 per cent
Fixed cost up a quarter, to TShs 1,200,000	24,000	50	up 25 per cent
Variable cost up a quarter, to TShs 45,000	15,000	64	up 60 per cent

Three shocks and their very different effect on the break even output of the Iringa workshop.

Set the last two rows side by side. Two cost rises of a quarter each move break even output by 25 per cent and by 60 per cent. Fixed cost lengthens the hill; variable cost takes away the legs.

Why the asymmetry arises: fixed cost enters once, as the numerator, so its effect is proportional. Variable cost enters the denominator, subtracted from a much larger price, so a modest rise is a large proportionate fall in contribution: the smaller the contribution, the more violent the effect.

What a producer does with this: because contribution is the sensitive quantity, the first defence against a cost shock is to protect the gap between price and variable cost, by buying materials better, cutting waste and scrap, or raising price where the market allows.

The Master Key: *Fixed cost sets the length of the climb; contribution sets the length of your stride, and losing stride hurts more.*

BINDER Question 254

A Morogoro block yard lost TShs 150,000 last month, and a friend tells the owner to close. Closing would have cost him TShs 400,000, and he cannot see the sense in it.

With the aid of a diagram, explain the short run shut down decision of a firm, and show why a firm that is making a loss may still be right to keep producing.

Model Answer

In the short run a firm should keep producing so long as price covers average variable cost, because fixed costs are paid whether the machine runs or not: the question is not whether there is a loss but whether producing makes it smaller.

Why the loss alone decides nothing: at least one cost is fixed: the rent contracted, the licence bought, the loan signed, none of which vanishes if the gates shut. A firm that closes falls not to zero but to a loss equal to its whole fixed cost.

The comparison that matters: set the loss from producing against the loss from closing. Producing is right whenever it leaves the smaller of the two, even though both are losses: the choice lies between two losses.

Take a block yard at Morogoro. Fixed costs are TShs 400,000 a month for rent, licence and watchman. It sells 500 blocks a month at TShs 3,000 each, and sand, cement, water and labour cost TShs 2,500 a block.

$$TR = 500 \times 3{,}000 = 1{,}500{,}000$$
$$TVC = 500 \times 2{,}500 = 1{,}250{,}000$$
$$TC = 400{,}000 + 1{,}250{,}000 = 1{,}650{,}000$$
$$\pi = 1{,}500{,}000 - 1{,}650{,}000 = -150{,}000$$

So working loses TShs 150,000. Close the yard and revenue and variable cost both vanish, but the rent, the licence and the watchman are still paid.

$$\text{Loss if it closes} = \text{TFC} = 400{,}000$$

The verdict for the block yard: working leaves a loss of TShs 150,000 and closing TShs 400,000, so the owner is TShs 250,000 a month better off with the mixer running. His friend's advice, kindly meant, would cost a quarter of a million.

Where the TShs 250,000 comes from: it is the total contribution. Each block sells at TShs 3,000 and costs TShs 2,500, leaving TShs 500 towards the rent, so 500 blocks leave TShs 250,000. Covering part of an unavoidable bill is worth doing.

$$\text{Total contribution} = 500 \times (3{,}000 - 2{,}500) = 250{,}000$$

Now the general rule, read off the average and marginal cost curves.

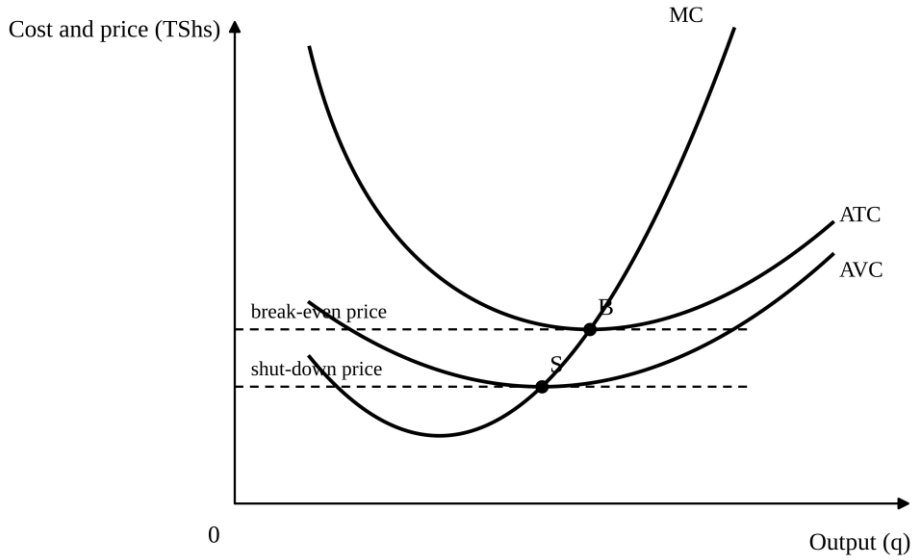


Figure 5.32: The break even point and the shut down point

B, the break even price: B is the lowest point of average total cost, where marginal cost cuts it from below. There price equals average cost and revenue exactly covers cost; above B the firm earns supernormal profit, below it a loss.

S, the shut down price: S is the lowest point of average variable cost, where each unit just pays its own variable cost and gives nothing to fixed costs, so the loss equals fixed cost whether the firm runs or stands idle. Below S it should stop.

The range between S and B: here price is above average variable cost but below average total cost, so against full cost the firm loses on every unit, yet each unit leaves a contribution and the loss stays below the fixed cost: the Morogoro yard's position.

Price	Position of the firm	Correct short run decision
Above the minimum of ATC	Total revenue exceeds total cost	Produce; the firm earns supernormal profit
Equal to the minimum of ATC, at B	Total revenue equals total cost	Produce; the firm breaks even and still earns normal profit
Between the minimum of AVC and the minimum of ATC	A loss, but every unit contributes something towards fixed cost	Produce; the loss is smaller than the fixed cost
Equal to the minimum of AVC, at S	Contribution is exactly zero	Indifferent; the loss equals the fixed cost either way
Below the minimum of AVC	Every unit loses money before fixed cost is counted	Shut down; lose the fixed cost and no more

The three ranges of price and the two boundaries between them.

The long run is different: in the long run there are no fixed costs, because leases end, machines wear out and loans mature, so the firm must cover average total cost or leave. The rule carries a firm through a bad season, not a bad decade.

So the short run rule is one line: produce if $P \geq AVC$, shut down if $P < AVC$, and bear the loss quietly in between, the only alternative being larger.

The Master Key: *Fixed costs are paid either way, so in the short run ask only whether price beats average variable cost.*

REAL Question 255

Follow one month at a Mbeya sembe mill, from the first sack, which costs the owner money, to the last, which finally pays him.

Calculate the mill's contribution a sack, its break even output, its break even revenue, its margin of safety in sacks and as a percentage, and its profit last month; then state what the figures tell the owner about where his danger lies.

A maize mill at Mbeya pays TShs 4,800,000 a month in rent, the operator's salary, the watchman, the licence and loan interest, whether it grinds or not.

Maize, gunny bags, electricity and casual labour cost TShs 32,000 for every sack of sembe it produces.

A sack of sembe sells at TShs 44,000, and last month the mill sold 640 sacks.

Model Answer

Each sack contributes TShs 12,000, the mill breaks even at 400 sacks worth TShs 17,600,000, its margin of safety is 240 sacks or 37.5 per cent, and last month it earned a profit of TShs 2,880,000.

Take the sack as the unit. Of the TShs 44,000 a sack fetches, TShs 32,000 goes out again on maize, bags, power and hands; the rest is the sack's contribution to the mill's standing costs.

$$\text{Contribution} = 44{,}000 - 32{,}000 = 12{,}000$$

$$q_b = \frac{\text{TFC}}{P - \text{AVC}} = \frac{4{,}800{,}000}{12{,}000} = 400 \text{ sacks}$$

$$TR_b = 400 \times 44{,}000 = 17{,}600{,}000$$

What the break even output means here: the mill must grind and sell 400 sacks a month, about thirteen a day, before it earns a shilling for its owner. Everything up to the four hundredth sack pays the rent, the salary, the watchman and the bank.

Now bring in what the mill actually sold.

$$\text{Margin of safety} = 640 - 400 = 240 \text{ sacks}$$

$$\text{Margin of safety} = \frac{240}{640} \times 100 = 37.5 \text{ per cent}$$

$$\pi = 240 \times 12{,}000 = 2{,}880{,}000$$

Check it by the long road. Revenue is 640 times TShs 44,000, or TShs 28,160,000, and total cost is TShs 4,800,000 plus 640 times TShs 32,000, or TShs 25,280,000. The difference is again TShs 2,880,000.

The same answer through average cost: spread over 640 sacks the fixed cost is TShs 7,500 a sack, and adding TShs 32,000 of variable cost gives an average total cost of TShs 39,500. At TShs 44,000 the mill clears TShs 4,500 a sack.

$$AFC = \frac{4{,}800{,}000}{640} = 7{,}500 \quad ATC = 7{,}500 + 32{,}000 = 39{,}500$$

$$\pi = (44{,}000 - 39{,}500) \times 640 = 2{,}880{,}000$$

Where the break even price hides: at 400 sacks the fixed cost spreads to TShs 12,000 a sack, so average total cost is $12{,}000 + 32{,}000 = 44{,}000$ shillings, exactly the selling price. Break even output and break even price are one fact from two directions.

What the owner should take away: a margin of 37.5 per cent means sales could fall by more than a third before the mill lost money, comfortable for a business facing a variable maize harvest. It also names his danger: not the price of sembe, steady in Mbeya, but the number of sacks sold.

Because contribution is TShs 12,000 a sack, every sack beyond 640 adds TShs 12,000 of pure profit, the fixed costs being paid. This is why a miller with idle hours chases an order that looks too cheap: anything above TShs 32,000 beats an idle machine.

The Master Key: *Four hundred sacks pay the mill's bills; every sack after that is worth its whole contribution in profit.*

REAL Question 256

The export price of Nile perch fillet has fallen, and a Mwanza plant must decide, before the boats go out, whether to open its cold store at all this season.

Advise the manager on both of his questions, showing in full the loss under each course of action.

A fillet plant on the lake shore at Mwanza has fixed costs of TShs 420,000,000 for the season: the cold store, insurance, the licence, the salaried staff and interest on the plant, all payable whether it runs or not.

Buying fish from the boats, ice, packing, power and casual labour cost TShs 7,200,000 for every tonne of fillet.

The plant can handle 500 tonnes in a season, and the export price has fallen from TShs 9,000,000 a tonne to TShs 7,800,000.

The manager asks two questions: should the plant run this season, and what should he do if the price falls further, to TShs 6,900,000?

Model Answer

At TShs 7,800,000 a tonne the plant should run, because running loses TShs 120,000,000 while closing loses the whole TShs 420,000,000 of fixed cost; at TShs 6,900,000 it should shut for the season, since running would then lose TShs 570,000,000.

Begin with the test that settles every short run shut down question: compare price with average variable cost, here TShs 7,200,000 a tonne, which does not move when the export price moves.

At TShs 7,800,000 price beats average variable cost: each tonne of fillet earns TShs 600,000 more than the fish, ice, packing and power that go into it, so each leaves that much towards the cold store and the salaried staff.

$$\text{Contribution a tonne} = 7{,}800{,}000 - 7{,}200{,}000 = 600{,}000$$

$$\text{Total contribution} = 500 \times 600{,}000 = 300{,}000{,}000$$

$$\text{Loss if it runs} = 300{,}000{,}000 - 420{,}000{,}000 = -120{,}000{,}000$$

$$\text{Loss if it closes} = 420{,}000{,}000$$

The advice for this season: run. The season ends in a loss whatever the manager does, but running ends it TShs 300,000,000 less badly, because 500 tonnes will have paid that much of the cold store's bill.

The full accounts agree. Revenue is TShs 3,900,000,000, variable cost TShs 3,600,000,000 and total cost TShs 4,020,000,000, so the loss is TShs 120,000,000 and average total cost is TShs 8,040,000 a tonne. The price lies between the two averages.

It cannot break even this season: at a contribution of TShs 600,000 a tonne the plant needs 700 tonnes to cover its fixed cost and can handle only 500. The loss is unavoidable; only its size lies within the manager's control.

$$q_b = \frac{420{,}000{,}000}{600{,}000} = 700 \text{ tonnes}$$

At TShs 6,900,000 the test fails: price now falls below average variable cost, so every tonne processed loses TShs 300,000 before a shilling of the cold store's cost is met. Working harder makes the position worse.

$$\text{Contribution a tonne} = 6{,}900{,}000 - 7{,}200{,}000 = -300{,}000$$

$$\text{Loss if it runs} = 420{,}000{,}000 + (500 \times 300{,}000) = 570{,}000{,}000$$

The advice at the lower price: shut down for the season. Closing loses TShs 420,000,000 and running TShs 570,000,000, so shut gates save TShs 150,000,000. Buying fish to sell at a loss is not loyalty; the plant serves the fishermen better by surviving to buy next year.

Two cautions. Some of what the accounts call fixed may be escapable: release staff and suspend the insurance and closing costs less than TShs 420,000,000. And this is a decision for one season; if TShs 6,900,000 lasts for years, the question becomes whether to stay in the fillet trade, settled against average total cost.

The Master Key: *Compare price with average variable cost first: above it the boats go out, below it the cold store stays shut.*

REAL Question 257

A Kariakoo baker wakes to a new price for flour. By nightfall his oven has baked the same 500 loaves, and a hundred more of them belong to the landlord.

Calculate the bakery's break even output, margin of safety and daily profit before and after the rise in the price of flour, and advise the owner on what he can now do.

A bakery at Kariakoo pays TShs 180,000 a day in shop rent, the instalment on the oven, the licence and the baker's salary.

Flour, yeast, sugar, gas and wrapping cost TShs 900 a loaf; a loaf sells at TShs 1,500; and the bakery sells 500 loaves a day.

The price of flour then rises, lifting the cost of a loaf to TShs 1,050.

The owner cannot raise his price, because four other bakeries sell in the same street.

Model Answer

The flour rise lifts break even output from 300 loaves to 400, halves the margin of safety from 200 loaves to 100 and cuts daily profit from TShs 120,000 to TShs 45,000, so the bakery is still worth running but has lost most of its cushion.

Work the two situations side by side, since only the variable cost has changed. Fixed cost, price and daily sales are unmoved.

$$\text{Contribution before} = 1{,}500 - 900 = 600 \quad \text{Contribution after} = 1{,}500 - 1{,}050 = 450$$

$$q_b \text{ before} = \frac{180{,}000}{600} = 300 \text{ loaves}$$

$$q_b \text{ after} = \frac{180{,}000}{450} = 400 \text{ loaves}$$

$$\pi \text{ before} = (500 \times 600) - 180{,}000 = 120{,}000$$

$$\pi \text{ after} = (500 \times 450) - 180{,}000 = 45{,}000$$

Item	Before the flour rise	After the flour rise
Contribution a loaf (TShs)	600	450
Break even output (loaves a day)	300	400
Margin of safety (loaves)	200	100
Margin of safety (per cent)	40	20
Daily profit (TShs)	120,000	45,000

The Kariakoo bakery before and after a rise of TShs 150 in the cost of a loaf.

A small cost rise, a large wound: the cost of a loaf rose by TShs 150, a tenth of the price, yet break even output rose by a third and profit fell by nearly two thirds, because the whole TShs 150 came out of the contribution.

The margin of safety is the frightening figure: before the rise the bakery could lose two fifths of its custom and still cover costs; now only a fifth. A week of rain, a holiday or one more oven in the street could push sales below 400 loaves.

The first remedy, price: to bring break even output back to 300 loaves the contribution must return to TShs 600, which needs a price of TShs 1,650. The street will not bear it: a Kariakoo trader with so many rivals is nearly a price taker.

$$P = AVC + \frac{TFC}{q_b} = 1{,}050 + \frac{180{,}000}{300} = 1{,}650$$

The second remedy, fixed cost: if price cannot move, fixed cost must. At TShs 450 a loaf a break even output of 300 needs fixed cost of TShs 135,000 a day, so he must find TShs 45,000: subletting part of the shop, settling the oven's instalment, or a cheaper frontage.

$$TFC = q_b \times \text{contribution} = 300 \times 450 = 135{,}000$$

The third remedy, volume: to earn his old TShs 120,000 a day at the new contribution he must sell about 667 loaves, a third more than now, the hardest of the three, though bulk supply to schools, guest houses and hotels is how Kariakoo bakers try.

$$q = \frac{120{,}000 + 180{,}000}{450} \approx 667 \text{ loaves}$$

What he must not do: close. A price of TShs 1,500 stands well above the variable cost of TShs 1,050, so every loaf still contributes TShs 450. Shutting turns a profit of TShs 45,000 a day into a loss of TShs 180,000 in an empty room.

The wider lesson is where a small firm's danger lies. This bakery was never seriously threatened by the rent it had signed for. It was threatened by TShs 150 on the cost of a loaf, the shilling that comes out of the contribution.

The Master Key: *A rise in the cost of materials is more dangerous than a rise in rent, because it eats the contribution out of which the rent is paid.*

HOT Question 258

A Mtwara cashew plant runs for four months and stands silent for eight. The accountant calls the silence waste; the manager calls it the season.

A cashew processing plant at Mtwara works for only four months of the year and stands idle for the remaining eight. Assess whether it should be closed down.

The plant's fixed costs are TShs 900,000,000 a year: the lease, the loan on the machinery, insurance, security and the permanent staff, all payable in the idle months as well as the busy ones.

In a good season it processes 4,000 tonnes of raw nut, and every tonne earns TShs 250,000 more than the nuts, the casual labour, the power and the packing cost.

Raw nut supply has become unreliable, and in a poor season the plant secures only 2,400 tonnes.

Model Answer

Idleness for eight months is no reason in itself to close, because the decision turns on whether the contribution earned in the four working months covers the fixed costs of the whole year, which it does comfortably in a good season and fails badly in a poor one.

Why the eight idle months prove nothing: the fixed costs run for twelve months whether the plant works four or none, and closing does not save them unless the lease is surrendered and the machinery sold. The working months add contribution a closed plant would never earn.

The test in a good season: 4,000 tonnes at a contribution of TShs 250,000 a tonne earn TShs 1,000,000,000 in four months, more than the whole year's fixed cost.

$$\text{Season contribution} = 4{,}000 \times 250{,}000 = 1{,}000{,}000{,}000$$

$$\text{Annual profit} = 1{,}000{,}000{,}000 - 900{,}000{,}000 = 100{,}000{,}000$$

In a good season it should stay open: it covers a full year of fixed cost out of four months' work and clears TShs 100,000,000 besides. The pattern belongs to the crop, harvested once a year: every processor from Mtwara to Lindi lives this way, as does a Kilombero cane mill in the wet season.

The test in a poor season: 2,400 tonnes earn only TShs 600,000,000 of contribution against TShs 900,000,000 of fixed cost, so the year closes TShs 300,000,000 down.

$$\text{Season contribution} = 2{,}400 \times 250{,}000 = 600{,}000{,}000$$

$$\text{Annual result} = 600{,}000{,}000 - 900{,}000{,}000 = -300{,}000{,}000$$

Even then, running beats closing within the year: once the lease is signed and the season open, TShs 600,000,000 of contribution is far better than none, so the plant should process every tonne it can get. Shutting would turn a loss of TShs 300,000,000 into TShs 900,000,000.

The long run answer may be opposite: if poor supply is the new normal the plant loses TShs 300,000,000 every year. In the long run lease, staff and machinery all become escapable, so the owner must ask what those assets would earn elsewhere: a plant that cannot reach 3,600 tonnes should not be rebuilt.

$$q_b = \frac{900{,}000{,}000}{250{,}000} = 3{,}600 \text{ tonnes}$$

The remedies that come before closing: the fixed cost is spread over four months only because the plant does one thing. Taking in sunflower from Singida in the off season, hiring out the warehouse, or handling a second crop spreads it over more contribution; clearing the machinery loan works from the other side.

The case that reaches beyond the firm: it buys nuts from thousands of Mtwara growers and keeps the secondary stage of production, with its wages and skills, in the country instead of shipping raw nut abroad. These are reasons for public action, not for a private owner to accept a permanent loss.

So the decision turns not on the eight silent months but on one question: does the season's contribution cover the year's fixed cost? Where supply is good it plainly does. Where it has settled below 3,600 tonnes, the plant is too large for its crop.

The Master Key: *Judge a seasonal plant by the year and not by the month: the season's contribution must cover the whole year's fixed cost.*

HOT Question 259

Three seasons, three losses, and the Shinyanga ginnery still opens its gates each June. The owner calls it patience; his bank manager has begun to call it something else.

A cotton ginnery in Shinyanga has made a loss in each of the last three seasons. Discuss whether it should now shut down.

> The ginnery's fixed costs are TShs 1,400,000,000 a season.
>
> Ginning has covered its own variable costs in each of the three seasons and left a contribution of about TShs 1,100,000,000, so the recorded loss has been about TShs 300,000,000 a season.
>
> World lint prices have been weak for three years. The owner believes they will recover; the bank is no longer sure.

Model Answer

Three seasons of loss are strong evidence but not a verdict: the short run rule says keep ginning while price covers variable cost, yet three seasons is long enough for the long run test, so the decision turns on whether price is expected to recover above average total cost.

The case for opening again this June: the ginnery still earns a contribution of TShs 1,100,000,000 against fixed costs of TShs 1,400,000,000, so it loses TShs 300,000,000 by ginning and TShs 1,400,000,000 by standing still. On the short run rule the gates open.

$$\text{Loss if it gins} = 1{,}100{,}000{,}000 - 1{,}400{,}000{,}000 = -300{,}000{,}000$$

$$\text{Loss if it closes} = 1{,}400{,}000{,}000$$

Why three seasons changes the question: the short run rule assumes fixed costs are already committed. Over three seasons that fails: leases fall in, machines are replaced, insurance is renewed and loans rolled over, each renewal a fresh commitment. The test becomes price against average total cost, failed three times.

The loss is economic, not merely accounting: economic cost already includes the normal profit the owner could have earned from the same capital, land and effort elsewhere, so a loss of TShs 300,000,000 a season is that much worse than the alternative he passed over: TShs 900,000,000 over three seasons.

The case for holding on: the cause of the loss matters more than its length. World lint prices move in long cycles, and a ginner who shuts at the bottom of a trough will not be there at the top. Closing also loses skilled staff, grower relations and buying arrangements.

The case for closing now: if the loss is structural, waiting is merely expensive. Too little cotton within haulage distance, machinery so old that ginning outturn is poor, or a permanent shift to synthetic fibre will not mend, and every season adds TShs 300,000,000 never recovered.

The questions that actually decide it: is price below average total cost because of the world market or because of this plant? Can the owner remove the loss himself, by contract farming for seed cotton, longer working to spread the fixed cost, or selling cotton seed and oil? How many seasons can he finance?

The ginnery should not stop in mid season while price still covers variable cost. But three seasons is no longer a short run: the owner should set a limit, a stated price recovery by a stated date, failing which the plant is sold or leased. Waiting because closing feels like defeat is the slow loss of a family's capital.

The Master Key: *One bad season is a short run question answered by variable cost; three bad seasons is a long run question answered by total cost.*

HOT Question 260

Two billion shillings lie buried in a half built Dodoma juice plant. The board says that is precisely why the work must go on. The money itself says nothing at all.

Examine the argument that a firm which has already invested heavily in a project should continue with it rather than abandon it.

A fruit juice plant at Dodoma has already absorbed TShs 1,800,000,000.

Finishing it would cost a further TShs 600,000,000, and the finished plant is now expected to be worth TShs 900,000,000, whether it is sold or run.

Abandoned today, the half built works and the machinery already delivered would fetch TShs 200,000,000.

One director says: we have already invested too much to stop now.

Model Answer

The argument is unsound, because the TShs 1,800,000,000 already spent is a sunk cost, equally gone under either course, and cannot distinguish between them; the plant should be finished only because finishing is worth TShs 300,000,000 against TShs 200,000,000 for abandoning it.

What a sunk cost is: a cost already incurred and not recoverable whatever the firm now decides. The TShs 1,800,000,000 has gone on excavation, foundations, imported machinery and fees; whether the board finishes or walks away, it is beyond recall.

Why it cannot enter the decision: a rational choice compares what each course will bring in from now on with what it will cost from now on. A figure appearing identically in both columns cancels out, and a sunk cost is exactly that: history.

Do the arithmetic the board should have done, counting only what still lies ahead.

$$\text{Value of continuing} = 900{,}000{,}000 - 600{,}000{,}000 = 300{,}000{,}000$$

$$\text{Value of abandoning} = 200{,}000{,}000$$

The right decision, reached for the right reason: continue, because TShs 300,000,000 beats TShs 200,000,000. The TShs 1,800,000,000 appears nowhere in that comparison. The board arrives where the director wanted, but by reasoning that would also have told it when to stop.

The test that exposes the fallacy: change one figure. Were the finished plant worth only TShs 500,000,000, continuing would be worth minus TShs 100,000,000 against TShs 200,000,000 for abandoning, so the works should be sold. The TShs 1,800,000,000 is identical in both versions, yet the answer reverses.

$$\text{Value of continuing} = 500{,}000{,}000 - 600{,}000{,}000 = -100{,}000{,}000$$

The same logic drives the shut down rule: within the short run a firm's fixed cost is sunk, which is why the shut down rule ignores it and looks only at price against average variable cost. The Dodoma director's error and the loss making firm's wisdom are one idea.

The grain of truth in the argument: heavy past investment often leaves assets worth more inside the project than outside, since a half built juice plant has little resale value. That lowers the remaining cost of carrying on, so such schemes frequently should be completed, but the reason is the cheap future, not the large past.

Where the argument does real harm: governments and firms pour good money into failing roads, factories and ships because stopping would admit the earlier money was wasted. The waste has happened; refusing to admit it enlarges it. A disciplined producer treats every morning as a fresh decision.

So the director's argument as stated is a fallacy. What he should have said is that finishing costs TShs 600,000,000 and yields TShs 900,000,000, a good return on money still to be spent. Money already spent is a fact to learn from, not a reason to spend more.

The Master Key: *Ask not what the project has cost, but what it will yet cost and what it will bring; the past is gone whichever way you choose.*

Production and Cost Decisions: Clinic and Capstone

Nothing in this chapter is difficult; almost everything in it is easy to get slightly wrong. A schedule is read one column across, a fixed cost is treated as a sunk one, a mill is closed that should have kept grinding. The first questions here set such errors beside their corrections. The rest follow one miller at Uyole outside Mbeya from a day's record of bags to the choice of a plant, so that every idea in the chapter is at last seen working together.

BINDER Question 261

An Iringa picker joins the tomato gang. The average falls, and the owner reaches for his money to pay the man off. Six full crates are standing behind him.

Identify the two errors in the answer below, correct each of them, and state what has actually happened to the farm's output.

> The question asked: an Iringa tomato farm employs five pickers and fills 60 crates a day. A sixth picker is engaged and the farm fills 66 crates a day. What has happened to the farm's output?
>
> A student answers: 'Average product is the extra output added by the last worker. Average product has fallen from 12 crates to 11 crates. Since average product has fallen, the farm's output has fallen. The sixth picker has therefore reduced the harvest and should be sent home.'

Model Answer

The answer confuses average product with marginal product and then reads a falling average as a falling total, when in truth the farm's output has risen by six crates and the sixth picker is well worth keeping.

The first error: average product is total product divided by the number of workers, not the extra output of the last worker, which is marginal product. One asks what a typical picker manages, the other what the newest adds.

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} \quad \text{and} \quad \mathrm{MP_L} = \frac{\Delta\,\mathrm{Q}}{\Delta\,\mathrm{L}}$$

$$\mathrm{AP_L}(5) = \frac{60}{5} = 12 \quad \text{and} \quad \mathrm{AP_L}(6) = \frac{66}{6} = 11$$

$$\mathrm{MP_L} = \frac{66 - 60}{6 - 5} = 6 \text{ crates}$$

The second error: a falling average product does not mean a falling output. Total product falls only when marginal product turns negative. Here marginal product is a positive 6 crates, so total product rose from 60 crates to 66.

The sixth picker brought 6 crates, less than the 12 the average picker managed, so he pulled the average down without taking a crate off the heap: a newcomer below the average still adds to the total.

What the record is really showing: diminishing returns, an ordinary condition of a working farm and not a warning. Land, crates and pick up are fixed, so each pair of hands has less unpicked ground and marginal product falls; only negative marginal product reduces the harvest.

The correct advice: keep the sixth picker so long as his 6 crates are worth more than his pay. At TShs 25,000 a crate they fetch TShs 150,000 against a day's pay of TShs 10,000, so sending him home would throw away TShs 140,000 a day.

So: output has risen from 60 to 66 crates, average product has fallen from 12 to 11 because the marginal product of 6 lies below the old average, and the picker should stay.

The Master Key: *Average product is divided, marginal product is differenced, and output falls only when the marginal turns negative.*

BINDER Question 262

Kilombero builds a second factory, doubles everything it owns, and finds sugar costs more a tonne than before. The phrase diminishing returns is on everybody's lips, and it is the wrong phrase.

Identify the errors in the explanation below, then set out the correct distinction between the law of diminishing returns and diseconomies of scale, and the correct meaning of the long run.

> The question asked: a sugar company at Kilombero builds a second factory. It doubles its cane land, doubles its workforce and doubles its machinery. Its cost per tonne of sugar rises. Explain what has happened.
>
> A student answers: 'This is the law of diminishing returns. When more of a factor is added, the extra output gets smaller and so cost per tonne rises. The law certainly applies here, because the company has been in business for more than five years, and after five years every firm is in the long run.'

Model Answer

The explanation is wrong twice: what Kilombero has met is diseconomies of scale, which belong to the long run in which every factor is varied, and the long run is not five years but the period in which no factor is fixed.

Diminishing returns is a short run law: it applies only where at least one factor is fixed and a variable factor is added in larger doses. What changes is the proportion between factors, hence the law of variable proportions.

Kilombero has fixed nothing: land, labour and machinery were all doubled together, so the proportions between factors are exactly what they were. Nothing is being crowded onto anything, so diminishing returns cannot be the explanation, however tempting the words sound.

What is happening is diseconomies of scale: the long run condition in which average cost rises as scale is enlarged. Its causes are managerial: one board cannot watch two factories, decisions arrive later, supervision thins; and bidding for cane and fitters in one district raises their prices.

Told apart by what is held fixed: diminishing returns concerns returns to a factor with the plant fixed; diseconomies concern returns to scale with the plant changed. The first sets in even in a perfectly run firm; the second better structure can postpone.

The long run is not five years: it is the period long enough for every factor, buildings and machinery included, to be varied, so that no factor remains fixed. It is defined by what can be changed, not by the calendar.

Its length differs by trade: a fortnight for a fundi cherehani, who can buy another sewing machine at Kariakoo that afternoon, ten years for a hydroelectric station. A firm can be in the short run for its buildings and the long run for its lorries.

Correctly stated, Kilombero varied every factor and moved along its long run average cost curve, and the rise in cost a tonne shows it has expanded past that curve's lowest point. The remedy is separate management, not fewer workers.

The Master Key: *One factor fixed and one varied gives diminishing returns; every factor varied gives returns to scale, and the long run is measured by what can change, never by years.*

BINDER Question 263

Neema's books at Mwanza show a profit every month. The teaching post she gave up and the savings she buried in the shop appear in no column at all.

Identify the errors in Neema's reckoning below, calculate her accounting profit and her economic profit, and state the correct treatment of the TShs 1,500,000.

> Neema left a post at a Mwanza secondary school paying TShs 800,000 a month in order to open a stationery shop. She put TShs 12,000,000 of her own savings into the stock and the fittings; that money had been earning 12 per cent a year at the bank.
>
> Her record for last month: sales TShs 4,200,000; stock bought TShs 2,600,000; rent, wages and power TShs 700,000.
>
> Neema writes: 'My profit is TShs 900,000 a month, so the shop is doing well. And I spent TShs 1,500,000 last year on a signboard and a fitted counter that nobody would ever buy from me. That money is in this business, so I cannot possibly close it, whatever happens.'

Model Answer

Neema's accounting profit of TShs 900,000 a month is right, but she has left out her own labour and capital, so her economic profit is a loss of TShs 20,000 a month, and the TShs 1,500,000 already spent is a sunk cost, irrelevant to any decision now.

Two mistakes hide in that short paragraph: one about which costs count, one about which costs are still alive.

Explicit costs are the payments she actually makes: the stock, the rent, the wages and the power. Taking these from sales gives accounting profit, what a bookkeeper reports and the tax office wants to see.

$$\text{Accounting profit} = 4{,}200{,}000 - (2{,}600{,}000 + 700{,}000) = 900{,}000$$

Implicit costs are borne without being paid: the earnings of the factors she owns and uses in the shop. Her own labour could have earned TShs 800,000 a month at the school, and her TShs 12,000,000 could have earned bank interest: real sacrifices, invisible to a bookkeeper.

$$\text{Interest foregone} = 12{,}000{,}000 \times \frac{12}{100} = 1{,}440{,}000 \text{ a year}$$

$$\text{Interest foregone a month} = \frac{1{,}440{,}000}{12} = 120{,}000$$

$$\text{Total implicit cost} = 800{,}000 + 120{,}000 = 920{,}000$$

$$\text{Economic profit} = 900{,}000 - 920{,}000 = -20{,}000$$

What that figure means: the shop earns TShs 20,000 a month less than her labour and savings would earn elsewhere: not bankruptcy, merely a little worse off than teaching with the money on deposit. She may report TShs 900,000 but not celebrate it.

The second error is the sunk cost: the TShs 1,500,000 spent on a signboard and fitted counter that cannot be resold is gone whether she stays or closes. A cost no present decision can alter belongs on neither side of the reckoning.

Sunk is not the same as fixed: the rent is fixed but not sunk: when the lease ends she can stop paying it. A resaleable machine is fixed but not sunk; the paint on its casing and the licence fee are.

Reasoning of the form 'I have already put so much in that I cannot stop now' has thrown good money after bad in more failed businesses than any shortage of capital.

So correct the books first and judge afterwards. The economic loss is small, and if trade is growing, or if Neema values working for herself at more than TShs 20,000 a month, staying is defensible.

The Master Key: *Accounting profit ignores what you own and gave up, economic profit counts it, and a cost that no decision can change belongs in neither.*

BINDER Question 264

A student draws the cost curves for a Tanga sisal shed and writes three confident notes beside them. All three are wrong, and each in a way a producer would feel.

Identify what is wrong with each of the three notes below, and state the correct position in each case.

> A sisal estate at Tanga runs a leaf cutting shed. A student produces the shed's cost curves and writes three notes beside them.
>
> Note one: 'The marginal cost curve cuts the average variable cost curve while average variable cost is still falling, and it cuts the average total cost curve some way after average total cost has begun to rise.'
>
> Note two: 'Far to the right the average total cost curve comes down and meets the average variable cost curve, and beyond that output the two run together as one curve.'
>
> Note three: 'The estate's ground rent has just risen, so the shed's marginal cost curve shifts upward. The cutters' pay has risen too, but that will not touch marginal cost.'
>
> The shed's own figures: fixed cost TShs 40,000 a day; total variable cost TShs 30,000 at ten tonnes of leaf and TShs 33,500 at eleven tonnes; the cutters are the only variable input.

Model Answer

All three notes are wrong: marginal cost cuts each average curve at that curve's own lowest point, average total cost and average variable cost draw closer for ever without meeting, and it is the cutters' pay, not the ground rent, that lifts marginal cost.

Note one is wrong about where marginal cuts: while marginal cost lies below an average curve it pulls that average down, so the average is still falling; while above, the average rises. The average is at its lowest only where marginal cost equals it.

The two lowest points differ: average total cost carries average fixed cost, which is still falling. That holds it down after average variable cost has begun to climb, so its minimum lies to the right of the other's.

Note two is wrong, average fixed cost never reaching zero: by definition $\mathrm{ATC} = \mathrm{AVC} + \mathrm{AFC}$, with $\mathrm{AFC} = \mathrm{TFC}/\mathrm{q}$. Total fixed cost is positive and output finite, so average fixed cost is positive at every output: the gap narrows for ever and never closes.

Note three is backwards on both counts: marginal cost is the addition to total cost from one more unit. A fixed cost is the same at every output, so it cancels out of the difference: a rent rise leaves marginal cost where it stood.

The shed's own figures settle it, with fixed cost at TShs 40,000 and total cost of TShs 70,000 at ten tonnes and TShs 73,500 at eleven.

$$\text{MC} = \frac{73{,}500 - 70{,}000}{11 - 10} = 3{,}500$$

Now let the ground rent rise, so that fixed cost becomes TShs 60,000 a day and total cost TShs 90,000 and TShs 93,500.

$$\text{MC} = \frac{93{,}500 - 90{,}000}{11 - 10} = 3{,}500$$

Marginal cost has not moved at all: average total cost, however, has risen from TShs 7,000 to TShs 9,000 a tonne at ten tonnes. The rent shows in the average alone, which is why it changes what a producer earns without changing what he produces.

The cutters' pay is the opposite case. Raise it by a fifth and total variable cost becomes TShs 36,000 and TShs 40,200.

$$\text{MC} = \frac{40{,}200 - 36{,}000}{11 - 10} = 4{,}200$$

Marginal cost has risen by exactly a fifth: from TShs 3,500 to TShs 4,200 a tonne, every extra tonne taking the same cutting time at a higher rate, while average variable cost rises from TShs 3,000 to TShs 3,600. A wage rise lifts the whole curve.

Behind all three notes lies one idea. Fixed costs decide whether a firm is worth running at all; variable costs decide how hard it is run.

The Master Key: *Marginal cuts each average at that average's lowest point, average total cost never reaches average variable cost, and only variable costs move marginal cost.*

REAL Question 265

Amani's press at Singida is cheapest at 140 litres a day, so he stops there. Twenty more litres would each cost less than they fetch, and he leaves that money behind.

Identify the two errors in Amani's reasoning, find the output that actually maximises his profit at TShs 3,300 a litre, and advise him what he should have done in the season when the price fell to TShs 2,600.

Amani presses alizeti, sunflower seed, into cooking oil at Singida. His costs for a day are:
Output in litres: 100, 120, 140, 160, 180, 200
Total cost in TShs: 300,000; 342,000; 392,000; 450,000; 522,000; 610,000
Of that total cost, TShs 140,000 a day is fixed. The press sells all the oil it makes at TShs 3,300 a litre.
Amani writes: 'Average total cost is lowest at 140 litres, so 140 litres is the output that earns me the most. And last season, when the price fell to TShs 2,600, every litre was costing more to make than it fetched, so I shut the press at once. A business that is losing money must stop.'

Model Answer

Both statements are wrong: profit is greatest at 160 litres and not at the output of lowest average total cost, and shutting the press when the price fell to TShs 2,600 cost Amani a further TShs 112,000 a day.

Set out average total cost and marginal cost first, because the answer turns on the difference.

Output (litres)	Total cost (TShs)	Average total cost (TShs a litre)	Marginal cost (TShs a litre)
100	300,000	3,000	-
120	342,000	2,850	2,100
140	392,000	2,800	2,500
160	450,000	2,812.50	2,900
180	522,000	2,900	3,600
200	610,000	3,050	4,400

A day at Amani's sunflower press at Singida, with marginal cost worked out over each step of twenty litres.

The first error: the lowest average total cost is the cheapest place to make a litre, not the most profitable place to stop. The gap between revenue and cost widens while the next litre adds more to revenue than to cost.

The press sells all it makes at TShs 3,300, so marginal revenue is TShs 3,300 a litre, while the twenty litres between 140 and 160 cost TShs 2,900 each.

$$\text{Gain} = (3{,}300 - 2{,}900) \times 20 = 8{,}000$$

The twenty litres between 160 and 180 cost TShs 3,600 each and fetch only TShs 3,300, so they take money away.

$$\text{Change} = (3{,}300 - 3{,}600) \times 20 = -6{,}000$$

So the profit maximising output is 160 litres: at 140 litres profit is $462{,}000 - 392{,}000 = 70{,}000$ shillings a day, at 160 litres $528{,}000 - 450{,}000 = 78{,}000$. Amani gives away TShs 8,000 a day, near TShs 240,000 a month, to keep his average cost tidy.

The second error: a firm making a loss should not always close at once. In the short run fixed costs are there whether the press turns or stands, so the comparison is between the loss from running and the loss from closing.

At TShs 2,600 the loss minimising output is 140 litres, since the step to 160 costs TShs 2,900 a litre. Takings are then TShs 364,000 against a cost of TShs 392,000.

$$\text{Loss from running} = 392{,}000 - 364{,}000 = 28{,}000 \text{ a day}$$

If he closes, revenue is nothing but the fixed cost of TShs 140,000 a day still falls due.

$$\text{Loss from closing} = 140{,}000 \text{ a day}$$

Running was better by TShs 112,000 a day: average variable cost at 140 litres is $\frac{392{,}000 - 140{,}000}{140} = 1{,}800$ shillings, so every litre sold at TShs 2,600 left TShs 800 towards fixed cost. Over 140 litres that is TShs 112,000 a day.

The correct rule: in the short run keep producing while price is at or above average variable cost, and shut down only when it falls below. A price under average total cost means a loss; under average variable cost, every litre makes the loss worse.

The two errors have one root: Amani reasons with averages where the question is marginal. Only the margin tells him whether the next twenty litres are worth pressing.

The Master Key: *Lowest average cost is where a litre is cheapest; marginal cost against marginal revenue is where profit is greatest; and a loss maker closes only when price falls under average variable cost.*

REAL Question 266

A Morogoro tank maker must drop his price on every tank to sell one more. He counts the extra tank's price as what it brings him, and the arithmetic punishes him.

Identify the error in the manager's reasoning, calculate total revenue, average revenue and marginal revenue at each level of output, and state how many tanks the works should make each week.

Kilimo Plastics moulds plastic water tanks at Morogoro. It is the only maker in the district, so in order to sell more tanks in a week it must lower the price on all of them.

Tanks a week: 1, 2, 3, 4, 5, 6

Price a tank in TShs: 300,000; 280,000; 260,000; 240,000; 220,000; 200,000

Cost of moulding that tank in TShs: 150,000; 160,000; 170,000; 175,000; 200,000; 230,000

Fixed cost is TShs 200,000 a week.

The manager writes: 'Average revenue and marginal revenue are the same thing, since both are revenue per tank. The fifth tank sells for TShs 220,000 and costs TShs 200,000 to mould, so it adds TShs 20,000 to my profit. We shall make five a week.'

Model Answer

A firm that must cut its price to sell more receives from the extra tank not its price but its price less what is surrendered on tanks already sold, so marginal revenue on the fifth tank is TShs 140,000, not TShs 220,000, and four tanks should be moulded.

Total revenue is price times quantity, average revenue is that divided by quantity and so is the price, and marginal revenue is the addition from one more tank.

$$\text{AR} = \frac{\text{TR}}{\text{q}} = \text{P} \quad \text{and} \quad \text{MR} = \frac{\Delta\,\text{TR}}{\Delta\,\text{q}}$$

Tanks	Price, that is AR (TShs)	Total revenue (TShs)	Marginal revenue (TShs)	Marginal cost (TShs)
1	300,000	300,000	300,000	150,000
2	280,000	560,000	260,000	160,000
3	260,000	780,000	220,000	170,000
4	240,000	960,000	180,000	175,000
5	220,000	1,100,000	140,000	200,000
6	200,000	1,200,000	100,000	230,000

Revenue and cost tank by tank at Kilimo Plastics, Morogoro.

Average revenue is the price; marginal revenue is not: average revenue is total revenue spread over the tanks sold, so it is the price itself, while marginal revenue is the change in the whole takings when one more tank leaves the yard.

Why they part company here: to sell the fifth tank the works must drop the price from TShs 240,000 to TShs 220,000 on all five, gaining TShs 220,000 from the new tank and giving up TShs 20,000 on each of the four already sold.

$$\text{MR} = 220{,}000 - (4 \times 20{,}000) = 220{,}000 - 80{,}000 = 140{,}000$$

$$\text{Check: MR} = \frac{1{,}100{,}000 - 960{,}000}{5 - 4} = 140{,}000$$

The fifth tank is a loss and not a gain: it adds TShs 140,000 to takings and TShs 200,000 to cost, so it removes TShs 60,000 from profit. The manager believed it added TShs 20,000; the gap of TShs 80,000 a week is an error of definition.

Where profit is greatest: go on while marginal revenue exceeds marginal cost and stop where they meet. The fourth tank brings TShs 180,000 against TShs 175,000, so it is worth moulding; the fifth brings TShs 140,000 against TShs 200,000, so it is not.

The profit column confirms it. With fixed cost at TShs 200,000 a week, total cost is TShs 855,000 at four tanks and TShs 1,055,000 at five.

$$\pi(4) = 960{,}000 - 855{,}000 = 105{,}000$$

$$\pi(5) = 1{,}100{,}000 - 1{,}055{,}000 = 45{,}000$$

A useful check on schedules of this shape: the price falls by TShs 20,000 for each extra tank while marginal revenue falls by TShs 40,000. Wherever demand falls in a straight line marginal revenue falls twice as steeply and reaches zero while price is still positive.

Any producer big enough to move the price by his own selling, the only miller in a district, the one bus on a route, the single hotel in a town, must reckon with this gap.

The Master Key: *For a price maker, marginal revenue is the price less what is surrendered on every unit already sold, and only that figure belongs against marginal cost.*

REAL Question 267

Follow one miller at Uyole from the maize arriving at his door to the plant he will build. Everything the chapter taught is waiting in one day's record of bags.

Complete the mill's product schedule, state where diminishing returns set in and where each stage of production begins and ends, then derive the mill's total variable cost, average variable cost and marginal cost at each level of employment.

Bahati Mwakalinga runs Uyole Maize Millers, a posho mill on the Tunduma road just outside Mbeya. Farmers and traders bring their mahindi, maize, and pay a charge for every 20 kg bag of sembe milled.

The shed, the grinding machine and its motor are fixed for this season. The only thing Bahati can vary is the number of hands he puts on for the day.

Each hand is paid TShs 12,000 for the day and is given a midday meal costing TShs 600, so a hand costs the mill TShs 12,600 a day.

There is always more maize waiting at the door than the mill can grind, so output is limited only by the hands engaged.

Hands engaged: 0, 1, 2, 3, 4, 5, 6, 7, 8

Bags of sembe milled in the day: 0, 20, 48, 84, 120, 150, 168, 175, 168

Model Answer

Average product rises to a peak of 30 bags a hand and marginal product to 36 bags, diminishing returns begin with the fifth hand, and at TShs 12,600 a hand average variable cost falls to its lowest of TShs 420 a bag where average product is highest.

Average product is total product divided by hands; marginal product is the extra bags the newest hand brings.

$$\mathrm{AP_L} = \frac{\mathrm{Q}}{\mathrm{L}} \quad \text{and} \quad \mathrm{MP_L} = \frac{\Delta\,\mathrm{Q}}{\Delta\,\mathrm{L}}$$

Hands (L)	Bags milled (Q)	Average product (bags a hand)	Marginal product (bags)
0	0	-	-
1	20	20	20
2	48	24	28
3	84	28	36
4	120	30	36
5	150	30	30
6	168	28	18
7	175	25	7
8	168	21	-7

The short run product schedule of Uyole Maize Millers, in 20 kg bags of sembe a day.

Marginal product turns before average product: marginal product is highest at 36 bags, with the third and fourth hands, and falls thereafter, while average product rises to 30 bags a hand and peaks with the fourth and fifth. The order never reverses.

Diminishing returns set in with the fifth hand: up to the fourth hand each pair adds as much as the last, hopper, scales and sacking bench being manned separately at last. From the fifth marginal product falls, 36 bags to 30, then 18, then 7.

Stage I runs from no hands to the fifth: average product rises throughout, reaching its maximum of 30 bags a hand where marginal product falls back to meet it, both at 30 with the fifth hand. No producer stops here.

Stage II runs from the fifth hand to the seventh: average product is now falling while marginal product is still positive, so every extra hand adds bags, the total reaching 175 with seven hands. This is the rational range.

Stage III begins with the eighth hand: marginal product turns negative at $168 - 175 = -7$ bags, so the eighth hand reduces the day's output as men get in one another's way at the hopper. No producer would engage him even for nothing.

Labour is the only variable factor, so total variable cost is the wage bill, average variable cost that bill spread over the bags, and marginal cost the wage divided by marginal product.

$$\mathrm{TVC} = \mathrm{w} \times \mathrm{L} = 12{,}600\mathrm{L}$$

$$\mathrm{AVC} = \frac{\mathrm{TVC}}{\mathrm{Q}} \quad \text{and} \quad \mathrm{MC} = \frac{\Delta\,\mathrm{TVC}}{\Delta\,\mathrm{Q}} = \frac{\mathrm{w}}{\mathrm{MP_L}}$$

Hands (L)	Bags (Q)	Total variable cost (TShs)	Average variable cost (TShs a bag)	Marginal cost (TShs a bag)
0	0	0	-	-
1	20	12,600	630	630
2	48	25,200	525	450
3	84	37,800	450	350
4	120	50,400	420	350
5	150	63,000	420	420
6	168	75,600	450	700
7	175	88,200	504	1,800
8	168	100,800	600	-

The mill's variable costs at a wage of TShs 12,600 a hand a day.

Every cost figure is a product figure upside down: marginal cost is lowest at TShs 350 where marginal product is highest at 36, since $12{,}600 \div 36 = 350$; average variable cost is lowest at TShs 420 where average product is highest at 30.

Marginal cost meets average variable cost at its foot: with the fifth hand both stand at TShs 420 a bag, by the rule and not by accident: while the marginal is below the average it pulls it down.

The eighth hand has no marginal cost: he adds nothing and takes away seven bags, so the mill pays TShs 12,600 for a smaller output, and average variable cost jumps from TShs 504 to TShs 600 a bag.

So one day's record of bags already holds the shape of everything that follows, and the place where costs turn is set by the fixed machine.

The Master Key: *Divide output by hands for the average and difference it for the marginal, then divide the wage by each to obtain their cost twins.*

REAL Question 268

The grinding machine at Uyole costs Bahati the same whether it turns all day or stands silent. Spread over enough bags it disappears; spread over too few it swallows the trade.

Add the mill's fixed costs to the schedule, complete average fixed cost and average total cost at each output, and find the number of hands and the number of bags at which Bahati makes the greatest profit.

Besides the hands, Uyole Maize Millers carries the rent of the shed, the monthly instalment on the grinding machine, the licence and the district levies, and the watchman. Together these come to TShs 1,575,000 a month, and the mill works 25 days in a month.

There are many posho mills around Uyole, so Bahati cannot set his own charge. He takes the going rate of TShs 1,050 for each 20 kg bag milled, and can mill as many bags as he has hands for at that charge.

His figures from the previous question stand: a hand costs TShs 12,600 a day, and the day's output is 0, 20, 48, 84, 120, 150, 168, 175 and 168 bags for zero to eight hands.

Model Answer

The mill's fixed cost is TShs 63,000 a day, its average total cost falls to a lowest of TShs 825 a bag at 168 bags, and Bahati makes his greatest profit of TShs 37,800 a day by engaging six hands and milling 168 bags.

Turn the monthly standing charges into a daily fixed cost first.

$$\text{TFC} = \frac{1{,}575{,}000}{25} = 63{,}000 \text{ a day}$$

That TShs 63,000 falls due whether the mill grinds 175 bags or none, so add it to each day's wage bill and spread the result over the bags.

$$\text{TC} = \text{TFC} + \text{TVC} = 63{,}000 + 12{,}600\text{L}$$

$$\text{AFC} = \frac{\text{TFC}}{\text{Q}} \quad \text{and} \quad \text{ATC} = \frac{\text{TC}}{\text{Q}} = \text{AFC} + \text{AVC}$$

Bags (Q)	Total cost (TShs)	Average fixed cost (TShs a bag)	Average total cost (TShs a bag)	Marginal cost (TShs a bag)
0	63,000	-	-	-
20	75,600	3,150	3,780	630
48	88,200	1,312.50	1,837.50	450
84	100,800	750	1,200	350
120	113,400	525	945	350
150	126,000	420	840	420
168	138,600	375	825	700
175	151,200	360	864	1,800

The full short run cost schedule of Uyole Maize Millers, in shillings a day and a bag.

Average fixed cost falls without ever stopping: from TShs 3,150 a bag at 20 bags to TShs 360 at 175, the same TShs 63,000 spread more thinly. This is why an idle mill is a ruinous mill, and why a miller grinds at almost any charge.

Average total cost is U shaped: it falls steeply while the fixed cost is spread, flattens, reaches its lowest of TShs 825 a bag at 168 bags, then turns up to TShs 864 at 175, as rising average variable cost beats falling average fixed cost.

Marginal revenue is TShs 1,050 at every bag: the mill takes the going charge and cannot move it, so average revenue and marginal revenue are the same figure. Go on while marginal cost lies below it and stop before it climbs above.

The sixth hand adds 18 bags at a marginal cost of TShs 700 a bag, below the charge of TShs 1,050, so he is worth engaging. The seventh adds only 7 bags.

$$\mathrm{MC}_7 = \frac{12{,}600}{7} = 1{,}800$$

Those 7 bags earn $7 \times 1{,}050 = 7{,}350$ shillings and cost TShs 12,600, so the seventh hand takes TShs 5,250 a day out of the till.

The mill should therefore engage six hands and mill 168 bags: with a total revenue of $168 \times 1{,}050 = 176{,}400$ shillings against a total cost of TShs 138,600.

$$\pi = 176{,}400 - 138{,}600 = 37{,}800 \text{ a day}$$

$$\text{Check: } \pi = (1{,}050 - 825) \times 168 = 225 \times 168 = 37{,}800$$

What that is worth to Bahati: TShs 37,800 a day over 25 working days is TShs 945,000 a month, what remains after shed, machine, licence, watchman, wages and meals are paid. It is his reward for owning and running the mill.

One warning. Here the greatest profit falls at the lowest average total cost, both at 168 bags, and it is tempting to think they always coincide. They do not: at a charge of TShs 1,900 the mill would run at 175 bags for TShs 181,300 a day against TShs 180,600.

The rule that decides output is always marginal cost against marginal revenue. Where the lowest average cost sits at the same output, that is the charge's doing, not the rule's.

The Master Key: *Fixed cost decides whether the mill is worth having; marginal cost against the charge decides how hard it is worked.*

HOT Question 269

The rains fail above Mbeya, the milling charge drops to seven hundred shillings, and every bag Bahati grinds now loses him money. His neighbour tells him to padlock the shed.

Calculate the output at which Uyole Maize Millers breaks even at the normal charge of TShs 1,050 a bag and at the lean season charge of TShs 700 a bag, and advise Bahati whether to keep the mill running through the lean season.

A poor season above Mbeya means less maize coming down to the mills and stiffer competition among them. The charge Bahati can get falls from TShs 1,050 to TShs 700 for each 20 kg bag milled.

His costs are unchanged: fixed cost TShs 63,000 a day; a hand costs TShs 12,600 a day; at the six hands he works, average variable cost is TShs 450 a bag; the lowest average variable cost the mill can reach is TShs 420 a bag; and the greatest output it can reach is 175 bags a day.

His neighbour tells him: 'You cannot cover your costs at TShs 700. Lock the mill until the charge recovers.'

Model Answer

Bahati should keep the mill grinding, because at TShs 700 a bag he loses TShs 21,000 a day by running and TShs 63,000 a day by closing, so the neighbour's padlock would cost him a further TShs 42,000 for every day of the lean season.

Break even output is where total revenue exactly covers total cost: each bag earns the charge, costs its average variable cost, and what is left, its contribution, goes towards the fixed cost.

$$\text{Break even output} = \frac{\mathrm{TFC}}{\mathrm{P} - \mathrm{AVC}}$$

At TShs 1,050, with average variable cost of TShs 450 a bag, each bag contributes TShs 600.

$$\text{Break even} = \frac{63{,}000}{1{,}050 - 450} = \frac{63{,}000}{600} = 105 \text{ bags a day}$$

In a normal season the mill is comfortable: it needs 105 bags a day merely to stand still and grinds 168, clearing the line by 63 bags. That margin is why a normal season leaves TShs 37,800 a day of profit.

At TShs 700 the contribution shrinks from TShs 600 to TShs 250 a bag.

$$\text{Break even} = \frac{63{,}000}{700 - 450} = \frac{63{,}000}{250} = 252 \text{ bags a day}$$

That output is out of reach: the greatest the mill can produce, seven hands and the machine flat out, is 175 bags a day, while break even at TShs 700 needs 252. A loss is unavoidable, so the question is how to lose least.

Compare the two losses. Running with six hands the mill grinds 168 bags for TShs 117,600 against a cost of TShs 138,600.

$$\text{Loss from running} = 138{,}600 - 117{,}600 = 21{,}000 \text{ a day}$$

Closing does not end the fixed cost: the shed rent, the machine instalment, the licence and the watchman go on being owed.

$$\text{Loss from closing} = \text{TFC} = 63{,}000 \text{ a day}$$

Running covers TShs 42,000 a day of fixed cost: each bag fetches TShs 700 and costs TShs 450, leaving TShs 250 towards the shed and machine. Over 168 bags that is TShs 42,000 a day met out of trade; closing throws all of it away.

The rule this illustrates: continue while price is at or above average variable cost, and shut down only when it falls below. TShs 700 is well above TShs 450, so the mill should turn; its shut down charge is TShs 420 a bag.

The case on the neighbour's side: he is not simply foolish. A loss of TShs 21,000 a day is TShs 525,000 over a 25 day month, payable in cash, and a miller with no savings may be broken by it. Closing is also right if he can let the shed for the season.

There are costs the arithmetic does not show: an idle shed loses its trained hands to other mills and its regular customers to rivals who stayed open. Against that, running flat out in a lean season wears the plates and brings the next overhaul forward.

The long run is a different question altogether: TShs 700 lies below the mill's lowest average total cost of TShs 825. If the charge stays there for good, Bahati should not renew when the lease ends: in the long run every cost must be covered.

So keep grinding, negotiate what can be negotiated, and watch the charge. Closing becomes right the day it falls below TShs 420 a bag, leaving the trade only if TShs 825 is out of reach for good. Over a month the two answers differ by TShs 1,050,000.

The Master Key: *Below average total cost you lose money; only below average variable cost do you lock the door.*

HOT Question 270

Two hectares near Njombe carry a father, a mother and five grown children. The hoes are the ones their grandfather used, and the harvest is not five times his.

To what extent does the theory of production and cost explain why output per worker in Tanzanian agriculture is low?

Model Answer

The theory explains the mechanism very well, because labour piled onto a fixed area with an unchanged technique must give a falling marginal and then a falling average product, but it explains far less about the cause, since the shortage of capital, technique, credit and markets lies outside the production function.

Diminishing returns is the heart of the matter: land is fixed, in many districts at a very small area per household after subdivision among sons, while labour arrives with each birth. Adding it to a fixed factor lowers marginal and then average product.

Where such holdings are producing: many family plots are worked past the end of Stage II, where the last pair of hands adds almost nothing and may subtract by trampling ridges and eating into seed. They stay because there is nowhere else to go.

Capital per worker is the second explanation: productivity is a property of the combination of factors, never a verdict on the worker. A hand with a hoe and a hand with a two wheeled tractor are the same hand; the output differs because the capital differs.

Scale and cost complete the picture: a holding of one hectare cannot come near the minimum of any long run average cost curve: it cannot load an indivisible machine, buy fertiliser by the tonne, borrow without collateral, spread risk, or learn what Dar es Salaam is paying.

But the theory takes technology as given: a production function is written for one technique, and the difficulty is that the technique has not changed in a lifetime. The theory says what happens on the old function, not why a better one was not adopted.

It also assumes a producer maximising money profit: a household growing food for its own pot is doing something the model does not describe. It keeps a member whose marginal product is nearly nothing, because elsewhere it is nothing at all and he still has to eat.

It is silent about risk and rain: a farmer who could raise his yield with fertiliser may refuse, because a failed season carrying a debt is worse than a poor season carrying none. Insecure tenure, harvest price collapses and variable rainfall are not points on a curve.

What the theory does give is direction: only three things raise output per worker: more capital a worker, a better technique, or fewer workers on the land. Irrigation in the Kilombero valley, improved maize seed, tractor hire, rural roads and growing towns are each one of the three.

So the extent is considerable but partial. The theory is an excellent diagnosis and a poor history: it shows why output per worker must be low given the land, capital and technique, but not why those have not changed.

The Master Key: *The theory explains why too many hands on too little land with too few tools must produce little; it does not explain why the tools never came.*

HOT Question 271

A minister may pay part of a factory's rent or part of its power bill. On the budget page they look alike; the factory's output answers only one.

A government that wants more industrial output is advised to subsidise firms' fixed costs. Discuss whether a subsidy to fixed costs or a subsidy to variable costs would raise output by more, and advise the government.

Model Answer

A variable cost subsidy raises the output of firms already producing, because it lowers marginal cost and moves the meeting of marginal cost and marginal revenue to the right, whereas a fixed cost subsidy leaves marginal cost and output untouched: for output now act on variable costs, for capacity later on fixed costs.

A firm chooses its output where marginal cost equals marginal revenue: so anything meant to change output must change one of the two. That settles most of the argument before any case is heard: the two subsidies answer different questions.

A fixed cost subsidy does not touch marginal cost: if the state pays half a Morogoro textile mill's rent, total cost falls equally at every output, so the gap between the cost of 1,000 metres and of 1,001 is unchanged: profit rises, output does not move.

A variable cost subsidy does touch marginal cost: cheaper power from TANESCO, a rebate on imported yarn, a lower fuel levy or a wage subsidy all lower the cost of each extra metre, so marginal cost shifts down and the mill expands until it meets price again.

A fixed cost subsidy is far from useless: it works on whether the firm exists. A firm priced above average variable cost but below average total cost leaves as its plant wears out; lowering average total cost keeps it in and draws new firms, as serviced land, special economic zones and cheap credit do.

The real distinction is one of timing: a variable cost subsidy raises output this quarter from plants that already stand; a fixed cost subsidy raises output in three or five years by adding plants that do not yet exist.

The case against subsidising variable costs: it is recurrent, paid for ever and growing with the output it encourages. It distorts technique, cheap power and imported inputs pushing firms towards capital intensity where labour is abundant. And output falls back the day it ends.

The case against subsidising fixed costs: it rewards ownership rather than production, since a firm producing nothing collects it in full. It keeps alive firms that ought to close, locking up land, credit and skilled workers, and granted case by case it reaches the best connected.

There is a third course better than either: much of what a subsidy would pay for is a cost the state created or failed to remove. Unreliable power, a slow port, twenty licences and impassable district roads are all costs to the firm; removing them lowers both kinds.

If the aim is more output from factories that already stand, act on variable costs, and on the largest of them, in Tanzanian manufacturing nearly always power and imported inputs. If the aim is more factories, act on the fixed cost of entry through serviced sites and long term credit.

The Master Key: *Fixed cost subsidies decide who is in the industry; variable cost subsidies decide how much the industry produces.*

HOT Question 272

One mill for one village, one tailor for one street, one welder for one row of shops. An adviser calls it backwardness; the village arithmetic says otherwise.

Assess whether the small scale of most Tanzanian firms is a weakness of the economy or a rational response to the size of the market.

Model Answer

The small scale of most Tanzanian firms is chiefly a rational response to small and poorly connected markets rather than a failure of the firms, though the high costs smallness forces on them are a real weakness: attack the size of the market, not the firm.

The case that it is a weakness: a small firm sits high on its long run average cost curve, well left of the minimum. It cannot load an indivisible machine, employ a specialist buyer or accountant, buy inputs by the lorry load, borrow cheaply, or spread risk.

It also shuts the firm out of wider markets: it cannot meet a standard, hold a certificate, fill a container or survive the forms an export demands, so it stays local, which keeps it small. Low productivity appears as low wages, and low wages as a small market.

But the other side is stronger than it looks: the optimum size is not the largest but the one whose short run curve touches the long run curve at the output the firm can sell. A mill built for five tonnes where the village eats one stands idle four fifths of the time.

The extent of the market really is small: Tanzanians are not few, but they are dispersed and the roads poor: thirty kilometres from tarmac, the next district is a foreign country. The division of labour is limited by the market's extent, and where it is large, in cement, beer, cooking oil and around Dar es Salaam, firms are large.

Small firms carry advantages the argument forgets: they change what they make within a week when the season turns, use abundant local labour instead of scarce foreign exchange, and the owner supervises his own workers, so managerial diseconomies never arise. That flexibility has value no cost curve records.

The two sides can be reconciled: smallness answers a small market and is at the same time a symptom of a weak economy. The weakness lies in the market's size, not the firm's decision, so blaming firms is like blaming a man for his shadow.

The conclusion for policy matters more: if smallness were the firms' fault the remedy would be to force them together, which has been tried and produced large firms with high costs and empty order books. If it answers the market, enlarge the market: tarmac, power, a working port, common standards across the East African Community, and payments letting a Mbeya firm sell in Dodoma.

So the verdict is divided, and the division is the point. Judged as a decision, the small firm is right. Judged as a fact about the country, the smallness of firms measures how disconnected the markets are.

The Master Key: *Firms grow to the size their markets allow, so enlarge the market and the firms will follow, but never the other way about.*

HOT Question 273

The tarmac reaches Uyole and the maize now comes to Bahati's door. For the first time the shed and the machine are no longer fixed, and everything is open to decision.

With the aid of a diagram, advise Bahati which of the three plants he should build for the expected market, and state what would have to be true for your advice to be different.

The new tarmac road and the growth of Mbeya town mean that from next season about 280 bags of 20 kg, that is 5.6 tonnes of sembe a day, will be brought to Uyole for milling. The charge is expected to hold at TShs 1,050 a bag.

Bahati may keep the present small plant and work it with extra shifts, build a middle sized plant, or build a large plant. His engineer's estimates are:

Present small plant: best output 168 bags a day, lowest average cost TShs 825 a bag, average cost at 280 bags a day TShs 1,080 a bag.

Middle plant: best output 280 bags a day, lowest average cost TShs 690 a bag, average cost at 280 bags a day TShs 690 a bag.

Large plant: best output 430 bags a day, lowest average cost TShs 720 a bag, average cost at 280 bags a day TShs 810 a bag.

Model Answer

Bahati should build the middle plant, because at the expected 280 bags a day it grinds at TShs 690 a bag, the lowest point of the whole long run average cost curve, earning him TShs 100,800 a day against TShs 67,200 from the large plant and a loss from the present one.

Every earlier question about this mill was a short run one, the shed and machine being fixed. Now Bahati is choosing the plant itself, so every factor can be varied, and the curve he must consult is a planning curve he will never operate on.

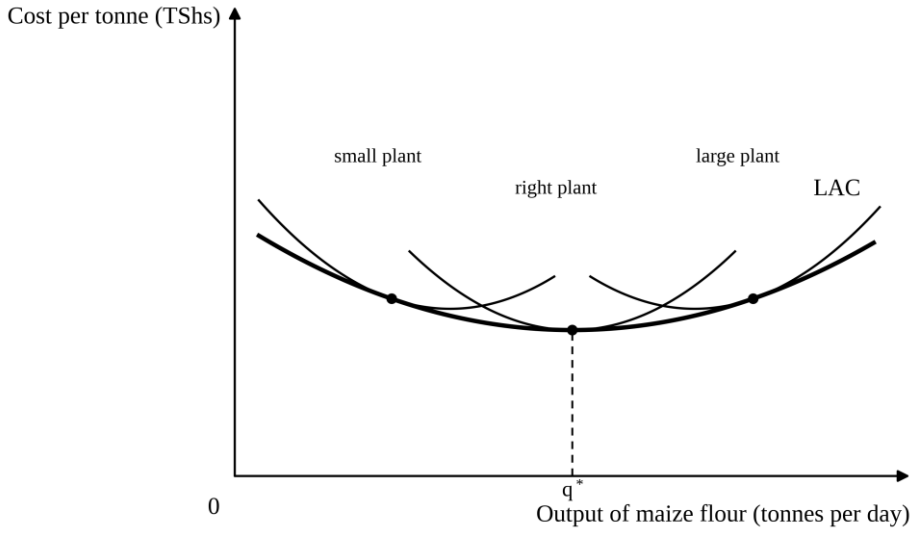


Figure 5.33: Choosing the plant size for a Mbeya maize mill

The long run average cost curve is an envelope: each short run curve belongs to one plant. The long run curve traces the lowest of them, touching each once and lying above none, so no plant can beat the envelope: the envelope is made of plants.

Only one plant touches at the envelope's lowest: the small plant touches it below q^*, left of its own lowest point; the large plant above q^*, right of its own. Only the middle plant touches where both curves are at their minimum together, the optimum size for this road.

The expected market falls at the curve's lowest point: 280 bags a day is 5.6 tonnes of sembe, the output shown as q^*, where the long run curve is lowest. The market he can reach and the cheapest size for his trade coincide, by grace of the road and the town.

Now put the engineer's figures against the expected trade. Revenue at 280 bags and TShs 1,050 a bag is the same whichever plant stands on the site.

$$\text{TR} = 280 \times 1{,}050 = 294{,}000 \text{ a day}$$

$$\text{Present plant: } \text{TC} = 280 \times 1{,}080 = 302{,}400 \quad \text{so} \quad \pi = -8{,}400$$

$$\text{Middle plant: } \text{TC} = 280 \times 690 = 193{,}200 \quad \text{so} \quad \pi = 100{,}800$$

$$\text{Large plant: } \text{TC} = 280 \times 810 = 226{,}800 \quad \text{so} \quad \pi = 67{,}200$$

The present plant would actually lose money: worked at 280 bags it is far beyond its efficient range, running extra shifts, paying night work and breaking down, so average cost climbs to TShs 1,080 a bag, above the charge itself.

The large plant is cheap at an output nobody offers: it reaches TShs 720 a bag at 430 bags a day, but at the 280 expected it runs below design load, average cost rising to TShs 810, giving up TShs 33,600 a day or TShs 840,000 a month.

It is dearer even at its own best output: TShs 720 a bag against the middle plant's TShs 690. That is diseconomies of scale, a long run matter and not diminishing returns: three shifts to supervise, a wider catchment, a manager who cannot see the whole shed.

The gain over standing still: the mill makes TShs 37,800 a day at 168 bags; the middle plant at 280 bags would make TShs 100,800, a gain of TShs 63,000 a day or TShs 1,575,000 a month, one month of the old standing charges.

What would change this advice: first, the expected market: if 180 bags is the honest figure, the middle plant would work left of its tangency and staying small would be right. Second, growth: if trade will reach 430 bags soon and a mill cannot be enlarged in stages, indivisibility argues for building large once. Third, dear credit carries interest the engineer omits. Fourth, a large machine idle in a power cut costs more each hour.

The whole chapter meets here: the product schedule told Bahati how many hands to engage, the cost schedule what a bag costs, marginal cost how much to mill, average variable cost whether to open in a bad season, and the long run curve how large a mill to build. What settled it was the road.

The Master Key: *Build the plant whose short run curve touches the long run curve at the output you expect to sell, and not one bag larger.*

Chapter Six

THE MARKET

What a Market Is

Before a single curve is drawn the word itself has to be pinned down. A market in economics is not the ground you stand on but the contact that makes exchange possible, and every later idea in this chapter, from the price taker to the cartel, rests on getting that one distinction straight. This section fixes the definition, names the essentials, sets the trading floor against the trading platform, and shows what the meeting of the two sides actually produces.

BINDER Question 1

At six in the morning the tarmac outside Kariakoo is still empty, yet a driver in Iringa has already agreed the price of the tomatoes he will unload there at noon. The market opened long before anybody arrived.

With the aid of a diagram, explain the meaning of a market in economics.

Model Answer

A market in economics is a mechanism through which buyers and sellers make contact and exchange goods and services, and it exists wherever two or more parties are willing to trade, whatever the place and whatever the hour. The place is incidental; the contact is the market.

A mechanism, not a location: The market is the arrangement that brings willing buyers and willing sellers together. Figure 6.1 shows the two sides in separate boxes with the market standing between them: money moves from buyers towards sellers, goods move the other way, and nothing in the picture is a building.

Two willing parties: Exchange needs at least one buyer willing to pay and one seller willing to part with the good. Willingness is the test, not numbers: a single grower and a single ginner standing at a weighing scale form a market as surely as the whole of Tandale does.

Contact by any means: Buyers and sellers must be able to reach one another, but the channel is free. A shout across Darajani, a telephone call to a broker, a listing on Kupatana and an order placed on Alibaba are all contact, so all four of them create markets.

The outcome is a price and a quantity: A market is recognised by what it produces. Bids and offers meet, and out of the meeting come two numbers: the price at which the good changes hands and the quantity that changes hands at it. Where no price and no quantity emerge, no market has operated.

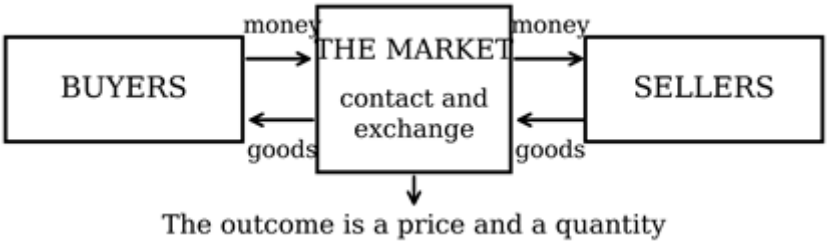


Figure 6.1: *The market as contact between buyers and sellers*

Ask not where the traders happen to be standing but whether a bargain can be struck between them.

The Master Key: *A market is a meeting of willingness, and the price is what the meeting leaves behind.*

BINDER Question 2

Take away the buyers and Mwanjelwa is a shed. Take away the price and it is a charity. Five things must stand together before any trade happens at all.

State and explain the essentials of a market.

Model Answer

A market requires five things at once: a good or service to be exchanged, buyers who want it, sellers who hold it, a price on which the two sides can settle, and contact between them. Remove any single one of the five and no exchange can take place.

A good or service: There must be something to trade, whether a bag of maize at Kibaigwa, an hour of a mason's labour or a treasury bill. It must also be transferable, since whatever cannot be handed over cannot be sold.

Buyers with the will and the means: Demand in a market is willingness backed by purchasing power. A crowd that admires the fish at Kibirizi but carries no money adds nothing to the market, because desire on its own never becomes a transaction.

Sellers holding the good: Somebody must own the good and be willing to release it at some price. Sellers may be growers, wholesalers, agents or a single state supplier, and their willingness fixes the lowest price at which any supply appears at all.

A price: Exchange needs a rate at which the good trades for money. The price does the reconciling: it is the figure at which the amount buyers will take equals the amount sellers will release, and without it the bargaining never closes.

Contact between the two sides: The sides must be able to communicate an offer and an acceptance. Contact may be a haggle across a stall, a telephone call, a message on a trading application or an order on a website, and modern communication has widened it enormously.

Each essential is a necessary condition, so a weakness in any one of them thins the trade that follows.

The Master Key: *Good, buyer, seller, price, contact: five legs, and a market cannot stand on four.*

BINDER Question 3

A trader at Darajani pays rent for three square metres of floor. A trader on Kupatana pays for a bundle of data. Both of them are selling the same kanga.

Distinguish between a physical market and an online market.

Model Answer

A physical market brings buyers and sellers together at a named location at a set time, while an online market brings them together through a digital channel with no shared location at all. Both are genuine markets, because both create the contact out of which a price emerges.

Place against channel: Kariakoo, Mwanjelwa and Kibirizi are grounds a trader can walk onto, and trading stops when the gates close. Kikuu, Kupatana and Alibaba have no ground and no closing hour, since the contact runs entirely through a website or an application.

Inspection against description: In a physical market the buyer squeezes the tomato and weighs the fish before paying. Online the buyer trades on a photograph and a written claim, so the quality of information, and the honesty standing behind it, carries far more weight.

Narrow reach against wide reach: A stall serves only the buyers who can reach it in a morning, which confines the market to a town or a district. A listing is visible to anyone holding a handset, so the same seller may face buyers in Mwanza, in Mbeya and in Guangzhou at once.

Different costs of trading: The physical trader carries rent, transport and the time spent searching for a buyer. The online trader carries data charges, delivery and the risk of payment, and because searching is cheap online, prices there are pulled closer together than prices in a shed.

The difference lies in how contact is made and what that contact costs, never in whether a market exists at all.

The Master Key: *Change the channel and you change the cost of trading, not the nature of the market.*

BINDER Question 4

Nobody at Kibaigwa announces the price of maize. By ten in the morning every trader in the yard knows it to the shilling, and not one of them chose it.

Explain how contact between buyers and sellers produces a price and a quantity.

Model Answer

Contact produces a price because buyers bid and sellers offer, and the two sets of numbers are pressed together until only one price can survive. At that price the amount buyers will take equals the amount sellers will release, and that amount is the quantity traded.

Bids and offers: Every buyer carries a highest price he will pay and every seller a lowest price he will accept, although neither writes it down. Wherever a buyer's limit lies above a seller's limit, a bargain can be struck, and trading begins.

Excess demand lifts the price: If the asking price is low, more is wanted than is on offer. Disappointed buyers outbid one another, sellers see the queue lengthen and raise their figure, so the shortage shrinks as the price climbs towards the level that clears it.

Excess supply pushes it down: If the asking price is high, sacks are still standing unsold at the close of the day. Sellers shade the price to clear their stock, buyers who had held back step forward, and the surplus is squeezed out as the price falls.

The pair that settles: Movement stops only where the two pressures balance, and that single point carries a price and a quantity together. Neither side chose the figure: it emerged from the contact, which is exactly why a market is called a mechanism rather than a decision.

Watch the direction of the pressure and you can say where the price will move next.

