After studying this chapter you will be able to:

◆ Define economics and distinguish between microeconomics and macroeconomics
◆ Explain the big questions of economics
◆ Explain the key ideas that define the economic way of thinking
◆ Describe how economists go about their work as social scientists and policy advisers

You are studying economics at a time when the world’s richest nations are recovering from a deep recession in which incomes shrank and millions of jobs were lost. At the same time some poorer nations, Brazil, China, India and Russia, are growing rapidly and playing ever-greater roles in an expanding global economy. In these turbulent times, new businesses are born and old ones die, new jobs are created and old ones disappear.

To face these challenges and seize new opportunities, you need to understand the powerful forces at play. The economics that you’re about to learn will be your most reliable guide. In this chapter you will find out about the questions economists ask, the way they think and the way they search for answers.
CHAPTER 1 WHAT IS ECONOMICS?

A Definition of Economics

All economic questions arise because we want more than we can get. We want a peaceful and secure world. We want clean air and rivers. We want long and healthy lives. We want good schools and universities. We want space and comfort in our homes. We want a huge range of sports and recreational gear from running shoes to motor bikes. We want the time to enjoy sports and games, read books and magazines, see films, listen to music, travel and so on.

What each one of us can get is limited by time, by the income we earn and by the prices we must pay. Everyone ends up with some unsatisfied wants. As a society, what we can get is limited by our productive resources. These resources include the gifts of nature, human labour and ingenuity and tools and equipment that we have produced.

Our inability to satisfy all our wants is called scarcity. The poor and the rich alike face scarcity. A child in Tanzania is hungry and thirsty because her parents can’t afford food and the well in her village is dirty and almost empty. The scarcity that she faces is clear and disturbing. But even David Beckham, a multi-millionaire, faces scarcity. He wants to spend the weekend playing football and filming an advert, but he can’t do both. We face scarcity as a society. We want to provide better healthcare and education and a cleaner environment and so on. Scarcity is everywhere. Even parrots face scarcity!

Faced with scarcity, we must choose among the available alternatives. The child in Tanzania must choose dirty water and scraps of bread or go thirsty and hungry. David Beckham must choose the football or the filming. As a society, we must choose among healthcare, education and the environment.

The choices that we make depend on the incentives that we face. An incentive is a reward that encourages or a penalty that discourages an action. If heavy rain fills the well, the child in Tanzania has an incentive to choose more water. If the fee received from filming is £1 million, David Beckham has an incentive to skip the football and make the advert. If computer prices tumble, we have an incentive as a society to connect more schools to the Internet.

Economics is the social science that studies the choices that individuals, businesses, governments and entire societies make as they cope with scarcity and the incentives that influence and reconcile those choices. The subject divides into two main parts:

◆ Microeconomics
◆ Macroeconomics

Microeconomics

Microeconomics is the study of the choices that individuals and businesses make, the way these choices interact in markets and the influence of governments. Some examples of microeconomic questions are: Why are people buying more mobile phones? How would a tax on downloading music affect the sales of CDs?

Macroeconomics

Macroeconomics is the study of the performance of the national economy and the global economy. Some examples of macroeconomic questions are: Why did unemployment increase in 2008 and 2009? Why did Japan’s economy stagnate during the 1990s? Can the Bank of England bring prosperity by keeping interest rates low?

Review Quiz

1 List some examples of scarcity that you face.
2 Find examples of scarcity in today’s headlines.
3 Find an illustration of the distinction between microeconomics and macroeconomics in today’s headlines.

You can work these questions in Study Plan 1.1 and get instant feedback.
Two Big Economic Questions

Two big questions summarize the scope of economics:

- How do choices end up determining what, how and for whom goods and services get produced?
- When do choices made in the pursuit of self-interest also promote the social interest?

What, How and For Whom?

Goods and services are the objects that people value and produce to satisfy wants. Goods are physical objects such as golf balls. Services are actions performed such as cutting hair and filling teeth. By far the largest part of what people in the rich industrial countries produce today are services such as retail and wholesale services, health services and education. Goods are a small and decreasing part of what we produce.

What?

What we produce changes over time. Every year, new technologies allow us to build better equipped homes, higher-performance sporting equipment and even deliver a more pleasant experience in the dentist’s chair. And technological advance makes us incredibly more productive at producing food and manufacturing goods.

Figure 1.1 shows some trends in what we produce in the UK. It highlights five items that have expanded and three that have shrunk since 2001. What are the forces that bring these changes in what we produce? Why are we producing more construction output and services such as health, education, finance and transport? Why are we producing fewer manufactured goods and doing less mining?

How?

Goods and services get produced by using productive resources that economists call factors of production. Factors of production are grouped into four categories:

- Land
- Labour
- Capital
- Entrepreneurship

Land

The ‘gifts of nature’ that we use to produce goods and services are called land. In economics, land is what in everyday language we call natural resources. It includes land in the everyday sense together with metal ores, oil, gas and coal, water, air, wind and sunshine.

Our land surface and water resources are renewable and some of our mineral resources can be recycled. But the resources that we use to create energy are non-renewable – they can be used only once.

Labour

The work time and work effort that people devote to producing goods and services is called labour. Labour includes the physical and the mental efforts of all the people who work on farms and construction sites and in factories, shops and offices.

The quality of labour depends on human capital, which is the knowledge and skill that people obtain from education, on-the-job training and work experience. You are building your own human capital today as you work on your economics course, and your human capital will continue to grow as you become better at your job.

Human capital expands over time and varies between countries. Figure 1.2 shows the proportion of young people entering post-secondary education and the growth in this measure since 2000 as a measure of human capital in different countries.
**CHAPTER 1 WHAT IS ECONOMICS?**

**Capital**

The tools, instruments, machines, buildings and other constructions that businesses now use to produce goods and services are called capital.

In everyday language, we talk about money, shares and bonds as being capital. These items are financial capital. Financial capital plays an important role in enabling businesses to borrow the funds that they use to buy capital. But financial capital is not used to produce goods and services – it is not a factor of production.

**Entrepreneurship**

The human resource that organizes labour, land and capital is called entrepreneurship. Entrepreneurs come up with new ideas about what and how to produce, make business decisions and bear the risks that arise from these decisions.

How are the quantities of factors of production that get used to produce the many different goods and services determined?

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**For Whom?**

Who gets the goods and services that are produced depends on the incomes that people earn. A large income enables a person to buy large quantities of goods and services. A small income leaves a person with few options and small quantities of goods and services.

People earn their incomes by selling the services of the factors of production they own:

1. Land earns rent.
2. Labour earns wages.
3. Capital earns interest.
4. Entrepreneurship earns profit.

Which factor of production earns the most income? The answer is labour. Wages and fringe benefits are around 70 per cent of total income. Land, capital and entrepreneurship share the rest. These percentages have been remarkably constant over time.

Knowing how income is shared among the factors of production doesn’t tell us how it is shared among individuals. You know of lots of people who earn very large incomes. J. K. Rowling earns more than £20 million a year and David Beckham will make $US250 million over five years.

You know of even more people who earn very small incomes. People who serve fast food earn £5 an hour. Some differences in income are persistent. On average, men earn more than women and whites earn more than ethnic minorities. Europeans earn more on average than Asians who in turn earn more than Africans. A typical annual income in the poorest countries of the world is just a few hundred pounds, less than the equivalent of a typical weekly wage in the richest countries of the world.

Why is the distribution of income so unequal? Why do women earn less than men? Why do J. K. Rowling and David Beckham earn such huge incomes? Why do university graduates earn more than people with only a few GCSEs? Why do Europeans earn more than Africans? Why are the incomes of Asians rising so rapidly?

Economics provides answers to all these questions about what, how and for whom goods and services get produced. And you will discover these answers as you progress with your study of the subject.

The second big question of economics that we’ll now examine is a harder question both to appreciate and to answer.
When Is the Pursuit of Self-interest in the Social Interest?

Every day, you and 465 million other EU citizens, along with 6.9 billion people in the rest of the world, make economic choices that result in what, how and for whom goods and services get produced.

Self-interest

A choice is in your self-interest if you think that choice is the best one available for you. You make most of your choices in your self-interest. You use your time and other resources in the ways that make the most sense to you, and you don’t think too much about how your choices affect other people. Think about when you order a pizza to be delivered to your home. You order the pizza because you are hungry and you don’t order it thinking that the delivery person needs an income. When the pizza arrives, the delivery person is not doing you a favour but is working in his or her self-interest.

Social Interest

A choice is in the social interest if it leads to an outcome that is the best for society as a whole. The social interest has two dimensions: efficiency and equity (or fairness). What is best for society is an efficient and fair use of resources.

Economists say that efficiency is achieved when the available resources are used to produce goods and services at the lowest possible cost and in the quantities that will give the greatest possible value or benefit. You will study the concept of efficiency in more detail in Chapter 5. For now, just think of efficiency as a situation in which resources are put to their best possible use.

Equity or fairness doesn’t have a precise definition. Reasonable people, including economists, have a variety of views about what is fair. There is always room for some disagreement and a need to be careful and clear about which notion of fairness is being used.

The Big Question

Now let’s ask whether we can organize our economic lives so that when each one of us makes a choice in our self-interest, we actually promote the social interest. Can trading in free markets achieve this social interest? Do we need government action to help achieve the social interest? Do we need international cooperation and treaties to help achieve the social interest?
The Information-age Economy

The technological change of the past 40 years has been called the Information Revolution.

The Information Revolution has clearly served your self-interest: it has provided your mobile phone, laptop, the latest applications and the Internet. It has also served the self-interest of Bill Gates of Microsoft and Gordon Moore of Intel, both of whom have seen their wealth soar.

But did the Information Revolution best serve the social interest? Did Microsoft produce the best possible Windows operating system and sell it at a price that was in the social interest? Did Intel make the right quality of microchips and sell them in the right quantities at the right prices? Was the quality too low and the prices too high? Would the social interest have been better served if Microsoft and Intel had faced competition from other firms?

Climate Change

Climate change is a huge political issue today. Every serious political leader is acutely aware of the problem and of the popularity of having proposals that might lower carbon emissions to reduce the impact of climate change. Every day you make self-interested choices to use electricity, petrol and diesel, but you also create carbon emissions; you leave your carbon footprint. You can lessen your carbon footprint by walking, riding a bike, taking a cold shower, or planting a tree. But can we rely upon the self-interested decisions of every individual to make decisions that affect the earth’s carbon-dioxide concentration in the social interest? Should governments change the incentives we face so that our self-interested choices are also in the social interest? How can governments change incentives? How can we discourage the use of fossil fuels and encourage the use of alternatives such as wind and solar power?

Microchips and Windows

Gordon Moore, who founded the chip-maker Intel, and Bill Gates, a co-founder of Microsoft, held privileged positions in the Information Revolution.

For many years, Intel chips were the only available chips and Windows was the only available operating system for the original IBM PC and its clones. The PC and Apple’s Mac competed, but the PC has a huge market share.

An absence of competition gave Intel and Microsoft the power and ability to sell their products at prices far above the cost of production. If the prices of microchips and Windows had been lower, more people would have been able to afford a computer and would have chosen to buy one.

Greenhouse Gas Emissions

Burning fossil fuels to generate electricity and to power aeroplanes and motor vehicles pours a staggering 28 billion tonnes – 4 tonnes per person – of carbon dioxide into the atmosphere each year.

Two thirds of the world’s carbon emissions are produced in the US, China, the EU, Russia and India. The fastest growing emissions are from India and China. The amount of global warming caused by economic activity and its effects are uncertain, but the emissions continue to grow and pose huge risks for climate change and our future.
Economic Stability and Financial Crisis

The years between 1993 and 2007 were a period of remarkable economic stability, so much so that they’ve been called the Great Moderation. During those years, European and global economies were booming. Incomes in the US increased by 30 per cent and incomes in China tripled. Even the economic shock waves of 9/11 brought only a small dip in the strong pace of US and global economic growth. But in August 2007, a period of financial stress began. A bank in France was the first to feel the pain that soon would grip the entire global financial system.

Banks take in people’s deposits and get more funds by borrowing from each other and from other firms. Banks use these funds to make loans. All the banks’ choices to borrow and lend and the choices of people and businesses to lend to and borrow from banks are made in self-interest. But does this lending and borrowing serve the social interest? Is there too much borrowing and lending that needs to be reined in, or is there too little and a need to stimulate more?

When the banks got into trouble, the Bank of England and the European Central Bank bailed them out with big loans backed by the taxpayers. Did the Bank of England’s bailout of troubled banks like Lloyds TSB serve the social interest? Did the Bank of England’s rescue action just allow banks to repeat their dangerous lending in the future?

Banks weren’t the only recipients of public funds. Some European governments supported their motor industries with a ‘scrapage’ scheme to encourage the purchase of new cars. Government support of the motor industry served the European motor industry self-interest. Did the scheme also serve the social interest?

Flush with funds and offering record low interest rates, banks went on a lending spree to home buyers. Rapidly rising home prices made home owners feel well off and they were happy to borrow and spend. Banks then bundled their home loans into new assets or securities that were sold and resold to other banks around the world to generate cash for more loans.

In 2006, interest rates began to rise and the rate of rise in home prices slowed and some borrowers defaulted on their loans. What started as a trickle became a flood. As more people defaulted, banks faced losses totalling billions of pounds by mid-2007.

Global credit markets stopped working as banks would not lend to each other or to businesses. Some retail banks faced collapse as depositors raced to withdraw their cash. People began to fear the financial crisis would lead to a prolonged slowdown in economic activity like the Great Depression of the 1930s. Central banks, including the Bank of England, determined to avoid a catastrophe, started lending on a very large scale to the troubled banks.

We’ve looked at four topics and asked many questions that illustrate the big question: Can choices made in the pursuit of self-interest also promote the social interest? We’ve asked questions but not answered them because we’ve not yet explained the economic principles needed to do so.

