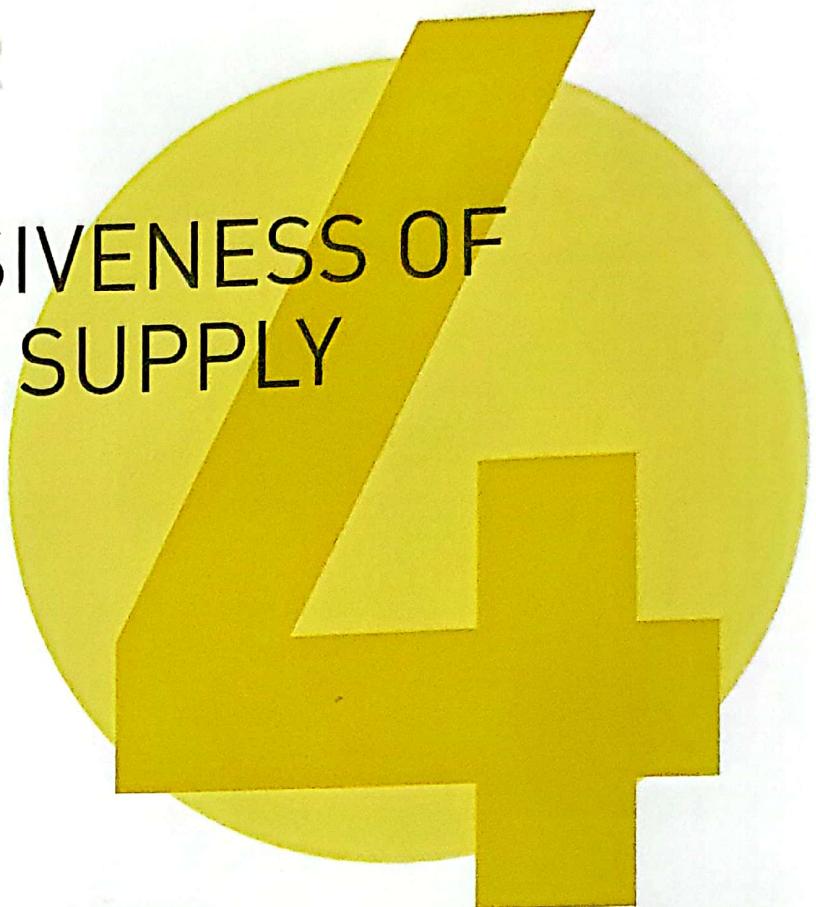


CHAPTER FOUR

ELASTICITY: THE RESPONSIVENESS OF DEMAND AND SUPPLY



LEARNING OBJECTIVES

AFTER STUDYING THIS CHAPTER YOU SHOULD BE ABLE TO:

1. Define price elasticity of demand and understand how to measure it.
2. Understand the determinants of the price elasticity of demand.
3. Understand the relationship between the price elasticity of demand and total revenue.
4. Define cross-price elasticity of demand and income elasticity of demand, and understand their determinants and how they are measured.
5. Use price elasticity and income elasticity to analyse economic issues.
6. Define price elasticity of supply, and understand its main determinants and how it is measured.

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DO PEOPLE CARE ABOUT THE PRICE OF PETROL?



PETROL MAKES UP just over half of all fuels used in domestic transport, followed by diesel at about one-third and liquefied petroleum gas (LPG) at around 6 per cent. Cars account for approximately 52 per cent of fuel used, trucks and light commercial vehicles 33 per cent, aviation 8 per cent and rail around 3 per cent.

Petrol is a necessity for transport, although sometime in the future this may change as alternative sources of energy are developed. As with all necessities, when the price rises the quantity demanded tends not to fall by very much—at least not by the same proportion as the price rise. However, *very large* price increases can have significant effects, and in the case of petrol the effects are not just on the quantity of fuel purchased but also on the types of vehicles purchased and the modes of transport used. According to research by the Department of Infrastructure, Transport, Regional Development and Local Government, between 2003 and 2008 petrol prices in Australia rose by 63 per cent in real terms. In the short term, for every 10 per cent increase in the petrol price the quantity demanded was estimated to have decreased by around 1.5 per cent. While this is not a large response, other effects measured over the five-year period included falls in purchases of 4WDs,

an increase in sales of relatively fuel efficient cars, an increase in the demand for cars running on diesel and gas and, in some cities, an increase in the use of public transport.