The Master Key: *A price is never announced in a market; it is what is left standing when the bidding stops.*

REAL Question 5

The dagaa reach Kibirizi at dawn in wet sacks. By eight the price is settled for the whole of Kigoma town, and not a single notice has been posted anywhere.

Using the case below, identify the essentials of a market and explain how each one is satisfied.

Neema Kalinga buys dried dagaa from canoe crews on Lake Tanganyika and sells them at Kibirizi market in Kigoma.

About forty other traders sell the same dried dagaa within the same shed.

Buyers are households, restaurant cooks, and two lorry agents who carry sacks to Tabora.

Trading opens at dawn and the price has settled by eight in the morning.

On the morning described the price settled at TShs 9,000 a kilogram.

Neema also takes orders by telephone from the Tabora agents on days when they do not travel.

The figures in this case are illustrative.

Model Answer

All five essentials are present at Kibirizi: dried dagaa as the good, households, cooks and lorry agents as the buyers, Neema and some forty rivals as the sellers, a price of TShs 9,000 a kilogram, and contact made both across the shed floor and down a telephone line. The market is therefore complete, and the shed itself is the only part of it that could be dispensed with.

The good: Dried dagaa are transferable, they keep for weeks once dried, and they can be measured by the kilogram. All three properties matter, because a good that cannot be handed over, stored for the morning or measured cannot be priced with any precision.

The buyers: Households, cooks and lorry agents all want the fish and all carry money, so their demand counts. They are not identical: the agents buy sacks for resale in Tabora and will walk away from a high price, while a cook needing supper cannot.

The sellers: Neema and about forty rivals hold stock bought from the canoe crews, and each of them will release it above some lowest acceptable figure. Because there are forty of them, no one seller can hold out for more than the others are asking.

The price: TShs 9,000 a kilogram was not posted by anybody; it emerged by eight in the morning from the bidding, and it reconciles what the buyers will take with what the traders will release. That single number is the market's own output.

The contact: Contact runs two ways at Kibirizi. Buyers and sellers meet face to face on the shed floor, and the Tabora agents deal by telephone without entering the shed at all, yet both sets of dealings settle at the same price, which proves they belong to one market.

Kibirizi shows the definition working in the open: nothing about the shed is essential except that it puts the two sides within reach of one another.

The Master Key: *The shed is convenient, but the contact is compulsory.*

REAL Question 6

A carpenter in Morogoro has never met the woman in Arusha who bought his bed. The bargain was struck in written messages, and the money arrived before the timber was planed.

Explain whether a market exists in the case below, and account for the price at which the bed finally sold.

Kazi Njema Furniture is a small workshop on the SIDO estate at Morogoro.

It lists beds and cupboards on an online trading platform, with photographs and measurements.

A buyer in Arusha saw the listing and offered TShs 260,000 for a bed advertised at TShs 320,000.

Four other workshops list a similar bed on the same platform, between TShs 280,000 and TShs 340,000.

The bed sold at TShs 290,000, with delivery paid separately by the buyer.

The figures in this case are illustrative.

Model Answer

A market plainly exists, since a good, a willing buyer, a willing seller, a price and contact are all present, and nothing in the definition requires the two parties to stand in the same room. The bed sold at TShs 290,000 because the rival listings fixed the narrow range inside which any bargain between the two of them could be struck.

Contact without a meeting place: The listing and the messages that followed it are contact in the full economic sense: an offer was made, considered and answered. Arusha and Morogoro are six hundred kilometres apart, which changes the cost of delivery but not the existence of the market.

Why the asking price could not hold: Four rival workshops advertise a similar bed from TShs 280,000, and the buyer can compare them in a minute without leaving her house. A workshop that insists on TShs 320,000 simply loses the sale, so cheap searching by buyers pulls the asking price down.

Why the offer could not hold either: TShs 260,000 lies below what the workshop will accept once timber, glue, labour and the trip to the bus stand are counted. A seller releases nothing below his own lowest acceptable figure, so the bargaining had to move upwards from the opening offer.

The settled price: TShs 290,000 sits inside the range the rivals set, above the workshop's floor and below the buyer's ceiling. It was chosen by neither party alone, which is the mark of a price produced by a market rather than fixed by a seller.

The quantity that went with it: One bed changed hands. A price never travels alone: the same bargaining that settled TShs 290,000 settled the quantity traded at that figure, and the two numbers together are what the market produced that day.

The platform did nothing more than lower the cost of finding a rival, and that alone moved the price by TShs 30,000.

The Master Key: *Cheap searching is what disciplines a price, and a shopfront alone never managed it.*

HOT Question 7

Rice at Makoroboi in Mwanza sells for less than rice at Kariakoo. Whether that is two markets or one market with a transport bill inside it depends on what happens next week.

To what extent can two separate trading places be regarded as a single market?

Model Answer

Two places form one market to the extent that a price change in one of them passes through to the other, because a linked price is the only observable sign of a shared mechanism. Where transport, information and law allow traders to move goods between the two, they are one market; where those links are cut, they are two, and the untouched price gap proves it.

The test is the behaviour of prices: If rice rises at Kariakoo, traders buy at Makoroboi and ship. Supply then rises at Kariakoo and falls at Mwanza, so the two prices close on each other. A shock that travels is the working definition of a single market.

Transport cost sets a band, not a single price: Arbitrage stops paying once the gap is no wider than the cost of moving a sack. A persistent small difference is therefore perfectly consistent with one market, and only a gap wider than the freight bill is evidence of two.

Information has to travel as well: A trader who does not know the Kariakoo price cannot act on it, and unexploited gaps then survive for months. The mobile telephone has joined Tanzanian markets that the roads had already joined physically, which is why price gaps have narrowed.

Barriers cut the link: A district levy, a movement restriction, a road that closes in the rains, or a good too perishable to survive the journey will each break the connection. The two prices then move only with local conditions, and the places are genuinely separate markets.

The definition already allows it: A market is contact rather than place, so a lorry driver and a telephone are enough to make two sheds one market. The reverse also holds: a single shed may contain a wholesale market and a retail market if the buyers cannot cross between them.

The extent of the claim: For storable and portable goods on good roads, such as maize, cement and cotton lint, the answer is largely yes and the country is one market. For fresh milk, tomatoes and cooked food it is no, and Tanzania holds hundreds of tiny markets instead.

Judge markets by their prices, never by their walls.

The Master Key: *If a price shock travels between two places, the market travels with it.*

HOT Question 8

Kupatana never closes and never charges rent. Yet at four in the morning the lorries still queue outside Kariakoo, and the traders inside are not going anywhere.

Discuss the view that online trading has made the physical market places of Tanzania unnecessary.

Model Answer

The view goes much too far. Online trading has captured the part of a market that is pure information, namely finding a counterparty and comparing prices, but the parts that need inspection, trust, immediate delivery and cash have stayed on the ground. The two forms now divide the work between them rather than one replacing the other.

What online trading genuinely does better: It widens reach beyond walking distance, cuts the cost of searching to almost nothing, and by doing so narrows the spread of prices for the same good. It also carries no rent and no closing hour, which suits a small seller with little capital.

Inspection still needs a hand: A photograph cannot show that the fish is fresh, the tomatoes unbruised or the second hand engine sound. Where quality varies from unit to unit and cannot be described, buyers pay willingly for the right to look, lift and squeeze before parting with money.

Trust has to be manufactured somehow: Strangers trading at a distance face the risk that goods never arrive or money never clears. A physical market supplies trust cheaply through repeat dealing, visible reputation and neighbours who will be back tomorrow, which no rating system fully reproduces.

Access is unevenly spread: Trading online requires a handset, data, a charged battery and enough literacy to use them. The poorest buyers and the smallest sellers hold none of these reliably, so a large part of Tanzanian trade remains at Kibaigwa, Kibirizi and Mwanjelwa by necessity.

Immediacy and small values defeat delivery: A cook wants onions this morning, not on Thursday, and no delivery charge can be spread across a purchase of TShs 500. Wherever the value is small and the need is urgent, the nearby stall beats the platform on cost every time.

The two forms are combining, not competing: The Kibirizi trader takes telephone orders and still sells across the shed; the Morogoro workshop lists online and delivers by road. What is changing is the mix of channels a single trader uses, which is a different claim from the death of the market place.

The place survives wherever the good must be seen, seized or eaten on the same day.

The Master Key: *Online trading removed the cost of searching, not the cost of trusting.*

The Size of a Market and What a Market Does

Two sellers may stand in the same yard and yet trade in markets of utterly different width, one reaching a single street and the other reaching another continent. This section asks first what decides how far a market stretches, and then what the market actually does once it exists: it fixes a price, moves resources towards the uses buyers value most, tells producers when to grow and when to retreat, and quietly builds the relations on which trade runs.

BINDER Question 9

Gold from Geita sells in Zurich. The mangoes on the next stall must sell in Geita or rot where they lie. One district, one morning, two markets of entirely different width.

Explain the factors that determine the size of a market.

Model Answer

The size of a market is the number of buyers a good can actually reach, and five things settle it: the nature of the good, the nature of demand for it, transport and communication, government policy, and the stability of the currency in which trade is priced.

The nature of the good: Goods that are durable, light and easily handled travel far, so gold, cotton lint and coffee command world markets. Goods that are perishable, bulky or heavy for their value, such as tomatoes, sand and fresh milk, are confined to a district because carriage and spoilage swallow the price.

The nature of the demand: A good wanted by almost everybody, such as diesel, salt or sugar, has buyers in every settlement and therefore a wide market. A specialised good has few buyers scattered thinly, so its market is narrow, although those few buyers will often pay a high price for it.

Transport and communication: Roads, ports and telephones decide how far a good and a bargain can be carried. Where they are developed the market widens to the whole country and beyond; where a road closes in the rains, the market shrinks back to the village that can be walked to.

Government policy: Subsidies and open borders bring in buyers who could not otherwise afford the good, widening the market. Duties, quotas, licensing and outright prohibition price buyers out or shut them out altogether, and each of them narrows the market by decision rather than by economics.

Stability of the currency: A distant seller parts with goods only against money he trusts to hold its value. A stable currency is therefore accepted far from home and widens the market, while an unstable one drives traders back to hard currency or to barter and shrinks it.

Ask of any good how far it can travel, who wants it when it arrives, and what stands in the way.

The Master Key: *A market is exactly as wide as the good can travel and the buyers can be reached.*

BINDER Question 10

Nobody in Dodoma planned the hectares put under sunflower last season. The price did the planning, and it did so without calling a single meeting.

Explain the functions performed by a market.

Model Answer

A market performs four functions. It fixes the price of the good, it allocates resources between competing uses by means of that price, it signals to producers when to expand and when to contract, and it builds lasting relations between the people who trade with one another.

Fixing the price: Bidding and offering bring the two sides to one figure at which the market clears. This is the market's first output and the foundation of the other three functions, since every later signal is carried by that number.

Allocating resources: A rise in the price of a good raises the return on producing it, so land, labour and capital move towards it and away from something else. Output then rises and the price eases back. Resources are directed to the uses buyers value most without any central instruction.

Signalling expansion or contraction: A large and growing market invites firms to scale up, add a line and hire; a shrinking one warns them to cut back or leave. Goods with small specialised markets stay small deliberately, serving few buyers who will pay above the ordinary price.

Building social relations: Repeated dealing between the same buyer and the same seller creates trust, and trust brings credit on a handshake, warning of shortages and shared transport. These relations lower the cost of trading and knit local and international communities together.

All four functions run on the same fuel, and the fuel is the price.

The Master Key: *A market does not merely record a price; it puts the price to work.*

BINDER Question 11

A tariff is a wall nobody can see. It stands at the port, and the market on the far side of it shrinks by precisely the height of the wall.

Explain how government policy can widen or narrow the size of a market.

Model Answer

Government policy alters the size of a market by changing who is permitted to trade and at what cost. Subsidies and open borders widen a market by bringing in buyers who could not otherwise afford the good, while duties, quotas, licences and prohibitions narrow it by pricing buyers out or shutting them out.

Subsidies widen the market: A subsidy on fertiliser or on a first electricity connection lowers the price the buyer actually pays. Households that stood just below the old price now come in, and the market extends into a layer of buyers who were previously outside it altogether.

Duties narrow it for some and widen it for others: A tariff raises the landed price of an imported good, so less is bought and the foreign seller loses part of his market. The same tariff hands part of that market to domestic sellers, which is usually the point of imposing it.

Quotas and licences cap it: A quota fixes the maximum quantity that may enter whatever buyers are willing to pay, so the market cannot grow past the ceiling. A licence works on the other side by limiting who may sell, which restricts supply and holds the price up.

Prohibition abolishes the legal market: An outright ban removes the market from the open economy at a stroke. The wanting does not disappear, so trade often moves underground, where the price rises to cover the risk of being caught and the quantity traded falls.

Policy does not change what buyers want; it changes what they are permitted and able to pay for it.

The Master Key: *Every rule written about trade is a rule written about the size of a market.*

BINDER Question 12

A village carpenter makes the whole chair himself. In a Morogoro workshop taking orders from four regions, one man does nothing all day but legs. The difference is the size of the market.

Explain the relationship between the size of a market and the division of labour.

Model Answer

The division of labour is limited by the extent of the market, because a worker can specialise in one narrow task only if enough output can be sold to keep him busy at it. A wide market therefore permits deep specialisation, and the specialisation then widens the market further by cutting cost.

Specialisation needs volume: A workshop selling four chairs a month cannot employ anybody full time on legs alone. The small market forces every worker to do every job, so nobody repeats a task often enough to become fast at it or to justify a machine built for it.

A wide market supplies the volume: Orders arriving from several regions justify splitting the work into separate operations. Each worker then repeats one task, gains dexterity, wastes no time changing tools, and the tools themselves can be specialised because they will be used all day.

Specialisation cuts cost, and lower cost widens the market again: Higher output per worker lowers average cost, and competition passes part of the saving into a lower price. Buyers who were previously priced out now enter, so the market widens, which permits still finer division of labour. The two grow together.

The limit works in both directions: Where transport is poor or demand is thin, specialisation halts. The village carpenter is not less able than the workshop hand; he is serving a smaller market, and it would ruin him to stand idle waiting for enough leg work to appear.

Widen the market and the division of labour deepens by itself, with no instruction needed.

The Master Key: *Nobody can specialise in a task that the market is too small to keep him busy at.*

REAL Question 13

Two lorries leave Kibaigwa on the same morning. One carries maize towards Dar es Salaam and the northern border. The other carries tomatoes, and it must stop at the first town it meets.

Account for the difference in market size between the two goods described below.

Kibaigwa in Dodoma holds one of the largest maize markets in the country.
Maize is dried, bagged and stacked, and it keeps in store for months.
Maize buyers come from Dar es Salaam, from Mbeya and from across the northern border.
Tomatoes grown in the same district are sold in open crates and lose most of their value within three days.
Tomato buyers come from Dodoma town and, at the furthest, from Morogoro.
The details of this case are illustrative.

Model Answer

Maize commands a market several hundred kilometres wide while the tomato market reaches barely a hundred, and the reason is not that maize is more wanted but that maize is physically able to make the journey. Durability, density, gradability and universal demand all work for the maize and against the tomato.

Durability decides how far a good may travel: Dried maize keeps for months, so a week on the road costs the seller almost nothing. A tomato loses value every day it travels, and that loss is a real transport cost taken straight out of the price the grower receives.

Bulk and handling decide the cost per kilogram: Bagged maize stacks tightly and survives rough loading, so a lorry carries a large value cheaply. Crated tomatoes bruise, must be stacked loosely with air between them and need careful handling, so the delivered cost per kilogram is far higher.

The nature of demand differs: Maize is a staple wanted in every town and across the border, so buyers exist wherever the lorry stops. Tomatoes are wanted everywhere too, but they are also grown everywhere, so a distant buyer simply uses the grower nearest to him instead.

Grading permits trade at a distance: Bagged maize of a known moisture and grade can be bought by telephone, sight unseen, because the description is trustworthy. A crate of tomatoes cannot be described in that way, so the distant buyer must come and look, and most will not travel to do it.

The proof lies in the prices: Maize prices at Kibaigwa move with prices in Dar es Salaam and beyond, which is the mark of one wide market held together by lorries. Tomato prices move only with local rain and local supply, which is the mark of many small separate markets.

The width of a market is set by what the good can survive on its way to the buyer, not by how much the buyer wants it.

The Master Key: *A good travels only as far as its value can outrun the cost of moving it.*

REAL Question 14

The gate price of seed cotton changed in May. By November the ridges around Kishapu had changed shape, and no official had issued a single instruction.

Using the case below, explain the functions the market is performing.

Mbuki Ginners buys seed cotton from growers around Kishapu in Shinyanga.

In one season the gate price rose from TShs 1,100 to TShs 1,600 a kilogram after world demand for lint strengthened.

The following season the growers planted more cotton and less of the sorghum they had grown before.

Two neighbouring villages formed a group to hire a lorry and deliver their crop together.

Several growers have sold to the same buyer for over ten years and receive seed on credit before planting.

The figures in this case are illustrative.

Model Answer

The market at Kishapu is performing all four of its functions at once. It fixes the gate price of seed cotton, it allocates land and labour between cotton and sorghum through that price, it signals to growers that the cotton trade may safely expand, and it has built the standing relations that make seed credit and shared transport possible.

Fixing the price: TShs 1,600 a kilogram was settled by contact between growers and buying agents, not decreed by anybody. The figure reconciles what growers will release with what ginners will take, and it carries the whole of the market's information in one number.

Allocating resources: At the higher price a hectare under cotton returns more than a hectare under sorghum. Land, labour and seed therefore move into cotton, which is exactly the reallocation a planner would have to compute, achieved here by growers acting only on the price in front of them.

Signalling expansion: A price rise driven by stronger demand tells growers that the market for lint has widened and that planting more is safe. Had the price fallen, the same mechanism would have carried the opposite instruction, telling them to cut the acreage or leave the crop.

Correcting its own signal: More cotton planted means more cotton offered next season, and greater supply by itself presses the price back down. The signal is therefore self limiting, and the grower who reads a single high price as permanent is the one who is caught by the correction.

Building social relations: Ten years of dealing with the same buyer has produced trust, and trust has produced seed on credit before planting and a jointly hired lorry. These relations cut the cost of trading for both sides, and they are themselves a product of the market.

Every one of these functions was carried by a single number moving from TShs 1,100 to TShs 1,600.

The Master Key: *A price is an instruction that nobody had to give and everybody obeys.*

HOT Question 15

A tarmac road takes three years to build. A tariff can be imposed before lunch. Which of the two decides how far a grower at Kishapu is able to sell?

Discuss the view that government policy is the most powerful determinant of the size of a market.

Model Answer

Policy is the quickest and often the sharpest instrument, since a ban or a quota can shut a market overnight while a road takes years to build. Even so it is not supreme, because policy cannot make a perishable good durable or manufacture a demand that does not exist. It governs the width of markets for tradable goods far more than for local ones.

Policy alone can close a market outright: No other determinant can reduce a market to nothing by decision. A prohibition ends legal trade at a stroke, a quota caps it at a chosen figure and a licence decides who may sell at all. That is real power, and it is exercised without notice.

Policy also works on cost, and it works fast: A duty adds to the landed price and a subsidy takes away from it, so the number of buyers who can afford the good changes within a single season. A port, a road or a telephone network takes years to alter the same cost by the same amount.

The nature of the good sets a ceiling policy cannot lift: No removal of duties will let fresh milk from Njombe reach Zanzibar in usable condition. Where the physical properties of the good bind first, the market stays small however friendly the law becomes, and policy is simply working on the wrong margin.

Demand must already exist: A government may free the trade in a specialised good entirely and still find only a handful of buyers. What makes fuel, salt and sugar wide markets is that almost everybody wants them, and permission cannot create wanting where there is none.

Transport and communication are the slower but deeper force: Tarmac and the mobile telephone have joined more Tanzanian markets in the last generation than any single trade measure, and they keep working through changes of government. Their effect is cumulative, whereas a tariff can be reversed in a budget speech.

A sound currency underlies the whole of it: A seller in another country parts with goods only against money he expects to hold its value. Where the currency is unstable, trade retreats into hard currency or into barter, and no schedule of duties can repair the loss of confidence that follows.

Judged over one season policy is the strongest lever; judged over a generation the road, the handset and a sound currency do more.

The Master Key: *Policy can close a market by decree, but it cannot open one that geography and demand have not already made possible.*

HOT Question 16

The maize price at Kibaigwa falls every August, and every August the same growers sell into it. The signal is loud, accurate and, to a man with nowhere to store, entirely useless.

To what extent can a market be relied upon to allocate resources correctly?

Model Answer

A market allocates well wherever the price measures the whole of what a good is worth to buyers and the whole of what it costs to produce. It allocates badly wherever that measurement fails, and it fails in four regular ways: unpriced side effects, goods nobody can be charged for, information that arrives late, and the fact that a price counts money rather than need.

What the mechanism does supremely well: Prices carry information cheaply and continuously. No trader needs to know the state of the whole economy, only the figure in front of him, and resources still move towards the uses buyers value most. No planning office could gather and act on the same information as quickly.

Unpriced side effects distort the answer: A fishing trade that empties a bay and a charcoal trade that clears a hillside pay nothing for the loss they cause. Part of the true cost falls outside the price, so the price understates it and the market allocates too much labour and capital into the activity.

Some goods cannot be priced at all: A rural road, a lighthouse and mosquito control cannot exclude whoever refuses to pay, so no seller can collect a price and the market supplies far too little of them. Here the failure is not that the price is wrong but that no price can form.

The information arrives one season late: Growers respond to this season's price with next season's crop, so a high price produces a glut and a low price produces a shortage. The signal is correct when it is sent and obsolete when it is acted upon, which is why farm prices swing.

The vote is a money vote: A market satisfies demand backed by purchasing power, so a luxury wanted by the rich outbids a necessity needed by the poor. That outcome can be efficient in the technical sense and still be one no society is willing to accept, which is where policy properly enters.

The extent of the reliance: For ordinary private goods with informed buyers and honest sellers, the price mechanism allocates better than any committee, and the burden of proof lies on whoever wants to overrule it. Outside those conditions it needs correcting at the margin rather than replacing wholesale.

The proper question is never whether a market allocates, but whether its price is telling the whole truth.

The Master Key: *A price allocates exactly as well as it measures.*

Markets Classified by What Is Traded

A carpenter buys timber, hires a helper and borrows from a bank before a single stool leaves the workshop, and those three purchases belong to three different markets. Sorting markets by what actually changes hands separates final goods from the services of the factors that make them and from the paper claims that finance the whole business. This section fixes the three classes, names the buyers and the sellers in each, and adds the distinctions between money and capital and between spot and forward dealing.

BINDER Question 17

A carpenter at Kariakoo buys timber, hires a helper and borrows for a saw bench before one stool is sold. Three purchases, three separate markets, one small workshop.

With the aid of a diagram, explain how markets are classified according to what is traded.

Model Answer

Markets fall into three classes according to what changes hands: product or commodity markets, where final goods and services are traded; factor markets, where the services of land, labour, capital and enterprise are traded; and financial markets, where money and financial assets such as shares, bonds and treasury bills are traded. Figure 6.2 sets the three beneath the single heading of markets.

Product or commodity markets: Here final goods and services change hands: cereals at Kibaigwa, clothes at Kariakoo, a bus ride, a night in a Zanzibar hotel, a consultation at a clinic. Firms are the sellers and households the buyers, and what is paid is simply called the price.

Factor markets: Here the services of the factors of production change hands. Households are the sellers and firms the buyers, so the roles are exactly reversed, and the prices carry separate names: wages for labour, rent for land, interest for capital and profit for enterprise.

Financial markets: Here money and claims to money change hands, in the form of shares, bonds, treasury bills and bank deposits. Savers supply the funds, while firms and government demand them, and the price is the rate of interest or the price of the security itself.

Three classes, one circuit: The classification names what is on the table, not who is standing at it. The same household earns in a factor market, spends in a product market and saves in a financial market, and a single firm may be trading in all three on the same afternoon.

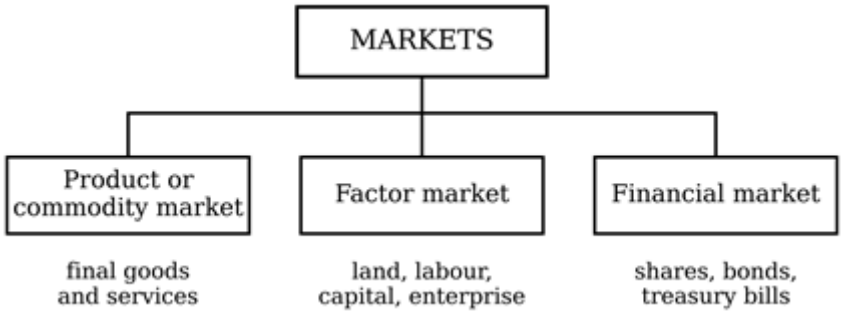


Figure 6.2: *Markets classified by what is traded*

Ask what is actually changing hands and the class of market names itself.

The Master Key: *Classify a market by what crosses the counter, never by who is standing behind it.*

BINDER Question 18

In the morning a Mwanza fisherman sells his labour to a boat owner. In the evening he buys rice. He has crossed to the other side of the counter without changing his job.

Distinguish between a product market and a factor market.

Model Answer

In a product market final goods and services are sold by firms and bought by households, while in a factor market the services of land, labour, capital and enterprise are sold by households and bought by firms. The two markets reverse the roles of the same people, and the second exists only because the first does.

What is traded: A product market trades finished output: a kilogram of maize, a kanga, a haircut, a lorry journey. A factor market trades the services of the productive resources themselves: an hour of labour, the use of a hectare for a season, the use of borrowed capital.

Who buys and who sells: The roles are exchanged between the two. Households supply factor services and demand goods; firms demand factor services and supply goods. The same person is a seller in one market in the morning and a buyer in the other in the evening.

What the price is called: In a product market the payment is called the price. In a factor market it is called a wage, a rent, an interest payment or a profit, but each is still a price settled by demand and supply and each moves for exactly the same reasons.

Factor demand is derived demand: No firm wants cane cutters for their own sake. The demand for cutters exists only because there is a demand for sugar, so a collapse in the product market drags the factor market down with it, while a boom in the product market pulls wages up.

The two markets form one circuit, since the money paid out as wages returns as spending on goods.

The Master Key: *Factor demand is borrowed demand, taken entirely from the product it helps to make.*

BINDER Question 19

The savings of a teacher in Songea can end up as a cement kiln in Tanga, and the two will never meet. A financial market is the introduction that makes it happen.

Describe the financial market and the instruments traded in it.

Model Answer

A financial market is the market in money and financial assets, and its work is to move funds from those who have saved to those who wish to invest. It divides into the money market, which trades short term claims, and the capital market, which trades long term claims such as shares and bonds.

What is traded and by whom: Savers supply funds, while firms, households and government demand them. What actually changes hands is a claim to money in the future, and the price of that claim is the rate of interest it carries or the price of the security itself.

The money market: This is the short end, where claims run for anything from overnight to about a year. Treasury bills, commercial paper and lending between banks are traded here. The purpose is liquidity: keeping idle cash working safely for short periods without locking it away.

The capital market: This is the long end. A bond is a promise to pay interest and repay a stated sum on a stated date; a share is part ownership carrying a claim on profit and no repayment date at all. The purpose is finance for factories, ports and expansion.

The Dar es Salaam Stock Exchange: It is the organised place where listed shares and bonds change hands. A new issue there raises fresh funds for the firm itself, while all later trading merely transfers ownership between investors and brings the firm not one shilling.

Why the market matters: Savings that would otherwise lie idle are put to work, risk is spread thinly across many holders, and the price of a security becomes a public verdict on how well the borrower is expected to do.

Nothing you can carry is traded here, yet every large factory in the country begins in it.

The Master Key: *A financial market sells time rather than goods, trading money now against money later.*

BINDER Question 20

A buyer at Mtwara agrees a price in July for cashew nuts that are still on the tree. If the price doubles by October the bargain stands, and both men knew it would.

Distinguish between spot trading and forward trading.

Model Answer

In spot trading the price is agreed and the good is delivered and paid for at once, while in forward trading the price is agreed today for delivery and payment at a stated future date. The difference is one of timing, and the purpose of the difference is the shifting of price risk.

Timing of delivery and payment: A spot bargain is completed on the spot: a sack of maize is paid for at Kibaigwa and carried away the same hour. A forward bargain is made now and performed months later, so the contract itself is all that exists in the meantime.

What each price reflects: A spot price reflects conditions today, the crop already harvested and the buyers already in the yard. A forward price reflects what both sides expect conditions to be at delivery, and what each of them will give up to be rid of the uncertainty.

Purpose: Spot trading serves an immediate need. Forward trading transfers risk, letting a grower fix his income before he plants and a processor fix his raw material cost before the season opens, so that both can plan and borrow against a known figure.

Who gains when the price moves: If the market price at delivery stands above the forward price, the buyer gains and the seller loses; if it stands below, the reverse holds. Neither has been cheated, because each accepted certainty in place of a gamble when the contract was made.

A forward contract does not remove risk from the world; it moves the risk to whoever minds carrying it less.

The Master Key: *A spot price settles today's trade, while a forward price settles today's worry.*

REAL Question 21

A sugar estate at Kilombero is a buyer and a seller several times over before one kilogram leaves the mill. Naming each of those markets correctly is the whole of the answer.

Identify the markets in which the estate described below trades, and state what is bought and sold in each.

A sugar estate at Kilombero mills its own cane and sells white sugar to wholesalers in Dar es Salaam and Mbeya.
It hires about two thousand seasonal cane cutters during the harvest.
It rents additional cane land from surrounding villages under annual agreements.
It financed a new boiler by issuing a bond that was taken up by a pension fund.
It has agreed a price now for sugar it will deliver in nine months.
The details of this case are illustrative.

Model Answer

The estate trades in all three classes at once. It sells white sugar in a product market, it buys the labour of cutters and the use of village land in two factor markets, and it sold a bond to a pension fund in a financial market. The nine month agreement is a forward trade inside the product market.

The product market: sugar: White sugar is a final good, so this is a product or commodity market. The estate is the seller and the wholesalers in Dar es Salaam and Mbeya are the buyers, and what is paid is simply the price per tonne.

A factor market: labour: Here the roles reverse. The estate is the buyer and the two thousand cutters are the sellers, what changes hands is a season of labour service rather than any person, and the price is the wage. This demand is derived entirely from the demand for sugar.

A factor market: land: The annual agreements buy the use of village land for a season, not the land itself. The villages are the sellers, the estate is the buyer and the price is rent, which will be bid up if a rival buyer appears for the same fields.

The financial market: the bond: The estate borrowed and the pension fund lent, so what changed hands is a claim to future money. This is the capital market rather than the money market, because a boiler is a long lived asset and the claim runs for years, not for weeks.

Spot against forward inside the product market: Day to day sales to wholesalers are spot trades, settled and delivered at once. The nine month agreement fixes today the price of sugar not yet made, which is a forward trade, and it protects the estate against a fall in the sugar price.

One firm stands in five markets, and only one of the five trades anything a person could eat.

The Master Key: *Never ask which market a firm belongs to; ask which markets it is standing in today.*

REAL Question 22

A Tanga processor sold a fifth of itself in a single morning and did not lose a machine. What the buyers carried away was paper, and the paper is the whole point.

Explain which market the firm below has entered, and describe what changes for the firm and for the buyers of its shares.

> Bahari Foods is a food processor at Tanga, owned until now by one family.
>
> It offers 20 per cent of its shares to the public and raises TShs 6,000,000,000 for a new processing line.
>
> The shares are then listed on the Dar es Salaam Stock Exchange, where holders may sell them to other investors.
>
> In the first month after listing the share price moved between TShs 480 and TShs 560.
>
> The figures in this case are illustrative.

Model Answer

Bahari Foods has entered the capital market, which is the long term half of the financial market, by making a new issue of shares. The firm gains TShs 6,000,000,000 of permanent finance and gives up a fifth of its ownership, while the buyers gain a claim on future profits together with the right to sell that claim to somebody else.

The class of market: This is a financial market, not a product market: what is sold is a claim, not a good. It is the capital market rather than the money market because a share has no maturity date at all, whereas a treasury bill would have matured within the year.

What changes for the firm: Share finance is not a loan. There is no interest to pay and no date on which the money must be returned, which suits a processing line that will earn slowly over many years. The price of that freedom is that profit and control are now shared with outsiders.

What changes for the buyers: A shareholder owns a slice of the firm. The return is a dividend when profit allows it, plus any rise in the price of the share, and there is no promise of either. If the firm fails, the shareholder is paid last, which is why he expects more than a lender does.

What the exchange adds: The movement between TShs 480 and TShs 560 is trading between investors, and not one shilling of it reaches Bahari Foods. The value of the listing is liquidity: buyers subscribed in the first place because they knew they could sell again without finding the firm.

The share price as a signal: A rising price says that the market expects better profits, and it makes any future issue cheaper because fewer shares need be sold to raise the same sum. A falling price is a public verdict and raises the cost of raising more.

The new line at Tanga was paid for by strangers who wanted a claim rather than a share of the machinery.

The Master Key: *A new issue raises money for the firm, while every trade after it only changes whose name is on the claim.*

HOT Question 23

Last season the cutters' wage, the price of sugar and the yield on the estate's bond all moved together. Three markets, or one machine with three dials on the front?

Discuss the view that classifying markets by what is traded is of little use, since the three classes are so tightly linked.

Model Answer

The linkage is real but the criticism fails. Classification never claimed the three markets were independent; it names what is being traded, who is buying and what the price is called, and without those names the links themselves could not even be described. The three classes are best read as three stages of one circuit.

The case for the criticism is strong: Derived demand ties the factor market to the product market, and the financial market funds the firms that trade in both. A fall in the sugar price cuts the cutters' wage and weakens the estate's bond in the same season, so the three move as one.

The same person appears in every class: A Mwanza fisherman sells labour, buys rice and holds a savings account, all within a week. Classifying markets therefore classifies neither people nor firms, and a student who expects tidy separate populations in each class will be disappointed.

Yet each class raises a different question: In a product market the question is who consumes and at what price. In a factor market it is what the derived demand is worth at the margin. In a financial market it is when the money returns and how likely it is to return at all.

Prices behave differently in each: A product price clears a flow of goods now. A factor price is governed by the marginal productivity of the factor and the product price standing behind it. An asset price is governed by expectations of income years away. The same word covers three mechanisms.

Policy has to know which market it is aiming at: A minimum wage acts on a factor market, a duty on a product market and an interest rate on the financial market. Each works through a different chain of cause and effect, and a government that confused them would pull the wrong lever and blame the result.

The verdict: The classification is a map and not a fence. Its whole value is that it lets the linkages be traced in order, from saving to capital, from capital to output, from output to income and back to saving. It makes the circuit visible rather than hiding it.

Naming the three markets is precisely what makes the traffic between them visible.

The Master Key: *A classification earns its keep when it makes connections easier to see, not when it denies them.*

HOT Question 24

A few dozen companies are listed at the Dar es Salaam Stock Exchange. The country holds millions of businesses. The gap between the two figures is the question.

To what extent does a country such as Tanzania need a well developed financial market?

Model Answer

The need is real but its reach is limited. Without a financial market savings lie idle and only firms that are already rich can invest, so the case for building one is strong. Yet in an economy where most enterprises are small, informal and financed by family, traders' credit and banks, a stock exchange touches only the top of the pyramid.

It moves savings to investment: The savings of a teacher in Songea can finance a kiln in Tanga only if some channel carries them there. Without one the saver holds cash and the investor waits, so real resources that could have been put to work sit still on both sides.

It prices capital and so allocates it: Interest rates and share prices rank competing projects, and funds flow towards the uses expected to yield most. That is the same allocative work a product market does for goods, performed here for the scarcest resource of a poor country.

It spreads risk and supplies liquidity: Many holders each carry a small part of a large risk, and each knows he can sell tomorrow. That assurance is what persuades a person to lock money into a kiln or a port today, so long lived projects become financeable that otherwise never would be.

It disciplines those who run firms: A listed firm publishes accounts and carries a visible price. A falling price is a public verdict delivered daily, and the threat that a badly run firm can be bought and its managers replaced is a restraint that an unlisted family firm never faces.

The limits are severe in practice: Trading is thin, listed firms are few, and the businesses that employ most Tanzanians are too small to list at all. Their binding constraints are collateral, written records and bank charges rather than the absence of an exchange, and a thin market can also price badly and swing on rumour.

The extent of the need: A financial market is necessary for large and long lived investment and for putting a price on capital, but it is not sufficient for development. Its usefulness grows with the number of firms big enough to use it, so building one is a long project rather than a switch to be thrown.

The exchange serves the top of an economy first and reaches the rest only as the rest grows into it.

The Master Key: *A financial market cannot create savings; it can only stop them lying still.*

Market Structure and How It Is Measured

Structure is the shape of the ground a firm stands on. Count the sellers, look at what they sell, ask how hard it is for a newcomer to open a door, and you can predict how the price will behave before you have drawn a single cost curve. This section defines market structure, sets out what determines it, places the four structures on one spectrum, and measures concentration with a ratio you can compute in the hall.

BINDER Question 25

Two shops face each other across the same street in Mwanjelwa. One can raise its price by a fifth and keep every customer; the other would lose them all before lunch. The difference is not the shopkeeper.

Define market structure and explain the factors that determine it.

Model Answer

Market structure means the nature and degree of competition in a market: the shape of that market read from the number and size of its sellers, the kind of product they sell, how much of the trade the largest hold, how easily a newcomer may enter, and how much buyers and sellers know. Those five are its determinants.

Number and size of sellers: Where sellers are very many and each is tiny, no one of them can move the price by withholding output, so all are price takers. Where one firm or a handful supply the bulk, each can name a price and the rest must answer it.

Nature of the product: A homogeneous good, one grade of maize for instance, leaves a buyer indifferent between sellers, so competition runs on price alone. A differentiated good, whether the difference is real or only believed, gives its seller loyal buyers and with them room to charge more.

Market share: The share of industry sales held by the largest firms shows how far power has gathered. A market where four firms sell nine tenths of the output behaves quite differently from one where the largest holds a twentieth, however many names the register carries.

Entry and exit conditions: Freedom to enter disciplines a profitable market, because supernormal profit draws newcomers whose output pushes the price back down. Where licences, patents, heavy fixed costs or sunk costs bar the door, that profit survives and the seller keeps the power to set price.

Information: When buyers and sellers know every price and quality on offer, nobody can charge above the ruling price for long. Where knowledge is patchy, two sellers hold different prices for the same good in the same market, and advertising begins to earn its keep.

Read the five together and the market announces in advance the behaviour you should expect from the firms inside it.

The Master Key: *Structure is what a market is; conduct is what its firms then do.*

BINDER Question 26

At Kibaigwa the maize is the same maize whichever line you walk down. At the water meter outside the gate there is one supplier and no line at all.

Distinguish between a perfect market and an imperfect market.

Model Answer

A perfect market is one in which very many small sellers offer an identical product to very many well informed buyers, with free entry and exit, so every seller takes the ruling price. An imperfect market breaks at least one of those conditions, which leaves its sellers power to set price: monopoly, monopolistic competition and oligopoly.

Number and size of sellers: In a perfect market sellers are so many that each supplies a negligible fraction and none can affect the price. In an imperfect market there is one seller, or a few large ones, or many sellers each holding a version of the product that is his own.

Nature of the product: A perfect market trades one homogeneous good, so every seller's output is a perfect substitute for every other's. An imperfect market trades goods that differ by brand, quality or location, or a good with no close substitute at all.

Control over price: The perfect competitor is a price taker facing a horizontal demand curve, so $P = AR = MR$. The imperfect competitor is a price maker facing a downward sloping curve, so he must cut price to sell one more unit and $AR > MR$.

Entry and knowledge: A perfect market has no barrier to entry or exit and complete knowledge of prices and quality, so advertising would be pointless. An imperfect market has barriers of law, cost or scale, and patchy knowledge, which is why brands and advertising exist at all.

Perfect competition is the benchmark; everything actually traded in Tanzania sits somewhere on the imperfect side of it.

The Master Key: *A perfect market contains price takers only; every imperfect market contains at least one price maker.*

BINDER Question 27

Set the four structures along one arrow and the argument becomes a walk. At the left hand end nobody can move the price. At the right hand end one firm writes it.

With the aid of a diagram, describe the four market structures as points on a spectrum of competition.

Model Answer

Figure 6.3 lays the four structures along a single arrow, with competition strongest at the left end and market power strongest at the right. Walking rightwards the number of sellers falls, the product grows more differentiated and the barriers rise: perfect competition, then monopolistic competition, then oligopoly, then monopoly.

Perfect competition, the left end: Very many firms sell an identical product, entry is free and knowledge is complete. No seller can shift the price by withholding output, so each takes what the market sets, and in the long run competition leaves only normal profit.

Monopolistic competition: Many firms sell close but differentiated substitutes and entry stays easy. Each seller holds a small band of loyal buyers, so the demand curve slopes down gently and stays highly elastic, which gives a slight and temporary power over price.

Oligopoly: A few large firms supply most of the market from behind high barriers. Each is big enough to matter to the others, so every price or output decision must anticipate the rivals' reply, and the result is often a rigid price.

Monopoly, the right end: One seller supplies the whole market with a good that has no close substitute, and entry is blocked by law, cost or ownership. Demand facing the firm is the market demand curve itself, so power over price is at its greatest here.

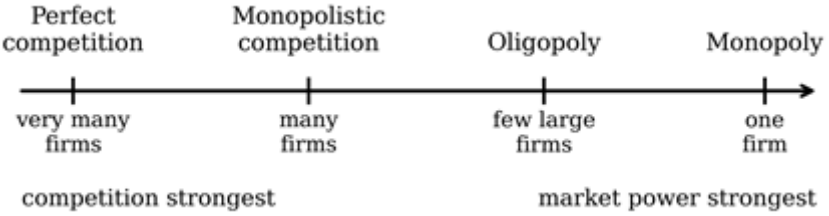


Figure 6.3: *The spectrum of market structures*

The arrow matters more than the four labels, because a real market usually stands between two marks rather than on one.

The Master Key: *Read a market by where it stands on the arrow, not by which of the four boxes you can force it into.*

BINDER Question 28

A trade register lists forty sellers of cooking oil and the market looks crowded. Three of them move three quarters of the litres, and the crowd turns out to be scenery.

Define the concentration ratio and calculate the three-firm and five-firm concentration ratios from the shares below.

An industry has six sellers and no others.
Firm A holds 34 per cent of sales, firm B 26 per cent and firm C 15 per cent.
Firm D holds 12 per cent, firm E 8 per cent and firm F 5 per cent.
The six shares add to 100 per cent.

Model Answer

The concentration ratio is the combined share of industry sales held by the largest few firms, written CR_n where n is the number of firms counted. Here CR_3 is 75 per cent and CR_5 is 95 per cent, so three sellers move three quarters of the output and the smallest of the six adds only a twentieth.

What the ratio measures: It measures how far sales are gathered into a few hands. Rank the firms by share, largest first, then add the shares of the first n of them; the answer is a percentage of the whole industry, and the count n must always be stated with it.

$$CR_n = s_1 + s_2 + \cdots + s_n$$

The computation: Reading down the cumulative column answers every version of the question at once. Three firms hold 75 per cent of sales and five hold 95 per cent, which leaves the sixth seller with the remaining twentieth of the market.

$$\mathrm{CR}_3 = 34 + 26 + 15 = 75\%$$
$$\mathrm{CR}_5 = 34 + 26 + 15 + 12 + 8 = 95\%$$

Firm	Share of industry sales (%)	Cumulative share (%)
A	34	34
B	26	60
C	15	75
D	12	87
E	8	95
F	5	100

Shares ranked largest first, with the running total that gives each ratio.

Reading a high ratio: A four-firm ratio above roughly sixty per cent says that a handful of sellers carry the market, which points to oligopoly: watch for price leadership, for prices that move together, and for competition carried on by advertising rather than by price.

Reading a low ratio: A low ratio says that the largest sellers are still small beside the market, so no one of them can hold a price away from the rest. Such a market behaves competitively whatever its sellers happen to be called.

The ratio is a first reading, not a verdict, because it counts sales today and says nothing about how easily a newcomer could take them tomorrow.

The Master Key: *The concentration ratio measures how much of a market the leaders hold, never how hard it would be to take it from them.*

BINDER Question 29

Two sacks of rice stand on the same counter, one loose and one printed with a name. The printed one asks TShs 3,000 more and still empties first, which tells you this is not the market it appears to be.

Explain how product differentiation and the conditions of entry together determine the power a seller has over price.

Model Answer

Differentiation decides whether a seller may charge above a rival and keep buyers; entry conditions decide whether the profit that follows lasts. Differentiation makes rival goods imperfect substitutes, which tilts the firm's own demand curve downwards and puts $\mathrm{AR} > \mathrm{MR}$**; barriers to entry then keep newcomers from competing that profit away.**

Real differences: Quality, design, durability, packaging that survives the journey, credit terms, after sales service and simple nearness to the buyer are all genuine differences. Each gives a buyer a reason to prefer one seller even at a slightly higher price.

Imagined differences: A brand, a wrapper or a sustained advertisement can divide a market even where a laboratory would find nothing to separate the goods. A difference believed by the buyer works exactly like a difference that exists.

What differentiation does to demand: As substitutes become imperfect, the demand curve facing the firm stops being horizontal and slopes down, and it grows less elastic the stronger the attachment. The seller now chooses a point on that curve, which is what price making means.

What entry conditions do: Where entry is free, a price above average cost invites newcomers whose supply drags the price back down, so differentiation earns only a temporary profit. Where licences, patents, minimum scale or unrecoverable sunk cost bar the way, the same profit survives indefinitely.

This is why monopolistic competition and monopoly stand at different ends of the arrow although both sell something a rival cannot copy exactly.

The Master Key: *Differentiation creates the power to price; barriers to entry decide how long that power is kept.*

REAL Question 30

A contractor in Mbeya rings round for cement and hears four prices within TShs 500 of one another. Nobody has met, and nobody needs to.

Calculate the four-firm concentration ratio for the market below and classify the structure it points to.

Kazi Imara Builders buys cement through merchants in Mbeya.

The shares below are illustrative, drawn from one quarter of merchant sales, and are used only to work the method.

Twiga holds 32 per cent of the bags sold, Dangote 24 per cent and Simba 18 per cent.

Tanga holds 14 per cent, Kilimanjaro 8 per cent and all other suppliers together 4 per cent.

Cement of a stated grade performs the same whichever bag it leaves in.

A new plant needs a quarry, a kiln and several years before its first bag reaches a merchant.

Model Answer

CR_4 is 88 per cent: the four largest suppliers move nearly nine bags in every ten, which places this market squarely in oligopoly. A concentrated few, a product buyers cannot tell apart once the grade is stated, and an entry cost measured in years together explain the narrow band of prices the contractor was quoted.

The calculation: Rank the suppliers by share and add the first four. The two remaining entries, Kilimanjaro and the small suppliers together, account for the other 12 per cent of the bags sold.

$$CR_4 = 32 + 24 + 18 + 14 = 88\%$$

Supplier	Share of quarterly sales (%)	Cumulative share (%)
Twiga	32	32
Dangote	24	56
Simba	18	74
Tanga	14	88
Kilimanjaro	8	96
Other suppliers	4	100

Merchant sales ranked largest first; the figures are illustrative.

What 88 per cent means: Four sellers carry the market. The tail of small suppliers is too light to discipline them, because even acting together it could not replace the output any one of the four would have to withdraw in order to move the price.

The two largest already hold 56 per cent: CR_2 is 56 per cent, so power is uneven even inside the leading group. A market shaped like this commonly settles into price leadership, with the largest supplier moving first and the others following within days.

A homogeneous product among few sellers: Because a stated grade of cement is the same everywhere, competition ought to run on price alone. With only four sellers that matter, each knows a cut would be matched at once and would leave every firm poorer, so the prices move together instead.

Barriers to entry: A quarry, a kiln, a grid connection and a licence are heavy outlays and largely sunk. Entry therefore takes years, so supernormal profit is not competed away as it would be at a maize market, and the structure holds from one quarter to the next.

The classification: Few large firms, high barriers, an identical product and constant mutual watching: this is a pure oligopoly rather than monopolistic competition, and the narrow band of prices is the interdependence showing itself.

The ratio does not show that these suppliers have agreed anything; it shows the conditions under which agreeing would be easy and detecting it hard.

The Master Key: *A high concentration ratio never proves collusion; it names the conditions in which collusion would be easy.*

REAL Question 31

Walk the maize line at Kibaigwa on a Tuesday and every sack opened holds the same grain. The only question a buyer has left is what each seller is asking.

Using the determinants of market structure, classify the maize market described below.

Several hundred sellers offer maize at Kibaigwa in Dodoma on the same morning.
The grain is of one grade, so a buyer opening two sacks finds no difference worth paying for.
The morning price is called and repeated down the line, and every trader knows it within minutes.
A farmer may join the line with a single sack and may stay away the following week without penalty.
The largest trader present handles about two sacks in every hundred.
Lorry hire from the villages is paid by the seller and differs with distance.

Model Answer

On every determinant except one this market is close to perfect competition. The sellers are very many and each is tiny, the grain is homogeneous, entry and exit cost nothing, information travels down the line in minutes and concentration is negligible, so every seller is a price taker; only transport cost, which differs with distance, breaks the pattern.

Number and size of sellers: Several hundred sellers with a largest share of about two per cent mean that no single trader can move the price. Withholding one sack changes market supply by an amount no buyer in the line would notice.

Nature of the product: One grade of maize is a homogeneous product, so a buyer is indifferent between sellers and competition can run on price alone. A trader asking above the morning price simply watches the queue move four steps along.

Market share and concentration: With the leader at two per cent of sales, even a five-firm ratio would still be in single figures. No trader is large enough to lead a price, and none is large enough for the market to feel his withdrawal, which is exactly what the model assumes.

Entry and exit conditions: A single sack is enough to enter and nothing is lost by staying away. No licence, no minimum scale and no sunk cost stand in the way, so any profit above the ordinary would be shared out among newcomers within a season.

Information: The called price is repeated down the line and known within minutes, so knowledge is close to perfect and search costs a buyer nothing. That is what makes one price rule the whole market on any given morning.

Where the model fails: Transport cost is real and differs with distance, so what a seller nets at the farm gate is not the same for all. One price rules at Kibaigwa, but not across the villages that feed it.

Call it a competitive market rather than a perfect one, and locate the whole of the difference in a lorry fare.

The Master Key: *Kibaigwa is not the model, but it is near enough that the model predicts its price.*

HOT Question 32

A regulator sees two firms holding four fifths of a market and reaches for the file. The following week a shipload of imports lands at Dar es Salaam and the price falls without anybody being fined.

To what extent does a high concentration ratio prove that a market lacks competition?

Model Answer

A high ratio is strong evidence and not proof. It measures where sales actually sit, which is a genuine symptom of market power, but it is blind to imports, to the threat of entry, to substitutes lying outside the industry as defined, and to the boundary drawn round the market in the first place. A high ratio can therefore sit beside keen competition, and a low one can hide a comfortable understanding.

What it does establish: Where a few firms carry most of the sales, each is large enough for its own output decision to move the price, and each has something to gain by restricting output. Concentration is a genuine precondition of market power, and its absence is fair evidence that no seller has any.

It counts domestic sellers only: A ratio built from local producers ignores imports altogether. If cement or cooking oil can be landed freely at a port, the effective number of sellers is larger than the register shows and the domestic price is capped by the landed cost.

It says nothing about the door: Two firms in a market where entry needs no unrecoverable outlay may price close to cost, because a third could open next month and undercut them. The threat of entry can discipline a market that the ratio calls concentrated.

The boundary decides the answer: Define the market as cement sold in Mbeya and concentration is high; define it as building materials, or as cement across East Africa, and it falls at once. A ratio is only as honest as the market definition standing behind it.

It ignores the shape of the tail: Two markets with the same CR_4 differ entirely if the remainder is one firm holding twelve per cent or fifty firms holding a quarter of a per cent each. The ratio compresses that difference away and reports the same number.

Why it survives the criticism: It is cheap, comparable across industries and available from ordinary sales returns, so it tells a regulator where to look first and which markets to leave alone. It sets the question; an investigation of entry, imports and conduct is what answers it.

Treat the ratio as the reason to open the file and never as the finding written inside it, because the decisive facts lie at the door of the market rather than in the sales column.

The Master Key: *A concentration ratio measures where the sales are, never how contestable the ground beneath them is.*

HOT Question 33

A candidate writes 'oligopoly' beside the name of a market and stops, satisfied. The market has thirty sellers, four that matter, and prices that move together only in the dry season.

Discuss the view that market structure is a matter of degree rather than a set of four separate categories.

Model Answer

The view is largely right. The four structures are marks on a continuous scale of competition, and most real markets stand between two marks rather than on one, because every determinant of structure, whether numbers, differentiation, barriers or information, varies by degree. The labels still earn their place, because each carries a whole model of behaviour, but they name a position and not a verdict.

The determinants are continuous: Sellers are not simply many or few but range from thousands to two. Differentiation runs from identical grain to a good with no substitute at all. Barriers run from a stall fee to a kiln. Nothing in these quantities sorts itself naturally into four boxes.

The awkward cases are the common ones: A market with thirty sellers of whom four matter is neither oligopoly nor monopolistic competition as taught. A monopolist with one distant substitute is not quite a monopolist. The interesting markets are almost always found between the marks.

Structure shifts with the boundary: The same trade is concentrated when measured in one town and competitive when measured across the country. Any label therefore depends on where the line round the market was drawn, which is a matter of judgement rather than of fact.

Structure shifts with time: A tarmac road, a mobile money service or an opened import licence widens a market and slides it leftwards along the arrow within a few years. A structure is a photograph of something that keeps moving, so a label fixed today may be wrong within a decade.

Why the labels still pay: Each of the four carries a determinate prediction: a horizontal demand curve here, a tangency of average revenue to average cost there, a kinked curve and a rigid price in the third. Naming the nearest structure hands you a model you can actually use.

How to use both together: State where the market stands on the arrow, name the structure nearest to it, and then say which assumption of that structure the market actually breaks. The third step is where the analysis lives.

Perfect competition and pure monopoly are the two ends of the ruler, and they exist chiefly so that everything lying in the middle can be measured against them.

The Master Key: *Name the nearest structure, then name the assumption it fails, because the second sentence carries the analysis.*

HOT Question 34

Ten sellers of identical sugar behave like a hundred. A hundred sellers of ten different soaps behave like ten. Counting heads is never enough.

Examine how far the nature of the product, rather than the number of sellers, decides the degree of competition in a market.

Model Answer

Both matter and neither is sufficient alone. The nature of the product decides whether rival output is a perfect substitute, and therefore whether the firm faces a horizontal demand curve at all; the number of sellers decides whether one firm's output is large enough to move the price. Entry conditions then decide whether whatever power the two create survives.

The product sets the shape of the curve: Where the good is homogeneous, every rival is a perfect substitute, demand facing one seller becomes perfectly elastic and price is the only weapon left. Differentiate that same good and the curve tilts downwards at once, whatever the number of sellers happens to be.

Many sellers need not mean strong competition: Under monopolistic competition sellers are numerous, yet each has buyers who prefer his particular version, so each may raise price a little without emptying the shop. Competition moves to quality, service and advertising, and none of that disturbs the count.

Few sellers need not mean weak competition: An identical product among four sellers should produce ruinous price cutting, since a small cut would win the whole market. It usually does not, because each seller knows the cut would be matched, which is interdependence rather than the number itself.

Numbers decide whether one firm can move the price: This is the part the product cannot do. A seller holding half the market withdraws output and the price rises; a seller holding one part in a thousand withdraws output and nothing whatever happens. Price taking is arithmetic about size.

Entry conditions decide whether either lasts: Barriers preserve the power that differentiation or small numbers create. Open the door and profit invites newcomers, which raises the count and thins each seller's loyal following at the same time, so both sources of power decay together.

The practical test: Ask what one seller loses by raising his price by a tenth. Nothing sold at all means homogeneity and large numbers; a small loss of the least loyal buyers means differentiation; a reply from three rivals within the week means oligopoly.

The product tells you whether buyers can switch, the number tells you whether their switching matters, and the door tells you how long the answer stays true.

The Master Key: *Homogeneity decides whether buyers can switch and numbers decide whether their switching moves the price.*

Perfect Competition: the Assumptions

Perfect competition is not a description of anywhere. It is a short list of assumptions, each doing a definite piece of work, which between them strip every seller of any power to choose his own price. Learn what each assumption does rather than merely reciting the list, and the equilibrium, the supply curve and the efficiency results of the sections ahead all follow from it.

BINDER Question 35

A cotton grower at Kishapu is asked what price he intends to charge this season. He laughs, because the question was never his to answer.

State the assumptions of a perfectly competitive market and explain what each one does in the model.

Model Answer

Perfect competition rests on six assumptions: very many buyers and sellers, a homogeneous product, free entry and exit, perfect knowledge, no transport cost, and perfect mobility of factors. Each does a definite job, and together they leave the individual firm facing a horizontal demand curve at the ruling price, unable to raise it and with no reason to lower it.

Very many buyers and sellers: Each party supplies or buys so small a fraction of the total that no action of his own shifts market supply or demand. Withholding output changes the price by nothing measurable, so every buyer and every seller is a price taker.

A homogeneous product: Every seller's output is a perfect substitute for every other's, so a buyer has no reason at all to pay one seller more than another. This is what makes the demand curve facing the single firm perfectly elastic instead of merely elastic.

Free entry and exit: No licence, patent, minimum scale or contract keeps a firm out of the industry or holds it in. This assumption governs the long run: it lets supernormal profit attract entry and lets loss drive firms out until only normal profit remains.

Perfect knowledge and no transport cost: Buyers and sellers know every price and quality on offer, so nobody can hold a price above the rest, and advertising has nothing to do. Zero transport cost then keeps that single price the same in every corner of the market.

Perfect mobility of factors: Labour, capital and land move freely between uses, firms and places without cost or delay. This is what makes entry and exit real rather than merely permitted, and it gives every firm access to the same techniques and the same cost curves.

Notice that not one of the six concerns the firm's costs: the model constrains the revenue side and leaves cost to do the remaining work.

The Master Key: *Every assumption of perfect competition exists to make one price rule and to leave no seller able to touch it.*

BINDER Question 36

A trader at Makoroboi raises his price by TShs 100 a kilogram. The queue does not argue with him; it simply moves four steps to his left.

Explain why a homogeneous product combined with perfect knowledge makes every seller a price taker.

Model Answer

Because the two assumptions together destroy every reason to buy from a dearer seller. Homogeneity makes each seller's output a perfect substitute for the rest, and perfect knowledge shows every buyer who is asking what. A seller who raises his price therefore loses all his buyers at once, and one who lowers it gives away revenue he never needed to give, so he takes the ruling price.

Homogeneity removes any defence of a higher price: There is no quality, brand, packaging or service by which one seller's goods can be told from another's, so nothing remains that a buyer might reasonably pay extra to obtain. Every rival lot is a perfect substitute for this seller's lot.

Perfect knowledge removes the search cost: Buyers know every price being asked in the market, and know it at once and without expense. A higher price cannot be hidden in a corner of the market, and a seller cannot rely on a buyer who has not troubled to compare.

The consequence of asking more: Raise the price by the smallest amount and sales fall not a little but to nothing, because every buyer moves to a seller offering the identical good for less. Demand facing the firm is therefore perfectly elastic at the ruling price.

The consequence of asking less: He can already sell every unit he wishes at the ruling price, so cutting it wins him no extra buyer he could not have had anyway, and it lowers the receipt on every unit he was going to sell. The cut is pure loss.

That horizontal line is the whole of the price taker's revenue problem, because it is his demand curve, his average revenue and his marginal revenue at the same time.

The Master Key: *Take away the difference between sellers and take away the cost of searching, and you have taken away the power to price.*

BINDER Question 37

Anyone at all may start selling maize tomorrow morning. That single sentence is what stops this morning's maize seller from ever growing rich.

Explain the part played by free entry and exit in the model of perfect competition.

Model Answer

Free entry and exit assumes that no legal, financial or technical barrier keeps a firm out of the industry or holds it inside. Its work is done in the long run: supernormal profit draws newcomers whose output lifts supply and drags the price down to average cost, while losses drive firms out, cutting supply and lifting price, so only normal profit survives.

What the assumption rules out: There are no patents, no licences, no minimum efficient scale a newcomer cannot reach, no exclusive control of a raw material and no sunk cost that would be lost on leaving. The door of the industry swings freely in both directions.

Entry follows profit: Supernormal profit is a public signal, since knowledge is perfect. Newcomers arrive, market supply shifts rightwards, the ruling price falls, and each firm's horizontal demand line drops with it until price has come down to average total cost and the extra profit is gone.

Exit follows loss: Where price sits below average total cost, firms leave for better uses of their resources. Market supply shifts leftwards, the ruling price rises, and the survivors are carried back to normal profit. The mechanism is the same one running backwards.

What the mechanism achieves: Resources are pulled towards the goods consumers value most and pushed away from those they value least, without anyone directing them. The industry finishes where price equals marginal cost and equals the minimum of long-run average cost.

Normal profit is counted inside cost, so a firm left with normal profit alone is being paid in full and is not working for nothing.

The Master Key: *Free entry is the mechanism that turns a supernormal profit into a lower price for the buyer.*

BINDER Question 38

A licence may be free and the door may stand open, and the market can still be closed, if the land, the loan and the trained hands cannot be got at any price.

Explain perfect mobility of factors of production as an assumption of perfect competition and show what it does in the model.

Model Answer

Perfect mobility means that factors of production move freely between uses, between firms and between places, at once and without cost. Its job is to make free entry more than a permission on paper: without it a newcomer may be legally free to enter and still unable to assemble the labour, land and capital with which to produce anything.

The two kinds of mobility: Occupational mobility means a factor can change the work it does, so a worker leaves one trade for another and a machine is turned to a new product. Geographical mobility means it can change where it does that work, moving from one region to another.

It makes entry effective: Entry is not a signature but an arrival of resources. If skilled labour or capital cannot be drawn into a profitable industry, the price of its product stays above average cost although nothing in law forbids a newcomer, and the long-run result of the model never arrives.

It equalises factor prices and cost curves: Factors flow from where they are paid less to where they are paid more until the reward is the same everywhere. Every firm therefore faces the same factor prices and the same techniques, which is why the model may treat firms as identical.

It makes exit real: A firm leaving a losing industry can redeploy or sell its resources at full value, so sunk cost is zero and no firm is trapped by assets it cannot recover. Exit is then a genuine choice rather than a ruin.

Reality runs the other way, because a cement kiln cannot become a bakery, and it is exactly that immobility which preserves profit in the imperfect markets ahead.

The Master Key: *Free entry is the permission and factor mobility is the ability, and a market needs both before it can be competitive.*

REAL Question 39

A grower at Kishapu carries his cotton to the buying post and hears the season's price read from a board. He was not consulted, and he will not argue.

Assess the seed cotton market described below against the assumptions of perfect competition.

Thousands of smallholders around Kishapu in Shinyanga grow seed cotton for sale.
The crop is bought at a small number of buying posts run by ginneries.
Cotton meeting the season's grade is treated as identical whichever farm it came from.
A grower may plant cotton or turn to another crop the following season without penalty.
The season price is announced before the harvest and posted at every buying post.
Growers far from a post pay more for transport and so receive less at the farm gate.

Model Answer

The market meets the assumptions on the selling side and fails them on the buying side. Very many sellers, a homogeneous graded crop and freedom to leave the crop next season all hold, and they make every grower a genuine price taker. But the buyers are few, knowledge runs one way, transport costs differ with distance and factors are far from mobile, so this is a competitive market on one side of the counter only.

Very many sellers, and each of them tiny: Thousands of smallholders each bring a negligible share of the crop, so no grower can shift the quantity arriving at a post by enough to move the price. On this assumption the market matches the model almost exactly.

A homogeneous product: Cotton meeting the season's grade is treated as identical whatever farm it came from, so no grower can ask above the posted price and expect a sale. Grading is precisely what manufactures homogeneity out of a natural product.

Entry and exit are reasonably free: A grower may plant cotton or turn to another crop without licence or penalty, so nothing holds him in a losing crop beyond the length of one season. The delay of a growing season slows the adjustment, but it does not block it.

The buying side is not competitive: The crop is bought at a small number of posts run by ginneries, so the buyers are few while the sellers are thousands. Perfect competition requires very many buyers as well, and a market with few buyers is an oligopsony, whatever the sellers look like.

Knowledge is not perfect: The price is announced by the buyer before the harvest. The grower does not know the lint price, the ginning margin or what a rival post might have paid, so the informational balance that the model assumes is simply absent.

Transport cost is real: Growers far from a post pay more to reach it and net less at the farm gate, so one price does not in fact rule everywhere. Distance divides a single market into many small ones, each with its own effective price.

Perfect competition demands competition on both sides of the market, and here it is the side with few participants that settles the price.

The Master Key: *A market can satisfy every assumption for its sellers and still not be competitive, because the buyers are also counted.*

REAL Question 40

Along the lanes near Darajani a dozen boards carry the same two numbers for the dollar, repainted within the hour whenever one of them moves.

Examine how closely the market described below satisfies the assumptions of perfect competition.

> A dozen licensed bureaux de change trade United States dollars within a few streets of Darajani in Zanzibar.
>
> One dollar is the same as any other, whichever counter it crosses.
>
> Every bureau paints its buying and selling rates on a board facing the street.
>
> A visitor can walk the length of the lane in five minutes and compare every board.
>
> Opening a bureau requires a licence from the central bank and a minimum capital.
>
> When one bureau changes its rate, the others follow within the hour.

Model Answer

This market satisfies four of the assumptions almost exactly and fails one outright. The product is perfectly homogeneous, the sellers are many relative to the trade, knowledge is close to perfect because rates are posted and searching costs a five minute walk, and transport cost is negligible. Only free entry fails, because a licence and a capital requirement stand at the door, so the market is competitive rather than perfect.

A perfectly homogeneous product: A dollar bought at one counter is indistinguishable from a dollar bought at the next, so no bureau can differentiate its product, advertise a quality or build a brand. The rate on the board is the only thing a customer has to compare.

Many sellers, each small: A dozen within a few streets and more across the town means no single bureau supplies enough of the trade to move the rate by holding back. Each takes the going rate for the same reason a maize seller takes the going price.

Knowledge is close to perfect: Rates face the street on painted boards and the lane can be walked in five minutes, so search costs almost nothing. A bureau posting a worse rate gets no business, which is exactly why the others follow a change within the hour.

Transport cost is negligible: The good is carried in a pocket and the whole market sits inside a few streets, so no part of the price is eaten by moving the goods. One rate can therefore rule the entire lane, as the model requires.

Entry is not free: A licence from the central bank and a minimum capital are genuine barriers, so the number of sellers is limited by law rather than by profit. Any lasting supernormal profit is therefore not fully competed away, and the long-run result of the model does not follow.

Call it the nearest thing to the model that you will find on the island, and then name the licence as the single reason it falls short.

The Master Key: *Posted prices and an identical product are what make a price taker; only free entry decides whether his profit lasts.*

HOT Question 41

No market in Tanzania satisfies all six assumptions, and a candidate is entitled to ask why anyone should spend a term studying a market that has never existed.

To what extent is a model whose assumptions no real market satisfies of any use?

Model Answer

It is of great use, provided it is used as a ruler and not as a description. Perfect competition earns its place because it yields determinate predictions, because it supplies the standard of efficiency against which every other structure is judged, and because it lets you diagnose a real market by naming the assumption it breaks. It earns its critics because the things it assumes away are the things firms actually compete on.

It predicts something definite: From the assumptions alone follow $P = AR = MR$, output where marginal cost equals marginal revenue with marginal cost cutting marginal revenue from below, and normal profit in the long run. A model that yields testable statements is worth more than a description that yields none.

It is the standard of efficiency: Perfect competition delivers allocative efficiency, where price equals marginal cost, and productive efficiency, where output is produced at minimum average total cost. Monopoly and monopolistic competition are then measured by how far they fall short of these two marks.

It works as a diagnosis: Name the assumption a market breaks and you have named the source of its market power and pointed at the remedy. Few sellers suggests one policy, blocked entry another, and poor information a third, and none of that analysis is available without the benchmark.

Some markets come close enough to behave as predicted: Graded crops, foreign currency and fish landed on one beach approach the assumptions closely, and their prices behave much as the model says. An approximation that predicts approximately is not a fantasy.

Against it, the model assumes away real competition: Firms compete by quality, brand, service and invention, and the model forbids all four by assuming a homogeneous product and perfect knowledge. It therefore has nothing to say about advertising or research, which is a serious silence in judging a growing industry.

Against it, the failures are the local ones: Perfect knowledge and zero transport cost are not harmless simplifications in a country of long distances and thin information. They fail hardest exactly where the model would be most useful, which is a fair criticism of applying it without adjustment.

Use the model as the ruler and it is indispensable; use it as a description and it will mislead you about every market you ever meet.

The Master Key: *Judge perfect competition by what it lets you measure, never by whether you can find it anywhere.*

HOT Question 42

Remove the assumptions one at a time and watch which removal breaks the horizontal demand curve first. The order in which the model collapses is the order of importance.

Discuss which of the assumptions of perfect competition does the most work in making a firm a price taker.

Model Answer

Homogeneity does the most work in the short run and free entry does the most in the long run. A homogeneous product read by well informed buyers is what makes rival output a perfect substitute and so makes the firm's demand curve horizontal; free entry is what prevents the resulting profit from lasting. Large numbers matter, but on their own they are neither sufficient nor decisive.

The case for homogeneity: Drop it and the firm's demand curve tilts downwards immediately, so average revenue exceeds marginal revenue and the firm becomes a price maker, however many sellers remain in the market. Nothing else in the list has that effect on its own.

Homogeneity needs knowledge beside it: An identical good sold to badly informed buyers still supports different prices in the same market, because a buyer who cannot compare cannot punish the dearer seller. Knowledge and homogeneity therefore work as a pair and neither is decisive alone.

The case for large numbers: With few sellers, even an identical product produces interdependence rather than price taking, as the cement trade shows: each seller knows a cut would be matched, so the price stays where it is. Numbers are necessary but plainly not sufficient.

The case for free entry: Whatever power the other assumptions leave behind, free entry is what stops it becoming permanent. A supernormal profit that anyone may pursue is a temporary profit, and even a fairly concentrated market can be disciplined by the credible threat of a newcomer.

The two answers belong to two time periods: Homogeneity with perfect knowledge produces the horizontal demand line and therefore the price taker of the short run. Free entry produces normal profit at minimum average total cost and therefore the long-run result. Ranking them without naming the period is what goes wrong in weak answers.

The supporting assumptions: Zero transport cost keeps one price ruling across the whole market and perfect factor mobility makes entry effective rather than merely lawful. Both are needed for the model to close, but neither creates a price taker by itself.

If you were allowed to keep only two of the six, keep a homogeneous product and an open door, and the rest of the model can be rebuilt around them.

The Master Key: *Homogeneity is what makes a firm a price taker and free entry is what keeps it one.*

HOT Question 43

Two firms supply a town with cooking gas and the price stays modest, because a third could be trading by Friday. A hundred tailors down the road hold their prices all year, because nobody new can afford the machines.

Examine the claim that it is free entry, and not the number of sellers, that keeps a market competitive.

Model Answer

The claim is half right and worth taking seriously. The threat of entry disciplines price even where sellers are few, so an open market with two firms may price more keenly than a closed one with twenty; but the number of sellers still decides whether any one firm's output can move the price, which is what makes a firm a price taker in the first place. Entry governs profit and numbers govern power.

Entry sets the ceiling on price: An incumbent charging well above cost is advertising an opportunity. The highest price he can safely hold is therefore the cost at which the next entrant could come in, and that is a limit set by the door rather than by how many are trading today.

Sunk cost is the real barrier: If assets can be resold or redeployed, entering costs little to attempt and leaving costs little to accept, so a newcomer can enter, undercut and withdraw. Where the outlay is unrecoverable, that gamble is unattractive and the incumbent is safe however profitable he becomes.

But numbers decide who is a price taker: Two sellers of an identical good each supply half the market, so either can raise the price by withholding output. That is genuine market power which the threat of entry may restrain but cannot remove, and no amount of openness makes such a firm perfectly elastic in its demand.

Numbers also decide interdependence: Where sellers are few, each must anticipate the reply of the others, which produces rigid prices, non price competition and the standing temptation to collude. Where sellers are very many, nobody is watched closely enough for any of that to arise.

What the evidence suggests: Trades with heavy sunk outlays, such as cement or electricity distribution, stay concentrated and priced well above cost. Trades with light sunk outlays, such as retailing or transport on a route, are keenly priced even where only a few operators are trading at any moment.

The judgement: Entry conditions matter more for the long-run level of profit, while numbers matter more for the way price behaves from day to day. A regulator who counts heads without examining the door will therefore misjudge both which markets are safe and which are not.

Concentration tells you who holds the market this morning, and the entry conditions tell you whether they will still be holding it next year.

The Master Key: *The door matters more than the crowd, because the door decides how long the crowd is kept outside.*

The Price Taker's Demand and Revenue

The demand curve for a whole industry slopes downwards, as every demand curve does. The single price taker inside that industry faces a flat horizontal line at the ruling price, and that one line is at the same moment his demand curve, his average revenue and his marginal revenue. This section proves the equality from first principles, sets it out in a schedule, and shows why the seller can neither raise his price nor gain anything by lowering it.

BINDER Question 44

A rice trader at Ifakara counts TShs 575,000 at the close of the day and calls it a good one. The figure that decides whether to load one more bag tomorrow is not that figure.

Define total revenue, average revenue and marginal revenue, and state the relation between them.

Model Answer

Total revenue is the whole receipt from sales, price multiplied by quantity sold. Average revenue is total revenue per unit sold, which under a single price is the price itself. Marginal revenue is the addition made to total revenue by selling one more unit, and it is the figure that governs how much a firm decides to produce.

Total revenue: The money taken in from selling a given output, found by multiplying the price by the quantity sold. It measures the scale of the business but says nothing at all about whether the last unit was worth producing.

$$\mathrm{TR} = \mathrm{P} \times \mathrm{q}$$

Average revenue: Total revenue divided by the number of units sold, which is the receipt per unit. Because the same quantity appears above and below the line, average revenue equals price, so the average revenue curve is also the firm's demand curve.

$$\mathrm{AR} = \frac{\mathrm{TR}}{\mathrm{q}} = \frac{\mathrm{P} \times \mathrm{q}}{\mathrm{q}} = \mathrm{P}$$

Marginal revenue: The change in total revenue caused by selling one more unit, found by dividing the change in total revenue by the change in quantity. It is the only revenue figure that answers the question the firm actually faces, which is whether to produce the next unit.

$$\mathrm{MR} = \frac{\Delta\,\mathrm{TR}}{\Delta\,\mathrm{q}}$$

How the three are related: Total revenue reports the day, average revenue names the price, and marginal revenue points the direction. Output is worth expanding while marginal revenue exceeds marginal cost, which is why the marginal figure carries the decision and the other two merely describe it.

Keep marginal revenue at the front of the mind, because profit is maximised where it equals marginal cost with marginal cost cutting it from below.

The Master Key: *Total revenue counts the day, average revenue names the price, and marginal revenue decides the next unit.*

BINDER Question 45

The market curve for maize slopes downwards like every demand curve you have ever drawn. The curve facing one seller standing in that market is flat, and both statements are true at the same moment.

With the aid of a diagram, explain why the demand curve facing a single firm in perfect competition is horizontal while the industry demand curve slopes downwards.

Model Answer

The two curves answer different questions. The left panel of figure 6.4 asks what all buyers together will take at each price, and they take more only at a lower price, so that curve slopes down. The right panel asks what one very small seller can sell at each price, and because his output is a negligible part of the whole, he can sell any quantity he likes at the ruling price and none at all above it.

The left panel makes the price: Industry demand and industry supply cross at equilibrium point E, and that crossing fixes the ruling price and the total quantity traded. This panel is where the price in the whole market actually comes from.

The right panel takes the price: The single firm then faces a horizontal line drawn at that price and labelled as demand, average revenue and marginal revenue together. The dashed verticals show the firm selling different quantities without the price altering by anything at all.

Why the firm's line is flat: The firm's output is too small a share of market supply for its own decisions to shift the market curve, so its sales never move the price. The product is homogeneous and buyers are informed, so any higher asking price sells nothing.

The scales are not the same: Industry quantity is measured in thousands of units and the firm's in single units, so the firm's line is a hugely magnified sliver of the market curve. Over so short a stretch the slope is too small to draw, and so it is drawn flat.

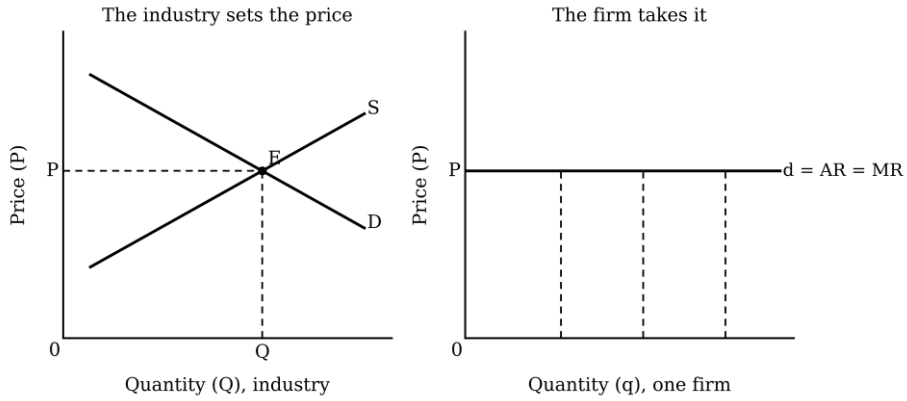


Figure 6.4: *The industry sets the price and the firm takes it*

Shift demand or supply in the left panel and the horizontal line in the right panel rises or falls to match, because the firm never draws its own price.