By working through this book, you will discover the economic principles that help economists figure out when the social interest is being served, when it is not and what might be done when it is not being served.
CHAPTER 1  WHAT IS ECONOMICS?

The Economic Way of Thinking

The questions that economics tries to answer tell us about the scope of economics, but they don’t tell us how economists think and go about seeking answers to these questions. You’re now going to see how economists go about their work.

We’re going to look at six key ideas that define the economic way of thinking. These ideas are:

◆ A choice is a trade-off.
◆ People make rational choices by comparing benefits and costs.
◆ Benefit is what you gain from something.
◆ Cost is what you must give up to get something.
◆ Most choices are ‘how-much’ choices made at the margin.
◆ Choices respond to incentives.

A Choice Is a Trade-off

Because we face scarcity, we must make choices. And when we make a choice, we select from the available alternatives. For example, you can spend Saturday night studying for your next economics test or having fun with your friends, but you can’t do both of these activities at the same time. You must choose how much time to devote to each. Whatever choice you make, you could have chosen something else.

You can think about your choice as a trade-off. A trade-off is an exchange – giving up one thing to get something else. When you choose how to spend your Saturday night, you face a trade-off between studying and hanging out with your friends.

Making a Rational Choice

Economists view the choices that people make as rational. A rational choice is one that compares costs and benefits and achieves the greatest benefit over cost for the person making the choice.

Only the wants of the person making a choice are relevant to determine its rationality. For example, you might like your coffee black and strong but your friend prefers his milky and sweet. So it is rational for you to choose espresso and for your friend to choose cappuccino.

The idea of rational choice provides an answer to the first question: What goods and services will be produced and in what quantities? The answer is those that people rationally choose to buy!

But how do people choose rationally? Why do more people choose an iPod rather than a Creative? Why has the UK government chosen to improve the A1 and M1 motorways joining the North and the South rather than build a new rail track? The answers turn on comparing benefits and costs.

Benefit: What You Gain

The benefit of something is the gain or pleasure that it brings and is determined by preferences – by what a person likes and dislikes and the intensity of those feelings. If you get a huge kick out of updating your Facebook page every day, that activity brings you a large benefit. If you have little interest in listening to a news podcast, that activity brings you a small benefit.

Some benefits are large and easy to identify, such as the benefit that you get from being at university. A big piece of that benefit is the goods and services that you will be able to enjoy with the boost to your earning power when you graduate. Some benefits are small, such as the benefit you get from a slice of pizza.

Economists measure benefit as the most that a person is willing to give up to get something. You are willing to give up a lot to be at university but you would give up only an iTunes download for a slice of pizza.

Cost: What You Must Give Up

The opportunity cost of something is the highest-valued alternative that must be given up to get it.

To make the idea of opportunity cost clear, think about your opportunity cost of being at university. It has two components: the things you can’t afford to buy and the things you can’t do with your time.

Start with the things you can’t afford to buy. You’ve spent all your available income on tuition, residence fees, books and a laptop. If you weren’t at university, you would have spent this money on going to clubs and films and all the other things that you enjoy. But that’s only the start of your opportunity cost. You’ve also given up the opportunity to get a job. Suppose that the best job you could get if you weren’t at university is working at HSBC as a trainee earning £18,000 a year. Another part of your opportunity cost of being at university is all the things that you could buy with the extra £18,000 you would have.
As you well know, being a student eats up many hours in class time, doing homework assignments, preparing for tests and so on. To do all these school activities, you must give up many hours of what would otherwise be leisure time spent with your friends. So the opportunity cost of being at university is all the good things that you can’t afford and don’t have the spare time to enjoy. You might want to put a value on that cost or you might just list all the items that make up the opportunity cost.

The examples of opportunity cost that we’ve just considered are all-or-nothing costs – you’re either at university or not at university. Most situations are not like this one. They involve choosing how much of an activity to do.

How Much? Choosing at the Margin

You can allocate the next hour between studying and emailing your friends. But the choice is not all or nothing. You must decide how many minutes to allocate to each activity. To make this decision, you compare the benefit of a little bit more study time with its cost – you make your choice at the margin.

The benefit that arises from an increase in an activity is called marginal benefit. For example, your marginal benefit from one more night of study before a test is the boost it gives to your grade. Your marginal benefit doesn’t include the grade you’re already achieving without that extra night of work.

The opportunity cost of an increase in an activity is called marginal cost. For you, the marginal cost of studying one more night is the cost of not spending that night on your favourite leisure activity.

To make your decisions, you compare marginal benefit against the marginal cost. If the marginal benefit from an extra night of study exceeds its marginal cost, you study the extra night. If the marginal cost exceeds the marginal benefit, you don’t study the extra night.

Choices Respond to Incentives

Economists take human nature as given and view people as acting in their self-interest. All people – consumers, producers, politicians and civil servants – pursue their self-interest.

Self-interested actions are not necessarily selfish actions. You might decide to use your resources in ways that bring pleasure to others as well as to yourself. But a self-interested act gets the most value for you based on your view about benefit.

The central idea of economics is that we can predict the self-interested choices that people make by looking at the incentives they face. People undertake those activities for which marginal benefit exceeds marginal cost and reject those for which marginal cost exceeds marginal benefit.

For example, your economics lecturer gives you a problem set and tells you these problems will be on the next test. Your marginal benefit from working on these problems is large, so you work hard on them. In contrast, your statistics lecturer gives you a problem set on a topic that she says will never be on a test. You get little marginal benefit from working on these problems, so you decide to skip most of them.

Economists see incentives as the key to reconciling self-interest and social interest. When our choices are not in the social interest, it is because of the incentives we face. One of the challenges for economists is to figure out when the incentives that result in self-interested choices are also in the social interest.

Economists emphasize the crucial role that institutions play in influencing the incentives that people face as they pursue their self-interest. Private property protected by a system of laws and markets that enable voluntary exchange are the fundamental institutions. You will learn as you progress with your study of economics that where these institutions exist, self-interest can indeed promote the social interest.

Review Quiz

1 Explain the idea of a trade-off and think of three trade-offs that you made today.
2 Explain what economists mean by rational choice and think of three choices that you’ve made today that are rational.
3 Explain why opportunity cost is the best forgone alternative and provide examples of some opportunity costs that you have faced today.
4 Explain what it means to choose at the margin and illustrate with three choices at the margin that you have made today.
5 Explain why choices respond to incentives and think of three incentives to which you have responded today.

You can work these questions in Study Plan 1.3 and get instant feedback.
Economics as a Social Science and Policy Tool

Economics is a social science and a toolkit for advising on policy decisions.

Economist as Social Scientist

As social scientists, economists seek to discover how the economic world works. In pursuit of this goal, like all scientists, economists distinguish between positive and normative statements.

Positive Statements

A *positive* statement is about what is. It says what is currently believed about the way the world operates. A positive statement might be right or wrong, but we can test it by checking it against the facts. ‘Our planet is warming because of the amount of coal that we’re burning’ is a positive statement. We can test whether it is right or wrong.

A central task of economists is to test positive statements about how the economic world works and to weed out those that are wrong. Economics first got off the ground in the late 1700s, so it is a young science compared with, for example, physics, and much remains to be discovered.

Normative Statements

A *normative* statement is about what ought to be. It depends on values and cannot be tested. Policy goals are normative statements. For example, ‘We ought to cut our use of coal by 50 per cent’ is a normative policy statement. You may agree or disagree with it, but you can’t test it. It doesn’t assert a fact that can be checked.

Unscrambling Cause and Effect

Economists are particularly interested in positive statements about cause and effect. Are computers getting cheaper because people are buying them in greater quantities? Or are people buying computers in greater quantities because they are getting cheaper? Or is some third factor causing both the price of a computer to fall and the quantity of computers bought to increase?

To answer such questions, economists create and test economic models. An *economic model* is a description of some aspect of the economic world that includes only those features that are needed for the purpose at hand. For example, an economic model of a mobile-phone network might include features such as the prices of calls, the number of mobile phone users and the volume of calls. But the model would ignore mobile-phone colours and ringtones.

A model is tested by comparing its predictions with the facts. However, testing an economic model is difficult because we observe the outcomes of the simultaneous change of many factors. To cope with this problem, economists look for natural experiments (situations in the ordinary course of economic life in which the one factor of interest is different and other things are equal or similar); conduct statistical investigations to find correlations; and perform economic experiments by putting people in decision-making situations and varying the influence of one factor at a time to discover how they respond.

Economist as Policy Adviser

Economics is useful. It is a toolkit for advising governments and businesses and for making personal decisions. Some of the most famous economists work partly as policy advisers.

For example, Sir Alan Budd, who was Provost of The Queen’s College, Oxford University until 2008, was the first Chair of the UK government’s new Office for Budget Responsibility in 2010. He has also been an economic adviser to the UK Treasury, Barclays Bank and Credit Suisse First Boston as well as many other economic organizations.

All the policy questions on which economists provide advice involve a blend of the positive and the normative. Economics can’t help with the normative part – the policy goal. But for a given goal, economics provides a method of evaluating alternative solutions – comparing marginal benefits and marginal costs and finding the solution that makes the best use of available resources.

Review Quiz

1. Distinguish between a positive statement and a normative statement and provide examples.
2. What is an economic model? Can you think of a model that you might use in your everyday life? Describe it.
3. How do economists try to disentangle cause and effect?
4. How is economics used as a policy tool?

You can work these questions in Study Plan 1.4 and get instant feedback.
**Key Points**

**A Definition of Economics (p. 2)**
- All economic questions arise from scarcity – from the fact that wants exceed the resources available to satisfy them.
- Economics is the social science that studies the choices people make as they cope with scarcity.
- The subject divides into microeconomics and macroeconomics.

Working Problem 1 will give you a better understanding of the definition of economics.

**Two Big Economic Questions (pp. 3–7)**
- Two big questions summarize the scope of economics:
  1. How do choices end up determining what, how and for whom goods and services get produced?
  2. When do choices made in the pursuit of self-interest also promote the social interest?

Working Problems 2 and 3 will give you a better understanding of the two big questions of economics.

**The Economic Way of Thinking** *(pp. 8–9)*
- Every choice is a trade-off – exchanging more of something for less of something else.
- People make rational choices by comparing benefit and cost.
- Cost – opportunity cost – is what you must give up to get something.
- Most choices are ‘how much’ choices made at the margin by comparing marginal benefit and marginal cost.
- Choices respond to incentives.

Working Problems 4 and 5 will give you a better understanding of the economic way of thinking.

**Economics as a Social Science and Policy Tool (p. 10)**
- Economists distinguish between positive statements – what is – and normative statements – what ought to be.
- To explain the economic world, economists create and test economic models.
- Economics is a tool-kit used to provide advice on government, business and personal economic decisions.

Working Problem 6 will give you a better understanding of economics as a social science and policy tool.

**Key Terms**
- Benefit, 8
- Capital, 4
- Economic model, 10
- Economics, 2
- Efficiency, 5
- Entrepreneurship, 4
- Factors of production, 3
- Goods and services, 3
- Human capital, 3
- Incentive, 2
- Interest, 4
- Labour, 3
- Land, 3
- Macroeconomics, 2
- Margin, 9
- Marginal benefit, 9
- Marginal cost, 9
- Microeconomics, 2
- Opportunity cost, 8
- Preferences, 8
- Profit, 4
- Rational choice, 8
- Rent, 4
- Scarcity, 2
- Self-interest, 5
- Social interest, 5
- Trade-off, 8
- Wages, 4
A Definition of Economics (Study Plan 1.1)

1 Apple decides to make iTunes freely available in unlimited quantities.
   a Does Apple’s decision change the incentives that people face?
   b Is Apple’s decision an example of a microeconomic or a macroeconomic issue?

Two Big Economic Questions (Study Plan 1.2)

2 Which of the following pairs does not match?
   a Labour and wages
   b Land and rent
   c Entrepreneurship and profit
   d Capital and profit

3 Explain how the following news headlines concern self-interest and the social interest:
   a Tesco Expands in Europe
   b McDonald’s Moves into Salads
   c Food Must Be Labelled with Nutrition Data

The Economic Way of Thinking (Study Plan 1.3)

4 The night before an economics exam, you go to the cinema instead of working your MyEconLab study plan. You get 50 per cent on your exam compared with the 70 per cent that you normally score.
   a Did you face a trade-off?
   b What was the opportunity cost of your evening at the cinema?

5 Costs Soar for London Olympics

   The regeneration of East London, the site of the 2012 Olympic Games, is set to add an extra £1.5 billion to taxpayers’ bill.
   Source: The Times, 6 July 2006

   Is the cost of regenerating East London an opportunity cost of hosting the 2012 Olympic Games? Explain.

Economics as a Social Science and Policy Tool (Study Plan 1.4)

6 Which of the following statements is positive, which is normative and which can be tested?
   a The EU should cut its imports.
   b China is the EU’s largest trading partner.
   c If the price of antiretroviral drugs increases, HIV/AIDS sufferers will consume fewer of the drugs.

A Definition of Economics

7 Hundreds Line up for 5 p.m. Ticket Giveaway

   By noon, hundreds of Eminem fans had lined up for a chance to score free tickets to the concert.
   Source: Detroit Free Press, 18 May 2009

   When Eminem gave away tickets, what was free and what was scarce? Explain your answer.

Two Big Economic Questions

8 How does the creation of a successful film influence what, how and for whom goods and services are produced?

9 How does a successful film illustrate self-interested choices that are also in the social interest?

The Economic Way of Thinking

10 Before starring in Iron Man, Robert Downey Jr. had appeared in 45 films that grossed an average of $5 million on the opening weekend. In contrast, Iron Man grossed $102 million.
   a How do you expect Iron Man’s success to affect the opportunity cost of hiring Robert Downey Jr.?
   b How have the incentives for a film producer to hire Robert Downey Jr. changed?

11 What might be an incentive for you to take an extra university course during the summer break? List some of the benefits and costs involved in your decision. Would your choice be rational?