However, not everyone has alternatives when the price of fuel rises. In the transport industry, trucks and rail freight cannot cut back on fuel use, and are hard hit by rising fuel costs. Tourism also suffers, with a survey carried out by the Victorian Tourism Industry Council showing that almost two-thirds of regional operators identified rising petrol prices as a critical constraint on their business. Retail sales and business activity are also affected, as higher petrol prices eat into household budgets and lead to a reallocation of spending.

The impact of rising fuel prices, together with the move to lower-emission cars, has impacted on producers of large cars. In 2008 Mitsubishi Motors Australia closed their Adelaide factory due to insufficient sales of their six-cylinder family car. In 2010 the presidents of Australia's two large vehicle manufacturers, Holden and Ford, both stated that the large car industry was in decline, although signalled hopes that future technological developments that are likely to make large cars more fuel efficient and environmentally friendly will stimulate sales in the years to come. In the closely related used car industry, dealers have been struggling to sell six-cylinder and eight-cylinder cars in recent years, citing high petrol prices as the main reason the prices for used large cars have plummeted, while the more fuel efficient four-cylinder cars are holding their value.

SOURCE: Department of Infrastructure, Transport, Regional Development and Local Government (2008), *How Do Fuel Use and Emissions Respond to Price Changes*, Commonwealth of Australia, at <www.bitre.gov.au>, viewed 19 August 2010; Sarah Wotherspoon (2008) 'Petrol prices change how we live', *Herald Sun*, 23 June, at <www.heraldsun.com.au>, viewed 18 August 2010.

WHETHER YOU ARE managing a large or small business, it is essential to know how an increase or decrease in the price of your products will affect the quantity consumers are willing to buy. This will affect your revenue from sales and ultimately profit levels. For example, if a firm is selling sporting equipment, will an increase in the price charged lead to an increase in revenue from sales, or will sales fall significantly, leading to a decrease in sales revenue? Governments also need to know the effect of price changes on quantity demanded. For example, will a tax placed on cigarettes that significantly increases their price discourage smoking? Will an increase in the price of water be an effective means of reducing water consumption or will it have little effect?

We saw in Chapter 3 that reducing the price of a good increases the quantity demanded, and that increasing the price reduces the quantity demanded. But the critical question is this: *How much* will the quantity demanded change as a result of a price increase or decrease? Economists use the concept of **elasticity** to measure how one economic variable—such as the quantity demanded—responds to changes in another economic variable—such as the price. For example, the responsiveness of the quantity demanded of a good to changes in its price is called the *price elasticity of demand*. Knowing the price elasticity of demand allows you to calculate the effect of a price change on the quantity demanded.

We also saw in Chapter 3 that the quantity of a good that consumers demand depends not just on the price of the good but also on consumer income and on the prices of related goods. As a manager, you would also be interested in measuring the responsiveness of demand to these other factors. For example, if the price of petrol rises car manufacturers need to know if the demand for cars, especially large cars, is going to fall and, if so, by how much. They will also need to know if the demand for smaller cars is going to increase. As we will see, we can use the concept of elasticity here as well. We are also interested in the responsiveness of the quantity supplied of a good to changes in its price, which is called the *price elasticity of supply*. For example, even though the price of oil rose significantly in the mid to late 2000s, the quantity of oil supplied did not greatly increase. We will learn about the factors that affect a firm's or an industry's willingness and ability to change the quantity supplied when the price changes.

LEARNING **1** OBJECTIVE

Define price elasticity of demand and understand how to measure it.

Price elasticity of demand

The responsiveness of the quantity demanded to a change in price, measured by dividing the percentage change in the quantity demanded of a product by the percentage change in the product's price.

THE PRICE ELASTICITY OF DEMAND AND ITS MEASUREMENT

We know from the law of demand that when the price of a product falls the quantity demanded of the product increases. But the law of demand tells firms only that the demand curves for their products slope downward. More useful is a measure of the degree of responsiveness of the quantity demanded to a change in price. This measure is called the **price elasticity of demand** (or sometimes own-price elasticity of demand).