The Master Key: *The firm's demand curve is the market curve seen through a magnifying glass, and at that magnification it is flat.*

BINDER Question 46

Every unit leaves the stall at the same price. Write that single fact down properly and the three revenue curves fold into one line.

Show that for a firm in perfect competition price, average revenue and marginal revenue are equal.

Model Answer

For a price taker every unit sells at the same ruling price, so average revenue works out at that price and marginal revenue works out at that price too. Demand, average revenue and marginal revenue are therefore a single horizontal line drawn at the height of the ruling price, which is what figure 6.5 shows.

Begin with total revenue: The firm sells whatever quantity it chooses at the ruling price, and that price does not change with the quantity it brings. Total revenue is therefore price multiplied by quantity, with price a constant.

$$TR = P \times q$$

Average revenue equals price: Divide total revenue by quantity. The quantity cancels, leaving the price itself, so average revenue is the same at every output. This is why the firm's demand curve and its average revenue curve are the same curve.

$$AR = \frac{TR}{q} = \frac{P \times q}{q} = P$$

Marginal revenue equals price: Each extra unit adds exactly the ruling price to the receipt, and nothing is lost on the units already sold, because no price cut was needed to shift the extra unit. Marginal revenue therefore equals price at every output as well.

$$MR = \frac{\Delta TR}{\Delta q} = \frac{P \times \Delta q}{\Delta q} = P$$

The contrast that proves the point: A price maker faces a downward sloping average revenue curve, so selling one more unit forces a lower price on every unit, and marginal revenue falls below average revenue. Only when price is constant do the two coincide.

$$AR = a - bQ, \quad TR = aQ - bQ^2, \quad MR = a - 2bQ$$

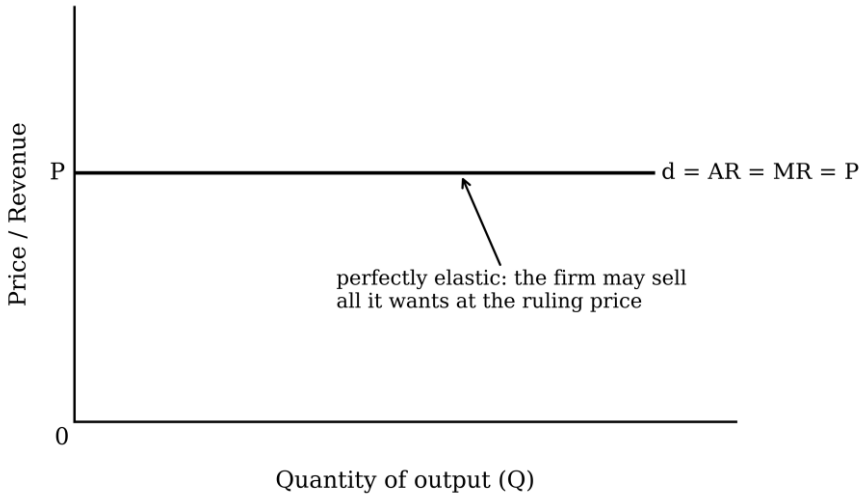


Figure 6.5: *The demand curve facing a price taker*

Figure 6.5 draws that line as perfectly elastic, which says the firm may sell all it wishes at the ruling price and nothing whatever above it.

The Master Key: $P = AR = MR$ *holds for one reason only, that the price taker never has to cut his price in order to sell more.*

BINDER Question 47

One price, six quantities, three columns of revenue. Fill them in and the proof stops being algebra and becomes arithmetic anyone can check.

Complete the revenue schedule for a price taker selling at a constant price of TShs 1,200 a unit, and state what each column shows.

Model Answer

At a constant price of TShs 1,200 the total revenue column rises by TShs 1,200 at every step, so total revenue climbs in a straight line from the origin, while average revenue and marginal revenue both stand at TShs 1,200 at every output. The schedule is $P = AR = MR$ **written out in money.**

The total revenue column: Multiply price by quantity at each row, so four units bring TShs 4,800 and six bring TShs 7,200. Because the additions are equal at every step, the total revenue curve is an upward sloping straight line through the origin rather than a curve.

Quantity q	Price (TShs)	TR (TShs)	AR (TShs)	MR (TShs)
1	1,200	1,200	1,200	1,200
2	1,200	2,400	1,200	1,200
3	1,200	3,600	1,200	1,200
4	1,200	4,800	1,200	1,200
5	1,200	6,000	1,200	1,200
6	1,200	7,200	1,200	1,200

Revenue schedule at a constant price of TShs 1,200 a unit.

The average revenue column: Divide each total by its quantity and the answer is TShs 1,200 every time, since TShs 4,800 shared among four units is TShs 1,200. Average revenue is constant and equal to price, so plotted against output it is a horizontal line.

The marginal revenue column: Take the difference between one total and the one above it. Moving from three units to four raises total revenue from TShs 3,600 to TShs 4,800, an addition of TShs 1,200, and every other step adds the same amount.

What the schedule means for the decision: Because marginal revenue never falls as output grows, revenue itself places no limit on how much the firm should produce. Only rising marginal cost does that, so output settles where marginal cost equals marginal revenue and cuts it from below.

Set this beside a price maker's schedule, where the price column itself falls as quantity grows and marginal revenue drops away below it.

The Master Key: *A flat price column produces a flat average revenue column and a flat marginal revenue column, and that is the whole of the price taker's revenue story.*

REAL Question 48

At Mkula the paddy price is called at TShs 1,150 a kilogram, and it does not move whether a grower arrives with one sack or with twenty.

Calculate total, average and marginal revenue for the grower described below, and advise her on the price she should ask.

Neema Mgeni farms paddy at Mkula in the Kilombero valley.
Buyers at the roadside collection point are paying TShs 1,150 a kilogram this week for paddy of the season's grade.
Several hundred growers bring paddy to the same point, and Neema's crop is a very small part of what arrives.
A neighbour tells her to ask TShs 1,250 because her grain is cleaner.
The figures are illustrative and are used only to work the method.

Model Answer

At every quantity in the schedule total revenue is TShs 1,150 multiplied by the kilograms sold, average revenue is TShs 1,150 and marginal revenue is TShs 1,150, so $\mathrm{P} = \mathrm{AR} = \mathrm{MR}$ **holds exactly. Neema should ask the ruling TShs 1,150. Asking TShs 1,250 for a graded crop that buyers treat as identical would leave her not with a smaller sale but with no sale at all.**

Total revenue: Multiply the ruling price by the kilograms sold. Three hundred kilograms bring TShs 345,000 and five hundred bring TShs 575,000, and each further hundred kilograms adds a further TShs 115,000 to the day's takings.

$$\mathrm{TR} = \mathrm{P} \times \mathrm{q} = 1{,}150 \times 300 = 345{,}000$$

Quantity (kg)	Price (TShs per kg)	TR (TShs)	AR (TShs per kg)	MR (TShs per kg)
100	1,150	115,000	1,150	1,150
200	1,150	230,000	1,150	1,150
300	1,150	345,000	1,150	1,150
400	1,150	460,000	1,150	1,150
500	1,150	575,000	1,150	1,150

Neema's revenue at the ruling price; illustrative figures.

Average revenue: Divide each total by the quantity that produced it, so TShs 345,000 shared among 300 kilograms gives TShs 1,150. The answer repeats at every row, which is the schedule confirming that average revenue is simply the price.

Marginal revenue: Moving from 300 to 400 kilograms lifts total revenue from TShs 345,000 to TShs 460,000, an addition of TShs 115,000 for 100 kilograms, which is TShs 1,150 for each extra kilogram sold.

$$\text{MR} = \frac{\Delta \text{TR}}{\Delta \text{q}} = \frac{115{,}000}{100} = 1{,}150$$

Why she cannot ask more: Graded paddy is homogeneous, several hundred growers bring it to the same point, and buyers know what is being paid there. At TShs 1,250 a buyer walks twenty paces to the next grower, so her sales fall to zero rather than merely falling.

Why she should not ask less: She can already sell every kilogram she has at TShs 1,150, so a cut to TShs 1,100 buys her no customer she did not already have and gives away TShs 50 on every kilogram. The cut lowers revenue at every output.

What she should do instead: Cleaner grain earns nothing extra where the buyer pays by grade, so the return per kilogram is fixed for her. Her profit can rise only if she lowers her cost per kilogram or carries the crop to a buyer who pays separately for quality.

A price taker holds only two levers, her output and her costs, because the price column was never hers to write.

The Master Key: *In a graded market a cleaner sack fetches the same price, so a price taker raises profit by cutting cost and never by naming a price.*

REAL Question 49

A fisher landing perch at Kirumba is certain that the more he brings ashore, the less each kilogram will fetch. His boat has never once moved the price on the slab.

Explain the error in the reasoning below and state the conditions under which the fisher would be right.

> Nile perch is landed and sold at the Kirumba landing in Mwanza at a price called each morning.
>
> Many boats land the same species at the same site, and buyers treat one boat's fish as another's.
>
> This morning the price is TShs 4,500 a kilogram.
>
> The fisher argues that the market demand curve for perch slopes downwards, so landing more must lower the price he receives, and that his marginal revenue is therefore below TShs 4,500.
>
> He landed 60 kilograms yesterday and 80 kilograms today.

Model Answer

The error is to read the market demand curve as though it were the demand curve facing one boat. The market curve does slope downwards, but this boat is far too small for its own landing to shift market supply, so the price he faces holds at TShs 4,500 and his marginal revenue is TShs 4,500 and not less. His receipts rose from TShs 270,000 to TShs 360,000, which is a clean TShs 4,500 for every extra kilogram.

Two different curves are being confused: The market curve answers what all buyers at Kirumba will take at each price, and they take more only at a lower price. The curve facing one boat answers what a single negligible seller can sell at the ruling price, and the answer is as much as he lands.

The arithmetic settles it: Sixty kilograms at TShs 4,500 brings TShs 270,000 and eighty brings TShs 360,000. The extra twenty kilograms added TShs 90,000, so marginal revenue is TShs 4,500 a kilogram, exactly the price he was paid.

$$\text{MR} = \frac{\Delta \text{TR}}{\Delta \text{q}} = \frac{360{,}000 - 270{,}000}{80 - 60} = 4{,}500$$

Why the price did not move: Twenty extra kilograms from one boat is a negligible addition to the whole morning's landings, so the market supply curve barely stirs and the equilibrium price is unchanged. It takes a shift in supply by all the boats together to move the slab price.

Homogeneity closes the argument: Buyers treat one boat's perch as another's, so a fisher asking above TShs 4,500 sells nothing. Marginal revenue below price would require him to cut his price to shift the extra fish, and he never has to cut anything.

When he would be right: If his catch were a real fraction of the day's landings, or if the landing were small and isolated so that his own supply visibly moved the price, then his demand curve would slope downwards and marginal revenue would fall below price. That describes a price maker, not a price taker.

The market curve slopes downwards for everyone together and lies flat for each one alone, and the two statements describe the same market from different distances.

The Master Key: *A downward sloping market curve does not hand the small seller a downward sloping curve of his own.*

HOT Question 50

The horizontal demand curve is an assumption wearing the clothes of a fact. Ask a maize seller at Kibaigwa to shift forty lorry loads this morning and watch what he is offered.

To what extent is it true that a firm in perfect competition faces a perfectly elastic demand curve?

Model Answer

It is true as an approximation and false as a literal statement. Strictly, one seller's extra output does add to market supply and does push the ruling price down by some minute amount, so his own demand curve slopes downwards imperceptibly. The model rounds that slope to zero because the firm is negligible, and the rounding is safe only while the firm stays small beside the market and the product stays homogeneous.

The literal position: Every seller is part of market supply, so raising his output shifts the supply curve rightwards by that amount and lowers the price. The slope facing him is not zero; it is merely far too small to measure or to draw.

Why the rounding is safe: A firm supplying one part in a thousand may double its output and change market supply by a tenth of one per cent, so the price change is smaller than the smallest coin in which the good is traded. Treating it as zero costs nothing at all.

What the rounding buys: It makes $P = AR = MR$ exact, so profit maximisation becomes the rule that price equals marginal cost with marginal cost cutting the price line from below, and it makes the firm's marginal cost curve above minimum average variable cost its supply curve.

It fails when the firm grows: A firm that comes to hold a tenth of its market genuinely faces a downward sloping curve, and its marginal revenue then falls below price. This is why the flat curve is always paired with the assumption of very many sellers; neither survives without the other.

It fails across distance: A village with one maize seller and a bad road is effectively its own small market, and that seller faces a downward sloping curve although the national market is competitive. Transport cost cuts a single market into many, and the model assumed transport cost away.

It fails the moment buyers have preferences: As soon as a buyer favours one seller for cleanliness, for credit or for long acquaintance, that seller can hold a slightly higher price and keep some custom, so his curve tilts. A great deal of real trade runs on precisely such preferences.

Keep the flat line for the model, and keep beside it the list of what would have to be true for the line to be exactly flat.

The Master Key: *The price taker's demand curve is not flat, only so nearly flat that treating it as flat costs nothing and buys everything.*

HOT Question 51

At six in the evening the tomato price at Tandale falls, and every seller who held out for the morning price carries her stock home again.

Discuss why a price taker has no reason to lower price below the ruling price, and consider whether that holds in practice.

Model Answer

Within the model the argument is watertight. The firm can already sell every unit it wishes at the ruling price, so a cut wins it not one extra buyer and lowers the receipt on every unit it was going to sell anyway. In practice sellers cut all the time, and each real cut marks a point where an assumption has quietly failed: perishability, a limit on how fast stock can be moved, imperfect knowledge, or a product buyers can tell apart.

The argument inside the model: Demand facing the firm is perfectly elastic at the ruling price, so quantity sold is unlimited at that price and zero above it. Cutting the price lowers average revenue and marginal revenue together on every unit, so profit falls at every level of output.

The revenue arithmetic agrees: Since total revenue is price multiplied by quantity, a lower price yields less at the same quantity. The firm's output is limited by its rising marginal cost and not by any shortage of willing buyers, so attracting more buyers wins nothing.

Where it breaks first, perishability: The model assumes one price rules all day. Tomatoes at Tandale at six in the evening are not the same good as tomatoes at eight in the morning, and the seller cutting her price is clearing stock whose value is about to become nothing.

Where it breaks, the speed of selling: A real seller cannot serve unlimited buyers at once, so the flat curve overstates how fast stock actually moves. A small discount buys a quicker turn of capital, which is worth having whenever storage, spoilage or borrowed money is expensive.

Where it breaks, knowledge and custom: Buyers do not know every price, so a discount is a way of being found, and a customer who returns is worth more than the margin given up to win her. That relationship is itself a form of differentiation, so the market was never quite perfect.

The judgement: The rule is a strict consequence of the assumptions, so within them cutting is irrational, and outside them every observed cut identifies the assumption a particular market breaks. Used that way the rule is a diagnostic instrument rather than a prediction that keeps failing.

The evening tomato price is not a refutation of the theory but the theory pointing squarely at the assumption that gave way.

The Master Key: *A price taker who cuts his price is telling you which assumption of the model his market does not keep.*

Short-run Equilibrium: the Three Outcomes

The price taker cannot choose a price, so the only decision left to it is how much to produce. This section sets out the two conditions that settle that quantity, and then reads the three short-run outcomes straight off the position of the price line against average total cost: supernormal profit, normal profit and loss. Learn to name the rectangle and its corners, and each of the three answers itself.

BINDER Question 52

A maize seller at Kibaigwa can tell you the price of a bag without looking up. What he cannot tell you, and what decides his season, is which bag ought to be the last one he grows.

State and explain the two conditions that must hold before a firm in a perfectly competitive market is maximising profit.

Model Answer

Profit is at its maximum only where marginal cost equals marginal revenue and where the marginal cost curve cuts marginal revenue from below. The first condition finds a turning point; the second proves that the turning point is a peak and not a trough.

Marginal cost equal to marginal revenue: while the extra unit brings in more than it costs, profit is still rising and the firm should go on producing. It stops where the extra unit costs exactly what it earns, because beyond that point every further unit takes more out of the till than it puts in.

$$\pi = \mathrm{TR} - \mathrm{TC}, \quad \text{a turning point where } \mathrm{MC} = \mathrm{MR}$$

Marginal cost cutting from below: the marginal cost curve is U shaped, so it can meet a horizontal marginal revenue line twice. At the first meeting marginal cost is still falling and profit is at its worst; only where marginal cost is rising through marginal revenue is profit at its best.

The rule in the price taker's form: the firm sells every unit at the going price, so average revenue and marginal revenue are both equal to that price. The two conditions can therefore be written as price equal to marginal cost on the rising arm, which is the form every diagram in this section uses.

$$\mathrm{P} = \mathrm{AR} = \mathrm{MR} \implies \mathrm{P} = \mathrm{MC} \text{ on the rising arm}$$

What the conditions do not settle: neither condition says whether the firm makes money. They fix the output only. The position of the price line against average total cost at that output then fixes whether the outcome is supernormal profit, normal profit or a loss.

The two conditions choose the quantity, and average total cost then delivers the verdict.

The Master Key: *Equality of marginal cost and marginal revenue finds the output, but only marginal cost rising through marginal revenue makes it the profitable one.*

BINDER Question 53

A shopkeeper knows he has had a good month when the till is fuller than the ledger. The economist draws the same piece of news as a rectangle.

With the aid of a diagram, show how a firm in a perfectly competitive market earns supernormal profit in the short run, and identify the profit rectangle by its corners.

Model Answer

The firm earns supernormal profit when the price line lies above average total cost at the output where marginal cost equals marginal revenue and cuts it from below. In figure 6.6 that output is the quantity under point A, and the profit is the rectangle standing between the price line and the average total cost level.

Equilibrium at A: the horizontal line drawn at the going price is at once the firm's demand, average revenue and marginal revenue curve. Marginal cost rises through it at A, so both conditions hold and the output under A is chosen.

Price above average total cost: the vertical from A meets the average total cost curve at B, which lies below A, and the matching cost level on the vertical axis is C. Each unit sold therefore covers its full average cost and leaves the distance AB over.

Revenue and cost as areas: total revenue is the rectangle standing on the output with height equal to price, and total cost is the rectangle of the same width with height equal to average total cost. Taking the second from the first leaves the shaded rectangle CBAP.

$$\text{Supernormal profit} = (\mathrm{P} - \mathrm{ATC}) \times \mathrm{Q_e}$$

The diagram in money: at a price of TShs 13.20 the firm settles at about 16.6 units, where average total cost is roughly TShs 8.49. The surplus is TShs 4.71 a unit, so the shaded rectangle is worth about TShs 78.

Why the rectangle is temporary: nothing bars entry to this market, so a visible surplus draws new firms in, industry supply rises and the price line is pushed down towards average total cost until the rectangle closes.

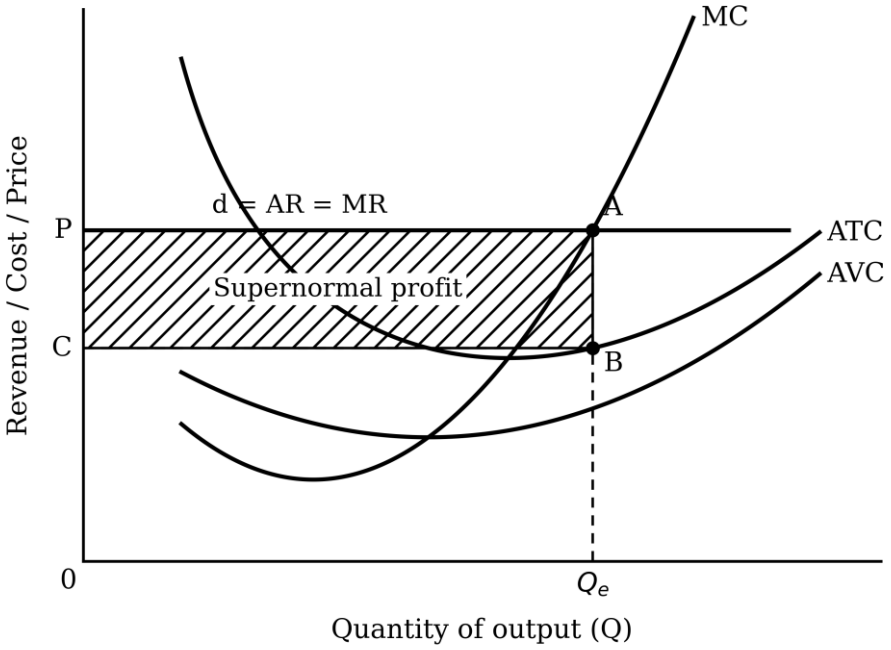


Figure 6.6: *Short-run supernormal profit under perfect competition*

Read the rectangle from its corners and the firm's whole short-run position is in front of you.

The Master Key: *Supernormal profit is a rectangle whose height is price less average total cost and whose width is the profit-maximising output.*

BINDER Question 54

A grower balances her books and finds that the season has left her exactly even. She calls it a wasted year, and she is wrong.

With the aid of a diagram, explain the position of a perfectly competitive firm earning only normal profit, and explain why such a firm is not earning nothing.

Model Answer

A firm earns normal profit when price equals average total cost at the profit-maximising output, so total revenue and total cost are the same and no rectangle is left over. In figure 6.7 the price line just touches the average total cost curve at its lowest point, and marginal cost passes through that same point from below.

The touch at the minimum: the price line at TShs 8.09 meets the bottom of the average total cost curve at 13.85 units. Marginal cost cuts marginal revenue and average total cost from below at that single point, so every condition is satisfied in one place.

No rectangle to shade: point A lies on the price line and on the cost curve at the same time, so the revenue rectangle and the cost rectangle are the identical area. The surplus above cost is therefore exactly zero.

Normal profit sits inside cost: the cost curve already carries a payment for the owner's own labour, land and capital, valued at what those resources would earn in their next best use. Covering average total cost therefore means that the owner has already been paid that amount in full.

Zero economic profit is not zero income: the firm earns precisely what it could earn elsewhere, so it has no reason to leave and no reason to expand. That is why this price is both the break-even price and the price at which a competitive trade finally settles.

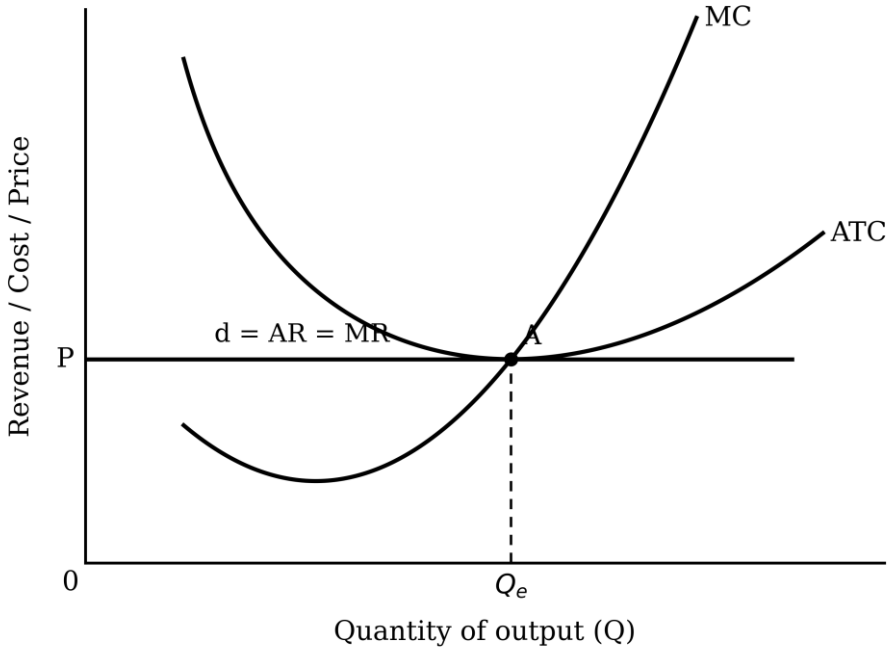


Figure 6.7: *Short-run normal profit under perfect competition*

Zero on the profit line and zero in the pocket are two very different statements.

The Master Key: *Normal profit is a cost that has already been paid, not an income that was never earned.*

BINDER Question 55

The price is the same for everyone in the trade, so when it falls it falls on all of them at once. What each firm still controls is how much of the fall it takes.

With the aid of a diagram, show a perfectly competitive firm making a short-run loss, and identify the loss rectangle by its corners.

Model Answer

A firm makes a loss when price lies below average total cost at the output where marginal cost equals marginal revenue and cuts it from below. In figure 6.8 the loss is the rectangle PABC, standing above the price line and reaching up to the average total cost level.

Loss minimising uses the same rule: the two conditions do not change when the news is bad. Marginal cost still rises through marginal revenue at A, and the output found there is the output at which the loss is smallest, not the output at which it is largest.

Cost above price at that output: the vertical from A meets the average total cost curve at B, which now lies above the price line, and C is the matching cost level on the vertical axis. Each unit sold fails to cover its average total cost by the distance AB.

The rectangle read off: revenue is the rectangle of height price, cost is the rectangle of height average total cost, and the shaded difference PABC is the loss.

$$\text{Loss} = (\text{ATC} - \text{P}) \times \text{Q}_\text{e}$$

The diagram in money: at a price of TShs 6.60 output settles near 12.8 units, where average total cost is about TShs 8.16. The shortfall is roughly TShs 1.56 a unit, so the shaded rectangle comes to about TShs 20.

Why the doors stay open: average variable cost at that output is only about TShs 5.03, so every unit sold still hands something towards the unavoidable fixed cost. Whether to produce at all is settled by average variable cost, never by the size of the loss rectangle.

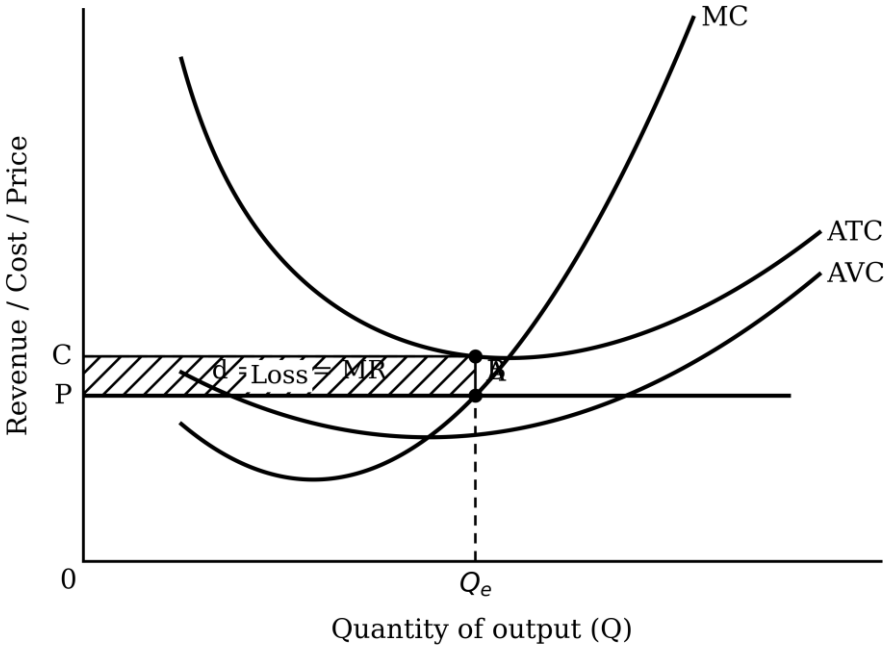


Figure 6.8: *Short-run loss under perfect competition*

A loss tells you how the season went; by itself it does not tell you to stop.

The Master Key: *A loss is minimised by the very same two conditions that maximise a profit.*

REAL Question 56

At Kibaigwa the price of a bag is chalked up before the first lorry arrives, and no grower can move it by a shilling. The only question left to her is how many bags to grow.

Calculate the profit-maximising output and the profit of the grower, and state which of the three short-run outcomes she is in.

Neema Mwakasege grows maize on four acres near Kibaigwa market in Dodoma.

The going price this season is TShs 32,000 a bag and she can sell every bag she brings.

Rent and the ploughing contract cost TShs 40,000 and are spent before a single bag is grown.

Her total cost rises with output as follows: one bag TShs 62,000; two bags TShs 78,000; three bags TShs 92,000; four bags TShs 110,000; five bags TShs 136,000; six bags TShs 170,000; seven bags TShs 214,000.

All figures are illustrative.

Model Answer

She maximises profit at five bags and earns TShs 24,000. The fifth bag costs TShs 26,000 to grow, which is the last marginal cost that the price of TShs 32,000 still covers, and marginal cost is rising there. Since price exceeds her average total cost of TShs 27,200 a bag, she is in the supernormal profit outcome.

The price is the marginal revenue: every bag sells at TShs 32,000 however many she brings, so average revenue and marginal revenue are both TShs 32,000. The profit-maximising rule can then be read as price equal to marginal cost on the rising arm.

Marginal cost decides the last bag: the fifth bag costs TShs 26,000 to grow and sells for TShs 32,000, so it adds TShs 6,000 to profit. The sixth would cost TShs 34,000 and take TShs 2,000 away again, which is exactly why she stops at five.

Both conditions checked: marginal cost falls to TShs 14,000 at the third bag and climbs steadily after it, so at five bags it is rising through marginal revenue and the turning point is a peak. The profit column agrees, rising to TShs 24,000 and falling away beyond it.

The outcome named: average total cost at five bags is TShs 136,000 divided by five, that is TShs 27,200. The price stands TShs 4,800 above it, and TShs 4,800 across five bags is the TShs 24,000 in the last column.

$$\text{Profit} = (32{,}000 - 27{,}200) \times 5 = 24{,}000$$

The rent plays no part in the choice: the TShs 40,000 spent before planting sits in every row of the schedule and so shifts every profit figure by the same amount. It cannot alter which output is best, and it is the reason the decision is taken on marginal cost alone.

What follows next season: entry into maize is free, so a visible surplus brings more growers to the same market, supply rises, the chalked price falls and the surplus is competed away until only normal profit is left.

Bags	Total cost (TShs)	Marginal cost (TShs)	Total revenue (TShs)	Profit (TShs)
0	40,000		0	−40,000
1	62,000	22,000	32,000	−30,000
2	78,000	16,000	64,000	−14,000
3	92,000	14,000	96,000	4,000
4	110,000	18,000	128,000	18,000
5	136,000	26,000	160,000	24,000
6	170,000	34,000	192,000	22,000
7	214,000	44,000	224,000	10,000

The grower's schedule at a market price of TShs 32,000 a bag.

Her decision is made one bag at a time, and the fifth bag is the last one worth growing.

The Master Key: *Grow every unit whose marginal cost the price still covers, and not one unit beyond it.*

REAL Question 57

A paddy grower at Kilombero closes her season, finds herself exactly even, and tells her neighbour that eight months have gone for nothing. Her own cost figures say otherwise.

Explain what it means to say that the grower earns only normal profit, and advise her on her claim that she has worked for nothing.

Amina Chagula grows paddy on twelve acres at Kilombero and sells at the going mill gate price.

That price is TShs 1,450 a kilogramme and she can sell every kilogramme she harvests.

At the output she has chosen, her average total cost is also TShs 1,450 a kilogramme.

That cost figure includes TShs 3,600,000 for the labour of the family and TShs 1,800,000 as the return the land and machinery could have earned in their next best use.

All figures are illustrative.

Model Answer

She is earning normal profit, which means total revenue exactly equals total cost, so there is no surplus above cost and no shortfall either. She has not worked for nothing, because the cost figure she has just covered already contains TShs 3,600,000 for the family's labour and TShs 1,800,000 for the use of her land and machinery.

Normal profit defined: it is the minimum return that keeps an owner in this line of business rather than in the next best one. Because it pays for resources the owner herself supplies, it belongs inside cost, exactly as a wage paid to a hired worker does.

Price equal to average total cost: she harvests the output at which marginal cost has risen to meet the price, and at TShs 1,450 the price line there lies neither above nor below average total cost, so the rectangle between them has no height at all. Economic profit is zero, while the money passing through her hands is very far from zero.

What she has actually received: TShs 5,400,000 in all, being the two allowances added together. Had she hired out her labour and rented out the land instead, she would have earned about the same sum, and that equality is the whole meaning of the word normal.

Why she should stay in paddy: the test for staying is not whether profit is positive but whether some other use of the same labour and land pays better. Nothing here pays better, so leaving would gain her nothing and cost her the crop she knows how to grow.

Where the mill gate price came from: free entry has pushed the price down to the lowest point of average total cost, which is the ordinary resting position of a competitive trade rather than a sign that something has gone wrong at Kilombero.

Advise her to read the whole cost column before she calls the season a waste.

The Master Key: *Zero economic profit means the owner has already been paid what her resources are worth elsewhere.*

REAL Question 58

The long rains empty Zanzibar of visitors and the room rate drops to whatever the guest house next door is charging. Every room let is now let at a loss, and the owner keeps letting them.

Calculate the nightly loss of the guest house and explain, with reference to the loss rectangle, why the owner is right to keep letting rooms.

Baraka Guest House stands on a lane behind Darajani market in Zanzibar.

In the long rains the going rate for a room of its class is TShs 45,000 a night and the owner cannot charge above it.

Twelve rooms are taken on a typical night at that rate.

Water, laundry, breakfast and casual help cost TShs 21,000 for each room let, and are spent only when the room is let.

Rent, licence, the watchman and the wear on the building come to TShs 372,000 a night, and are owed whether the rooms are let or not.

All figures are illustrative.

Model Answer

The guest house loses TShs 84,000 a night, since twelve rooms at TShs 45,000 bring in TShs 540,000 against a total cost of TShs 624,000. The owner is right to keep letting, because every room let contributes TShs 24,000 towards costs that must be met whether that room is occupied or empty.

The loss rectangle in numbers: average total cost is TShs 624,000 divided by twelve, that is TShs 52,000 a room. The rate of TShs 45,000 falls short by TShs 7,000, and TShs 7,000 across twelve rooms gives the loss of TShs 84,000.

$$\text{Loss} = (52{,}000 - 45{,}000) \times 12 = 84{,}000$$

The same rectangle on the diagram: its height is the gap between the price line and the average total cost level, and its width is the number of rooms let. It is the profit rectangle turned upside down, standing above the price line instead of below the cost level.

Twelve rooms is the loss minimising output: the owner still lets rooms up to the point where the cost of taking one more guest equals the rate charged, with that cost rising. Letting only six rooms would not remove the loss; it would surrender the contribution and make the loss larger.

Why closing would be worse: shutting the doors saves the TShs 252,000 of room costs but not a shilling of the TShs 372,000 of standing costs, so the loss would grow from TShs 84,000 to TShs 372,000 a night.

Raising the rate is not open to her: a dozen guest houses of the same class stand within a short walk, so a room offered at TShs 52,000 would simply stand empty while the others fill. A price taker cannot cure a loss by asking for more.

This is a short-run answer only: a rate below average total cost cannot be borne for ever. If the high season fails to restore it, the sensible course is to sell the building or turn it to another use, and that is a long-run decision.

The size of a loss decides nothing; what the price manages to cover decides everything.

The Master Key: *Go on producing while the price covers the cost that would stop when you stop.*

HOT Question 59

Two different outputs on the same diagram can satisfy the rule that marginal cost equals marginal revenue. At one of them the firm is doing as well as it possibly can, and at the other as badly.

Examine the claim that the equality of marginal cost and marginal revenue is on its own enough to locate the profit-maximising output.

Model Answer

The claim is only half right. The equality is necessary but not sufficient, because a U shaped marginal cost curve can cross a horizontal marginal revenue line twice, and at the first crossing profit is at its worst. Only where marginal cost is rising through marginal revenue does the equality mark a maximum.

What the equality actually tells you: it identifies an output at which one more unit would add nothing to profit, so profit has stopped changing. A quantity at which a total has stopped changing may sit at a peak or at the bottom of a trough, and the equality alone cannot say which.

The first crossing is the worst output: on the falling arm of marginal cost the next unit costs less than it earns, so producing more raises profit. A point that can be improved on by moving away from it is not a maximum of anything.

The second crossing is the best output: on the rising arm every unit before it added more than it cost and every unit after it costs more than it adds. Profit therefore climbs steadily to that output and falls away beyond it, which is what a peak means.

The test written out: profit is total revenue less total cost. Setting its rate of change against output at zero gives the first condition, and requiring that rate to be falling as output rises gives the second, which is marginal cost cutting marginal revenue from below.

$$\pi = \mathrm{TR} - \mathrm{TC}; \quad \frac{\mathrm{d}\pi}{\mathrm{dQ}} = 0 \Rightarrow \mathrm{MC} = \mathrm{MR}; \quad \frac{\mathrm{d}^2\pi}{\mathrm{dQ}^2} < 0$$

A worked check on the standard firm: at a price of TShs 6.60 marginal cost equals price twice, near 2.2 units on the falling arm and near 12.8 units on the rising arm. The first leaves a loss of about TShs 44, worse even than closing, and the second a loss of about TShs 20.

Where candidates throw marks away: a diagram that shows marginal cost meeting marginal revenue on the falling arm, or an answer that states the equality and stops there, has described a firm at its very worst. State both conditions and the mark is safe.

Necessary and sufficient are not the same thing, and here the difference is the whole answer.

The Master Key: *The equality finds the output, and the direction of the cut decides whether that output is the best or the worst.*

HOT Question 60

A trader who has just covered every cost to the last shilling is told by his brother to sell up and put the money in a fixed deposit. The advice sounds shrewd, and is usually wrong.

Discuss the advice that a firm earning only normal profit should close down and place its capital in a bank instead.

Model Answer

The advice is generally wrong, because the interest the bank would pay is already inside the cost that the firm has just covered. Normal profit is the return the owner's own labour and capital could earn

in the next best use, so a firm covering average total cost is already matching the bank, and closing would gain it nothing.

Economic cost includes the owner's alternatives: the cost curves of the firm are drawn to include the wage the owner could have earned in employment and the interest the capital could have earned on deposit. Once those are inside cost, covering cost means that both have been paid.

Accounting profit against economic profit: the books of the business would show a healthy surplus, because they subtract only the money actually paid out. Economic profit subtracts the sacrificed alternatives as well, and it is that stricter figure which stands at zero.

Only a better alternative justifies leaving: the correct test is whether some other use of the same labour and capital pays more than this one does. If the deposit rate has risen above the return already built into the cost curves, then and only then does the brother's advice bite.

The comparison is not risk free either: a deposit is safe while a maize store or a workshop is not, so the return needed to keep an owner in business must also pay for bearing that risk. Payment for risk is part of normal profit, which is why the two returns are not compared shilling for shilling.

Normal profit is where competition ends up: free entry drives price down to the lowest point of average total cost, so every firm in a settled competitive trade earns exactly this and no more. If that were a reason to close, no competitive trade could survive its own long run.

When the advice is sound: if the firm cannot even cover average variable cost, or if the owner's skills genuinely fetch more elsewhere, then selling up is correct. The case is then made by the numbers on the alternative, never by the zero on the profit line.

Advise the brother that the interest he is pointing at has already been counted once.

The Master Key: *A firm at normal profit is not working for nothing; it is being paid exactly what its resources are worth elsewhere.*

Break-even, Shut-down and the Supply Curve

Price does more than decide how much profit a firm makes. Below a certain level it decides whether the firm produces at all. This section fixes the two prices that govern that choice, the break-even price at the bottom of average total cost and the shut-down price at the bottom of average variable cost, works the comparison in money, and then builds the firm's supply curve, and the whole industry's, out of what is left of the cost diagram.

BINDER Question 61

Two prices sit on the same diagram and look very much alike, which is why they are confused more often than any other pair in the subject. One of them costs a firm its profit, the other costs it its doors.

Distinguish between the break-even point and the shut-down point of a firm operating under perfect competition.

Model Answer

The break-even point lies at the lowest point of average total cost, at a price of TShs 8.09 and an output of 13.85 units, while the shut-down point lies at the lowest point of average variable cost, at a price of TShs 4.94 and an output of 11.25 units. The first is where profit disappears; the second is where production disappears.

Break-even, the price that leaves normal profit: at the higher price total revenue exactly equals total cost, so every cost is met, including the return the owner's own resources could have earned elsewhere. A shilling less and the firm is losing, a shilling more and a surplus rectangle opens.

Shut-down, the price that leaves nothing for fixed cost: at the lower price revenue covers the variable cost and not one shilling beyond it, so the loss is exactly the fixed cost, which is the same loss the firm would carry with its machines standing idle. Below that price, producing makes the loss larger.

Why break-even is the higher of the two: average total cost is average variable cost plus average fixed cost, so it lies above average variable cost at every output. Its lowest point therefore sits higher up and further to the right, and marginal cost passes through both minima.

How figure 6.9 shows the pair: marginal cost cuts average variable cost at its lowest point, and a price line drawn through that point marks the shut-down output. Marginal cost cuts average total cost at its lowest point further to the right, and the price line through it marks the break-even output.

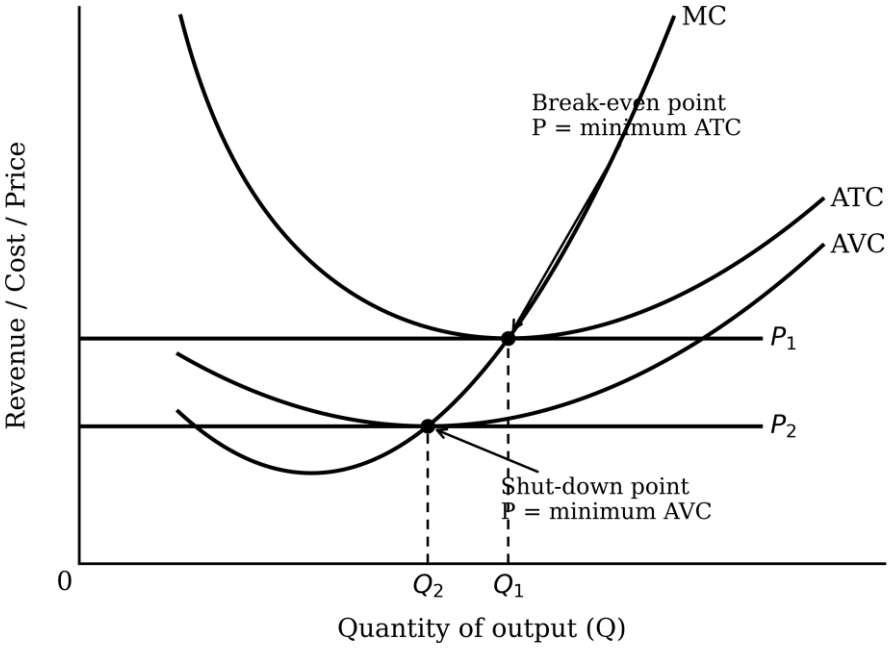


Figure 6.9: *The break-even point and the shut-down point*

Between the two prices the firm is losing money and is still worth running.

The Master Key: *Above the break-even price you profit, below the shut-down price you close, and in between you produce at a loss because the fixed cost is owed either way.*

BINDER Question 62

A falling price puts the same question to every firm in the trade at the same moment, and there are only three possible answers to it.

State the rule that tells a firm whether to produce in the short run, and explain what it should do in each of the three ranges of price.

Model Answer

Produce whenever price is at least equal to average variable cost, and shut down at once when it is not. Above average total cost the firm earns a surplus; between average variable cost and average total cost it produces at a loss, because that loss is smaller than the fixed cost; below average variable cost it stops.

Price above average total cost: every cost is covered and a surplus is left over, so the firm produces the output at which marginal cost equals price and is rising through it. This is the supernormal outcome, and in a market with free entry it also invites company.

Price between the two averages: revenue covers all of the variable cost and part of the fixed cost, so the loss is smaller than the fixed cost that closing would leave. The firm produces through the short run and leaves the trade in the long run if nothing improves.

Price below average variable cost: each unit produced now adds more to cost than it adds to revenue, so producing pushes the loss past the fixed cost. The firm stops at once and carries the fixed cost alone, which is the smaller of the two losses on offer.

Why fixed cost is absent from the test: the fixed cost is owed whether the gate is open or shut, so it appears on both sides of the comparison and cannot decide it. What the firm avoids by stopping is the variable cost, and that is the cost price must be measured against.

Compare price with average variable cost first, and only afterwards ask how large the loss is.

The Master Key: *The shut-down test measures price against avoidable cost, never against total cost.*

BINDER Question 63

A workshop owner with TShs 1,000 of standing costs is offered TShs 550 for work that costs TShs 555 to do. The arithmetic of that single offer contains the whole shut-down rule.

Show, for a firm whose fixed cost is TShs 1,000 and whose minimum average variable cost is TShs 555, why it shuts down at a price of TShs 550 but produces at a price of TShs 600.

Model Answer

At TShs 550 the firm shuts down and at TShs 600 it produces. The fixed cost of TShs 1,000 is owed in either case, so it cannot settle the matter: what settles it is that the first price adds TShs 5 a unit to that loss, while the second takes TShs 45 a unit off it.

The price of TShs 550: it lies below the lowest average variable cost of TShs 555, so the firm cannot even cover what it spends on materials and wages. Producing a single unit costs TShs 5 more than that unit earns, and the total loss becomes TShs 1,005.

Shutting down instead: with nothing produced there is no variable cost at all, so the whole loss is the unavoidable TShs 1,000. That is TShs 5 better than producing one unit, and every further unit produced would widen the gap between the two.

The price of TShs 600: it stands TShs 45 above the lowest average variable cost, so a unit produced covers its own variable cost and hands TShs 45 towards the fixed cost. The loss falls to TShs 955, which is TShs 45 better than closing the workshop.

The rule the example proves: the decision never turns on whether the firm is making a loss, since it makes one at both prices. It turns on whether price clears average variable cost, and TShs 555 is precisely the price at which the owner is indifferent between the two courses.

Price (TShs)	Minimum AVC (TShs)	Contribution a unit (TShs)	Loss if one unit is produced (TShs)	Loss if the firm shuts (TShs)	Decision
550	555	−5	1,005	1,000	Shut down
555	555	0	1,000	1,000	Indifferent
600	555	45	955	1,000	Produce

The shut-down comparison at three prices, with a fixed cost of TShs 1,000.

The firm at TShs 600 is losing money and is still doing the best that can be done.

The Master Key: *Below minimum average variable cost every unit produced makes the loss bigger, so the machines should stop.*

BINDER Question 64

Ask a grower how much he will bring to market and he will ask you the price first. His answer at every price, drawn out, is a curve that is already sitting on his cost diagram.

With the aid of a diagram, explain why the short-run supply curve of a firm in perfect competition is its marginal cost curve above the minimum of average variable cost.

Model Answer

A supply curve answers the question of how much the firm offers at each price, and the firm answers it by setting marginal cost equal to price on the rising arm. Marginal cost is therefore the supply

curve, but only above TShs 4.94, the lowest average variable cost, since below that price the firm offers nothing at all.

Each price picks a point on marginal cost: raise the price line and the equilibrium slides up the rising arm to a larger output; lower it and output falls back down the same arm. Collecting those pairs of price and quantity is exactly how a supply curve is constructed.

Only the rising arm can qualify: the second condition of profit maximisation requires marginal cost to cut marginal revenue from below, so no point on the falling arm is ever an equilibrium. The same fact explains why supply slopes upwards, since diminishing returns make each extra unit dearer than the last.

The curve stops at TShs 4.94: at any price under the lowest average variable cost the firm shuts down, so quantity supplied drops to zero rather than sliding gradually. Supply is the thickened stretch of marginal cost in figure 6.10, running upwards from the shut-down point, and nothing whatever below it.

What the supply curve leaves out: fixed cost appears nowhere in the decision, because it does not change with output and so never enters marginal cost. Two firms with the same marginal cost curve offer the same quantity at a given price however unequal their rents.

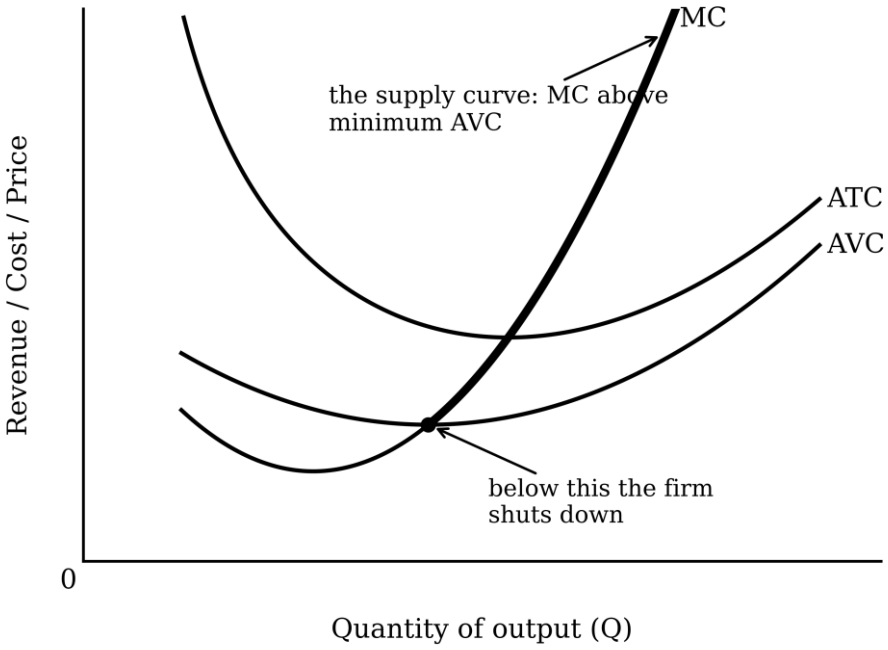


Figure 6.10: *The short-run supply curve of the competitive firm*

Supply is what remains of the cost diagram once the shut-down price has cut the bottom off it.

The Master Key: *The firm's short-run supply curve is its marginal cost curve above minimum average variable cost, and nothing below it.*

BINDER Question 65

One grower's answer to a price is a few crates. The market's answer is a lorry park full of them, and it is assembled one grower at a time.

Using the schedule of the three firms, derive the industry supply schedule and explain how an industry supply curve is obtained from the supply curves of individual firms.

Three growers supply crates of tomatoes to the same market and each of them takes the price as given.
At TShs 400 a crate the offers are 20 crates from Firm A, none from Firm B and none from Firm C.
At TShs 500 a crate the offers are 30, 10 and none.
At TShs 600 a crate the offers are 38, 22 and 12.
At TShs 700 a crate the offers are 45, 32 and 22.
At TShs 800 a crate the offers are 51, 40 and 30.

Model Answer

The industry supply curve is the horizontal summation of the firms' supply curves, which means adding the quantities offered at each price rather than adding the prices themselves. At TShs 600 the three firms offer 38, 22 and 12 crates, so the industry offers 72, and the completed industry column reads 20, 40, 72, 99 and 121.

Add quantities, never prices: one price rules the whole of a perfectly competitive market, so it is the quantities that differ between firms and the quantities that are summed. Working straight across a row of the schedule yields one point on the industry curve.

Each firm enters at its own shut-down price: Firm B offers nothing until TShs 500 and Firm C nothing until TShs 600, because below those prices neither can cover its average variable cost. The industry curve therefore bends outwards at every price where another firm joins in.

Why the industry curve is the flatter: at each price it carries the output of every firm at once, so a given rise in price brings out a far larger rise in quantity than it does from any single grower. Industry supply is the more elastic of the two curves.

What figure 6.11 shows: the two left hand panels each draw one firm's marginal cost above its minimum average variable cost, and the right hand panel repeats that shape on a much wider quantity scale, because at every price the industry quantity is the sum of the firms' quantities.

Price (TShs a crate)	Firm A	Firm B	Firm C	Industry supply
400	20	0	0	20
500	30	10	0	40
600	38	22	12	72
700	45	32	22	99
800	51	40	30	121

Industry supply as the horizontal sum of three firms' supply schedules.

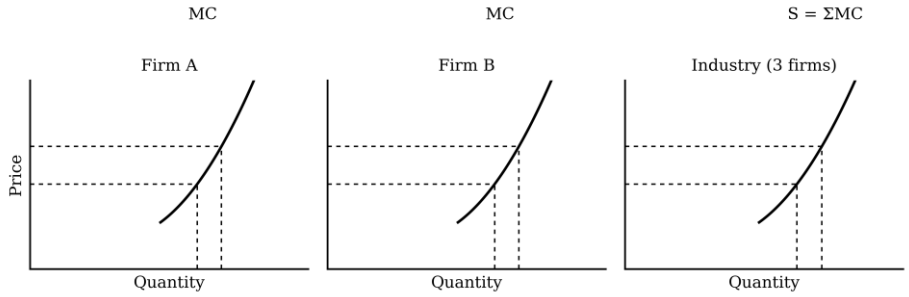


Figure 6.11: *Industry supply as the horizontal sum of the firms' marginal cost curves*

The market curve is nothing more than the firms' own curves laid side by side.

The Master Key: *Sum the firms sideways at a common price and the industry supply curve appears.*

REAL Question 66

The rains thin the passengers on the Mbeya road and the fare settles at whatever the other coaches are charging. The owner works out that every trip loses money, and wonders whether to park the coach until the season turns.

Advise the owner whether to keep the coach on the road, showing the loss under each course of action.

Salama Coach runs one daily trip from Mbeya to Dar es Salaam.

In the low season the fare settles at TShs 45,000 and the owner has no power to raise it.

Forty seats are sold on a typical trip.

Fuel, the crew, tolls and running repairs come to TShs 1,320,000 a trip, and are spent only if the coach travels.

Licence, insurance, the loan on the vehicle and the yard come to TShs 700,000 a day, and are owed whether it travels or not.

Model Answer

Advise the owner to keep the coach running. Each trip earns TShs 1,800,000 against running costs of TShs 1,320,000, so it hands TShs 480,000 towards standing costs of TShs 700,000 and leaves a loss of TShs 220,000. Parking the coach saves the running costs but none of the standing costs, so the loss would then be the whole TShs 700,000.

Price against average variable cost: the running costs come to TShs 33,000 a seat, which the fare of TShs 45,000 clears comfortably. The first test is passed, so the journey is worth making even in a poor season.

Price against average total cost: all costs together are TShs 2,020,000 a trip, which is TShs 50,500 a seat, so the fare falls TShs 5,500 short of it. Forty seats at TShs 5,500 gives precisely the loss of TShs 220,000.

$$\text{ATC} = \frac{1{,}320{,}000 + 700{,}000}{40} = 50{,}500$$

The comparison that decides it: running the coach loses TShs 220,000 and parking it loses TShs 700,000, so travelling is TShs 480,000 the better course. That figure is exactly the contribution the trip makes, which is no coincidence at all.

Where the operator sits on the diagram: the fare lies between the lowest average variable cost and the lowest average total cost, which is the middle range of the rule. The coach runs at a loss, and that loss is the smallest one available to the owner this season.

Changing the fare is not an option: the coach is one of many on the same road, so a fare above TShs 45,000 would leave the seats empty, and a fare below it would only surrender revenue on seats that already fill. The fare is given, and the decision left is whether to travel.

The advice for the long run: if the fare stays at this level once the season has turned, the licence and the loan can both be escaped by selling the vehicle, and the capital is better placed elsewhere. Short-run patience is not the same thing as long-run commitment.

Keep the wheels turning this season, and review the route when the loan next falls due.

The Master Key: *Park the vehicle only when the fare stops covering the cost of the journey itself.*

REAL Question 67

The cotton is standing ready at Kishapu and the buying price has come in below the cost of picking it. Leaving a crop in the field feels like madness, and is the cheaper of two bad courses.

Advise the grower whether to harvest the crop, and calculate the loss under each course of action.

Mbaraka Sengo has ten acres of seed cotton at Kishapu in Shinyanga, with about four thousand kilogrammes standing in the field.

The price at the buying post has settled at TShs 900 a kilogramme and no grower can obtain more.

Picking, bagging and carting to the post cost TShs 1,050 a kilogramme, and are spent only if the crop is harvested.

Land preparation, seed and spraying have already cost TShs 1,400,000 and cannot be recovered.

All figures are illustrative.

Model Answer

Advise him to leave the crop unpicked. At TShs 900 the price is below the average variable cost of TShs 1,050, so every kilogramme he brings to the post loses TShs 150 before anything at all is set against the TShs 1,400,000 already spent. Harvesting would turn a loss of TShs 1,400,000 into a loss of TShs 2,000,000.

The shut-down test applied: a price of TShs 900 against an avoidable cost of TShs 1,050 fails the only test that matters in the short run. Every kilogramme carried to the buying post enlarges the loss instead of reducing it.

The arithmetic of harvesting: four thousand kilogrammes would bring in TShs 3,600,000 and cost TShs 4,200,000 to pick and cart, a shortfall of TShs 600,000 which is then added to the TShs 1,400,000 that has already gone.

$$\text{Loss if harvested} = 1{,}400{,}000 + (1{,}050 - 900) \times 4{,}000 = 2{,}000{,}000$$

The arithmetic of stopping: leaving the cotton standing costs nothing further, so the loss is the TShs 1,400,000 spent before the price was known. That money is gone under either course, which is why it cannot influence the choice between them.

Why the money already spent tempts him: a grower who has put TShs 1,400,000 into a field feels he must harvest in order to recover something. What he would recover is TShs 3,600,000 of revenue at a cost of TShs 4,200,000, and no sum already spent can make that exchange worth making.

How a better price would change the answer: at TShs 1,200 a kilogramme the crop would bring in TShs 4,800,000 against picking costs of TShs 4,200,000, contributing TShs 600,000 and cutting the loss to TShs 800,000. He would pick at once, still at a loss, because the loss would then be the smaller one.

What he should do instead: the labour, the sacks and the transport can be turned to a crop whose price still covers the cost of gathering it, and next season the acreage should be settled with one eye on the price the buying post is likely to announce.

A crop that costs more to gather than it fetches is worth more left standing in the field.

The Master Key: *Money already spent belongs to the past, and only avoidable cost belongs in the decision.*

REAL Question 68

The ice plant beside the Mwanza landing site sells to fish traders who will not pay a shilling above the going rate. Its owner wants the two prices that govern him, the one that leaves him whole and the one that closes him down.

Calculate the average variable cost and the average total cost at each output, and hence state the break-even price and the shut-down price of the plant.

Tumaini Ice supplies blocks of ice to fish traders at the Kirumba landing site in Mwanza.

Costs that stand whether the plant runs or not come to TShs 300,000 a day.

Variable cost rises with output as follows: 100 blocks TShs 200,000; 200 blocks TShs 340,000; 300 blocks TShs 480,000; 400 blocks TShs 680,000; 500 blocks TShs 1,000,000.

The plant sells at the going rate and cannot set a price of its own.

All figures are illustrative.

Model Answer

The break-even price is TShs 2,450 a block and the shut-down price is TShs 1,600 a block. The first is the lowest figure in the average total cost column, reached at 400 blocks a day, and the second is the lowest figure in the average variable cost column, reached at 300 blocks a day.

How the columns are built: total cost is the standing TShs 300,000 added to the variable cost of that output, and each average is a total divided by the number of blocks. At 400 blocks, TShs 980,000 divided by 400 gives an average total cost of TShs 2,450.

$$\text{ATC} = \frac{300{,}000 + 680{,}000}{400} = 2{,}450$$

The break-even price: at TShs 2,450 a block, revenue of TShs 980,000 exactly meets total cost, so the owner covers every outlay together with the return his capital could have earned elsewhere. Below that price he is losing, and above it a surplus opens.

The shut-down price: at TShs 1,600 a block, revenue of TShs 480,000 meets the variable cost exactly and leaves nothing for the standing TShs 300,000, so his loss is the same as it would be with the compressors switched off.

The range that lies between them: at TShs 2,100 a block his best output is 400, the last hundred blocks whose rising marginal cost of TShs 2,000 the price still covers. He is TShs 350 a block short and loses TShs 140,000, while switching off would lose the whole TShs 300,000, so the plant keeps running.

Why the two averages turn at different outputs: average variable cost bottoms out first and rises as the compressors are pushed beyond their comfortable load. Average total cost keeps falling for a while longer, because the standing TShs 300,000 is still being spread over more and more blocks.

Blocks a day	Variable cost (TShs)	Total cost (TShs)	Average variable cost (TShs)	Average total cost (TShs)
100	200,000	500,000	2,000	5,000
200	340,000	640,000	1,700	3,200
300	480,000	780,000	1,600	2,600
400	680,000	980,000	1,700	2,450
500	1,000,000	1,300,000	2,000	2,600

The daily cost schedule of the ice plant, with standing costs of TShs 300,000.

Two prices, one drawn from each average, and between them lies every hard decision he will face.

The Master Key: *The bottom of average total cost tells you when profit ends and the bottom of average variable cost tells you when production ends.*

HOT Question 69

A loss reads like a verdict, and the first instinct is to obey it at once. The firms that obey it too quickly are often the ones that never open again.

Discuss the view that a firm making a loss in the short run should close down at once.

Model Answer

The view is too quick. In the short run the fixed cost is owed whether the firm produces or not, so the choice is not between a loss and no loss but between two losses, and producing is the smaller of the two whenever price covers average variable cost.

The comparison the view leaves out: closing cancels neither rent nor licences nor the loan on the machinery. It cancels only the variable cost, so a firm that shuts still carries the whole of its fixed cost while earning nothing whatever against it.

Contribution is what keeps the doors open: every unit sold above average variable cost hands the difference over to the fixed cost. While that difference remains positive each unit sold makes the loss smaller, and stopping production would simply give the difference up.

When the view is right: if price has fallen below average variable cost then every unit widens the loss, and staying open would cost the firm more than the fixed cost it is trying to defend. Closing at once is then exactly correct, and the rule agrees with the view in that one case only.

The short run against the long run: in the long run there is no fixed cost, since leases end and machines can be sold, so a firm that cannot cover average total cost ought to leave the trade altogether. Shutting down and leaving are different decisions answering to different tests.

The cost of stopping and starting again: skilled staff scatter, customers form other habits and a restart carries a bill of its own, so a firm that expects the price to recover has a further reason to hold on through one bad season.

The danger at the other extreme: a firm may also stay far too long, telling itself that trade will improve while the losses accumulate and the capital wastes away. The honest test is a repeated comparison with what those resources would earn in their next best use.

The right question is never whether there is a loss, but which of the two losses is smaller.

The Master Key: *In the short run a firm chooses between two losses, and the fixed cost sits inside both of them.*

HOT Question 70

The industry curve is drawn by adding the firms sideways, and for a single season that is exactly what it is. Stretch the season a little and the addition quietly stops working.

Examine the claim that the supply curve of a perfectly competitive industry is simply the horizontal sum of the marginal cost curves of its firms.

Model Answer

The claim holds for the short run subject to three qualifications, and fails outright in the long run. Only the stretch of each marginal cost curve above minimum average variable cost belongs in the sum, the number of firms must be treated as fixed, and factor prices must not move as the industry expands.

The part of marginal cost that counts: below its own shut-down price a firm supplies nothing, so the falling arm and the stretch beneath minimum average variable cost are excluded. What is summed is supply curves, and marginal cost only becomes a supply curve above that point.

The kinks the summation creates: firms differ in their costs, so they enter the sum at different prices. The industry curve bends outwards each time a higher cost firm becomes willing to produce, and it is smooth only in the special case where every firm is alike.

Factor prices may refuse to stay put: if every firm expands at once, the demand for pickers, transport and inputs rises with it, costs climb and each firm's marginal cost curve shifts upwards. The industry then offers less at each price than the simple addition had promised.

The number of firms is held fixed: the summation counts only the firms already trading today, which makes it a short-run construction, valid while entry and exit are ruled out and no longer.

Why the long run breaks the claim: supernormal profit attracts entry and losses drive exit, so the number of curves being added is itself decided by price. Long-run supply is governed by that entry and exit, and can be perfectly flat, or even fall, in a decreasing cost industry.

What survives the examination: as a short-run device the summation is sound and genuinely useful, since it explains why the market curve slopes upwards, why it is far more elastic than any one firm's curve, and why a price rise draws more output from every producer at once.

Add the curves sideways for a season, and reason about entry for anything longer than that.

The Master Key: *The horizontal sum is a short-run truth, correct above the shut-down price and only while the roll of firms stays closed.*

Long-run Equilibrium under Perfect Competition

A firm in the short run is trapped inside its own factory gate. In the long run the gate opens both ways, and every shilling of supernormal profit becomes an advertisement, read by outsiders who are free to answer it. This section follows that advertisement through the industry until nothing is left of it but normal profit, fixes the resting place at price equal to marginal cost equal to the minimum of long-run average cost, and then asks what the short run could not: when a whole industry expands, what happens to the costs of the firms inside it.

BINDER Question 71

In the short run a maize seller can hire another sorter by Friday. In the long run she can build a new store, or sell the old one and walk away, and so can everybody watching her.

Define the long run as it applies to a firm under perfect competition and state the conditions that must hold when such a firm is in long-run equilibrium.

Model Answer

The long run is the period long enough for every factor to be varied and, decisively, for firms to enter or leave the industry, so a firm under perfect competition is in long-run equilibrium only where price equals long-run marginal cost and equals the minimum of long-run average cost, with LMC cutting LMR from below and nothing but normal profit earned.

The long run defined: every input is variable, so there is no fixed cost and no fixed plant. The firm may change its scale, and outsiders may build a plant of their own. Nothing in the industry is locked, which is why the long run is marked by freedom of movement rather than by a number of months.

Profit maximisation still binds: the firm still produces where long-run marginal cost equals long-run marginal revenue, and where LMC cuts LMR from below. Both conditions hold in every run: the first finds the turning point, the second makes that turning point a maximum instead of a minimum.

Entry and exit add a second condition: short-run equilibrium needs only $\mathrm{MC} = \mathrm{MR}$. The long run demands more, because supernormal profit invites entry and loss forces exit. Rest comes only when neither pull is acting, and that is where price sits at the minimum of long-run average cost.

The two conditions meet at one point: for a price taker AR is horizontal, and a horizontal line can touch a U-shaped LAC only at its lowest point. So the whole position collapses into a single equality. For the standard firm of this chapter that price is TShs 8.09 and that output is 13.85 units.

$$\mathrm{P} = \mathrm{LAR} = \mathrm{LMR} = \mathrm{LMC} = \mathrm{LAC}_{\mathrm{min}}$$

A firm resting there is not trapped; it is being paid exactly what it takes to keep it in this trade and no more.

The Master Key: *The long run is not a length of time but a state in which the door stands open, and the open door is what drives price down to the floor of LAC.*

BINDER Question 72

A trader at Kibaigwa makes a fat margin on maize in January. By June there are eleven more traders under the same roof and the margin has gone. Nobody took it from him.

With the aid of a diagram, explain how the entry of new firms removes supernormal profit from a perfectly competitive industry.

Model Answer

Supernormal profit is removed by entry rather than by any decision of the firms already inside: profit attracts newcomers, the industry supply curve shifts to the right, the market price falls, and each firm's horizontal AR line drops with it until the line rests on the minimum of average total cost, where only normal profit survives.

The starting position: the left panel of figure 6.12 shows industry demand crossing supply S_1 at a high price. The right panel shows one firm accepting that price P_1 as a horizontal AR equals MR line lying above ATC, so every firm in the industry is earning supernormal profit.

The signal travels: knowledge is perfect and entry is free, so outsiders see the margin and meet no barrier when they move towards it. Each newcomer builds a plant and adds its own marginal cost curve to the industry total.

Supply shifts and price falls: the extra firms shift industry supply from S_1 to S_2. Against an unchanged demand curve a larger supply must sell at a lower price, and note that this fall is a movement of the whole market, not a choice made by any one firm.

The chain stops itself: as the price falls the horizontal line in the right panel drops and the profit rectangle thins. Entry continues while any supernormal profit remains, so it can only halt at P_2, where the price line just touches the floor of ATC at TShs 8.09 and an output of 13.85 units.

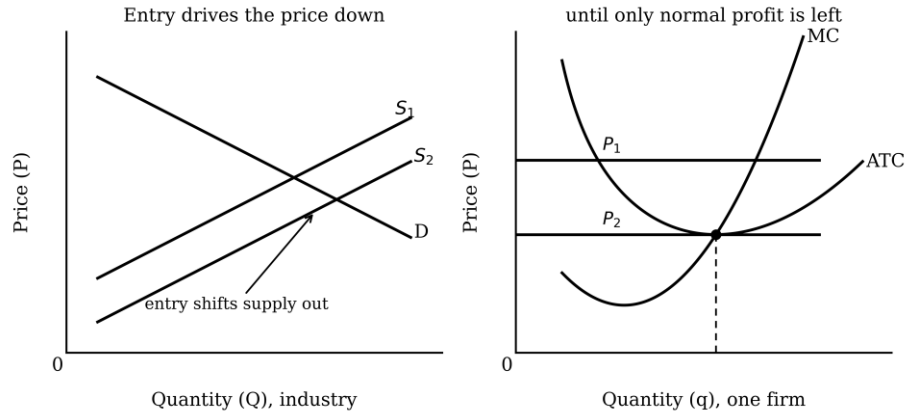


Figure 6.12: *Entry drives the competitive industry to long-run equilibrium*

The mechanism has no manager and needs none: it is simply what an open door does to a price.

The Master Key: *Profit under perfect competition is not a reward you keep but a message you broadcast to your future competitors.*

BINDER Question 73

Told that his workshop will earn zero economic profit for ever, a Morogoro carpenter asks why he should bother to open. The answer is hiding inside the word cost.

Explain how exit restores normal profit to a loss-making perfectly competitive industry, and explain why zero economic profit does not mean that the owners earn nothing.

Model Answer

Exit is entry running backwards: losses drive firms out, industry supply contracts, price rises and the loss is squeezed away until the survivors again earn normal profit at the minimum of LAC. That outcome is not destitution, because normal profit is already counted inside cost as the least return that will keep an owner in this trade.

A long-run loss cannot be carried: when price lies below average total cost the firm fails to cover the whole of its cost. In the short run it may still produce, since a price above AVC bleeds less than shutting down. In the long run every contract expires and nothing compels the owner to sign again.

The chain in order: firms leave, so the industry supply curve shifts to the left, so along an unchanged demand curve the price rises, so the horizontal AR lines of the survivors rise, so their losses shrink. Exit continues while any loss remains and therefore stops at the minimum of LAC.

Normal profit defined: normal profit is the return just sufficient to hold the entrepreneur in this industry rather than in the next best one open to him. It is an opportunity cost, so an accountant's books never show it, yet the economist's cost curve already contains it in full.

What zero really means: zero economic profit therefore says the owner is doing exactly as well here as anywhere else, not that the till is empty. The carpenter draws a full living from the workshop. What he does not draw is a surplus above the living that some other trade would have paid him.

That is why nobody walks out of an industry in long-run equilibrium and nobody hurries in.

The Master Key: *Zero economic profit is the entrepreneur's wage already paid, not a wage withheld.*

BINDER Question 74

The first thousand hectares of any valley are flat, watered and beside the road. The ten thousandth hectare is none of these, and what grows on it costs more to grow.

Distinguish between constant cost, increasing cost and decreasing cost industries, and show what each implies for the shape of the long-run supply curve.

Model Answer

A constant cost industry is one whose expansion leaves input prices and therefore minimum LAC untouched, so its long-run supply curve is horizontal; an increasing cost industry bids input prices up and raises minimum LAC, so its long-run supply curve slopes upward; a decreasing cost industry enjoys external economies that lower minimum LAC, so its long-run supply curve slopes downward.

The long-run supply curve defined: it joins the pairs of price and industry output at which entry and exit have finished their work and every surviving firm earns normal profit alone. Shift demand, let the adjustment run to its end, read off the new resting price, and the points you collect trace the curves of figure 6.13.

Constant cost: the industry buys too small a share of its inputs to move their prices, so an entrant's cost curves are identical to an incumbent's. Price returns to the same minimum LAC and only the number of firms has altered. The left panel is a horizontal line.

Increasing cost: expansion competes for a limited input, so rents or wages rise and every firm's LAC curve shifts upward. The new resting price stands above the old one and the middle panel slopes up. This is the ordinary case in farming, where the good land runs out first.

Decreasing cost: growth brings external economies such as better roads, specialised suppliers and a pool of trained labour, so LAC curves shift downward and the new resting price lies below the old. The right panel slopes down, and of the three cases this is the rarest.

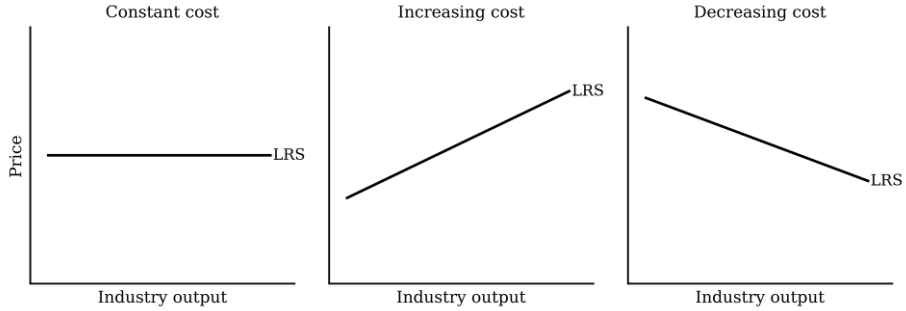


Figure 6.13: *Long-run supply in constant, increasing and decreasing cost industries*

In every case the individual firm still ends at the floor of its own LAC; what moves between the cases is where that floor sits.

The Master Key: *The long-run supply curve records not what one firm will offer but what an industry can offer once the cost of being crowded has been counted.*

REAL Question 75

Two seasons ago there were forty traders on the Kibaigwa maize floor and a comfortable margin. Today there are eighty and the margin is a rumour. Nothing changed except the number of doors.

Using the information in the box, trace the long-run adjustment in this trade and state the price and output at which it must come to rest.

Zawadi Grain buys, dries and resells maize at the Kibaigwa market in Dodoma, one of about forty near-identical traders.

Maize on that floor is graded, so a bag from one trader is the same as a bag from any other, and the day's price is called openly along the row.

Entry is free: a store, a tarpaulin and a weighing scale are all a newcomer needs.

Zawadi Grain's costs are those of the standard firm used throughout this chapter: average total cost is least at TShs 8.09 a unit, reached at an output of 13.85 units.

Last season the floor price stood at TShs 13.20 a unit, and forty new traders have opened since.

Model Answer

Zawadi Grain is a price taker in a trade that meets the conditions of perfect competition, so its season of supernormal profit at TShs 13.20 cannot last: entry will shift the industry supply curve to the right, pull the called price down, and bring the whole trade to rest at TShs 8.09 a unit, with each trader handling 13.85 units and earning normal profit only.

The trade meets the model: many sellers, a graded and therefore homogeneous product, an openly called price and free entry. Zawadi Grain can shift no price of its own, so its demand curve is horizontal at whatever the floor calls and $P = AR = MR$ throughout.

Season one, supernormal profit: at TShs 13.20 the price line lies well above the least average total cost of TShs 8.09. The firm handles the quantity at which MC equals MR with MC rising through MR from below, and every unit at that output carries a margin above average cost.

The signal is read: nothing conceals the margin, and a newcomer needs only a store and a scale to chase it. Forty of them open, and each brings its own marginal cost curve, so the industry supply curve, which is the horizontal sum of those curves, shifts to the right.

Price falls and profit is squeezed: against unchanged demand the enlarged supply can only clear at a lower called price. Zawadi Grain's horizontal line drops, the profit rectangle thins from above, and the firm slides back down its own marginal cost curve to a smaller output.

Where it must rest: entry can only halt when there is nothing left to attract it, and that is at TShs 8.09, the floor of average total cost, with the firm handling 13.85 units. There $P = MC = ATC$ at its minimum and profit is normal.

Zawadi Grain will still be trading at Kibaigwa; it will simply no longer be worth anybody else's while to join it.

The Master Key: *In a trade that anybody may enter, today's margin is tomorrow's crowd.*

REAL Question 76

A higher rice price drew hundreds of new growers into the Kilombero valley, exactly as the model says it should. What the model then says is that rice will be dearer, not cheaper, and it is right.

Explain, with reference to the case in the box, why the long-run supply curve of this industry slopes upward instead of lying flat.

> Rice in the Kilombero valley is grown by a very large number of small growers producing one identical milled grade.
>
> Entry is easy: land is rented by the season and the equipment needed is modest.
>
> A rise in the milled rice price two seasons ago drew many new growers into the valley.
>
> Rents on irrigated plots near the road have risen sharply since, and trained pump operators now command higher wages.
>
> The cost curves of every grower in the valley, old and new alike, have shifted upward.

Model Answer

The valley is an increasing cost industry: entry did compete the supernormal profit away, but in expanding, the industry bid up the price of the scarce inputs it depends on, so every grower's LAC curve shifted upward and the price at which entry finally stops now lies above the old one, which is exactly what an upward sloping long-run supply curve records.

Free entry still does its work: the higher price gave supernormal profit, and since land is rented by the season the profit was both visible and answerable. Growers entered, planted area rose and the industry supply curve shifted to the right. So far this is the ordinary long-run mechanism of any competitive trade.

The industry is a large buyer of a scarce input: the valley holds only so much irrigated land near the road and only so many trained pump operators. A bigger industry bids for both, so the price of both rises. That is an external diseconomy, external because no single grower brought it about.

Cost curves shift upward: a rise in rents and wages lifts every grower's average and marginal cost at every level of output. Minimum long-run average cost is therefore higher than it was, and it is higher for the newcomers and the established growers alike, since all of them rent in the same valley.