Economics as a Social Science and Policy Tool

12 Look at today’s Financial Times. What is the leading economic news story? With which big economic questions does it deal? What trade-offs does it discuss?

13 Give two microeconomic and two macroeconomic statements and classify them as positive or normative.
After studying this appendix, you will be able to:

- Make and interpret a scatter diagram
- Identify linear and non-linear relationships and relationships that have a maximum and a minimum
- Define and calculate the slope of a line
- Graph relationships among more than two variables

**Graphing Data**

A graph represents a quantity as a distance. Figure A1.1 shows two examples. A distance on the horizontal line represents temperature. A movement from left to right shows an increase in temperature. The point marked 0 represents zero degrees. To the right of 0, the temperature is positive and to the left of 0, it is negative. A distance on the vertical line represents height. The point marked 0 represents sea level. Points above 0 represent metres above sea level. Points below 0 (indicated by a minus sign) represent metres below sea level.

In Figure A1.1, the scale lines are perpendicular to each other and are called axes. The vertical line is the y-axis, and the horizontal line is the x-axis. Each axis has a zero point, which is shared by the two axes. This common zero point is called the origin.

To show something in a two-variable graph, we need two pieces of information: the value of the x variable and the value of the y variable. For example, off the coast of Norway on a winter’s day, the temperature is 0°C, and a fishing boat is located 0 metres above sea level. Points above 0 (indicated by a minus sign) represent metres below sea level.

In the heated cabin of the boat, the temperature is a comfortable 24°C. Points above 0 represent metres above sea level. Points below 0 (indicated by a minus sign) represent metres below sea level.

Finally, the temperature of the ice cube in the drink of the airline passenger is shown by the point marked D. This point represents 9,000 metres above sea level at a temperature of 0°C.

We can draw two lines, called coordinates, from point C. One, called the y-coordinate, runs from C to the horizontal axis. Its length is the same as the value marked off on the y-axis. The other, called the x-coordinate, runs from C to the vertical axis. Its length is the same as the value marked off on the x-axis. We describe a point in a graph by the values of its x-coordinate and its y-coordinate. For example, at point C, x is 24 degrees and y is 9,000 metres.

Graphs like that in Figure A1.1 can show any type of quantitative data on two variables. The graph can show just a few points, like Figure A1.1, or many points. Before we look at graphs with many points, let’s reinforce what you’ve just learned by looking at two graphs made with economic data.

Economists measure variables that describe what, how and for whom goods and services are produced. These variables are quantities produced and prices. Figure A1.2 shows two examples of economic graphs.

Figure A1.2(a) is a graph about iTunes song downloads in January 2010. The x-axis measures the quantity...
of songs downloaded per day and the $y$-axis measures the price of a song. Point $A$ tells us what the quantity and price were. You can ‘read’ this graph as telling you that in January 2010, 8.3 million songs a day were downloaded at a price of 99¢ per song.

Figure A1.2(b) is a graph about iTunes song and album downloads in January 2010. The $x$-axis measures the quantity of songs downloaded per day and the $y$-axis measures the quantity of albums downloaded per day. Point $B$ tells us what these quantities were. You can ‘read’ this graph as telling you that in January 2010, 8.3 million songs a day and 0.4 million albums a day were downloaded.

The three graphs that you’ve just seen tell you how to make a graph and how to read a data point on a graph, but they don’t improve on the raw data. Graphs become interesting and revealing when they contain a number of data points because then you can visualize the data.

Economists create graphs based on the principles in Figures A1.1 and A1.2 to reveal, describe and visualize the relationships among variables. We’re now looking at some examples. These graphs are called scatter diagrams.

**Scatter Diagrams**

A scatter diagram plots the value of one variable against the value of another variable for a number of different values of each variable. Such a graph reveals whether a relationship exists between two variables and describes their relationship.

The table in Figure A1.3 shows some data on two variables: the number of tickets sold at the box office and the number of DVDs sold for eight of the most popular films in 2009.

What is the relationship between these two variables? Does a big box office success generate a large volume of DVD sales? Or does a box office success mean that fewer DVDs are sold?

We can answer these questions by making a scatter diagram. We do so by graphing the data in the table. Each point in the graph shows the number of box office tickets sold (the $x$ variable) and the number of DVDs sold (the $y$ variable) of one of the films. With eight films, eight points are ‘scattered’ within the graph.

The point labelled $A$ tells us that Star Trek sold 34 million tickets at the box office and 6 million DVDs. The dots in this graph form a pattern, which reveals that larger box office sales are associated with larger DVD sales. But the points also tell us that this association is weak. You can’t predict DVD sales with any confidence by knowing only the number of tickets sold at the box office.

Figure A1.4 shows two scatter diagrams of economic variables. Part (a) shows the relationship between expenditure and income on average. Each dot shows expenditure per person and income per person in a given year from 1999 to 2009. The dots are ‘scattered’ within the graph. The red dot tells us that in 2007, income per person was £14,000 and expenditure per person was £13,700. The dots in this graph form a pattern, which reveals that as income increases, expenditure increases.
The table lists the number of tickets sold at the box office and the number of DVDs sold for eight popular films. The scatter diagram reveals the relationship between these two variables. Each point shows the values of the two variables for a specific film. For example, point A shows the point for Star Trek, which sold 34 million tickets at the box office and 6 million DVDs. The pattern formed by the points shows that there is a tendency for large box office sales to bring greater DVD sales. But you couldn’t predict how many DVDs a film would sell just by knowing its box office sales.

Figure A1.4(b) shows a scatter diagram of UK unemployment and inflation from 1999 to 2009. The points show no close relationship between the two variables. Movements in the inflation rate are not related to those in the unemployment rate in any simple way.

You can see that a scatter diagram conveys a wealth of information, and it does so in much less space than we have used to describe only some of its features. But you do have to ‘read’ the graph to obtain all this information.

The scatter diagram in part (a) shows the relationship between income and expenditure from 1999 to 2009. The red dot shows that in 2007, income was £14,000 and expenditure was £13,700. The dots form a pattern that shows that as income increases so too does expenditure.

The scatter diagram in part (b) shows a weak relationship between UK unemployment and inflation during most of the 2000s.
Breaks in the Axes

Figure A1.4(a) and Figure A1.4(b) have breaks in their axes, as shown by the small gaps. The breaks indicate that there are jumps from the origin, 0, to the first values recorded. In Figure A1.4(a), the breaks are used because the lowest values exceed £11,000. With no breaks in the axes, there would be a lot of empty space, all the points would be crowded into the top right corner and it would be hard to see the relationship between these two variables. By breaking the axes, we bring the relationship into view.

Putting a break in the axes is like using a zoom lens to bring the relationship into the centre of the graph and magnify it so that it fills the graph.

Misleading Graphs

Breaks can be used to highlight a relationship. But they can also be used to mislead – to make a graph that lies. The most common way of making a graph lie is to use axis breaks and either to stretch or compress a scale. For example, suppose that in Figure A1.4(a), the y-axis that measures expenditure ran from zero to £15,000 while the x-axis was the same as the one shown, running from £12,000 to £15,000. The graph would now create the impression that despite a huge increase in income, expenditure had barely changed.

To avoid being misled, it is a good idea to get into the habit of looking closely at the values and the labels on the axes of a graph before you start trying to interpret it.

Correlation and Causation

A scatter diagram that shows a clear relationship between two variables, such as Figure A1.4(a), tells us that the two variables have a high correlation. When a high correlation is present, we can predict the value of one variable from the value of the other variable. But correlation does not imply causation.

Sometimes a high correlation is a coincidence, but sometimes it does arise from a causal relationship. It is likely, for example, that rising income causes rising expenditure (Figure A1.4a).

You’ve now seen how we can use graphs in economics to show economic data and to reveal relationships between variables. Next, we’ll learn how economists use graphs to construct and display economic models.

Graphs Used in Economic Models

The graphs used in economics are not always designed to show real-world data. Often they are used to show general relationships among the variables in an economic model.

An economic model is a stripped down, simplified description of an economy or of a component of an economy such as a business or a household. It consists of statements about economic behaviour that can be expressed as equations or as curves in a graph. Economists use models to explore the effects of different policies or other influences on the economy in ways that are similar to the use of model aeroplanes in wind tunnels and models of the climate.

You will encounter many different kinds of graphs in economic models, but there are some repeating patterns. Once you’ve learned to recognize these patterns, you will instantly understand the meaning of a graph. Here, we’ll look at the different types of curves that are used in economic models, and we’ll see some everyday examples of each type of curve. The patterns to look for in graphs are the four cases in which:

- Variables move in the same direction
- Variables move in opposite directions
- Variables have a maximum or a minimum
- Variables are unrelated

Variables That Move in the Same Direction

A relationship in which two variables move in the same direction is called a positive relationship or a direct relationship. Figure A1.5 shows some examples of positive relationships. Notice that the line that shows such a relationship slopes upward.

Figure A1.5 shows three types of relationships, one that has a straight line and two that have curved lines. But all the lines in these three graphs are called curves. Any line on a graph – no matter whether it is straight or curved – is called a curve.

A relationship shown by a straight line is called a linear relationship. Figure A1.5(a) shows a linear relationship between the number of kilometres travelled in 5 hours and speed. For example, point A shows that if
our speed is 40 kms per hour, we will travel 200 kilometres in 5 hours. If we double our speed to 80 kms per hour, we will travel 400 kilometres in 5 hours.

Figure A1.5(b) shows the relationship between distance sprinted and recovery time (the time it takes the heart rate to return to its normal resting rate). This relationship is an upward-sloping one that starts out quite flat but then becomes steeper as we move along the curve away from the origin. The reason this curve slopes upward and becomes steeper is because the additional recovery time needed from sprinting an additional 100 metres increases. It takes less than 5 minutes to recover from the first 100 metres but more than 10 minutes to recover from the third 100 metres.

Figure A1.5(c) shows the relationship between the number of problems worked by a student and the amount of study time. This relationship is an upward-sloping one that starts out quite steep and becomes flatter as we move away from the origin. Study time becomes less productive as you increase the hours spent studying and become more tired.

Variables That Move in Opposite Directions

A relationship between variables that move in opposite directions is called a negative relationship or an inverse relationship. Figure A1.6 shows some examples. Figure A1.6(a) shows the relationship between the number of hours available for playing squash and for playing tennis when the total is 5 hours. One extra hour spent playing tennis means one hour less playing squash and vice versa. This relationship is negative and linear.

Figure A1.6(b) shows the relationship between the cost per kilometre travelled and the length of a journey. The longer the journey, the lower is the cost per kilometre. But as the journey length increases, the cost per kilometre decreases, but the fall in the cost is smaller, the longer the journey. This feature of the relationship is shown by the fact that the curve slopes downward, starting out steep at a short journey length and then becoming flatter as the journey length increases. This relationship arises because some of the costs are fixed.
Figure A1.6(c) shows the relationship between the amount of leisure time and the number of problems worked by a student. Increasing leisure time produces an increasingly large reduction in the number of problems worked. This relationship is a negative one that starts out with a gentle slope at a small number of leisure hours and becomes steeper as the number of leisure hours increases. This relationship is a different view of the idea shown in Figure A1.5(c).

Variables That Have a Maximum or a Minimum

Many relationships in economic models have a maximum or a minimum. For example, firms try to make the largest possible profit and to produce at the lowest possible cost. Figure A1.7 shows relationships that have a maximum or a minimum.

Figure A1.7(a) shows the relationship between rainfall and wheat yield. When there is no rainfall, wheat will not grow, so the yield is zero. As the rainfall increases up to 10 days a month, the wheat yield increases. With 10 rainy days each month, the wheat yield reaches its maximum at 2.0 tonnes per hectare (point A). Rain in excess of 10 days a month starts to lower the yield of wheat. If every day is rainy, the wheat suffers from a lack of sunshine and the yield decreases to zero. This relationship is one that starts out sloping upward, reaches a maximum and then slopes downward.

Figure A1.7(b) shows the reverse case – a relationship that begins sloping downward, falls to a minimum and then slopes upward. Most economic costs are like this relationship. An example is the relationship between the travel cost per kilometre and the speed of a car. At low speeds, the car is creeping in a traffic jam. The number of kilometres per litre is low, so the cost per kilometre is high. At high speeds, the car is travelling faster than its efficient speed, using a large quantity of petrol, and again the number of kilometres per litre is low and the cost per kilometre is high. At a speed of 85 kms per hour, the cost per kilometre is at its minimum (point B). This relationship is one that starts out sloping downward, reaches a minimum and then slopes upward.
Variables That Are Unrelated

There are many situations in which no matter what happens to the value of one variable, the other variable remains constant. Sometimes we want to show the independence between two variables in a graph, and Figure A1.8 shows two ways of achieving this.

In describing the graphs in Figures A1.5 to Figure A1.8, we have talked about curves that slope upward or slope downward and curves that become steeper and less steep. Let’s spend a little time discussing exactly what we mean by slope and how we measure the slope of a curve.

This figure shows how we can graph two variables that are unrelated. In part (a), a student’s grade in economics is plotted at 75 per cent on the y-axis regardless of the price of bananas on the x-axis. The curve is horizontal.

In part (b), the output of the vineyards of France on the x-axis does not vary with the rainfall in Australia on the y-axis. The curve is vertical.
The Slope of a Relationship

We can measure the influence of one variable on another by the slope of the relationship. The slope of a relationship is the change in the value of the variable measured on the y-axis divided by the change in the value of the variable measured on the x-axis. We use the Greek letter \( \Delta \) to represent ‘change in’. So \( y \) means the change in the value of the variable measured on the y-axis, and \( x \) means the change in the value of the variable measured on the x-axis. The slope of the relationship is:

\[
\frac{\Delta y}{\Delta x}
\]

If a large change in the variable measured on the y-axis (\( y \)) is associated with a small change in the variable measured on the x-axis (\( x \)), the slope is large and the curve is steep. If a small change in the variable measured on the y-axis (\( y \)) is associated with a large change in the variable measured on the x-axis (\( x \)), the slope is small and the curve is flat.