MEASURING THE PRICE ELASTICITY OF DEMAND

We can measure the price elasticity of demand using the slope of the demand curve, because the slope of the demand curve tells us how much quantity demanded changes as price changes. Using the slope of the demand curve to measure price elasticity has a drawback, however: the measurement of slope is sensitive to the units chosen for quantity and price. For example, suppose a \$1 decrease in the price of wheat leads to an increase in the quantity of wheat demanded, from 1.1 billion tonnes to 1.2 billion tonnes. The change in quantity is 0.1 billion tonnes and the change in price is -\$1, so the slope is $0.1/-1 = -0.1$. But if we measure price in cents, rather than dollars, the slope is $0.1/-100 = -0.001$. If we measure price in dollars, and wheat in millions of tonnes, the slope is $100/-1 = -100$. Clearly the value we calculate for the slope can change dramatically depending on the units we use for quantity and price.

To avoid this confusion over units economists use percentage changes when measuring the price elasticity of demand. Percentage changes are not dependent on units. (For a review of calculating percentage changes see the appendix to Chapter 1.) No matter what units we use to measure the quantity of wheat, 10 per cent more wheat is 10 per cent more wheat.

Therefore, the price elasticity of demand is measured by dividing the percentage change in the quantity demanded by the percentage change in the price. Or,

$$\text{Price elasticity of demand} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

It's important to remember that *the price elasticity of demand is not the same as the slope of the demand curve*.

If we calculate the price elasticity of demand for a price reduction, the percentage change in price will be negative and the percentage change in quantity demanded will be positive. Similarly, if we calculate the price elasticity of demand for a price increase, the percentage change in price will be positive and the percentage change in quantity will be negative. Therefore, the price elasticity of demand is always negative. In comparing elasticities, though, we are usually interested in their relative size. So we often drop the minus sign and compare their absolute values. In other words, although -3 is actually a smaller number than -2 , a price elasticity of -3 is larger than a price elasticity of -2 .

ELASTIC DEMAND AND INELASTIC DEMAND

If the quantity demanded is responsive to changes in price the percentage change in quantity demanded will be *greater* than the percentage change in price, and the price elasticity of demand will be greater than 1 in absolute value. In this case, we say that demand is **elastic**. For example, if a 10 per cent decrease in the price of bread rolls results in a 20 per cent increase in the quantity of bread rolls demanded, then

$$\text{Price elasticity of demand} = \frac{20\%}{-10\%} = -2$$

and we can conclude that the demand for bread rolls is *elastic*.

When the quantity demanded is not very responsive to price, however, the percentage change in quantity demanded will be *less* than the percentage change in price, and the price elasticity of demand will be less than 1 in absolute value. In this case, we say that demand is **inelastic**. For example, if a 10 per cent decrease in the price of wheat results in a 5 per cent increase in the quantity of wheat demanded, then

$$\text{Price elasticity of demand} = \frac{5\%}{-10\%} = -0.5$$

and we can conclude that the demand for wheat is *inelastic*.

In the special case in which the percentage change in the quantity demanded is equal to the percentage change in price, the price elasticity of demand equals -1 (or 1 in absolute value). In this case, we say that demand is **unit-elastic**.

AN EXAMPLE OF CALCULATING PRICE ELASTICITIES

Suppose you own a small bookshop and you are trying to decide whether to reduce the price you are charging for the new John Grisham mystery novel. You are currently at point *A* in Figure 4.1: selling 16 copies of the novel per day at a price of $\$30$ per copy. How many more copies you will sell by reducing the price to $\$20$ depends on the price elasticity of demand for this novel. Let's consider two possibilities: if D_1 is the demand curve for this novel in your shop, your sales will increase to 28 copies per day, point *B*.

But if D_2 is your demand curve, your sales will increase only to 20 copies per day, point *C*. We might expect—correctly, as we will see—that between these points demand curve D_1 is *elastic* and demand curve D_2 is *inelastic*.