The resting price is higher: long-run equilibrium still requires price equal to minimum LAC with normal profit only. Since minimum LAC has risen, the price at which entry stops has risen with it. A larger industry output is now matched by a higher long-run price rather than the old one.

Hence the upward slope: join the old pair of price and industry output to the new pair and the line rises. That is the middle panel of figure 6.13. The long-run supply curve slopes up because a bigger industry is genuinely dearer to run, not because any grower has grown careless.

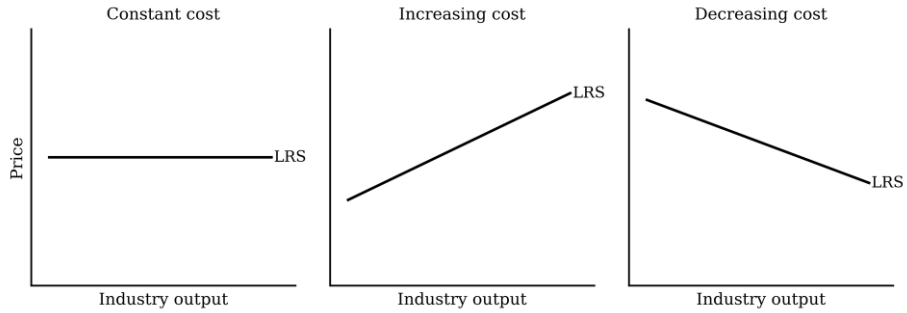


Figure 6.13: *Long-run supply in constant, increasing and decreasing cost industries*

Nothing here contradicts the model; the model has simply been made to count the cost of being crowded.

The Master Key: *An industry that must bid harder for its inputs the larger it grows carries its own rising supply curve on its back.*

HOT Question 77

Free entry is supposed to wipe out supernormal profit within a season or two. Some traders at Makoroboi have held a comfortable margin for a decade, and any honest model has to account for them.

To what extent does free entry guarantee that firms in a competitive Tanzanian trade will earn only normal profit in the long run?

Model Answer

Only in part: free entry genuinely pushes a competitive trade towards normal profit, and the pull is strong enough to be watched at any market in the country, but the guarantee holds only in the limit, because entry is seldom costless, knowledge is seldom complete, products are seldom truly identical, and conditions keep moving before the adjustment can finish.

The mechanism is real and visible: you can watch it work. A good season in tomatoes or in second-hand clothing draws newcomers within months, margins narrow and the weakest sellers withdraw. Where the capital needed is small, the model's prediction is not a fantasy but a plain description of what happens.

Entry is rarely free in practice: a stall licence, a place in the shed, a line of credit and a relationship with a transporter are all barriers. Each is small, yet together they can slow entry for years, and a slow chain leaves supernormal profit standing for the whole of the delay.

Knowledge is not perfect: the model assumes outsiders read the margin at once. In practice takings are private, records are thin and a watcher needs a season or two before he is sure. Delay is not the same as absence, but a candidate should never treat the two as one.

Products are not quite homogeneous: a trader known for honest weights and a fair scale keeps customers at a slightly higher price. That is a differentiated product, and the return it earns is one that entry cannot compete away, which drags the trade towards monopolistic competition rather than perfect competition.

The long run may never arrive: harvest, weather, exchange rates and policy all move faster than the adjustment they set off. The industry is forever heading for a resting point it never reaches, so a persistent margin can be evidence of a moving target rather than of a broken mechanism.

The verdict: free entry guarantees normal profit only in the limit and only where entry is truly costless and knowledge truly full. As a tendency it is sound, and it explains why comfortable trades attract crowds. As a description of any one Mwanza or Dodoma trade on any one day it claims far too much.

Judge the mechanism by the direction it predicts, never by the speed.

The Master Key: *Free entry fixes the destination and says nothing whatever about the length of the journey.*

HOT Question 78

If every shilling of profit is competed away, asks a sharp student, why would anybody build the first mill? The model has an answer, and it is not that entrepreneurs cannot count.

Discuss whether the prediction that firms earn only normal profit in the long run makes perfect competition an unattractive place to invest.

Model Answer

It deters some kinds of investment but not entry itself: with no barrier to shelter it, a competitive firm cannot hold on to any return from research, and normal profit leaves it no surplus to fund research with, yet normal profit is by construction the going return on capital, and the temporary supernormal profit available during every adjustment is prize enough to draw firms in.

The case that it deters investment: a firm that innovates and cuts its cost keeps the gain only until rivals copy it, and under perfect knowledge that is at once. With no patent, no brand and no barrier, the reward for effort is brief and small, so the incentive to spend on research is genuinely weak.

And no funds to invest with: normal profit in the long run means no retained surplus. Firms are small by assumption and cannot borrow easily against a commodity margin, so even a willing innovator finds himself short of the money the innovation would need.

The case that it does not deter entry: normal profit is by definition enough to keep the owner in the trade, since it equals what the next best use of the same capital would pay him. An investor who receives the going return has not been robbed of anything, and nothing in the model asks him to work for less.

The short run is where the money is made: every long-run equilibrium is reached through a run of short-run positions. The firm that enters early, or cuts its cost first, earns supernormal profit for as long as the adjustment takes. That, and not the resting state, is the prize the entrant is actually chasing.

The balance: the criticism holds for research and for any product needing heavy fixed investment, and it fails as a claim that nobody would ever enter. Perfect competition is a hopeless structure for developing a new medicine and an excellent one for milling maize.

The model never says that effort goes unpaid; it says the payment comes early and does not last.

The Master Key: *Supernormal profit under perfect competition is a prize for arriving first, not a rent for merely being there.*

HOT Question 79

A district officer proposes to bring three hundred new growers into a valley so that the crop will be cheaper. Whether he is right depends entirely on what the valley does to costs.

Advise a district authority that hopes to lower the long-run price of a crop by encouraging many new growers to enter the trade.

Model Answer

Advise caution: entry lowers price only while supernormal profit is being competed away, so if the growers already earn no more than normal profit the price is already at minimum long-run average cost, new entrants will simply make losses and leave, and in an increasing cost valley they will push

the long-run price up, which means the money is better spent on lowering the cost curve than on crowding the trade.

Ask first where the trade stands: if growers are already earning normal profit alone, price already equals the minimum of long-run average cost. Pushing three hundred more onto the land will drive price below that floor, losses will appear, and the newcomers or the weakest incumbents will leave again. The gain is brief and the disruption is not.

Entry answers profit, and only profit: the mechanism the authority is leaning on is a response to supernormal profit, not a substitute for it. Where the margin is fat, entry will happen without any encouragement at all. Where the margin is thin, encouragement can only manufacture losses.

In an increasing cost industry the plan can backfire: if the valley's good land and skilled labour are limited, a larger industry bids their prices up, minimum LAC rises, and the long-run price settles above where it started. More growers then mean a dearer crop, which is the opposite of the announced aim.

Only a lower cost floor lowers the long-run price: price comes to rest at the bottom of the average cost curve, so the authority should attack that bottom directly. A road that cuts haulage, an irrigation scheme, a better seed or a cheaper source of fertiliser shifts every grower's cost curve down and lowers the resting price permanently.

Where entry is the right instrument: if the trade is held back by licences, credit rationing or a ring of buyers, price stands above minimum LAC and removing the obstruction genuinely lowers it. Opening entry is the cure for a barrier, and it is never the cure for a cost.

The advice in one line: count first whether the growers earn more than normal profit. If they do, find and remove whatever is blocking entry. If they do not, spend the same money on the cost curve, because that is the only thing the price can follow downward.

Cheapness in the long run is a question about costs, and about nothing else.

The Master Key: *You cannot push a long-run price below the floor of the average cost curve; you can only lower the floor.*

Efficiency, Merits and Demerits of Perfect Competition

Perfect competition earns its long place in the course not because any market looks like it, but because it is the one structure in which both of the great efficiency tests are passed at the same instant, and passed by accident, since nobody in the model is trying to pass them. This section names those tests, allocative efficiency and productive efficiency, shows exactly where on the long-run diagram each one is satisfied, and then sets the merits of the structure against its defects, ending with the question a thoughtful candidate is entitled to ask: why study a market that has never existed.

BINDER Question 80

Two quite separate questions hide inside the word efficient: is the right thing being made, and is it being made in the cheapest way. Perfect competition answers both, and answers them without anybody in it intending to.

Define allocative efficiency and productive efficiency, and show that a perfectly competitive firm satisfies both in long-run equilibrium.

Model Answer

Allocative efficiency means producing where price equals marginal cost, so that the value a buyer places on the last unit equals what that unit costs society to make; productive efficiency means producing at the minimum of average total cost, so that nothing is made more dearly than it need be; and a perfectly competitive firm in long-run equilibrium satisfies both at one point, at TShs 8.09 and 13.85 units.

Allocative efficiency defined: the price a buyer will pay for the last unit measures what that unit is worth to the buyer. Marginal cost measures what the resources used to make it are worth elsewhere. Where the two are equal, no shifting of resources between goods can make anybody better off.

$$P = MC \quad \text{allocative efficiency}$$

Why the structure delivers it: the firm maximises profit where MC = MR with MC cutting MR from below, and for a price taker MR = P. The profit-maximising rule is therefore the efficiency condition itself, written out. Nobody aims at efficiency; it falls out of ordinary self-interest.

Productive efficiency defined: a firm is productively efficient when it produces at the lowest point of its average total cost curve, so that each unit absorbs the smallest possible quantity of resources and no plant stands partly idle.

$$\text{output where ATC is least} \quad \text{productive efficiency}$$

Why the structure delivers that too: free entry competes the price down until it just touches the floor of long-run average cost, since anywhere above that floor a margin would still be calling entrants in. In figure 6.14 the horizontal AR equals MR line meets ATC exactly at its minimum, where MC also passes.

$$P = MC = ATC_{min} = \text{TShs } 8.09$$

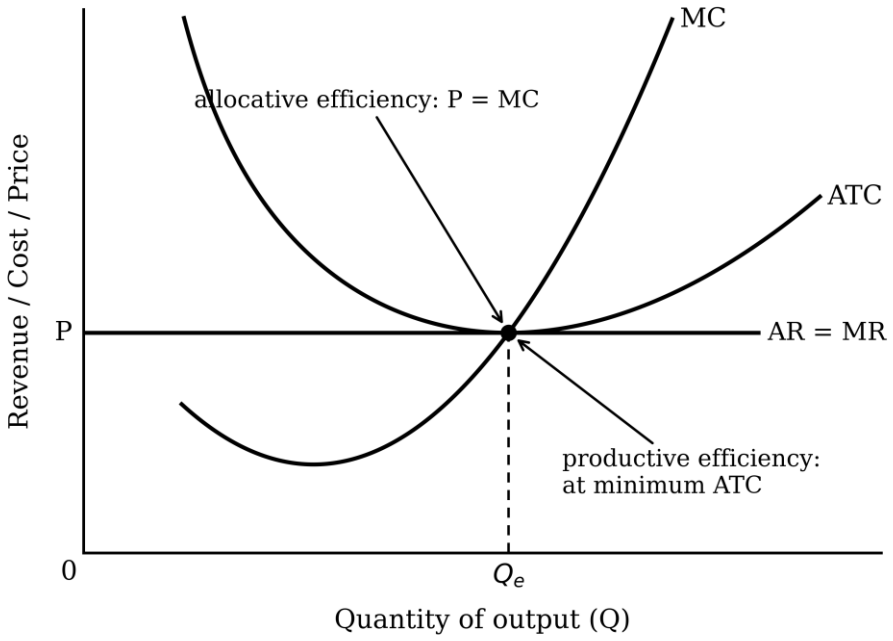


Figure 6.14: *Allocative and productive efficiency under perfect competition*

Two conditions, two different engines: profit maximisation supplies the first and free entry supplies the second.

The Master Key: *Profit maximisation buys allocative efficiency and free entry buys productive efficiency, which is why only perfect competition collects both.*

BINDER Question 81

Ask why economists keep a market that nobody has ever seen. The answer is a list of good things that all happen to occur in the same diagram, at the same point on it.

Explain five merits of a perfectly competitive market.

Model Answer

The merits are efficiency on both tests, a price that is both low and stable, the complete absence of excess capacity, consumer sovereignty, and nothing spent on persuasion; and every one of the five is produced by the same two forces, the pursuit of profit inside each firm and the freedom of outsiders to enter.

Efficiency on both tests: price equals marginal cost, so the right quantity is made, and output sits at minimum average total cost, so it is made in the cheapest way available. No other structure passes both, which is precisely why this one is the benchmark against which the others are measured.

Low and stable prices: the long-run price equals the lowest average total cost attainable, so it is the lowest price at which sellers can survive at all. Consumers buy at cost. Because entry and exit keep restoring that level, the price is steady as well as low.

No excess capacity: the plant is worked at exactly the output where average total cost is least, so nothing that was built stands unused. Set this against monopolistic competition, where the long-run tangency lies to the left of minimum ATC and every firm carries capacity it never uses.

Consumer sovereignty: production follows demand and nothing else. A firm that makes what buyers do not want meets a price below its own cost and is driven out, so it is buyers rather than producers who settle what gets made and in what quantity.

Nothing spent on persuasion: knowledge is perfect and the product homogeneous, so advertising could convince nobody and no resources are laid out on it. Every shilling the buyer pays goes into the good itself and into moving it, not into the selling of it.

Notice that not one of these merits is intended by anybody trading inside the market.

The Master Key: *Perfect competition is the only structure in which the cheapest possible price and the correct possible quantity are the very same point on the diagram.*

BINDER Question 82

A market can pass every efficiency test in the book and still be a bleak place to live in. Identical goods, no research and no roads is a strange thing to call an ideal.

Explain five demerits of a perfectly competitive market.

Model Answer

The demerits are no variety, no funds and no motive for research, no supply of public goods, assumptions that no real market satisfies, and a scale too small to capture economies of scale; together they make the structure a measuring rod for other markets rather than a state any economy should try to reach.

No variety: the product is homogeneous by assumption, so the buyer has nothing to choose between. Efficiency is bought here by abolishing exactly the choice that most buyers value, and a model of identical maize tells you very little about how to supply a market for clothing.

No research and no funds for it: only normal profit survives the long run, so no surplus is left over to spend on invention, and perfect knowledge means any improvement is copied the moment it appears. Neither the money for progress nor the motive to seek it exists inside the structure.

Public goods go unsupplied: a road or a street light cannot be withheld from those who decline to pay, so no competitive firm can charge for one. Goods that are valuable but not excludable are simply missing from a purely competitive economy, however efficient the rest of it looks.

The assumptions are never met: no real buyer holds perfect knowledge of quality and price, transport is never free, and firms differentiate whatever they can lay hands on. A structure whose conditions are never satisfied cannot be offered as a description of anything actually trading.

Scale economies are forbidden: every firm must stay too small to move the price, which rules out the very scale at which average cost would keep falling. Where an industry carries heavy fixed costs, splitting it into many tiny firms is the expensive way to run it.

The structure earns its place as a standard of comparison and forfeits it the instant it is held up as a goal.

The Master Key: *Perfect competition is superb at making one thing cheaply and useless at deciding what things there ought to be.*

REAL Question 83

A seed cotton grower at Kishapu has never once thought about allocative efficiency. He thinks about whether the next acre pays its way, and in thinking only that, he delivers it.

Using the case in the box, show that this grower satisfies both efficiency conditions in the long run, and assess what that efficiency is worth to him.

Bahati Farm grows seed cotton at Kishapu in Shinyanga, one of many thousands of growers of the same ginning grade.

The buying price is announced for the season and no single grower can move it.

Entry is free: any household with land may plant cotton, and a great many did when the price last rose.

Bahati Farm's costs are those of the standard firm used throughout this chapter: average total cost is least at TShs 8.09 a unit, at an output of 13.85 units.

After two seasons of entry the announced price has settled at TShs 8.09.

Model Answer

Bahati Farm satisfies allocative efficiency because profit maximisation forces $P = MC$**, and productive efficiency because two seasons of entry have driven the announced price down to TShs 8.09, the floor of its average total cost, where it produces 13.85 units; and both are worth nothing at all to the grower himself, who earns normal profit and no more.**

The grower is a price taker: thousands of sellers, one ginning grade and a price announced for the season together make the farm's demand curve horizontal, so $P = AR = MR$ at TShs 8.09 and the farm can shift none of them.

Allocative efficiency holds: the farm plants up to the acre at which marginal cost equals marginal revenue, with MC rising through MR from below. Since $MR = P$ for a price taker, that is the same statement as $P = MC$. The last unit of cotton costs society exactly what the buyer judges it to be worth.

Productive efficiency holds: two seasons of entry pushed the announced price down to TShs 8.09, which is the floor of the farm's average total cost curve. At 13.85 units the farm is producing at the lowest cost per unit its technique allows, with no part of its capacity idle.

Both hold at one point, and must: a horizontal price line can rest on a U-shaped ATC curve only at its minimum, and MC passes through that minimum. So the two conditions cannot be separated once entry has finished its work. Figure 6.14 is a picture of Bahati Farm.

What the efficiency is worth to him: nothing extra. Efficiency is a property of the outcome for society, not a payment to the producer, and the grower is left with normal profit alone. He would much rather have a barrier to entry, which is exactly why the rest of the country should not let him have one.

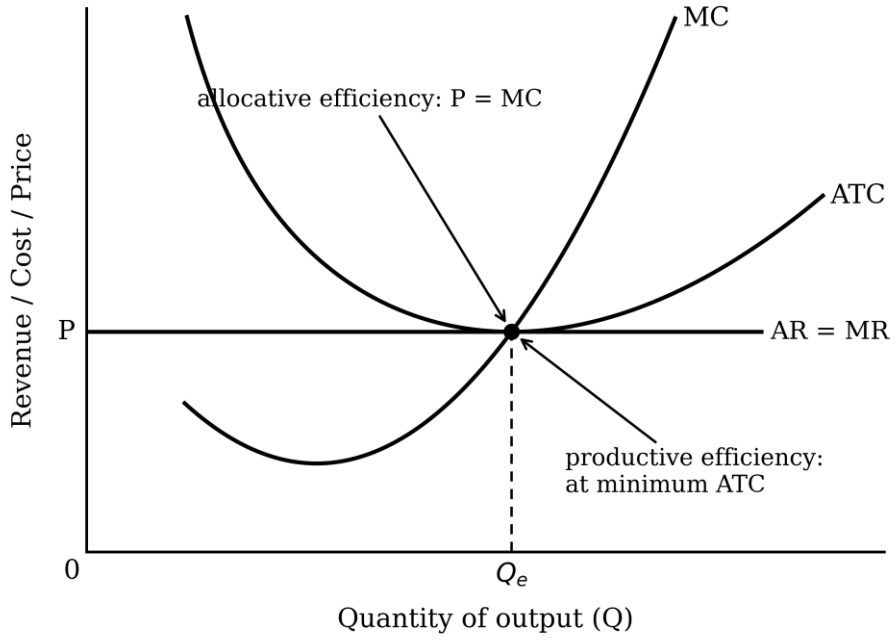


Figure 6.14: *Allocative and productive efficiency under perfect competition*

The efficiency at Kishapu is entirely real, and the grower is entitled to point out that it was never his idea.

The Master Key: *Allocative and productive efficiency are things a competitive market does to a grower, not things a grower does for it.*

REAL Question 84

At Mwanjelwa the tomatoes are cheap, the heaps are the same size at every stall, and nobody advertises. The row delivers everything the model promises, including everything the model leaves out.

Examine what the buyers at this market gain and what they lose from trading in a market that comes close to perfect competition.

About four hundred sellers offer tomatoes at Mwanjelwa market in Mbeya, in heaps of one standard size.

Prices are called openly along the row and no seller can hold out above them for long.

Anyone may take a place in the row for a small daily fee.

No seller advertises, and none offers a washed, graded or packed tomato.

Margins are thin, and after a glut some sellers leave the row and return the following season.

Model Answer

The buyers gain a price very near the floor of average cost, a complete absence of money spent on persuading them, and real sovereignty over what is brought to the row; they lose all choice of quality, and they lose any prospect of improvement, because a trade with no supernormal profit has neither the funds nor the reason to invest in anything better.

The price sits close to cost: free entry at a small daily fee and an openly called price hold the margin down to very nearly normal profit, so the buyer pays something close to minimum average cost. That is the cheapest tomato this structure can produce, and it is the first thing the model promises.

Nothing is wasted on selling: no seller spends on advertising, packaging or persuasion, since with a standard heap and a called price there is nothing left to advertise. Every shilling the buyer hands over is a shilling of tomato and of haulage, and none of it is a shilling of publicity.

The buyer decides what is grown: when buyers turn towards a different variety, the sellers who cannot supply it lose money and drift out of the row. Consumer sovereignty at Mwanjelwa is not a phrase from a definition; it is a fact that can be observed week by week.

But there is no choice whatever: the heaps are identical, so a buyer who wants a washed, graded or carefully packed tomato cannot obtain one at any price. The row is efficient at supplying the tomato it supplies, and completely silent about every other tomato that might be wanted.

And nothing improves: thin margins leave nobody with the money or the motive to invest in cold storage, better varieties or a reduction in spoilage. A structure that permits no lasting surplus has no engine of improvement, so next season's tomato is this season's tomato again.

The buyers at Mwanjelwa receive the model's virtues in full measure, and they pay its price in full measure too.

The Master Key: *A market can be cheap, honest and efficient and still be quite incapable of ever getting any better.*

HOT Question 85

Not one Tanzanian market meets even four of the assumptions, and yet this structure is taught first and taught at length. That is either a serious mistake or a deliberate method.

To what extent is it worth studying a market structure that exists nowhere in the real world?

Model Answer

It is worth studying, and worth studying early, but strictly as a measuring rod and a training ground rather than as a description or an aim: the objection that its assumptions are false is entirely correct

and entirely beside the point, because a benchmark earns its keep by being the case in which every inefficiency equals zero, and the danger is only that a reader mistakes the rod for a destination.

The objection is fair on its face: not one assumption survives contact with a real trade. Buyers are ignorant, transport is dear, products are branded and entry costs money. A structure built on five statements that are all false cannot be a description of any market now trading in the country.

But a benchmark is not a description: the model's task is to supply a standard against which real structures can be measured. Phrases such as allocative inefficiency, excess capacity and welfare loss have no meaning at all until there exists one case in which each of them is zero. This structure is that case.

It supplies the tools used everywhere else: MC = MR with MC cutting from below, P = AR = MR, break-even and shut-down, the entry and exit chain. Each is first met here in its simplest setting, with a horizontal revenue line, and each is then carried unchanged into monopoly, monopolistic competition and oligopoly.

Real markets do approach it: a cotton buying floor, a foreign exchange dealing room and a graded maize market with an openly called price all behave very much as the model says they will. The prediction that a fat margin draws a crowd can be confirmed at any market town in a single season.

The genuine danger of teaching it: a benchmark quietly becomes an ideal. A candidate who leaves with the impression that policy should aim at perfect competition will recommend breaking up firms whose scale is the only reason the good is affordable, and will have no answer at all for public goods or for research.

The verdict: study it, and study it first, provided its status is stated plainly every time it is used. It is a ruler for measuring other structures and a workshop for learning the technique. It is not a picture of anywhere and it is not a policy.

The model is perfectly honest about being unreal; the mistake, when it is made, belongs to the reader.

The Master Key: *A perfect competitive market is a ruler, and a ruler is useful precisely because nothing in the world is exactly one metre long.*

HOT Question 86

Perfect competition offers the cheapest possible shirt and exactly one shirt. Monopolistic competition offers forty shirts, each a little dearer than it needs to be. No diagram settles which of the two is better.

Discuss whether the efficiency of perfect competition is worth more to a society than the variety of monopolistic competition.

Model Answer

Neither dominates the other: efficiency is worth most where the good is standard and the buyer is poor, since price then equals both marginal cost and minimum average cost, while variety is worth most where the differences between versions are the very thing the buyer is paying for, and the honest answer is that a sensible economy contains both structures and should not try to make either of them universal.

What the efficiency is worth: under perfect competition price equals marginal cost and equals minimum average total cost, so the good is made in the cheapest way and in the right quantity. Nothing goes on persuasion and no plant lies idle. For a necessity bought weekly by poor households, that saving is the whole of the argument.

What the variety is worth: a differentiated market lets a buyer match the good to the want. The gain is genuine even though no diagram measures it, because a shirt that fits is worth more than the same quantity of cloth cut to one standard pattern that suits nobody exactly.

The cost of variety, priced: differentiation is paid for in excess capacity. In the long run the firm's demand curve is tangent to average total cost to the left of its minimum, so every firm carries capacity it never uses and the buyer meets that in the price. Variety is not free; its cost per unit can be measured.

It depends on the good: for cement, salt, sugar and maize flour the buyer wants the cheapest version of one standard thing, and differentiation would be pure waste. For clothing, prepared food, music and furniture the differences are the product, and forcing homogeneity would destroy most of the value.

It depends on the buyer: a household spending most of its income on food gains far more from a lower price than from a wider choice. The claim that variety is worth its cost is an argument most easily made by people who can already afford to have it made.

The judgement: efficiency should govern where the good is standard and the purse is thin; variety should govern where the differences are what is actually being bought. The two are not rival answers to one question but answers to different questions about different goods.

Ask which structure fits the good in front of you, and the argument about which is better in general quietly dissolves.

The Master Key: *Do not ask whether variety is worth its cost, ask whether it is worth its cost for this good and this buyer.*

HOT Question 87

Offer a shopper at Kariakoo a market with the lowest possible price, no brands, no grades, no credit and no new products for the rest of her life. Watch how long she takes to answer.

Discuss whether a Tanzanian consumer would in fact prefer to buy in a perfectly competitive market.

Model Answer

She would prefer it for staples, where a standard grade is what she wants anyway and price is the only variable that matters, and she would reject it for nearly everything else; what she actually wants is competitive pressure, which is not the same thing at all, since pressure can be had from many sellers and easy entry while differentiation is still allowed.

The case for yes, on price: the long-run price equals minimum average total cost, the lowest price that still leaves sellers in business. For a household whose food and transport already take most of its income, a permanently lower price outweighs almost anything else that could be offered instead.

And on protection: no seller can hold a price above the rest, because the buyer walks four steps to the next stall. The consumer is protected by the structure of the market rather than by an inspector, and where enforcement capacity is thin that is a serious practical advantage.

The case for no, on choice: homogeneity abolishes brands, grades and quality tiers together. A buyer willing to pay more for a shoe that lasts two years or a cleaner grade of rice simply cannot do so, because the market has been given no way to express that preference.

On everything a seller adds: credit, delivery, repair after sale, guarantee and packaging are all forms of differentiation, so a perfectly competitive market contains none of them. Consumers demonstrate daily that they value these things, and often value them above a few shillings on the price.

On tomorrow's goods: normal profit funds no research, so the consumer receives a permanently cheap version of precisely the goods that exist today. Across a working life that is a large sacrifice, and it hides comfortably behind a small daily gain at the stall.

What she really wants: many sellers, easy entry and good information, with quality and service still free to differ. That is competition without homogeneity, and it describes a well run monopolistic market far better than it describes the perfect one.

The wish is coherent: the pressure of perfect competition without its uniformity is a perfectly sensible thing to want.

The Master Key: *Consumers do not want perfect competition, they want competitive pressure, and the two part company the moment choice becomes worth paying for.*

HOT Question 88

Allocative efficiency says price should equal marginal cost. It does not say whose cost, and a workshop tipping dye into a river is not paying all of it.

Assess the claim that a perfectly competitive economy allocates society's resources in the best possible way.

Model Answer

The claim is true inside its own frame and misleading everywhere outside it: perfect competition does allocate efficiently among privately costed, excludable goods and at the existing distribution of income, but it overproduces wherever costs spill onto others, underproduces wherever benefits spill onto others, supplies no public goods at all, and has nothing whatever to say about fairness.

What the claim gets right: every firm produces where $P = MC$ and at minimum average total cost, so within the set of goods actually traded, no reshuffling of resources can make one person better off without making another worse off. That is a genuine result and a strong one, not a trick.

It counts private cost only: the MC in the diagram is the firm's own marginal cost. Where production imposes a cost on outsiders, dye in a river or dust from a quarry, the cost to society is higher than the curve shows, so $P = MC$ produces too much of the good rather than the right amount.

And it ignores spillover benefits: a household that vaccinates a child or keeps a daughter in school confers a benefit on neighbours for which it cannot charge. Where benefits spill outward, a competitive market produces too little, and efficiency in the private sense quietly conceals the shortfall.

Public goods fall outside it altogether: roads, flood defences and street lighting cannot be withheld from those who do not pay, so no competitive firm will supply them at any price at all. A market that cannot supply a good is not allocating resources to it efficiently; it is allocating none.

Efficiency is silent about who gets what: an allocation in which one household eats well and another does not can satisfy every efficiency condition, because the test asks only whether resources could be reshuffled to help somebody without hurting anybody. Fairness is a separate question the model never puts.

The assessment: accept the claim with its frame attached and reject it without. Externalities, public goods and the distribution of income all lie outside that frame, and every one of them is a standing reason for a government to act in a market that is otherwise working perfectly.

The result is a conditional one, and the conditions are exactly the ground on which policy is built.

The Master Key: $P = MC$ *is the right test only when the marginal cost drawn in the diagram is society's, and usually it is not.*

Monopoly: Meaning, Characteristics and Sources

Perfect competition placed many sellers in one market and left every one of them without power over price. Monopoly is the opposite case: one seller, a good with no close substitute, and a wall around the industry that keeps rivals outside. This section defines monopoly by those three conditions taken together, draws out the characteristics that follow from them, and works through where monopoly power actually comes from. The lesson to carry forward is that the wall matters more than the seller, because it is the barrier, and not the size of the firm, that makes a monopolist.

BINDER Question 89

One shop in a small town sells sugar, and it is no monopolist, because the road to the next town is open. What keeps a monopolist alone is never the empty street but the wall at the end of it.

Define monopoly and explain the three conditions a market must satisfy before it can be called one.

Model Answer

Monopoly is a market structure in which one firm is the sole seller of a good that has no close substitute, and in which barriers keep new firms out. Three conditions must hold at once: a single seller, the absence of any close substitute, and barriers to entry. Remove any one of the three and the market is something else.

A single seller: The firm is the whole industry, so the output of the firm and the output of the market are the same quantity. There is no rival to undercut it and no price settled elsewhere for it to accept, so it must set its own price.

No close substitute: Buyers who dislike the price have nowhere comparable to spend, so cross elasticity of demand between this good and every other good is very low. A seller of one brand of soap faces close substitutes on the next shelf and is therefore no monopolist.

Barriers to entry: Something must stop other firms coming in to share the profit: a law, a patent, ownership of the input, or a cost advantage no entrant could match. Without a barrier the profit itself invites entry, and the single seller does not stay single for long.

The three work together: Being the only seller today makes a firm a monopolist only if the other two conditions hold as well, since a lone seller facing easy entry and near substitutes must price as though rivals were already trading. The wall does the work, not the loneliness.

Test any firm against all three conditions before naming it a monopolist, because most firms popularly called monopolies fail at least one of them.

The Master Key: *One seller, no close substitute and a barrier that holds, and only the three together make a monopoly.*

BINDER Question 90

Ask what a monopolist can do that no other firm can, and the answer is short. It writes the price, and then reads its own output off the market's demand curve.

Explain the main characteristics of a monopoly market.

Model Answer

A monopoly market has one seller who is the entire industry, a product with no close substitute, and barriers that block entry. From these follow the features that matter in analysis: the firm is a price maker, the curve it faces is the market demand curve and slopes downwards, average revenue exceeds marginal revenue at every positive output, and supernormal profit can survive into the long run.

Single seller and no close substitute: The firm supplies the whole market, so its output is industry output and its demand curve is the market curve. Buyers cannot turn to a comparable good, and that absence of an alternative is what gives the seller its grip on price.

Price maker, not price taker: With no rival to be undercut, the firm names the price. What it cannot name is the quantity that will then be bought, because that is settled by buyers moving along the demand curve.

A downward sloping demand curve: More can be sold only at a lower price, so the curve falls from left to right. The monopolist faces the whole law of demand rather than the flat line at a ruling price that confronts a seller in perfect competition.

Average revenue above marginal revenue: Selling one more unit forces the price down on every unit and not only on the last, so the addition to revenue falls short of the price received. Hence AR $>$ MR at every positive output, and the marginal revenue curve lies below the demand curve.

Supernormal profit that can last: Barriers keep entrants out, so profit is not competed away as it is under perfect competition. Profit is not guaranteed, since weak demand can still leave the firm with a loss, but nothing erodes it from outside the industry.

Every one of these features traces back to the barrier, which is why any examination of a monopoly should begin there.

The Master Key: *A monopolist is a price maker whose single constraint is the demand curve it has to sell along.*

BINDER Question 91

A patent registry and an oil field do the same economic work. Each puts a fence around a market that no rival is able to climb.

Explain how law and the ownership of scarce inputs give rise to monopoly.

Model Answer

Law and ownership create monopoly by making entry impossible rather than merely unattractive. A patent or copyright forbids imitation for a period, control of an essential raw material starves a rival of what it must have in order to produce, an exclusive franchise reserves an area to one supplier, and state ownership closes an industry to private entry altogether.

Patents and copyright: The state grants an inventor or an author the sole right to exploit the work for a fixed period, so imitation becomes an offence rather than a business. The monopoly is deliberate, since it is the reward that pays for the invention, and it expires by design.

Control of an essential raw material: A firm or a group of states owning the input that every producer needs can simply refuse to sell it and keep the market to itself. The oil exporting states acting together through OPEC hold exactly this kind of power over crude petroleum.

An exclusive legal right or franchise: Government may grant one supplier the sole right to serve an area, as with the authority licensed to pipe water to Dar es Salaam. A second firm may be perfectly able to lay pipes and is simply not permitted to lay them.

Government ownership: Where the state itself owns the supplier of post, water or transmission, competition is excluded by ownership as well as by law. This barrier is political rather than economic, so it can be removed by a decision rather than by a rival.

Every barrier in this group was placed there by somebody, which is why a change of law can dismantle any of them.

The Master Key: *Where the state or a single owner controls what a rival must have, the rival never reaches the starting line.*

BINDER Question 92

Two firms stand alone in their markets. Repeal the statute protecting the first and a rival appears within the year; repeal nothing at all for the second and still no rival appears, because none could survive.

Distinguish between natural and artificial barriers to entry, and explain why the distinction matters.

Model Answer

A natural barrier arises from the technology and cost conditions of the industry itself, so it would stand even if no law existed. An artificial barrier is placed there by statute or by the deliberate conduct of the firm already inside, so it can be taken away by a decision. The distinction matters because the two call for entirely different treatment.

Natural barriers: Economies of scale so large that long run average cost is still falling at the output the whole market takes mean one firm can always supply more cheaply than two. Ownership of a uniquely placed deposit or site works in the same way and owes nothing to law.

Natural monopoly explained: Where a grid of wires or a network of pipes must be built before a single unit is sold, the fixed cost is spread over more units as output grows, so average cost falls across the whole range of demand. A second network duplicates that cost and halves each firm's output, leaving both dearer than one.

Artificial barriers: A patent, a franchise, a licensing rule, a tariff on imports, an exclusive contract with distributors, or price cutting aimed at driving out an entrant. None of these follows from the cost of production; each is put in place by the state or by the incumbent firm.

Why the distinction decides policy: An artificial barrier can usually be removed, and competition then does its own work on price. A natural barrier cannot be removed without raising the cost of supply, so the answer there is to regulate the single firm rather than to invite in a second.

Ask of any monopoly whether a rival could survive if every relevant statute vanished tonight, and the answer sorts the barrier into one class or the other.

The Master Key: *A natural barrier is built by cost and an artificial one by decision, and only one of the two can be legislated away.*

BINDER Question 93

A firm will risk an enormous sum to enter a market when it can walk away with the equipment. It will hesitate over a far smaller sum that would stay in the ground.

Explain why sunk cost, rather than the size of the investment required, is the real barrier to entry.

Model Answer

Sunk cost is expenditure that cannot be recovered if the firm leaves the market, and it is what genuinely deters entry. A large outlay that can be resold or redeployed is a risk the entrant can reverse, so it frightens nobody. A smaller outlay that vanishes on exit is money the entrant would certainly lose if the firm already inside decided to fight.

What makes a cost sunk: A cost is sunk when the asset has no value outside this one use and cannot be sold on. Laying a water main under a street, sinking a shaft or advertising a brand into existence are sunk; lorries, aircraft and general machinery are not, because a second hand market exists for them.

Why recoverable cost does not deter: An entrant able to sell its assets and leave loses only the difference between what it paid and what it recovers, so entry is a bet it can call off. The prospect of an orderly exit at modest loss makes even an expensive market worth attempting.

Why sunk cost deters: If the firm inside cuts its price after entry, the newcomer cannot retreat without losing everything it committed. Knowing that before it commits, it stays out, and the incumbent is protected without ever having to cut the price at all.

The consequence for policy: A market with little sunk cost is contestable, so the mere threat of entry disciplines the price even of a single seller. Removing licences achieves little where sunk cost is heavy, which is why network industries need a regulator rather than an open door.

Look for what an entrant would lose on the way out, not for what it must raise on the way in.

The Master Key: *Entry is deterred by the money an entrant could never get back, not by the money it has to find.*

REAL Question 94

Every unit of power that lights a room in Mbeya travels along wires that only one company may own. That single fact is worth more to the company than any advertisement it could buy.

Explain which sources of monopoly power protect the company described below, and state in each case whether the barrier is natural or artificial.

The Tanzania Electricity Supply Company, TANESCO, generates, transmits and distributes electricity over the national grid.
The transmission network of towers, high voltage lines and substations was built at enormous cost and has no use other than carrying electricity along those routes.
Distribution to households is licensed, and the tariff is approved by the regulator, EWURA.
Households with a generator or a solar panel obtain some power, but at a much higher cost for each unit and not on the same scale.
The details are illustrative and are used only to work the argument.

Model Answer

Three sources of monopoly power protect the company at once. The grid is a natural monopoly, because the cost of the network is spread thinner as more electricity flows through it, so a second grid would raise the cost of supplying the country. The exclusive licence to distribute is an artificial barrier granted by law. The network itself is very largely sunk cost, which deters entry even where the law would permit it.

Economies of scale in the network: Towers, lines and substations must be paid for before a single unit is sold, so fixed cost per unit falls as output grows and average cost declines across the whole range of national demand. One network therefore supplies the country more cheaply than two ever could.

The licence is an artificial barrier: The exclusive right to distribute to households is a legal grant and not a fact of engineering. It can be withdrawn by a decision, which is exactly what happens when a government opens generation to independent producers while keeping the grid itself closed.

The network is sunk cost: A transmission line has no value except carrying power along that route, so an entrant that built one and then lost a tariff war would recover almost nothing. That prospect deters entry more reliably than the licence does, because it would still be there if the licence went.

Substitutes exist but are not close: A generator or a solar panel supplies some power at a far higher cost for each unit and not on the same scale, so cross elasticity of demand is low. The company keeps its power over price even though the alternatives are not literally absent.

What the classification implies: Since the principal barrier is natural, opening the market would not produce cheap competition but duplicated wires and higher cost. The sensible response is to regulate the tariff, which is why the price is approved by EWURA rather than competed down by a rival.

A monopoly that owes its position to cost has to be regulated; one that owes it only to a licence can be opened.

The Master Key: *Where the wires themselves are the barrier, the answer is a regulator and not a rival.*

REAL Question 95

A firm with mains under half a city sells water. A young man with a handcart of jerricans sells water too. Only one of the two is called a monopolist, and working out why is the whole exercise.

Examine whether the authority described below is a monopolist, testing it against each condition in the definition.

> The Dar es Salaam Water Supply and Sanitation Authority, DAWASA, holds the exclusive right to supply piped water in the city.
>
> Its mains, pumping stations and treatment works were laid over decades and have no alternative use.
>
> Where the mains do not reach, households buy from vendors with handcarts and from private boreholes, at several times the price for each twenty litres.
>
> The tariff for piped water is approved by the regulator.
>
> A connected household rarely buys from a vendor except when the supply is interrupted.

Model Answer

It is a monopolist of piped water, and the test is worth working carefully. The single seller condition holds inside the licensed area, the barrier condition holds twice over through the exclusive right and through mains that could never be recovered on exit, and the no close substitute condition holds for connected households, since vendor water is bought only when the tap fails. Where the mains do not reach, the market is a different one and this authority is not the seller in it.

A single seller within the licensed area: No other firm may lay a main and sell piped water in the city, so inside that area the authority is the industry. Its output and the output of the market are the same quantity, which is what the first condition requires.

No close substitute for a connected household: Vendor water costs several times as much for each twenty litres and arrives by the bucket, so a connected household turns to it only when the tap fails. That behaviour is the evidence, since a close substitute would be bought whenever the tariff rose, not only when supply stopped.

Barriers of two different kinds: The exclusive right is an artificial barrier created by law. The mains, pumps and treatment works are sunk cost, having no use but carrying water along those routes, so even a change of law would not quickly produce a competing supplier.

Where the definition stops holding: In unserved neighbourhoods the buyers are supplied by vendors and boreholes competing against one another, which is far closer to competition than to monopoly. The authority is not the seller there, so its monopoly is bounded by the reach of its pipes.

The consequence of the verdict: Because the good has no close substitute for those it does serve, demand is inelastic and an unregulated tariff could be raised a long way before customers walked away. That is precisely why the price is approved by a regulator instead of being chosen by the seller.

Define the market before naming the monopolist, since the same firm can be the sole seller on one street and absent from the next.

The Master Key: *A monopoly is always a monopoly of some defined market, and how that market is defined decides the answer.*

HOT Question 96

The only miller in a small town grinds every bag of maize brought to him. A cement firm holding a third of the national market watches four rivals every morning. Ask which of the two has more power over its price.

To what extent does monopoly power come from the size of a firm rather than from barriers to entry?

Model Answer

Monopoly power comes from barriers, and size is only sometimes the form a barrier happens to take. A large firm with easy entry behind it must price as though rivals were already trading, because very soon they would be. A small firm protected by a patent, a licence or an unrepeatable sunk investment can hold its price far above cost for years. Size matters where size is itself the barrier, which is the case of natural monopoly and no other.

The case for barriers: Nothing protects a large firm from being undercut except something that keeps entrants out. Where a market is contestable, the threat of quick entry and quick exit disciplines price whatever the number of sellers, so the share held by the largest firm tells you very little.

Size can be the barrier: In a natural monopoly size is not incidental at all. Average cost falls over the whole range of market demand, so the largest firm is also the cheapest and any entrant must be smaller and dearer. Here the barrier and the size are one and the same thing.

Small firms with genuine power: The only ice plant at a lake landing, the only pharmacy holding a patented medicine, the only ferry licensed on a crossing: each is tiny in national terms and each faces a steeply falling demand curve. Distance, patent and licence are barriers with nothing to do with size.

Large firms without much power: A firm supplying most of a market that anyone may enter next month prices close to cost, because a rise invites the entry that would remove the profit. Its measured share overstates its power by exactly as much as the low barrier is overlooked.

Why measures of size mislead: A concentration ratio counts sellers and their shares and cannot see a patent, a licence or a sunk investment. Two industries with identical ratios can behave entirely differently once the conditions of entry are known, so the ratio is a first question and never the last.

The judgement: Size is evidence of monopoly power rather than its source. Ask first what would happen to the firm inside if a rival attempted to enter, because the answer to that question, and not the market share, decides the price the buyer ends up paying.

Read the barrier first and the market share second.

The Master Key: *Market share describes a firm as it is today, while the barrier decides what it can still charge tomorrow.*

HOT Question 97

Patents, franchises, licences and state ownership are written by the same hand. It is tempting to conclude that no monopoly would exist if government kept out of markets altogether, and the conclusion is exactly half right.

Discuss the claim that every monopoly is ultimately the creation of government.

Model Answer

The claim is half true. Patents, copyrights, exclusive franchises, import restrictions and outright state ownership are monopolies written into law, and every one of them could be repealed tomorrow. But economies of scale, ownership of a uniquely placed resource and heavy sunk cost owe nothing whatever to the state, and aggressive conduct by a firm already inside is something law restrains rather than creates. Government makes many monopolies and prevents others.

The strongest part of the claim: Patents, copyrights and franchises are monopolies by statute, and so is a licensing rule that lets one supplier serve an area. A tariff keeping imports out creates a monopoly for a domestic producer just as surely, and each of these dies on the day the law changes.

State ownership goes further still: Where the state owns the supplier of post, water or transmission, it is at the same moment the barrier, the seller and the regulator. Entry is closed by ownership and not merely by the withholding of permission, so no private firm can even apply.

But some barriers are pure cost: A national grid or a water network has an average cost that falls across the entire range of market demand. Repeal every statute and no second network appears, because a second one would raise the cost of supply and leave neither firm covering it.

And some are geography or ownership: A single deposit of a mineral, a hot spring, a site at the one crossing point of a river: whoever owns the thing owns the market, and no legislature made any of them scarce. These monopolies would outlast the repeal of every relevant law.

Government also destroys monopoly: Competition law, the removal of licences, the opening of an industry to imports and the work of a competition commission all cut monopoly power down. The same hand that grants a patent breaks up an agreement among sellers to fix a price.

The judgement: The claim holds for legal monopoly and fails for natural monopoly, so the useful version is narrower. Where a monopoly rests on law the state is both cause and cure, and where it rests on cost the state can only regulate what it never created.

Test each case by asking what would still be standing after the repeal of every statute that touches it.

The Master Key: *Repeal the law and a legal monopoly disappears, while a natural one simply carries on supplying.*

The Monopolist's Demand and Revenue

The price taker's revenue story was a single flat line doing three jobs at once. The monopolist's story is two lines that leave the price axis together and then draw apart, and the widening gap between them carries everything that follows. This section derives the marginal revenue function from a straight line demand curve, links marginal revenue to the elasticity of demand and to the peak of total revenue, and shows why a monopolist can have a price and a quantity yet never a supply curve.

BINDER Question 98

A seller who is alone in a market may name any price on the board. What the board never shows is that every extra sale has to be bought by cutting the price on the sales already made.

Explain why the demand curve facing a monopolist slopes downwards, why it is the market demand curve, and why average revenue exceeds marginal revenue at every positive output.

Model Answer

The monopolist is the only seller, so the demand of all buyers in the market is the demand facing the firm, and it slopes downwards because buyers take more only at a lower price. Since one price rules at any moment, average revenue is that price, so the demand curve is also the average revenue curve. Selling one more unit forces the price down on every unit, so the addition to revenue falls short of the price and $\text{AR} > \text{MR}$ **at every positive output.**

The firm is the industry: With no other seller in existence, the quantity buyers wish to take at each price is the quantity this firm can sell at each price. The market demand curve and the firm's demand curve are therefore one and the same line, which is never true of a price taker.

Why it slopes downwards: The law of demand governs the market as a whole, so more is bought only at a lower price. The monopolist may set the price and let buyers choose the quantity, or set the quantity and let buyers bid the price, but it can never choose both.

Demand is also average revenue: Average revenue is total revenue divided by quantity, and under a single price that returns the price itself. Every point on the demand curve therefore names both the price and the average revenue at that output, which is why the curve is labelled $D = AR$.

$$AR = \frac{TR}{Q} = \frac{P \times Q}{Q} = P$$

Why marginal revenue lies below: To shift an extra unit the price must come down, and the lower price applies to the units that would have sold at the old price as well. The gain on the extra unit is reduced by the loss on all the others, so marginal revenue is less than price.

The loss on the earlier units fixes the gap between the curves, and the gap widens as output grows.

The Master Key: *A price maker buys each extra sale by cutting the price on the sales it already had, and that is the whole reason* $AR > MR$.

BINDER Question 99

Two straight lines leave the price axis from the same point. One reaches the bottom at twice the speed of the other, and a single line of differentiation is the whole explanation.

Derive the marginal revenue function from the linear average revenue function $AR = a - bQ$**, and show that marginal revenue falls twice as fast as average revenue.**

Model Answer

Begin from $AR = a - bQ$**. Average revenue is price, so total revenue is** $TR = aQ - bQ^2$**, and differentiating gives** $MR = a - 2bQ$**. Marginal revenue keeps the same intercept and takes twice the slope, so it starts where the demand curve starts, falls twice as fast, and meets the horizontal axis at half the output at which demand meets it.**

Average revenue is the price: Under a single price, average revenue is total revenue divided by quantity, which returns the price itself, so the demand curve is the average revenue curve. The demand function may therefore be read as the price the market will pay at each output.

$$P = AR = a - bQ$$

Form total revenue: Multiply the price by the quantity. A linear demand function becomes a quadratic total revenue function, which rises, flattens and then falls, because the price being multiplied is itself shrinking as quantity grows.

$$TR = P \times Q = (a - bQ)Q = aQ - bQ^2$$

Differentiate to get marginal revenue: Marginal revenue is the rate at which total revenue changes as output changes, which is the derivative of the total revenue function. Differentiating term by term leaves the intercept untouched and doubles the coefficient on quantity.

$$MR = \frac{dTR}{dQ} = a - 2bQ$$

Same intercept, twice the slope: Put $Q = 0$ into both functions and each returns a, so the two lines begin together on the price axis. The slope of demand is $-b$ and the slope of marginal revenue is $-2b$, so marginal revenue falls twice as fast and lies below demand at every positive output.

The bisection rule for drawing: Marginal revenue meets the horizontal axis at half the output at which demand meets it, so at any height the marginal revenue line sits exactly halfway between the price axis and the demand curve. Figure 6.15 is drawn from that rule alone, with no calculation at all.

$$AR = 0 \text{ at } Q = \frac{a}{b}, \quad MR = 0 \text{ at } Q = \frac{a}{2b}$$

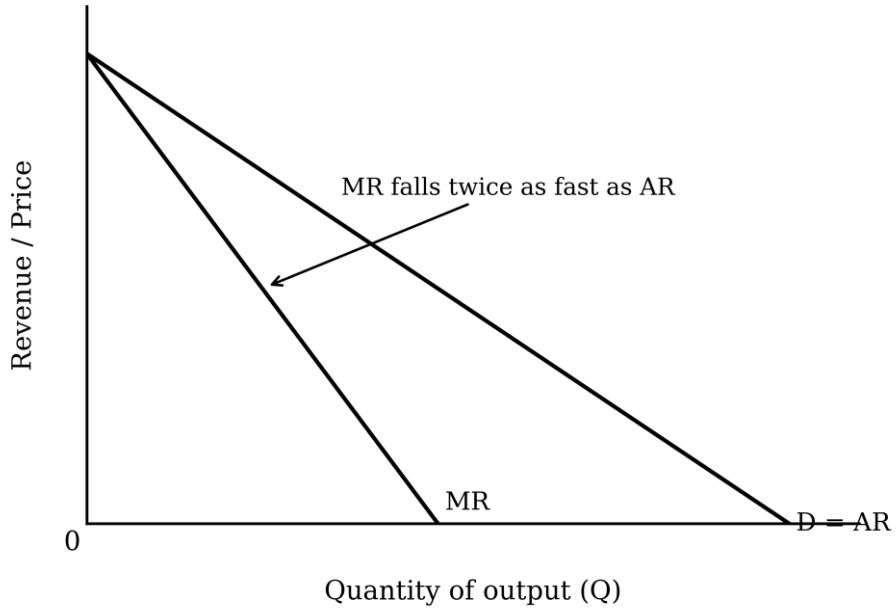


Figure 6.15: *The monopolist's demand and revenue curves*

For a straight line demand curve the halfway rule is exact, so the marginal revenue line can always be put in with a ruler.

The Master Key: *Same intercept, double the slope, half the horizontal distance, and that is the whole of the marginal revenue line.*

BINDER Question 100

Eight rows of arithmetic settle an argument that words rarely finish. Watch the takings climb, hesitate, and then fall away while the price is still comfortably positive.

Complete the revenue schedule for a monopolist facing the demand function $P = 1{,}200 - 100Q$**, and state what it shows about average and marginal revenue.**

Model Answer

Total revenue rises to a peak of TShs 3,600 at six units and then falls, although the price is still positive at every row. Average revenue is the price and falls by TShs 100 a step, while marginal revenue falls by TShs 200 a step, lies below average revenue everywhere, and turns negative after the sixth unit.

Average revenue is the price column: Read the price at each output from the demand function, so three units sell at TShs 900 and six units at TShs 600. That price is also average revenue, since dividing total revenue by quantity gives the price back whenever one price rules.

Quantity Q	Price = AR (TShs)	TR (TShs)	MR (TShs)
1	1,100	1,100	1,100
2	1,000	2,000	900
3	900	2,700	700
4	800	3,200	500
5	700	3,500	300
6	600	3,600	100
7	500	3,500	-100
8	400	3,200	-300

Revenue schedule for the demand function P = 1,200 less 100Q.

Total revenue climbs and then falls: Multiply price by quantity at each row. Total revenue rises from TShs 1,100 at one unit to TShs 3,600 at six, then drops back to TShs 3,500 at seven, because the price cut needed to move the seventh unit costs more than the seventh unit brings in.

Marginal revenue falls twice as fast: Take the difference between each total and the one above it. The steps run TShs 1,100, then 900, 700, 500, 300 and 100, and then minus 100, falling by TShs 200 each time while the price falls by only TShs 100.

$$P = 1{,}200 - 100Q \quad \Rightarrow \quad MR = 1{,}200 - 200Q$$

What the schedule proves: Marginal revenue lies below average revenue at every positive output, and it passes through zero exactly where total revenue peaks. Beyond that output the firm sells more units and takes less money, which is why no monopolist would willingly produce there.

The same shape appears whatever the numbers, because a straight line demand curve always yields a total revenue curve that rises to a peak and comes down again.

The Master Key: *The price column falls by one step and the marginal revenue column by two, and where the second reaches zero the takings are at their highest.*

BINDER Question 101

Elasticity was learned as a property of a demand curve. It is also a statement about the monopolist's next shilling, and the two meanings meet at the top of the total revenue curve.

Derive the relation $MR = P(1 - 1/e)$ **and explain what it says about producing where demand is inelastic.**

Model Answer

Total revenue is price multiplied by quantity, so differentiating that product gives $MR = P(1 - 1/e)$**. When** $e > 1$ **marginal revenue is positive, when** $e = 1$ **it is zero and total revenue stands at its peak, and when** $e < 1$ **it is negative. A monopolist maximising profit therefore never produces where demand is inelastic.**

Differentiate total revenue: Total revenue is price multiplied by quantity, and the price itself depends on quantity, so the product rule is needed. The first term is what the extra unit brings in; the second is what is given up on every unit already being sold.

$$MR = \frac{d(PQ)}{dQ} = P + Q\frac{dP}{dQ}$$

Bring in the elasticity: Factor the price out of both terms. Price elasticity of demand compares the proportionate change in quantity with the proportionate change in price, so what is left inside the bracket is one less the reciprocal of that elasticity.

$$e = -\frac{dQ}{dP} \times \frac{P}{Q} \quad \Rightarrow \quad MR = P\left(1 - \frac{1}{e}\right)$$

Reading the three cases: With $e > 1$ the bracket is positive, so marginal revenue is positive and a price cut raises total revenue. With $e = 1$ the bracket is zero, marginal revenue is zero and total revenue peaks. With $e < 1$ the bracket is negative, so selling more actually reduces total revenue.

Why the inelastic range is never chosen: Suppose output were in the inelastic range. Cutting it back would raise total revenue and lower total cost at the same moment, so profit would rise on both counts. No firm maximising profit leaves that move unmade, so the output chosen always lies on the elastic stretch.

Where the diagram puts it: In figure 6.16 the marginal revenue line crosses the horizontal axis directly beneath the peak of the total revenue curve. Demand is elastic to the left of that output and inelastic to the right, so a monopolist works only in the left half of its own demand curve.

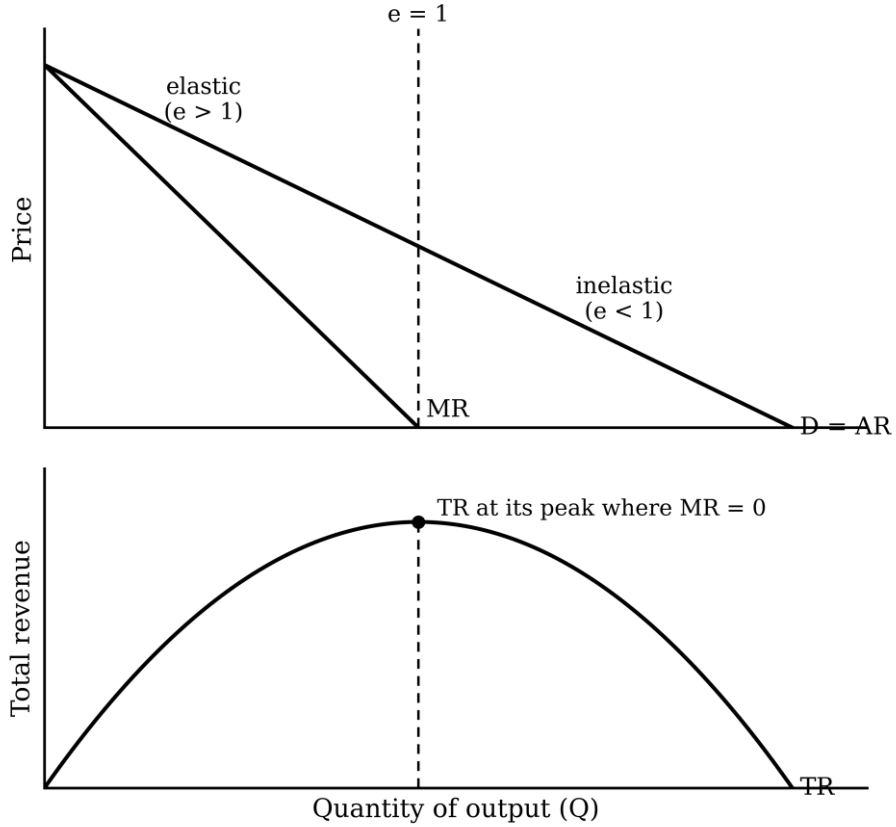


Figure 6.16: *Marginal revenue, elasticity and the peak of total revenue*

Since marginal cost is positive, the firm stops short even of the revenue peak, which places its output strictly inside the elastic range.

The Master Key: *Where demand is inelastic the last unit sold takes money away, so a monopolist never goes there.*

BINDER Question 102

A regulator asks a sole seller for its supply schedule and gets an answer that sounds like evasion. The answer is not evasion. No such schedule exists to be sent.

Explain why a monopolist has no supply curve.

Model Answer

A supply curve pairs each price with the one quantity a firm would offer at it. A monopolist is never handed a price, so it has nothing to answer from: it chooses price and quantity together as a single point on the demand curve. The same output can be sold at different prices, and the same price can go with different outputs, according to how the demand curve lies and how elastic it is, so no unique pairing exists.

What a supply curve requires: A supply curve answers the question of how much a firm would offer at a given price. It exists for a price taker because the price arrives from the market and the firm replies by equating marginal cost to it, so one price yields one quantity.

$$P = MC \quad \Rightarrow \quad q = q(P)$$

The monopolist is never given a price: It faces the whole demand curve and picks a point on it. Output comes from setting marginal cost equal to marginal revenue with marginal cost cutting from below, and the price is then read off the demand curve above that output, so price is an outcome and never a datum.

One output at two different prices: Take a second demand curve that is flatter but still cuts marginal cost through marginal revenue at the very same output. The firm produces exactly as before and charges a different price, so a single quantity is consistent with many prices.

One price at two different outputs: The construction runs equally well in reverse, so a single price is consistent with many quantities. The relation is one to many in both directions, which makes it no function at all, and what is not a function cannot be drawn as a supply curve.

What the monopolist has instead of a curve is a rule, which is to produce where marginal cost equals marginal revenue and cuts it from below.

The Master Key: *A supply curve answers a question about a given price that no monopolist is ever asked.*

REAL Question 103

Ice sells at the Kibirizi landing every day of the year, and the plant that freezes it is the only one for many hours in any direction. Its manager wants to sell every block the plant can make, which is the one thing it should not do.

Calculate total and marginal revenue for the plant described below, and advise the manager on the output at which to stop.

Barafu Bora is the only ice plant at the Kibirizi fish landing in Kigoma, and the nearest alternative supply is many hours away.

The plant can freeze up to eight blocks of ice an hour.

Traders will take one block an hour at TShs 8,000, and each further block an hour requires the price on every block to fall by TShs 1,000.

Once the plant is running, one more block costs about TShs 1,500 to make.

All figures are illustrative and are used only to work the method.

Model Answer

Total revenue peaks at TShs 20,000, reached at both four and five blocks an hour, and marginal revenue falls by TShs 2,000 a block while the price falls by only TShs 1,000. The plant should stop at four blocks an hour and charge TShs 5,000, because the fourth block adds TShs 2,000 against a cost of TShs 1,500 while the fifth adds nothing at all. Freezing all eight blocks would drag the hour's takings back down to TShs 8,000.

The demand function: One block sells at TShs 8,000 and every further block costs TShs 1,000 on the price of all blocks, so the price at any output is TShs 9,000 less TShs 1,000 for each block sold. That price is also average revenue.

$$P = AR = 9{,}000 - 1{,}000Q$$

Total and marginal revenue: Multiply price by quantity along each row and take the differences for marginal revenue. Total revenue climbs to TShs 20,000 and then falls away, while marginal revenue drops by TShs 2,000 at every step and reaches zero between the fourth block and the fifth.

Blocks an hour	Price = AR (TShs)	TR (TShs)	MR (TShs)
1	8,000	8,000	8,000
2	7,000	14,000	6,000
3	6,000	18,000	4,000
4	5,000	20,000	2,000
5	4,000	20,000	0
6	3,000	18,000	-2,000
7	2,000	14,000	-4,000
8	1,000	8,000	-6,000

Revenue for Barafu Bora at Kibirizi; illustrative figures.

Where to stop: Compare marginal revenue with the TShs 1,500 that one more block costs. The smooth marginal revenue line falls to TShs 1,500 at three and three quarter blocks, and since a block is a whole thing, the fourth is the last one worth freezing.

$$\text{MR} = 9{,}000 - 2{,}000\text{Q} = 1{,}500 \quad \Rightarrow \quad \text{Q} = 3.75$$

Why full capacity is the wrong target: The manager's instinct is to fill the plant, but the eighth block requires a price of TShs 1,000 on all eight, which returns takings of TShs 8,000 after eight blocks have been paid for. Capacity sets a limit on output and is never an objective.

The elasticity check: At four blocks the price is TShs 5,000 and elasticity of demand is 1.25, so demand is elastic and marginal revenue is still positive. Beyond four and a half blocks the plant would be in the inelastic range, where selling more takes money away.

Profit is maximised where marginal cost equals marginal revenue and marginal cost cuts marginal revenue from below, and for this plant that is the fourth block.

The Master Key: *A plant that can freeze eight blocks and should sell four has learned the difference between capacity and profit.*

REAL Question 104

A regulator writes to the only electricity supplier in the country asking for its supply curve. The company cannot send one, and the reason has nothing to do with commercial secrecy.

Explain to the regulator described below why the schedule requested cannot be produced, and state what should be asked for instead.

The regulator has written to the national electricity supplier asking for a schedule showing the quantity it would supply at each of several prices.

The supplier is the only firm licensed to distribute to households, and its tariff is set subject to approval.

In the dry season, demand is much less responsive to price, because pumping and milling cannot be postponed.

In the wet season the same customers can switch off pumps and mills, so demand is far more responsive to price.

The firm's marginal cost at the output it chooses is much the same in both seasons.

Model Answer

The schedule cannot be produced because the firm has no supply curve. A supply curve pairs each given price with one quantity, and a price maker is never given a price: it produces where marginal cost equals marginal revenue with marginal cost cutting from below, and then reads the price off the demand curve. The two seasons show why the pairing is not unique, since the same output goes with a higher price when demand is less elastic. What should be requested instead is the cost schedule and the demand estimates.

Why a price taker has a supply curve and this firm has none: A competitive firm is handed a price by the market and replies by producing where marginal cost equals it, which pairs one price with one quantity. The sole seller is handed no price at all, so there is no question of that form for it to answer.

How the output is actually chosen: The firm finds the output where marginal cost equals marginal revenue with marginal cost cutting marginal revenue from below, then takes its price from the demand curve directly above that output. Price is the result of the decision rather than an input to it.

The two seasons prove the point: Take the inelastic dry season demand and the elastic wet season demand, each crossing marginal revenue where marginal cost stands at the same level. The firm supplies the very same units in both seasons and charges more in the dry one, so one quantity goes with two prices.

$$\text{MR} = \text{P}\left(1 - \frac{1}{\text{e}}\right) = \text{MC} \quad \Rightarrow \quad \text{P} = \frac{\text{MC}}{1 - 1/\text{e}}$$

The relation runs one to many both ways: The same construction in reverse gives one price sitting with two different quantities. A supply curve has to be a function of price, and a relation that is one to many in both directions is not a function, so it cannot be drawn.

What should be asked for instead: Request the marginal and average cost schedules, the demand estimate for each season, and the output and price the firm proposes in each. Those are the things that actually decide its conduct, and they are what a tariff review is able to test.

A regulator who understands that no supply curve exists stops hunting for one and starts examining costs and demand instead.

The Master Key: *Ask a price maker what it would supply at a given price and you have asked the one question its behaviour never answers.*

HOT Question 105

The complaint that a monopolist charges whatever it likes is half a compliment and half a mistake. It may name any price on the board, but the buyers still decide how many units will leave at it.

To what extent is a monopolist free to charge whatever price it wishes?

Model Answer

A monopolist may name any price, but it cannot name a price and a quantity together, and that is the whole of the limit. Every price it chooses fixes the quantity buyers will take, so it is picking a point on the demand curve rather than a number out of the air. Since marginal revenue lies below price and has to equal marginal cost, the profit maximising price is one particular price, and it is neither the highest on the curve nor one that leads into the inelastic range.

The demand curve is the constraint: Price and quantity are not two decisions but one. Set a high price and buyers take few units; set a low price and they take many. The firm may pick either variable it likes, and the other is then settled for it by the market.

The highest price is not the best price: At a price so high that buyers take almost nothing, revenue is almost nothing as well, so the very high price destroys the profit it was meant to collect. The objective is maximum profit and not maximum price, and the two sit at quite different places on the curve.

Marginal revenue governs the output: Because $AR > MR$, the firm equates marginal cost to marginal revenue and not to price, with marginal cost cutting marginal revenue from below. The price is then read off the demand curve above that output, which leaves price standing above marginal cost.

The low price end is closed to it: Where $e < 1$, marginal revenue is negative, so an output that large is never chosen. The restriction bites at the cheap end of the curve, since a monopolist will not cut price into the inelastic range and raise its costs while its receipts fall.

Limits arriving from outside: Distant substitutes exist for almost everything, buyers have limited incomes, potential entrants watch the profit, and a regulator may cap the tariff. Each of these flattens the demand curve or cuts it short, and a flatter curve means less power over price.

The judgement: The freedom is genuine but narrow. The monopolist chooses where on the demand curve to stand, which is more than any price taker can do, but the curve itself was drawn by the buyers and the firm has to live somewhere on it.

The monopolist sets the price and the buyers set the quantity, and neither side can do the other's work.

The Master Key: *A monopolist chooses a point on the demand curve, never a price and a quantity.*

HOT Question 106

Two moves that usually pull against each other point the same way when demand is inelastic. Selling less brings in more money and costs less to do, which is why no monopolist stays there for long.

Discuss the proposition that a monopolist never produces where demand is price inelastic, and consider whether it ever fails.

Model Answer

For a firm maximising profit the proposition is a theorem rather than an observation. Where $e < 1$ **marginal revenue is negative, so cutting output raises total revenue and lowers total cost together and profit must rise, and the firm keeps cutting until it is back on the elastic stretch. The proposition fails only where the firm is not maximising profit, where a regulator has fixed the price, or where marginal cost is zero.**

The proof in one line: From $MR = P(1 - 1/e)$, an elasticity below one makes the bracket negative and marginal revenue negative with it. Negative marginal revenue means the last unit sold reduced total receipts, so that unit should never have been produced.

Both blades cut the same way: Reducing output where marginal revenue is negative raises revenue, and since marginal cost is positive it lowers cost as well. Profit rises on both counts at once, so the move is unambiguous and no maximising firm leaves it unmade.

It reaches further than the elastic range: Marginal revenue is zero at unit elasticity, so a firm with any positive marginal cost stops before that point and works strictly inside the elastic stretch. Total revenue is therefore not at its maximum at the profit maximising output, a point that is easily missed.

The case of zero marginal cost: A bridge already built, a broadcast already made, a seat on a train about to leave: the extra unit costs nothing, so the firm produces where marginal revenue is zero and elasticity is exactly one. Even this boundary case does not enter the inelastic range.

Where a regulator fixes the price: A ceiling can compel a utility to sell at a price where demand is inelastic, and a public supplier under an obligation to serve must meet whatever is demanded at the approved tariff. Such a firm is not choosing its own output, so the theorem does not govern it.

Where the objective is not profit: A firm maximising sales revenue stops where marginal revenue is zero, and one maximising output subject only to covering cost pushes well into the inelastic range. The proposition follows from the objective, so change the objective and the proposition goes with it.

Whenever a sole seller appears to be trading in the inelastic range, look for the constraint or the objective that has taken the place of profit maximisation.

The Master Key: *A monopolist in the inelastic range could sell less, take more and spend less, which is why it never stays there.*

Monopoly Equilibrium, Short Run and Long Run

A monopolist chooses its output by exactly the rule that governs every other firm, and then reads its price off the demand curve standing above that output. What changes is what happens next. Nothing can enter to compete a surplus away, so the rectangle a competitive firm would lose in its long run is the rectangle a monopolist keeps. This section works the three positions, and shows why weak demand can still leave a sole seller with a loss.

BINDER Question 107

The only water company in a town may name any price it likes. It cannot make the town buy at that price, and that single fact settles how much it will supply.

State and explain the conditions that must hold before a monopolist is maximising profit in the short run.

Model Answer

A monopolist maximises profit at the output where marginal cost equals marginal revenue and where marginal cost cuts marginal revenue from below. The price is then read off the demand curve above that output, and the position of that price against average total cost decides whether the outcome is supernormal profit, normal profit or a loss.

Marginal cost equal to marginal revenue: while a further unit brings in more than it adds to cost, profit is still climbing. The monopolist stops at the unit where the two are equal, because every unit after it takes more out of the till than it puts in.

$$\pi = TR - TC, \quad \frac{d\pi}{dQ} = 0 \Rightarrow MR = MC$$

Marginal cost cutting from below: the marginal cost curve is U shaped and the marginal revenue line falls, so the two can meet twice. At the earlier meeting marginal cost is still falling and profit is at its worst. Only where marginal cost is rising through marginal revenue is the turning point a peak.

The price is not the marginal revenue: for a price maker average revenue lies above marginal revenue at every positive output, so the quantity is found on the marginal revenue line but the price is taken from the demand curve vertically above it. Reading the price off the wrong line is the commonest way marks are lost here.

$$AR = a - bQ \Rightarrow MR = a - 2bQ, \quad AR > MR \text{ for } Q > 0$$

What the two conditions leave open: they fix the quantity and, through the demand curve, the price. They say nothing whatever about profit. Compare that price with average total cost at the same output and the verdict follows: above it a surplus, level with it normal profit, below it a loss.

Choose the quantity at the margin, read the price off the demand curve, and let average total cost pronounce.

The Master Key: *A monopolist sets the quantity at the margin and lets the demand curve set the price.*

BINDER Question 108

A sole seller with a queue at the gate and a modest cost sheet is looking at the picture every firm would like to own. Its shape is a rectangle.

With the aid of a diagram, show how a monopolist earns supernormal profit in the short run and identify the profit rectangle by its corners.

Model Answer

A monopolist earns supernormal profit when the price read off the demand curve lies above average total cost at the output where marginal cost cuts marginal revenue from below. In figure 6.17 that output is a little over 13 units, the price is about TShs 13.47 against an average total cost of about TShs 8.13, and the surplus is the shaded rectangle CBAP.

Equilibrium at E: the rising arm of marginal cost passes upward through the marginal revenue line at E, and the output beneath that crossing is just over 13 units. Both conditions hold there, so no other quantity can do better.

The price is read at A: carry the vertical from E upward to the demand curve and it meets it at A, at a price of about TShs 13.47. Point E gives the quantity and nothing else; it never gives the price.

Average total cost at B: the same vertical meets the average total cost curve at B, at about TShs 8.13, and the matching cost level on the vertical axis is C. Each unit sold therefore leaves the distance AB, about TShs 5.34, above its full average cost.

The rectangle in money: the surplus a unit multiplied by the output gives the shaded area, worth roughly TShs 70 on the scale of the diagram. Total revenue is the taller rectangle of height P and total cost the shorter one of height C.

$$\text{Supernormal profit} = (P - ATC) \times Q_e \approx (13.47 - 8.13) \times 13.05 \approx 70$$

Why this rectangle is safe: no rival may enter to undercut the price, so the surplus is not a temporary reward for being quick. It is the ordinary position of a protected seller, and figure 6.19 shows the same rectangle still standing after the long run has run its course.

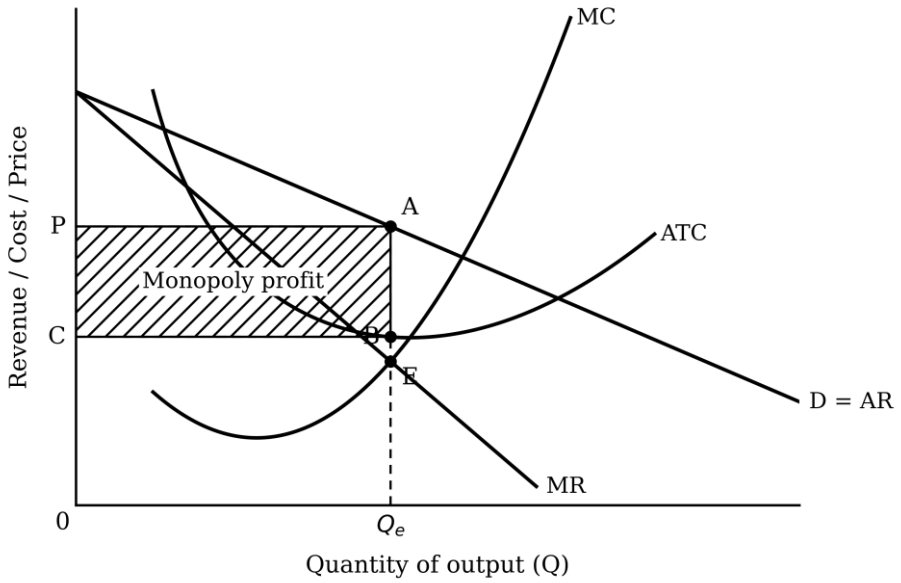


Figure 6.17: *Short-run supernormal profit under monopoly*

Read E for the quantity, A for the price and B for the cost, and the rectangle tells the rest.

The Master Key: *Monopoly profit is the rectangle between the demand curve and the cost curve, standing on the output that the margin chose.*

BINDER Question 109

A sole seller in a thin and poor town may set whatever price it wishes and still end the month behind. Being the only shop is not the same as having customers.

With the aid of a diagram, explain how a monopolist can make a loss in the short run and identify the loss rectangle by its corners.

Model Answer

A monopolist makes a loss when demand is so weak that the price read off the demand curve lies below average total cost at the loss minimising output. In figure 6.18 output settles near 8.6 units, the price is about TShs 7.70 against an average total cost of about TShs 9.87, and the loss is the shaded rectangle PABC.

Weak demand, not high cost: the cost curves are the same as in figure 6.17 and only the demand curve has fallen. It now lies below the average total cost curve at every output, so no quantity at all could have been sold at a profit.

The rule does not change: marginal cost still rises through marginal revenue at E, and the output found there is the one at which the loss is smallest rather than largest. Producing more or producing less would both deepen it.

The rectangle read off: A on the demand curve gives the price, B on the average total cost curve gives the cost, and C is the matching level on the vertical axis. The shortfall of about TShs 2.17 a unit across 8.6 units is the shaded rectangle PABC, worth roughly TShs 19.

$$\text{Loss} = (\text{ATC} - \text{P}) \times \text{Q}_\text{e} \approx (9.87 - 7.70) \times 8.60 \approx 19$$

Why the doors stay open: average variable cost at that output is only about TShs 5.22, so every unit sold hands about TShs 2.48 towards a fixed cost of TShs 40. Closing would save none of that fixed cost and would turn a loss of about TShs 19 into a loss of TShs 40.

Price maker, not demand maker: a monopolist chooses a point on the demand curve and never chooses the curve itself. Asking more than the price at A would only shrink sales further, which is why sole suppliers in poor markets are so often loss makers.

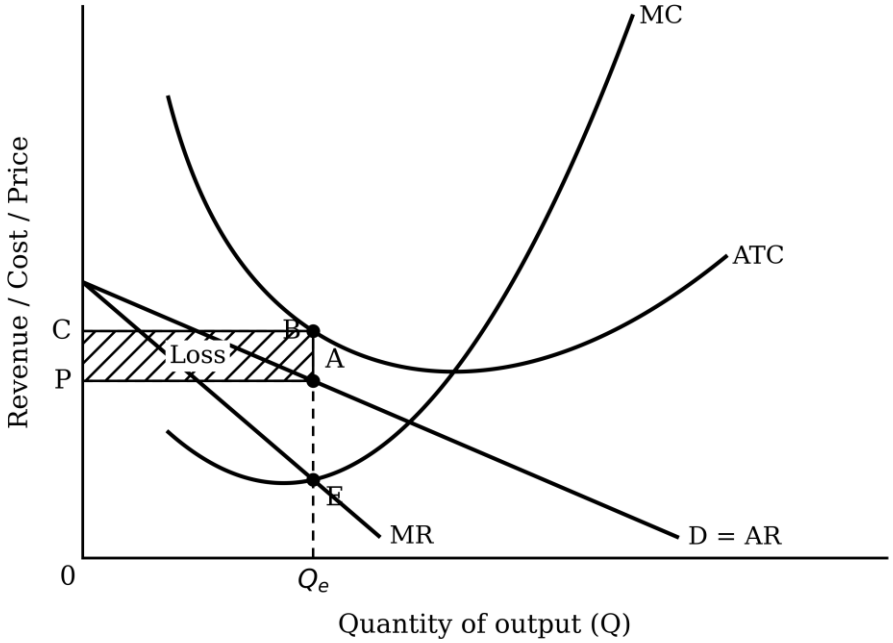


Figure 6.18: *Short-run loss under monopoly*

A single seller governs the price it asks and nothing at all about the willingness to pay.