We can make the idea of slope sharper by doing some calculations.

The Slope of a Straight Line

The slope of a straight line is the same regardless of where on the line you calculate it. The slope of a straight line is constant.

Figure A1.9 The Slope of a Straight Line

To calculate the slope of a straight line, we divide the change in the value of the variable measured on the y-axis (\( \Delta y \)) by the change in the value of the variable measured on the x-axis (\( \Delta x \)), as we move along the curve.

Part (a) shows the calculation of a positive slope. When \( x \) increases from 2 to 6, \( x \) equals 4. That change in \( x \) brings about an increase in \( y \) from 3 to 6, so \( y \) equals 3. The slope (\( \frac{\Delta y}{\Delta x} \)) equals 3/4.

Part (b) shows the calculation of a negative slope. When \( x \) increases from 2 to 6, \( x \) equals 4. That increase in \( x \) brings about a decrease in \( y \) from 6 to 3, so \( y \) equals –3. The slope (\( \frac{\Delta y}{\Delta x} \)) equals –3/4.
Let’s calculate the slopes of the lines in Figure A1.9. In part (a), when \( x \) increases from 2 to 6, \( y \) increases from 3 to 6. The change in \( x \) is +4; that is, \( x = 4 \). The change in \( y \) is +3; that is, \( y = 3 \). The slope of that line is:

\[
\frac{y}{x} = \frac{3}{4}
\]

In part (b), when \( x \) increases from 2 to 6, \( y \) decreases from 6 to 3. The change in \( y \) is minus 3; that is, \( y = -3 \). The change in \( x \) is plus 4; that is, \( x = 4 \). The slope of the curve is:

\[
\frac{y}{x} = -\frac{3}{4}
\]

Notice that the two slopes have the same magnitude (3/4), but the slope of the line in part (a) is positive (3/4), while the slope in part (b) is negative (–3/4). The slope of a positive relationship is positive; the slope of a negative relationship is negative.

**The Slope of a Curved Line**

The slope of a curved line is trickier. The slope of a curved line is not constant. Its slope depends on where on the line we calculate it. There are two ways to calculate the slope of a curved line: you can calculate the slope at a point, or you can calculate the slope across an arc of the curve. Let’s look at the two alternatives.

**Slope at a Point**

To calculate the slope at a point on a curve, you need to construct a straight line that has the same slope as the curve at the point in question. Figure A1.10 shows how this is done. Suppose you want to calculate the slope of the curve at point \( A \). Place a ruler on the graph so that it touches point \( A \) and no other point on the curve, then draw a straight line along the edge of the ruler. The straight red line is this line, and it is the tangent to the curve at point \( A \). If the ruler touches the curve only at point \( A \), then the slope of the curve at point \( A \) must be the same as the slope of the edge of the ruler. If the curve and the ruler do not have the same slope, the line along the edge of the ruler will cut the curve instead of just touching it.

Now that you have found a straight line with the same slope as the curve at point \( A \), you can calculate the slope of the curve at point \( A \) by calculating the slope of the straight line. Along the straight line, as \( x \) increases from 0 to 4 ( \( x = 4 \) ) \( y \) increases from 2 to 5 ( \( y = 3 \). The slope of the line is:

\[
\frac{y}{x} = \frac{3}{4}
\]

So the slope of the curve at point \( A \) is 3/4.

**Slope Across an Arc**

An arc of a curve is a piece of a curve. In Figure A1.11, you are looking at the same curve as in Figure A1.10. But instead of calculating the slope at point \( A \), we are going to calculate the slope across the arc from \( B \) to \( C \).

You can see that the slope is greater at \( B \) than at \( C \). When we calculate the slope across an arc, we are calculating the average slope between two points. As we move along the arc from \( B \) to \( C \), \( x \) increases from 3 to 5 and \( y \) increases from 4 to 5.5. The change in \( x \) is 2 ( \( x = 2 \)), and the change in \( y \) is 1.5 ( \( y = 1.5 \)).
The slope of the red line $BC$ is:

$$\frac{\Delta y}{\Delta x} = \frac{1.5}{2} = \frac{3}{4}$$

So the slope of the curve across the arc $BC$ is $3/4$.

This calculation gives us the slope of the curve between points $B$ and $C$. The actual slope calculated is the slope of the straight line from $B$ to $C$. This slope approximates the average slope of the curve along the arc $BC$. In this particular example, the slope across the arc $BC$ is identical to the slope of the curve at point $A$. But the calculation of the slope of a curve does not always work out so neatly. You might have some fun constructing some more examples and some counter examples.

You now know how to make and interpret a graph. But so far, we’ve limited our attention to graphs of two variables. We’re now going to learn how to graph more than two variables.

### Graphing Relationships Among More Than Two Variables

We have seen that we can graph the relationship between two variables as a point formed by the $x$- and $y$-coordinates in a two-dimensional graph. You may be thinking that although a two-dimensional graph is informative, most of the things in which you are likely to be interested involve relationships among many variables, not just two. For example, the amount of ice cream consumed depends on the price of ice cream and the temperature. If ice cream is expensive and the temperature is low, people eat a lot less ice cream than when ice cream is inexpensive and the temperature is high. For any given price of ice cream, the quantity consumed varies with the temperature; and for any given temperature, the quantity of ice cream consumed varies with its price.

Figure A1.12 shows a relationship among three variables. The table shows the number of litres of ice cream consumed each day at various temperatures and ice cream prices. How can we graph these numbers?

To graph a relationship that involves more than two variables, we use the *ceteris paribus* assumption.

### Ceteris Paribus

*Ceteris paribus* (often shortened to *cet. par.*) means ‘if all other relevant things remain the same’. To isolate the relationship of interest in a laboratory experiment, a scientist holds everything constant except for the variable whose effect is being studied. Economists use the same method to graph a relationship that has more than two variables.

Figure A1.12(a) shows an example. There, you can see what happens to the quantity of ice cream consumed as the price of ice cream varies when the temperature is held constant.

The curve labelled $20^\circ C$ shows the relationship between ice cream consumption and the price of a scoop if the temperature remains at $20^\circ C$. The numbers used to plot that curve are those in the first two columns of the table. For example, if the temperature is $20^\circ C$, 10 litres are consumed when the price is £1.20 a scoop and 6 litres are consumed when the price is £1.60 a scoop.

The curve labelled $25^\circ C$ shows the relationship between ice cream consumption and the price of a scoop when the temperature remains at $25^\circ C$. The numbers used to plot the curve are those in the first and third
When the price of ice cream changes but the temperature is constant, you can think of what happens in the graph as a movement along one of the curves. At 20°C there is a movement along the blue curve and at 25°C there is a movement along the red curve.

When Other Things Change

The temperature is held constant along each of the curves in Figure A1.12, but in reality the temperature changes. When that event occurs, you can think of what happens in the graph as a shift of the curve.

With what you have learned about graphs, you can move forward with your study of economics. There are no graphs in this book that are more complicated than those that have been explained in this appendix. Use this appendix as a refresher if you find that you’re having difficulty interpreting or making a graph.
Equations of Straight Lines

If a straight line in a graph describes the relationship between two variables, we call it a linear relationship. Figure 1 shows the linear relationship between Cathy’s expenditure and income. Cathy spends £100 a week (by borrowing or spending her past savings) when income is zero. And out of each pound earned, Cathy spends 50 pence (and saves 50 pence).

All linear relationships are described by the same general equation. We call the quantity that is measured on the horizontal (or $x$-axis) $x$ and we call the quantity that is measured on the vertical (or $y$-axis) $y$. In the case of Figure 1, $x$ is income and $y$ is expenditure.

A Linear Equation

The equation that describes a linear relationship between $x$ and $y$ is:

$$ y = a + bx $$

In this equation, $a$ and $b$ are fixed numbers and they are called constants. The values of $x$ and $y$ vary so these numbers are called variables. Because the equation describes a straight line, it is called a linear equation.

The equation tells us that when the value of $x$ is zero, the value of $y$ is $a$. We call the constant $a$ the $y$-axis intercept. The reason is that on the graph the straight line hits the $y$-axis at a value equal to $a$. Figure 1 illustrates the $y$-axis intercept.

For positive values of $x$, the value of $y$ exceeds $a$. The constant $b$ tells us by how much $y$ increases above $a$ as $x$ increases. The constant $b$ is the slope of the line.

Slope of a Line

As we explain on p. 22, the slope of a relationship is the change in the value of $y$ divided by the change in the value of $x$. We use the Greek letter (delta) to represent ‘change in’. So $\Delta y$ means the change in the value of the variable measured on the $y$-axis, and $\Delta x$ means the change in the value of the variable measured on the $x$-axis. Therefore the slope of the relationship is:

$$ \frac{\Delta y}{\Delta x} $$

To see why the slope is $b$, suppose that initially the value of $x$ is $x_1$, or £200 in Figure 2. The corresponding value of $y$ is $y_1$, also £200 in Figure 2. The equation of the line tells us that:

$$ y_1 = a + bx_1 $$

Now the value of $x$ increases by $x$ to $x_1 + \Delta x$ (or £400 in Figure 2). And the value of $y$ increases by $\Delta y$ to $y_1 + \Delta y$ (or £300 in Figure 2).

The equation of the line now tells us that:

$$ y_1 + \Delta y = a + b(x_1 + \Delta x) $$

Figure 1 Linear relationship

Figure 2 Calculating slope
To calculate the slope of the line, subtract equation (1) from equation (2) to obtain:

\[ y = bx + c \]  
(3)

and now divide equation (3) by \( x \) to obtain:

\[ \frac{y}{x} = b \]

So the slope of the line is \( b \).

We can calculate the slope of the line in Figure 2. When \( x \) increases from 200 to 400, \( y \) increases from 200 to 300, so \( x \) is 200 and \( y \) is 100. The slope, \( b \), equals:

\[ \frac{y}{x} = \frac{100}{200} = 0.5 \]

Position of the Line

The \( y \)-axis intercept determines the position of the line on the graph. Figure 3 illustrates the relationship between the \( y \)-axis intercept and the position of the line on the graph. In this graph, the \( y \)-axis measures saving and the \( x \)-axis measures income.

When the \( y \)-axis intercept, \( a \), is positive, the line hits the \( y \)-axis at a positive value of \( y \) – as the blue line does. Its \( y \)-axis intercept is 100.

When the \( y \)-axis intercept, \( a \), is zero, the line hits the \( y \)-axis at the origin – as the purple line does. Its \( y \)-axis intercept is 0.

When the \( y \)-axis intercept, \( a \), is negative, the line hits the \( y \)-axis at a negative value of \( y \) – as the red line does. Its \( y \)-axis intercept is \(-100\).

As the equations of the three lines show, the value of the \( y \)-axis intercept does not influence the slope of the line. All three lines have a slope equal to 0.5.

Positive Relationships

Figures 1 and 2 show a positive relationship – the two variables \( x \) and \( y \) move in the same direction. All positive relationships have a slope that is positive. In the equation of the line, the constant \( b \) is positive.

In the example in Figure 1, the \( y \)-axis intercept, \( a \), is 100. The slope \( b \) equals 0.5. The equation of the line is:

\[ y = 100 + 0.5x \]

Negative Relationships

Figure 4 shows a negative relationship – the variables \( x \) and \( y \) move in opposite directions. All negative relationships have a slope that is negative. In the equation of the line, the constant \( b \) is negative.

In the example in Figure 4, the \( y \)-axis intercept, \( a \), is 30. The slope, \( b \), equals \( \frac{y}{x} \) as we move along the line. When \( x \) increases from 0 to 2, \( y \) decreases from 30 to 10, so \( x \) is 2 and \( y \) is \(-20\). The slope equals \( \frac{y}{x} \), which is \(-20/2 \) or \(-10\). The equation of the line is:

\[ y = 30 - 10x \]
the variable measured on the x-axis, that is, \( y/ x \).

◆ A straight line has a constant slope.

◆ A curved line has a varying slope. To calculate the slope of a curved line, we calculate the slope at a point or across an arc.

3 Explain how we ‘read’ the three scatter diagrams in Figure A1.3 and A1.4.

4 Draw a graph to show the relationship between two variables that move in the same direction.

5 Draw a graph to show the relationship between two variables that move in opposite directions.

6 Draw a graph to show the relationship between two variables that have a maximum and a minimum.

7 Which of the relationships in Questions 4 and 5 is a positive relationship and which is a negative relationship?

8 What are the two ways of calculating the slope of a curved line?

9 How do we graph a relationship among more than two variables?

10 Explain what change will bring a movement along a curve.

11 Explain what change will bring a shift of a curve.

You can work these questions in Study Plan 1.A and get instant feedback.

**Summary**

**Key Points**

**Graphing Data (pp. 13–16)**

◆ A graph is made by plotting the values of two variables \( x \) and \( y \) at a point that corresponds to their values measured along the x-axis and y-axis.

◆ A scatter diagram is a graph that plots the values of two variables for a number of different values of each.

◆ A scatter diagram shows the relationship between two variables. It shows whether two variables are positively related, negatively related, or unrelated.

**Graphs Used in Economic Models (pp. 16–19)**

◆ Graphs are used to show relationships among variables in economic models.

◆ Relationships can be positive (an upward-sloping curve), negative (a downward-sloping curve), positive and then negative (have a maximum point), negative and then positive (have a minimum point), or unrelated (a horizontal or vertical curve).

**The Slope of a Relationship (pp. 20–22)**

◆ The slope of a relationship is calculated as the change in the value of the variable measured on the y-axis divided by the change in the value of the variable measured on the x-axis, that is, \( y/ x \).

◆ We then plot the value of one of the variables against the value of another.

◆ A cet. par. change in the value of a variable on an axis of a graph brings a movement along the curve.

◆ A change in the value of a variable held constant along the curve brings a shift of the curve.