To confirm that D_1 is elastic between these points and that D_2 is inelastic, we need to calculate the price elasticity of demand for each curve. In calculating price elasticity between two points on a demand curve, though, we run into a problem because we get a different

Elastic demand

Demand is elastic when the percentage change in quantity demanded is greater than the percentage change in price, so the price elasticity is greater than 1 in absolute value.

Inelastic demand

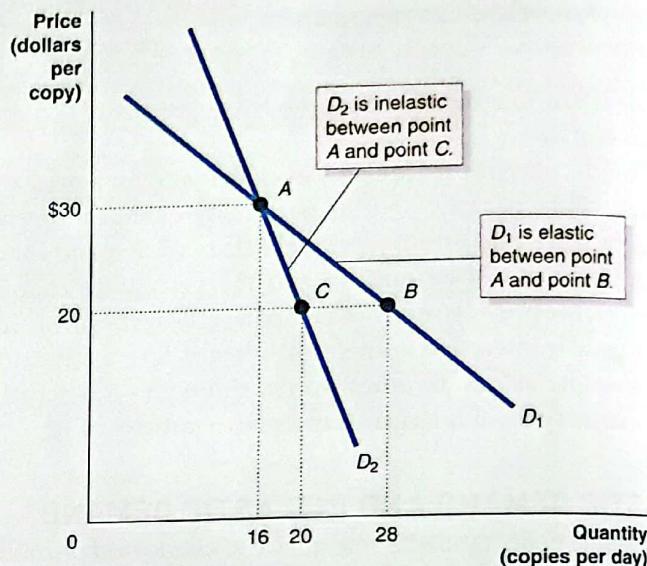
Demand is inelastic when the percentage change in quantity demanded is less than the percentage change in price, so the price elasticity is less than 1 in absolute value.

Unit-elastic demand

Demand is unit-elastic when the percentage change in quantity demanded is equal to the percentage change in price, so the price elasticity is equal to 1 in absolute value.

FIGURE 4.1 ELASTIC AND INELASTIC DEMAND CURVES

Along D_1 , demand is elastic between point A and point B, so reducing the price from \$30 to \$20 increases the number of copies sold from 16 per day to 28 per day. Along D_2 , demand is inelastic between point A and point C, so reducing the price from \$30 to \$20 increases the number of copies sold from 16 per day to only 20 per day



value for price increases than for price decreases. For example, suppose we calculate the price elasticity for D_2 as the price is reduced from \$30 to \$20. This is a 33 per cent price reduction that increases the quantity demanded from 16 books to 20 books, or by 25 per cent. Therefore, the price elasticity of demand between points A and C is $25/-33 = -0.8$. Now let's calculate the price elasticity for D_2 as the price is increased from \$20 to \$30. This is a 50 per cent price increase that decreases the quantity demanded from 20 books to 16 books, or by 20 per cent. So, now our measure of the price elasticity of demand between points A and C is $-20/50 = -0.4$. It can be confusing to have different values for the price elasticity of demand between the same two points on the same demand curve. As we will see in the next section, to avoid this confusion economists often use a particular formula when calculating elasticities.

THE MIDPOINT FORMULA

We can use the *midpoint formula* to ensure that we have only one value of the price elasticity of demand between the same two points on the same demand curve. The midpoint formula uses the *average* of the initial and final quantity and the initial and final price. If Q_1 and P_1 are the initial quantity and price and Q_2 and P_2 are the final quantity and price, the midpoint formula is:

$$\text{Price elasticity of demand} = \frac{(Q_2 - Q_1)}{\left(\frac{Q_1 + Q_2}{2}\right)} \div \frac{(P_2 - P_1)}{\left(\frac{P_1 + P_2}{2}\right)}$$

The midpoint formula may seem challenging at first, but the numerator is just the change in quantity divided by the average of the initial and final quantities, and the denominator is just the change in price divided by the average of the initial and final prices.

Let's apply the formula to calculating the price elasticity of D_2 in Figure 4.1. Between point A and point C on D_2 , the change in quantity is 4 and the average of the two quantities is 18. Therefore, there is a 22.2 per cent change in quantity. The change in price is -\$10 and the average of the two prices is \$25. Therefore, there is a -40 per cent change in price. So the price elasticity of demand is $22.2/-40.0 = -0.6$. Notice the following three results from calculating the price elasticity of demand using the midpoint formula. First, as we suspected from examining Figure 4.1, demand curve D_2 is inelastic between points A and C. Second, our

value for the price elasticity calculated using the midpoint formula is between the two values we calculated earlier. Third, the midpoint formula will give us the same value whether we are moving from the higher price to the lower price, or from the lower price to the higher price.