The Master Key: *Monopoly shelters a firm from rivals, never from a market that cannot afford it.*

BINDER Question 110

Under perfect competition a surplus is a summons: new firms arrive and carry it off. Behind a barrier the summons is never served.

Explain, with the aid of a diagram, why a monopolist can go on earning supernormal profit in the long run, and how this differs from perfect competition.

Model Answer

A monopolist keeps its supernormal profit in the long run because entry is blocked, so no new supply arrives to push the price down towards average total cost. Figure 6.19 is figure 6.17 unchanged: the same output a little over 13 units, the same price near TShs 13.47, the same rectangle of about TShs 70, still standing once the adjustment period has passed.

The same two conditions, the long-run curves: output is set where long-run marginal cost cuts long-run marginal revenue from below, and the price is read off the demand curve above it. Nothing in the rule itself changes with the length of the period.

Why the competitive mechanism never starts: under perfect competition a surplus attracts entry, industry supply rises and price falls until only normal profit is left. A patent, an exclusive licence, control of a raw material or the sheer scale of the plant keeps those entrants out, so the process that would erode the rectangle cannot begin.

The long run is an opportunity here: the monopolist may also rebuild at the plant size that suits its chosen output, which lowers its cost curves. Its long-run profit is therefore at least as large as its short-run profit, and frequently larger.

The profit is still not unlimited: the demand curve has not moved, so the price the chosen output will fetch has not moved either. Charging more would sell less and shrink the very rectangle it was meant to enlarge.

The barrier does all the work: should the patent expire or the licence be opened, entry begins and the rectangle closes exactly as it would in any competitive trade. Long-run monopoly profit is a fact about the barrier rather than about the firm.

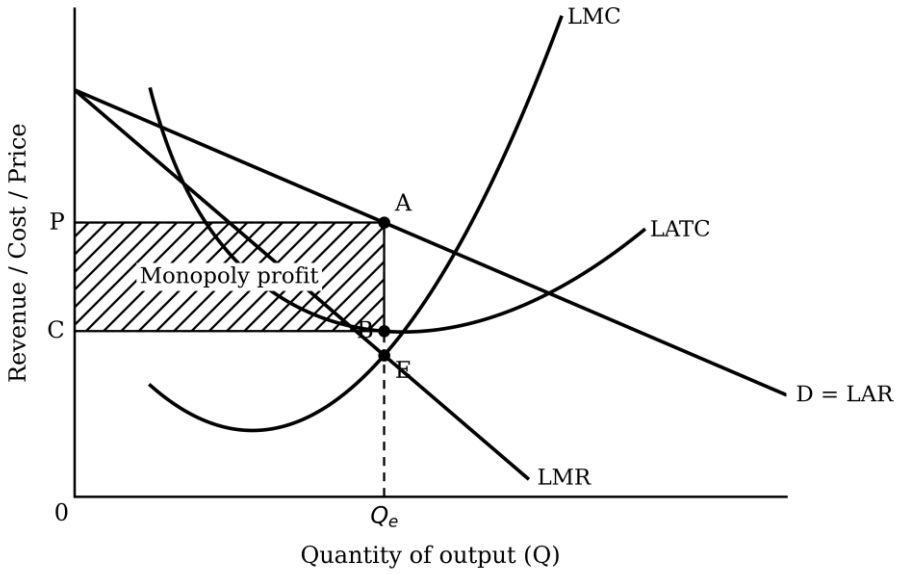


Figure 6.19: *Long-run supernormal profit under monopoly*

Draw figure 6.17 a second time, label it the long run, and the answer is complete.

The Master Key: *Competition removes profit by letting rivals in, so a barrier that keeps them out keeps the profit as well.*

REAL Question 111

The catch comes ashore at Mwanza in the afternoon heat and is worth nothing by morning without ice. There is one plant, and every boat owner knows it.

Calculate the profit-maximising output, price and profit of the ice plant, and show that the price it charges is not the highest price on its schedule.

Mlima Barafu is the only ice plant serving the fish landing at Mwanza.
The nearest alternative plant is a day away by road, so boat owners buy here or lose the catch.
Fixed costs of TShs 80,000 a day are owed whether the plant runs or not.
The day's demand and cost figures are set out in the schedule below.
All figures are illustrative.

Model Answer

The plant maximises profit at five tonnes of ice a day, sold at TShs 65,000 a tonne, and earns TShs 45,000 a day. The fifth tonne adds TShs 45,000 to revenue against TShs 40,000 to cost, while the sixth would add TShs 35,000 against TShs 60,000. The highest price on the schedule, TShs 85,000, would move one tonne and lose TShs 45,000.

Marginal revenue falls faster than price: to move a further tonne the plant must cut the price on every tonne, not only on the last one. At four tonnes the price is TShs 70,000 yet the fourth tonne adds only TShs 55,000, and that gap between average and marginal revenue is what makes a price maker different.

The last tonne worth making: the fifth tonne costs TShs 40,000 and brings in TShs 45,000, so it adds TShs 5,000 to profit. The sixth would cost TShs 60,000 and bring in TShs 35,000, taking TShs 25,000 away again, which is exactly why the plant stops at five.

Both conditions checked: marginal cost falls to TShs 35,000 at the third and fourth tonnes and climbs steadily afterwards, so at five tonnes it is rising through a falling marginal revenue and the turning point is a peak. The profit column agrees, rising to TShs 45,000 and falling away on either side.

The profit rectangle: average total cost at five tonnes is TShs 280,000 divided by five, that is TShs 56,000. The price stands TShs 9,000 above it, and TShs 9,000 across five tonnes is the figure in the last column.

$$\text{Profit} = (65{,}000 - 56{,}000) \times 5 = 45{,}000$$

Why not the highest price: at TShs 85,000 a single tonne would move, revenue would be TShs 85,000 and cost TShs 130,000. A monopolist looks for the widest gap between two totals, and that gap is almost never found at the top of the demand curve.

Nothing arrives to spoil it: a second plant would need a site, a licence and a great deal of capital before it sold a single tonne, so this surplus is not competed away next season as it would be at a maize market.

Tonnes	Price (TShs)	Total revenue (TShs)	Marginal revenue (TShs)	Total cost (TShs)	Marginal cost (TShs)	Profit (TShs)
0		0		80,000		−80,000
1	85,000	85,000	85,000	130,000	50,000	−45,000
2	80,000	160,000	75,000	170,000	40,000	−10,000
3	75,000	225,000	65,000	205,000	35,000	20,000
4	70,000	280,000	55,000	240,000	35,000	40,000
5	65,000	325,000	45,000	280,000	40,000	45,000
6	60,000	360,000	35,000	340,000	60,000	20,000
7	55,000	385,000	25,000	420,000	80,000	−35,000

A day at the ice plant: price, revenue and cost against tonnes of ice.

The plant is free to name any price on the schedule, and only one of them is worth naming.

The Master Key: *A monopolist picks the quantity where the margins meet and accepts whatever price the demand curve then offers.*

REAL Question 112

A treatment works, a pump and eleven kilometres of pipe were laid for a town that turned out smaller and poorer than the plan assumed. The company is the only supplier, and it loses money every month.

Calculate the monthly loss and advise the company whether to keep supplying water while the loss continues.

Tumaini Maji holds the sole licence to pipe treated water to a small town in the Kigoma region.

At the output where marginal cost cuts marginal revenue from below it delivers 30,000 cubic metres a month at TShs 900 a cubic metre.

Chemicals, pumping power and meter reading come to TShs 500 for each cubic metre delivered.

The loan on the treatment works, the licence and the standing staff come to TShs 15,000,000 a month, owed whether the pumps run or not.

All figures are illustrative.

Model Answer

The company loses TShs 3,000,000 a month, since 30,000 cubic metres at TShs 900 bring in TShs 27,000,000 against a total cost of TShs 30,000,000. It should keep supplying, because each cubic metre delivered covers its own variable cost of TShs 500 and hands TShs 400 towards costs that fall due whether the pumps run or not.

The loss in numbers: average total cost is TShs 30,000,000 divided by 30,000, that is TShs 1,000 a cubic metre. The tariff falls TShs 100 short of it, and TShs 100 across 30,000 cubic metres is the monthly loss.

$$\text{Loss} = (1{,}000 - 900) \times 30{,}000 = 3{,}000{,}000$$

Why a sole seller can still lose: the licence keeps rivals out; it does not put money in the townspeople's pockets. The whole demand curve lies below the average total cost curve, so there is no output at which this scheme could have covered its full cost.

The chosen output is still the best one: marginal cost rises through marginal revenue at 30,000 cubic metres, so this is the smallest loss available. Pumping less would surrender contribution and enlarge the loss rather than reduce it.

What closing would cost: shutting the works saves the TShs 15,000,000 of chemicals, power and meter reading but not one shilling of the TShs 15,000,000 owed on the loan, the licence and the standing staff. The monthly loss would rise from TShs 3,000,000 to TShs 15,000,000.

Raising the tariff is not a cure: at a higher price households return to the shallow wells, so revenue falls rather than rises. The tariff already sits at the output where marginal revenue meets marginal cost, and any move away from it makes matters worse.

This answer has a closing date: a loss cannot be carried for ever. In the long run either the tariff is reviewed, or a subsidy is agreed, or the pipes pass to an operator who can run them for less, and that is the standing difficulty of a scheme whose fixed costs dwarf its market.

Advise the company to keep the pumps running this month and to reopen the tariff file before the year ends.

The Master Key: *Go on producing while the price covers the costs that would stop when you stop, monopolist or not.*

REAL Question 113

A groundnut sheller built on the SIDO estate at Morogoro does in a morning what nine women do in a day. The drawings are protected for ten years, and the price shows it.

Explain why the workshop can go on earning supernormal profit year after year, and advise the owner on what will happen when the patent expires.

Kazi Njema Engineering is a workshop on the SIDO estate at Morogoro.
It holds a ten year patent on a pedal driven groundnut sheller of its own design.
It sells 400 shellers a year at TShs 250,000 each, and its average total cost at that output is TShs 160,000.
Four years of the patent remain.
All figures are illustrative.

Model Answer

The workshop earns TShs 36,000,000 a year and keeps it because the patent is a legal barrier no rival may cross, so the surplus never calls forth the entry that would compete it away. When the patent expires the barrier goes with it: copies appear, the demand curve facing the workshop flattens and falls, price is driven down towards average total cost and normal profit is what remains.

The barrier is the whole explanation: the workshop's costs and skill are ordinary. What is not ordinary is the ten year right to be the only maker, and without it nothing about this machine would keep imitators out for a single season.

The rectangle now: at 400 shellers a year the price is TShs 250,000 against an average total cost of TShs 160,000, so each machine leaves TShs 90,000 above full cost and the year leaves TShs 36,000,000.

$$\text{Profit} = (250{,}000 - 160{,}000) \times 400 = 36{,}000{,}000$$

Why the signal goes unanswered: in a trade with free entry a surplus of that size would bring new workshops within two seasons and push the price down. A patent switches the signal off: it is seen by everyone and acted upon by nobody.

What the expiry will do: buyers will gain alternatives, so the curve facing this workshop becomes both lower and more elastic, and the price it can charge falls towards average total cost. The rectangle closes by exactly the mechanism that never operated while the patent held.

Advise the owner on the four years: treat the profit as a fund with a closing date. Spend it on the next design, on a name that outlives the patent and on getting costs below anything a newcomer could reach, so that some advantage survives the barrier.

Normal profit is not ruin: once price settles at average total cost the owner is still paid for labour, capital and risk in full, because those payments sit inside the cost figure. What ends is the surplus above them, not the living.

Advise the owner to count the remaining years as carefully as the shillings.

The Master Key: *Supernormal profit lasts exactly as long as the barrier that protects it and not one season longer.*

HOT Question 114

The word monopoly is used as though it meant a licence to print money. Plenty of sole sellers have gone quietly out of business.

Discuss the claim that a monopolist always earns supernormal profit.

Model Answer

The claim is too strong. Barriers to entry guarantee only that a surplus, once earned, is not competed away; they do not guarantee that any surplus is earned. Profit requires the price read off the demand curve to exceed average total cost at the output where marginal cost cuts marginal revenue from below, and demand, cost or regulation can each prevent that.

What the barriers actually promise: under perfect competition a surplus draws entry until it is gone, so the competitive firm is pushed to normal profit in the long run. A monopolist is spared that mechanism, which is a statement about survival and not about size.

Demand may be too weak: where the whole demand curve lies below the average total cost curve, as in figure 6.18, every possible output makes a loss and the best available choice is the smallest one. Sole suppliers in small and poor markets are in that position constantly.

Costs may be too high: a natural monopoly carrying an enormous plant may find long-run average cost above what buyers will pay at any output at all. The very scale that keeps rivals out is then the thing that makes the business unprofitable.

Regulation caps the rectangle: where a ceiling is imposed the price is no longer chosen freely on the demand curve, and a ceiling set at average cost leaves normal profit by design. A tax on monopoly profit does the same work more quietly.

Time and substitutes erode it: no barrier is permanent. Patents expire, exclusive licences are opened, and a good enough substitute turns a monopoly of the old product into a monopoly of nothing, as any seller of a superseded technology discovers.

The claim also mistakes short run for long: a monopolist may run at a loss for a season while it covers variable cost, exactly as any other firm does, and only leaves when the loss looks permanent. Nothing in the model forbids a bad year to a sole seller.

The defensible version: a monopolist can earn supernormal profit in both the short run and the long run, which no perfectly competitive firm can. That statement is true, and the word doing the work in it is can rather than always.

Being the only seller settles who is allowed to compete, never whether anybody will buy.

The Master Key: *Barriers decide whether profit survives while demand and cost decide whether there is any profit to survive.*

HOT Question 115

Two firms obey the same rule to the letter and finish their long run in completely different places. The rule is not what separates them.

Compare the long-run equilibrium of a monopolist with that of a firm under perfect competition, and examine what accounts for the difference.

Model Answer

Both firms produce where marginal cost equals marginal revenue and cuts it from below, so the rule is identical. The competitive firm ends the long run at normal profit, producing at the lowest point of long-run average cost with price equal to marginal cost, while the monopolist ends it with its supernormal profit intact, a higher price and a smaller output. The whole difference is entry.

The rule is common ground: profit is total revenue less total cost in both structures, so the margin settles output in both. Anyone who explains the difference by giving the monopolist a greedier objective has misread the model rather than understood it.

The revenue side is where they part: the price taker faces a horizontal demand curve, so price, average revenue and marginal revenue are one number. The monopolist faces the market curve, so average revenue exceeds marginal revenue and the price charged always stands above the marginal revenue that was equated to cost.

$$\text{price taker: } P = AR = MR \quad \text{price maker: } AR > MR$$

Entry imposes the competitive result: a surplus attracts firms, industry supply rises, price falls, and the process halts only when price has reached the lowest point of long-run average cost. Normal profit is not chosen by the competitive firm; it is done to it.

Barriers protect the monopoly result: with entry blocked, nothing shifts the demand curve facing the monopolist and nothing pushes the price down. Figure 6.19 is figure 6.17 unchanged, and that identity is the finding rather than an oversight in the drawing.

The efficiency verdict follows: the competitive firm finishes at price equal to marginal cost and at minimum average cost, so it is both allocatively and productively efficient. The monopolist sets price above marginal cost and produces short of the minimum, so it is neither.

One thing the two share: neither is guaranteed to survive. A competitive firm leaves when price stays below average cost, and a monopolist whose demand is too weak leaves for precisely the same reason and by the same test.

What follows for policy: since the barrier does all the work, measures that lower it, opening a licence, refusing a merger or ending an exclusive right, move the outcome towards the competitive one without any change in what the firm is trying to do.

Same rule, different revenue curve, different door.

The Master Key: *The two structures differ not in what firms want but in whether anybody else is allowed to want it too.*

Monopoly by Calculus

Everything the diagrams show can be done with a pen and two derivatives, and it is done faster. Write profit as a function of output, differentiate once and set the result to zero, and the first order condition delivers marginal revenue equal to marginal cost. Differentiate a second time and the second order condition delivers the requirement that marginal cost cut marginal revenue from below. This section builds the method, works two full problems and checks every answer by substituting it back.

BINDER Question 116

The profit curve is a hill. The famous rule about margins is nothing more elaborate than an instruction to stop climbing at the top.

Show that the first order condition for maximum profit is marginal revenue equal to marginal cost, and state the second order condition that must accompany it.

Model Answer

Profit is total revenue less total cost, both written as functions of output. Setting the first derivative to zero gives the first order condition, which rearranges to marginal revenue equal to marginal cost, and requiring the second derivative to be negative gives the second order condition, which guarantees that the turning point is a peak rather than a trough.

Profit as a function of output: choose the quantity and everything else follows: the price comes from the demand curve, revenue from the price and quantity together, and cost from the cost function. Profit is therefore a single curve plotted against output.

$$\pi(Q) = TR(Q) - TC(Q)$$

The first order condition: differentiate and set the result to zero. The derivative of total revenue is marginal revenue and the derivative of total cost is marginal cost, so the condition says the last unit made adds exactly as much to receipts as it adds to costs.

$$\frac{d\pi}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} = MR - MC = 0 \Rightarrow MR = MC$$

The second order condition: a zero derivative marks a top or a bottom without saying which. Requiring the second derivative to be negative selects the top, where profit was rising before the point and falls away after it.

$$\frac{d^2\pi}{dQ^2} < 0$$

What figure 6.20 shows: the upper panel carries total revenue as a hill and total cost as a rising curve, and profit is the vertical gap between them. That gap is widest where the two curves run parallel, which is the first order condition drawn instead of written.

Reading the peak in money: for the firm in that figure the gap opens widest a little above 13 units, where total revenue is about TShs 176 against a total cost of about TShs 106. The lower panel plots the difference, and it peaks at about TShs 70 exactly where its slope is zero.

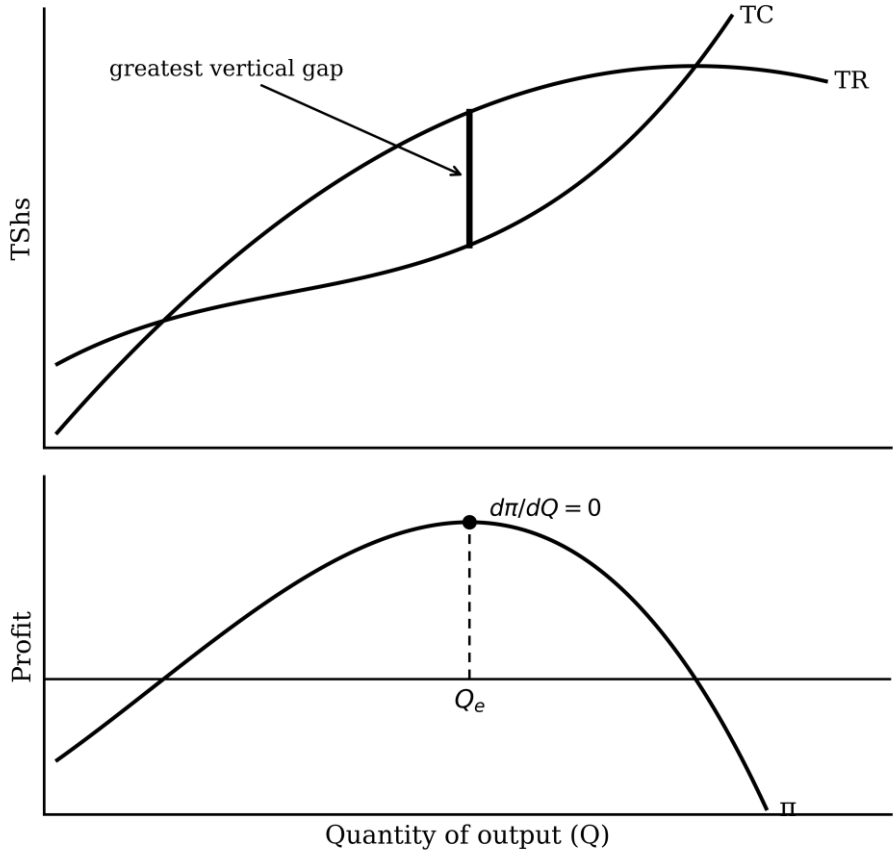


Figure 6.20: *Profit maximisation by the total curves and the profit curve*

One derivative finds the flat spot and the second proves it is the summit.

The Master Key: *Set the first derivative of profit to zero to find the output, then check the second is negative to be sure it is the best one.*

BINDER Question 117

Two sentences that sound nothing alike say precisely the same thing. One is written with a second derivative and the other with the word below.

Show that the second order condition for profit maximisation is the same statement as the requirement that marginal cost cuts marginal revenue from below.

Model Answer

Differentiating profit twice gives the slope of marginal revenue less the slope of marginal cost, so demanding a negative result is demanding that marginal cost be the steeper of the two where they meet. A curve that arrives steeper and passes upward through the one it crosses is a curve cutting from below, so the two statements are one statement.

The second derivative unpacked: the first derivative of profit is marginal revenue less marginal cost, so differentiating a second time gives the slope of marginal revenue less the slope of marginal cost. The condition is a comparison of slopes and nothing more.

$$\frac{d^2\pi}{dQ^2} = \frac{dMR}{dQ} - \frac{dMC}{dQ} < 0 \text{ is the same as } \frac{dMC}{dQ} > \frac{dMR}{dQ}$$

What that looks like on the diagram: marginal revenue for a price maker falls with a slope of minus two b. Marginal cost must therefore be rising, or at the very least falling more gently, so that it passes upward through the marginal revenue line at the crossing.

Why the other crossing is rejected: on the falling arm of a U shaped marginal cost curve the slope is strongly negative, more negative than the slope of marginal revenue, so the second derivative comes out positive. That crossing is a minimum, and moving output away from it in either direction improves matters.

A worked instance: take marginal revenue as 65 less three times output and marginal cost as three times output squared, less 59 times output, plus 115. The second derivative of profit is 56 less six times output, negative above about 9.33 units and positive below, exactly the range over which marginal cost has begun to climb.

$$\frac{d^2\pi}{dQ^2} = (-3) - (6Q - 59) = 56 - 6Q$$

Why both conditions are always demanded: the first condition on its own can land a candidate on the worst output in the diagram, since it is satisfied there too. Stating the second, in either form, is what turns a turning point into an answer.

Write it with a second derivative or write it with a single word, but write one of them.

The Master Key: *The second order condition is the sentence about cutting from below, translated into calculus.*

BINDER Question 118

A price maker who sells one more unit must lower the price on all the others as well. The second derivative of that sentence is where marginal revenue comes from.

Derive, by differentiation, the marginal revenue function of a monopolist facing a linear demand curve, and use it to find the profit-maximising output, price and profit when marginal cost is constant.

Model Answer

From a demand curve of the form average revenue equals a less bQ, total revenue is aQ less bQ squared and marginal revenue is a less 2bQ, so marginal revenue shares the intercept but falls twice as steeply. With average revenue 100 less 2Q and total cost 200 plus 20Q, the profit-maximising output is 20 units, the price is TShs 60 and the profit is TShs 600.

Total revenue from the demand curve: revenue is price multiplied by quantity, and for a price maker the price itself depends on the quantity. Substituting the demand curve into the product gives revenue as a function of output alone.

$$TR = P \times Q = (a - bQ)Q = aQ - bQ^2$$

Marginal revenue by differentiation: differentiate with respect to output. The intercept survives untouched and the slope doubles, so marginal revenue lies below average revenue at every positive output and reaches zero while price is still comfortably positive.

$$\text{MR} = \frac{\text{dTR}}{\text{dQ}} = \text{a} - 2\text{bQ}$$

The condition applied: with average revenue 100 less 2Q, marginal revenue is 100 less 4Q, and constant marginal cost of TShs 20 comes straight from the cost function. Equating them gives an output of 20 units.

$$100 - 4\text{Q} = 20 \Rightarrow \text{Q} = 20$$

Price and profit read off: the price is taken from the demand curve at that output, giving TShs 60, and revenue of TShs 1,200 against a total cost of TShs 600 leaves TShs 600. Average total cost is TShs 30, and TShs 30 across 20 units is the same figure.

$$\pi = 80\text{Q} - 2\text{Q}^2 - 200 = 1{,}600 - 800 - 200 = 600$$

The checks: the second derivative of profit is minus four, comfortably negative, and a flat marginal cost line crossed by a falling marginal revenue line is a cut from below. Elasticity at the chosen point is 1.5, so the answer sits in the elastic range as it must.

Double the slope, equate to marginal cost, and read the price from the demand curve above the answer.

The Master Key: *Marginal revenue keeps the intercept of the demand curve and doubles its slope, which is why price always exceeds marginal cost for a price maker.*

BINDER Question 119

A demand function handed to you the wrong way round has sunk more candidates than any cost curve ever drawn. The repair takes one line.

Explain why a demand function written with quantity as the subject must be inverted before marginal revenue can be found, and show how the inversion is done.

Model Answer

Marginal revenue is the derivative of total revenue with respect to output, so total revenue must first be written as a function of output alone. That requires price to be made the subject of the demand relation. Rearranging quantity equals 40 less 0.02 times price gives price equals 2,000 less 50 times quantity, and only then can revenue be formed and differentiated.

Why the inversion is needed at all: total revenue is price multiplied by quantity. While price is still buried inside an expression for quantity, the product cannot be written in output alone, and a derivative with respect to output has nothing to work on.

The rearrangement itself: move the price term to one side, then divide through by its coefficient. Dividing by 0.02 is the whole of the work, and it is the step at which most of the marks in this part are won or lost.

$$\text{Q} = 40 - 0.02\text{P} \Rightarrow 0.02\text{P} = 40 - \text{Q} \Rightarrow \text{P} = \frac{40 - \text{Q}}{0.02} = 2{,}000 - 50\text{Q}$$

The slope is not the same number: the coefficient on price was 0.02 while the coefficient on quantity is 50, because dividing by 0.02 is multiplying by 50. Copying the 0.02 across is the standard slip, and it turns a very steep demand curve into an almost flat one.

Two checks on the inverted line: at zero output the price is TShs 2,000, which is the price at which the last buyer gives up. At a price of zero the quantity is 40, which is the most that could ever be taken. Both agree with the original relation.

Then the usual machinery: revenue follows from the inverted line and marginal revenue from one differentiation, with the slope doubled as always. The price intercept is shared and the quantity intercept is halved.

$$\text{TR} = 2{,}000\text{Q} - 50\text{Q}^2, \quad \text{MR} = 2{,}000 - 100\text{Q}$$

Turn the function round first and the remainder of the question is arithmetic.

The Master Key: *Marginal revenue is a derivative with respect to output, so make price the subject before you differentiate.*

REAL Question 120

The only hall at Kemondo with a working decoder is showing the match on Saturday. Forty benches, one owner, and an entry fee that nobody in the ward can undercut.

Calculate the profit-maximising entry fee, attendance and profit of the hall, and verify that the second order condition holds.

Mwangaza Hall at Kemondo in Kagera holds the only licence in the ward to screen the match.
Demand for seats is $Q = 40 - 0.02P$, where P is the entry fee in shillings and Q the number of viewers.
Generator fuel, the decoder subscription and the doorman cost TShs 8,000 for the evening, whether anyone comes or not.
Each further viewer costs TShs 4 in a paper ticket and wear on the benches.
All figures are illustrative.

Model Answer

The hall maximises profit at an entry fee of TShs 1,002 with 19.96 viewers, earning TShs 11,920.08, and the second derivative of profit is minus 100, so that output is a maximum. Because viewers arrive in whole numbers the practical answer is 20 viewers at TShs 1,000, worth TShs 11,920, which is eight senti below the theoretical peak.

Invert the demand function: the relation arrives with quantity as the subject, so make the fee the subject before touching revenue. The choke fee is TShs 2,000 and the hall could give away at most 40 seats, both of which agree with the original.

$$Q = 40 - 0.02P \Rightarrow P = 2{,}000 - 50Q$$

Revenue and marginal revenue: revenue is the fee multiplied by attendance, and one differentiation doubles the slope. The fee falls by TShs 50 for each extra viewer while marginal revenue falls by TShs 100, which is the price maker's gap in plain figures.

$$TR = 2{,}000Q - 50Q^2, \quad MR = 2{,}000 - 100Q$$

Cost and the first order condition: total cost is the TShs 8,000 for the evening plus TShs 4 for each viewer, so marginal cost is a flat TShs 4. Equating marginal revenue to it gives an attendance of 19.96.

$$TC = 8{,}000 + 4Q, \quad MC = 4; \quad 2{,}000 - 100Q = 4 \Rightarrow Q = 19.96$$

The second order condition verified: write profit in output alone and differentiate twice. The result is minus 100, safely negative, and it says in another language that a flat marginal cost line is cut by a steeply falling marginal revenue line from below.

$$\pi = 1{,}996Q - 50Q^2 - 8{,}000; \quad \frac{d\pi}{dQ} = 1{,}996 - 100Q; \quad \frac{d^2\pi}{dQ^2} = -100 < 0$$

The answer in money, and checked: the fee is TShs 2,000 less 50 times 19.96, that is TShs 1,002, and profit is TShs 11,920.08. Substituting back confirms it: average total cost is TShs 404.80, and TShs 597.20 a viewer across 19.96 viewers gives the same figure.

$$\pi = 1{,}996(19.96) - 50(19.96)^2 - 8{,}000 = 39{,}840.16 - 19{,}920.08 - 8{,}000 = 11{,}920.08$$

Rounding honestly: 19.96 is not a whole number of people. Twenty viewers at a fee of TShs 1,000 earn TShs 11,920, which is 8 senti short of the peak and is the answer to give. Never round the output and then quote the profit that belongs to the exact root.

Two derivatives, one inversion and a substitution back settle the evening before the match begins.

The Master Key: *Invert, differentiate, solve, and then put the answer back into the profit function before you write it down.*

REAL Question 121

A bookkeeper fits a curve to a year of records and hands the manager an equation. The equation is obedient, which is not the same as being true.

Derive the profit equation in terms of output, determine the output that maximises profit, verify the second order condition, and check the result against the cost figures.

Uwemba Mill is the only maize mill within reach of the villages above Njombe, so growers mill there or carry the crop a day's journey.

A bookkeeper has fitted the mill's records and reports total cost as $TC = Q^3 - 29.5Q^2 + 115Q + 120$.

Average revenue over the same records is $AR = 65 - 1.5Q$.

Output Q is measured in tonnes milled a week and every money figure is in thousands of shillings. All figures are illustrative.

Model Answer

The profit equation is minus Q cubed plus 28Q squared less 50Q less 120. Setting its derivative to zero gives the quadratic 3Q squared less 56Q plus 50, whose roots are about 0.94 and about 17.73 tonnes. The second order condition is positive at the smaller root and negative at the larger, so 0.94 is rejected as a minimum and the profit-maximising output is about 17.73 tonnes a week.

Total revenue from average revenue: average revenue is revenue per tonne, so multiplying it by output gives total revenue. Differentiating that doubles the slope in the usual way.

$$TR = AR \times Q = 65Q - 1.5Q^2, \quad MR = 65 - 3Q$$

The profit equation: subtract cost from revenue and collect terms. The squared terms give 28Q squared because 29.5 less 1.5 is 28, the linear terms give minus 50Q, and the fixed 120 carries through with its sign reversed.

$$\pi = (65Q - 1.5Q^2) - (Q^3 - 29.5Q^2 + 115Q + 120) = -Q^3 + 28Q^2 - 50Q - 120$$

The first order condition: differentiate once and set the result to zero. Dividing through by minus one gives a tidier quadratic, and the formula returns two roots, neither of them a whole number, so both are quoted to two places.

$$\frac{d\pi}{dQ} = -3Q^2 + 56Q - 50 = 0 \text{ that is } 3Q^2 - 56Q + 50 = 0$$

$$Q = \frac{56 \pm \sqrt{2{,}536}}{6} = \frac{28 \pm \sqrt{634}}{3} = 0.94 \text{ or } 17.73$$

The second order condition rejects the smaller root: at 0.94 tonnes the second derivative is plus 50.36, so profit is at a local minimum there and the loss is about 143. At 17.73 tonnes it is minus 50.36, so that root is the maximum. In words, at the smaller root marginal cost is still falling steeply and cuts marginal revenue from above.

$$\frac{d^2\pi}{dQ^2} = -6Q + 56; \quad Q = 0.94 \Rightarrow +50.36 \text{ (minimum)}; \quad Q = 17.73 \Rightarrow -50.36 \text{ (maximum)}$$

The answer in money: at 17.73 tonnes the milling charge is 38.41, about TShs 38,410 a tonne, and the profit equation gives 2,221.90, about TShs 2,221,900 a week. Marginal revenue and marginal cost both come to 11.82 there, which confirms the root.

$$P = 65 - 1.5(17.73) = 38.41; \quad \pi = -(17.73)^3 + 28(17.73)^2 - 50(17.73) - 120 = 2{,}221.90$$

Now check it back: put 17.73 into the cost equation and total cost comes out at about minus 1,541, while the profit exceeds a total revenue of only 680.90. No mill can have a negative total cost. The fitted curve stops behaving like a cost function above about 5.7 tonnes, so the algebra is sound and the equation is not a mill. Report the output, and report the check beside it.

An examiner wants the derivation and the two conditions, and a manager wants to be told that the equation broke.

The Master Key: *Finish every calculus answer by substituting the output back, because a derivative will cheerfully maximise an impossible firm.*

REAL Question 122

A district council wants TShs 11,400 a day from the village mini grid and asks whether to take it on each unit sold or as a flat fee. The calculus answers before the meeting ends.

Show, using calculus, why a levy of TShs 60 on each unit of electricity changes the operator's output and tariff while a flat fee of the same daily value does not.

Nuru Gridi holds the exclusive licence to run the solar mini grid at a village near Mafinga in Iringa.

Demand for electricity is $P = 1{,}400 - 3Q$, where Q is units sold a day.

The battery bank and the metering cost TShs 200 for each unit sold, so marginal cost is constant.

Panels, batteries, the licence and the technician come to TShs 90,000 a day whatever is sold.

All figures are illustrative.

Model Answer

A levy on each unit enters marginal cost and so changes the first order condition: output falls from 200 units a day to 190 and the tariff rises from TShs 800 to TShs 830, which is half the levy. A flat fee is a constant in the profit function and vanishes on differentiation, so output and tariff are untouched and the whole fee comes out of profit.

The position before the levy: marginal revenue falls twice as steeply as the tariff. Equating it to marginal cost of TShs 200 gives 200 units a day at TShs 800, and the second derivative of minus six confirms a maximum.

$$MR = 1{,}400 - 6Q = 200 \Rightarrow Q = 200,\ P = 800,\ \pi = 30{,}000$$

A unit levy raises marginal cost: the levy is paid on every unit sold, so it joins the variable cost and lifts marginal cost from TShs 200 to TShs 260. The first order condition is solved again with the new figure and the answer moves.

$$1{,}400 - 6Q = 260 \Rightarrow Q = 190,\ P = 1{,}400 - 570 = 830$$

Half the levy reaches the consumer: because marginal revenue falls twice as steeply as the tariff, a rise of TShs 60 in marginal cost lifts the tariff by TShs 30. The operator absorbs the other half, which is the general result for a straight demand curve and a constant marginal cost.

What the levy leaves behind: profit falls from TShs 30,000 to TShs 18,300 a day, while the council collects 190 units at TShs 60, that is TShs 11,400. The operator loses TShs 11,700, rather more than the council gains, and consumers lose ten units as well.

A flat fee disappears on differentiation: add a constant to cost and it survives in the profit level but not in the derivative, so the output and the tariff are exactly where they were. Profit is simply TShs 30,000 less the fee.

$$\pi = 1{,}200Q - 3Q^2 - 90{,}000 - F;\ \frac{d\pi}{dQ} = 1{,}200 - 6Q \Rightarrow Q = 200,\ P = 800$$

The advice that follows: for the same TShs 11,400 a day the flat fee leaves 200 units at TShs 800 instead of 190 units at TShs 830, and leaves the operator TShs 18,600 instead of TShs 18,300. A charge that does not touch the margin cannot distort the margin.

Only what varies with output can change the output.

The Master Key: *A tax on each unit moves the margin and therefore the answer, while a lump sum moves the profit alone.*

REAL Question 123

The manager is told to fill the coaches and the accountant is told to raise the profit. On this route they are being sent to two different places.

Calculate the output that maximises total revenue and the output that maximises profit, and advise the manager which of the two targets to set.

Uhuru Coaches holds the only licence on the road from Sumbawanga to Mpanda, and no other operator serves it.

Demand for seats is $P = 50{,}000 - 250Q$, where Q is seats sold a day.

Fuel, the seat levy and passenger insurance come to TShs 10,000 for each seat sold.

Coaches, crews, the depot and the licence come to TShs 900,000 a day whatever is sold.

All figures are illustrative.

Model Answer

Revenue is greatest at 100 seats a day sold at TShs 25,000, and profit is greatest at 80 seats a day sold at TShs 30,000. The manager should set 80. Chasing revenue would add TShs 100,000 to the day's takings and remove TShs 100,000 from the day's profit, because the twenty extra seats cost more to carry than they bring in.

Two different derivatives: revenue is greatest where the derivative of total revenue is zero, that is where marginal revenue is nil. Profit is greatest where the derivative of profit is zero, that is where marginal revenue equals marginal cost. The two coincide only when marginal cost is nothing at all.

$$\frac{\mathrm{dTR}}{\mathrm{dQ}} = \mathrm{MR} = 0 \quad \text{against} \quad \frac{\mathrm{d}\pi}{\mathrm{dQ}} = \mathrm{MR} - \mathrm{MC} = 0$$

The revenue maximising output: marginal revenue falls twice as steeply as the fare and reaches zero at 100 seats. The fare there is TShs 25,000 and the day takes TShs 2,500,000, the most the route can yield.

$$50{,}000 - 500\mathrm{Q} = 0 \;\Rightarrow\; \mathrm{Q} = 100, \quad \mathrm{P} = 25{,}000, \quad \mathrm{TR} = 2{,}500{,}000$$

The profit maximising output: equating marginal revenue to the marginal cost of TShs 10,000 gives 80 seats at a fare of TShs 30,000. Takings fall to TShs 2,400,000 and profit rises to TShs 700,000.

$$50{,}000 - 500\mathrm{Q} = 10{,}000 \;\Rightarrow\; \mathrm{Q} = 80, \quad \mathrm{P} = 30{,}000, \quad \pi = 700{,}000$$

The comparison in money: at 100 seats profit is TShs 600,000 against TShs 700,000 at 80. The last twenty seats bring in TShs 100,000 between them and cost TShs 200,000 to carry, so filling them is a real service to nobody but the seat count.

The elasticity reading: at 80 seats the elasticity of demand is 1.5 and at 100 seats it is exactly one, which is where marginal revenue is nil. A profit-maximising monopolist always stops while demand is still elastic, because a positive marginal cost forces a positive marginal revenue.

Advise the manager: set 80 seats and a fare of TShs 30,000, and treat a revenue target as a trap. Both outputs pass the second order test, since the second derivative is minus 500 in each case, so the difference lies in the objective and not in the mathematics.

A fuller coach and a thinner year are the same decision seen from opposite ends.

The Master Key: *Maximum revenue and maximum profit are different outputs, and only one of them pays the wages.*

HOT Question 124

A derivative does not know what a shilling is. Set it on an impossible firm and it will find the impossible firm's maximum without a murmur.

Examine the checks that should be run on an output obtained by calculus before it is reported as the profit-maximising output.

Model Answer

The first order condition is a piece of arithmetic that returns an answer for any function, sensible or not, and the second order condition tests only the shape of the curve and never its meaning. Before an output is reported it should be tested for the second order condition, for a positive price and cost when substituted back, for the shut-down rule, for elasticity, and for whether it lies inside the range the functions were built to describe.

The second order condition first: a quadratic first order condition has two roots and one of them is always a minimum. Rejecting it by the sign of the second derivative is the cheapest mark in the section and the one most often left on the table.

Put the answer back in: substituting the output into total cost and total revenue takes a moment and catches the impossible. A total cost that comes out negative, or a profit larger than total revenue, means a fitted curve has been pushed far outside the range of output it was built from.

Is the price positive and above average variable cost: an output beyond the choke price returns a negative price, which is nonsense on any diagram. An output where price has fallen below average variable cost is a shut-down, and the profit figure must then be replaced by minus the fixed cost.

Is demand still elastic: marginal cost is positive, so marginal revenue at the optimum must be positive too, which places the answer on the elastic stretch of the demand curve. Any answer beyond the peak of total revenue carries an arithmetic error somewhere behind it.

$$\mathrm{MR} = \mathrm{P}\left(1 - \frac{1}{\mathrm{e}}\right) > 0 \quad \text{is the same as} \quad \mathrm{e} > 1$$

Does the output fit the firm: forty benches in a hall, one shift on one machine, the width of a pipe: a root of 19.96 is comfortable and a root of 400 is not. Capacity is a constraint the derivative was never shown.

Round in the right direction: where the good comes in whole units, test the two whole numbers on either side of the root in the profit function and keep the better one. Quoting the exact peak profit alongside a rounded output is a small dishonesty that a marker will notice.

What the checks are worth: they cost four lines and they turn an answer into an argument. A candidate who reports the output, the sign of the second derivative and one substitution back has done everything a question of this kind can ask for.

The mathematics is never wrong; the mathematics is only obedient.

The Master Key: *A derivative maximises whatever function it is handed, so the last step of every calculus answer is to ask whether that function was a firm.*

HOT Question 125

The same four symbols settle the output of a cotton grower at Kishapu and of the company that lights the whole country. Only one thing between them changes.

Examine the claim that the calculus of profit maximisation is identical in every market structure and that only the revenue side changes.

Model Answer

The claim is very nearly right. Profit is total revenue less total cost in every structure, so the first order condition is always marginal revenue equal to marginal cost and the second order condition is always a negative second derivative. What differs is the demand curve each firm faces, and therefore its marginal revenue function, and that single difference produces almost every contrast drawn between the structures.

The objective and the conditions are common ground: these three lines are written the same way for a price taker, a monopolist, a monopolistic competitor and an oligopolist acting alone. Nothing in them mentions the number of firms in the market.

$$\pi = \mathrm{TR} - \mathrm{TC}; \quad \frac{\mathrm{d}\pi}{\mathrm{dQ}} = 0; \quad \frac{\mathrm{d}^2\pi}{\mathrm{dQ}^2} < 0$$

The price taker's revenue: a horizontal demand curve makes price a constant, so revenue is that constant multiplied by output and the derivative is the price itself. Marginal revenue, average revenue and price collapse into one number and the condition becomes price equal to marginal cost.

$$\mathrm{TR} = \mathrm{P} \times \mathrm{Q} \text{ with P fixed } \Rightarrow \mathrm{MR} = \mathrm{P} = \mathrm{AR}$$

The price maker's revenue: a downward sloping demand curve makes price a function of output, so differentiating the product gives a marginal revenue that falls twice as steeply and lies below price throughout. Price then exceeds marginal cost at the optimum, and that is where allocative inefficiency comes from.

$$\mathrm{TR} = (\mathrm{a} - \mathrm{bQ})\mathrm{Q} \Rightarrow \mathrm{MR} = \mathrm{a} - 2\mathrm{bQ} < \mathrm{AR}$$

Every contrast follows from that one line: a higher price, a smaller output, price above marginal cost and a surplus that survives the long run are all consequences of average revenue exceeding marginal revenue, together with whatever barrier keeps entrants out. Nothing else in the algebra had to change.

Where the claim needs qualifying: an oligopolist's revenue depends on what rivals decide to do, so there is no single marginal revenue function to differentiate. A kinked demand curve gives a marginal revenue that jumps, and at a jump there is no derivative to set to zero at all.

And costs are not quite fixed either: long-run curves replace short-run ones as the period lengthens, and a firm large enough to reach serious economies of scale genuinely owns a lower cost function. The revenue side is not the only thing that moves between one structure and another.

The verdict: as a statement about method the claim holds and is worth carrying into the hall: write profit, differentiate, set to zero, check the sign, read the price off the demand curve. As a statement about economics it survives everywhere except oligopoly.

One method, many demand curves, and the demand curve is the market structure.

The Master Key: *Every structure obeys the same two derivatives, and what separates them is the marginal revenue curve each firm faces.*

Price Discrimination

One good, one seller, one day, and two different prices. Nothing in the cost of supply has moved; only the buyer has changed. This section defines the practice and shows why the clause about cost carries the whole definition, sorts it into its three degrees, sets out the four conditions without which it collapses, and then works the profit rule across two markets in money, so that you can say not merely that the stubborn buyer pays more but exactly how much more and exactly why.

BINDER Question 126

A trader at Mwanjelwa asks a stranger TShs 5,000 for the bunch of bananas she sells her neighbour for TShs 3,500. The bananas were cut from one stem on one morning, and that is the whole of the matter.

Define price discrimination and explain why the qualification that the price difference is unrelated to cost is essential to the definition.

Model Answer

Price discrimination is the sale of the same good or service to different buyers at different prices for reasons unconnected with any difference in the cost of supplying them. The final clause carries the whole weight of the definition, because it is what separates a genuine act of discrimination from the ordinary business of charging more where more has been spent.

The same good, the same seller, two prices: the article must be identical in every respect the buyer cares about, and one seller must be setting both figures. Two rates for the same unit of electricity qualify. A higher fare for a cushioned seat than for a wooden bench does not, because those are two different goods.

Why the clause about cost must be there: without it every price list in the country would count as discrimination. A cement depot charging more at Kigoma than at Dar es Salaam is recovering a lorry fare, not discriminating. Take the cost difference out of any price gap first, and only what survives is discrimination.

The motive is profit, not spite: the seller is chasing willingness to pay. Each buyer is charged as close to what that buyer will bear as the seller can manage, so revenue rises with no change at all in what is produced or in what producing it costs.

It presupposes power over price: a seller who must accept the going price has no second price to offer, because the moment she asks more the buyer walks to the next stall. Price discrimination is therefore a practice of imperfect markets only, and never appears under perfect competition.

Ask of every price gap what the extra shilling actually buys; if the answer is nothing, you are looking at discrimination.

The Master Key: *Different prices are discrimination only when the difference lies in the buyer and never in the cost.*

BINDER Question 127

One monopolist can take your surplus one person at a time, one block at a time, or one group at a time. Which method it uses depends entirely on how much it knows about you.

Distinguish between first, second and third degree price discrimination, giving a Tanzanian example of each.

Model Answer

The three degrees differ in how finely the seller can cut the market. First degree charges every buyer the most that buyer would have paid, second degree charges according to the size of the purchase, and third degree charges one price to each identifiable group. The finer the cut, the more of the buyer's surplus the seller collects.

First degree, buyer by buyer: each unit is sold at the highest price that particular buyer would pay, so no surplus is left on the buyer's side of the counter. Hard bargaining over a carving at Mwenge, where the seller reads the customer before naming a figure, is as near as ordinary trade comes to it.

Second degree, block by block: the price a unit falls as the quantity taken rises, and the buyer chooses the block for himself. A twenty litre tin of cooking oil priced below twenty single litres, and a large data bundle priced below the same megabytes bought singly, both work in this way.

Third degree, group by group: the seller sorts buyers into identifiable groups and sets one price for each group. Child and adult fares on a coach out of Mbeya, resident and non-resident gate fees at a national park, and commercial against domestic tariffs at TANESCO are all of this kind.

What really separates the three: the seller needs more information as the degree rises. Third degree needs only a label on a group, second degree needs the buyer to sort himself by quantity, and first degree needs to know each person's maximum, which is why it is the rarest of the three.

The three are one idea applied at three levels of knowledge about the person paying.

The Master Key: *First degree knows the person, second degree knows the quantity, and third degree knows only the group.*

BINDER Question 128

A shopkeeper who tries two prices for the same sugar soon finds the cheap buyer standing outside with a bucket, reselling to the dear one. Discrimination has conditions, and most attempts at it fail them.

State and explain the conditions necessary for a firm to practise price discrimination successfully.

Model Answer

Four conditions must hold together: the firm must be a price maker facing a downward sloping demand curve, the two markets must be separable with no resale between them, the buyers in each must differ in their elasticity of demand, and buyers must not know what is charged in the other market. Fail any one of the four and the two prices collapse into one.

The firm must be a price maker: it needs a downward sloping demand curve, so that raising the price loses some buyers but not all of them. A price taker faces a horizontal line at the going price and can charge nothing else, which is why discrimination is never found in a perfectly competitive market.

The markets must be separable and resale impossible: if a unit bought in the cheap market can be carried into the dear one and sold again, the two prices converge and the scheme dies. Metered water, current down a wire and a ticket checked against a face at the gate are safe; sugar in sacks is not.

The groups must differ in elasticity of demand: if both groups respond to a price change in the same way, one price is best for both and splitting the market gains nothing. It is precisely the difference in elasticity that makes two prices more profitable than one, and it decides which group gets which.

Buyers must not know the other price: a buyer who learns of the cheaper market will demand the same terms or find a way into it. The seller therefore keeps the two price lists apart, which is far easier across a border, a season or a meter class than across a single counter.

Every one of the four is really the same condition: the seller must keep the two markets from ever meeting.

The Master Key: *No price-making power, no separation, or no difference in elasticity means no discrimination.*

BINDER Question 129

Two panels, two demand curves, and one flat cost line running straight through both of them. Where that line meets each marginal revenue curve, the whole pricing policy of the firm is settled.

With the aid of a diagram, show how a monopolist supplying two separated markets from one plant arrives at a different price in each.

Model Answer

The monopolist treats the plant as one and the markets as two. It divides output so that marginal revenue is the same in both markets and equal to marginal cost, which is the rule $\mathrm{MR}_1 = \mathrm{MR}_2 = \mathrm{MC}$, and then reads the price for each market off that market's own demand curve. Because the two demand curves differ in slope, the two prices differ, and the inelastic market carries the higher one.

What the two panels of figure 6.21 show: the left panel carries the steep, inelastic demand curve with its marginal revenue curve below it, and the right panel the flatter, elastic pair. One horizontal marginal cost line runs across both panels, because one plant supplies both markets and the last unit costs the same wherever it goes.

The rule that splits the output: units are allocated until the last one sent to either market adds the same amount to revenue, and that amount equals marginal cost. Profit is maximised where marginal cost equals marginal revenue and cuts it from below, which a horizontal cost line against a falling marginal revenue line satisfies at once.

Reading the two prices off the diagram: drop a line from each intersection to the horizontal axis to find the quantity, then carry it up to that market's demand curve and across to the vertical axis to find the price. The steep panel yields a high price on a small quantity, the flat panel a lower price on a larger one.

Why the inelastic market pays more: marginal revenue equals $\mathrm{MR} = \mathrm{P}(1 - 1/\mathrm{e})$, so with marginal cost the same in both markets the group with the smaller elasticity must sit at the higher price for its marginal revenue to come down to the common level. The elastic market always gets the lower price.

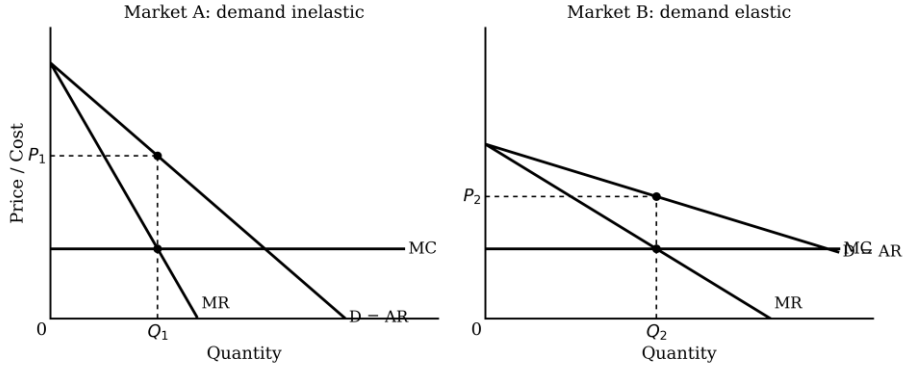


Figure 6.21: *Third-degree price discrimination across two markets*

One plant, one marginal cost, and two marginal revenue curves brought down separately to meet it.

The Master Key: *Split the output until the last unit earns the same in both markets, then let each demand curve name its own price.*

BINDER Question 130

Under a single price the buyer who would gladly have paid double keeps the difference and walks away pleased. Perfect discrimination is the art of leaving him nothing, and it enlarges the market while doing so.

Explain, with the aid of a diagram, what perfect price discrimination does to consumer surplus and to the level of output.

Model Answer

Perfect price discrimination transfers the whole of consumer surplus to the seller, and at the same time raises output to the level at which price equals marginal cost. The outcome is therefore allocatively efficient, which a single price monopoly is not, and distributionally severe, because every shilling of the buyers' gain has become the seller's profit. Both halves of that verdict must be stated.

Consumer surplus under a single price: at one price the area between the demand curve and the price line is surplus, the extra that buyers would have paid and did not have to. In figure 6.22 it is the triangle above the price line and below demand, and it belongs to the buyers.

The perfect discriminator takes that triangle: charging each buyer the maximum that buyer would pay turns every point on the demand curve into a price actually paid. The triangle is not destroyed but transferred, and the demand curve itself becomes the seller's marginal revenue curve, because a further sale no longer forces down the price of earlier units.

Output rises until $P = MC$**:** with marginal revenue now equal to price, the seller keeps selling until price meets marginal cost. Buyers priced out under the single price are served, output is larger, and the deadweight loss that the single price monopoly created disappears entirely.

Efficient and severe at the same time: the last unit produced is worth exactly what it cost to make, which is the test of allocative efficiency. Yet no buyer keeps any gain from trade whatever, so the entire benefit of the enlarged market rests with the seller.

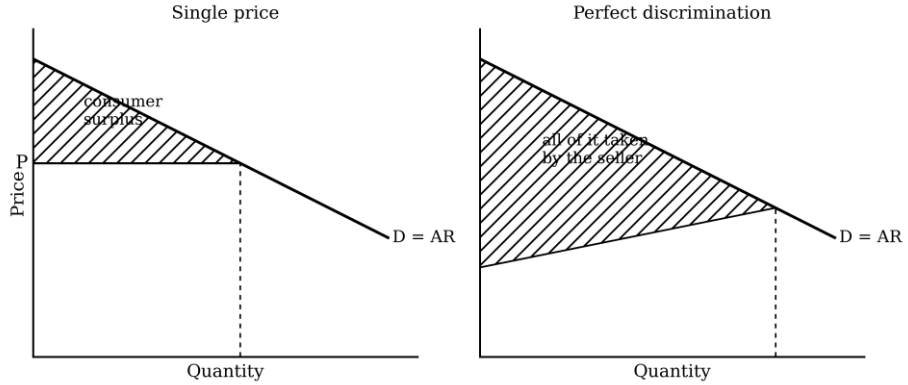


Figure 6.22: *A single price against perfect price discrimination*

Efficiency and fairness part company here more sharply than anywhere else in the subject.

The Master Key: *Perfect discrimination cures the monopoly's output problem and makes its distribution problem total.*

REAL Question 131

Two meters, two tariffs, one reservoir. The lodge on the main road pays more for a unit of water than the household behind it, and not one shilling of the gap is explained by the pipe.

Calculate the profit-maximising price and quantity in each market, and show which market ends up paying more and why.

Chemchemi Maji is the sole piped-water supplier on the town scheme at Njombe.
Every connection is metered under a named account, and water cannot be moved from one meter to another.
Commercial connections, mainly lodges and small processors, face the demand curve $AR_1 = 900 - 3Q_1$.
Domestic connections face the demand curve $AR_2 = 600 - 2Q_2$.
Prices are in TShs a unit and quantities in thousands of units a month.
Marginal cost is constant at TShs 120 a unit, whichever meter the water passes through.
All figures are illustrative.

Model Answer

Equating marginal revenue to marginal cost market by market gives 130 thousand units at TShs 510 to the commercial connections and 120 thousand units at TShs 360 to the domestic ones, a total of 250 thousand units. The commercial market pays the higher price because its demand is the less elastic of the two, and the common marginal cost of TShs 120 is what binds the two answers together.

Marginal revenue in each market: with a straight line average revenue curve the marginal revenue curve keeps the same intercept and doubles the slope, so both marginal revenue curves follow at once from the two demand curves.

$$\mathrm{MR}_1 = 900 - 6\mathrm{Q}_1 \quad \mathrm{MR}_2 = 600 - 4\mathrm{Q}_2$$

Equating each to the common marginal cost: profit is maximised where marginal cost equals marginal revenue and cuts it from below, and a horizontal cost line against a falling marginal revenue line meets both conditions. Solving each market on its own splits the total output.

$$900 - 6\mathrm{Q}_1 = 120 \Rightarrow \mathrm{Q}_1 = 130 \quad 600 - 4\mathrm{Q}_2 = 120 \Rightarrow \mathrm{Q}_2 = 120$$

Reading the two prices: substitute each quantity back into its own average revenue curve, never into the marginal revenue curve, because price is what the buyer hands over while marginal revenue is what the seller gains from the last unit alone.

$$\mathrm{P}_1 = 900 - 3(130) = 510 \quad \mathrm{P}_2 = 600 - 2(120) = 360$$

The check on elasticity: at these points elasticity is 17 over 13, about 1.31, in the commercial market and exactly 1.5 in the domestic one. Substituting each into $\mathrm{MR} = \mathrm{P}(1 - 1/\mathrm{e})$ returns TShs 120 in both, so the rule $\mathrm{MR}_1 = \mathrm{MR}_2 = \mathrm{MC}$ holds exactly and the less elastic market carries the higher price.

$$510\left(1 - \frac{13}{17}\right) = 120 \quad 360\left(1 - \frac{2}{3}\right) = 120$$

What the split is worth: the two prices bring in TShs 109,500,000 a month. The best single price the firm could set is TShs 420, which on the same 250 thousand units brings in TShs 105,000,000, so discrimination adds TShs 4,500,000 for no extra cost at all.

Why no unit should be moved across: the last unit in each market earns exactly TShs 120. Move one across and the market losing it gives up more than the market receiving it gains, so revenue falls whichever way the unit travels. That is what makes the split an equilibrium rather than a guess.

Market	Demand	Marginal revenue	Output (thousands)	Price (TShs)	Elasticity there
Commercial	$\mathrm{AR}_1 = 900 - 3\mathrm{Q}_1$	$\mathrm{MR}_1 = 900 - 6\mathrm{Q}_1$	130	510	1.31
Domestic	$\mathrm{AR}_2 = 600 - 2\mathrm{Q}_2$	$\mathrm{MR}_2 = 600 - 4\mathrm{Q}_2$	120	360	1.50
Both at one price	$\mathrm{AR} = 720 - 1.2\mathrm{Q}$	$\mathrm{MR} = 720 - 2.4\mathrm{Q}$	250	420	1.40

The two markets solved separately against a common marginal cost of TShs 120 a unit, with the single price alternative underneath.

The reservoir sends out the same 250 thousand units either way, so the two tariffs settle only who receives the water and who keeps the gain.

The Master Key: *Bring every market down to the same marginal cost, and the buyer who cannot do without is left holding the higher price.*

REAL Question 132

A workshop at Makoroboi and the house behind it draw current from one wire and one power station, and they are billed at different rates for it. The reason is nowhere in the cable.

Explain how TANESCO should set the price of electricity for its two groups of customers, state which group will be charged more and why, and set out the conditions that make the practice possible.

TANESCO is the sole supplier of grid electricity in Tanzania.

Its customers fall into two groups, commercial users and domestic users.

The company charges the two groups different rates for the same unit of electricity.

Assume the aim of the company is to maximise profit.

Assume a unit costs the same to generate and deliver whichever meter it passes through.

Model Answer

TANESCO should treat the two groups as separate markets and divide output so that marginal revenue in each equals the common marginal cost, then read each rate off that group's own demand curve. Commercial users will be charged the higher rate, because their demand for power is the less elastic of the two. The practice is possible only because the markets are separable, resale down a metered wire is impossible, the elasticities differ, and neither group bargains over the other's tariff.

How the rate for each group is found: the company does not set one national price. It allocates units between the two groups until the last unit sold to each adds the same amount to revenue, and that amount equals the marginal cost of generating and delivering it.

$$\mathrm{MR}_{\mathrm{commercial}} = \mathrm{MR}_{\mathrm{domestic}} = \mathrm{MC}$$

Why commercial users are charged more: a workshop cannot run its lathes on charcoal, and power is a small part of what it charges its own customers, so a higher tariff barely reduces the units it draws. A household can switch off a light, cook on charcoal or move to a solar panel, so its demand falls away far faster when the rate rises.

The elasticity rule behind that answer: marginal revenue equals $\mathrm{P}(1 - 1/\mathrm{e})$, so bringing both markets down to one marginal cost requires the market with the smaller elasticity to sit at the higher price. The elastic group receives the lower rate, and never the other way about.

The company must be a price maker: TANESCO faces the market demand curve for grid power with no rival to undercut the dear market, so it can name two rates and hold them. A supplier obliged to take a going price could not, which is why discrimination is absent from competitive trades.

Separation and the impossibility of resale: every customer is metered under a named account in a tariff class fixed at connection, and the class follows the use of the premises rather than the wish of the occupant. No household can buy cheap units and sell them on to the workshop, because current cannot be lifted off one meter and put onto another.

What the practice is worth to the country: the heavy fixed cost of generation and lines has to be carried somewhere. Recovering more of it from the group that will pay allows domestic connections to be priced nearer to marginal cost, so households are served who could not be served at a single average rate.

The current is identical; only the willingness to pay differs, and the tariff simply reads that difference off the meter class.

The Master Key: *Same wire, same cost, two tariffs, and the group that cannot do without electricity pays the higher one.*

REAL Question 133

A hotel at Nungwi keeps four different prices for what looks like one room and calls all four of them business. Only two are price discrimination, and sorting them is the whole exercise.

Identify which of the hotel's four practices amount to price discrimination and which do not, giving reasons in each case.

Bahari Njema is a small hotel at Nungwi in Zanzibar.

A standard room costs the hotel the same amount to run on any night of the year.

The standard room is let at TShs 90,000 a night in the low season and TShs 210,000 a night in the high season.

Within either season a resident of Tanzania is charged TShs 60,000 a night less than a visitor from abroad for the same room.

A room facing the sea is let at TShs 40,000 a night above an otherwise identical room facing the garden.

A guest booking seven nights pays TShs 15,000 a night less than a guest booking one night.

Turning a room over between guests costs the hotel TShs 7,000 in laundry and cleaning.

All figures are illustrative.

Model Answer

Two of the four are price discrimination and two are not, or not entirely. The season rate and the residence rate are third degree discrimination, since the same room on the same terms is sold to different groups at different prices for reasons that have nothing to do with cost. The sea view supplement is not discrimination at all, and the weekly rate is second degree discrimination only in the part of it that exceeds the changeover cost the hotel saves.

The season rate is third degree discrimination: the same bed, the same staff and the same breakfast cost no more in the high season than in the low, yet the rate more than doubles. What changes is elasticity: the high season visitor turned away has nowhere else on the coast to go, so the price rises with the group's willingness to pay.

The residence rate is third degree discrimination: residence is checked at the desk against a document and the booking cannot be transferred, so the two markets are sealed. A visitor from abroad has already paid the airfare and will not abandon the trip over a room rate, so that demand is the less elastic and carries the higher price.

The sea view supplement is not discrimination: here the buyer pays more and receives more. A room facing the sea is a different good, not the same good at a second price, and the definition requires the good to be identical. Apply the test and the answer is plain: the extra shilling buys the sea.

The weekly rate is second degree, but only in part: the price a night falls as the quantity taken rises and the guest sorts himself into the block, which is the shape of second degree discrimination. Seven nights avoid six changeovers worth TShs 42,000, or TShs 6,000 a night, so of the TShs 15,000 discount only TShs 9,000 is discrimination.

Why the distinction is worth the trouble: a price gap that merely recovers a cost is ordinary trade and no regulator would look at it twice. A gap still standing after every cost difference has been stripped out is a transfer from the buyer's surplus into the seller's profit, and that is exactly what the definition was built to catch.

Ask of each price gap what the extra shilling buys; the sea view has an answer and the calendar has none.

The Master Key: *Take the cost difference out of every price gap first, and whatever is left standing is the discrimination.*

HOT Question 134

Price discrimination takes money from buyers who have no way of refusing. It also keeps routes running, clinics lit and small connections cheap that a single price would never have supported at all.

Discuss whether price discrimination by a monopolist should be regarded as against the public interest.

Model Answer

It should not be condemned outright. Price discrimination works against the public interest where it merely transfers the buyers' surplus into profit, pushes the dear market further from $P = MC$ and burns real resources on policing the boundary. It works for the public interest where the revenue it raises brings into existence a service that no single price would sustain. The verdict turns on what the extra revenue does and on who is left paying the higher price.

It raises revenue and can save the service: some undertakings carry very heavy fixed costs against a demand that no single price will cover. Splitting the market lets the seller collect more from those who value the service most, and the total may cross the line into viability. Without discrimination the service may simply not exist.

It can extend supply to those with least: if the high rate on one group carries the fixed cost, the other group can be served at little above marginal cost. A rural connection, a child's fare and a resident's gate fee are each made possible by somebody else being charged more.

Against that, consumer surplus is transferred: every shilling of the higher price is a shilling some buyer would otherwise have kept. The transfer itself creates nothing, and the buyers in the inelastic market are precisely those least able to walk away from the counter.

Allocative inefficiency in the dear market: wherever price exceeds marginal cost, units worth more to buyers than they cost to make go unproduced. Third degree discrimination lifts the price in the inelastic market above the single price, so that market is left further from allocative efficiency than it was before.

The cost of keeping the markets apart: meters, identity checks, ticket inspection and separate billing all absorb labour and capital. That administration is a genuine loss to society rather than a transfer between two parties, and it has to be set against whatever the scheme achieves.

The awkward case of the poorer buyer: nothing in the rule makes the rich the inelastic group. A household with no alternative to the single village shop, or a patient with no second hospital within reach, may be charged the higher price precisely because it has nowhere else to go.

The verdict: judge each scheme by its effect and never by its name. Where the higher price funds a service the poorer group could not otherwise have, permit it and watch the margin. Where it simply harvests captive buyers, regulate it.

The same practice can be a lifeline or a levy, and only the facts of the particular case decide which.

The Master Key: *Ask who is trapped and where the extra revenue goes, and those two answers settle the argument.*

HOT Question 135

The standard complaint against monopoly is that it produces too little. Perfect price discrimination removes that complaint completely, and almost nobody is pleased about it.

To what extent is perfect price discrimination preferable to a single price monopoly?

Model Answer

It is preferable on the efficiency test and worse on every distributional test, so the answer depends entirely on which test is being applied. Perfect discrimination lifts output to the point where price equals marginal cost and so removes the deadweight loss the single price monopoly creates, but it achieves this by taking the whole of consumer surplus, leaving buyers with no gain from trade at all.

The case on output: a single price monopolist holds output back because selling one more unit forces the price down on every unit. A perfect discriminator pays no such penalty, since each unit is sold at its own price, so its demand curve is its marginal revenue curve and it sells on until price meets marginal cost.

The deadweight loss disappears: under a single price the units between the monopoly output and the competitive output are worth more to buyers than they cost to produce, and none of them is made. Perfect discrimination makes every one of them, so the total surplus generated is as large as it can possibly be.

But the whole of that surplus is the seller's: the triangle buyers kept under a single price is collected, and so is the triangle that used to be lost to everybody. Each buyer pays exactly what the unit is worth to him and is left indifferent between buying it and going without.

Efficiency and equity give opposite answers: on the test of allocative efficiency, P = MC, perfect discrimination passes and the single price monopoly fails. On any test of distribution the ranking reverses completely, because under a single price at least some buyers keep something for themselves.

It is close to impossible in practice: knowing every buyer's maximum requires information no seller has, and the buyer has every reason to conceal it. Real attempts, from bargaining at a carvers' stall to a doctor charging what the patient appears able to bear, are rough approximations that leave some surplus behind.

Where it might still be defended: an undertaking whose average cost falls across the whole range of demand cannot cover its costs at a price equal to marginal cost. Allowing it to discriminate can keep it alive without a subsidy, and a market served with no surplus beats a market not served at all.

The extent of the answer: preferable in the narrow sense that output and total surplus are both larger, and not preferable in any sense a buyer would recognise. State both halves or the answer is only half given.

An efficient outcome and a fair one are different questions, and this is the case that proves they can point opposite ways.

The Master Key: *Perfect discrimination bakes society the largest possible cake and hands every crumb of it to the seller.*

HOT Question 136

A seed cotton grower at Kishapu accepted two different figures from two buyers on the same morning. An advocate in Mwanza charges two clients differently for the same hour of advice. Only one of them is discriminating.

Examine the view that only a monopolist can practise price discrimination.

Model Answer

The view is half right. Power over price is genuinely necessary, so a price taker cannot discriminate under any circumstances whatever, but that power does not require a pure monopoly: firms under monopolistic competition and oligopoly hold quite enough of it to sustain two prices. A great deal of what looks like discrimination, moreover, is a difference in cost or in the good itself, and so is not discrimination at all.

Why a price taker cannot discriminate: a seller facing a horizontal demand curve at the going price loses every buyer the moment she asks for more, and gains nothing by asking less, since she can already sell her whole crop at the going price. No second price is available to her.

The grower's two figures are not discrimination: a grower at Kishapu who receives two prices in one morning is watching the market price move, or is selling two grades, or is saving one buyer a lorry journey. Each of those is a difference in cost or in quality, and the definition excludes both.

But monopoly is not required either: what is required is a downward sloping demand curve, and every imperfectly competitive firm has one. An advocate, a hotel, a private school and a coach operator all face buyers who will not all leave at once when the price is raised, and each can therefore run two prices.

Discrimination is common outside monopoly: differentiated products give each seller a small captive following, and that following is power enough. Coach operators price by season, mobile networks price by bundle size, and hotels price by the passport at the desk, and not one of them is a monopolist.

What monopoly really adds is durability: with no rival able to undercut the dear market, a monopolist can hold its price gap indefinitely. A firm in monopolistic competition finds its high price attacked by entry, so its discrimination is narrower, smaller and shorter lived, though it is discrimination nonetheless.

The condition that actually binds: separation, not monopoly, is the scarce ingredient. Any seller who faces a sloping demand curve and can stop the cheap buyer reselling to the dear one may run two prices; any seller who cannot will watch the two prices collapse into one, whatever its share of the market.

Market power is the entry ticket to the practice, and a monopoly seat merely makes it comfortable.

The Master Key: *A price taker can never discriminate, but a discriminator need not be a monopolist.*

Monopoly Judged: Welfare Loss and the Balance Sheet

Everything so far has shown what a monopolist does. This section asks what it costs. Put the monopoly outcome beside the competitive outcome on one diagram and the harm separates cleanly into two parts that are almost always confused. One part is a rectangle of money that changes hands, which is a question about who gets what. The other is a triangle of trades that now never happen at all, which is a question about how much there is altogether. Only after that separation is the balance sheet worth drawing up, because a seller whose very size lowers the cost of production has something real to set against the triangle.

BINDER Question 137

The monopolist's profit is usually named as the harm monopoly does. It is not. Those shillings are still in the country. The harm is a wedge of trade that would have been worth making and that nobody now makes.

Define consumer surplus and producer surplus, and with the aid of a diagram show what happens to each when a competitive industry passes into the hands of a single seller.

Model Answer

Consumer surplus is what buyers would have paid less what they did pay, and producer surplus is receipts less marginal cost; when a competitive industry falls into one pair of hands, output is cut back from where $\mathrm{P} = \mathrm{MC}$ **to where** $\mathrm{MC} = \mathrm{MR}$**, consumer surplus shrinks, a rectangle of it passes to the seller as profit, and a triangle between them is lost to everybody.**

Consumer surplus: what a buyer would have been willing to pay, less what the buyer actually paid. Each unit along the demand curve is worth its own height to somebody, yet all sell at one price, so the buying side's gain is the area beneath demand and above the price.

$$\text{Consumer surplus} = \text{area under } \mathrm{D} \text{ and above } \mathrm{P}$$

Producer surplus: the receipts on a unit less what that unit cost to make. Since marginal cost measures the cost of the last unit, the selling side's gain is the area above the marginal cost curve and below the price.

$$\text{Producer surplus} = \text{area above } \mathrm{MC} \text{ and below } \mathrm{P}$$

What the single seller changes: a competitive industry produces where price equals marginal cost, at $\mathrm{Q_c}$ and $\mathrm{P_c}$. The single seller equates marginal cost with marginal revenue instead, and marginal revenue lies below average revenue, so it stops short at $\mathrm{Q_m}$ and reads a higher price off the same demand curve.

$$\mathrm{Q_m} < \mathrm{Q_c} \qquad \mathrm{P_m} > \mathrm{P_c} = \mathrm{MC}$$

The rectangle that is transferred: on every unit still sold, buyers now pay more than before. That rectangle was consumer surplus and is now the monopolist's profit. Nothing has been destroyed. The money has changed pockets, and whether that matters is a question about fairness, not efficiency.

$$\text{Transfer} = (\mathrm{P_m} - \mathrm{P_c}) \times \mathrm{Q_m}$$

The triangle that is destroyed: between $\mathrm{Q_m}$ and $\mathrm{Q_c}$ every unit was worth more to a buyer than it cost to produce, and none is now produced. The triangle between demand and marginal cost over that range goes to nobody. That is the deadweight welfare loss.

$$\text{Deadweight loss} = \mathrm{tfrac12}(\mathrm{P_m} - \mathrm{P_c})(\mathrm{Q_c} - \mathrm{Q_m})$$

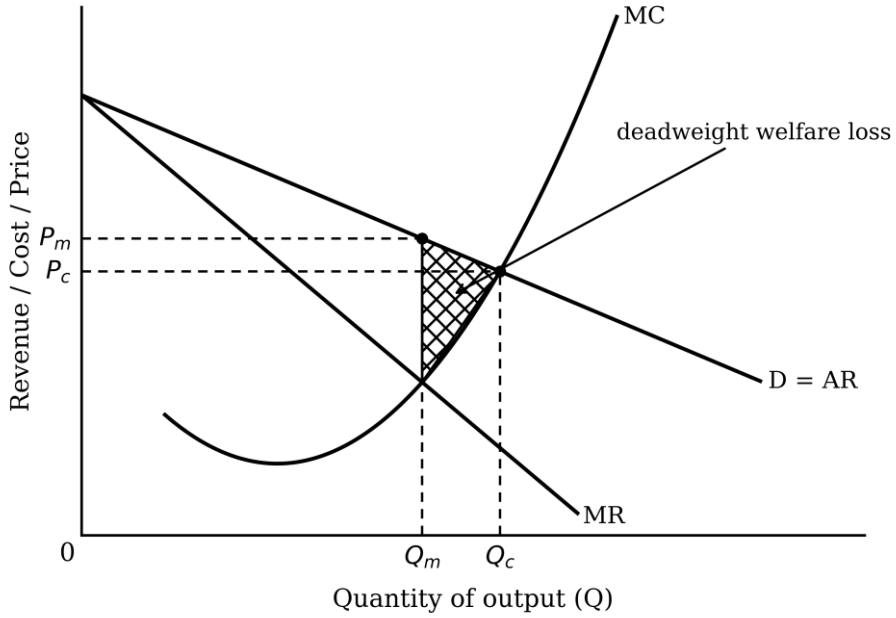


Figure 6.23: *The deadweight welfare loss of monopoly*

In figure 6.23 the rectangle sits directly above the triangle, which is why one is so often handed in for the other.

The Master Key: *Monopoly profit is taken from somebody, but monopoly's deadweight loss is taken from everybody and handed to nobody.*

BINDER Question 138

Nobody proposes two sets of pylons down the same street, or three water mains under one road. There are trades in which a single seller is not an accident to be corrected but the cheapest arrangement available.

Explain four advantages of a monopoly market.

Model Answer

A monopoly can lower unit cost by capturing economies of scale that no small firm could reach, it holds the funds and the protected return that pay for research and innovation, it avoids the duplication of plant that competing suppliers of a networked good would build, and it makes viable those projects whose fixed cost is so large that no firm would sink it if the return had to be shared.

Economies of scale: one firm supplying the whole market runs far down its long-run average cost curve, spreading heavy fixed costs over every unit sold. Where those savings are large, the monopolist's cost per unit is genuinely below what several competing firms could achieve, and part of that saving can reach the consumer as a lower price.

Funds and motive for research: supernormal profit survives the long run because barriers hold entrants out. That surplus is money available for invention, and the barrier is also the reason to spend it, since a discovery cannot be copied the moment it appears. A firm earning only normal profit has neither the funds nor the protection.

No wasteful duplication: competition in a networked trade means laying two grids, two pipe systems or two rail tracks where one would carry the traffic. That is not rivalry, it is repetition, and society pays for it twice. A single supplier lets one set of assets serve every customer.