**Key Terms**

*Ceteris paribus*, 22

Direct relationship, 16

Inverse relationship, 17

Linear relationship, 16

Negative relationship, 17

Positive relationship, 16

Scatter diagram, 14

Slope, 20
Use this spreadsheet to answer Problems 1 to 3. The spreadsheet gives data on the US economy: column A is the year, column B is the inflation rate, column C is the interest rate, column D is the growth rate and column E is the unemployment rate.

1. Draw a scatter diagram to show the relationship between the inflation rate and the interest rate. Describe the relationship.

2. Draw a scatter diagram to show the relationship between the growth rate and the unemployment rate. Describe the relationship.

3. Draw a scatter diagram to show the relationship between the interest rate and the unemployment rate. Describe the relationship.

Use the following news clip to work Problems 4 to 6.

**Clash of the Titans Tops Box Office With Sales of $61.2 million:**

<table>
<thead>
<tr>
<th>Film</th>
<th>Cinemas (number)</th>
<th>Revenue (dollars per cinema)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clash of the Titans</td>
<td>3,777</td>
<td>16,213</td>
</tr>
<tr>
<td>Tyler Perry’s Why Did I Get Married</td>
<td>2,155</td>
<td>13,591</td>
</tr>
<tr>
<td>How To Train Your Dragon</td>
<td>4,060</td>
<td>7,145</td>
</tr>
<tr>
<td>The Last Song</td>
<td>2,673</td>
<td>5,989</td>
</tr>
</tbody>
</table>

Source: Bloomberg, 5 April 2010

4. Draw a graph of the relationship between the revenue per cinema on the y-axis and the number of cinemas on the x-axis. Describe the relationship.

5. Calculate the slope of the relationship between 4,060 and 2,155 cinemas.

6. Calculate the slope of the relationship between 4,060 and 2,673 cinemas.

7. Calculate the slope of the following relationship:

8. Calculate the slope of the relationship at point A and at point B.

9. Calculate the slope across the arc AB.

Use the following relationship to work Problems 8 and 9.

Use the following table, which gives the price of a balloon ride, the temperature and the number of rides per day, to work Problems 10 and 11.

<table>
<thead>
<tr>
<th>Price (pounds per ride)</th>
<th>Balloon rides (number per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.00</td>
<td>32</td>
</tr>
<tr>
<td>10.00</td>
<td>27</td>
</tr>
<tr>
<td>15.00</td>
<td>18</td>
</tr>
<tr>
<td>20.00</td>
<td>10</td>
</tr>
<tr>
<td>10°C</td>
<td>40</td>
</tr>
<tr>
<td>20°C</td>
<td>32</td>
</tr>
<tr>
<td>30°C</td>
<td>27</td>
</tr>
</tbody>
</table>

10. Draw a graph of the relationships between the price and the number of rides, holding the temperature constant at 20°C.

11. What happens in the graph in Problem 10 if the temperature rises to 30°C?
19 Calculate the slope at points A and B.

20 Calculate the slope across the arc AB.

Use the following table, which gives the price of an umbrella, the amount of rainfall and the number of umbrellas purchased, to work Problems 21 to 23.

<table>
<thead>
<tr>
<th>Umbrellas (number purchased per day)</th>
<th>Price (pounds per umbrella)</th>
<th>0</th>
<th>200</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.00</td>
<td>7</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>10.00</td>
<td>4</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
<td>2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>20.00</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

21 Draw a graph of the relationship between the price and the number of umbrellas purchased, holding the amount of rainfall constant at 200 mm. Describe the relationship.

22 What happens in the graph in Problem 21 if the price rises and rainfall is constant?

23 What happens in the graph in Problem 21 if the rainfall increases from 200 mm to 400 mm?
After studying this chapter you will be able to:

- Define the production possibilities frontier and calculate opportunity cost
- Distinguish between production possibilities and preferences and describe an efficient allocation of resources
- Explain how current production choices expand future production possibilities
- Explain how specialization and trade expand our production possibilities
- Describe the economic institutions that coordinate decisions

Why does food cost much more today than it did a few years ago? One reason is that we now use part of our food crop to produce biofuel as a substitute for petrol and diesel. Another reason is that droughts have decreased global grain production.

In this chapter, you will study an economic model – the production possibilities frontier – and you will learn why biofuel production and drought have increased the cost of producing food. You will also learn how to assess whether it is a good idea to increase maize production to produce fuel and how we gain by trading with others.

At the end of the chapter, in Reading Between the Lines, we’ll apply what you’ve learned to understanding why biofuel production is raising the cost of food.
CHAPTER 2 THE ECONOMIC PROBLEM

Production Possibilities and Opportunity Cost

Every working day, in mines and factories, shops and offices, on farms and construction sites, 200 million European workers produce a vast variety of goods and services valued at €50 billion. But the quantities of goods and services that we can produce are limited by both our available resources and technology. And if we want to increase our production of one good, we must decrease our production of something else – we face trade-offs.

You are going to learn about the production possibilities frontier, which describes the limit to what we can produce and provides a neat way of thinking about and illustrating the idea of a trade-off.

The production possibilities frontier (PPF) is the boundary between those combinations of goods and services that can be produced and those that cannot. To illustrate the PPF, we focus on two goods at a time and hold the quantities produced of all the other goods and services constant. That is, we look at a model economy in which everything remains the same (ceteris paribus) except for the production of the two goods we are considering.

Let’s look at the production possibilities frontier for CDs and pizza, which stand for any pair of goods or services.

Production Possibilities Frontier

The production possibilities frontier for CDs and pizza shows the limits to the production of these two goods, given the total resources available to produce them. Figure 2.1 shows this production possibilities frontier. The table lists some combinations of the quantities of pizzas and CDs that can be produced in a month given the resources available. The figure graphs these combinations. The x-axis shows the quantity of pizzas produced and the y-axis shows the quantity of CDs produced.

The PPF illustrates scarcity because we cannot attain the points outside the frontier. They are points that describe wants that can’t be satisfied. We can produce at all the points inside the PPF and on the PPF. These points are attainable. Suppose that in a typical month, we produce 4 million pizzas and 5 million CDs. Figure 2.1 shows this combination as point E and as possibility E in the table. The figure also shows other production possibilities.

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Pizzas (millions)</th>
<th>CDs (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

The table lists six points on the production possibilities frontier for CDs and pizza. Row A tells us that if we produce no pizza, the maximum quantity of CDs we can produce is 15 million. Points A, B, C, D, E, and F in the figure represent the rows of the table. The line passing through these points is the production possibilities frontier (PPF).

The PPF separates the attainable from the unattainable. Production is possible at any point inside the orange area or on the PPF. Points outside the frontier are unattainable. Points inside the frontier such as point Z are inefficient because resources are either wasted or misallocated. At such points, it is possible to use the available resources to produce more of either or both goods.
For example, we might stop producing pizza and move all the people who produce it into producing CDs. Point $A$ in Figure 2.1 and possibility $A$ in the table show this case. The quantity of CDs produced increases to 15 million, and pizza production dries up. Alternatively, we might close the CD factories and switch all the resources into producing pizza. In this situation, we produce 5 million pizzas. Point $F$ in the figure and possibility $F$ in the table show this case.

**Production Efficiency**

We achieve **production efficiency** if we cannot produce more of one good without producing less of some other good. When production is efficient, we are at a point on the PPF. If we are at a point inside the PPF, such as point $Z$, production is inefficient because we have some unused resources or we have some misallocated resources or both.

Resources are unused when they are idle but could be working. For example, we might leave some of the factories idle or some workers unemployed.

Resources are misallocated when they are assigned to tasks for which they are not the best match. For example, we might assign skilled pizza makers to work in a CD factory and skilled CD makers to work in a pizza shop. We could get more pizza and more CDs from these same workers if we reassigned them to the tasks that more closely match their skills.

If we produce at a point inside the PPF such as $Z$ in Figure 2.1, we can use our resources more efficiently to produce more pizzas, more CDs, or more of both pizzas and CDs. But if we produce at a point on the PPF, we are using our resources efficiently and we can produce more of one good only if we produce less of the other. That is, along the PPF, we face a trade-off.

**Trade-off Along the PPF**

Every choice along the PPF involves a trade-off – we must give up something to get something else. On the PPF in Figure 2.1, we must give up some CDs to get more pizza or give up some pizza to get more CDs.

Trade-offs arise in every imaginable real-world situation, and you reviewed several of them in Chapter 1. At any given point in time, we have a fixed amount of labour, land, capital and entrepreneurship. By using our available technologies, we can employ these resources to produce goods and services. But we are limited in what we can produce. This limit defines a boundary between what we can attain and what we cannot attain. This boundary is the real world’s production possibilities frontier, and it defines the trade-offs that we must make. On our real-world PPF, we can produce more of any one good or service only if we produce less of some other goods or services.

When doctors say that we must spend more on AIDS and cancer research, they are suggesting a trade-off: more medical research for less of some other things. When a politician says that she wants to spend more on education and healthcare, she is suggesting a trade-off: more education and healthcare for less defence expenditure or less private spending (because of higher taxes). When an environmental group argues for less logging in tropical rainforests, it is suggesting a trade-off: greater conservation of endangered wildlife for less hardwood. When your parents say that you should study more, they are suggesting a trade-off: more study time for less leisure or sleep.

All trade-offs involve a cost – an opportunity cost.

**Opportunity Cost**

The **opportunity cost** of an action is the highest-valued alternative forgone. The PPF helps us to make the concept of opportunity cost precise and enables us to calculate it. Along the PPF, there are only two goods, so there is only one alternative forgone: some quantity of the other good. Given our current resources and technology, we can produce more pizzas only if we produce fewer CDs. The opportunity cost of producing an additional pizza is the number of CDs we must forgo. Similarly, the opportunity cost of producing an additional CD is the quantity of pizzas we must forgo.

For example, at point $C$ in Figure 2.1, we produce fewer pizzas and more CDs than at point $D$. If we choose point $D$ over point $C$, the additional 1 million pizzas cost 3 million CDs. One pizza costs 3 CDs.

We can also work out the opportunity cost of choosing point $C$ over point $D$ in Figure 2.1. If we move from point $D$ to point $C$, the quantity of CDs produced increases by 3 million and the quantity of pizzas produced decreases by 1 million. So if we choose point $C$ over point $D$, the additional 3 million CDs cost 1 million pizzas. So 1 CD costs 1/3 of a pizza.

**Opportunity Cost Is a Ratio**

Opportunity cost is a ratio. It is the decrease in the quantity produced of one good divided by the increase in the quantity produced of another good as we move along the production possibilities frontier.
Because opportunity cost is a ratio, the opportunity cost of producing an additional CD is equal to the inverse of the opportunity cost of producing an additional pizza. Check this proposition by returning to the calculations we’ve just worked through. When we move along the PPF from C to D, the opportunity cost of a pizza is 3 CDs. The inverse of 3 is 1/3, so if we decrease the production of pizzas and increase the production of CDs by moving from D to C, the opportunity cost of a CD must be 1/3 of a pizza. You can check that this number is correct. If we move from D to C, we produce 3 million more CDs and 1 million fewer pizzas. Because 3 million CDs cost 1 million pizzas, the opportunity cost of 1 CD is 1/3 of a pizza.

**Increasing Opportunity Cost**

The opportunity cost of a pizza increases as the quantity of pizzas produced increases. Also, the opportunity cost of a CD increases as the quantity of CDs produced increases. This phenomenon of increasing opportunity cost is reflected in the shape of the PPF – it is bowed outward.

When a large quantity of CDs and a small quantity of pizzas are produced – between points A and B in Figure 2.1 – the frontier has a gentle slope. A given increase in the quantity of pizzas costs a small decrease in the quantity of CDs, so the opportunity cost of a pizza is a small quantity of CDs.

When a large quantity of pizzas and a small quantity of CDs are produced – between points E and F in Figure 2.1 – the frontier is steep. A given increase in the quantity of pizzas costs a large decrease in the quantity of CDs, so the opportunity cost of a pizza is a large quantity of CDs.

The PPF is bowed outward because resources are not all equally productive in all activities. People with several years of experience working for Philips are good at producing CDs but not very good at making pizzas. So if we move some of these people from Philips to Domino’s, we get a small increase in the quantity of pizzas but a large decrease in the quantity of CDs. Similarly, people who have spent years working at Domino’s are good at producing pizzas, but they have no idea how to produce CDs. So if we move some of these people from Domino’s to Philips, we get a small increase in the quantity of CDs but a large decrease in the quantity of pizzas. The more of either good we try to produce, the less productive are the additional resources we use to produce that good and the larger is the opportunity cost of a unit of that good.

**Increasing Opportunity Costs Are Everywhere**

Just about every activity that you can think of is one with an increasing opportunity cost. We allocate the most skilful farmers and the most fertile land to the production of food. And we allocate the best doctors and the least fertile land to the production of healthcare services. If we shift fertile land and tractors away from farming to hospitals and ambulances and ask farmers to become hospital porters, the production of food drops drastically and the increase in the production of healthcare services is small. The opportunity cost of a unit of healthcare services rises. Similarly, if we shift our resources away from healthcare towards farming, we must use more doctors and nurses as farmers and more hospitals as hydroponic tomato factories. The decrease in the production of healthcare services is large, but the increase in food production is small. The opportunity cost of a unit of food rises. This example is extreme and unlikely, but these same considerations apply to most pairs of goods.

There may be some rare situations in which opportunity cost is constant. Switching resources from bottling ketchup to bottling mayonnaise is a possible example. But in general, when resources are reallocated, they must be assigned to tasks for which they are an increasingly poor match. Increasing opportunity costs are a general fact of life.

**Review Quiz**

1. How does the production possibilities frontier illustrate scarcity?
2. How does the production possibilities frontier illustrate production efficiency?
3. How does the production possibilities frontier show that every choice involves a trade-off?
4. How does the production possibilities frontier illustrate opportunity cost?
5. Why is opportunity cost a ratio?
6. Why does the PPF for most goods bow outward and what does that imply about the relationship between opportunity cost and the quantity produced?