We can also use the midpoint formula to calculate the elasticity of demand between point *A* and point *B* on D_1 . In this case, there is a 54.5 per cent change in quantity and a -40 per cent change in price. So the price elasticity of demand is $54.5/-40.0 = -1.4$. Once again, as we suspected, demand curve D_1 is price elastic between points *A* and *B*.

SOLVED PROBLEM 4.1 CALCULATING THE PRICE ELASTICITY OF DEMAND FOR WHEAT USING THE MIDPOINT FORMULA

Suppose the following table gives data on the price of wheat and the number of tonnes of wheat sold in 2012 and 2013. Assuming that the demand curve for wheat did not shift between 2012 and 2013, use the information in the table and the midpoint formula to calculate the price elasticity of demand for wheat.

YEAR	PRICE (PER TONNE)	QUANTITY (IN THOUSANDS OF TONNES)
2012	\$300	24 000
2013	\$340	22 000

SOLVING THE PROBLEM

STEP 1: Review the chapter material. This problem requires calculating the price elasticity of demand, so you may want to review the material in the section 'The midpoint formula', which begins on page 94.

STEP 2: As the first step in using the midpoint formula, calculate the average quantity and the average price.

$$\text{Average quantity} = \frac{(24\ 000 + 22\ 000)}{2} = 23\ 000$$

$$\text{Average price} = \frac{(\$300 + \$340)}{2} = \$320$$

STEP 3: Now calculate the percentage change in the quantity demanded and the percentage change in price.

$$\text{Percentage change in quantity demanded} = \frac{(22\ 000 - 24\ 000)}{23\ 000} \times 100 = -8.7\%$$

$$\text{Percentage change in price} = \frac{(\$340 - \$300)}{\$320} \times 100 = 12.5\%$$

STEP 4: Finally, divide the percentage change in the quantity demanded by the percentage change in price to arrive at the correct answer.

$$\text{Price elasticity of demand for wheat} = \frac{-8.7\%}{12.5\%} = -0.7$$

Notice that because this calculation was for a price increase, the percentage change in the quantity demanded was negative and the percentage change in the price was positive.



YOUR TURN

FOR MORE PRACTICE DO RELATED PROBLEM 1 ON PAGE 119
AT THE END OF THIS CHAPTER.

WHEN DEMAND CURVES INTERSECT, THE FLATTER CURVE IS MORE ELASTIC

Remember that elasticity is not the same thing as slope. Slope is calculated using changes in quantity and price, whereas elasticity is calculated using percentage changes. But it is true that when two demand curves intersect, the one with the smaller slope (in absolute value)—the flatter demand curve—is more elastic, and the one with the larger slope (in absolute value)—the steeper demand curve—is less elastic. In Figure 4.1, for a given change in price, demand curve D_1 is more elastic than demand curve D_2 .

POLAR CASES OF PERFECTLY ELASTIC AND PERFECTLY INELASTIC DEMAND

Perfectly inelastic demand

Demand is perfectly inelastic when a change in price results in no change in quantity demanded.

Although they do not occur frequently, you should be aware of the extreme, or polar, cases of price elasticity. If a demand curve is a vertical line it is **perfectly inelastic**. In this case the quantity demanded is completely unresponsive to price changes and the price elasticity of demand equals zero. However much price may increase or decrease, the quantity remains the same. For only a very few products will the quantity demanded be completely unresponsive to the price, making the demand curve a vertical line.

The drug insulin is an example. Many people with diabetes must take a certain amount of insulin each day. If the price of insulin declines it will not affect the required dose and thus will not increase the quantity demanded. Similarly, a price increase will not affect the required dose or decrease the quantity demanded. Therefore the demand curve for insulin is vertical, or perfectly inelastic. (Of course, some people with diabetes will not be able to afford insulin at a higher price. If so, even in this case the demand curve may not be completely vertical and, therefore, not perfectly inelastic.)