Viability under huge fixed costs: electricity generation, water supply, railways and an iron and steel plant demand an outlay that must be recovered over decades. No investor sinks such a sum knowing a rival may arrive and split the market. Exclusivity is often the only condition on which the asset is built at all.

Each of these advantages rests on the shape of the cost curve, so each disappears the moment the scale economies are exhausted.

The Master Key: *Monopoly is defensible only where one firm can genuinely make the good more cheaply than several, and nowhere else.*

BINDER Question 139

A monopolist does not raise the price by decree. It raises the price by producing less, and the shortage it manufactures is the whole of its power.

Explain five disadvantages of a monopoly market.

Model Answer

Monopoly charges a higher price and supplies a smaller output than a competitive industry would, it fails both efficiency tests because price exceeds marginal cost and production need not sit at minimum average total cost, it removes consumer choice, it invites X-inefficiency because no rival punishes slack, and its restriction of output reduces the demand for labour and other inputs.

Higher price and lower output: the seller chooses the quantity and lets the demand curve set the price. Producing a small quantity creates an artificial scarcity, and buyers who have no substitute to turn to must meet the price. The exploitation is done through the quantity decision, never by announcement.

Allocative inefficiency: at the profit-maximising output, price stands above marginal cost. Buyers value the next unit more highly than the resources needed to make it, yet it is not made. Resources are therefore in the wrong place, and this misallocation is what the deadweight loss triangle measures.

Productive inefficiency: nothing compels the monopolist to produce where average total cost is least. It settles wherever marginal cost cuts marginal revenue from below, which is generally on the falling or the rising limb of the average cost curve, so each unit absorbs more resources than the technique requires.

No choice and no pressure to improve: one seller means one product. A buyer who dislikes the quality, the packaging or the service has nowhere else to go, so quality may fall without any loss of custom, and the firm can add to cost through advertising the consumer never asked for.

X-inefficiency and unemployment: with no rival waiting to take the market, slack costs, overstaffing and comfortable habits are never punished, so the cost curves themselves drift upwards. Restricted output also means less demand for labour, materials and transport.

Only the last is uncertain; the price above marginal cost follows from the diagram itself.

The Master Key: *A monopolist does not have to charge a high price, it only has to withhold output, and the price rises by itself.*

REAL Question 140

A household at Njombe turns a tap and pays what it is asked. Nobody in the town can say what the water would have cost if two companies had laid pipes, but the arithmetic can, to the shilling.

Calculate the deadweight welfare loss this monopoly imposes on the town, and explain what your figure does and does not capture.

Mlima Maji Company is the only supplier of piped water to the town of Njombe.
At a price of TShs 900 a unit nobody buys at all, and every fall of TShs 2 in the price adds one more unit to the quantity demanded each day.
Marginal cost is constant at TShs 100 a unit at every level of output.
There is no borehole close enough or clean enough to serve as a substitute.
The regional water authority wants to know what the town loses by being served by one seller instead of many.

Model Answer

The town loses TShs 40,000 a day: a competitive industry would sell 400 units at TShs 100, while Mlima Maji sells 200 units at TShs 500, so a rectangle of TShs 80,000 a day passes from buyers to the company as profit and a triangle worth TShs 40,000 a day is destroyed outright, and only that second figure is a loss to the country as a whole.

The demand and revenue curves: the schedule in the box is a straight demand line with an intercept of 900 and a slope of 2. Average revenue is that line. Marginal revenue falls twice as steeply from the same intercept, which is why the monopolist stops so far short of the competitive quantity.

$$\text{AR} = 900 - 2\text{Q} \;\Rightarrow\; \text{TR} = 900\text{Q} - 2\text{Q}^2 \;\Rightarrow\; \text{MR} = 900 - 4\text{Q}$$

The competitive benchmark: many sellers would be driven to the output at which price equals marginal cost, since any unit worth more to a buyer than it costs to supply would otherwise be left unsold. That gives the quantity and price against which the monopoly outcome must be measured.

$$\text{P} = \text{MC}\text{:}\;\; 900 - 2\text{Q} = 100 \;\Rightarrow\; \text{Q}_\text{c} = 400,\;\; \text{P}_\text{c} = \text{TShs}\;\; 100$$

The monopoly outcome: Mlima Maji equates marginal cost with marginal revenue, with marginal cost cutting marginal revenue from below, and then charges what the demand curve will bear at that quantity. Output is halved and the price is five times marginal cost.

$$\text{MR} = \text{MC}\text{:}\;\; 900 - 4\text{Q} = 100 \;\Rightarrow\; \text{Q}_\text{m} = 200,\;\; \text{P}_\text{m} = 900 - 400 = \text{TShs}\;\; 500$$

The transfer, which is not the loss: on each of the 200 units still sold, households pay TShs 400 more than the competitive price. That money leaves the town's households and enters the company's accounts. It is a distribution question, and the country is no poorer for it.

$$\text{Transfer} = (500 - 100) \times 200 = \text{TShs}\;\; 80{,}000 \;\; \text{a day}$$

The deadweight loss itself: the 200 units between the monopoly output and the competitive output were each worth more than TShs 100 to somebody, and none is now supplied. Consumer surplus falls from TShs 160,000 to TShs 40,000, of which TShs 80,000 is transferred and the rest simply vanishes.

$$\text{DWL} = \text{tfrac12}(500 - 100)(400 - 200) = \text{TShs}\;\; 40{,}000 \;\; \text{a day}$$

What the figure leaves out: it ignores any slack cost the company carries because no rival disciplines it, any resources spent defending the licence, and any decline in quality. It also assumes many small firms could supply water at the same TShs 100, which for a piped network is doubtful, so the true loss could be larger or smaller.

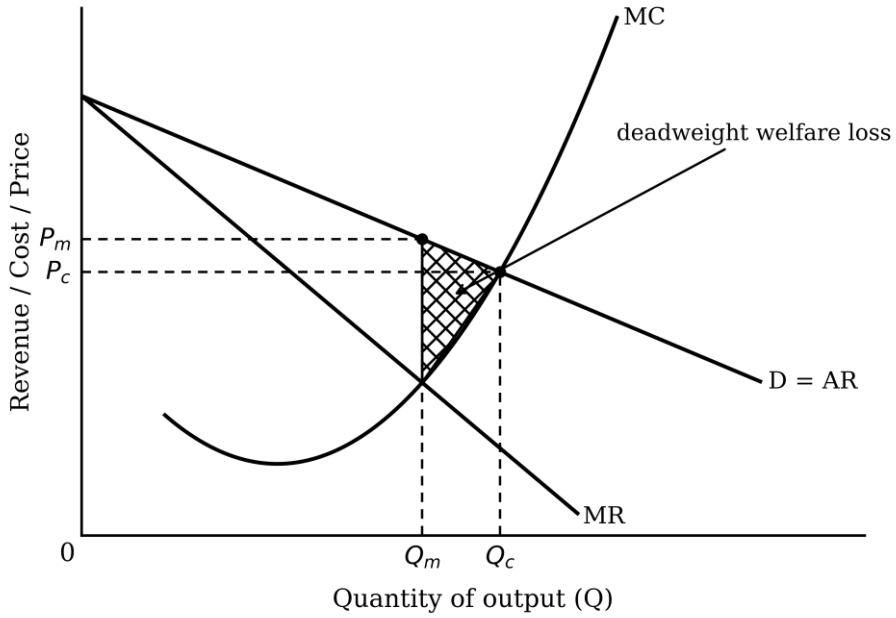


Figure 6.23: *The deadweight welfare loss of monopoly*

Report the TShs 40,000 as the measurable core of the harm and say honestly that it is a floor rather than a total.

The Master Key: *Halve a monopolist's price gap and you halve the transfer, but the loss to the country falls by three quarters, because it is a triangle.*

REAL Question 141

Builders at Mpanda grumble that the cement is dear. They are right. They also assume a second works would fix it, and that is where the argument stops being obvious.

Examine the advantages and the disadvantages that these two regions draw from being served by a single cement works, and advise the regional authority.

Tumaini Cement runs the only cement works serving Katavi and Kigoma, on the outskirts of Mpanda.

The nearest rival plant lies so far away that road haulage adds more to the delivered price than the cement itself costs.

The works cost a very large sum to build, and its long-run average cost is still falling at the tonnage the two regions absorb.

Its price stands well above the cost of making one more tonne, and its margin has been comfortable for several seasons.

The regional authority is being urged to encourage a second works at Mpanda.

Model Answer

The regions gain a cement works that exists at all and a unit cost lower than two smaller plants could reach, and they pay for it with a price above marginal cost, a deadweight loss, no choice of supplier and no pressure on quality or delivery; the authority should therefore regulate the price and attack the haulage barrier rather than invite a second works that would raise both plants' average costs.

The advantage is written in the cost curve: long-run average cost is still falling at the tonnage these regions absorb, which means the plant has not yet exhausted its economies of scale. One works at full stretch therefore makes cement more cheaply per tonne than two works each running half empty.

And in the fact that it was built: an outlay of this size is recovered over decades. An investor facing the prospect of an immediate rival splitting the tonnage would very likely have built nothing, and the two regions would be importing every bag over the same expensive roads. Something is better than the alternative that was on offer.

The disadvantage is the price above marginal cost: the works sets output where marginal cost cuts marginal revenue from below, then charges what demand will bear. Every project abandoned because cement is dear is a trade worth making that nobody makes, and that is the deadweight loss in physical form.

And the absence of any pressure: with no rival within haulage distance, there is nothing to punish late delivery, uneven grade or slack costs. X-inefficiency does not announce itself, but a comfortable margin held for several seasons is precisely the condition under which it grows.

Why a second works is the wrong remedy: splitting a demand that does not yet fill one plant leaves two plants each further up its average cost curve. Unit cost rises for both, and neither can price low for long. Duplicating a costly asset to obtain competition is buying the cure at more than the disease costs.

The advice: keep the single works, and take the margin down by other means: a maximum price set with reference to the firm's costs, published accounts, and above all a road that lowers the haulage barrier, since a credible outside supplier disciplines the price without anybody building a second kiln.

The complaint at Mpanda is sound and the proposed remedy is not, which is the commonest shape an economic argument takes.

The Master Key: *Where average cost is still falling, the answer to a dear monopolist is a cheaper road, not a second factory.*

HOT Question 142

The triangle can be measured, so it gets measured, and what gets measured gets treated as the whole. Ask a household at the end of an unreliable line whether its complaint is a triangle.

Discuss whether the deadweight loss triangle measures the whole of the harm done by monopoly.

Model Answer

It does not: the triangle is an honest measure of the trades forgone at given cost curves, but it omits the slack that raises those curves, the real resources burned in acquiring and defending the position, and every loss of quality and pace of improvement, while in the opposite direction it can overstate the harm wherever the competitive alternative it assumes was never technically available, so the triangle is best treated as a floor under the damage rather than a total.

What it genuinely captures: between the monopoly output and the competitive output lie units each worth more to a buyer than the resources they would absorb. None is produced. That is a real loss, it accrues to nobody, and it can be put in shillings, which is more than can be said for most objections to monopoly.

It omits X-inefficiency: the triangle is drawn on a marginal cost curve that is taken as given. But a firm no rival threatens lets costs drift: overstaffing, comfortable procurement, plant kept past its time. If the curve itself sits higher than it need, the waste is a slab beneath it, not a triangle beside it.

It omits the cost of holding the position: the transfer rectangle is a prize, and prizes attract expenditure. Lobbying for the licence, litigating against entrants, building capacity purely to frighten them off: these consume real labour and capital that produce nothing. Part of what looks like a mere transfer is therefore converted into genuine loss.

It omits quality and the passage of time: the diagram holds one product with one specification. It cannot show a grade that quietly worsens, a repair service that lengthens, or a decade in which nothing improves because nothing had to. Over a working life the dynamic loss can dwarf the annual triangle.

But it can also overstate: the calculation compares the monopolist with an industry of many firms sharing the same marginal cost curve. Where long-run average cost falls across the whole market, that industry could not exist, and the many small firms would face higher costs, so part of the measured triangle is comparing reality with a fiction.

The judgement: use the triangle, because a number that can be defended beats an adjective. Then state what it excludes. In a network trade check the counterfactual before believing it; in an ordinary trade with slack management assume the true harm is a good deal larger.

A measure that is honest about its own boundaries is worth more than a larger number nobody can justify.

The Master Key: *The triangle is the harm you can prove, not the harm that is done.*

HOT Question 143

A shilling moved from a household at Tandale to a shareholder is still a shilling in the country. The national accounts do not flinch. The household does.

To what extent should an economist be concerned about the transfer of surplus from consumers to a monopolist?

Model Answer

On the narrow efficiency test the transfer deserves no concern at all, since nothing is destroyed and the country's total is unchanged; but that test buys its silence by treating a shilling to a poor buyer as identical to a shilling to an owner, and once the good is a necessity, once real resources are spent competing for the prize, and once the question is which policy to adopt rather than which outcome is efficient, the transfer becomes one of the most important facts in the case.

The case for ignoring it: efficiency asks whether resources could be rearranged to help somebody without hurting anybody. A transfer fails that test by construction: it helps one party exactly as much as it hurts the other. The analysis is deliberately silent about who holds what, and that silence is not an oversight.

Why the silence is purchased: the argument works only if a shilling counts the same wherever it lands. Nobody actually believes that. A hundred shillings taken from a household spending most of its income on water and electricity is not the same event as a hundred shillings added to a comfortable balance sheet.

Necessities make it regressive: water, current and cooking fuel take a far larger share of a poor household's income than of a rich one's. A monopoly price on such a good transfers surplus upward in

proportion to how little the payer has, which is a distributional outcome no government can be indifferent to.

The prize is not costless to win: because the rectangle is large, firms spend to obtain it and to keep it. Every shilling of lobbying, litigation and deterrent capacity is a real resource turned to no productive use, so part of the transfer becomes a loss after all. The distinction between rectangle and triangle is cleaner in theory than in fact.

The other side: what the transfer buys: supernormal profit is also the fund from which a network is extended, a plant renewed or a discovery paid for. Where it is genuinely reinvested, the transfer works as a forced saving with a return, and where the owner is the state, it returns to the citizen as taxpayer what was taken from the citizen as buyer.

The extent, stated: concern yourself with the triangle when asking whether the country is poorer, and with the rectangle when asking what to do about it. Every practical remedy, a maximum price, a profit tax, a licence condition, is chosen partly on who ends up holding the money.

Efficiency permits you to look away from the transfer; policy never does.

The Master Key: *The triangle tells you how large the problem is and the rectangle tells you why anybody bothers to argue about it.*

HOT Question 144

Two lists sit side by side in every set of notes on monopoly, one headed advantages and one headed disadvantages, as though the reader were meant to count the entries and declare a winner.

To what extent do the advantages of a monopoly market outweigh its disadvantages?

Model Answer

They outweigh the disadvantages only under conditions that can be checked, never in general: monopoly is defensible where long-run average cost is still falling at the whole market output, where the profit is visibly turned into investment or research, and where a regulator can hold the price near cost, and it is indefensible wherever scale economies run out early, because then the higher price and the lost output are bought with no compensating saving whatever.

The whole case rests on the cost curve: if long-run average cost is still falling at the output the market absorbs, one firm supplies the good more cheaply per unit than several could. That saving is real and measurable, and it is the only advantage of monopoly that does not depend on the firm choosing to behave well.

The research argument is real but conditional: protected profit supplies both the funds for invention and the assurance of keeping the return. That is precisely why patents exist. But nothing obliges a monopolist to spend the surplus that way, and profit that is safe is profit that need not be earned a second time.

The disadvantages are automatic: the price above marginal cost, the restricted output and the deadweight triangle follow from the profit-maximising rule itself. They require no bad intention and no management decision. Set the contingent advantages against the certain harms and the asymmetry alone should make you cautious.

Where scale economies stop early: in retailing, milling, transport by road or the supply of most manufactured goods, average cost bottoms out at a modest output. A monopolist there enjoys no cost advantage at all, so society pays the full price of restriction and receives nothing back. Such positions have no economic defence.

The absence of pressure cuts both ways: some monopolies are exceedingly well run, because their managers choose to be. The point is that nothing compels it. X-inefficiency is a standing risk rather than a certainty, which is exactly why supervision, published accounts and cost benchmarks do so much work in practice.

The verdict and its test: ask three questions before defending any monopoly. Is average cost still falling at the market output. Is the surplus visibly reinvested. Is there a regulator with the information to hold the price near cost. Three answers of yes make the case; a single no destroys it.

The lists are not meant to be counted; they are meant to be applied to a particular firm with a particular cost curve.

The Master Key: *Monopoly earns its keep only where one firm is genuinely cheaper than many, and that is a fact about costs, not a matter of opinion.*

HOT Question 145

A firm with no rivals has all the money it needs to invent and no reason on earth to bother. A firm with many rivals has every reason and no money. Neither extreme looks promising.

Discuss whether a monopolist is more likely than a competitive firm to innovate.

Model Answer

Neither structure is reliably the more inventive: monopoly supplies the funds and the protection that make research worth undertaking, which is why patents deliberately create temporary monopolies, while competition supplies the fear that makes it urgent, and the firms that actually innovate tend to be those large enough to pay for discovery yet still exposed to a credible entrant, so the decisive variable is the threat of entry rather than the number of firms.

Monopoly has the money: research is a large fixed cost with an uncertain return, and only supernormal profit can absorb it. A competitive firm earning normal profit in the long run has no surplus at all, so it can fund nothing beyond its ordinary operations however much it might wish to.

And it can keep the return: under perfect knowledge any improvement is copied at once, so the innovator carries the cost and shares the benefit. Barriers let the discoverer collect what the discovery earns. A patent is exactly this argument turned into law: a monopoly granted for a term, in order to buy an invention.

And it can spread the cost: a fixed research outlay divided across a very large output adds little to unit cost, whereas the same outlay would be ruinous to a small firm. Scale is the reason heavy industry, pharmaceuticals and telecommunications do most of the world's formal research.

But safety removes the urgency: a firm nobody can displace loses nothing by standing still. The quiet life is a genuine preference of managers who are not being chased, and X-inefficiency in research is simply X-inefficiency applied to the future rather than to this year's costs.

And an innovation can destroy its own assets: a new technique may make an existing plant worthless. A protected firm that owns that plant has a positive reason to delay or suppress the improvement, whereas an entrant owning nothing has every reason to bring it forward. Incumbency can therefore work directly against progress.

What settles it: the fear of losing the market. Where a monopolist can be displaced by a plausible entrant, it innovates hard, because the profit must be defended. Where the barrier is absolute, it need not. The useful policy conclusion is to keep entry credible rather than to break firms into small pieces.

Grant the profit that pays for invention and keep the threat that makes it necessary, and the two arguments stop contradicting each other.

The Master Key: *Innovation is funded by profit and forced by fear, so the inventive firm is the rich one that is still frightened.*

Controlling and Regulating Monopoly

A government that dislikes a monopoly has several instruments, and they do not all work in the way the name suggests. A maximum price raises a monopolist's output, which is the reverse of what a ceiling does in a competitive market. A tax on profit can leave the price on the shelf exactly where it stood. And where the industry is a natural monopoly, the regulator meets a dilemma with no clean exit, because the price that is allocatively right sends the firm into loss and the price that keeps the firm alive is allocatively wrong. This section takes each instrument in turn and says plainly what it can and cannot do.

BINDER Question 146

A tariff for current at Sumbawanga is not settled by the meeting of two curves. It is settled in an office, by people who must guess where those curves lie.

Explain five methods by which a government may control a monopoly.

Model Answer

A government may cap the price, forbid monopolistic conduct by law and refuse further expansion, tax away the surplus profit, lower the barriers that keep entrants out, or establish a standing commission to watch the trade; the first three attack conduct, while lowering barriers attacks the position itself and is the only one that eventually makes the others unnecessary.

Price control: the authority sets a maximum above which the firm may not sell. In Tanzania the tariffs for electricity and water are fixed this way by EWURA rather than by the supplier. Well placed, a ceiling lowers the price and raises the quantity supplied.

Anti-monopoly law: statute may forbid the practices by which market power is built and held: price fixing between rivals, predatory pricing to drive out an entrant, exclusive dealing. The law may also block a merger or refuse a dominant firm permission to expand.

Taxation of monopoly profit: a levy on the surplus transfers it from the owners to the treasury, where it can fund services or a subsidy elsewhere. Note what it does not do. It reduces the return to holding the position; it does not reduce the price a household pays.

Lowering the barriers to entry: licences may be issued to newcomers, a monopolist required to let rivals use its network for a fee, import duties cut, and roads improved so that a distant supplier becomes a real alternative. This removes the cause rather than treating the symptom.

A standing competition commission: a body such as the Fair Competition Commission investigates conduct and reports on inefficiency in monopolised trades. Its purpose is to prevent abuse rather than punish it afterwards, and the prospect of an inquiry alone changes how a dominant firm behaves.

Choose the instrument by diagnosis: treat conduct where the position is unavoidable, and attack the position wherever it is not.

The Master Key: *Regulate a monopoly you cannot remove, and remove the barrier wherever you can, because no regulator is as effective as a rival.*

BINDER Question 147

Ask a regulator to set the allocatively correct price for a water network and you will have asked it to bankrupt the supplier. The efficient price and the survivable price are not the same number.

Explain the dilemma facing a regulator who must set the price charged by a natural monopoly.

Model Answer

In a natural monopoly long-run average cost is still falling at the whole market output, which forces long-run marginal cost below it, so the efficient price $P = LMC$ **leaves the firm unable to cover average cost and it must be subsidised, while** $P = LAC$ **lets the firm break even but holds price above marginal cost and output below the efficient level; no third option is costless.**

What makes the monopoly natural: the fixed cost of the network is enormous and the cost of serving one more customer small, so average cost keeps falling however far output is pushed. One firm therefore supplies the market more cheaply than two, and figure 6.24 shows demand cutting LAC while it falls.

The arithmetic that creates the dilemma: a marginal value can only pull an average downwards by lying beneath it. Since long-run average cost falls everywhere in the relevant range, long-run marginal cost sits below it throughout.

$$\text{LAC falling} \iff \text{LMC} < \text{LAC}$$

Marginal cost pricing is efficient and loss making: set price where LMC cuts demand, at Q_1. The last unit is then valued by buyers at exactly what it costs society, which is allocative efficiency. But that price lies below average cost, so the firm loses on every unit and cannot continue without a subsidy.

$$P_1 = LMC < LAC_1 \Rightarrow \text{loss} = (LAC_1 - P_1) \times Q_1$$

Average cost pricing is solvent and inefficient: set price where LAC cuts demand, at Q_2. Every cost is covered, including the normal profit that is part of economic cost, so the firm survives with no call on the treasury. But Q_2 is smaller than Q_1 and price exceeds marginal cost, so some inefficiency remains.

$$P_2 = LAC_2 > LMC, \quad Q_2 < Q_1$$

Somebody pays either way: under the first rule the taxpayer funds the subsidy through taxes that carry their own distortions. Under the second the consumer pays above marginal cost and some buyers are shut out. The regulator chooses which cost to bear, never whether to bear one.

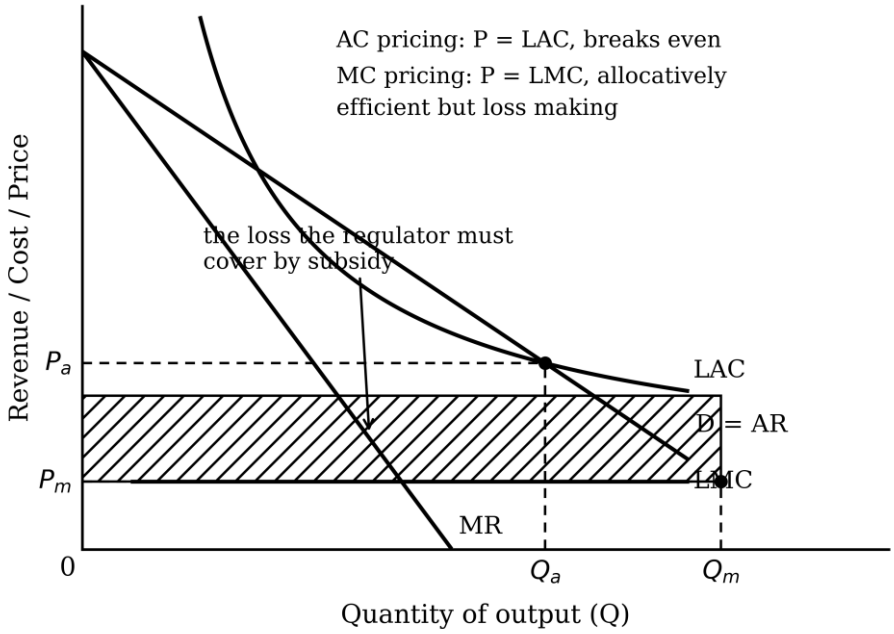


Figure 6.24: *Regulating a natural monopoly: marginal cost against average cost pricing*

Both prices lie far below the unregulated monopoly price, so this is a choice between two improvements.

The Master Key: *Where average cost is still falling, the efficient price cannot pay for the pipes.*

BINDER Question 148

A maximum price in a maize market causes queues and empty stalls. A maximum price on a monopolist can cause the opposite: more of the good, not less. The same instrument, two contrary results.

With the aid of a diagram, show why a well chosen price ceiling raises a monopolist's output, and explain why a ceiling has the opposite effect in a competitive market.

Model Answer

A ceiling makes average revenue horizontal at the maximum price, and over that flat stretch marginal revenue equals the ceiling too, because an extra sale no longer forces a price cut on units already sold; marginal cost therefore meets a much higher marginal revenue than before, so output rises and price falls together, whereas a competitive firm was already at $P = MC$ and a ceiling can only push it back down its marginal cost curve.

Why output was restricted: average revenue slopes down, so selling one more unit means charging less on every unit. Marginal revenue therefore falls twice as steeply, and the firm stops where that low marginal revenue meets marginal cost. The gap between the two curves is the engine of restriction.

$$AR = a - bQ \Rightarrow MR = a - 2bQ$$

What the ceiling does to the revenue curves: the firm may not charge above P_k. Up to the quantity Q_k buyers will take at that price, effective average revenue is flat at P_k, and since price no longer falls as sales rise, marginal revenue equals it exactly. Beyond Q_k both curves revert to their old paths.

$$AR = MR = P_k \quad \text{for } Q \leq Q_k$$

The new equilibrium: marginal cost now cuts a marginal revenue line at the ceiling rather than far below it, so the profit-maximising output moves rightwards, out to where marginal cost rises to P_k, or to Q_k itself if marginal cost is still below the ceiling there.

$$MC = P_k \Rightarrow Q_{new} > Q_m$$

Where to place it, and the contrast: the best ceiling sits where marginal cost cuts the demand curve, giving $P = MC$ with no shortage; set lower, marginal cost exceeds the ceiling before demand is met and queues appear. A competitive firm, already producing where price equals marginal cost, has no withheld output to release, so a ceiling only drives it down its marginal cost curve and contracts supply.

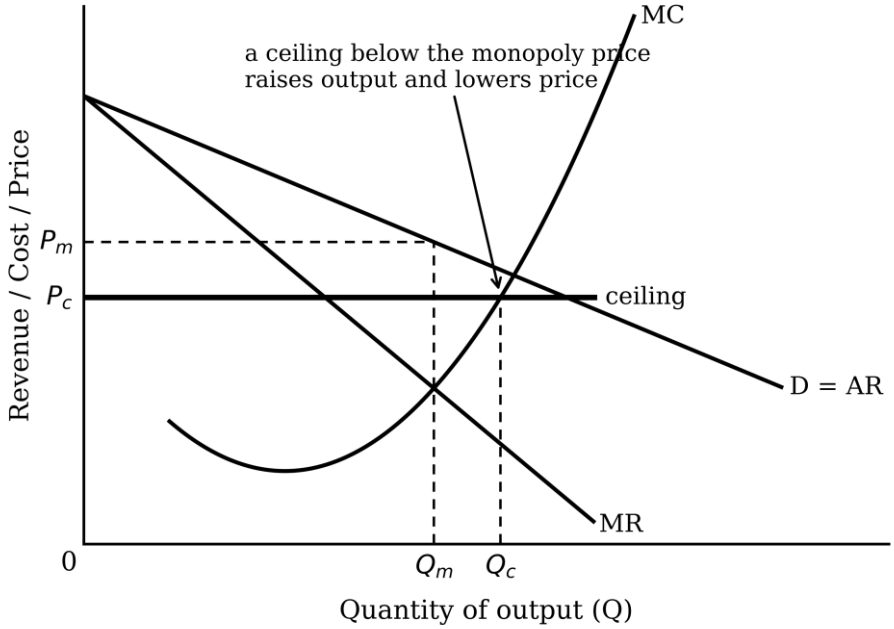


Figure 6.25: *A price ceiling on a monopolist*

The instrument is the same; what differs is whether the seller had been holding output back.

The Master Key: *A ceiling cuts output where the seller was already producing enough and raises it where the seller was holding back.*

BINDER Question 149

A minister announces a heavy tax on a monopolist's profits and expects the price to come down. It will not move at all, and the reason is written in the definition of marginal cost.

Distinguish between a lump sum tax and a per unit tax on a monopolist, and explain the effect of each on price and output.

Model Answer

A lump sum tax is a fixed charge that does not vary with output, so it never enters marginal cost, the equality of marginal cost with marginal revenue is undisturbed, and price and output do not move while profit falls by the whole tax; a per unit tax adds to the cost of every unit, lifts marginal cost, and so cuts output and raises price, widening the welfare loss.

The lump sum tax defined: a fixed sum demanded whatever the firm produces: a licence fee, an annual charge, a levy on profit already earned. Because it does not vary with output, it behaves like a fixed cost, shifting average total cost upwards without touching marginal cost.

Why it leaves price and output alone: profit is maximised where marginal revenue equals marginal cost with marginal cost cutting from below. A lump sum is a constant, and a constant differentiates to zero, so it vanishes from that condition altogether and the same output still maximises profit.

$$\pi = TR - TC - T \Rightarrow \frac{d\pi}{dQ} = MR - MC = 0$$

The per unit tax defined: a charge of t shillings on every unit sold. Total cost rises by t for each extra unit, so the marginal cost curve shifts vertically upward by t at every output. This tax does enter the profit-maximising condition.

$$TC' = TC + tQ \Rightarrow MC' = MC + t$$

And what it does: the raised marginal cost curve cuts the unchanged marginal revenue curve at a smaller output, and the demand curve delivers a higher price. Part of the tax passes to the buyer, output falls further below the competitive level, and the deadweight triangle widens.

Reading the two for policy: a lump sum, or a tax at a fixed rate on profit, takes the rent and leaves the harm untouched, since maximising a fixed share of profit is the same problem as maximising profit. A per unit tax raises revenue and worsens the harm.

A tax large enough to turn supernormal profit into loss drives the firm out in the long run, rarely the intended outcome.

The Master Key: *Only a tax that changes marginal cost can change what a monopolist charges.*

REAL Question 150

The lines to Namanyere cost a fortune to string. Sending one more unit of current down them costs almost nothing. Every difficulty a regulator has with this firm grows out of that single sentence.

Advise EWURA whether to set this tariff at marginal cost or at average cost, and state the consequence of each choice.

Nuru Grid Company distributes electricity to Sumbawanga and Namanyere under an exclusive licence.
Building the lines, poles and substations absorbed a very large sum, recoverable only over many years.
Sending one more unit of current down a line already built costs very little.
Long-run average cost is still falling at every level of demand the two towns can generate.
At a tariff equal to marginal cost, receipts would not come near covering the cost of the network.
EWURA must now set the tariff.

Model Answer

Set the tariff at average cost as the working rule, because marginal cost pricing here is allocatively efficient but guarantees a loss that the treasury must fund every year; then soften the inefficiency deliberately, with a first block of units for small domestic customers priced near marginal cost and paid for by higher rates on large users, and hold the allowed average cost to a published benchmark rather than to whatever the company happens to spend.

This is a natural monopoly: an enormous fixed outlay in poles and substations, a negligible cost of serving one more customer, and average cost still falling at the largest demand the two towns can produce. A second network alongside the first would leave both running at higher unit cost, so competition is not available here.

Marginal cost lies below average cost: an average that is still falling can only be pulled down by a marginal value beneath it. That is not a peculiarity of this firm; it follows from the shape of the curve, and it is the whole source of EWURA's difficulty.

$$\text{LAC falling at every } Q \implies LMC < LAC$$

What marginal cost pricing would deliver: the largest output, the lowest tariff and the most households connected, with the last unit of current valued by the buyer at exactly what it costs to supply. It is the allocatively efficient answer, and figure 6.24 shows it as the point where LMC cuts the demand curve.

$$\text{Annual subsidy required} = (LAC_1 - LMC) \times Q_1$$

And what it would cost: a loss every year equal to the gap between average cost and the tariff, on every unit sold. Somebody must find that money through taxes that carry distortions of their own, and a firm whose losses are covered whatever their size has weak reason to keep costs down.

What average cost pricing delivers: the firm covers every cost including normal profit, so it survives without any claim on public funds and can borrow to extend the network. The price is against it: the tariff

stands above marginal cost, so households who value current at more than the cost of sending it will still go without.

The advice, and how to blunt its edge: adopt average cost pricing, then recover the fixed cost mostly from large commercial users while pricing a lifeline block for small domestic meters near marginal cost. Benchmark the allowed costs against comparable networks, so the tariff reflects what the network should cost rather than what this firm chooses to spend.

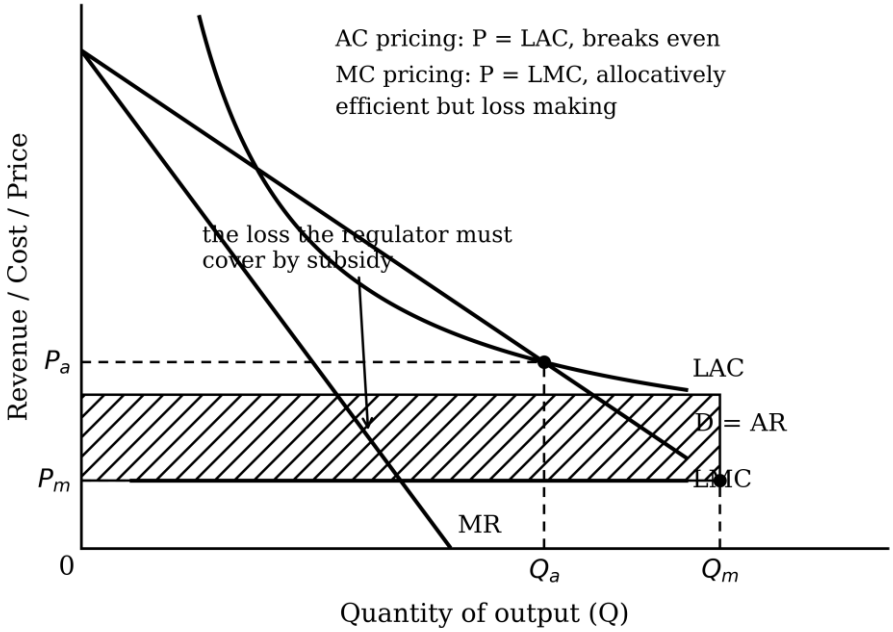


Figure 6.24: *Regulating a natural monopoly: marginal cost against average cost pricing*

Both rules leave the tariff far below what an unlicensed monopolist would charge, which is worth saying to anyone calling the choice a defeat.

The Master Key: *When average cost is falling, a regulator is not choosing the best price but deciding who pays for the pipes and wires.*

REAL Question 151

Households along the Tanga road are drifting back to charcoal. That is not a line on any diagram, and it is the clearest evidence the Commission has that something is wrong with the price of gas.

Advise the Fair Competition Commission which of the three remedies before it best serves consumers, and justify the choice.

Bahari Gesi is the only importer and bottler of cooking gas serving Tanga and the coast down to Pangani.

Its depot is the sole bulk facility on that stretch of coast, and no rival can land gas without building another.

Its price now stands well above the cost of filling one more cylinder, and its margin has been comfortable for two years.

Households have begun returning to charcoal.

Three remedies are before the Commission: a maximum price per cylinder, a tax on the firm's profit, and a duty to let rivals use the depot for a published fee.

Model Answer

Require access to the depot at a published fee, because that alone removes the barrier that creates the power, and set a maximum price per cylinder as an interim measure while the first rivals

establish themselves; reject the profit tax as a consumer remedy, since a levy on profit does not enter marginal cost and therefore leaves the price of a cylinder exactly where it is.

Diagnose the harm first: price stands above the cost of filling one more cylinder, which means output is restricted below the level at which buyers value gas at what it costs to supply. The return to charcoal is that deadweight loss made visible, and it carries costs in health and in trees that no diagram records.

What a maximum price would do: capped at P_k, average revenue becomes flat up to the quantity buyers will take, so marginal revenue equals the cap over that stretch instead of falling below it. The firm's profit-maximising output therefore rises. A ceiling on this monopolist means more cylinders filled, not fewer.

$$AR = MR = P_k \Rightarrow MC = P_k \Rightarrow Q \text{ rises}$$

But a ceiling has to be set by somebody: placed where marginal cost cuts demand it restores $P = MC$ with no shortage; placed too low it produces empty depots and queues; and it must be revised as costs move. It also requires the Commission to know the firm's costs, which the firm has every reason to overstate.

Why the profit tax fails the consumer: a levy on profit, or any fixed annual charge, does not vary with the number of cylinders filled, so it never enters marginal cost. The equality of marginal cost with marginal revenue is undisturbed and the shelf price does not move. It raises revenue and relieves nobody.

Why depot access is the durable remedy: the power rests entirely on one facility that cannot economically be duplicated. Open it on published terms and a rival can land gas tomorrow, after which the price is disciplined by a competitor rather than by an inspector, and the Commission need not guess at costs it cannot see.

The advice, in order: impose the access duty as the permanent measure, with the fee set to cover the depot's costs and a fair return on it. Run a maximum price alongside it until at least one rival is trading, then withdraw the cap. Use the profit tax, if at all, for revenue and never as a defence of the household.

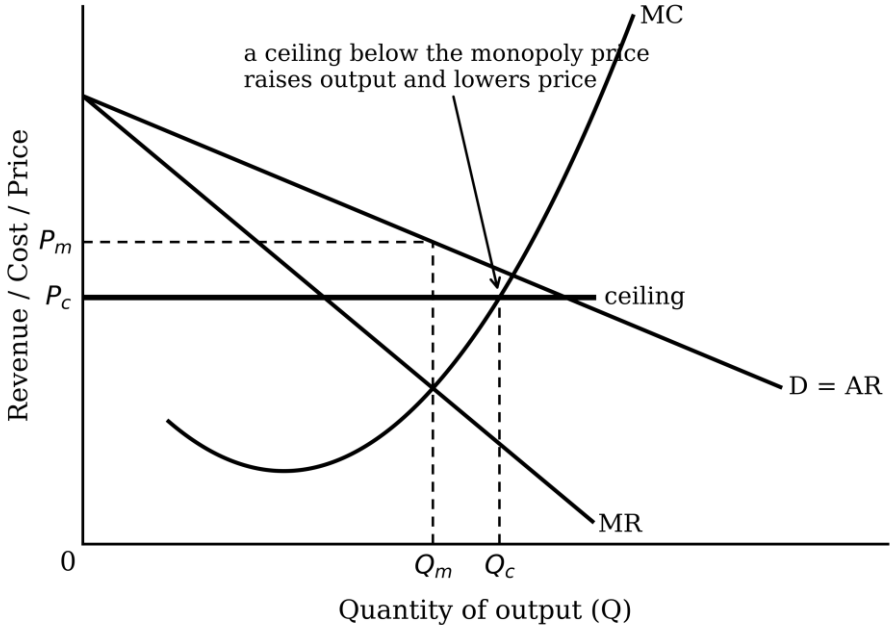


Figure 6.25: *A price ceiling on a monopolist*

The test of a remedy is whether it survives the departure of the regulator, and only the third one does.

The Master Key: *Attack the facility that makes the monopoly possible, and the price falls without anyone having to be told what to charge.*

HOT Question 152

Marginal cost pricing is the only answer a diagram can give, and it is the right one. It also requires a cheque from the treasury every year, without end.

To what extent should a natural monopoly be required to price at marginal cost?

Model Answer

Only to the extent that the subsidy can be raised cheaply, targeted honestly and monitored: marginal cost pricing genuinely maximises the gain from the network and is strongest where the fixed cost is already sunk and where connection carries wide benefits, but the subsidy must be funded by taxes that distort other markets, it removes the firm's reason to control cost, and it often flows to households already connected rather than to those still waiting.

The case is a real one: once the poles are up, the cost of sending another unit of current is tiny. Charging above that cost excludes buyers who value the good at more than it costs society to provide, which is waste of the purest kind. Every unit blocked by an average cost tariff was worth making.

And it is strongest where the cost is sunk: a fixed cost already incurred cannot be recovered by any pricing rule, so recovering it from users is a distributional decision rather than an efficiency one. Where the network exists and will not be rebuilt, the argument for pricing the marginal unit at marginal cost is at its most persuasive.

But public money is not free money: the subsidy must be raised, and the taxes that raise it distort labour supply, saving or the price of some other good. Every shilling has an opportunity cost in a health post or a road elsewhere. The allocative gain in the utility must exceed the allocative loss created in raising the funds.

A covered loss is a weakened discipline: a firm whose deficit is met whatever its size has little reason to negotiate hard with suppliers or to hold staffing down. X-inefficiency then quietly enlarges the very subsidy that is meant to buy efficiency, and the regulator cannot easily tell an unavoidable loss from an indulged one.

And it may reach the wrong households: a subsidised tariff benefits those already on the network. Where the poorest are unconnected, the subsidy is regressive, and the same money spent extending lines would serve them better. Ask who holds a meter before calling a low tariff a measure for the poor.

The extent, settled: require marginal cost pricing for a defined lifeline block, funded transparently, with the rest of the cost recovered from larger users, and pair it with cost benchmarks so the deficit cannot expand at will. Insisting on it for the whole output is a rule that ignores where the money comes from.

The correct question is never whether the price is efficient but whether the whole arrangement, funding included, leaves the country better off.

The Master Key: *Marginal cost pricing is right about the last unit and silent about who pays for the first thousand.*

HOT Question 153

One remedy needs an office of clever people who must be right every year. The other needs a road, a licence and then nobody at all. They are not equally durable.

Discuss whether regulating a monopolist or opening the market to entry is the better remedy for monopoly power.

Model Answer

Opening entry is the better remedy wherever entry is technically possible, because a rival disciplines price continuously and needs no official to know the firm's costs, while regulation is the necessary remedy wherever scale economies make a second supplier genuinely more expensive; the mistake to avoid is applying either instrument in the other's territory, since duplicating a network wastes real resources and regulating a trade that could simply be opened invites capture and endless argument about cost.

The case for opening entry: a rival does automatically what a regulator must attempt deliberately. Price is driven towards cost by the threat of losing custom, quality is disciplined by the buyer's ability to walk away, and no official has to discover what the incumbent's costs really are. The remedy also outlives the government that introduced it.

And the threat alone can be enough: where a market is genuinely contestable, an incumbent prices as though rivals were present, because a fat margin would summon them. What matters is not how many firms trade today but how quickly one could arrive and how much of the outlay could be recovered on leaving.

Where opening entry destroys value: a second grid, a second water main or a second cement works in a region that cannot fill the first leaves every plant further up its average cost curve. Competition bought by duplication raises the real cost of the good, and the consumer pays for the rivalry in the price.

The case for regulation, and its price: where one supplier is genuinely cheapest, only a regulator stands between the buyer and the monopoly price. But the regulator must estimate costs the firm knows far better, is lobbied continuously by the only party with the data, and can drift into defending the industry it was created to check.

The instruments differ in what they need: entry needs a licence, a road, a port or a duty to share a facility, and then it runs itself. Regulation needs information, independence and constant renewal. A country with thin administrative capacity should prefer the instrument that does not depend on being administered well.

The judgement: test the cost curve first. If average cost stops falling at an output smaller than the market, open entry and dismantle the barrier. If it is still falling at the whole market, regulate, and regulate the parts that must be shared while opening every part that need not be.

Most real trades are a mixture, with a network that must be regulated and services over it that can be thrown open.

The Master Key: *Use a regulator only where a rival is physically impossible, because a rival works every day and a regulator only when it is watching.*

HOT Question 154

Taxing a monopolist is popular because it looks like justice. Whether the household at the meter ever sees a shilling of it is a separate question, and the answer is usually no.

Assess the claim that taxing a monopolist's profit protects the consumer.

Model Answer

As a direct defence of the consumer the claim is false: a lump sum levy or a tax at a fixed rate on profit does not enter marginal cost, so the profit-maximising output and the price are both unchanged and the deadweight loss stands exactly where it was, while a per unit tax does change price, in the wrong direction; the claim can only be rescued indirectly, through what the revenue funds and through the smaller prize the tax leaves for firms competing to hold the position.

Why the price does not move: the firm produces where marginal cost equals marginal revenue with marginal cost cutting from below. A fixed charge adds nothing to the cost of the next unit, so neither curve moves and the same output still maximises profit. Average total cost rises, profit falls by the tax, and the shelf price is untouched.

A proportional profit tax behaves the same way: if the state takes a fixed share of profit, the firm maximises what is left, and the output that maximises a fixed share of profit is the output that maximises profit. The tax alters how the surplus is divided and leaves every quantity and price decision exactly as it was.

A per unit tax is worse than useless here: it raises marginal cost by the tax, so the new marginal cost cuts marginal revenue at a smaller output and the demand curve returns a higher price. The consumer pays part of it, output falls further below the competitive level, and the welfare loss triangle widens.

What can be said for the tax: the surplus is a transfer, and returning it to the public through the treasury answers a genuine grievance about who ends up holding the money. Where a household pays a high tariff for water and the profit funds clinics, that household is compensated, even though the tariff has not fallen.

And a real indirect effect: a smaller prize is worth less to defend. Firms spend on lobbying, litigation and deterrent capacity in proportion to the rent available, and shrinking the rent shrinks that expenditure, which is a true saving of resources rather than a transfer. The revenue can also fund the subsidy that permits marginal cost pricing elsewhere.

The assessment: call the tax what it is: a measure of distribution and revenue, not of protection. If the aim is to lower the price the household pays, the instruments are a maximum price or an opened barrier. Taxing profit and hoping the price falls is a policy that mistakes the rectangle for the triangle.

A tax and a ceiling both take money from the monopolist, and only one of them puts anything back on the shelf.

The Master Key: *Nothing a monopolist pays that does not vary with output will ever change what it charges.*

Monopolistic Competition: Meaning and Characteristics

Between the two extremes already studied lies the market most people actually trade in. There are many sellers, as under perfect competition, but the goods are not identical: a name, a wrapper, a location or a style separates one seller's version from the next. That small difference hands every firm a downward sloping demand curve of its own, and with it the power to name a price, while the closeness of the substitutes keeps that power on a short leash. This section defines the structure, sets out its characteristics, and supplies the two ideas the diagrams depend on and rarely state: what product differentiation actually is, and what it costs to create.

BINDER Question 155

Two hundred shops in a town sell soap. No shop can double its price and keep a single buyer, yet every shop can charge a little more than the shop opposite and keep most of them. That small freedom is a whole market structure.

Define a monopolistic competitive market and explain five of its characteristics.

Model Answer

Monopolistic competition is a market structure in which many sellers offer products that are close but imperfect substitutes, so that each firm holds a small monopoly over its own version while facing stiff rivalry from the rest; its characteristics are many small sellers, differentiated products, relatively free entry and exit, limited price-making power, and heavy reliance on advertising.

Many sellers, each of them small: no single firm supplies enough of the trade to move the market by its own action, and each treats the prices around it as given rather than anticipating a reply. That absence of interdependence separates this structure from oligopoly.

Differentiated but close substitute products: the goods satisfy the same want and differ in brand, packaging, quality, style, location or service. Because they differ, each has buyers of its own; because they remain close substitutes, those buyers will walk to a rival once the price gap grows large enough.

Relatively free entry and exit: no patent, no exclusive licence and no ownership of a scarce input keeps a newcomer out, and the capital needed is modest. A firm may set up on the strength of a name and a stall and may leave without heavy loss, which is why profit here is never held for long.

Some power over price: each firm faces a downward sloping demand curve of its own, so it chooses a price instead of reading one off the market. The power is small and bounded, since a large rise empties the shop, but it is genuine, and a price taker has none of it at all.

Stiff competition, carried on by advertising: rivalry runs through brand, packaging, quality, credit and service as much as through price. Advertising is normal here and unknown under perfect competition, because there a homogeneous good and perfect knowledge leave a seller with nothing to tell anybody.

Read the name itself: monopoly over one's own version, competition against everyone else's.

The Master Key: *Monopolistic competition is many small monopolies pressed hard against one another.*

BINDER Question 156

Two bars of soap leave the same vat on the same morning. One is wrapped in green paper and sells for a third more. Nothing in the soap explains it, and the demand curve does not care.

Distinguish between real and imagined product differentiation, and explain why the demand curve facing a firm under monopolistic competition slopes downward yet remains elastic.

Model Answer

Real differentiation is a difference in the product that a buyer could verify, while imagined differentiation exists only in the buyer's belief, created by a name, a wrapper or a jingle; either kind wins the firm buyers of its own, which is why its demand curve slopes downward, and because rival versions remain close substitutes that curve stays far flatter than a monopolist's.

Real differentiation: a difference in the good or the service attached to it. A sandal stitched rather than glued, a shop open until nine, a workshop that repairs what it sold. Test it by asking whether a buyer who could not see the wrapper would notice.

Imagined differentiation: a difference in the buyer's mind rather than in the product. Two detergents from one plant under two names, the same tablet at two prices, a colour of packet that suggests freshness. The goods are identical; the demand curves facing them are not.

Why the curve slopes downward: differentiation carves out a sub market. Some buyers prefer this version and will pay a little more, so a rise in price loses part of the custom instead of all of it, and the firm moves along a curve of its own instead of facing a going price.

Why it is nonetheless elastic: the substitutes stand on the next stall. A modest rise sends a large share of buyers to a version that does almost the same work, so the curve is shallow, and the more alike the versions the flatter it becomes.

The revenue consequence: selling one more unit requires a lower price on every unit, so marginal revenue lies below average revenue at every output. This firm is a price maker, like a monopolist and unlike a price taker for whom the three are one number.

$$\mathrm{AR} = \mathrm{a} - \mathrm{bQ} \;\Rightarrow\; \mathrm{MR} = \mathrm{a} - 2\mathrm{bQ}, \quad \mathrm{MR} < \mathrm{AR}$$

For the diagram it makes no difference which kind of difference it is, provided the buyer believes in it.

The Master Key: *Differentiation buys the slope of the demand curve, and the closeness of the substitutes decides how gentle that slope will be.*

BINDER Question 157

A cotton grower at Kishapu has never once paid for a poster. A soap maker with a tenth of his turnover pays for posters, wrappers and a jingle. The difference is not ambition; it is market structure.

Explain what selling costs are and why a firm under perfect competition never incurs them.

Model Answer

Selling costs are the outlays a firm makes to shift the demand curve for its own version rather than to produce the good at all: advertising, branding, packaging, promotion, display, free delivery and the wages of those who sell; they are a real cost that enters average total cost and lifts it at every output, and a perfectly competitive firm carries none of them because its product is identical to every rival's and its buyers already know every price.

What they are: spending aimed at demand instead of at output. A radio spot, a printed wrapper, a registered name, a free sample, a delivery van. The good produced would be the same without them, and the number of units sold would not.

How they enter cost: add them to production cost and average total cost rises at every output, lifting the whole curve. They behave largely as a fixed cost, since one campaign covers whatever quantity follows, so the selling cost carried by each unit falls as sales grow.

$$\mathrm{ATC} = \frac{\mathrm{TC}_{\mathrm{production}} + \mathrm{TC}_{\mathrm{selling}}}{\mathrm{Q}}$$

What they buy: a demand curve further to the right and, where the name takes hold, a steeper one, because a buyer attached to a brand tolerates a wider price gap before leaving. The spending is worth making only while the revenue it brings in exceeds the cost it adds.

Why a price taker spends nothing: the product is homogeneous, so an advertisement for one grower's cotton advertises every grower's cotton equally. Knowledge is perfect, so nobody needs telling the price. And the firm can already sell its whole output at the going price, leaving nothing for a poster to shift.

The presence of a selling cost curve is the plainest practical mark that a market is imperfect.

The Master Key: *A firm advertises only when a buyer could tell its product from a rival's, which is exactly why no price taker ever does.*

REAL Question 158

Forty stalls at Chief Kingalu sell sandals. Ask any one of them the price and he names his own, not the market's. Ask him to name a large one and he laughs.

Identify the market structure in which these workshops operate and justify the answer by reference to its characteristics.

About forty small workshops cut, stitch and sell leather sandals at Chief Kingalu market in Morogoro.

Each stamps its own name on the sole and cuts its straps to a pattern of its own.

Prices run from TShs 12,000 to TShs 18,000 a pair, and every stall knows what the others are charging.

A new maker needs a bench, hand tools and leather, and two workshops opened during the last season.

Buyers compare several stalls before choosing, and most say another maker's sandal would do if their usual maker were closed.

No workshop supplies more than a small share of the trade, and none advertises beyond a painted board.

Model Answer

These workshops trade under monopolistic competition, neither perfect competition nor oligopoly: the sandals are close but imperfect substitutes, since buyers say a rival's pair would serve, the sellers are many and individually small, entry needs only a bench and tools and has recently happened, and each maker names a price of its own within a band instead of accepting one going price.

Many small sellers: forty workshops, not one of them large enough to move the market by its own decision, and not one of them obliged to guess a rival's reply before acting. That last point rules out oligopoly, where interdependence is the defining feature of every decision.

Differentiated, yet close substitutes: the stamped name and the cut of the strap give each maker buyers of its own, so the product is not homogeneous and this cannot be perfect competition. But buyers say a rival's pair would do, so the substitutes are close and no maker holds a captive market.

Entry is relatively free: a bench, hand tools and leather are the whole of the barrier, and two makers opened last season. There is no patent, licence or scarce input to keep anyone out, which is why any profit above the normal will shortly be shared out among newcomers.

Price making within a band: a spread from TShs 12,000 to TShs 18,000 that survives a season shows each maker choosing a price rather than reading one off the market. Under perfect competition that spread could not last, since buyers with full knowledge of an identical good would desert the dearer stall entirely.

The demand curve this implies: each maker faces a downward sloping but shallow curve. Add TShs 500 to a pair and a few regulars stay; add TShs 5,000 and the stall empties. So average revenue exceeds marginal revenue, and the price charged will stand above marginal cost.

$$P = AR > MR = MC$$

Even the painted board is evidence: a seller only pays to be identified where buyers can tell one seller from another. The board is a small selling cost, and a selling cost of any size is impossible in a market of identical goods and perfect knowledge.

The label is not a formality: it predicts that a good season here will be a shared season next year.

The Master Key: *Place a market by asking how wide a price gap a buyer would tolerate before walking to the next stall.*

REAL Question 159

The beans in the two packets came off the same slopes on the same lorry. One packet fetches a third more than the other, and the whole of the difference is printed on the outside.

Explain how this spending affects the firm's cost and revenue curves, and state the condition under which it is worth making.

Kahawa Bora roasts and packs coffee at Moshi and sells through Meimoria market and a few shops in the town.

Eleven other roasters sell in the same market, and the beans all come from the same slopes.

The firm spends TShs 1,400,000 a month on printed pouches, a registered name and spots on a local radio station.

Production cost alone works out at TShs 6,200 for a half kilogramme packet, and is much the same at any output it can reach.

It now sells 2,000 packets a month at TShs 9,000, against 1,400 packets a month at TShs 8,200 before the spending began.

Any roaster in the market could copy the pouch and the radio spots within a season.

Model Answer

The outlay is a selling cost: it adds nothing to the coffee, it shifts the demand curve for this firm's coffee outward and steepens it a little, and it lifts average total cost by TShs 700 a packet at present sales; it is worth making because the extra revenue of TShs 6,520,000 a month exceeds the extra production and selling costs together by TShs 1,400,000, and it stays worth making only for as long as the eleven rivals have not copied it.

A selling cost, not a production cost: the pouch, the registered name and the radio spots add nothing whatever to the coffee inside. They are spent on demand rather than on output, which is why a grower selling unbranded beans by weight would never spend a shilling on them.

What it does to the cost curves: add the monthly outlay to production cost and average total cost rises at every output. At the present 2,000 packets it adds TShs 700 to each one. Because one campaign covers whatever quantity follows, that addition grows smaller as sales grow.

$$\text{ATC} = 6{,}200 + \frac{1{,}400{,}000}{2{,}000} = 6{,}900$$

What it does to the revenue curves: the firm now sells 600 more packets at a price TShs 800 higher. Only an outward shift of the demand curve can do that, since a movement along one curve trades quantity against price. Buyers attached to the name also tolerate a wider gap before switching, so the curve steepens.

The test, applied: compare what the change added to revenue with what it added to cost, and spend while the first is larger.

$$\Delta\,\text{TR} = 18{,}000{,}000 - 11{,}480{,}000 = 6{,}520{,}000$$
$$\Delta\,\text{TC} = 3{,}720{,}000 + 1{,}400{,}000 = 5{,}120{,}000$$

The answer in money: the surplus above all costs rises from TShs 2,800,000 to TShs 4,200,000 a month, so the campaign pays the firm TShs 1,400,000. Note that the test is a marginal one and takes no view on whether the buyers were told anything true.

The warning attached to it: any roaster may copy the pouch within a season. When twelve roasters all advertise, each may hold the share it began with while every one of them carries the higher cost curve, so the gain is competed away and only the raised cost remains.

Selling cost earns its keep only while it moves buyers, and it moves fewest buyers precisely when every rival is carrying it too.

The Master Key: *Advertising is an investment in a demand curve, and like any investment it pays only until the neighbours make the same one.*

HOT Question 160

Ask a buyer why she pays more for the wrapped bar and she will give a reason. Ask a chemist to find the difference and he will not. Both of them are telling the truth.

Discuss whether it matters, for economic analysis, that many of the differences between products under monopolistic competition are imagined rather than real.

Model Answer

For the mechanics of the model it does not matter at all, because a demand curve is drawn from what buyers believe and an imagined difference gives the firm exactly the same downward sloping curve as a real one; for the welfare verdict it matters a great deal, since real differentiation extends what can actually be had while imagined differentiation may only rearrange buyers among identical goods at a genuine cost in printing and airtime, although the satisfaction a believed difference delivers is itself real.

The model does not ask the question: a demand curve records willingness to pay. If buyers will pay more for the wrapped bar than the plain one, the firm faces a curve that slopes downward, and every line of the diagram is identical whether the belief behind it is well founded or not.

The satisfaction is real even when the difference is not: utility is subjective, and a buyer who enjoys the branded soap more does obtain more from it. To call that a delusion is to put the analyst's judgement in place of the buyer's, which the rest of the subject consistently refuses to do.

But real differentiation adds a genuine option: a sandal that lasts two seasons, a shop open after dark, a bread baked without sugar for a buyer who must avoid it. These widen the range of what can actually be obtained, and a market producing them is doing something no single standard product could do.

Imagined differentiation can consume resources for nothing: where two names come off one vat, the wrappers, the campaigns and the shelf space are real costs producing no real difference. Society pays in paper and airtime for a redistribution of buyers between goods that were the same at the outset.

It changes what policy should attempt: where the difference is real, forcing standardisation destroys value that buyers wanted. Where it is imagined, honest labelling, published test results and enforced content standards can leave buyers equally satisfied at a lower cost, and that is a gain rather than a restriction.

And it changes how durable the advantage is: a real advantage is defended by doing something rivals cannot easily match. An imagined one rests on a belief and the next campaign can dislodge it, which is why trades built on imagined differences carry the heaviest and most continuous selling costs of all.

The honest position is that a belief is a fact about the world, and the resources spent creating it are a fact as well.

The Master Key: *An imagined difference bends the demand curve exactly as a real one does, and only the welfare verdict can tell the two apart.*

HOT Question 161

Every stall in the row sells the same rice, until you ask a buyer why she walks past four of them to reach the fifth.

Examine the view that monopolistic competition describes most Tanzanian retail trade better than perfect competition does.

Model Answer

The view is largely right: goods sold in a market street are rarely homogeneous once location, credit, trust and service are counted as part of what is bought, knowledge is imperfect because searching costs time, and different prices for apparently similar goods plainly persist, all of which perfect competition forbids; but the fit is not complete, since some trades in graded produce come genuinely close to price taking, and in others the sellers are few enough that oligopoly describes them far better.

The products are not homogeneous: two stalls selling the same rice differ in where they stand, in whether credit is given, in whether the measure is trusted and in whether the seller knows the buyer by name. Those differences are part of the purchase, and they are enough to give each seller a curve of its own.

Prices differ, and go on differing: a spread of prices for a similar good, holding across a whole season, is the plainest evidence against perfect competition. Under that model the dearer seller would lose every buyer at once. That she does not is proof that buyers treat the versions as different things.

Knowledge is imperfect because it is costly: a buyer would have to walk the whole market to learn every price, and walking costs time she could sell. That search cost by itself gives each seller a little room to price above the cheapest, and that room is precisely what the model requires.

Entry is easy, which fits exactly: the capital needed to open a stall is small, and new sellers appear wherever a trade begins to look profitable. That is the second half of monopolistic competition, and it explains why margins in these trades stay thin and good years are rarely repeated.

Where the fit fails on one side: a cotton grower at Kishapu or a maize seller at Kibaigwa faces a going price for a graded, standard crop and cannot influence it by anything he does. For those trades the price taking model is not a caricature at all but a fair working description.

And where it fails on the other: in cement, telecommunications and brewing the firms are few, each watches the others closely, and every price decision anticipates a reply. Interdependence of that kind belongs to oligopoly, and calling those trades monopolistically competitive would conceal the most important fact about them.

Classify a market by testing its assumptions one at a time, never by counting the shops in the street.

The Master Key: *Most real trade sits in the middle of the spectrum, and monopolistic competition is the model built for the middle.*

Short-run Equilibrium under Monopolistic Competition

This is the third time the same apparatus is put to work, and it should take a fraction of the time the first pass did. The rule for choosing output has not changed and will not change: marginal cost equal to marginal revenue, with marginal cost cutting marginal revenue from below. The three outcomes are still read off the position of price against average total cost. Exactly one thing is new, and it is the slope of the demand curve. It falls, because the product is differentiated, so marginal revenue lies below price and the price charged exceeds marginal cost; and it falls gently, because a close substitute always stands on the next stall. Work this section as a comparison, not as a fresh derivation.

BINDER Question 162

You have drawn this diagram twice, once with a flat demand curve and once with a steep one. The third drawing changes nothing but the slope, and the slope decides the price.

With the aid of a diagram, show the short-run equilibrium of a firm under monopolistic competition that is earning supernormal profit.

Model Answer

The firm produces where marginal cost equals marginal revenue with marginal cost cutting marginal revenue from below, reads its price off the average revenue curve above that output, and earns supernormal profit because at that output price exceeds average total cost; the only difference from perfect competition is that average revenue slopes downward, so marginal revenue lies beneath it and the chosen price stands above marginal cost.

The conditions are the familiar ones: nothing new is required. Profit is maximised where marginal cost equals marginal revenue and marginal cost cuts marginal revenue from below, the second condition ruling out the earlier intersection at which profit is at its worst.

$$\text{MC} = \text{MR} \quad \text{and} \quad \text{MC rising through MR}$$

What differs is the demand curve: average revenue slopes downward because the product is differentiated, so an extra sale needs a lower price on every unit and marginal revenue falls below average revenue. The curve is shallow, because close substitutes stand next door.

$$AR > MR$$

Reading figure 6.26: marginal cost cuts marginal revenue from below at the equilibrium output. Go straight up to the average revenue curve and across for the price, and up only as far as the average total cost curve for the cost per unit. Price stands above cost per unit.

The profit rectangle: supernormal profit is the block lying between the price and average total cost at that output, running back to the vertical axis. Its height is profit per unit and its width is the output.

$$\pi = (P - ATC) \times Q_e$$

Where price sits against marginal cost: average revenue exceeds marginal revenue, and marginal revenue equals marginal cost, so price exceeds marginal cost. A price taker at its own equilibrium has price equal to marginal cost, so this outcome is already allocatively inefficient.

$$P = AR > MR = MC$$

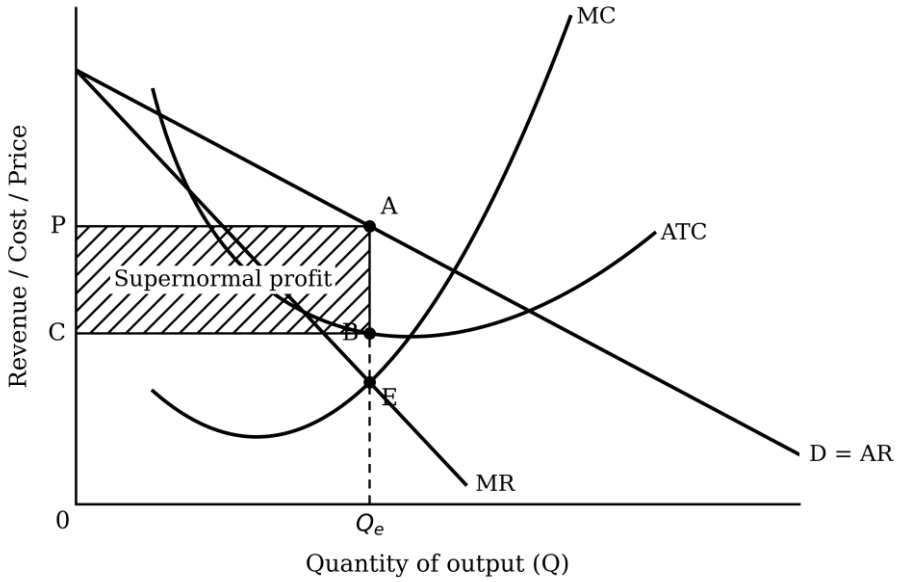


Figure 6.26: *Short-run supernormal profit under monopolistic competition*

Notice the word short: the rectangle you have just shaded is precisely what will bring the next firm into the trade.

The Master Key: *The conditions never change, only the gap between average and marginal revenue, and that gap is the whole of the firm's market power.*

BINDER Question 163

A guest house on a wet Tuesday takes less for a room than the room costs to keep. It opens anyway, and the arithmetic that says it should is the same arithmetic used in a maize field.

With the aid of a diagram, show a firm under monopolistic competition making a short-run loss, and explain why it may continue to produce.

Model Answer

The firm still produces where marginal cost equals marginal revenue with marginal cost cutting from below, but demand has fallen so far that at that output the price lies below average total cost, and the loss is the block between them; it goes on producing so long as the price covers average variable cost, because the fixed cost falls due whether it opens or not and every shilling above variable cost reduces the loss.

The same two conditions find the output: a loss-making firm still minimises its loss where marginal cost equals marginal revenue with marginal cost cutting from below. The conditions locate the best output; the position of price against average total cost then decides whether that best is a profit or a loss.

Reading the loss off figure 6.27: at the equilibrium output the average total cost curve lies above the average revenue curve. The block between the two, running from the axis out to the output, is the loss, and its height is the loss carried by each unit.

$$\text{Loss} = (\text{ATC} - \text{P}) \times \text{Q}_\text{e}$$

Why it does not close at once: fixed costs are already committed and cannot be escaped in the short run. If price covers average variable cost with something over, that surplus goes towards the fixed cost, so the loss from opening is smaller than the loss from standing idle.

$$\text{P} > \text{AVC} \Rightarrow \text{continue in the short run}$$

When it must close: if price falls below average variable cost, every unit sold widens the loss and shutting limits it to the fixed cost. That rule was learned under perfect competition and is untouched by the slope of the demand curve, because it compares price with an escapable cost only.

$$\text{P} < \text{AVC} \Rightarrow \text{shut down}$$

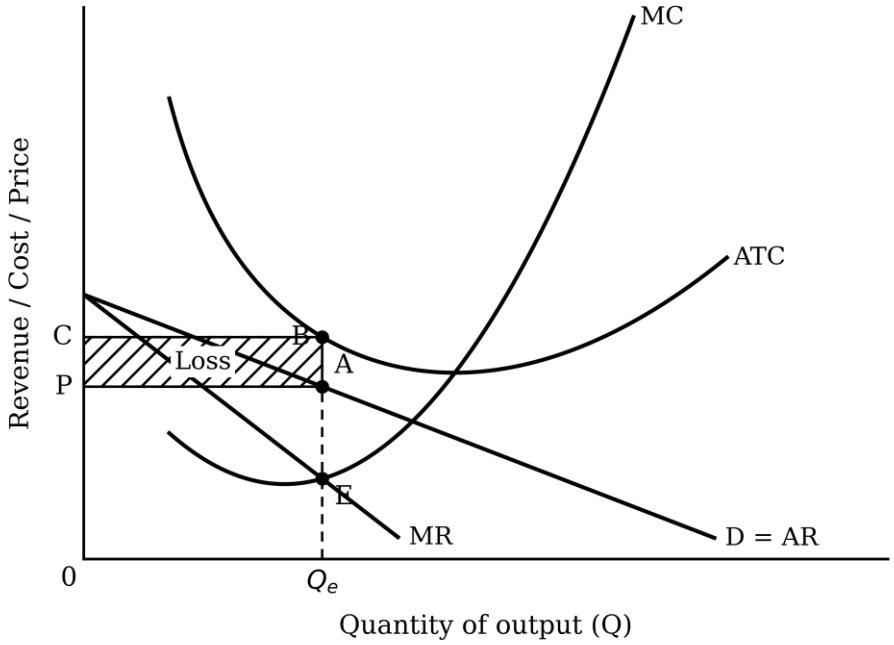


Figure 6.27: *Short-run loss under monopolistic competition*

In the long run no cost is committed, so the loss cannot stand and the firm leaves, which is how the survivors' demand curves recover.

The Master Key: *Break-even is settled at average total cost and survival at average variable cost, whatever shape the demand curve happens to have.*

BINDER Question 164

Three market structures, three diagrams, one rule. A student who has learned it three times has not learned three things.

Compare the short-run equilibrium of a firm under monopolistic competition with that of a firm under perfect competition and of a monopolist.

Model Answer

All three maximise profit in the same place, where marginal cost equals marginal revenue and marginal cost cuts marginal revenue from below, and in all three the outcome is read off the position of price against average total cost; they differ only in the firm's own demand curve, horizontal for the price taker, steeply falling for the monopolist, and gently falling for the monopolistic competitor whose close substitutes make it the more elastic of the two price makers.

What is identical: the profit-maximising rule and both of its conditions, the reading of supernormal profit, normal profit or loss from price against average total cost, and the shut-down test at average variable cost. Learn the apparatus once and it serves everywhere.

What differs, in a single line: the elasticity of demand facing the individual firm, which is infinite under perfect competition, high but finite here, and low under monopoly. That one difference generates every other difference in the diagram.

$$e_{\text{perfect}} = \infty > e_{\text{monopolistic}} > e_{\text{monopoly}}$$

The revenue consequence: for the price taker the demand curve is also the marginal revenue curve. For both price makers marginal revenue lies below average revenue, so the price charged exceeds marginal revenue and therefore exceeds marginal cost as well.

$$P = AR = MR \text{ (price taker)}, \quad AR > MR \text{ (price maker)}$$

The size of the profit differs: a monopolist's supernormal rectangle can be tall, because no rival stands ready to undercut it. The same rectangle appears here in the short run, but it is thinner, since a substitute version already exists and buyers may be had for a small price cut.

And the long run will differ: entry is blocked under monopoly, so the profit survives. Entry is free here and under perfect competition, so it will not. That is why the short-run diagram for this structure tells only half the story.

One rule for output, three demand curves, and everything that looks new comes from the demand curve alone.

The Master Key: *Learn the apparatus once and thereafter ask only one question of a new structure: how elastic is the demand curve facing this firm.*

REAL Question 165

Every room behind the seafront is taken in August and the owner is counting a very good month. She should also count the builders on the plot two doors down.

Calculate the guest house's profit for the month and explain why its price stands so far above marginal cost.

Bahari Njema Guest House is one of many small guest houses in the streets behind the seafront at Stone Town, Zanzibar.

Each house differs in its rooms, its position and the breakfast it serves, and visitors compare several before booking.

In the August season the house lets 300 room nights in the month at TShs 90,000 a night.

Average total cost at that occupancy is TShs 62,000 a room night, of which TShs 38,000 is variable.

Preparing and servicing one more room for one more night costs about TShs 55,000, since extra staff must be paid at overtime rates.

Two more guest houses are being built in the same street.

Model Answer

The house earns supernormal profit of TShs 8,400,000 in the month, being the TShs 28,000 by which price exceeds average total cost on each of 300 room nights; price stands at TShs 90,000 against a marginal cost of TShs 55,000 because the house is a price maker whose average revenue exceeds its marginal revenue, and profit is maximised where marginal cost equals that lower marginal revenue, never where it equals price.

The equilibrium these figures describe: the house lets rooms up to the point where the cost of servicing one more room night equals the revenue that room night adds, with marginal cost rising through marginal revenue from below. At 300 room nights that marginal cost is TShs 55,000.

The profit: profit per room night is price less average total cost, and the month's profit is that multiplied by the nights let. This is supernormal profit, because normal profit already sits inside the TShs 62,000 as the return the owner's capital would earn elsewhere.

$$\pi = (90{,}000 - 62{,}000) \times 300 = 8{,}400{,}000$$

Why price exceeds marginal cost: to fill one more room the house must shade the price on rooms it could have let dearer, so the revenue an extra night adds is well below the price it fetches. Setting that marginal revenue equal to marginal cost leaves price far above marginal cost.

$$P = 90{,}000 > MC = 55{,}000$$

How much power that implies: the relation between marginal revenue and price measures it. Demand facing this house is elastic, as close substitutes require, but a long way from the infinite elasticity a price taker meets.

$$MR = P\left(1 - \frac{1}{e}\right) \Rightarrow 55{,}000 = 90{,}000\left(1 - \frac{1}{e}\right) \Rightarrow e \approx 2.6$$

On figure 6.26: average revenue lies above average total cost at the chosen occupancy, and the rectangle between them is the profit. Marginal cost of TShs 55,000 is below average total cost, so average cost is still falling and the house is not working its rooms at their cheapest.

The builders two doors down: none of this is protected. Entry needs a house and a licence, the two new places will take a share of next August, and this firm's demand curve will shift left and flatten until the rectangle has gone.

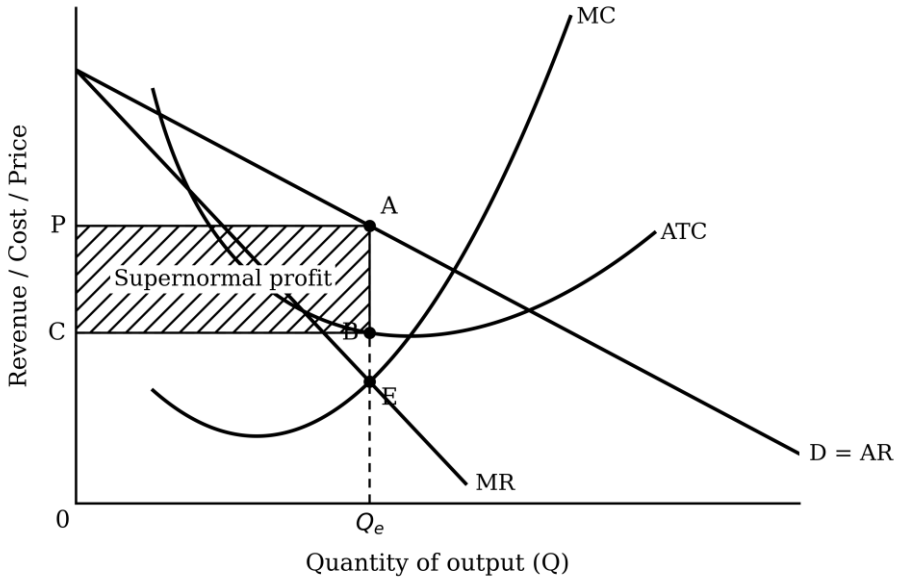


Figure 6.26: *Short-run supernormal profit under monopolistic competition*

A good August is evidence about this month and a warning about the next one.

The Master Key: *Supernormal profit in a trade anyone may enter is not a reward but an advertisement.*

REAL Question 166

The oven at the back is worth more standing hot at a loss than standing cold. Working out why is the whole of the shut-down rule.

Advise the owner whether to close the bakery for the remainder of the season, showing the calculation on which the advice rests.

Baraka Bakery is one of about a dozen small bakeries at Singida, each selling a wrapped loaf under its own name.

A new bakery opened in March, and a poor harvest has since raised the price of flour.

The bakery now sells 400 loaves a day at TShs 900, which is the most its buyers will pay.

Average total cost is TShs 1,050 a loaf and average variable cost is TShs 780.

Rent on the premises and the instalment on the oven come to TShs 108,000 a day whether it bakes or not.

Cutting the price to TShs 800 would sell about 60 loaves a day more, and no more than that.

Model Answer

Keep the oven working to the end of the season, because the loss of TShs 60,000 a day from baking is smaller than the TShs 108,000 a day of rent and instalments that would fall due with the doors shut; the price of TShs 900 covers average variable cost of TShs 780 and leaves TShs 120 a loaf towards the fixed cost, cutting the price would deepen the loss, and if nothing has improved when the lease falls due the bakery should leave the trade.