We’ve seen that what we can produce is limited by the production possibilities frontier. We’ve also seen that production on the PPF is efficient. But we can produce many different quantities on the PPF. How do we choose among them? How do we know which point on the PPF is the best one?
**Using Resources Efficiently**

We achieve *production efficiency* at every point on the *PPF*, but which point is best? The answer is the point on the *PPF* at which goods and services are produced in the quantities that provide the greatest possible benefit. When goods and services are produced at the lowest possible cost and in the quantities that provide the greatest possible benefit, we have achieved *allocative efficiency*.

The questions that we raised when we reviewed the four big issues in Chapter 1 are questions about allocative efficiency. To answer such questions, we must measure and compare costs and benefits.

### The PPF and Marginal Cost

*Marginal cost* is the opportunity cost of producing *one more unit*. We can calculate marginal cost from the slope of the *PPF*. As the quantity of pizzas produced increases, the *PPF* gets steeper and marginal cost of a pizza increases. Figure 2.2 illustrates the calculation of the marginal cost of a pizza.

Begin by finding the opportunity cost of pizza in blocks of 1 million pizzas. The first million pizzas cost 1 million CDs, the second million pizzas cost 2 million CDs, the third million pizzas cost 3 million CDs, and so on. The bars in part (a) illustrate these calculations.

The bars in part (b) show the cost of an average pizza in each of the 1 million pizza blocks. Focus on the third million pizzas – the move from *C* to *D* in part (a). Over this range, because the 1 million pizzas cost 3 million CDs, one of these pizzas, on the average, costs 3 CDs – the height of the bar in part (b).

Next, find the opportunity cost of each additional pizza – the marginal cost of a pizza. The marginal cost of a pizza increases as the quantity of pizzas produced increases. The marginal cost at point *C* is less than it is at point *D*. On the average over the range from *C* to *D*, the marginal cost of a pizza is 3 CDs. But it exactly equals 3 CDs only in the middle of the range between *C* and *D*.

The red dot in part (b) indicates that the marginal cost of a pizza is 3 CDs when 2.5 million pizzas are produced. Each black dot in part (b) is interpreted in the same way. The red curve that passes through these dots, labelled *MC*, is the marginal cost curve. It shows the marginal cost of a pizza at each quantity of pizza as we move along the *PPF*. 

![Figure 2.2 The PPF and Marginal Cost](image-url)
_preferences and Marginal Benefit

The **marginal benefit** from a good or service is the benefit received from consuming one more unit of it. This benefit is subjective. It depends on people’s preferences – people’s likes and dislikes and the intensity of those feelings.

Marginal benefit and preferences stand in sharp contrast to marginal cost and production possibilities. Preferences describe what people like and want and the production possibilities describe the limits or constraints on what is feasible.

We need a concrete way of illustrating preferences that parallels the way we illustrate the limits to production using the PPF.

The device that we use to illustrate preferences is the **marginal benefit curve**, which is a curve that shows the relationship between the marginal benefit from a good and the quantity consumed of that good. Note that the marginal benefit curve is unrelated to the PPF and cannot be derived from it.

We measure the marginal benefit from a good or service by the most that people are willing to pay for an additional unit of it. The idea is that you are willing to pay less for a good than it is worth to you but you are not willing to pay more: the most you are willing to pay for something is its marginal benefit.

It is a general principle that the more we have of any good or service, the smaller is its marginal benefit and the less we are willing to pay for another unit of it. This tendency is so widespread and strong that we call it a principle – the **principle of decreasing marginal benefit**.

The basic reason why the marginal benefit of a good or service decreases as we consume more of it is that we like variety. The more we consume of any one good or service, the more we tire of it and would prefer to switch to something else.

Think about your willingness to pay for pizza (or any other item). If pizza is hard to come by and you can buy only a few slices a year, you might be willing to pay a high price to get an additional slice. But if pizza is all you’ve eaten for the past few days, you are willing to pay almost nothing for another slice.

You’ve learned to think about cost as opportunity cost, not pounds or euros. You can think about marginal benefit and willingness to pay in the same terms. The marginal benefit, measured by what you are willing to pay for something, is the quantity of other goods and services that you are willing to forgo. Let’s continue with the example of CDs and pizza and illustrate preferences this way.

Figure 2.3 illustrates preferences as the willingness to pay for pizza in terms of CDs. In row $A$, pizza production is 0.5 million, and at that quantity people are willing to pay 5 CDs per pizza. As the quantity of pizzas produced increases, the amount that people are willing to pay for a pizza falls. When pizza production is 4.5 million, people are willing to pay only 1 CD per pizza.

Let’s now use the concepts of marginal cost and marginal benefit to describe the efficient quantity of pizzas to produce.
Efficient Use of Resources

At any point on the PPF, we cannot produce more of one good without giving up some other good. At the best point on the PPF, we cannot produce more of one good without giving up some other good that provides greater benefit. We are producing at the point of allocative efficiency – the point on the PPF that we prefer above all other points.

Suppose in Figure 2.4, we produce 1.5 million pizzas. The marginal cost of a pizza is 2 CDs and the marginal benefit from a pizza is 4 CDs. Because someone values an additional pizza more highly than it costs to produce, we can get more value from our resources by moving some of them out of producing CDs and into producing pizzas.

Now suppose we produce 3.5 million pizzas. The marginal cost of a pizza is now 4 CDs, but the marginal benefit from a pizza is only 2 CDs. Because the additional pizza costs more to produce than anyone thinks it is worth, we can get more value from our resources by moving some of them away from producing pizzas and into producing CDs.

But suppose we produce 2.5 million pizzas. Marginal cost and marginal benefit are now equal at 3 CDs. This allocation of resources between pizzas and CDs is efficient. If more pizzas are produced, the forgone CDs are worth more than the additional pizzas. If fewer pizzas are produced, the forgone pizzas are worth more than the additional CDs.

The greater the quantity of pizzas produced, the smaller is the marginal benefit (MB) from pizza – the fewer CDs people are willing to give up to get an additional pizza. But the greater the quantity of pizzas produced, the greater is the marginal cost (MC) of pizza – the more CDs people must give up to get an additional pizza. When marginal benefit equals marginal cost, resources are being used efficiently.

You now understand the limits to production and the conditions under which resources are used efficiently. Your next task is to study the expansion of production possibilities.
Economic Growth

During the past 30 years, production per person in the EU has doubled. An expansion of production possibilities is called economic growth. Economic growth increases our standard of living, but it does not overcome scarcity and avoid opportunity cost. To make our economy grow, we face a trade-off—the faster we make production grow, the greater is the opportunity cost of economic growth.

The Cost of Economic Growth

Economic growth comes from technological change and capital accumulation. Technological change is the development of new goods and of better ways of producing goods and services. Capital accumulation is the growth of capital resources, which includes human capital.

Technological change and capital accumulation have vastly expanded our production possibilities. We can produce automobiles that provide us with more transportation than was available when we had only horses and carriages. We can produce satellites that provide global communications on a much larger scale than that available with the earlier cable technology. But if we use our resources to develop new technologies and produce capital, we must decrease our production of consumption goods and services. New technologies and new capital have an opportunity cost. Let’s look at this opportunity cost.

Instead of studying the PPF of pizzas and CDs, we’ll hold the quantity of CDs produced constant and examine the PPF for pizzas and pizza ovens. Figure 2.5 shows this PPF as the blue curve ABC. If we devote no resources to producing pizza ovens, we produce at point A. If we produce 3 million pizzas, we can produce 6 pizza ovens at point B. If we produce no pizza, we can produce 10 ovens at point C.

The amount by which our production possibilities expand depends on the resources we devote to technological change and capital accumulation. If we devote no resources to this activity (point A), our PPF remains the blue curve $PPF_0$ in Figure 2.5. If we cut the current production of pizza and produce 6 ovens (point B), then in the future, we’ll have more capital and our PPF will rotate outward to the position shown by the red curve $PPF_1$. The fewer resources we devote to producing pizza and the more resources we devote to producing ovens, the greater is the future expansion of our production possibilities.

Economic growth brings enormous benefit in the form of increased consumption, but it is not free and does not abolish scarcity.

In Figure 2.5, to make economic growth happen we must use some resources to produce new ovens, which leaves fewer resources to produce pizza. To move to $B'$ in the future, we must move from $A$ to $B$ today. The opportunity cost of more pizzas in the future is fewer pizzas today. Also, on the new $PPF$, we continue to face a trade-off and opportunity cost.

The ideas about economic growth that we have explored in the setting of the pizza industry also apply to nations. Hong Kong and the EU provide a striking case study.
We have seen that we can increase our production possibilities by accumulating capital and developing new technology. Next, we’ll study another way in which we can expand our production possibilities – the amazing fact that both buyers and sellers gain from specialization and trade.

A Nation’s Economic Growth

The experience of the EU and Hong Kong make a striking example of the effects of our choices about consumption and capital goods on the rate of economic growth.

Figure 1 shows that, in 1970, the production possibilities per person in the EU were more than double those in Hong Kong. In 1970, the EU was at point A on its PPF and Hong Kong was at point A on its PPF. Since 1970, the EU has devoted one-fifth of its resources to accumulating capital and the other four-fifths to consumption. Hong Kong has devoted one-third of its resources to accumulating capital and two-thirds to consumption.

By 2010, the production possibilities per person in Hong Kong had reached a similar level to those in the EU. If Hong Kong continues to devote more resources to accumulating capital than the EU does (at point B on its 2010 PPF), Hong Kong will continue to grow more rapidly. But if Hong Kong increases consumption and decreases capital accumulation (moving to point C on its 2010 PPF), then its economic growth rate will slow.

The EU is typical of the rich industrial countries and Hong Kong is typical of the fast-growing Asian economies. Countries like China, India and Taiwan have expanded their production possibilities by between 5 and 10 per cent a year.

If such high growth rates are maintained, these other Asian countries will continue to close the gap between themselves and the EU, as Hong Kong has done.
Gains from Trade

People can produce for themselves all the goods and services that they consume, or they can produce one good or a few goods and trade with others. Producing only one good or a few goods is called specialization.

We are going to discover how people gain by specializing in the production of the good in which they have a comparative advantage and trading with each other.

Comparative Advantage and Absolute Advantage

A person has a comparative advantage in an activity if that person can perform the activity at a lower opportunity cost than anyone else. Differences in opportunity costs arise from differences in individual abilities and from differences in the characteristics of other resources.

No one excels at everything. One person is an outstanding batter but a poor catcher; another person is a brilliant lawyer but a poor teacher. In almost all human endeavours, what one person does easily, someone else finds difficult. The same applies to land and capital. One plot of land is fertile but has no mineral deposits; another plot of land has outstanding views but is infertile. One machine has great precision but is difficult to operate; another is fast but often breaks down.

Although no one excels at everything, some people excel and can outperform others in many activities—perhaps all activities. A person who is more productive than others has an absolute advantage.

Absolute advantage involves comparing productivities—production per hour—whereas comparative advantage involves comparing opportunity cost.

A person who has an absolute advantage does not have a comparative advantage in every activity. Maria Sharapova can run faster and play tennis better than most people. She has an absolute advantage in these two activities. But compared with other people, she is a better tennis player than runner, so her comparative advantage is in playing tennis.

Because people’s abilities and the quality of their resources differ, they have different opportunity costs of producing various goods and services. Such differences give rise to comparative advantage.

To explore the idea of comparative advantage, and its astonishing implications, we’ll look at the production process in two smoothie bars: one operated by Erin and the other operated by Jack.

Erin’s Smoothie Bar

Erin produces smoothies and salads. In Erin’s high-tech bar, she can turn out either a smoothie or a salad every 2 minutes—see Table 2.1.

If Erin spends all her time making smoothies, she can produce 30 an hour. And if she spends all her time making salads, she can also produce 30 an hour. If she splits her time equally between the two, she can produce 15 smoothies and 15 salads an hour. For each additional smoothie Erin produces, she must decrease her production of salads by one, and for each additional salad she produces, she must decrease her production of smoothies by one. So

Erin’s opportunity cost of producing 1 smoothie is 1 salad, and

Erin’s opportunity cost of producing 1 salad is 1 smoothie.

Erin’s customers buy smoothies and salads in equal quantities, so she splits her time equally between the items and produces 15 smoothies and 15 salads an hour.

Jack’s Smoothie Bar

Jack also produces both smoothies and salads. But Jack’s bar is smaller than Erin’s. Also, Jack has only one blender, and it’s a slow old machine. Even if Jack uses all his resources to produce smoothies, he can produce only 6 an hour—see Table 2.2. But Jack is good in the salad department, so if he uses all his resources to make salads, he can produce 30 an hour.

Jack’s ability to make smoothies and salads is the same regardless of how he splits an hour between the two tasks. He can make a salad in 2 minutes or a smoothie in 10 minutes. For each additional smoothie Jack produces, he must decrease his production of salads by 5. And for each additional salad he produces, he

<table>
<thead>
<tr>
<th>Table 2.1</th>
<th>Erin’s Production Possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Minutes to produce 1</td>
</tr>
<tr>
<td>Smoothies</td>
<td>2</td>
</tr>
<tr>
<td>Salads</td>
<td>2</td>
</tr>
</tbody>
</table>
must decrease his production of smoothies by 1/5 of a smoothie. So

**Jack’s opportunity cost of producing 1 smoothie is 5 salads,**

and

**Jack’s opportunity cost of producing 1 salad is 1/5 of a smoothie.**

Jack’s customers, like Erin’s, buy smoothies and salads in equal quantities. So Jack spends 50 minutes of each hour making smoothies and 10 minutes of each hour making salads. With this division of his time, Jack produces 5 smoothies and 5 salads an hour.