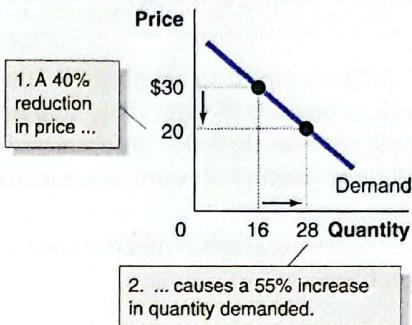
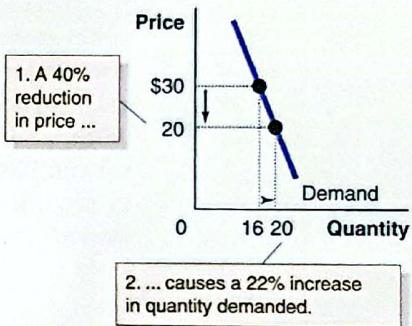
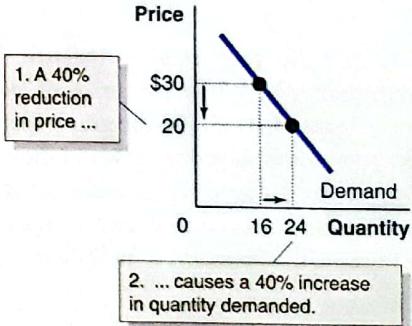
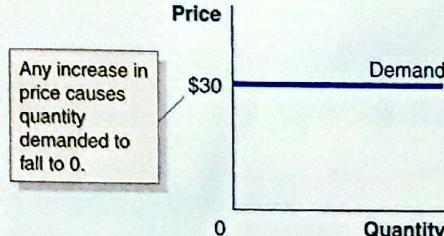
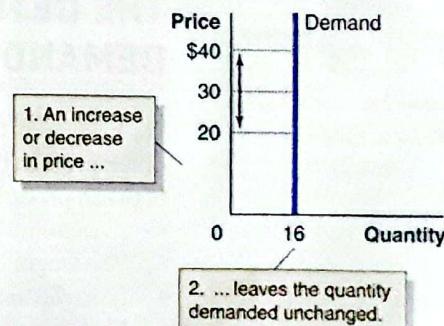
We read in the opening case that when the price of petrol increases, the quantity demanded is not very responsive. Is petrol perfectly inelastic? For many Australians the private car is the only form of transport used, particularly in the outer city suburbs where access to reliable public transport is generally not as good as in the inner city suburbs, and in some rural regions where public transport is non-existent. Clearly petrol is a necessity for transport. Also, the most popular cars have traditionally been large family vehicles such as the Holden Commodore and Ford Falcon. For Australians to reduce demand for petrol would mean significant changes to consumer behaviour and this has led to a view that the demand for petrol is perfectly inelastic—consumers will buy petrol no matter what the cost! However, as the opening case shows, when the price of petrol rises significantly some people move to public transport, fewer people buy large cars in order to reduce petrol consumption and some people will take fewer trips in their cars. It is clear that the demand for petrol is not perfectly inelastic. However, it is also true that although the demand for petrol is not *perfectly* inelastic, it is inelastic. As also shown in the opening case, in the short term a 10 per cent rise in petrol was estimated to lead to a 1.5 per cent fall in the quantity purchased, which indicates a price elasticity of -0.15 , which we know is an inelastic price response.

Perfectly elastic demand

Demand is perfectly elastic when a change in price results in an infinite change in quantity demanded.

If a demand curve is a horizontal line it is **perfectly elastic**. In this case the quantity demanded would be infinitely responsive to price changes and the price elasticity of demand equals infinity. If a demand curve is perfectly elastic, an increase in price causes the quantity demanded to fall to zero. Once again, markets with perfectly elastic demand curves are rare and it is important not to confuse elastic with perfectly elastic. Table 4.1 summarises the different price elasticities of demand.