Establish the loss: at 400 loaves the price of TShs 900 lies below average total cost of TShs 1,050, so each loaf loses TShs 150 and the day loses TShs 60,000.

$$\text{Loss} = (1{,}050 - 900) \times 400 = 60{,}000$$

Compare it with the loss from closing: shutting the doors cancels neither the rent nor the instalment, so closing converts a loss of TShs 60,000 a day into a loss of TShs 108,000 a day. The comparison, not the size of the loss, is what settles the decision.

$$\text{Loss if closed} = 108{,}000 > 60{,}000$$

The rule behind the comparison: price covers average variable cost with TShs 120 to spare on every loaf, and 400 loaves contribute TShs 48,000 a day towards the fixed cost. Produce while price exceeds average variable cost; close at once when it does not.

$$(900 - 780) \times 400 = 48{,}000 = 108{,}000 - 60{,}000$$

Do not try to price the way out: dropping to TShs 800 would sell 60 loaves more and raise takings by only TShs 8,000, which is about TShs 133 a loaf against a variable cost of TShs 780. Marginal revenue that far below marginal cost makes the loss worse, not better.

On figure 6.27: average total cost lies above average revenue at the equilibrium output, and the block between them is the daily loss. The output itself is still fixed where marginal cost cuts marginal revenue from below, because losing money changes neither condition.

The long run is a different answer: this cannot outlast the lease. Either flour falls, or somebody in the dozen leaves and the survivors' demand curves shift back, or this bakery is the one that goes. In the long run every cost can be escaped and a loss-making firm escapes them.

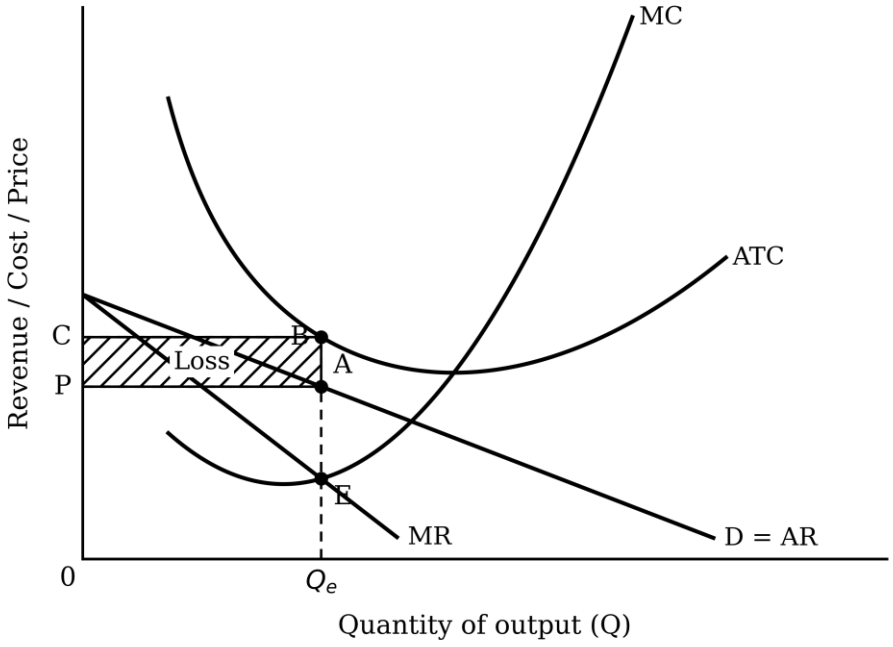


Figure 6.27: *Short-run loss under monopolistic competition*

Advise on the margin and not on the mood: the question is never whether the bakery is doing badly but whether closing would do worse.

The Master Key: *A firm shuts down when the price stops covering the costs it could escape by shutting down.*

HOT Question 167

The tailor charges a third more than the stall opposite and his customers keep coming back. Somebody will call that exploitation, and the diagram has something more careful to say.

Assess the claim that a firm earning supernormal profit under monopolistic competition is exploiting its customers.

Model Answer

The claim has a foundation but overstates the case: price does exceed marginal cost, so buyers who value the good above what the last unit costs to make go without it, and that allocative loss is real; but the gap is held narrow by the elasticity that close substitutes impose, the buyer is under no compulsion and pays the premium because the difference is worth something to her, part of the premium covers a genuinely dearer product, and free entry removes the surplus within a season or two.

The charge has a real basis: at the chosen output price stands above marginal cost, so units that buyers would value at more than they cost to make are never made. That is a genuine allocative loss and it is not an accounting quibble about who holds the money.

But the power is small and bounded: demand facing the firm is elastic, because a rival version stands on the next stall. A price much above the rest of the trade empties the shop, so the width of the gap between price and marginal cost is fixed by the buyer's willingness to walk away.

The buyer is not compelled: no barrier stops the customer taking a rival's version, and the premium she pays measures what the difference is worth to her. A price paid freely with substitutes on either side is weak evidence of exploitation, whatever it looks like on the receipt.

Part of the premium is cost, not surplus: the differentiated version may genuinely cost more to provide, in position, in service, in materials or in the selling cost of the name. Only the part of the margin above every cost, normal profit included, is surplus at all, and it is smaller than the price gap suggests.

And it is temporary by construction: the profit is visible and nothing keeps a newcomer out, so rivals arrive and compete it away. A structure that dismantles its own supernormal profit within a season or two is a poor candidate for the charge.

The assessment: call it a small and self-correcting inefficiency rather than exploitation. The allocative loss is real but bounded, the buyer holds alternatives, and the remedy is already inside the market. Keep the harder word for structures where a barrier holds the price up permanently.

The interesting question is not whether this firm is charging above marginal cost but why nobody has yet undercut it.

The Master Key: *Price above marginal cost is a real cost to society, but exploitation needs a barrier, and there is none here.*

HOT Question 168

A firm losing money feels obliged to do something. The two things it usually does, cutting the price and buying advertising, are not equally sensible, and one of them is almost never sensible at all.

Discuss whether a firm under monopolistic competition making a short-run loss should respond by cutting its price or by spending on advertising.

Model Answer

Neither should be reached for by reflex, and both answer to the same test, whether the move adds more to revenue than it adds to cost; a price cut usually fails that test, because the lower price applies to every unit already selling and the loss on those swallows the gain on the new ones, while advertising can pass it, because it shifts the demand curve outward instead of sliding the firm down it, though only for as long as the rivals have not answered with campaigns of their own.

What a price cut actually does: it moves the firm along its own demand curve, so the new lower price applies to every unit, not merely to the extra ones. Marginal revenue therefore falls well below the new price, and where it falls below marginal cost the cut deepens the loss.

When a cut is nevertheless right: if the firm is sitting where marginal revenue still exceeds marginal cost, it is priced above its profit-maximising point and should cut. That is a question about its position on the curve, not about how bad the month has been, and the two are easily confused.

What advertising does instead: a selling cost aims to shift the demand curve rightwards and steepen it, so the firm may sell more without surrendering price. If it works, average revenue rises at every output rather than falling, which is precisely what a firm short of revenue needs.

But advertising is a cost as well: it enters average total cost and must be paid whether or not it succeeds. A firm already unable to cover average total cost is spending against a shift it cannot be sure of, which is an uncomfortable position from which to gamble.

The rival's reply decides both: if all twelve firms advertise, each may hold the share it began with while every one carries a higher cost curve. A price cut invites matching in the same way. Either move pays only while the firm is alone in making it.

Diagnose before prescribing: if the loss came from a cost rise, neither instrument touches it and the firm should attack the cost. If demand fell because a rival entered, a modest and specific selling effort is the better bet. If the loss survives to the end of the fixed-cost period, leave.

The pressure to act is strongest exactly when a marginal calculation matters most, which is why so many firms cut price and so few of them recover.

The Master Key: *A price cut gives away money on the units already sold, while advertising at least aims at the units not yet sold.*

Long-run Equilibrium and Excess Capacity

The short-run diagram is only half the story, because nothing keeps a newcomer out of this trade. Supernormal profit calls in rivals, the rivals take a share of every existing firm's custom, and each firm's demand curve retreats until it merely touches the average total cost curve. At that tangency the firm earns normal profit, exactly as under perfect competition. What is not the same, and what the diagram shows without ever saying, is where the tangency sits: on the falling branch of the cost curve, short of the output at which cost per unit would be lowest. That shortfall has a name, a measurement, an efficiency verdict and a defence, and this section supplies all four.

BINDER Question 169

Nine more salons opened on the road in three years. Not one of the fourteen now earns more than the owner could have earned elsewhere, and every one of them still has a name of its own.

Explain how supernormal profit is eliminated in the long run under monopolistic competition, and state the conditions holding at the long-run equilibrium.

Model Answer

Supernormal profit attracts new firms, and because the newcomers sell close substitutes they take part of every existing firm's custom, so each firm's demand curve shifts to the left and flattens as buyers gain more versions to choose between; entry continues until the demand curve has been pushed back to a single point of contact with average total cost, where price equals average total cost and only normal profit is left.

The signal and the response: a supernormal rectangle is visible to everyone in the trade, and no patent, licence or scarce input keeps a newcomer out. Firms enter until the reason for entering has disappeared.

What entry does to the firm's own curve: the same buyers are now shared among more versions, so this firm sells less at every price and its demand curve shifts leftward. It also flattens, because each buyer now has more near substitutes and will leave for a smaller price gap.

Where the process stops: it stops when no supernormal profit is left anywhere, which happens when the demand curve has retreated until it merely touches the average total cost curve. At that tangency, price and average total cost are the same number at the equilibrium output.

$$\mathrm{AR} = \mathrm{ATC} \quad \text{at} \quad \mathrm{Q_e}$$

The conditions that hold there: all three together. The first two locate the output and the third describes the profit. Losses work the same way in reverse: firms leave, the survivors' curves shift rightward, and the tangency is reached from below.

$$\text{LMC} = \text{LMR}, \quad \text{LMC cuts LMR from below}, \quad \text{P} = \text{LATC}$$

Normal profit is not nothing: normal profit is part of economic cost and already sits inside average total cost, so the owner receives exactly what the same capital and effort would have earned in their next best use. Zero economic profit means no surplus, not no income.

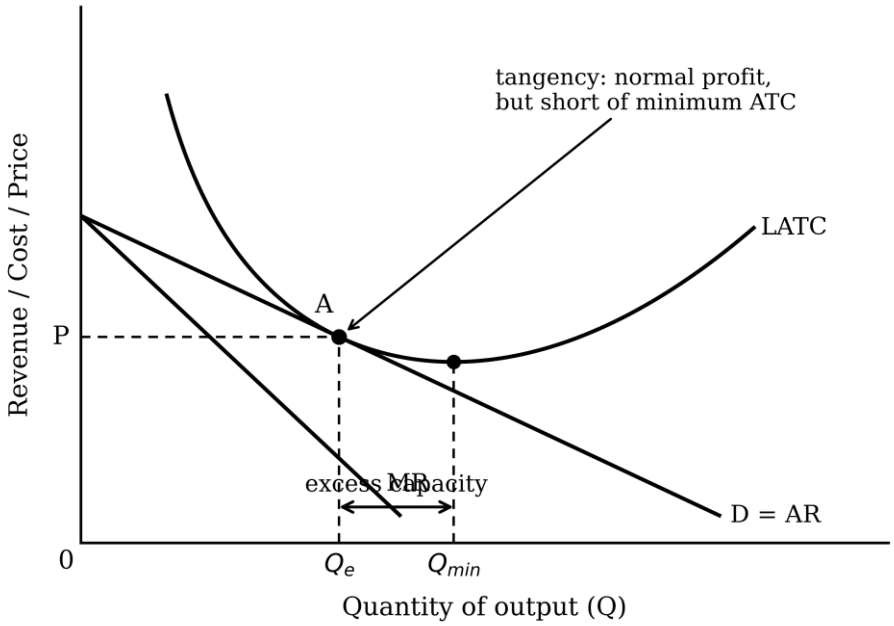


Figure 6.28: *Long-run tangency and excess capacity under monopolistic competition*

The firm ends up as well off as a perfectly competitive one, and at a higher cost for every unit it makes.

The Master Key: *Free entry removes the profit but never the differentiation, so the demand curve finishes by touching the cost curve rather than crossing it.*

BINDER Question 170

In every drawing of this equilibrium the two curves touch on the falling side of the cost curve, never at its bottom. That is not a slip of the draughtsman's hand. It is forced, and it has a name.

Define excess capacity and show how it is measured under monopolistic competition.

Model Answer

Excess capacity is the amount by which a firm's long-run output falls short of the output at which its average total cost would be lowest; under monopolistic competition it cannot be avoided, because a downward sloping average revenue curve can only be tangent to a U-shaped average total cost curve at a point where that cost curve is still falling, which lies to the left of the minimum, and the horizontal gap between the two outputs is the measure of it.

The definition: the shortfall of actual output below the output that minimises average total cost. It is not machinery standing idle in a slump. It is a permanent feature of the long-run equilibrium, present while the firm is doing the best it possibly can.

$$\text{Excess capacity} = \text{Q}_{\text{min ATC}} - \text{Q}_{\text{e}}$$

Why the tangency must lie on the falling branch: where two curves are tangent they have the same slope. Average revenue slopes downward, so average total cost must slope downward at that point too, and a U-shaped cost curve slopes downward only before its minimum. The tangency is therefore always to the left of it.

Measured on the firm used throughout this chapter: average total cost reaches its lowest value of TShs 8.09 at an output of 13.85 units. Suppose entry leaves the tangency at 10.5 units, where average total cost is TShs 9.20. The excess capacity is 3.35 units, about a quarter of the least-cost output.

$$13.85 - 10.5 = 3.35 \text{ units} \approx 24\% \text{ of } 13.85$$

What it costs: every unit is made for TShs 1.11 more than this same plant could have managed, so the trade's output could have been produced by fewer firms each working nearer capacity. Half empty guest houses and salons with idle chairs are this diagram out in the street.

$$9.20 - 8.09 = 1.11 \text{ per unit}$$

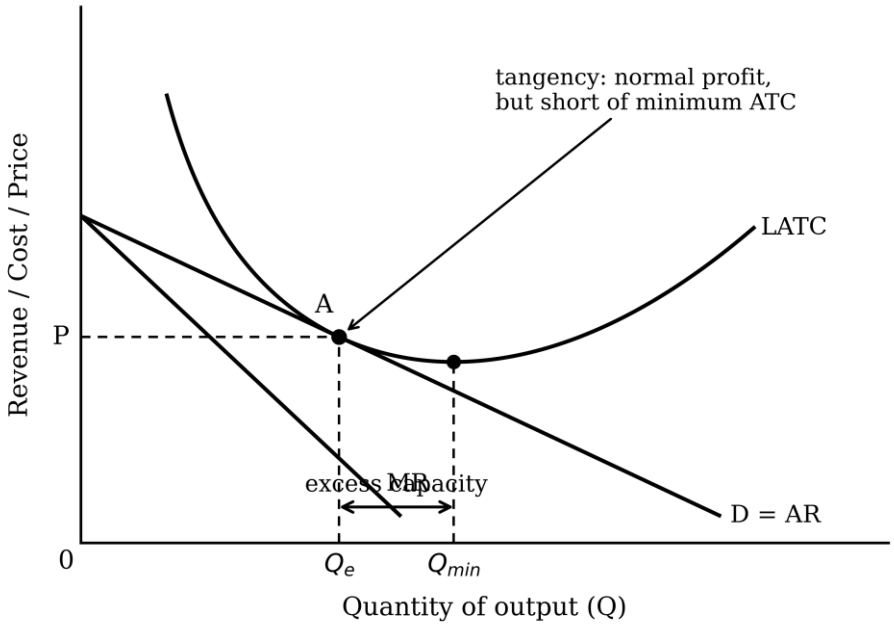


Figure 6.28: *Long-run tangency and excess capacity under monopolistic competition*

The excess capacity is what a market pays for the right to offer its buyers a choice.

The Master Key: *A falling demand curve can only touch a U-shaped cost curve on the way down, and the distance from there to the bottom is excess capacity.*

BINDER Question 171

The firm covers every cost, cheats nobody and earns no surplus at all. It still fails both tests of efficiency, and it fails them for the same reason its customers have something to choose between.

Explain why a firm in long-run equilibrium under monopolistic competition is neither allocatively nor productively efficient.

Model Answer

Allocative efficiency requires price to equal marginal cost, and here price equals average revenue, which exceeds marginal revenue, which equals marginal cost, so price stands above marginal cost and buyers who value the good above what it costs to make go without; productive efficiency requires production at minimum average total cost, and the long-run tangency lies to the left of that minimum, so every unit is made for more than the lowest attainable cost.

Allocative efficiency, stated and tested: the test asks whether the last unit made is worth to buyers exactly what it costs society to make. The demand curve gives the value and marginal cost gives the cost, and here the chain of inequalities settles it.

$$\text{P} = \text{AR} > \text{MR} = \text{MC} \Rightarrow \text{P} > \text{MC}$$

Productive efficiency, stated and tested: the test asks whether the good is made at the lowest average cost the firm could reach. The tangency sits on the falling branch of the average total cost curve, so the test fails by exactly the width of the excess capacity.

How large the failure is: smaller than under monopoly on both counts. The demand curve here is elastic, so the gap between price and marginal cost is narrow, and free entry strips away the supernormal profit a monopolist keeps. This is a failure of degree, not of kind.

What the inefficiency buys: the excess capacity is the price of variety. A single standard product made at minimum average total cost would pass both tests and would leave every buyer one version to choose from, so the comparison is not between this outcome and a costless ideal.

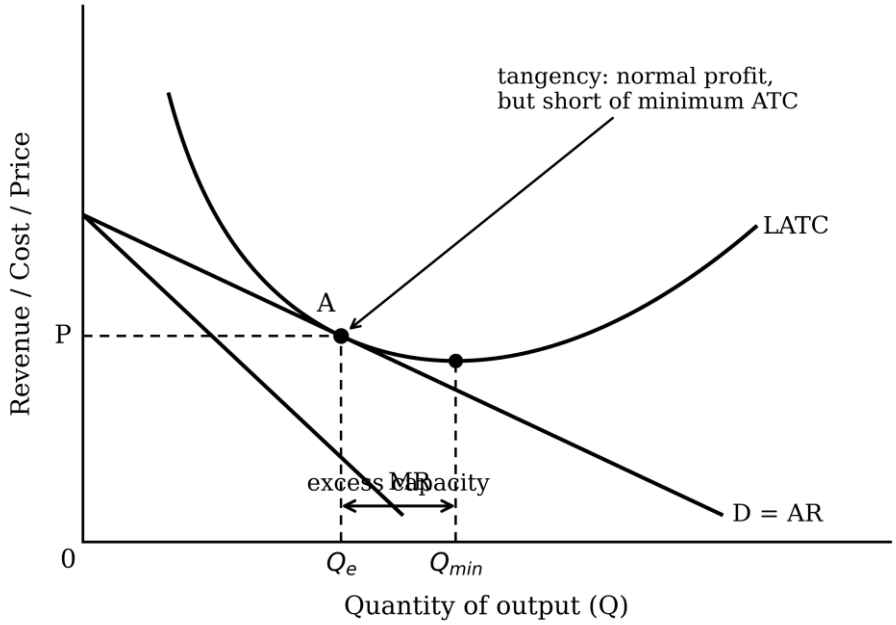


Figure 6.28: *Long-run tangency and excess capacity under monopolistic competition*

The benchmark this structure fails demands an identical product, which is the very thing its buyers are refusing.

The Master Key: *Both efficiency tests fail for one reason, that the demand curve slopes down, and that is the same reason buyers have a choice at all.*

REAL Question 172

Fourteen salons on one road and not a chair occupied at eleven on a Tuesday morning. Every empty chair is drawn in the long-run diagram, and it is drawn there permanently.

Explain why the salon now earns only normal profit despite having a name of its own, and why its chairs stand idle for much of the week.

Neema Salon is one of fourteen hairdressing salons along the Kagera road at Bukoba.

Each is known for a different style of braiding and keeps its own regular customers.

Three years ago there were five salons on the road and each was comfortably profitable.

Any trained hairdresser may open a salon with a mirror, four chairs and a dryer.

Neema charges TShs 18,000 for a full braid, and its average total cost at present custom is also about TShs 18,000.

Its four chairs are full on Saturdays and mostly empty from Monday to Thursday.

Model Answer

Entry has done it: profits were visible three years ago and nothing kept newcomers out, so nine more salons opened, the town's custom is now shared among fourteen versions instead of five, and Neema's demand curve shifted left and flattened until price and average total cost met at a single point of tangency; the idle chairs are the excess capacity that tangency forces, since a downward sloping demand curve can only touch a U-shaped cost curve while the cost curve is still falling, which means at an output below the one four chairs could serve at least cost.

The old profit was a signal: a comfortable return in a trade needing only a mirror, chairs and a dryer is an invitation. There was no licence, patent or scarce skill to keep anybody out, so entry went on until the reason for entering had gone.

What entry did to the demand curve: the same townspeople now choose among fourteen salons, so Neema sells fewer braids at every price and its curve moved leftward. It also flattened, because a customer annoyed by a price rise now has thirteen alternatives instead of four.

Why the name did not save her: the braiding style gives Neema a downward sloping curve and some power over her price, and it kept her regulars. What it cannot do is stop other people differentiating as well. A distinctive style protects the slope of the curve, never its position.

Normal profit is not nothing: price equal to average total cost means every cost is covered, including the return her capital and effort would earn in their next best use, which economists place inside average total cost. She is being paid a living; she is not being paid a surplus.

Why the chairs stay empty: at the tangency the average total cost curve is still falling, so the salon works below the output at which cost per braid would be lowest. Filling all four chairs all week would lower that cost, but there is not the custom to fill them at TShs 18,000.

This is the equilibrium, not a slump: a slump ends when demand recovers. This does not, because any recovery restores a profit, a profit brings a fifteenth salon, and the curve is pushed back again. Figure 6.28 shows the idle Monday as the gap between the tangency output and the least-cost output.

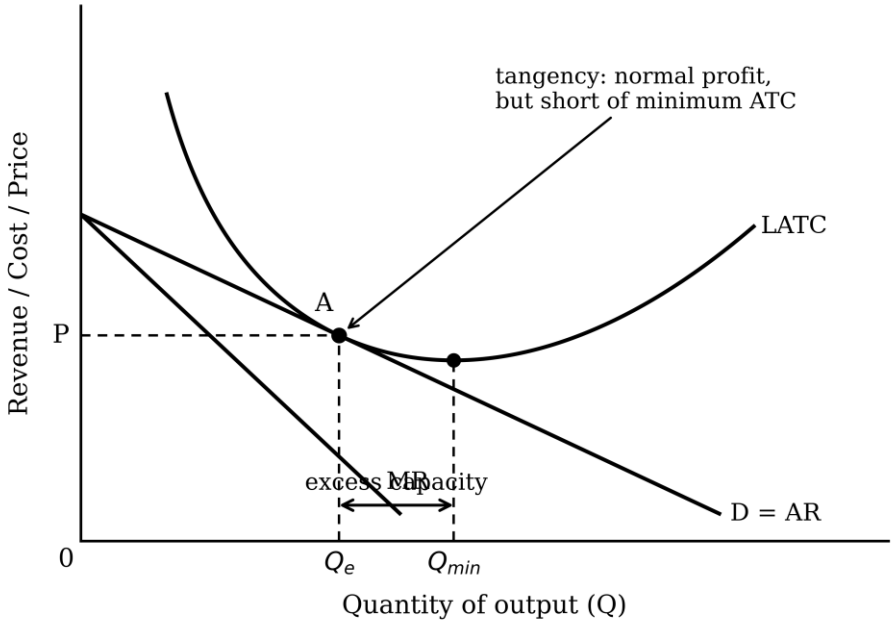


Figure 6.28: *Long-run tangency and excess capacity under monopolistic competition*

The fourteenth salon made every existing one slightly less efficient and every customer slightly better served.

The Master Key: *Free entry takes the profit away and leaves the empty chair behind.*

REAL Question 173

The wrapping machine can handle 2,400 bars a month. It handles 1,800, and it will go on handling 1,800 for as long as the market stays as it is.

Calculate the firm's excess capacity and the cost it imposes, and explain why competition has left the firm in this position.

Ziwa Soap makes a scented bar under its own wrapper at Musoma and sells it in the town and the villages around. Nine other small makers sell competing bars, all made from the same tallow and caustic soda. Ziwa sells 1,800 bars a month at TShs 2,500, and its average total cost at that output is also TShs 2,500. Its plant would reach its lowest average total cost, TShs 2,200 a bar, at 2,400 bars a month. It cannot sell 2,400 bars at TShs 2,500; to move them it would have to drop the price well below cost. Any soap maker in the region may enter, and two have entered in the last two years.

Model Answer

Excess capacity is 600 bars a month, the difference between the 2,400 bars at which average total cost would be lowest and the 1,800 actually made, which is a quarter of the least-cost output; it raises the cost of every bar by TShs 300 and so costs TShs 540,000 a month, and competition produced it because free entry pushed the firm's demand curve back until it merely touched the average total cost curve, and a downward sloping curve can only touch a U-shaped one on its falling branch.

The measurement: excess capacity is the gap between the output that minimises average total cost and the output actually produced, expressed in units of the good.

$$2{,}400 - 1{,}800 = 600 \text{ bars a month} = 25\% \text{ of } 2{,}400$$

What it costs: each bar carries TShs 300 more cost than the same plant could have achieved at 2,400 bars, so the shortfall is not a loss of profit but a rise in real cost that the buyers of Musoma ultimately pay in the price.

$$(2{,}500 - 2{,}200) \times 1{,}800 = 540{,}000 \text{ a month}$$

Why the firm cannot simply make more: its demand curve slopes downward, so shifting another 600 bars means cutting the price on all 2,400. The revenue those extra bars would bring falls well below the cost of making them, and the profit-maximising output stays where it is.

Why competition left it here: two makers entered in two years and ten now share the district. Each entrant pulled Ziwa's demand curve leftward until no supernormal profit remained, which is the same as saying until the curve merely touched average total cost.

Why the touching point is not the lowest point: at a tangency the curves share a slope. The demand curve slopes downward, so average total cost must be sloping downward there too, and it slopes downward only before its minimum. Excess capacity is forced by geometry, not by bad management.

What Ziwa is actually earning: price equals average total cost at TShs 2,500, so the firm earns normal profit and nothing above it. Normal profit is part of economic cost, so the owner is receiving what the plant and her effort would earn elsewhere, which is a living rather than a surplus.

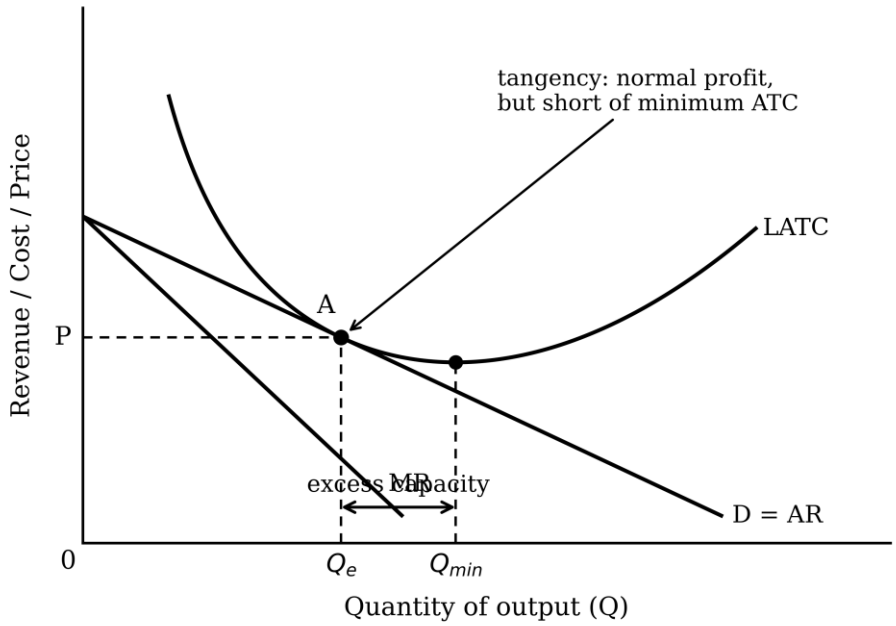


Figure 6.28: Long-run tangency and excess capacity under monopolistic competition

Ziwa is not badly run; it is correctly run in a market with more soap makers than the district can keep busy.

The Master Key: *Excess capacity is measured in units of output and paid for in cost per unit, and free entry guarantees both.*

HOT Question 174

Fourteen salons, each half empty, could be five salons working full. The saving is real, and so is what would be lost with the other nine.

Discuss whether the variety offered by monopolistic competition is worth the excess capacity it creates.

Model Answer

Usually it is, because variety is a genuine gain that neither efficiency test is built to measure, and free entry keeps demand elastic, which keeps the tangency close to the minimum and the excess capacity modest; but it turns against variety where the differences are small or imagined, where the good is a necessity bought by poor households, and where the least-cost scale is large, so that running many firms below capacity is costly.

Name the exchange precisely: on one side, the gap between the tangency output and the least-cost output, valued at the extra shillings each unit costs. On the other, the number of distinct versions a buyer may choose between. Both sides of that exchange are real.

Variety is a gain the tests cannot see: the efficiency conditions are written for a given product. They compare this outcome with a world of one standard version and count only the cost of the difference. A buyer who finds the loaf she actually wants has gained something no diagram records.

The cost is bounded by elasticity: the flatter the demand curve, the nearer the tangency to the minimum of average total cost. Free entry keeps substitutes close and demand elastic, so in a trade of many small sellers the excess capacity is usually modest rather than gross.

But the technology decides how heavy it is: where the least-cost scale is large relative to the market, running many firms at a fraction of capacity is ruinous. Fourteen half empty salons waste little; fourteen half idle cement works would waste an enormous amount, which is why that trade is not organised this way.

And so does who is buying: a household spending most of its income on food gains more from a lower price for a standard version than from the right to choose among eight brands. Variety is a good with an income elasticity, and the case for it is weakest where incomes are lowest.

And whether the difference is real: if the versions differ only in the wrapper, society pays excess capacity and selling costs for a choice that is a choice in name. Where they differ in something a buyer can use, the payment buys a thing that would not otherwise exist.

The judgement: accept the excess capacity where differences are real, scale is small and buyers have alternatives; count it a serious cost where the good is a staple made under heavy economies of scale. Note too that nobody has to decide: entry and exit settle it trade by trade.

The choice was never between this market and a perfect one, but between many versions made at some extra cost and one version made cheaply.

The Master Key: *Excess capacity is the invoice for variety, and whether it is worth paying turns on what is genuinely different between the brands.*

HOT Question 175

Ten soap makers advertise, all ten keep the share they began with, and every bar in the district costs more than it did. Somebody has paid for something, and it is not clear anybody received it.

Assess the claim that advertising under monopolistic competition is a waste of resources.

Model Answer

The claim holds wherever advertising is purely combative, since when every firm in a trade advertises to take share from the others each may end with the share it began with while all carry a higher cost curve, so buyers pay for a redistribution that never happened; it fails where advertising informs, because a buyer who learns what exists, what it costs and where to find it chooses better and searches less, and it fails again where the extra sales carry the firm down a falling average cost curve.

The case for waste, at its strongest: selling costs enter average total cost and lift the price. If all ten makers advertise and the shares are unchanged, the paper, the airtime and the design have produced no extra output and no better allocation of anything. That is waste in the strict sense.

And it can raise the barrier it was supposed to lower: an established name is itself an obstacle, because a newcomer must now spend heavily merely to be noticed. Advertising can therefore choke off the free entry that keeps this structure competitive, turning a mild inefficiency into a durable one.

But information is a real product: a buyer who does not know a product exists cannot buy it. An advertisement carrying a price, an address or a specification lowers the cost of searching, and cheaper search makes demand more elastic and prices keener, which is the reverse of the usual charge.

And it can lower cost rather than raise it: where average cost is still falling, advertising that lifts sales moves the firm rightward down its cost curve. If the fall in average production cost is larger than the selling cost added to each unit, the advertised good is cheaper than the unadvertised one would have been.

Test it by what the advertisement contains: one that states a price, a place and a specification is largely informative. One that attaches a feeling to a name without a single claim that could be checked is largely persuasive. The two do quite different work and deserve different verdicts.

The assessment: part waste, part service, in proportions that differ by trade. The sensible response is not prohibition but making the information reliable, through labelling rules, honest weights and published standards, which raises the informative share and shrinks the persuasive one.

The firm's own test, whether the campaign adds more to revenue than to cost, is not society's test, and that is precisely why the two verdicts differ.

The Master Key: *Advertising that tells you something is an investment, and advertising that only makes you feel something is a cost you pay in the price.*

HOT Question 176

Eight brands of maize flour on one shelf, all milled from the same grain, each in its own printed bag. Sweep six of them away and the flour gets cheaper to make. Whether it gets cheaper to buy is another matter entirely.

Examine whether consumers would be better off if the number of competing brands in a trade were reduced.

Model Answer

They would gain on cost and lose on choice, and which side wins depends on the trade: fewer firms would each work nearer the minimum of average total cost and carry less duplicated selling cost, so the good would be cheaper to produce, but nothing would compel the survivors to pass the saving on once competition is weaker, and every brand withdrawn was somebody's preferred version; a reduction imposed from outside is almost always worse than the entry and exit that already govern the number.

The gain in cost is real: each surviving firm moves rightward along its average total cost curve towards the minimum, so the excess capacity per firm shrinks. The selling costs carried by the vanished brands vanish with them. The cost of making and selling a unit genuinely falls.

But a saving in cost is not a fall in price: price falls only if competition forces it down. Cut the number of sellers and the demand curve facing each survivor steepens, marginal revenue drops further below price, and the survivors hold both a lower cost and more room to keep the price where it was.

The choice lost falls on somebody: every brand withdrawn was the version some buyer preferred, and she must now take one she likes less or go without. The gain in cost is spread thinly over everyone, while the loss lands heavily on those whose version disappeared.

Somebody has to choose which go: a market withdraws the versions buyers desert. An authority withdrawing brands must decide which differences are worth having, which requires it to know what buyers value better than the buyers do. That is a poor bet and an invitation to lobbying.

Where the case for fewer is strongest: in a staple bought by poor households, where the versions barely differ and the least-cost scale is large. There a public specification can deliver a real fall in price for a trivial loss of choice, and standard grades for cement or standard formulations for medicines do exactly that.

The better instrument: leave the number to entry and exit, and attack the excess capacity indirectly by making information cheap, so that buyers switch readily, demand stays elastic and the tangency is pushed nearer the minimum of average total cost. That lowers cost without removing a single version by decree.

Consumers are better off with fewer brands only where the brands were never really different and the survivors can still be made to compete.

The Master Key: *Fewer brands would certainly lower the cost of production, and would just as certainly hand the saving to the firms that survived.*

HOT Question 177

The firm ends the long run with normal profit, like a price taker, and with a price above marginal cost, like a monopolist. Which parent it takes after is a question worth answering carefully.

Assess whether the long-run outcome under monopolistic competition is closer to perfect competition or to monopoly.

Model Answer

It is closer to perfect competition on the outcome that matters most, since free entry drives profit down to normal in both while a monopolist keeps a surplus indefinitely behind its barriers; but it resembles monopoly in its mechanism, because the demand curve slopes down, price exceeds marginal cost and output falls short of minimum average total cost, so the fair verdict is a competitive result reached by monopolistic means, with the elasticity of the firm's demand curve deciding how near a particular trade sits to either pole.

On profit it sides with perfect competition: entry is free, so any supernormal profit is competed away and the long run leaves only normal profit. A monopolist behind a patent, a licence or a network keeps its surplus for as long as the barrier holds, and that is the sharpest difference of the three.

$$\text{P} = \text{ATC (both)} \quad \text{against} \quad \text{P} > \text{ATC (monopoly)}$$

On price against marginal cost it sides with monopoly: the demand curve slopes downward, so average revenue exceeds marginal revenue and the profit-maximising price exceeds marginal cost. A price taker charges exactly marginal cost. Both imperfect structures leave an allocative gap, differing only in width.

On productive efficiency it sides with monopoly again: production sits at a tangency on the falling branch, not at the minimum of average total cost, so there is excess capacity here as under monopoly and none at all under perfect competition. The gap is far narrower here, but it is a gap.

Elasticity settles the degree: the closer the substitutes, the flatter the demand curve, the nearer marginal revenue lies to price and the nearer the tangency to the minimum. A trade with twenty near identical versions is almost perfectly competitive; one with two loyal followings is nearly a monopoly.

What the consumer actually gets: choice, which perfect competition by assumption cannot supply, at a price above marginal cost, which perfect competition does not charge. Less choice than the number of brands suggests, since the versions are close, and a far better price than a monopolist would ever offer.

The assessment: closer to perfect competition, and better than it in one respect the model has no way to value. The wider lesson is that the profit outcome and the two efficiency conditions move independently, so a structure may fail both tests and still deliver the competitive result.

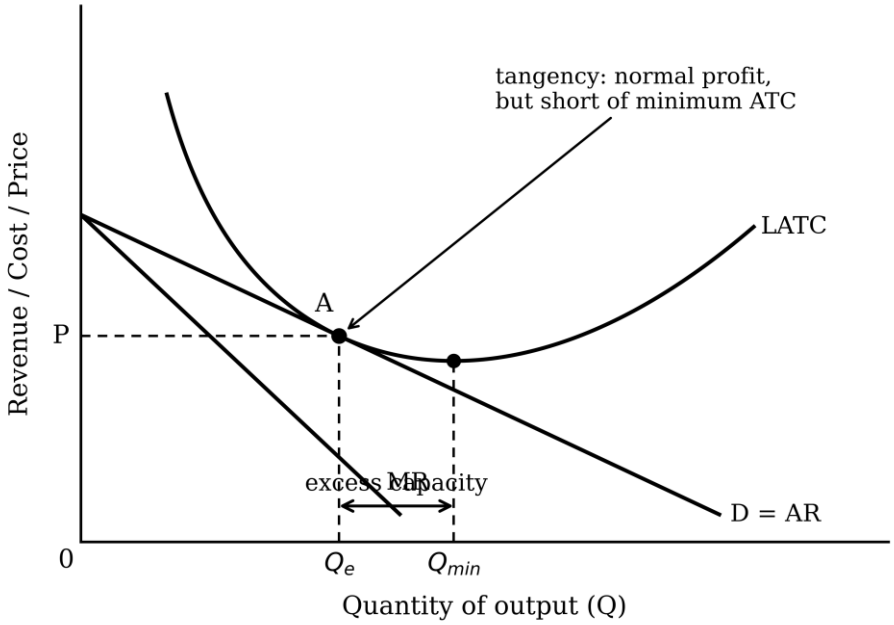


Figure 6.28: *Long-run tangency and excess capacity under monopolistic competition*

Judge a structure on all three tests, because no real market ever passes or fails them together.

The Master Key: *Free entry decides the profit and the slope of the demand curve decides the efficiency, and monopolistic competition takes one from each parent.*

Oligopoly: Meaning, Types and Characteristics

Perfect competition puts many sellers in a market and monopoly puts one. Between those extremes sits the structure that most large industries actually take: a handful of firms, each big enough that what it does is felt by the others. This section defines oligopoly, separates the pure kind from the differentiated kind, and sets out the characteristics that follow from fewness and from the barriers that keep the group small. Hold one idea at the centre of all of it. Interdependence is what makes an oligopolist an oligopolist, because no other seller in economics has to work out the reply before making the move.

BINDER Question 178

Five plants bag cement in Tanzania, and not one of them can print a new price list without first working out what the other four will do about it. That single question is the whole of oligopoly.

Define oligopoly and distinguish between pure and differentiated oligopoly.

Model Answer

Oligopoly is a market structure dominated by a few large firms, each holding a share big enough for its decisions to be felt by the others, and protected by high barriers to entry. It takes two forms. A pure or perfect oligopoly is one in which the few sellers produce an identical product, while an imperfect or differentiated oligopoly is one in which they produce close but distinguishable ones.

Few firms, each of them large: Fewness is not a matter of counting alone but of size, since each firm must hold a share big enough for its move to be noticed. Cement in Tanzania is bagged by plants trading as Twiga, Simba, Tanga, Dangote and Kilimanjaro, and every one of them is large enough to be watched by the rest.

Pure or perfect oligopoly: The few sellers produce a homogeneous good, so the output of one is a perfect substitute for the output of another. Cement, cable wire and dry batteries are of this kind. A buyer cannot tell the plants apart, so price, delivery and availability decide the sale.

Imperfect or differentiated oligopoly: The few sellers produce goods that do the same work without being identical, so brand, design and reputation carry weight. Motor vehicles are the standard case, and mobile telephone service is close to it, since each operator wraps much the same minutes and data in a bundle of its own.

What both kinds share: Few firms, high barriers and mutual awareness belong to both, so the distinction changes the weapons and not the war. A pure oligopolist fights on price and delivery and a differentiated one on brand and service, yet each must still guess the reply before it moves.

Count the sellers to settle the structure, then look at the product to see how the fighting will be done.

The Master Key: *A few large firms make it an oligopoly, and the product decides only whether they fight with prices or with names.*

BINDER Question 179

A trader at Tandale can tell you the price of every rival before he opens his stall. A cement firm has to tell itself what every rival will do next, which is a harder thing to know and a far more valuable one.

Explain the main characteristics of an oligopoly market.

Model Answer

An oligopoly market has few large firms, each with a substantial share; high barriers to entry; products either homogeneous or differentiated; rigid prices and vigorous non-price competition; a standing temptation to collude; and supernormal profit that entry does not erode. Running through all of them is interdependence, the mutual awareness that forces strategic behaviour.

Few firms with substantial shares: A small number of sellers supplies the whole market and each holds enough of it to matter. Because the share is substantial, a change in one firm's output or price shifts the quantity left for the others, which is why they respond.

High barriers to entry: Entry is difficult rather than merely unattractive. The capital needed for a kiln or a national network, ownership of technology, an operating licence and an established chain of dealers all keep newcomers out, so the group of sellers stays small for years.

Products homogeneous or differentiated: The good may be a perfect substitute across sellers, as cement is, or distinguished by brand and design, as motor vehicles are. Oligopoly is settled by the number and size of the firms, so the product changes the conduct without changing the structure.

Interdependence and the rigid price it produces: Each firm must anticipate the reply before it acts. A rise is not followed, so the firm that raises loses customers; a cut is matched, so it gains little and every margin falls. Prices therefore stand still and rivalry moves into advertising, delivery, service and opening hours.

Collusion and lasting supernormal profit: Few firms find agreement easy, whether written or merely understood, and a group that fixes price and shares output behaves like a single monopolist. Barriers then keep the profit safe, so price stays above average total cost without attracting the entry that would compete it away.

Every characteristic on the list follows from two facts together, that the sellers are few and that the door behind them is shut.

The Master Key: *Few firms, a closed door, and every decision taken with one eye on the rivals.*

BINDER Question 180

A maize seller at Kibaigwa who drops his price by a shilling changes nothing for anyone but himself. An airtime operator who drops a bundle price by a shilling starts a meeting in five head offices before lunch.

Explain why interdependence is the feature that distinguishes oligopoly from every other market structure.

Model Answer

Interdependence means that the outcome of one firm's decision depends on how its rivals answer it, and only oligopoly has this property. It arises because the firms are few and each is large, so a move by one is big enough to be felt by the others and therefore big enough to be answered. Every other structure removes either the fewness or the size, and with it the need to anticipate a reply.

What interdependence actually means: A firm's sales depend not only on its own price but on what rivals do about that price. It cannot read its own demand curve off a page, because the curve will have moved by the time the rivals have finished responding.

Why the other structures escape it: Under perfect competition and monopolistic competition the sellers are so many that one firm's cut is spread thinly over all of them and no single rival feels enough to reply. A monopolist has no rival at all. Only in oligopoly is the loss concentrated on a few identifiable firms.

It forces strategic behaviour: The firm must choose what to do given what it expects the others to do, while they are choosing on exactly the same basis about it. A decision becomes a move in a game rather than a calculation against a fixed curve, and guessing wrongly is expensive.

It is why there is no single model of price: Elsewhere the demand curve is given and the outcome follows from it. Here the curve depends on the assumed reply, so different assumptions give different theories: rivals match a cut but ignore a rise, or the firms agree, or one leads and the rest follow.

Whenever an answer on oligopoly begins to drift, bring it back to the reply the rivals are expected to make.

The Master Key: *In every other market a firm studies its buyers, and in oligopoly it studies its rivals.*

BINDER Question 181

Supernormal profit is meant to be a signal that summons new firms. In an oligopoly the signal sounds clearly and nobody is able to come.

Explain why firms in an oligopoly are able to earn supernormal profit in the long run.

Model Answer

They keep supernormal profit because the barriers that made them few also keep them few. Price stays above average total cost, the profit is plainly visible, and entry still does not happen, because a newcomer would need the capital, the technology, the licence and the distribution that the firms inside already hold. Fewness and the option of collusion then help the group restrain output and hold the price up.

Barriers block the usual correction: Under free entry, profit attracts firms, supply rises and price falls until only normal profit remains. Here the heavy capital of a plant, ownership of technology, a granted licence and an established dealer network stop that sequence before it begins, so the profit survives.

Sunk cost deters even the willing: A kiln, a refinery or a network of masts has almost no value in any other use, so an entrant that provoked a price war could not retreat without losing everything it committed. Knowing that in advance, it stays out, and the firms inside never need to fight at all.

Few sellers restrain output: Each firm knows that pushing extra output onto the market drags the price down for everybody, itself included. That knowledge produces caution without any agreement, and cautious output keeps price comfortably above average total cost.

Collusion raises the profit further: Firms that agree on price and quantity, or that quietly follow a leader, capture between them the profit a monopolist would earn. Profit is still not guaranteed, since weak demand or a price war can remove it, but nothing outside the industry erodes it.

Read the barrier before the profit figure, because the barrier is what decides how long that figure can last.

The Master Key: *Entry is the force that destroys supernormal profit, and an oligopoly is built precisely to keep entry out.*

REAL Question 182

A bag of cement from one plant sets exactly as hard as a bag from any other. Where nothing at all distinguishes the goods, everything depends on what the seller across the road is about to do.

Explain, with reference to the industry described below, why cement manufacturing in Tanzania is classified as a pure oligopoly, and how that classification shapes the conduct of the firms.

Cement in Tanzania is bagged by a small number of large plants trading under names such as Twiga, Simba, Tanga, Dangote and Kilimanjaro.

A bag of one brand does the same work on a building site as a bag of any other.

A new plant needs a limestone deposit, a kiln, a heavy power connection and several years of capital spending before the first bag leaves the gate.

Hardware dealers at Kariakoo and along the road to Morogoro quote the brands within a few hundred shillings of one another.

The trading details are illustrative and are used only to work the argument.

Model Answer

Cement is a pure oligopoly on both tests at once. A few large plants supply the whole market, and to the buyer their output is identical, which is what pure or perfect oligopoly means. The capital, the deposit and the power connection keep newcomers out. The classification then explains the conduct: quoted prices sit close together and move rarely, each plant studies the others before it moves, and the real competing is done through delivery, credit and dealer relations rather than through the ex factory price.

Few plants, each with a substantial share: A handful of plants supplies a national market, so each holds a share large enough for its output decisions to be felt by the others. That is the first condition of oligopoly, and the number of names in the box satisfies it plainly.

The product is homogeneous: A bag that meets the standard performs the same work whatever name is printed on it, so the brands are perfect substitutes in use. That makes the market pure rather than differentiated, and it means a dealer offered a lower price has no reason at all to refuse it.

Barriers built of capital and geology: A plant must sit on limestone, must run a kiln that consumes power heavily, and must be paid for long before it sells anything. Almost none of that outlay could be recovered on exit, so the barrier is sunk cost as much as money, and entry stays rare.

Interdependence in the quoted price: Raise the ex factory price while the others hold theirs and dealers simply order elsewhere, because the bags are interchangeable. Cut it and the others cut within days, so the volume gained is small and every margin is thinner. Neither move pays, and the prices stay level with one another.

Competition moves off the price: What is left to compete with is delivery to the site, credit terms for dealers, reliability of supply through the building season, bag strength and technical advice. These are genuine services, and they are where the rivalry between the plants actually shows itself.

What the classification implies for policy: No plant is a price taker and none is a monopolist, so prices that move together prove nothing on their own, since identical costs produce identical responses. It is movement unexplained by any change in cost that gives a competition authority reason to look closely.

Homogeneous goods and few sellers are the sharpest form of interdependence there is, because nothing except price and service can hold a customer.

The Master Key: *When the bags are identical, the only thing a plant can differentiate is the way it treats the dealer.*

REAL Question 183

Six networks sell the same minute of talk in six different wrappers. Watch what happens to the wrapper on the day one of them changes the price of what is inside.

Explain how interdependence shapes the conduct of the mobile telephone operators described below, and state which type of oligopoly the industry represents.

Mobile telephone service in Tanzania is supplied by a small number of licensed operators, among them TTCL, Vodacom, Airtel, Halotel, Zantel and Tigo.

Each sells voice, data and mobile money, packaged into bundles carrying its own name and its own conditions.

An operator must hold a licence and spectrum, and must build masts and switching equipment, before it carries a single call.

A subscriber may move to another operator and keep the same number.

When one operator improves the terms of a daily bundle, comparable offers appear from the others within days.

The trading details are illustrative and are used only to work the argument.

Model Answer

The industry is an imperfect or differentiated oligopoly: few licensed operators, each with a substantial share, selling a service that does the same job everywhere but arrives wrapped in bundles, brands and mobile money schemes of its own. Interdependence then governs the conduct. An improvement in terms is matched within days, so no operator gains lastingly by price alone, and the rivalry is pushed into coverage, advertising, agent networks and the design of the bundles themselves.

Few operators, each of them large: Licence and spectrum are granted to a small number of firms, and each of them carries a share of the traffic big enough to be noticed when it moves. Fewness here is created by the licensing itself, which is why the count changes so slowly.

Differentiated rather than identical: A minute is a minute, but the bundle around it is not. Names, conditions, mobile money schemes and network reputation distinguish one operator from another, which places the industry in the imperfect class rather than beside cement.

Barriers of licence and sunk network: A newcomer must be granted spectrum before it may trade at all, and must then build masts and switching equipment that have no use outside this business. The legal barrier and the sunk cost reinforce each other, so entry is a rare event rather than a continuous threat.

Every move anticipates a reply: Because a subscriber can move and keep the number, switching is cheap, so better terms are copied quickly and the gain in subscribers is temporary while the lower revenue is permanent. Terms that are made worse are not copied at all, and the subscribers leave. Each operator therefore prices with the others in mind.

Rivalry moves to non-price ground: What follows is competition in coverage in the rural districts, in advertising and sponsorship, in the density of agents selling airtime, in handset offers, and in free calls inside the network. These bind the subscriber in ways a temporary price cut never can.

Why no other structure fits: There are too many sellers for monopoly and far too few for monopolistic competition, and no operator can be a price taker when its own decision moves the market. It is the mutual watching, more than the count itself, that settles the classification.

Differentiation softens the blow of a rival's price cut, but it never removes the need to expect one.

The Master Key: *Where a customer can leave and keep the number, every price decision is really a decision about the rivals.*

HOT Question 184

Two industries each have five sellers. In one, a price cut brings four telephone calls before evening. In the other, nobody notices. The number is the same, so the number cannot be the definition.

To what extent is oligopoly defined by the number of firms rather than by the way those firms behave?

Model Answer

The number is how oligopoly is identified and interdependence is what it actually is. Fewness matters because it makes a move noticeable and traceable to the firm that made it, but a market with few sellers and an open door behaves competitively, while firms that are few, protected and mutually

aware behave strategically. The count is therefore strong evidence and the conduct is the definition, so a full answer uses both.

The case for counting: Numbers are observable and comparable, which is why the concentration ratio exists. A high share held by the largest three or five firms is a reliable warning that decisions in that industry are taken with rivals in mind, and it can be computed before anything is known about conduct.

Why fewness matters at all: Interdependence needs the loss from a rival's cut to land on identifiable firms. With many sellers the loss is spread so thinly that nobody feels it and nobody replies, so the same cut that starts a war among five sellers passes unnoticed among five hundred.

But the count can mislead badly: Where entry is easy and little is sunk, five firms may price close to cost because a sixth could appear next month. The threat of entry disciplines them as effectively as a crowd of rivals would, and their measured concentration overstates their power by the whole width of the open door.

It can mislead in the other direction too: Firms may be counted together while trading in separate regions or separate qualities, so they never meet and never react to one another. A national count then records an oligopoly where there are several small local markets instead.

The behavioural test: Ask whether a firm's pricing decision turns on its expectation of the reply. If the answer is yes, the market is an oligopoly whatever the count says; if a firm simply reads a going price and adjusts output, it is not, whatever share the register records.

The judgement: Fewness and barriers together produce interdependence, and interdependence is what gives oligopoly its distinctive behaviour, its rigid prices and its pull towards collusion. Count first because counting is quick, then test the conduct, because that is where the answer really lies.

A structure is named by what its firms must think about, not by how many of them there happen to be.

The Master Key: *The number tells you where to look, and the reaction tells you what you have found.*

HOT Question 185

The same mutual watching that keeps four firms from raising a price can also keep all four from lowering it. Which of the two happens is worth a great deal to every buyer in the country.

Discuss whether the interdependence of oligopolists works for or against the Tanzanian consumer.

Model Answer

It works both ways, and which way it falls depends on whether the firms fear one another or trust one another. Fear produces restraint on price rises, hard bargaining for dealers and heavy investment in coverage and service. Trust produces rigid prices, matched increases and, at the limit, a cartel charging what a monopolist would charge. The consumer gains from the first and loses from the second, so the outcome is a matter for competition policy rather than for prediction.

Against the consumer: prices stop working: A rigid price passes on neither a fall in costs nor a change in demand, so the signal that should guide buyers and producers goes quiet. Prices that will not fall when costs fall leave the whole of the saving with the firms.

Against: the pull towards collusion: Few firms and a shared interest make agreement easy, whether written or merely understood. A colluding group restricts output and lifts price above marginal cost exactly as a monopolist does, so the consumer pays more, buys less, and loses the surplus that the restriction destroys.

Against: the cost of combative advertising: Where price is closed off, spending moves to advertising, much of which only shifts share between brands rather than adding anything. It is a cost of production and is recovered in the price, so the buyer pays for a contest fought over the buyer's own custom.

For the consumer: mutual fear disciplines price: Each firm knows that a rise will not be followed and that its customers would leave, so the price cannot drift upward as it can under an unregulated monopoly. That restraint costs the state nothing and is enforced by rivals who are watching anyway.

For: scale, investment and reach: Only large firms can finance a kiln or a national network of masts, and the fall in average cost that size brings can reach the buyer as a lower price. Supernormal profit also funds the investment that carries service into districts a small firm could never serve.

For: non-price competition delivers real things: Free delivery and installation, after sales service, long opening hours at fuel stations and wider coverage are all things a buyer would willingly pay for separately. Where price is stuck, these are the ground on which customers are actually won.

The judgement: Interdependence is neither good nor bad in itself; it concentrates the outcome on the relationship between a few firms. The consumer therefore needs a competition authority to keep that relationship rivalrous, since the same structure delivers a price war or a cartel with equal ease.

Judge an oligopoly by whether its firms are watching each other as rivals or as partners.

The Master Key: *The few firms watch each other either way, and the consumer's fortune turns on whether that watching is suspicious or friendly.*

The Kinked Demand Curve Model

Oligopoly gives price a peculiar stillness. Costs drift, seasons turn, the shilling loses a little ground, and the figure on the price list does not move. The kinked demand curve model, put forward by Paul Sweezy in 1939, explains that stillness without any agreement between the firms at all. Its whole content is a single asymmetry: each firm expects a price rise to be ignored and a price cut to be matched. This section builds the curve from that expectation, opens the gap it tears in marginal revenue, draws out the price rigidity that follows, and then weighs honestly what the model cannot do.

BINDER Question 186

Raise your price and you stand alone. Lower it and everyone comes with you. A seller who believes both of those things at once will find that the demand curve in front of it has developed a corner.

With the aid of a diagram, explain why the demand curve facing a firm in an oligopoly is kinked.

Model Answer

The curve is kinked because the firm expects rivals to ignore a price rise and to match a price cut. Above the going price the firm alone is dearer, so it loses many customers and demand is elastic. Below it everybody is cheaper together, so it gains few and demand is inelastic. The two segments meet at the going price, and that meeting point is the kink.

The asymmetric expectation: Each firm believes a rise will be left unfollowed, since rivals would rather collect the customers it sheds, and that a cut will be matched, since they will not watch their own customers leave. A rise is a gift to a rival and a cut is a threat.

Elastic above the kink: Raise the price and buyers move to rivals who did not follow, so a small rise brings a large fall in quantity. The upper segment is therefore flat, demand there is elastic, and total revenue falls because custom is lost faster than price is gained.

Inelastic below the kink: Cut the price and the rivals cut too, so relative prices are unchanged and shares stay where they were. The firm wins only the few extra sales a cheaper market attracts, so a large cut brings a small rise in quantity, the lower segment is steep, and revenue falls again.

What figure 6.29 shows: The kink is at point E, where the price is TShs 400 and output is 4 units. The flatter elastic segment comes down from the left to E and the steeper inelastic segment continues from E to the right, so the curve bends inward at E.

Why the shape matters: Both directions are unattractive, since raising loses customers heavily and cutting surrenders revenue without buying share. The best move is to leave the price alone, which is where price rigidity comes from.

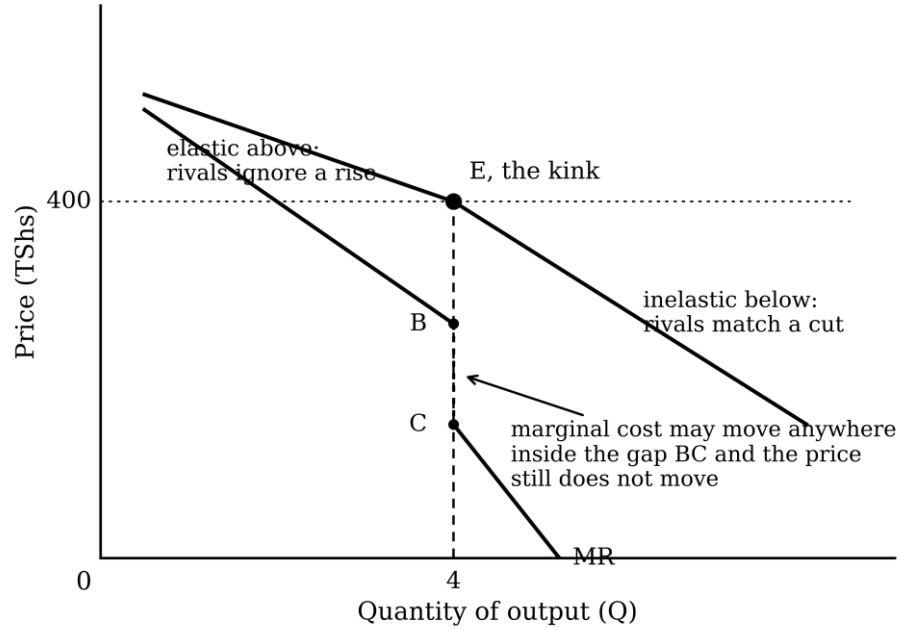


Figure 6.29: *The kinked demand curve and the gap in marginal revenue*

Draw the flat segment above and the steep one below, since reversing them reverses the model.

The Master Key: *Elastic above because nobody follows a rise, inelastic below because everybody follows a cut.*

BINDER Question 187

A bend in a road slows a car. A bend in a demand curve does something stranger to marginal revenue: it tears it in two and leaves a piece of empty air between the halves.

Explain why the marginal revenue curve associated with a kinked demand curve is discontinuous.

Model Answer

Marginal revenue is discontinuous because the firm is really facing two demand curves joined at the kink, and each of them has a marginal revenue of its own. For a straight demand line marginal revenue keeps the same intercept and takes twice the slope, so the flat upper segment yields a gently falling marginal revenue while the steep lower segment yields a sharply falling one. At the kink output the first ends at a point B and the second begins lower down at a point C.

Two segments, two marginal revenues: If average revenue on a segment is $AR = a - bQ$ then total revenue is $TR = aQ - bQ^2$ and marginal revenue is $MR = a - 2bQ$. Each segment of the kinked curve carries its own intercept and its own slope, so each generates a marginal revenue line of its own.

$$AR = a - bQ \Rightarrow TR = aQ - bQ^2 \Rightarrow MR = a - 2bQ$$

The upper segment falls gently: Twice a small slope is still a small slope, so the marginal revenue belonging to the elastic segment declines slowly and is still comparatively high when it reaches the kink output. Its last point there is B.

The lower segment falls sharply: Twice a large slope is a very large slope, so the marginal revenue belonging to the inelastic segment declines steeply and has already dropped a long way by the time it reaches the kink output. Its first point there is C, which lies well below B.

The vertical gap BC: Directly beneath the kink, marginal revenue jumps straight down from B to C without taking any of the values in between. The curve is therefore broken and not merely bent, and the gap BC is a genuine hole in the schedule at that one level of output.

A corner in average revenue always tears marginal revenue apart, because the marginal quantity exaggerates whatever the average does.

The Master Key: *Under the kink marginal revenue does not bend, it drops from B to C and touches nothing in between.*

BINDER Question 188

The cost of clinker rises, the cost of diesel rises, the wage bill rises, and the price on the list does not stir. Something is absorbing the shock, and it is a gap in a curve.

Explain how the kinked demand curve model accounts for price rigidity in an oligopoly.

Model Answer

Price is rigid because the profit maximising output does not move when cost moves. Profit is maximised where marginal cost equals marginal revenue and marginal cost cuts marginal revenue from below, and every marginal cost curve that passes through the vertical gap BC satisfies both conditions at the kink output. Marginal cost may therefore rise or fall anywhere inside that gap and the firm still sells 4 units at TShs 400.

The profit rule is unchanged: Expand while marginal revenue exceeds marginal cost and stop when it no longer does. Below the kink output marginal revenue lies on the high upper piece and exceeds marginal cost; above it marginal revenue has dropped to the low lower piece and is exceeded by marginal cost. Output settles at the kink, with marginal cost cutting from below.

$$\mathrm{MR_B} \geq \mathrm{MC} \geq \mathrm{MR_C} \quad \text{at } \mathrm{Q} = 4 \text{ units}$$

Any marginal cost inside the gap gives the same answer: A rise in the price of fuel or of an imported input lifts the whole marginal cost curve. So long as the new curve still crosses the stretch between B and C, equilibrium output is still 4 units and the price is still TShs 400, so nothing on the list needs changing.

What would actually move the price: Only a shock large enough to lift marginal cost clean above B, or to drop it below C, shifts the intersection off the kink onto one of the two segments. A shift of the demand curve itself does the same. Small disturbances are absorbed; large ones are not.

Rigidity without any agreement: No cartel is needed, no leader, no conversation between the firms, and no letter that a competition authority could produce in evidence. A shared belief about the reply is enough to hold a price still, which is the real achievement of the model.

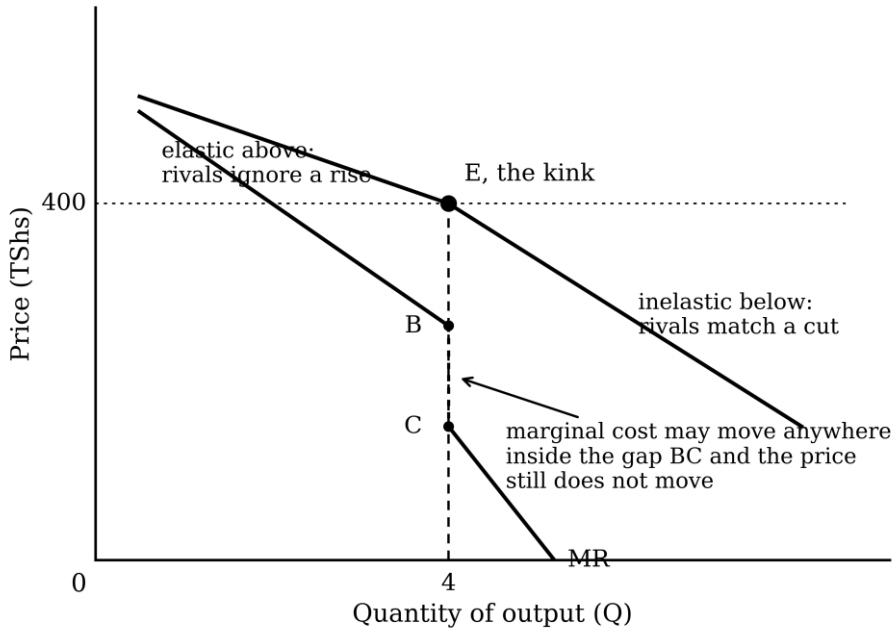


Figure 6.29: *The kinked demand curve and the gap in marginal revenue*

The gap BC is the shock absorber of an oligopoly, and its width measures how much cost movement the price can swallow.

The Master Key: *Cost may wander anywhere inside the gap BC and the price will not notice it.*

BINDER Question 189

A model that explains why a price will not move, and cannot say how the price got there, has told you about the brakes and nothing about the engine.

Explain the weaknesses of the kinked demand curve model.

Model Answer

The model has four serious weaknesses. It never explains how the going price was arrived at, so it is a theory of rigidity and not a theory of price. There is little empirical evidence that the kink exists. The reactions of rivals are assumed rather than derived. And it is silent on entry, on collusion and on the price wars that oligopolies plainly do fight.

It cannot produce the price it explains: The argument begins by assuming that TShs 400 is already being charged and then shows why it will stay. Where the figure came from is outside the model altogether, so it is indeterminate at the very point where a theory of price ought to be most useful.

Little evidence of a kink: Studies of how prices actually behave find firms following one another upward often enough, particularly when the cost of a shared input has risen for the whole industry. Where every rival wants the higher price, a rise is matched, the elastic upper segment never appears, and there is no kink to be found.

The reactions are asserted, not explained: Nothing in the model derives the pattern of replies from the rivals' own interest. A firm might well match a rise to protect a comfortable margin, or ignore a cut because its buyers are loyal to the brand, and either answer would remove the kink at once.

What it leaves standing: It still explains price stability without collusion, and it correctly predicts what firms do instead of cutting price. They compete by non-price means: advertising, free delivery and installation, after sales service, credit for dealers and long opening hours at fuel stations.

Use the model for the question it answers and reach for collusion or price leadership when the question is where the price came from.

The Master Key: *It explains why an established price stands still and never explains how it came to be standing there.*

REAL Question 190

Diesel rose, wages rose, and the fare from Mbeya to Dar es Salaam stayed at the figure it had held all season. The stillness is not laziness on anybody's part; it is arithmetic.

Using the kinked demand curve model, explain why the fare described below does not move although costs have risen, and state what would have to happen before it did.

Four coach companies work the trunk route from Mbeya to Dar es Salaam and between them carry almost every passenger on it.

A seat is much the same whichever company sells it, and the journey takes the same road.

The one way fare has stood at TShs 45,000 for two seasons.

A company that raised its fare to TShs 50,000 ran half empty while the other three stayed full at the old fare.

When one company dropped to TShs 40,000 the other three matched within a day, and each ended the week carrying much the same load as before.

The price of diesel has risen modestly since the fare was set.

The companies and the figures are illustrative and are used only to work the argument.

Model Answer

The fare stands still because each company faces a kinked demand curve at TShs 45,000. Above that fare demand is elastic, since rivals hold and passengers walk to the next booking office, which the

half empty coaches at TShs 50,000 showed. Below it demand is inelastic, since rivals match and loads scarcely change, which the week at TShs 40,000 showed. The kink breaks marginal revenue into two pieces separated by a vertical gap, and the modest rise in diesel lifts marginal cost only within that gap, so the profit maximising fare does not move.

The elastic half has already been proved: The attempt at TShs 50,000 made the upper segment visible. The rivals did not follow, one seat is much like another on the same road, and passengers switched heavily, so a small rise in fare brought a large fall in numbers carried.

The inelastic half has been proved too: At TShs 40,000 the other three matched within a day, so relative fares were as before and loads barely moved. The company carried the same passengers at a lower fare, which is a large cut in price for a very small gain in quantity.

Both experiments reduced revenue: Raising the fare lost passengers faster than it raised the money taken from each; cutting lowered the money taken from each faster than it won passengers. Whichever way the fare moves the company is worse off, and that is what a kink at TShs 45,000 means.

Marginal revenue is broken beneath the fare: The flat upper segment carries a gently falling marginal revenue ending at a point B at the current load. The steep lower segment carries a sharply falling marginal revenue beginning at a point C well below B. Between B and C there is nothing.

Why the diesel rise changes nothing: Profit is maximised where marginal cost equals marginal revenue with marginal cost cutting marginal revenue from below. A modest rise lifts the marginal cost of running a coach but leaves it crossing inside the gap, so the same seats at the same fare still maximise profit.

What would move the fare: A fuel or road charge increase big enough to push marginal cost above B, a fall in demand that shifts the whole curve, or an agreement among the four. Since all four face the same fuel bill, a large shock lifts every marginal cost together and the fares rise together.

The gap under the kink is why a small cost rise is absorbed in the margin while a large one appears in the fare.

The Master Key: *The fare ignores a shilling of diesel and answers a hundred, and the gap decides which is which.*

REAL Question 191

The model says the firm that raises its price stands alone and pays for it. In a month when the electricity tariff rises for every kiln in the country, nobody stands alone at all.

Examine, with reference to the case below, whether the kinked demand curve model can account for the price change described, and explain what the case reveals about the model.

> Cement in Tanzania is made by a small number of large plants, among them Twiga, Simba, Tanga, Dangote and Kilimanjaro.
>
> For most of a year the price of a bag at the plant gate stood at TShs 14,000 wherever it was bought.
>
> The tariff for electricity and the landed price of coal for the kilns then rose sharply, and the rise fell on every plant at the same time.
>
> Within a month each plant had lifted its price to about TShs 16,000, and none of them lost its dealers.
>
> The figures and trading details are illustrative and are used only to work the argument.

Model Answer

The model accounts for the year of stillness and only partly for the month of movement. While costs drifted gently, marginal cost stayed inside the gap BC beneath the kink, so no plant had reason to move its price and none did. When the tariff and the coal price rose for every plant at once, marginal cost was lifted clear above B at all of them, and the belief the kink rests on, that a rise will not be followed, no longer held.

The rigid year is the model working: Modest cost changes left marginal cost still cutting marginal revenue from below somewhere inside the gap, so the profit maximising output and price were unchanged. The price held at TShs 14,000 across the industry without a single meeting between the plants.

A shared cost shock destroys the asymmetry: The kink depends on a firm believing that a rise will leave it alone and dearer. When every rival's bill has risen by the same amount, each knows the others want the higher price too, so the expectation of being left alone is simply no longer reasonable.

Marginal cost was lifted out of the gap: A large enough rise puts marginal cost above B, so the intersection with marginal revenue moves onto the elastic upper segment, output falls and price rises. The model itself predicts a price change once the shock exceeds the width of the gap, and here it plainly did.

No dealer was lost, and that is the awkward part: The model says a firm that raises alone is punished heavily. Here nobody raised alone, so the elastic upper segment was never tested and the prices simply moved together. Observations of this kind are why so little evidence for an actual kink has been found.

What the model still cannot say: It offers no reason why the new price settled near TShs 16,000 rather than at TShs 15,000 or TShs 18,000. It explains stillness and never the level, so the size of the increase must be explained by cost, by demand, or by one plant leading and the rest following.

The practical lesson: When prices in an oligopoly move together and quickly, look first for a cost shared by every firm and second for an understanding between them. The kink explains the months when nothing happened, not the month when everything did.

Test the model by asking whether the firm that moved first was left standing on its own, because that is the assumption the whole kink rests upon.

The Master Key: *A cost rise that lands on one firm keeps the price still, and a cost rise that lands on all of them moves it.*

HOT Question 192

A theory that predicts nothing will happen is right on most days and useless on the day that matters. That is the case for the defence and the case for the prosecution in a single sentence.

To what extent does the kinked demand curve model explain price behaviour under oligopoly?

Model Answer

It explains one thing very well and leaves the rest untouched. Prices in concentrated industries do change less often than costs do, and the model produces that result from a single plausible belief without any conspiracy at all, which is a real achievement. But it cannot name the price it defends, the kink is hard to find in the evidence, the reactions are assumed rather than reasoned, and price wars lie entirely outside it. Treat it as one true pattern rather than a general theory.

Its great merit is rigidity without collusion: Before the model, a stable price among rivals invited the conclusion that they must have agreed on it. The kink shows that no agreement is needed, since a shared expectation about the reply is enough. That is a genuine insight and it survives every criticism made of the rest.

The asymmetry is realistic: A price rise really is a gift to a rival, so ignoring it costs nothing and gains custom. A price cut really is a threat, so matching it protects the rival's share. The expectation the model puts in the firm's head is the one a sensible manager would actually hold.

But it is a theory of a price it cannot name: The going price is assumed at the start and merely defended thereafter, so the model is indeterminate exactly where price theory is supposed to deliver. Collusion and price leadership do explain the level, which shows how much of the subject the kink leaves to others.

The evidence for the kink is thin: Prices in oligopoly move oftener than the model suggests, and they move together when an input cost rises for everyone. Studies looking for the discontinuity in real pricing behaviour have generally failed to find it, and firms themselves report following a rival upward.

The reactions are assumed rather than derived: The model tells the firm what rivals will do and never asks whether doing it would be in their interest. Analysis using game theory improves on this by making

the reply a decision, so cooperation, retaliation and the temptation to cheat all emerge instead of being written in at the start.

The judgement: The model deserves its place as a description of one common pattern, not as the theory of oligopoly price. Use it to explain why an established price stands still, use collusion or price leadership to explain the level, and expect an oligopoly to spend most of its energy competing away from price altogether.

Judge a model by the question it was built to answer and not by the questions it never claimed to touch.

The Master Key: *The kink is an excellent account of a price that will not move and no account whatever of a price that must first be chosen.*

HOT Question 193

A fuel station in Dodoma keeps its lights on until midnight and its price identical to the station opposite. Somebody is paying for those extra hours, and it is worth asking who and whether it was worth it.

Discuss whether the non-price competition forced on oligopolists by price rigidity benefits the consumer.

Model Answer

Much of it benefits the consumer and some of it does not, and the test is whether the buyer would have paid for the thing separately. Delivery, service, coverage and opening hours pass that test, because each is a real addition to what is bought. Purely combative advertising fails it, because it moves custom between brands without adding anything, and its cost is recovered in the price. Non-price competition also thickens the barrier that keeps the group of sellers small.

Why it happens at all: The kink closes off price as a weapon, since a cut is matched and a rise is punished, but the rivalry does not disappear. It is diverted into advertising, free delivery and installation, after sales service, credit for dealers and long opening hours, because those are the moves a rival cannot copy overnight.

Real gains for the buyer: A station open through the night, a mast raised in a district that had no signal, a bag of cement delivered to the site, a handset repaired without argument: each of these is something the buyer values and would pay for on its own. Competition has delivered it without any fall in price at all.

Variety and quality improve: Where price cannot fall the product itself has to get better, so differentiated oligopolists push design, reliability and range. A buyer facing five competing bundles has a choice that no single seller would ever have troubled to offer.

But much advertising is purely combative: Spending that only persuades a customer to switch brands adds nothing to output, and when every firm does it the shares end roughly where they started. The whole outlay is a cost of production recovered in the price, so buyers finance a contest fought over their own custom.

It raises the barrier to entry: Brand loyalty built over years of spending is an expense a newcomer must match before it can sell anything, so the rivalry that looks so fierce actually keeps the door shut. Non-price competition can therefore protect the very supernormal profit that a consumer would like to see competed away.

The judgement: Sort the spending by asking what the buyer receives. Service, delivery and coverage are worth having, and a lower price would usually be worth more than either of them. The sound policy is not to forbid non-price competition but to keep entry as open as the industry allows, so that price competition is available too.

Ask of every free extra whether it would survive if the firms were free to compete on price instead.

The Master Key: *Non-price competition is a benefit when it adds something to the good and a waste when it only moves a customer across the street.*

Collusion, Cartels and Price Leadership

Firms that cannot beat one another are always tempted to join one another. A cartel is nothing more elaborate than a monopoly assembled out of firms that remain legally separate, and the diagram that describes it is the monopoly diagram with the output cut into quotas. But the same agreement that makes the group rich makes each member richer still by breaking it, and a payoff matrix shows exactly why, which is a far better account of the record of cartels than any remark about the honesty of their members. Where the law forbids an express agreement, the same price can still be reached in silence, with one firm setting it and the rest following.

BINDER Question 194

Two coach owners at Ubungo need never meet. If each simply stops undercutting the other, the fare behaves exactly as though a contract had been signed.

Define collusion and distinguish between overt and tacit collusion, explaining why oligopoly in particular invites it.

Model Answer

Collusion is an agreement among rivals to stop competing, on price, on quantity or on the territory each will serve, so that the group behaves as one seller and holds profit above the level rivalry would leave. It is overt where the firms expressly agree, which is a cartel, and tacit where each simply follows a common pattern, such as the price the largest firm sets.

Collusion defined: an understanding between firms that would otherwise compete, by which they fix a price, share out quantities, divide the market by region, or agree not to bid against one another. The purpose is to capture the monopoly outcome without merging.

Why oligopoly invites it: the sellers are few and each is large enough to be felt by the rest. A price cut is matched within days, so rivalry destroys profit for all of them and leaves market shares where they were. Agreeing pays each firm more than winning.

Overt collusion, or the cartel: an express agreement, with meetings, a settled price and published quotas. The oil exporting countries meet to fix production levels, which is the clearest surviving example. Where the law reaches price fixing, overt collusion is unlawful precisely because it works.

Tacit collusion: no meeting, no document and nothing to prosecute. The firms simply learn a pattern: the largest moves its price and the others follow within the week. The outcome resembles a cartel and the evidence does not.