**Erin’s Comparative Advantage**

In which of the two activities does Erin have a comparative advantage? Recall that comparative advantage is a situation in which one person’s opportunity cost of producing a good is lower than another person’s opportunity cost of producing that same good. Erin has a comparative advantage in producing smoothies. Her opportunity cost of a smoothie is 1 salad, whereas Jack’s opportunity cost of a smoothie is 5 salads.

**Jack’s Comparative Advantage**

If Erin has a comparative advantage in producing smoothies, Jack must have a comparative advantage in producing salads. His opportunity cost of a salad is 1/5 of a smoothie, whereas Erin’s opportunity cost of a salad is 1 smoothie.

**Achieving the Gains from Trade**

Erin and Jack run into each other one evening in a singles bar. After a few minutes of getting acquainted, Erin tells Jack about her amazing smoothie business. Her only problem, she tells Jack, is that she wishes she could produce more because potential customers leave when the queue gets too long.

Jack is hesitant to risk spoiling his chances by telling Erin about his own struggling business, but he takes the risk. Jack explains to Erin that he spends 50 minutes of every hour making 5 smoothies and 10 minutes making 5 salads. Erin’s eyes pop. “Have I got a deal for you!” she exclaims.

Here’s the deal that Erin sketches on a serviette. Jack stops making smoothies and allocates all his time to producing salads. Erin stops making salads and allocates all her time to producing smoothies. That is, they both specialize in producing the good in which they have a comparative advantage. Together they produce 30 smoothies and 30 salads – see Table 2.3(b).

They then trade. Erin sells Jack 10 smoothies and Jack sells Erin 20 salads – the price of a smoothie is 2 salads – see Table 2.3(c).

After the trade, Jack has 10 salads – the 30 he produces minus the 20 he sells to Erin. He also has the 10 smoothies that he buys from Erin. So Jack now has increased the quantities of smoothies and salads that he can sell to his customers – see Table 2.3(d).

**Table 2.2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Minutes to produce 1</th>
<th>Quantity per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoothies</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Salads</td>
<td>2</td>
<td>30</td>
</tr>
</tbody>
</table>

**Table 2.3**

<table>
<thead>
<tr>
<th>Erin and Jack Gain from Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Before trade</td>
</tr>
<tr>
<td>Smoothies</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Salads</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>(b) Production</td>
</tr>
<tr>
<td>Smoothies</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Salads</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>(c) Trade</td>
</tr>
<tr>
<td>Smoothies</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Salads</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>(d) After trade</td>
</tr>
<tr>
<td>Smoothies</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Salads</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>(e) Gains from trade</td>
</tr>
<tr>
<td>Smoothies</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
<tr>
<td>Salads</td>
</tr>
<tr>
<td>Erin</td>
</tr>
<tr>
<td>Jack</td>
</tr>
</tbody>
</table>
Erin has 20 smoothies – the 30 she produces minus the 10 she sells to Jack. And she has the 20 salads she buys from Jack – see Table 2.3(d). Both Erin and Jack gain 5 smoothies and 5 salads – see Table 2.3(e).

To illustrate her idea, Erin grabs a fresh serviette and draws the graphs in Figure 2.6. The blue PPF in part (a) shows Jack’s production possibilities. Before trade, he is producing 5 smoothies and 5 salads an hour at point A. The blue PPF in part (b) shows Erin’s production possibilities. Before trade, she is producing 15 smoothies and 15 salads an hour at point A.

Erin’s proposal is that they each specialize in producing the good in which they have a comparative advantage. Jack produces 30 salads and no smoothies at point B on his PPF. Erin produces 30 smoothies and no salads at point B on her PPF.

Erin and Jack then trade smoothies and salads at a price of 2 salads per smoothie or 1/2 of a smoothie per salad. Jack buys smoothies from Erin for 2 salads each, which is less than the 5 salads it costs him to produce a smoothie. Erin buys salads from Jack for 1/2 a smoothie each, which is less than the 1 smoothie that it costs her to produce a salad.

With trade, Jack has 10 smoothies and 10 salads at point C – a gain of 5 smoothies and 5 salads. Jack moves to a point outside his PPF.

With trade, Erin has 20 smoothies and 20 salads at point C – a gain of 5 smoothies and 5 salads. Erin moves to a point outside her PPF.

Despite Erin being more productive than Jack, both Erin and Jack gain from producing more of the good in which they have a comparative advantage and trading.
People gain by specializing in the production of those goods and services in which they have a comparative advantage and trading with each other. Erin and Jack, whose production of salads and smoothies we studied earlier in this chapter, can get together and make a deal that enables them to enjoy the gains from specialization and trade. But for billions of individuals to specialize and produce millions of different goods and services, their choices must somehow be coordinated.

Two competing economic coordination systems have been used: central economic planning and decentralized markets.

Central economic planning might appear to be the best system because it can express national priorities. But when this system was tried, as it was for 60 years in Russia and for 30 years in China, it was a miserable failure. Today, these and most other previously planned economies are adopting a decentralized market system.

Decentralized coordination works best, but for it to do so it needs four complementary social institutions:

- Firms
- Markets
- Property rights
- Money

**Firms**

A firm is an economic unit that employs factors of production and organizes them to produce and sell goods and services. Tesco and Virgin Atlantic are examples of firms.

Firms coordinate a huge amount of economic activity. A Starbucks coffee shop, for example, might buy the machines and labour services of Erin and Jack and start to produce salads and smoothies at all its outlets.

But Tesco would not have become Britain’s largest retailer if it had produced all the things that it sells. It
became the largest UK retailer by specializing in providing retail services and buying the goods and services it sells from other firms that specialize in their production (just like Erin and Jack did). This trade between Tesco and the producers of the goods and services it sells takes place in markets.

Markets

In ordinary speech, the word *market* means a place where people buy and sell goods such as fish, meat, fruits and vegetables. In economics, a *market* has a more general meaning. A *market* is any arrangement that enables buyers and sellers to get information and to do business with each other. An example is the market in which oil is bought and sold – the world oil market. The world oil market is not a place. It is the network of oil producers, oil users, wholesalers and brokers who buy and sell oil. In the world oil market, decision makers do not meet physically. They make deals throughout the world by telephone, fax and direct computer link.

Markets have evolved because they facilitate trade. Without organized markets, we would miss out on a substantial part of the potential gains from trade. Enterprising individuals and firms, each pursuing their own self-interest, have profited from making markets – standing ready to buy or sell the items in which they specialize. But markets can work only when property rights exist.

Property Rights

The social arrangements that govern the ownership, use and disposal of anything that people value are called *property rights*. *Real property* includes land and buildings – the things we call property in ordinary speech – and durable goods such as plant and equipment. *Financial property* includes shares and bonds and money in the bank. *Intellectual property* is the intangible product of creative effort. This type of property includes books, music, computer programs and inventions of all kinds and is protected by copyrights and patents.

Where property rights are enforced, people have the incentive to specialize and produce the goods and services in which they have a comparative advantage. Where people can steal the production of others, resources are devoted not to production but to protecting possessions. Without property rights, we would still be hunting and gathering like our Stone Age ancestors.

Money

*Money* is any commodity or token that is generally acceptable as a means of payment. Erin and Jack didn’t use money; they exchanged salads and smoothies. In principle, trade in markets can exchange any item for any other item. But you can perhaps imagine how complicated life would be if we exchanged goods for other goods. The ‘invention’ of money makes trading in markets much more efficient.

Circular Flows Through Markets

Figure 2.7 shows the flows that result from the choices that households and firms make. Households specialize and choose the quantities of labour, land, capital and entrepreneurship to sell or rent to firms. Firms choose the quantities of factors of production to hire. These (red) flows go through the *factor markets*. Households choose the quantities of goods and services to buy, and firms choose the quantities to produce. These (red) flows go through the *goods markets*. Households receive incomes from firms and make expenditures on goods and services (the green flows).

How do markets coordinate all these decisions?

Coordinating Decisions

Markets coordinate decisions through price adjustments. To see how, think about the market for fresh-baked bread. Suppose that some people who want to buy fresh-baked bread are not able to do so. To make the choices of buyers and sellers compatible, buyers must switch to prepackaged bread or more fresh-baked bread must be offered for sale (or both). A rise in the price of fresh-baked bread produces this outcome. A higher price encourages bakers to offer more fresh-baked bread for sale. It also encourages some people to change the bread they buy. Fewer people buy fresh-baked bread, and more buy prepackaged bread. More fresh-baked bread (and more prepackaged bread) are offered for sale.

Alternatively, suppose that more fresh-baked bread is available than people want to buy. In this case, to make the choices of buyers and sellers compatible, more fresh-baked bread must be bought or less fresh-baked bread must be offered for sale (or both). A fall in the price of fresh-baked bread achieves this outcome. A lower price encourages bakers to produce a smaller quantity of, and encourages people to buy more fresh-baked bread.
You have now begun to see how economists approach economic questions. Scarcity, choice and divergent opportunity costs explain why we specialize and trade and why firms, markets, property rights and money have developed. You can see all around you the lessons you’ve learned in this chapter.

Reading Between the Lines on pp. 44–45 provides an opportunity to apply the PPF model to deepen your understanding of the reasons for the increase in the cost of food associated with the increase in maize production.

Households and firms make economic choices and markets coordinate these choices.

Households choose the quantities of labour, land, capital and entrepreneurship to sell or rent to firms in exchange for wages, rent, interest and profit. Households also choose how to spend their incomes on the various types of goods and services available.

Firms choose the quantities of factors of production to hire and the quantities of the various goods and services to produce.

Goods markets and factor markets coordinate these choices of households and firms.

The counterclockwise red flows are real flows – the flow of factors of production from households to firms and the flow of goods and services from firms to households.

The clockwise green flows are the payments for the red flows. They are the flow of incomes from firms to households and the flow of expenditure on goods and services from households to firms.

You can work these questions in Study Plan 2.5 and get instant feedback.

1. Why are social institutions such as firms, markets, property rights and money necessary?
2. What are the main functions of markets?
3. What are the flows in the market economy that go from firms to households and from households to firms?
4. In the circular flows of the market economy, which flows are real flows? Which flows are money flows?

You can work these questions in Study Plan 2.5 and get instant feedback.
The Essence of the Story

◆ In 2006, the UN’s Food and Agriculture Organization expected biofuel to reduce poverty and the EU promoted the use of biofuels to counter climate change.

◆ Farmers around the world switched from producing crops for food to crops for biofuel.

◆ World food prices rose 80 per cent in 3 years and policy advisers say the switch to growing crops for biofuels has reduced the amount of food available, adding to the pressure for food price rises.

◆ The UK’s chief scientist said the prospect of food shortages must be tackled immediately by politicians, scientists and farmers.

The Rising Opportunity Cost of Food

Two years ago the UN’s Food and Agriculture Organization expected biofuels to help eradicate hunger and poverty. . . . Yesterday the UN secretary general, Ban Ki-moon raised real doubt over that policy amid signs that the world was facing its worst food crisis in a generation.

Since . . . 2006 tens of thousands of farmers have switched from food to fuel production. . . . Spurred by generous subsidies and an EU commitment to increase the use of biofuels to counter climate change, at least 8m hectares (20m acres) of maize, wheat, soya and other crops which once provided animal feed and food have been taken out of production in the US. In addition, large areas of Brazil, Argentina, Canada and eastern Europe are diverting . . . crops to biofuels. The result, exacerbated by . . . shortages because of severe weather, has been big increases of all global food commodity prices.

Lester Brown, director of the Earth Policy Institute in Washington, said . . . ‘the US has diverted 60m tonnes of food to fuel. On the heels of seven years of consumption of world grains exceeding supply, this has put a great strain on the world’s grain supplies’.

Robert Zoellick, president of the World Bank, said this week that prices of all staple food had risen 80% in three years, and that 33 countries faced unrest because of the price rises . . . In Bangladesh . . . a government source said: ‘One reason is that the overall drop in food production because of biofuels has prevented food being exported.’ . . .

Last month the UK’s chief scientist and food expert, Professor John Beddington, said the prospect of food shortages over the next 20 years was so acute that politicians, scientists and farmers must tackle it immediately.

Reading Between the Lines
Economic Analysis

- Biofuel is made from maize (and several other crops), so biofuel and food compete to use the same resources.
- To produce more biofuel under UN and EU policy, farmers increased the number of acres devoted to biofuel crop production.
- Increasing the production of crops for biofuel means decreasing the production of crops for food and decreasing the production of other crops.
- Figure 1 shows the EU production possibilities frontier, PPF, for one of the biofuel crops, maize, and other goods and services.
- A movement along the PPF in Figure 1 from point A to point B illustrates the increase in the production of maize and decrease in the production of other goods and services.
- In moving from point A to point B, the EU incurs a higher opportunity cost of producing maize, as the greater slope of the PPF at point B indicates.
- In other regions of the world, despite the fact that more land was devoted to maize production, the amount of maize produced didn’t change in 2007 and 2008.
- The reason is that bad weather lowered the crop yield per hectare in those regions.
- Figure 2 shows the rest of the world’s PPF for maize and other goods and services in 2007 and 2008.
- The increase in the amount of land devoted to producing maize is illustrated by a movement along PPF_{07}.
- With a decrease in the crop yield, production possibilities decreased and the PPF rotated inward.
- The rotation from PPF_{07} to PPF_{08} illustrates this decrease in production possibilities.

The opportunity cost of producing maize in the rest of the world increased for two reasons: the movement along its PPF and the inward rotation of the PPF.

With a higher opportunity cost of producing maize, the cost of both biofuel and food increases.
CHAPTER 2  THE ECONOMIC PROBLEM

SUMMARY

Key Points

Production Possibilities and Opportunity Cost (pp. 30–32)
- The benefit of economic growth is increased future consumption. Working Problem 11 will give you a better understanding of economic growth.
- Gains from Trade (pp. 38–41)
  - A person has a comparative advantage in producing a good if that person can produce the good at a lower opportunity cost than everyone else.
  - People gain by specializing in the activity in which they have a comparative advantage and trading. Working Problems 12 and 13 will give you a better understanding of the gains from trade.