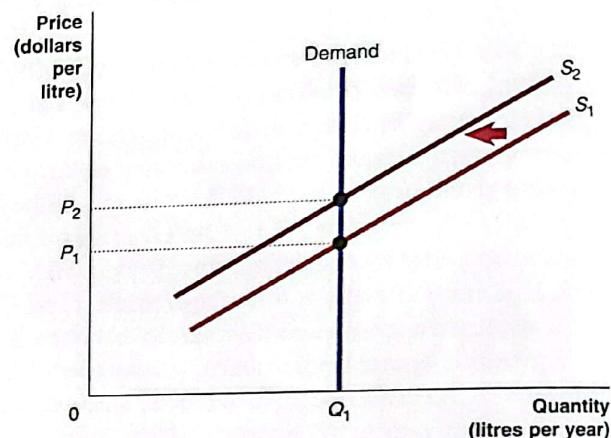
TABLE 4.1 SUMMARY OF THE PRICE ELASTICITIES OF DEMAND

IF DEMAND IS ...	THEN THE ABSOLUTE VALUE OF PRICE ELASTICITY IS									
elastic	greater than 1	 <p>1. A 40% reduction in price ...</p> <p>2. ... causes a 55% increase in quantity demanded.</p> <table border="1"> <thead> <tr> <th>Price</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>\$30</td> <td>16</td> </tr> <tr> <td>20</td> <td>28</td> </tr> </tbody> </table>	Price	Quantity	\$30	16	20	28		
Price	Quantity									
\$30	16									
20	28									
inelastic	less than 1	 <p>1. A 40% reduction in price ...</p> <p>2. ... causes a 22% increase in quantity demanded.</p> <table border="1"> <thead> <tr> <th>Price</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>\$30</td> <td>16</td> </tr> <tr> <td>20</td> <td>20</td> </tr> </tbody> </table>	Price	Quantity	\$30	16	20	20		
Price	Quantity									
\$30	16									
20	20									
unit-elastic	equal to 1	 <p>1. A 40% reduction in price ...</p> <p>2. ... causes a 40% increase in quantity demanded.</p> <table border="1"> <thead> <tr> <th>Price</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>\$30</td> <td>16</td> </tr> <tr> <td>20</td> <td>24</td> </tr> </tbody> </table>	Price	Quantity	\$30	16	20	24		
Price	Quantity									
\$30	16									
20	24									
perfectly elastic	equal to infinity	 <p>Any increase in price causes quantity demanded to fall to 0.</p> <table border="1"> <thead> <tr> <th>Price</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>\$30</td> <td>0</td> </tr> </tbody> </table>	Price	Quantity	\$30	0				
Price	Quantity									
\$30	0									
perfectly inelastic	equal to 0	 <p>1. An increase or decrease in price ...</p> <p>2. ... leaves the quantity demanded unchanged.</p> <table border="1"> <thead> <tr> <th>Price</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>\$40</td> <td>16</td> </tr> <tr> <td>30</td> <td>16</td> </tr> <tr> <td>20</td> <td>16</td> </tr> </tbody> </table>	Price	Quantity	\$40	16	30	16	20	16
Price	Quantity									
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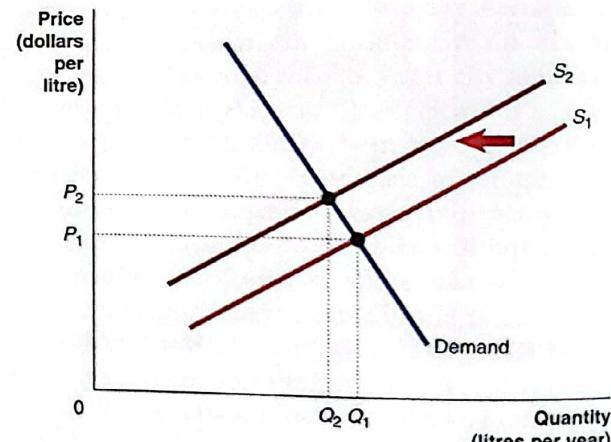
DON'T LET THIS HAPPEN TO YOU DON'T CONFUSE INELASTIC WITH PERFECTLY INELASTIC

You may be tempted to simplify the concept of elasticity by assuming that any demand curve described as being inelastic is *perfectly* inelastic. You should never assume this because perfectly inelastic demand curves are rare. For example, consider the following problem: 'Use a demand and supply graph to show how a decrease in supply affects the equilibrium quantity of petrol. Assume that the demand for petrol is inelastic.'