What the firms gain by it: relative certainty about the demand curve each faces, freedom from the fear of being undercut, and supernormal profit held at the highest level the group can sustain. Those gains are why collusion reappears wherever sellers are few.

The law can reach an agreement, and it struggles to reach a habit.

The Master Key: *Collusion is competition switched off by consent, whether the consent is written down or merely understood.*

BINDER Question 195

Five firms that agree on a price have not become five firms with a good understanding. Arithmetically they have become one firm with five factories.

With the aid of a diagram, show how a cartel fixes the price and the output of the industry, and how it shares that output among its members.

Model Answer

A cartel pools the price and output decision, so industry demand becomes the group's average revenue curve and joint profit is maximised exactly as a monopolist maximises profit: output goes to where industry marginal revenue equals industry marginal cost, with marginal cost cutting from below, and the price is read off the demand curve. The total is then split into quotas, each member producing where its own marginal cost equals that common marginal revenue.

The group becomes one decision maker: industry demand is now the cartel's average revenue curve, so marginal revenue lies below it and falls twice as fast, while the horizontal sum of members' marginal cost curves becomes the cartel's marginal cost, as the left panel of figure 6.30 shows.

$$\mathrm{AR} = \mathrm{a} - \mathrm{bQ} \;\Rightarrow\; \mathrm{MR} = \mathrm{a} - 2\mathrm{bQ}$$

The joint profit maximising output: the group restricts industry output to $\mathrm{Q_c}$, where summed marginal cost cuts industry marginal revenue from below, then charges the price $\mathrm{P_c}$ the demand curve returns there. Since $\mathrm{P_c}$ exceeds average total cost, supernormal profit is earned.

$$\Sigma\,\mathrm{MC} = \mathrm{MR} \;\Rightarrow\; \mathrm{Q_c}, \quad \mathrm{P_c} = \mathrm{AR}(\mathrm{Q_c}) > \mathrm{MC}$$

Quotas share the total at least cost: if one member's marginal cost stood above another's, moving a unit from the dear plant to the cheap one would cut the group's cost without changing its output. Joint profit is largest when every member produces where its marginal cost equals the common marginal revenue.

$$\mathrm{MC_1} = \mathrm{MC_2} = \cdots = \mathrm{MC_n} = \mathrm{MR}$$

The outcome is the monopoly outcome: price above marginal cost, output below the level competition would have produced, supernormal profit sustained while entry is barred, and the same deadweight loss. From the buyer's side the group cannot be distinguished from a single seller.

And the seed of its own destruction: the right panel shows one member facing the agreed price as a horizontal line, far above the marginal revenue that fixed the group's output. At that price it would gladly sell beyond its quota, and every member sees the same thing.

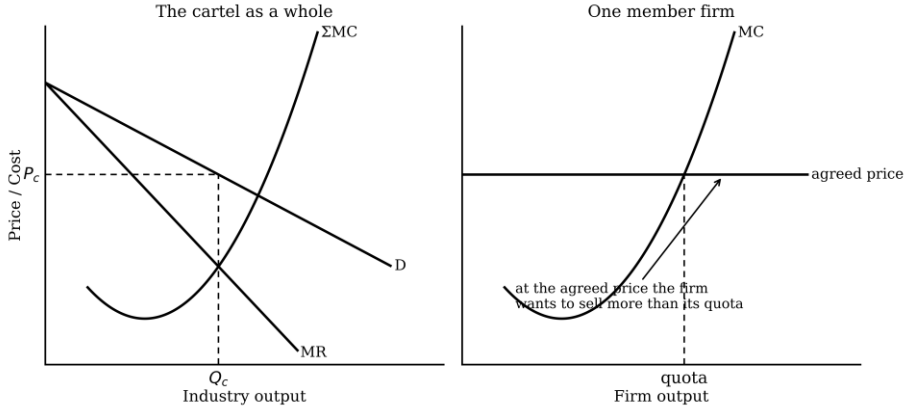


Figure 6.30: *A cartel sets price like a monopolist and shares output by quota*

A cartel's diagram is a monopoly's diagram with the output cut into slices.

The Master Key: *A cartel is a monopoly built out of firms that stay legally separate and privately tempted.*

BINDER Question 196

A cartel of oil exporters can hold a price for years. A cartel of cabbage growers at Lushoto would not survive a single market day, and the difference is written in one elasticity.

Explain the conditions that must hold if a cartel is to succeed.

Model Answer

A cartel succeeds where demand for its product is inelastic, so restricting output raises price more than proportionately; where the members are few enough to watch one another; where none cheats on its quota; where costs are similar, so all want the same price; and where no effective law stands against the agreement. Remove one condition and it weakens, remove two and it collapses.

Demand must be inelastic: there must be few close substitutes, so that when the group withholds output buyers pay rather than switch. Oil qualifies. Cabbage does not: raise the price and the buyer takes another vegetable, so the group loses the sale and gains nothing.

$$\mathrm{e} < 1 \;\Rightarrow\; \text{a cut in } \mathrm{Q} \text{ raises } \mathrm{P} \times \mathrm{Q}$$

The firms must be few, and all inside: a quota can be watched among five members and not among five hundred. Any producer left outside is free to expand at the high price, quietly supplying the market the members are withholding and taking their share while they pay for it.

Members must not cheat: the hardest condition of all, because each member gains privately by slipping extra output out at the agreed price while the others hold back. Detection must be quick and retaliation certain, or the incentive to defect does its work.

Costs must be similar: members with the same cost curve want the same price. A low cost member prefers a lower price and a larger share, a high cost member needs the price kept up to survive, and where the gap is wide no figure suits everyone.

No effective law, and a barrier at the door: where price fixing is prosecuted the agreement cannot be enforced in any court and must live in secret. Entry must also be blocked, since newcomers attracted by the high price will supply exactly the output the members agreed to withhold.

The high price that makes a cartel worth having is what tempts its members and summons rivals.

The Master Key: *Every condition for a cartel is a condition about who could take advantage of the price it sets.*

BINDER Question 197

No agreement is signed, no meeting is held and nothing can be prosecuted. Yet by Friday every fuel station in Moshi is charging what the largest one charged on Monday.

With the aid of a diagram, explain price leadership by a dominant firm, and distinguish it from barometric price leadership.

Model Answer

Under price leadership one firm sets the price and the rest follow, so the industry arrives at a common price with no agreement for a court to reach. A dominant leader is much the largest firm: it subtracts what the small firms will supply at each price from market demand, then behaves as a monopolist on the demand left to it. A barometric leader need not be large, and is followed because the others trust its reading of the market.

The tacit alternative to a cartel: the firms reach the cartel price with no express agreement to discover, no quota to police and no member to prosecute. Where price fixing is unlawful, this is the form of collusion that survives.

The leader's own demand curve: at each price, take what the market will buy and subtract what the followers together will supply. What is left is the leader's demand, which in figure 6.31 lies below the market curve at every price.

$$D_L = D_{market} - S_{followers}$$

The leader then behaves as a monopolist: on that curve it draws its own marginal revenue, falling twice as steeply, and produces Q_L where its marginal cost equals that marginal revenue and cuts it from below. The price P_L is read off its own curve.

$$MR_L = MC_L \Rightarrow Q_L, \quad P_L = D_L(Q_L)$$

The followers behave as price takers: each small firm treats P_L as given, so for it price equals average revenue equals marginal revenue, and it supplies where its own marginal cost rises to P_L. It collects a price above marginal cost without the trouble of setting one.

Barometric leadership distinguished: here the leader compels nothing. It is simply the firm with the surest feel for costs and demand, so its move is read as news rather than instruction. A barometric leader may be small and the role passes between firms, whereas a dominant leader keeps it as long as its size.

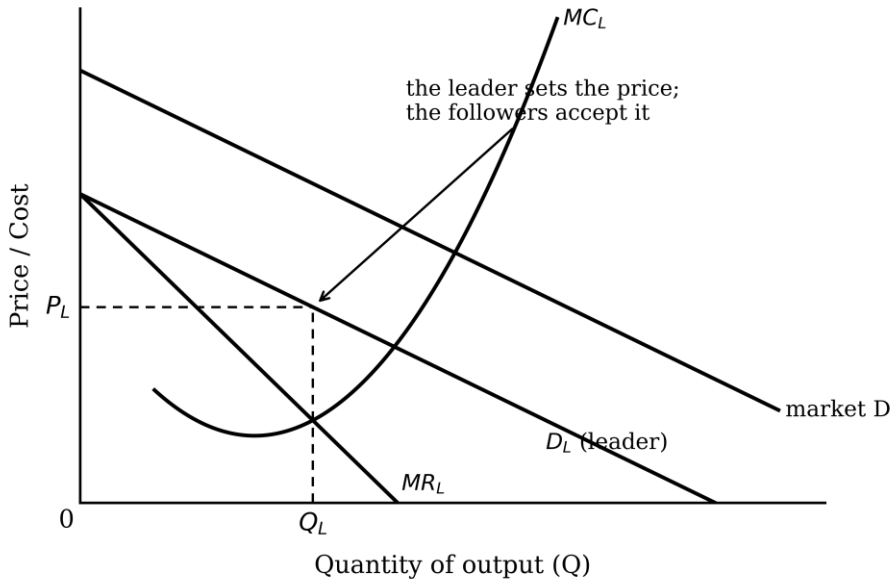


Figure 6.31: *Price leadership by a dominant firm*

The test is whether the leader could be ignored without cost.

The Master Key: *Price leadership buys a cartel's price without a cartel's paperwork, and that is why it is so hard to stop.*

REAL Question 198

The two owners shake hands at Mbeya over a fare and a timetable. Both will have broken the agreement by the end of the month, and both know it as they shake.

Using the payoff matrix below, explain why each company will cheat on the agreement although both would be better off keeping it.

Nyanda Express and Kipepeo Coach are the only two operators licensed on the Mbeya to Dar es Salaam route.

They agree a common fare and a quota of departures each week.

Either may keep its quota or cheat by running unannounced extra departures at the agreed fare.

If both keep the quota, each earns TShs 80 million in the season.

If one cheats while the other keeps the quota, the cheat earns TShs 100 million and the loyal firm TShs 30 million.

If both cheat, the extra seats break the fare and each earns TShs 50 million.

Model Answer

Cheating is a dominant strategy for each company. If Kipepeo keeps its quota, Nyanda earns TShs 100 million by cheating against TShs 80 million by keeping; if Kipepeo cheats, Nyanda earns TShs 50 million by cheating against TShs 30 million by keeping. Whatever the rival does, Nyanda gains TShs 20 million by cheating, and the matrix is symmetric, so Kipepeo reasons identically. Both therefore cheat and each takes TShs 50 million, which is TShs 30 million less than the quota would have paid.

Read the matrix first: each cell holds two figures, Nyanda's first and Kipepeo's second, in millions of shillings for the season. Neither firm can choose a cell: Nyanda chooses a row, Kipepeo chooses a column, and the two choices together settle where the season lands.

Nyanda's best reply if Kipepeo keeps: compare 80 with 100 down the first column. The extra coaches fill at the agreed fare, because the rival is still holding its own departures back and the fare is holding up. Cheating gains TShs 20 million, so Nyanda cheats.

Nyanda's best reply if Kipepeo cheats: compare 30 with 50 down the second column. Keeping the quota now means watching passengers board the rival's extra coaches while the fare falls anyway. Cheating gains TShs 20 million again, so Nyanda cheats here too.

Cheating is therefore a dominant strategy: a dominant strategy is one that is best whatever the other side does, so Nyanda need not predict Kipepeo at all. That is what makes the conclusion so strong: it survives every belief either owner might hold about the other.

Both end worse off than the agreement promised: the season settles at TShs 50 million each, when the quota offered TShs 80 million each, so joint profit falls from TShs 160 million to TShs 100 million. Neither owner behaved foolishly and both are poorer for it.

$$160 \text{ rightarrow } 100 \quad (\text{joint profit, TShs million})$$

What this explains about cartels: the record of broken quotas is not a record of weak characters but of this arithmetic. A cartel holds only where the structure is changed, by output that can be observed, retaliation that is swift, and a relationship expected to last long enough for punishment to outweigh one season's gain.

Nyanda Express	Kipepeo keeps its quota	Kipepeo cheats
Keeps its quota	80, 80	30, 100
Cheats	100, 30	50, 50

Profit for the season in millions of shillings, Nyanda Express first in each cell.

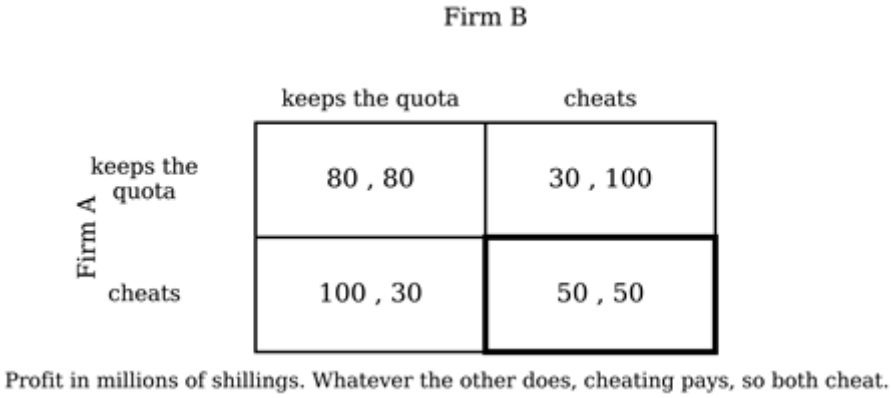


Figure 6.32: *The payoff matrix: why a cartel member cheats*

The agreement is not broken by dishonest people, it is broken by the numbers in the cells.

The Master Key: *Where cheating pays whatever the rival does, an agreement needs no enemies in order to fail.*

REAL Question 199

Three price lists reach a Mwanza hardware shop on the same Monday, each adding exactly TShs 1,500 to a bag. Identical prices are not proof of an agreement, and the Commission must know the difference.

Advise the Fair Competition Commission what evidence would distinguish a cartel from ordinary parallel pricing, and explain the harm the agreement would do if it were proved.

Ziwa, Nyanza and Sabasaba Cement supply almost all the cement sold in Mwanza, Shinyanga and Kagera.

For two years the three have quoted the same price for a bag within a day of one another.

Deliveries outside each firm's usual districts have stopped, although freight costs would still allow them.

One plant is markedly older and its costs are higher, yet its share of sales has not fallen.

Prices rose in a season when the cost of clinker and of fuel fell.

No document recording any agreement has been found.

Model Answer

Parallel pricing on its own proves nothing, because firms selling an identical good under identical cost conditions move together anyway. Advise the Commission to look for what competition cannot explain: the freezing of delivery territories, a high cost plant holding its share, and a price that rose in a season when costs fell. If the agreement is proved, the harm is that price stands above marginal cost so output is restricted, buyers are taxed for the members' benefit, and the weakest plant is sheltered from the pressure to become cheaper.

Why identical prices are not evidence: cement is homogeneous, so no buyer knowingly pays more than the going rate and prices are bound to converge. All three burn the same fuel and grind the same clinker, so their costs move together as well. Competition among sellers of an identical good looks very like this.

Frozen territory is the strong evidence: a firm that competes delivers wherever the margin covers the freight. Deliveries stopping at a district boundary that no freight cost explains points to an agreement to share the market, which is the part of a cartel least likely to have arisen by accident.

The dear plant that keeps its share: under rivalry the older works should be losing volume to the cheaper plants, or cutting price to hold it and earning less. A stable share for a high cost producer, at a common price, is the signature of a quota rather than of competition.

A price that rose when costs fell: marginal cost fell and price went up. Competing firms pass a cost fall on because each fears losing volume to the first rival that does. A group setting one price on the industry's joint marginal revenue has no such fear and no such reason.

The harm, if it is proved: price above marginal cost restricts output, so bags that builders valued above the cost of making them are never sold, and the loss falls on housing across three regions. The sheltered plant is never forced to renew its kiln, so the zone's cement stays dearer for years.

Turn the members' own temptation against them: since cheating pays each member whatever the others do, the group is held together only by mutual fear. A leniency rule that spares the first member to come forward exploits that structure directly, and recovers evidence no search of offices is likely to find.

An agreement nobody wrote down can still be read in the pattern of who sells where.

The Master Key: *Prove a cartel by what competition cannot explain, and break it by giving one member a reason to move first.*

HOT Question 200

The obvious harm of a cartel is the extra shilling on the price. The lasting harm is that nobody in the trade has any reason left to find a cheaper way of working.

To what extent are cartels harmful, and can one ever serve the public interest?

Model Answer

Cartels are harmful in almost every case: they lift price above marginal cost and restrict output, transfer wealth from buyers to members, shelter high cost producers from the pressure that would force them to improve, and remove the reward for finding a better technique. The defences are narrow, applying mainly where small sellers face powerful buyers or where the cooperation concerns research rather than price, so the sound rule is to prohibit agreements on price, output and territory outright and to judge the rest case by case.

The allocative harm: the group holds price above marginal cost, so units that buyers value at more than they cost to produce are never made. The triangle between the demand curve and marginal cost measures what is lost, and nobody receives it: it is destroyed rather than transferred.

$$P > MC \Rightarrow \text{units worth making are not made}$$

The transfer, and where it falls: buyers who still purchase pay more for exactly the same good, and the difference goes to the members. When the cartelised good is cement, fertiliser or fuel, that transfer lands on the building of houses and the growing of crops.

Inefficient members are protected: a quota guarantees a share whatever the member's costs, so the worst run plant survives and production never settles at minimum average total cost. Full exposure to rivals would have closed it or forced it to improve.

And improvement stops: research is expensive and its reward is a lead over rivals. A cartel abolishes the lead, since price and share are settled in advance, so the money is not spent and technique stands still. Over a decade this costs the buyer more than the price rise did.

The harm spreads, and the collapse hurts too: members police the door, so the trade hardens into a private monopoly, and a dear input raises costs in every trade that uses it. The agreement is fragile besides, and when a member defects the price war that follows leaves the industry in disarray.

The narrow defence: where thousands of small growers face two or three exporters, an association bargaining together is countervailing power rather than seller power, and may lift the farm gate price towards the competitive one. Joint research and common standards also cut costs without fixing any price.

The verdict: prohibit agreements on price, output and market sharing without further argument, because the gain to members is always a larger loss to everybody else. Permit cooperation that leaves each firm free to set its own price.

The damage outlasts the agreement, because a trade that has stopped competing must learn how to do it again.

The Master Key: *A cartel takes money from buyers this year and takes efficiency from the industry for good.*

HOT Question 201

Every cartel in the record carries the same obituary: it worked, and then a member quietly sold more than its share. The interesting question is not why they break but why any of them last.

Discuss why cartels have proved unstable, and state the circumstances in which one may nevertheless survive.

Model Answer

Cartels break because cheating is a dominant strategy: whatever the others do, a member gains by slipping extra output out at the agreed price, so every member has the same reason to defect and all of them finish worse off than the quota would have left them. A cartel survives only where that arithmetic has been altered, by members few enough to watch, output visible enough to verify, retaliation swift enough to make one season's gain smaller than the price war it triggers, and demand steady enough that no member is desperate.

The temptation, stated exactly: a member that cheats sells its extra units at the high price the group's restriction is holding up. The gain is entirely its own, while the cost, a slightly weaker price, is spread across every member including the innocent ones. That asymmetry is the whole story.

Which leaves everyone worse off: when each member reasons that way, output rises, the price falls and the group ends with less than the quota promised. Each acted sensibly and all of them lost, which is a property of the situation rather than a failing of the people in it.

Detection is the first repair: cheating pays only while it passes unnoticed. Where output is visible, published, or shipped through ports the others can watch, the defector is identified within a season and the calculation that tempted him changes.

Repetition and retaliation are the second: the matrix describes a single season, and firms deal with each other for decades. A member weighing one season's gain against a permanent price war may well keep its quota. A cartel is sustained by a threat the members believe, never by good faith.

What defeats the repairs: too many members to watch; costs so different that a low cost member does better outside; a slump that makes the extra sale essential; outsiders drawn in by the very price the group protects; and any member with a short horizon, since a firm that may not trade next year has nothing to lose.

The circumstances that hold: few members, similar costs, inelastic demand, an output that can be observed, high barriers against newcomers, and a legal order that either enforces the agreement or at least does not prosecute it. The oil exporters have most of these, which is why their agreement re-forms after each breach.

Ask of any cartel not whether its members are honest but whether cheating can be seen and punished before it pays.

The Master Key: *A cartel holds only where punishment arrives sooner than the reward for defecting.*

HOT Question 202

One arrangement is an offence and the other is a habit. They can produce precisely the same price, and only one of them can be brought before a court.

Assess whether price leadership should be treated as seriously as a formal cartel.

Model Answer

Judged by its effect on the buyer, dominant firm leadership deserves to be taken as seriously, since it delivers the same price above marginal cost, the same restricted output and the same shelter for high cost followers, and it is more durable because there is no quota to break. Judged by the remedy it calls for, it cannot be treated the same way: there is no agreement to prohibit, barometric leadership is often no more than the passing of information, and the harm depends on the barrier rather than on the following.

The effects can be identical: the leader sets price on its own residual demand curve, where its marginal revenue equals its marginal cost, and the followers take that price as given. Price stands above marginal cost, output is restricted and the welfare loss is the same. From the price list the buyer cannot tell the two apart.

And leadership is the more durable arrangement: cartels collapse because a member is tempted to break a quota. Under leadership there is no quota to break, no meeting to record and no member to prosecute, so the very instability that destroys formal agreements has been engineered out of it.

But there is nothing to prohibit: a law can void an agreement; it cannot forbid a firm to choose the same price as its largest rival, because matching a rival's price is exactly what competition also produces. A rule against following would condemn innocent behaviour far more often than it caught anything.

Barometric leadership may be harmless: where the leader is simply the firm that reads costs and demand best, its price move is information, and followers who cannot survey the market use it as a barometer. Leadership then passes to whichever firm is trusted next, which is not what market power looks like.

The real test is entry, and punishment: leadership becomes serious where the leader can flood the market and the followers know it, and where barriers keep newcomers out. Then following is obedience rather than convenience. Where entry is easy, no leader can hold a price above cost for long.

The proportionate response: treat a proved agreement as an offence and treat leadership as a symptom. Lower the barriers, remove exclusive access to ports, quarries and networks, watch for the punishment of a follower that dares to cut, and let entry accomplish what prosecution cannot.

The price list may look the same either way, and the remedy cannot be the same.

The Master Key: *Punish the agreement where there is one, and where there is none, attack the barrier that makes following profitable.*

HOT Question 203

A cartel of oil exporters costs a Tanzanian household at every pump. A cartel of coffee exporters would put money in a Kilimanjaro farmer's pocket. The instrument is identical, and where you stand decides the verdict.

To what extent would a cartel of primary exporting countries serve the interest of a country such as Tanzania?

Model Answer

Only where the country sells the cartelised good, where demand for it is genuinely inelastic, and where the producing countries are few enough for a quota to be policed. Most of Tanzania's exports fail those conditions, since coffee, cotton, cashew and tobacco have many producing countries, ready substitutes and land that can be brought into cultivation within a season, while as an importer of oil the country pays for the one cartel that does meet them.

The gain, where the conditions do hold: restricting the supply of a good whose demand is inelastic raises the price more than proportionately, so export earnings rise even as the volume shipped falls, and the terms of trade move towards the producer. Steadier earnings also make a budget easier to write.

$$e < 1 \Rightarrow \text{a fall in } Q \text{ raises } P \times Q$$

Most agricultural exports fail the elasticity test: a buyer of coffee can move to another origin, another grade or another drink, and cashew, cotton and tobacco each face substitutes of their own. Withhold supply and the buyer switches, so the country loses the sale without lifting the price it still receives.

The number of producers is fatal: dozens of countries grow coffee, and within each the crop comes from thousands of separate farms. A quota that cannot be allocated, watched or enforced is not an agreement at all, and primary agriculture supplies exactly the conditions a cartel cannot work in.

Entry undoes whatever the short run gains: a high price brings new land, new countries and better technique into production within a few seasons, and makes a substitute that was too dear worth developing. The members commonly lose market share permanently in exchange for a few good years.

Tanzania sits on the buying side of the successful one: demand for oil is inelastic in the short run, which is why that agreement works, and the country pays for it in transport, in electricity generation and in every price that carries a freight charge. What is good for a member is by construction bad for its customers.

The judgement: support a producers' agreement only in the rare good with few sellers and no substitute, and treat it as a bargaining device rather than a lasting income. The buying side matters more here: a cooperative facing two or three exporters at the farm gate raises the grower's price without any of the enforcement problems above.

A price held up by agreement lasts as long as the agreement, and a price earned by lower cost lasts as long as the cost advantage.

The Master Key: *A cartel is worth joining only where the conditions for one already exist, and for most of what Tanzania sells they do not.*

The Four Structures Side by Side

Everything in this chapter now goes onto one page. The four structures answer the same set of questions differently, and every difference descends from two facts about a market: how many sellers it holds and how hard it is to enter. The comparison table below is the most useful page in the chapter, and the section that follows it explains why the second of those two facts matters more than the first. A market with one seller and an open door can serve buyers better than a market with six sellers behind a licence, which is the strongest single line available in any argument about whether competition is good for the consumer.

BINDER Question 204

A maize seller at Kibaigwa, a hairdresser at Mwanjelwa, a cement plant and TANESCO are all sellers. What separates them is not effort or size but how easily a rival could arrive.

Complete a table comparing perfect competition, monopolistic competition, oligopoly and monopoly across the number of sellers, the nature of the product, control over price, barriers to entry and exit, freedom of choice, the demand curve facing the firm, efficiency and long-run profit.

Model Answer

The four structures lie on one spectrum, with perfect competition at one end and monopoly at the other, and every row of the table below is generated by two facts: how many sellers there are and how high the barriers stand. The number of sellers and the nature of the product fix the slope of the

firm's demand curve, that slope fixes how much control over price the firm has, and the height of the barriers fixes whether supernormal profit survives the long run.

Read the table downwards, not across: each column is one structure, and everything in it follows from the two entries at the top. Once you know that there are very many sellers of an identical good, the horizontal demand curve, the absence of price control and the long-run normal profit are all settled for you.

The demand curve is where structure becomes economics: a price taker faces a horizontal curve, so price is also its marginal revenue. Every other structure faces a downward sloping curve, so average revenue exceeds marginal revenue, and from that single inequality come price above marginal cost, restricted output and allocative inefficiency.

$$P = AR = MR \quad \text{(price taker)}; \qquad AR > MR \quad \text{(price maker)}$$

Efficiency is read off two comparisons only: allocative efficiency asks whether price equals marginal cost. Productive efficiency asks whether output is at minimum average total cost. Perfect competition satisfies both in the long run and the other three satisfy neither, though for different reasons.

Long-run profit is read off the barrier alone: where entry is free, supernormal profit attracts entrants until only normal profit remains, which is why perfect and monopolistic competition give the same long-run answer while differing everywhere else. Where entry is blocked, the surplus is never competed away.

Feature	**Perfect competition**	**Monopolistic competition**	**Oligopoly**	**Monopoly**
Sellers and buyers	Very many of both, each too small to move price	Many sellers, many buyers	Few sellers, many buyers	One seller, many buyers
Nature of the product	Homogeneous, perfect substitutes	Differentiated, close substitutes	Homogeneous or differentiated	Unique, no close substitute
Control over price	None, the firm is a price taker	Slight, within a narrow band	Considerable, but limited by rivals' reactions	Great, limited only by demand
Barriers to entry and exit	None, entry and exit are free	Low, entry is fairly free	High	Very high or absolute
Consumer's freedom of choice	Of seller only, the good is the same	Wide, variety is the point	Limited to a few brands	None, buy or go without
The firm's demand curve	Horizontal, perfectly elastic	Downward sloping, very elastic	Kinked at the ruling price	Downward sloping, least elastic
Revenue relation	$P = AR = MR$	$AR > MR$	$AR > MR$, MR discontinuous	$AR > MR$
Allocative efficiency	Achieved, $P = MC$	Not achieved, $P > MC$	Not achieved, $P > MC$	Not achieved, $P > MC$
Productive efficiency	Achieved, output at minimum ATC	Not achieved, excess capacity	Not achieved	Not achieved
Long-run profit	Normal profit only	Normal profit only	Supernormal profit can persist	Supernormal profit persists
Non-price competition	None, there is nothing to differentiate	Heavy, branding and advertising	Heavy, the chief weapon	Little needed
Tanzanian illustration	Maize at Kibaigwa, seed cotton at Kishapu	Salons, tailors and eating houses	Cement and telecommunications	TANESCO and DAWASA

The four market structures compared.

These are not four theories but one theory answered under four different entry conditions.

The Master Key: *Count the sellers and measure the barrier, and every other line of the table follows.*

BINDER Question 205

Only one of the four structures makes a last unit worth exactly what it costs, and it is the one no real market quite reaches.

Explain why perfect competition achieves both allocative and productive efficiency in the long run while the other three structures achieve neither.

Model Answer

Allocative efficiency requires price to equal marginal cost, and productive efficiency requires production at minimum average total cost. The price taker meets the first because price is also its marginal revenue, so equating marginal cost to marginal revenue equates it to price; it meets the second because free entry drives price down to the lowest point of the average cost curve. The other three face downward sloping demand curves, so price ends above marginal cost, and none is driven to minimum average total cost.

Allocative efficiency under perfect competition: for a price taker price equals average revenue equals marginal revenue. Profit is maximised where marginal cost equals marginal revenue and cuts it from below, so at that output marginal cost equals price: the last unit costs society exactly what the buyer thinks it is worth.

$$P = AR = MR = MC$$

Productive efficiency under perfect competition: entry continues while price exceeds average total cost, so in the long run price is driven to the lowest point of that curve. Output settles at minimum average cost, which is the cheapest the known technique allows.

$$P = MC = \text{minimum LAC}$$

Monopolistic competition fails both at a tangency: free entry still removes supernormal profit, but the firm's demand curve slopes down, so it can only touch average total cost on the falling stretch. Price equals average cost, giving normal profit, yet exceeds marginal cost, and output stops short of the minimum. That gap is excess capacity.

$$P = ATC > MC, \quad q_{\text{tangency}} < q_{\min ATC}$$

Oligopoly and monopoly fail both behind a barrier: average revenue again exceeds marginal revenue, so price stands above marginal cost; and since entry is blocked, nothing drives price down to minimum average cost. Supernormal profit persists, and a firm under no pressure may not even reach the cost curve it could, which is X-inefficiency.

Efficiency is not a reward for good conduct, it is what a horizontal demand curve and an open door produce between them.

The Master Key: *Price above marginal cost is the single failure the three imperfect structures share, and a downward sloping demand curve is its cause.*

BINDER Question 206

Put the four demand curves side by side and the whole chapter fits on one line: flat, gently falling, kinked, steeply falling.

With the aid of a diagram, distinguish the four market structures by the shape of the demand curve facing the individual firm.

Model Answer

The firm's demand curve is horizontal under perfect competition, downward sloping and very elastic under monopolistic competition, kinked at the ruling price under oligopoly, and downward sloping and least elastic under monopoly. The shape is set by how close the substitutes are and by how rivals react, and it decides everything else, because a horizontal curve makes price equal to marginal revenue while any downward slope puts marginal revenue below price.

Perfect competition, horizontal: the firm's output is a negligible share of the whole and the good is identical to every rival's, so raising the price by a shilling loses every buyer and lowering it is pointless. The firm can sell all it wishes at the ruling price, so price equals average revenue equals marginal revenue.

Monopolistic competition, sloping and elastic: differentiation earns a few loyal customers, so a small price rise loses some custom rather than all of it. But close substitutes stand in every neighbouring shop, which keeps the curve flat, and marginal revenue now lies below price.

Oligopoly, kinked: rivals ignore a price rise and match a price cut, so demand is elastic above the ruling price and inelastic below it. The kink makes marginal revenue discontinuous, so marginal cost can move within the gap without changing price, which is price rigidity.

Monopoly, sloping and least elastic: the firm is the industry, so its curve is the market demand curve, and with no close substitute it is the least elastic of the four. That gives the widest gap between average and marginal revenue and the greatest control over price. Even so, the monopolist picks a point on the curve and never the curve itself.

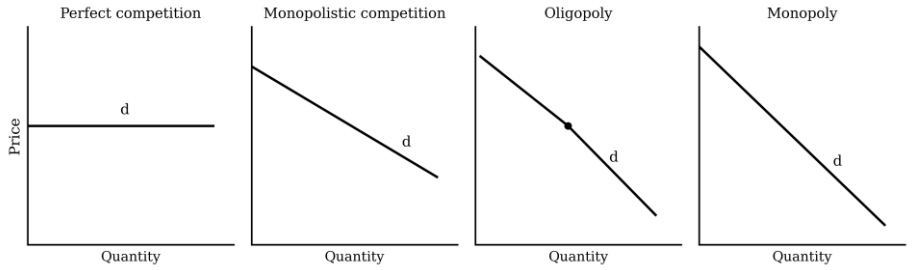


Figure 6.33: *The demand curve facing the firm in each of the four structures*

Everything a structure does to price, output and profit is written in the slope of the line the firm faces.

The Master Key: *The flatter the demand curve facing a firm, the less of its price is its own decision.*

BINDER Question 207

One airline flies to Songea and the fare is modest. What holds it down is not the rival on the tarmac but the rival who could be there within a season.

Explain what is meant by a contestable market, and why the height of the barriers may matter more than the number of firms.

Model Answer

A contestable market is one in which entry and exit are cheap, because the assets a newcomer needs can be hired and given back, so an entrant may arrive, take the profit and leave before the incumbent can respond. The threat of that hit-and-run entry forces the incumbent to hold price near average cost even when it is the only firm trading, so what matters is the sunk cost of entering rather than the number of sellers.

The conditions: entry and exit must be free, no cost incurred on entering may be unrecoverable on leaving, the entrant must reach the same buyers with the same technique, and the incumbent must be slow to change price. Where all four hold, the market is perfectly contestable.

Hit-and-run entry: a fat margin is an invitation. A newcomer hires a lorry or an aircraft, undercuts, takes the profit and withdraws when the incumbent replies, losing nothing on the way out because nothing was sunk. The prospect alone does the work.

The outcome, with a single seller: knowing this, the incumbent prices near average total cost and settles for normal profit, so a market with one firm delivers something close to the competitive result. Slack costs are an invitation too, so it cannot afford X-inefficiency.

Sunk cost is the real barrier: a fixed cost that can be recovered on exit deters nobody, because the entrant risks only the return and never the capital. What keeps entrants out is cost that cannot be recovered: a sunk well, a laid pipe, an established brand.

What follows for policy: count barriers rather than firms. Selling a state monopoly to a private owner changes nothing if the barrier survives, while opening a route or admitting imports changes a great deal even if the number of sellers stays at one.

The number of firms is a fact about today, and the barrier is a fact about tomorrow.

The Master Key: *What disciplines a seller is the rival who could enter, and sunk cost decides whether that rival is real.*

REAL Question 208

Five sellers, five different lives. One cannot name a price at all, one names it and is obeyed, and three sit somewhere between.

Identify the market structure under which each of the five sellers in the box operates, and justify each answer.

> Amina sells maize at Kibaigwa, where hundreds of sellers offer identical grain and the day's price is known before she arrives.
>
> TANESCO supplies electricity to households in Sumbawanga under an exclusive licence.
>
> About forty salons at Mwanjelwa in Mbeya each cut hair, each has its own name and regulars, and a new one opens most months.
>
> Five cement plants supply almost all the cement sold in the country, and each watches what the other four charge.
>
> Kazi Njema Furniture on the SIDO estate at Morogoro makes chairs to order in a town with a dozen other workshops.

Model Answer

Amina at Kibaigwa sells under something very close to perfect competition, TANESCO in Sumbawanga is a monopoly, the salons at Mwanjelwa and the Morogoro workshop are both monopolistic competition, and the five cement plants form an oligopoly. Every classification rests on three questions only: how many sellers there are, whether the product is identical or differentiated, and how easily a newcomer can enter.

Amina, perfect competition: many sellers, homogeneous grain, free entry and a going price she must accept. Her demand curve is horizontal at that price, so price equals average revenue equals marginal revenue, and in the long run she can expect normal profit only.

TANESCO, monopoly: one seller, no close substitute for grid current at that scale, and a legal barrier no rival may cross. Its demand curve is the market's, average revenue exceeds marginal revenue, price stands above marginal cost, and profit is limited by the regulator rather than by any rival.

The salons, monopolistic competition: many small sellers, a differentiated service and free entry, which the opening of a new salon each month demonstrates. Each has slight power over price, and entry leaves normal profit at a tangency with excess capacity, visible as empty chairs at midday.

Cement, oligopoly: few large firms, high barriers since a kiln costs a fortune, and interdependence so complete that no plant sets a price without predicting the other four. Prices are rigid, competition runs through delivery and credit terms, and supernormal profit can persist.

Kazi Njema, monopolistic competition again: chairs made to order are differentiated, a dozen rivals are close substitutes, and any joiner with tools may enter. Note what did not matter: the workshop is tiny and TANESCO is huge, yet size is not the criterion. Substitutability and entry are.

The method, for any seller: ask how many sellers, whether the product is the same and how hard entry is, then check by asking what the seller can do to price. One who cannot move price is a price taker; one who can raise it and keep most customers has power, and the amount of it is the structure.

Two of the five share a structure and would not recognise themselves in each other, which is exactly why markets are classified by conditions and not by trade.

The Master Key: *Classify a market by the number of sellers, the sameness of the product and the ease of entry, never by the size of the firm.*

REAL Question 209

One airline, one route, no rival in sight, and a fare that has hardly moved in three years. The Commission would like to know who is holding it down.

Advise the Fair Competition Commission whether the fare charged by this single operator should be controlled.

Ruvuma Air is the only operator flying Songea to Dar es Salaam.

Its two aircraft are leased and can be returned at three months' notice.

The airport is public, and any licensed carrier may use its apron and terminal.

A licence to fly the route takes about a season to obtain.

Fares stand a little above the airline's average total cost and have hardly moved in three years.

A rival that entered last year withdrew after four months and lost nothing on the way out.

Model Answer

Do not control the fare. Ruvuma Air is the only firm on the route, but the route is contestable: the aircraft are leased rather than owned, the airport is open to any licensed carrier, and last year's entrant left without loss. The threat of hit-and-run entry is therefore real and is already holding the fare near average total cost, which is the outcome a control would be trying to produce. Protect the conditions that make entry cheap instead.

One seller is not the same as market power: power means the ability to hold price above marginal cost and keep it there. The fare here sits a little above average total cost, which is what a firm earning normal profit charges, and it has not been raised in three years although no rival has been present.

Apply the sunk cost test: leased aircraft returned at three months' notice, a public apron, no terminal of its own. Almost nothing an entrant spends here is unrecoverable, which is precisely the condition for contestability, and last year's entrant proved it by leaving without loss.

How the threat does the work: if Ruvuma Air raised the fare, the margin would summon a carrier that could be flying within a season and could withdraw again if the fare came back down. Knowing that, the airline prices as though the rival were already on the apron.

What a fare cap would achieve, and cost: at best it would reproduce a price the market already delivers. Set too low it would end the service, since the route cannot be flown at a loss, and administering it would oblige the Commission to estimate costs the airline knows far better than it does.

Where the danger actually lies: exclusive use of the apron or of ground handling, a long exclusive licence, a slow or discretionary licensing process, or a promise to match any entrant's fare for as long as it takes. Each converts a contestable route into a protected one, and each is worth prohibiting.

The advice: leave the fare alone; keep the licence quick to obtain and non-exclusive; keep airport access open on published terms; and act at once against conduct aimed at raising the cost of entry. Review the decision if the fare rises without a movement in fuel or lease costs.

The right question was never how many airlines fly the route but how quickly a second one could.

The Master Key: *Where nothing is sunk, one seller can be as disciplined as many, and the Commission's work is to keep it that way.*

HOT Question 210

More sellers is the natural answer to any complaint about price. It is also the answer that would give a small town four half empty flour mills in place of one working at capacity.

To what extent is more competition always better for the consumer?

Model Answer

More competition is usually better for the consumer, because rivalry drives price towards marginal cost, pushes production towards minimum average total cost and removes the rent a protected seller collects. It is not always better, since a market whose costs fall over the whole range of demand is served more cheaply by one firm than by several, since variety and research are both funded out of margins that pure rivalry removes, and since what actually disciplines price is the ease of entry rather than the number of sellers.

The case for competition is the stronger one: rivals force price down towards marginal cost, entry erodes supernormal profit, and a firm that cannot pass on slack must find the lowest point of its average cost curve. The buyer also gains choice and the right to walk away, which no regulator can manufacture.

But competition bought by duplication raises costs: where economies of scale run out to the whole market, splitting output between four plants leaves each of them higher up its average cost curve, and the consumer pays that higher cost in the price. Two water networks in one town is rivalry no buyer benefits from.

And pure rivalry funds nothing: a firm earning only normal profit has no surplus for research and no reason to spend one if it had, since the result would be copied at once. Some of what buyers want most, new medicines and new networks, is paid for out of margins that perfect competition removes.

Variety has a price, and it is usually worth paying: under monopolistic competition entry leaves each firm short of minimum average total cost, so every salon has idle chairs. That excess capacity is the cost of having forty salons rather than one large one, and most buyers would pay it willingly.

Contestability changes the question: the threat of entry disciplines price even where one firm trades. Where sunk costs are low, an incumbent prices near average cost because a fat margin would summon an entrant who could leave again at no loss. Counting sellers would have found a monopoly and missed the discipline entirely.

The extent, settled: measure the barrier rather than the headcount: a high concentration ratio behind an open door is harmless, and a low one behind exclusive access to a port or a network is not. Competition is better for the consumer wherever a second firm can produce at no higher unit cost, and where it cannot, the aim should be an open door rather than a crowd.

The consumer never wanted rivals as such, only the price and the quality that rivals usually bring.

The Master Key: *Competition is a means, so ask not how many firms are in the market but how easily another could enter.*

HOT Question 211

Two villages, one shop in each. In the first the shopkeeper charges what he likes; in the second he charges what the lorry from the next town would charge if he did not.

Discuss whether a market with a single seller is necessarily a market with monopoly power.

Model Answer

It is not. A single seller holds monopoly power only where something prevents a second seller from arriving, so where entry is cheap and nothing is sunk the incumbent must price near average cost or summon a rival, and where imports, second hand goods or a substitute technology are available the market is wider than a count of local sellers suggests. Power is the ability to hold price above marginal cost for a period, and that rests on barriers rather than on a headcount.

Define the power, not the number: market power is the ability to raise price above marginal cost and keep it there. A firm that would lose its customers within a season to an entrant or to an import has no such ability, whatever share of today's sales it happens to hold.

The contestable case: leased assets, a facility open to all comers and a licence quickly obtained mean an entrant risks nothing it cannot recover. The incumbent then prices as though the rival already existed, and the market delivers close to the competitive outcome with one firm in it.

How the market is defined decides the answer: the only bus operator on a route competes with lorries, with motorcycles and with the decision to stay at home. The only cement plant in a region competes with imports through the port. Draw the boundary narrowly enough and every seller looks like a monopolist.

When a single seller does hold power: where the outlay cannot be recovered on exit, where an exclusive legal right stands in the way, where the incumbent owns the one facility a rival would need, or where the product has no substitute at any price the buyer will pay. Then output can be restricted for years.

The evidence to look for instead of counting: does the margin persist over several years; has any entrant tried and left, and why; does the price respond to costs; are the firm's costs defensible against a comparable firm elsewhere. Persistent supernormal profit with no attempted entry is the real symptom.

Why the diagnosis matters: mistaking one seller for monopoly power invites a price control the market did not need and cannot administer well. Mistaking a protected market for a contested one leaves a real barrier standing. Either error is expensive, and only an inquiry into entry avoids both.

A monopoly is a position, and a position is only as strong as the wall around it.

The Master Key: *One seller is a fact about the market today, and monopoly power is a fact about what would happen if a second one tried.*

HOT Question 212

Perfect competition makes the cheapest chair that today's technique allows. It has neither the money nor the reason to invent a better one, and over twenty years that is the more expensive failing.

Compare the four market structures on efficiency, and discuss which serves the consumer best over the long run.

Model Answer

On static efficiency the ranking is not in doubt: perfect competition alone gives price equal to marginal cost and production at minimum average total cost, monopolistic competition buys variety at the price of excess capacity, and oligopoly and monopoly restrict output behind a barrier. But static efficiency is a snapshot, and on dynamic efficiency the ranking can reverse, since research must be funded from a margin and rewarded by a lead over rivals, both of which pure competition removes.

The static ranking, stated: perfect competition satisfies both efficiency tests in the long run. Monopolistic competition satisfies neither, since the tangency leaves price above marginal cost and output short of minimum average cost. Oligopoly and monopoly satisfy neither and keep their supernormal profit besides.

Why that ranking is not the whole answer: it holds technology still. Over ten years the cost curve itself moves, and a structure that lowers the whole curve does more for the buyer than one that sits on the lowest point of a curve which never falls at all.

The dynamic case for scale and margin: research is expensive, risky and worth undertaking only if the result can be held for a while. A firm earning normal profit has neither the funds nor the reward, which is why the largest advances in technique rarely come out of the most competitive trades.

But protection without pressure produces nothing: a monopolist safe behind a legal barrier may bank the surplus and change nothing, and X-inefficiency with a quiet life is the usual result. Improvement happens where a firm is large enough to afford it and frightened enough to need it.

Variety belongs in the reckoning: the excess capacity of monopolistic competition buys forty salons, a hundred designs and shops that stay open late. Efficiency measured on a single homogeneous good gives that no value at all, and buyers plainly do.

The judgement: the structure that serves the consumer best over a long period is a contested oligopoly, where a few firms are large enough to fund improvement and entry is open enough to force them to pass it on. Perfect competition stays the benchmark for the static questions and a poor description of where progress comes from.

The consumer buys from the cost curve of ten years from now, and only some structures move it.

The Master Key: *Judge a structure by the price today and the cost curve tomorrow, and no single structure wins on both.*

HOT Question 213

The only shop in a village near Kigoma is a monopoly on a wet Tuesday and one seller among hundreds on market day. The structure changed and the shop did not.

To what extent do the four market structures describe real markets in Tanzania?

Model Answer

They describe tendencies rather than categories. No Tanzanian market meets the assumptions of perfect competition in full, most real trades sit between the four boxes, and the classification of any market depends on how widely the product and the area are defined. The four structures remain the right tools all the same, because each isolates one force, namely the number of sellers, the closeness of substitutes, interdependence and the barrier, and a real market is read by asking how much of each force is present.

Structure is a matter of degree: the spectrum runs from many sellers of an identical good with free entry to one seller behind a wall, and real markets sit at points along it. Nothing obliges a trade to fall into one of four boxes, and the useful question is how far along it lies.

Perfect competition is never met in full: at Kibaigwa the grain is nearly homogeneous and the sellers are many, yet knowledge is imperfect, transport is costly and a sack from a known seller fetches more than one from a stranger. The model is a benchmark and was never a description.

The boundary you draw decides the answer: call the market cement in the Lake zone and there are three sellers; call it cement in the country and there are five; call it walling material and mud brick, timber and stone all compete. The same choice arises geographically, and it changes the verdict.

Real markets are hybrids: cement is a differentiated oligopoly with a fringe of small importers, telecommunications is an oligopoly whose members compete on bundles like monopolistic competitors, and a village shop is a local monopoly restrained by the bus fare to the next town.

Contestability cuts across the whole classification: the count of sellers can be right while the conclusion is wrong, since a route with one carrier and no sunk cost behaves better for buyers than a trade with six firms sheltering behind a licence. Barriers do not appear in the name of any structure.

What the classification is still good for: each model isolates one force and predicts what that force does, so the models work as questions to ask of a market rather than as boxes to sort it into. Used that way the analysis holds even where the label plainly does not.

A model that no market matches can still be the fastest way to see what a market is doing.

The Master Key: *The four structures are four questions to ask about a market, not four shelves to put it on.*

The Market Clinic and Whole-chapter Capstone

Twenty four sections have built the apparatus. This last one takes it into the clinic, because nearly all the marks lost on this chapter are lost to a small handful of errors that repeat themselves year after year, and an error is unlearned faster when you meet it first in the exact form you would have written it. Every question that follows therefore puts the wrong answer down before the right one. Three decisions with real figures then test whether the corrections survive contact with a schedule, and the chapter closes with a single industry run through every instrument the chapter owns.

BINDER Question 214

Two prices sit at the bottom of two different curves, and under pressure the wrong one is reached for about half the time. The mistake closes a workshop that should have kept its doors open.

Identify the error in each of the two answers in the box, and correct it.

The first answer reads: a firm breaks even at the lowest point of average variable cost, and shuts down at the lowest point of average total cost.

The second answer reads: any firm making a loss should close down at once, because a loss cannot be carried.

Both were written by candidates who could draw the diagram correctly.

Model Answer

The first answer has the two prices the wrong way round. Break-even is at the lowest point of average total cost, TShs 8.09 for the firm used throughout this chapter, and shut-down is at the lowest point of average variable cost, TShs 4.94. The second answer forgets that fixed cost is owed whether the gate is open or shut, so a loss-making firm whose price still covers average variable cost makes its loss smaller by producing.

Break-even must be the higher price: average total cost is average variable cost plus average fixed cost, so it lies above average variable cost at every output. The price that just covers the larger average must be the larger price, and no rearrangement of the diagram reverses that order.

What each price settles: at the bottom of average total cost every cost is met, including the return the owner's own resources could have earned elsewhere, so profit is exactly normal. At the bottom of average variable cost only materials and wages are covered, so the loss is the whole fixed cost.

The second answer compares the wrong things: closing cancels neither rent nor licences nor the loan on the machinery. The choice is never between a loss and no loss but between two losses, and producing is the smaller of them whenever price clears average variable cost.

Where the second answer happens to be right: below the bottom of average variable cost each unit adds more to cost than to revenue, so staying open drives the loss past the fixed cost. Closing at once is then correct, which is why the wrong answer feels so convincing.

Put the two prices back in their proper order and the second error usually corrects itself.

The Master Key: *Profit ends at the bottom of average total cost and production ends at the bottom of average variable cost.*

BINDER Question 215

The diagram is drawn from memory, and memory hands over the one it has drawn most often. Two lines fall away from the same point on the axis, and a firm with no power over price has just been handed some.

Identify the error in the answer described in the box, and show what the revenue curves of a price taker look like instead.

A candidate is asked to draw the revenue curves of a firm in a perfectly competitive market.

The answer shows average revenue sloping downwards, with marginal revenue falling from the same intercept at twice the slope.

The candidate then puts the equilibrium where marginal cost meets marginal revenue, and reads the price off the average revenue line above it.

Model Answer

The error is that a price taker's average revenue does not slope downwards and its marginal revenue does not lie beneath it. For such a firm, price, average revenue and marginal revenue are one horizontal line at the ruling market price. The diagram drawn belongs to a monopolist and has been fitted to a firm that cannot choose a price at all.

Average revenue is the price itself: average revenue is total revenue divided by output, and total revenue is the ruling price multiplied by output, so output cancels and the price is what remains. Any quantity sells at that price, so the line is flat.

$$\text{AR} = \frac{\text{TR}}{\text{q}} = \frac{\text{Pq}}{\text{q}} = \text{P}$$

Marginal revenue is the price as well: marginal revenue is the addition to total revenue from one more unit sold. That unit fetches what every unit before it fetched, and no earlier unit is marked down to move it, so the addition is the price.

$$\text{MR} = \frac{\Delta\,\text{TR}}{\Delta\,\text{q}} = \text{P}$$

Where the borrowed curve comes from: industry demand does slope downwards, and it is the industry curve that has been drawn. One seller among many is far too small to shift it, so the firm faces a flat slice of it at the settled price.

What the wrong diagram would predict: with marginal revenue beneath average revenue the firm would hold output back to lift its price, the one thing a price taker cannot profit from. Ask a shilling more and every buyer leaves, since the product is homogeneous and knowledge perfect.

The equilibrium the correct diagram gives: the flat line is demand, average revenue and marginal revenue together, and the firm produces where marginal cost rises through it. Profit or loss is read from the gap between price and average total cost.

Draw the flat line first and every other line on the price taker's diagram falls into place.

The Master Key: *Only a price maker has marginal revenue below average revenue; for a price taker* $\text{P} = \text{AR} = \text{MR}$.

REAL Question 216

The manager at the maize yard finds the rule in his notes, runs a finger down the schedule and stops at the first place where the two figures agree. That is the worst output on the sheet.

Calculate the outputs at which marginal cost equals marginal revenue, and advise the manager which of them maximises profit.

Mbegu Nane Traders shells, cleans, grades and bags maize at the Kibaigwa market in Dodoma.
The wholesale price is settled by the market at TShs 730,000 a tonne and no single yard can move it.
The yard's total cost in thousands of shillings, at an output of Q tonnes a day, is ten Q cubed less one hundred and fifty Q squared, plus one thousand Q, plus two hundred.
Costs that stand whether the yard runs or not come to TShs 200,000 a day.
All figures are illustrative.

Model Answer

Marginal cost equals marginal revenue at two outputs, 1 tonne and 9 tonnes a day, and only the second maximises profit. At 1 tonne marginal cost is still falling, so it cuts marginal revenue from above and the yard sits at a loss of TShs 330,000 a day, worse even than closing. At 9 tonnes marginal cost is rising through marginal revenue and profit peaks at TShs 2,230,000 a day.

The yard is a price taker: the market has settled the price, so average revenue and marginal revenue are both TShs 730,000 a tonne. Marginal revenue is therefore a flat line, and the whole of the shape in the problem belongs to the cost side.

$$\text{P} = \text{AR} = \text{MR} = 730 \ \ (\text{TShs}\ '000 \text{ a tonne})$$

Finding the two candidate outputs: differentiate total cost to get marginal cost, set it equal to marginal revenue, and a quadratic appears with two roots. Both satisfy the first condition, and the wrong answer stops here.

$$\text{MC} = \frac{\text{dTC}}{\text{dQ}} = 30\text{Q}^2 - 300\text{Q} + 1{,}000$$

$$30\text{Q}^2 - 300\text{Q} + 1{,}000 = 730 \ \Rightarrow\ \text{Q}^2 - 10\text{Q} + 9 = 0 \ \Rightarrow\ \text{Q} = 1 \text{ or } \text{Q} = 9$$

The second condition sorts them out: the slope of marginal cost is 60Q less 300. At 1 tonne that slope is negative, so marginal cost cuts marginal revenue from above and profit is at its lowest. At 9 tonnes the slope is positive and profit is at its highest.

$$\frac{d^2\pi}{dQ^2} = -60Q + 300: \quad +240 \text{ at } Q = 1, \quad -240 \text{ at } Q = 9$$

The money confirms the algebra: profit is total revenue less total cost at each output. At 1 tonne the yard loses TShs 330,000, which is worse than the TShs 200,000 it would lose with the sheller switched off. At 9 tonnes it earns TShs 2,230,000.

$$\pi = 730Q - (10Q^3 - 150Q^2 + 1{,}000Q + 200) = -10Q^3 + 150Q^2 - 270Q - 200$$

Why the first root is a trap and not an oddity: between 1 and 9 tonnes marginal cost lies below the price, so every extra tonne adds more to revenue than to cost. Stopping at 1 tonne throws all of that away, which is exactly what a candidate quoting the equality alone would advise.

The advice: run the yard at 9 tonnes a day. Beyond it marginal cost passes TShs 730,000 and the tenth tonne costs more than it fetches, which is why profit falls back to TShs 2,100,000 at 10 tonnes.

Output (tonnes a day)	Marginal cost (TShs '000 a tonne)	Total revenue (TShs '000)	Total cost (TShs '000)	Profit (TShs '000)
0	1,000	0	200	−200
1	730	730	1,060	−330
2	520	1,460	1,680	−220
5	250	3,650	2,700	950
8	520	5,840	3,720	2,120
9	730	6,570	4,340	2,230
10	1,000	7,300	5,200	2,100

Marginal cost is the derivative of total cost at each output. Marginal cost equals the price of TShs 730,000 at 1 tonne and again at 9 tonnes.

The equality found two outputs and the slope of marginal cost decided between them.

The Master Key: *Where marginal cost is still falling as it meets marginal revenue, you have found the profit minimum.*

REAL Question 217

The board of a ferry with no rival reasons that a monopolist should charge whatever it likes, and proposes to like a very large number. The empty deck that follows is written into the demand curve.

Calculate the fare that maximises the ferry's profit, and advise the board on its proposal.

Ziwa Kuu Ferry holds the only licence to carry foot passengers between Mwanza and Ukerewe island.

At a fare of TShs 10,000 nobody crosses at all, and every fall of TShs 25 in the fare brings one more passenger a day.

Carrying one more passenger costs the ferry TShs 1,000.

The vessel, the crew, the licence and the moorings cost TShs 500,000 a day whether it sails full or empty.

The board proposes a fare of TShs 8,000, on the ground that a monopolist should charge the highest fare it can obtain.

All figures are illustrative.

Model Answer

The profit-maximising fare is TShs 5,500, carrying 180 passengers a day for a profit of TShs 310,000. The board's TShs 8,000 would fill only 80 seats and leave TShs 60,000, so the higher fare costs the ferry TShs 250,000 a day; and the highest fare it can obtain, TShs 10,000, sells no crossings whatever.

The revenue curves: the schedule in the box is a straight demand line with an intercept of 10,000 and a slope of 25. Average revenue is that line, and marginal revenue falls from the same intercept at twice the slope.

$$\text{AR} = 10{,}000 - 25\text{Q} \;\Rightarrow\; \text{TR} = 10{,}000\text{Q} - 25\text{Q}^2 \;\Rightarrow\; \text{MR} = 10{,}000 - 50\text{Q}$$

The fare that maximises profit: set marginal revenue equal to marginal cost and read the fare off the demand line above that quantity. Marginal cost is flat and marginal revenue is falling, so marginal cost cuts marginal revenue from below and the second condition holds.

$$10{,}000 - 50\text{Q} = 1{,}000 \;\Rightarrow\; \text{Q} = 180, \quad \text{P} = 10{,}000 - 4{,}500 = \text{TShs } 5{,}500$$

What the board's fare would cost: at TShs 8,000 only 80 passengers cross, and each pays TShs 7,000 above the cost of carrying them. That gives TShs 560,000 against standing costs of TShs 500,000, so the day ends with TShs 60,000 instead of TShs 310,000.

$$\pi_{8{,}000} = (8{,}000 - 1{,}000) \times 80 - 500{,}000 = \text{TShs } 60{,}000$$

Why the highest fare is the emptiest: the demand curve is a constraint, not a list of prices to pick from. Choosing a fare chooses the number of passengers with it, and at TShs 10,000 the deck is empty and the whole TShs 500,000 is lost.

Where a monopolist never goes: revenue peaks at 200 passengers and a fare of TShs 5,000, where marginal revenue is zero and elasticity is one. Below that fare demand is inelastic, marginal revenue is negative, and carrying fewer passengers would raise revenue and cut cost at once.

$$\text{MR} = \text{P}\left(1 - \frac{1}{\text{e}}\right): \quad 5{,}500\left(1 - \frac{1}{1.22}\right) = 1{,}000 = \text{MC}$$

The advice: set the fare at TShs 5,500. It is not generosity: it is the fare at which the last passenger carried still adds more than the TShs 1,000 he costs, and it remains five and a half times marginal cost, which is where a regulator's interest properly begins.

A monopolist picks the point on the demand curve it likes best, and the top of that curve is never it.

The Master Key: *A monopolist charges the profit-maximising price, always on the elastic stretch of demand, never the highest price it could name.*

REAL Question 218

The baker's book shows TShs 90,000 for the day and an economist tells her the profit is nothing at all. Both are right, and the oven that stands half idle is the more interesting half of the story.

Calculate the bakery's excess capacity, and explain why its economic profit is zero although its books show a surplus.

Baraka Bakery is one of many small bakeries around the Mwanjelwa market in Mbeya, each with its own loaf and its own regular buyers.

It sells 600 loaves a day at TShs 1,200, and average total cost at that output is also TShs 1,200.

Average total cost is at its lowest, TShs 900 a loaf, at an output of 900 loaves a day.

To sell 900 loaves the owner would have to drop the price to TShs 850.

Flour, fuel, hired wages and rent come to TShs 630,000 a day.

The owner's own labour would earn TShs 60,000 a day elsewhere, and the TShs 60,000,000 she has in the oven, the van and the shop would earn about TShs 30,000 a day in another trade.

Model Answer

Excess capacity is 300 loaves a day, the gap between the 600 loaves she bakes and the 900 at which each loaf would be cheapest, a third of the least-cost output. Economic profit is zero because the TShs 90,000 in her book is exactly the sum of her forgone wage and the forgone return on her capital, both of which are costs to an economist and to nobody else.

What the book leaves out: accounting subtracts only the payments actually made. Economic cost adds the implicit ones: the wage the owner gives up by baking rather than working for another, and the return her capital would earn if it were placed elsewhere.

$$\text{Economic profit} = 720{,}000 - 630{,}000 - (60{,}000 + 30{,}000) = 0$$

Zero economic profit is not ruin: she is drawing TShs 60,000 a day for her work and TShs 30,000 a day on her capital, which is precisely what both would fetch anywhere else. Normal profit is part of cost, so covering it is a livelihood and not a disaster.

How the long run brought her here: entry into baking is easy. Each new bakery around the market took a slice of her custom, shifting the demand curve she faces inwards until it merely touched her average total cost curve. At that tangency the surplus that attracted the newcomers has gone.

Measuring the excess capacity: least-cost output is 900 loaves and she bakes 600, so 300 loaves of capacity stand unused and every loaf costs TShs 300 more than it need. She is on the falling arm of average total cost, never at its bottom.

$$\text{Excess capacity} = 900 - 600 = 300 \text{ loaves a day}$$

Why she cannot simply bake the other 300: at TShs 850 the 900 loaves fetch TShs 765,000 against a cost of TShs 810,000, a loss of TShs 45,000 a day. Her demand curve lies below her cost curve everywhere except at the one point where the two touch.

What the idle third buys: buyers around Mwanjelwa get a choice of loaf and a bakery within walking distance of most doors. The unused capacity is the price of that variety, and it is why this market is efficient in neither sense while nobody in it is being exploited.

Her books and the diagram are telling the same story in two languages.

The Master Key: *Zero economic profit means every resource is earning exactly what it would earn elsewhere, which is a reason to stay rather than to go.*

HOT Question 219

The rule fits on one line, and one line is what most answers give. It is half a rule, and the missing half is the difference between the best output on the schedule and the worst.

Examine why the answer that profit is maximised where marginal cost equals marginal revenue is incomplete, and state what must be added to it.

A candidate is asked for the conditions of profit maximisation.

The whole answer reads: profit is maximised at the output where marginal cost equals marginal revenue.

Nothing is said about the shape of the marginal cost curve or about which way it crosses.

Model Answer

The answer gives a necessary condition and stops short of a sufficient one. Marginal cost equals marginal revenue at every turning point of the profit curve, at the bottom quite as much as at the top, so the equality by itself cannot separate the largest profit from the smallest. What must be added is that marginal cost cuts marginal revenue from below, and that single clause selects the maximum.

What the equality does establish: while marginal revenue exceeds marginal cost, the next unit adds more to receipts than to costs and should be made. Once marginal cost exceeds marginal revenue the last unit should not have been made. The equality marks where the adding stops.

$$\frac{d\pi}{dQ} = MR - MC = 0$$

Why the curves meet twice: marginal cost falls and then rises, so a flat or gently falling marginal revenue line crosses it at two outputs. Both satisfy the equality and they cannot both be the best, since one of them is the worst.

The first crossing is a profit minimum: there marginal cost is still falling and cuts marginal revenue from above, so just beyond that output marginal revenue is the greater and every further unit adds to profit. Stopping is exactly the wrong response; expanding is the right one.

The second crossing is the maximum: there marginal cost is rising through marginal revenue. A unit short of it would have added to profit and a unit past it would subtract, so profit stands at its peak and no small change in output can improve on it.

The same clause in calculus: the first order condition sets the slope of the profit curve to zero; the second order condition requires that slope to be falling, which is the algebraic form of marginal cost rising more steeply than marginal revenue.

$$\frac{d^2\pi}{dQ^2} < 0 \iff \frac{dMC}{dQ} > \frac{dMR}{dQ}$$

Why it holds in every structure: the price taker with flat marginal revenue, the monopolist and the monopolistic competitor with falling marginal revenue all need the rising arm of marginal cost. That is also why a competitive firm's supply curve is marginal cost above minimum average variable cost and nothing lower.

How to write it in three seconds: give the equality, then the clause about cutting from below, then a phrase saying that marginal cost must be rising. The third is only the second restated, and an examiner who wants both conditions has now been given both twice.

One clause turns a description of two outputs into an instruction that names one.

The Master Key: *Marginal cost equals marginal revenue at the worst output as surely as at the best, and only the direction of the cut tells them apart.*

HOT Question 220

A single seller is told it can charge what it likes, and the sentence is true. What it likes turns out not to be the largest number on the demand curve, because at that number the shop is empty.

Discuss the claim that a monopolist charges the highest price it can obtain.

> The answer given reads: having no rival, a monopolist charges the highest possible price and takes all the buyer's money.
>
> It adds that the monopolist gains most where demand is inelastic, since buyers must then pay whatever is asked.

Model Answer

Both sentences are wrong, and the second is wrong in a way the first conceals. A monopolist is a price maker, but the demand curve is a constraint and not a list to choose from: at its highest price nothing at all is sold. The seller takes the profit-maximising price, where marginal cost equals marginal revenue and cuts it from below, and that price never lies on the inelastic stretch of demand.

Price and quantity are one decision: the monopolist may set the price or the quantity but never both, because the demand curve pairs them. Naming a higher price is naming a smaller quantity, and the seller must weigh the shillings gained on each unit against the units lost.

The highest price sells nothing: at the vertical intercept of average revenue the quantity demanded is zero, so total revenue is zero and the firm carries its whole fixed cost as a loss. The claim, taken literally, describes the fastest route to bankruptcy available.

What the monopolist actually does: it equates marginal cost with marginal revenue, with marginal cost cutting marginal revenue from below, then reads the price off average revenue above that output. Since average revenue exceeds marginal revenue, price exceeds marginal cost, which is the true charge against monopoly.

$$MC = MR \quad \text{and} \quad P = AR > MR = MC$$

Why the inelastic stretch is never chosen: marginal revenue is negative wherever elasticity is below one, so cutting output there would raise total revenue and lower total cost at the same moment. No profit maximiser refuses both gains, so the chosen output always lies where demand is elastic.

$$\text{MR} = \text{P}\left(1 - \frac{1}{\text{e}}\right) < 0 \quad \text{when } \text{e} < 1$$

The limits a monopolist still faces: buyers have incomes, distant substitutes exist and can be invented, a price held too high invites entry however high the barrier, and a regulator may be watching. Power over price is real and it is bounded on every side.

What is right in the claim: the price does stand above marginal cost and above what a competitive industry would charge, output is restricted, and buyers do lose surplus. The complaint is sound; only the mechanism is misdescribed, because the harm is done by withholding output rather than by naming a number.

Why the wrong version is dangerous in an answer: it leads straight to a diagram with no marginal revenue curve on it, and from there to the claim that a monopolist has a supply curve. It has none, precisely because it chooses a point on demand rather than a quantity at a given price.

The demand curve is the monopolist's master quite as much as its opportunity.

The Master Key: *A monopolist chooses the price that maximises profit on the elastic stretch of demand, and would starve at the highest price it could name.*

HOT Question 221

Long-run equilibrium under perfect competition gets written up as zero profit, and the word zero does the damage. Every firm still standing in that equilibrium is being paid exactly what it is worth.

Discuss the view that a firm earning zero economic profit in the long run is earning nothing and ought to leave the trade.

> The answer given reads: in the long run a perfectly competitive firm makes zero profit, so nobody in the industry earns anything at all.
>
> It concludes that the firms stay only out of habit, and that such an industry must eventually empty itself.

Model Answer

The view mistakes an accounting word for an economic one. Zero economic profit means revenue exactly covers economic cost, and economic cost already contains normal profit, the return the owner's own labour and capital could earn in their next best use. A firm at that point is being paid the going rate on everything it owns, which is why nobody leaves and why the equilibrium is a resting place rather than a ruin.

What economic cost contains: the explicit payments for materials, wages, fuel and rent, and the implicit ones as well: the salary the owner forgoes, the return the capital would earn elsewhere, the rent of a building the owner happens to own.

$$\text{Economic cost} = \text{explicit cost} + \text{implicit cost, including normal profit}$$

Normal profit is defined by the alternative: it is the least return that keeps resources where they are. Below it they walk to the better use; above it strangers arrive to compete for the surplus. Only at that level does nobody wish to move, which is what equilibrium means.

The books say something quite different: accounting profit deducts explicit cost alone, so a firm at zero economic profit shows a comfortable surplus in its own records, equal to the sum of its implicit costs. The owner eats, pays school fees and does not feel poor.

Why the industry does not empty: leaving means shifting the same labour and capital into their next best use, which by the definition of normal profit pays the same. There is nothing to be gained by going, and that is exactly why the number of firms stops changing.

How the position is reached: supernormal profit draws entrants, industry supply rises and price falls; losses drive firms out, supply contracts and price recovers. The movement halts where price equals average total cost at its minimum, so the outcome is also productively efficient.

When the alarm would be justified: the comfort depends entirely on the alternative being valued honestly. If the owner's skill would fetch far more in another trade, that larger figure belongs in the cost, and the firm is then making a genuine economic loss and should indeed go.

What the equilibrium does cost: with no surplus there is nothing to fund research or to carry a bad season, which is a fair criticism of the perfectly competitive long run. It is a criticism about the future, not evidence that anyone is earning nothing today.

The number is zero because the cost of every alternative has already been subtracted.

The Master Key: *Normal profit is a cost, so zero economic profit is the going rate on everything the firm owns.*

HOT Question 222

The long run under monopolistic competition ends where price equals average total cost, and the sentence invites three words that are not in it: at its minimum. Those three words cost more marks than any others in the chapter.

Examine the statement that in the long run a firm under monopolistic competition produces at the minimum of its average total cost.

> The answer given reads: entry continues until price equals average total cost, so the firm ends at the lowest point of the average total cost curve.
>
> It concludes that the firm is productively efficient, exactly as under perfect competition.

Model Answer

The statement is wrong at the single place that matters. Entry does continue until price equals average total cost, but the firm's average revenue curve slopes downwards, so it can only touch the cost curve at a tangency, and a falling line touches a U-shaped curve only on the falling arm, to the left of the minimum. The gap between that output and the least-cost output is excess capacity, and the firm is efficient in neither sense.

Why the tangency cannot sit at the minimum: at the lowest point of average total cost the curve is momentarily flat. A downward sloping line could touch it there only by being flat too, which average revenue is not. Tangency requires equal slopes, so the touching point lies where cost is still falling.

What that leaves the firm doing: it produces on the falling arm, where average total cost is above the least it could be. The plant, the oven or the workshop is never worked at the output that would make each unit cheapest, and the firm knows it.

Excess capacity named and measured: the horizontal distance between the tangency output and the minimum cost output is excess capacity. It is not idleness through mismanagement but the settled outcome of many differentiated sellers dividing a market that one of them could have supplied more cheaply.

Why the firm does not simply expand: more can be sold only at a lower price, and away from the tangency the average revenue curve lies below average total cost at every output. Expanding to the least-cost quantity would turn normal profit into a loss.

The efficiency verdict is a double failure: productive efficiency needs production at minimum average total cost, which does not happen here. Allocative efficiency needs price to equal marginal cost, and since average revenue exceeds marginal revenue while marginal revenue equals marginal cost, price stands above marginal cost.

What the statement gets right: price does equal average total cost and profit is normal, so no surplus is being extracted and entry has done its work. The failure is one of arrangement rather than of plunder, which is why the case against this structure is so much milder than the case against monopoly.

What the unused capacity buys: buyers get variety, a seller near at hand and a choice of style and service. Whether that is worth the higher unit cost is a judgement, and it cannot be settled by the diagram that reveals the cost.

The tangency is the whole answer, and it sits to the left of the minimum by construction.

The Master Key: *A falling average revenue curve can touch a U-shaped cost curve only where the cost curve is still falling, which is why excess capacity is unavoidable.*

HOT Question 223

A price rises, less is bought, and the sentence that follows is almost always that demand has fallen. Demand has not stirred. Something else did, and telling the two apart is a habit rather than a rule.

Explain the difference between a movement along a demand curve and a shift of the whole curve, and identify the error in each of the three statements in the box.

The first statement reads: when a monopolist raises its price, its demand curve shifts to the left.
The second reads: supernormal profit attracts new firms into a monopolistically competitive market, so the existing firm slides down its own demand curve until profit is normal.
The third reads: a good harvest lowers the price of maize, so demand for maize rises.

Model Answer

Only a change in the good's own price moves you along a demand curve; a change in anything else moves the curve itself. So the first statement is wrong because a monopolist raising its price merely slides up a curve that has not moved, the second is wrong because entry takes buyers away and shifts the firm's average revenue curve bodily inwards, and the third is wrong because the harvest shifts supply while buyers slide down an unmoved demand curve.

The rule that divides them: a demand curve is drawn holding everything but the good's own price constant. A change in that price is a movement along the curve. A change in income, in the price of a related good, in tastes, in the number of buyers or in expectations shifts the whole curve.

The first statement corrected: the monopolist's average revenue curve is the market demand curve, and it is given data for the firm. Choosing a price is choosing a point on it, so the pair of price and quantity moves while the curve stays exactly where it was.

And why that matters twice over: it is the reason a monopolist has no supply curve. A supply curve answers what quantity is offered at a given price, but the monopolist is not given a price: it selects a point on demand, and a different demand curve would yield a different price at the same output.

The second statement corrected: entry hands buyers more sellers to choose between, so at every price the existing firm now sells less. Its average revenue curve shifts inwards and grows flatter, and the shifting continues until the curve is tangent to average total cost.

The third statement corrected: the harvest shifts the supply curve rightwards. The new equilibrium is further down a demand curve that never moved, so quantity demanded has risen while demand itself is unchanged. A price can never cause a shift in the very curve that helped set it.

The price taker, where both things happen: the firm faces a horizontal line at the ruling price. When the industry price changes, that line shifts bodily up or down, and the firm then moves along its marginal cost curve to a new output. It never slides along its own demand line, having only one price on offer.

The test to carry into the hall: ask what changed. If it was the good's own price, the curve is innocent and you are moving on it. If it was anything else, the curve has moved and the price is a result rather than a cause.

Two different pencil strokes, and choosing the wrong one turns a correct chain of reasoning into a wrong one.

The Master Key: *The good's own price moves you along the curve; everything else moves the curve.*

HOT Question 224

A bag of cement at Mpanda and a bag at Bukoba come from the same short list of works, and the price at each works barely stirs from one month to the next although the owners are not friends. It takes a whole chapter to explain that stillness.

Analyse the cement industry in Tanzania: classify the market, identify its structure with evidence, describe its short-run and long-run equilibrium, give an efficiency verdict, and state what policy is justified.

The cement sold in Tanzania comes from a short list of works, among them Twiga, Simba, Tanga, Dangote and Kilimanjaro.
A bag of ordinary cement from one works does the same job as a bag from another.
A works costs an enormous sum to build, and most of that sum cannot be recovered if it ever closes.
Cement is heavy and cheap for its bulk, so haulage adds sharply to the delivered price far from the kiln.
Works prices move seldom, and when one producer moves, the others are watching.

Model Answer

Cement is traded in a product market, national in law and regional in practice, and its structure is oligopoly: few large works, a homogeneous product, barriers of capital and sunk cost, interdependent decisions. Each works sets output where marginal cost cuts marginal revenue from below and prices above it, barriers carry supernormal profit into the long run, the outcome fails both efficiency tests, and the justified policy is to guard against collusion and lower the barriers rather than break up plants whose size makes cement cheap.

Classifying the market: cement is a good, so this is a product market, not a factor or financial one. Haulage then carves the country into zones around each kiln, so a builder at Mpanda faces fewer real suppliers than the national list suggests.

The evidence for oligopoly: a handful of works hold nearly the whole market, so the concentration ratio sits near its ceiling; the product is homogeneous; entry demands capital that cannot be recovered; prices move together. The alternatives fail: too few sellers for perfect competition, too many for monopoly, products too alike for monopolistic competition.

Short-run equilibrium: each works has power over price, so average revenue exceeds marginal revenue. It sets output where marginal cost cuts marginal revenue from below and reads the price off average revenue, so price exceeds marginal cost. A poor season still brings losses, borne while price covers average variable cost.

Why the price sits still: a rise would be ignored and a cut matched, so demand is elastic above the going price and inelastic below it, and marginal revenue breaks over a vertical gap inside which marginal cost may wander without moving the price.

The long run and the temptation: entry is barred, so profit is not competed away as under perfect competition. The greater temptation is an understanding on price or quotas, making the group behave as one seller; but every member gains by quietly exceeding its quota, so such arrangements decay.

The efficiency verdict: price exceeds marginal cost, so buildings worth putting up are not put up and a deadweight loss follows. Nor need production sit at minimum average total cost. Against that, a kiln must be very large before cement is cheap, so few works is not itself an indictment.

The policy that is justified: watch for collusion through the competition authority, publish works prices, and above all make the market contestable by cutting the haulage barrier with better roads and rail, since a credible outside supplier disciplines price for nothing. Breaking up works would raise average cost, and a ceiling below it drives investment away.

The stillness of the price is a standoff, not calm, and the barrier makes it safe.

The Master Key: *Where the barrier is the real seller of the cement, open the road before you touch the kiln.*

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