Economic Coordination (pp. 41–43)
- Firms coordinate a large amount of economic activity, but there is a limit to the efficient size of a firm.
- Markets coordinate the economic choices of people and firms.
- Markets can work efficiently only when property rights exist and money makes trading in markets more efficient. Working Problem 14 will give you a better understanding of economic coordination.

Using Resources Efficiently (pp. 33–35)
- Allocative efficiency occurs when goods and services are produced at the least possible cost and in the quantities that bring the greatest possible benefit.
- The marginal cost of a good is the opportunity cost of producing one more unit of it.
- The marginal benefit from a good is the benefit received from consuming one more unit of it and is measured by the willingness to pay for it.
- The marginal benefit of a good decreases as the amount of the good available increases.
- Resources are used efficiently when the marginal cost of each good is equal to its marginal benefit. Working Problems 4 to 10 will give you a better understanding of using resources efficiently.

Economic Growth (pp. 36–37)
- Economic growth, which is the expansion of production possibilities, results from capital accumulation and technological change.
- The opportunity cost of economic growth is forgone current consumption.
- Key Terms
  - Absolute advantage, 38
  - Allocative efficiency, 33
  - Capital accumulation, 36
  - Comparative advantage, 38
  - Economic growth, 36
  - Firm, 41
  - Marginal benefit, 34
  - Marginal benefit curve, 34
  - Marginal cost, 33
  - Market, 42
  - Money, 42
  - Opportunity cost, 31
  - Preferences, 34
  - Production efficiency, 31
  - Production possibilities frontier, 30
  - Property rights, 42
  - Technological change, 36
Production Possibilities and Opportunity Cost (Study Plan 2.1)

Use the following information to work Problems 1 to 3.

Brazil produces ethanol from sugar, and the land used to grow sugar can be used to grow food crops. Suppose that Brazil’s production possibilities for ethanol and food crops are as follows:

<table>
<thead>
<tr>
<th>Ethanol (barrels per day)</th>
<th>Food crops (tonnes per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>64</td>
<td>1</td>
</tr>
<tr>
<td>54</td>
<td>2</td>
</tr>
<tr>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

1. **a** Draw a graph of Brazil’s PPF and explain how your graph illustrates scarcity.
   
   **b** If Brazil produces 40 barrels of ethanol a day, how much food must it produce to achieve production efficiency?
   
   **c** Why does Brazil face a trade-off on its PPF?

2. **a** If Brazil increases its production of ethanol from 40 barrels per day to 54 barrels per day, what is the opportunity cost of the additional ethanol?
   
   **b** If Brazil increases its production of food crops from 2 tonnes per day to 3 tonnes per day, what is the opportunity cost of the additional food?
   
   **c** What is the relationship between your answers to parts (a) and (b)?

3. **a** Does Brazil face an increasing opportunity cost of ethanol? What feature of Brazil’s PPF illustrates increasing opportunity cost?

Using Resources Efficiently (Study Plan 2.2)

Use the table in Problem 1 to work Problems 4 and 5.

4. Define marginal cost and calculate Brazil’s marginal cost of producing a tonne of food when the quantity produced is 2.5 tonnes per day.

5. Define marginal benefit, explain how it is measured, and explain why the data in the table does not enable you to calculate Brazil’s marginal benefit from food.

6. Distinguish between production efficiency and allocative efficiency. Explain why many production possibilities achieve production efficiency but only one achieves allocative efficiency.

Use the following graphs to work Problems 7 to 10.

Harry enjoys tennis but wants a high grade in his economics course. The graphs show his PPF for these two ‘goods’ and his MB curve for tennis.

7. What is Harry’s marginal cost of tennis if he plays for (i) 3 hours a week, (ii) 5 hours a week and (iii) 7 hours a week?

8. **a** If Harry uses his time to achieve allocative efficiency, what is his economics mark and how many hours of tennis does he play?
   
   **b** Explain why Harry would be worse off getting a higher mark than your answer in part (a)?

9. If Harry becomes a tennis superstar with big earnings from tennis, what happens to his PPF, his MB curve and his efficient time allocation?

10. If Harry suddenly finds high marks in economics easier to attain, what happens to his PPF, his MB curve and his efficient time allocation?
Economic Growth (Study Plan 2.3)

11 A farm grows wheat and produces pork. The marginal cost of producing each of these products increases as more of it is produced.
   a Make a graph that illustrates the farm’s PPF.
   b The farm adopts a new technology that allows it to use fewer resources to fatten pigs. On a graph show the impact of the new technology on the farm’s PPF.
   c With the farm using the new technology described in part (b), has the opportunity cost of producing a tonne of wheat increased, decreased or remained the same? Explain and illustrate your answer.
   d Is the farm more efficient with the new technology than it was with the old one? Why?

Gains from Trade (Study Plan 2.4)

12 In an hour, Sue can produce 40 caps or 4 jackets and Tessa can produce 80 caps or 4 jackets.
   a Calculate Sue’s opportunity cost of producing a cap.
   b Calculate Tessa’s opportunity cost of producing a cap.
   c Who has a comparative advantage in producing caps?
   d If Sue and Tessa specialize in producing the good in which each of them has a comparative advantage, and they trade 1 jacket for 15 caps, who gains from the specialization and trade?

13 Suppose that Tessa buys a new machine for making jackets that enables her to make 20 jackets an hour. (She can still make only 80 caps per hour.)
   a Who now has a comparative advantage in producing jackets?
   b Can Sue and Tessa still gain from trade?
   c Would Sue and Tessa still be willing to trade 1 jacket for 15 caps? Explain your answer.

Economic Coordination (Study Plan 2.5)

14 For 50 years, Cuba has had a centrally planned economy in which the government makes the big decisions on how resources will be allocated.
   a Why would you expect Cuba’s production possibilities (per person) to be smaller than those of the EU?
   b What are the social institutions that Cuba might lack that help the EU to achieve allocative efficiency?

Economics in the News (Study Plan 2.N)

Use the following data to work Problems 15 to 17.

Brazil produces ethanol from sugar at a cost of 83 cents per gallon. The US produces ethanol from corn at a cost of $1.14 per gallon. Sugar grown on one acre of land produces twice the quantity of ethanol as the corn grown on an acre. The US imports 5 per cent of the ethanol it uses and produces the rest itself. Since 2003, US ethanol production has more than doubled and US corn production has increased by 45 per cent.

15 a Does Brazil or the US have a comparative advantage in producing ethanol?
   b Sketch the PPF for ethanol and other goods and services for the US.
   c Sketch the PPF for ethanol and other goods and services for Brazil.

16 a Do you expect the opportunity cost of producing ethanol in the US to have increased since 2003? Explain why.
   b Do you think the US has achieved production efficiency in its manufacture of ethanol? Explain why or why not.
   c Do you think the US has achieved allocative efficiency in its manufacture of ethanol? Explain why or why not.

17 Make a graph similar to Figure 2.6 to show how both the US and Brazil gain from specialization and trade.

Use this news clip to work Problems 18 to 20.

Time For Tea

Americans are switching to loose-leaf tea for its health benefits. Tea could be grown in the US, but picking tea leaves would be costly because it can only be done by workers and not by machine.

Source: The Economist, 8 July 2005

18 a Sketch PPFs for the production of tea and other goods and services in India and the US.
   b Sketch marginal cost curves for the production of tea in India and the US.

19 a Sketch the marginal benefit curves for tea in the US before and after Americans began to appreciate the health benefits of loose tea.
   b Explain how the quantity of loose tea that achieves allocative efficiency has changed.
   c Does the change in preferences towards tea affect the opportunity cost of producing tea?

20 Explain why the US does not produce tea and instead imports it from India.
Production Possibilities and Opportunity Cost

Use the following information to work Problems 21 and 22.

<table>
<thead>
<tr>
<th>Sunland’s production possibilities are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food (kilograms per month)</td>
</tr>
<tr>
<td>300</td>
</tr>
<tr>
<td>200</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

21 a Draw a graph of Sunland’s production possibilities frontier.
b If Sunland produces 150 kilograms of food how much sunscreen must it produce if it achieves production efficiency?
c What is Sunland’s opportunity cost of producing 1 kilogram of food?
d What is Sunland’s opportunity cost of producing 1 litre of sunscreen?
e What is the relationship between your answers to parts (c) and (d)?

22 What feature of a PPF illustrates increasing opportunity cost? Explain why Sunland’s opportunity cost does or does not increase.

Using Resources Efficiently

23 In Problem 21, what is the marginal cost of a kilogram of food in Sunland when the quantity produced is 150 kilograms per month? What is special about the marginal cost of food in Sunland?

24 The table describes the preferences in Sunland:

<table>
<thead>
<tr>
<th>Sunscreen (litres per month)</th>
<th>Willingness to pay (kilograms per litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>75</td>
<td>2</td>
</tr>
<tr>
<td>125</td>
<td>1</td>
</tr>
</tbody>
</table>

a What is the marginal benefit from sunscreen and how is it measured?
b Draw a graph of Sunland’s marginal benefit from sunscreen.

Economic Growth

25 Capital accumulation and technological change bring economic growth, which means that the PPF keeps shifting outward: production that was unattainable yesterday becomes attainable today; production that is unattainable today will become attainable tomorrow. Why doesn’t this process of economic growth mean that scarcity is being defeated and will one day be gone?

Gains from Trade

Use the following data to work Problems 26 and 27.

Kim can produce 40 pies or 400 cakes an hour. Liam can produce 100 pies or 200 cakes an hour.

26 a Calculate Kim’s opportunity cost of a pie and Liam’s opportunity cost of a pie.
b If each spends 30 minutes of each hour producing pies and 30 minutes producing cakes, how many pies and cakes does each produce?
c Who has a comparative advantage in producing pies? Who has a comparative advantage in producing cakes?

27 a Draw a graph of Kim’s PPF and Liam’s PPF.
b On your graph, show a point at which each produces when they spend 30 minutes of each hour producing pies and 30 minutes producing cakes.
c On your graph, show what Kim produces and what Liam produces when they specialize.
d When they specialize and trade, what are the total gains from trade?
e If Kim and Liam share the total gains equally, what trade takes place between them?

Using Resources Efficiently

23 In Problem 21, what is the marginal cost of a kilogram of food in Sunland when the quantity produced is 150 kilograms per month? What is special about the marginal cost of food in Sunland?

Economic Coordination

28 Indicate on a graph of the circular flows in the market economy, the real and money flows in which the following items belong:

a You buy an iPad from the Apple Store.
b Apple Inc. pays the designers of the iPad.
c Apple Inc. decides to expand and rents an adjacent building.
d You buy a new e-book from Amazon.
e Apple Inc. hires a student as an intern during the summer.
Economics in the News

29 After you have studied Reading Between the Lines on pp. 44–45 answer the following questions.

a Why might EU climate change policy increase US production of maize?

b Why would you expect an increase in the quantity of US or EU maize production to raise the opportunity cost of maize?

c Why did the cost of producing maize increase in the rest of the world?

d Is it possible that the increased quantity of maize produced, despite the higher cost of production, moves the US closer to allocative efficiency?

30 Malaria Eradication Back on the Table

In response to the Gates Malaria Forum in October 2007, countries are debating the pros and cons of eradication. Dr. Arata Kochi of the World Health Organization believes that with enough money malaria cases could be cut by 90 per cent, but he believes that it would be very expensive to eliminate the remaining 10 per cent of cases. He concluded that countries should not strive to eradicate malaria.


a Is Dr. Kochi talking about production efficiency or allocative efficiency or both?

b Make a graph with the percentage of malaria cases eliminated on the x-axis and the marginal cost and marginal benefit of driving down malaria cases on the y-axis. On your graph:

(i) Draw a marginal cost curve that is consistent with Dr. Kochi’s opinion.

(ii) Draw a marginal benefit curve that is consistent with Dr. Kochi’s opinion.

(iii) Identify the quantity of malaria eradicated that achieves allocative efficiency.

Use the following news clip to work Problem 31.

31 Lots of Little Screens

Inexpensive broadband access has created a generation of television producers for whom the Internet is their native medium. As they redirect the focus from TV to computers, mobile phones, and iPods, the video market is developing into an open digital network.


a How has inexpensive broadband changed the production possibilities of video entertainment and other goods and services?

b Sketch a PPF for video entertainment and other goods and services before broadband.

c Show how the arrival of inexpensive broadband has changed the PPF.

d Sketch a marginal benefit curve for video entertainment.

e Show how the new generation of TV producers for whom the Internet is their native medium might have changed the marginal benefit from video entertainment.

f Explain how the efficient quantity of video entertainment has changed.

Use the following news clip to work Problems 32 to 34.

Britain’s Music Stores Squeezed off the High Street

The article describes trends in music retailing: Sony Music and Amazon selling online, supermarkets selling at low prices, and traditional high street music retailers HMV, Music Zone, and Virgin Megastores all struggling.

Source: The Economist, 20 January 2007

32 Draw the PPF curves for high street music retailers and online music retailers before and after the Internet became available.

33 Draw the marginal cost and marginal benefit curves for high street music retailers and online music retailers before and after the Internet became available.

34 Explain how changes in production possibilities, preferences or both have changed the way in which recorded music is retailed.

Use the following news clip to work Problems 35 and 36.

He Shoots! He Scores! He Makes Films!

All-star basketball player Baron Davis and his school friend, Cash Warren, premiered their first film Made in America at the Sundance Festival in January 2008. The film, based on gang activity in South Central Los Angeles, received good reviews.


35 a Does Baron Davis have an absolute advantage in basketball and film directing and is this the reason for his success in both activities?

b Does Baron Davis have a comparative advantage in basketball or film directing or both and is this the reason for his success in both activities?

36 a Sketch a PPF between playing basketball and producing other goods and services for Baron Davis and for yourself.

b How do you (and people like you) and Baron Davis (and people like him) gain from specialization and trade?