The following graph would be an *incorrect* answer to this problem.



The demand for petrol is inelastic but it is not perfectly inelastic. When the price of petrol rises the quantity demanded falls. So the graph that would be the correct answer to this problem would show a downward-sloping demand curve rather than a vertical demand curve. The curve should be drawn with a relatively steep slope to show that demand is inelastic.



LEARNING OBJECTIVE

Understand the determinants of the price elasticity of demand.

THE DETERMINANTS OF THE PRICE ELASTICITY OF DEMAND

We have seen that the demand for some products may be elastic, while the demand for other products may be inelastic. In this section we examine why price elasticities differ between products. The key determinants of the price elasticity of demand are as follows:

- Availability of close substitutes
- The length of time involved
- Luxuries versus necessities
- Definition of the market
- Share of expenditure on the good in the consumer's budget.

AVAILABILITY OF CLOSE SUBSTITUTES

The availability of substitutes is the most important determinant of price elasticity of demand because how consumers react to a change in the price of a product depends on what alternatives they have. The other key determinants of the price elasticity of demand that follow in this section are largely based on the availability of substitutes. When the price of petrol rises consumers have few alternatives, so the quantity demanded falls only a little. However, in the market for pizzas, if Domino's raises the price of pizza consumers have many alternative pizza makers they can buy from, so the quantity demanded is likely to fall quite a lot. In fact, a key constraint on a firm's pricing policies is how many close substitutes exist for its product. In general, *if a product has more substitutes available, it will have more elastic demand. If a product has fewer substitutes available, it will have less elastic demand.*

LENGTH OF TIME INVOLVED

It usually takes consumers some time to adjust their buying habits when prices change. If the price of chicken falls it will take a while before consumers decide to change from eating chicken for dinner once a week to eating it twice a week. If the price of petrol increases it will also take a while for consumers to decide to, or be able to, shift towards buying cars that are more fuel efficient, or to find a job closer to where they live, in order to reduce the quantity of petrol they buy. Further, while today there may not be readily available substitutes for a product, over time more substitutes may be developed. For example, alternative energy sources to oil may be more readily available in the future. *The more time that passes, the more elastic the demand for a product becomes.*

THE PRICE ELASTICITY OF DEMAND FOR BREAKFAST CEREAL

Economist Jerry Hausman has estimated the price elasticity of demand for breakfast cereal. He divided breakfast cereals into three categories: children's cereals, such as Froot Loops; adult cereals, such as muesli; and family cereals, such as Sultana Bran. Some of the results of his estimates are given in the following table.

CEREAL	PRICE ELASTICITY OF DEMAND
Sultana Bran	-2.5
All family breakfast cereals	-1.8
All types of breakfast cereals	-0.9

SOURCE: Jerry A. Hausman (1997), 'The price elasticity of demand for breakfast cereal', in Timothy F. Bresnahan and Robert J. Gordon (eds), *The Economics of New Goods*, The University of Chicago Press. Used with permission.

Just as we would expect, the price elasticity for a particular brand of cereal, such as Sultana Bran, was larger in absolute value than the elasticity for all family cereals, and the elasticity for all family cereals was larger than the elasticity for all types of breakfast cereals. Sultana Bran has a price elasticity of demand of -2.5. Therefore, if the price of Sultana Bran increases by 10 per cent sales will decline by 25 per cent as many consumers switch to a similar cereal of bran mixed with sultanas. The price elasticity of demand for all family breakfast cereals is -1.8. Therefore if the prices of all family breakfast cereals rise by 10 per cent sales will drop by 18 per cent as consumers switch to child or adult cereals. In both of these cases demand is elastic. But if the prices of all types of breakfast cereals rise by 10 per cent sales will only decline by 9 per cent as the price elasticity of demand is only -0.9. Demand for all breakfast cereals is, therefore, inelastic.

SOURCE: 'Valuation of New Goods under Perfect and Imperfect Competition', in Timothy F. Bresnahan and Robert J. Gordon (eds), *The Economics of New Goods*, The University of Chicago Press. Used with permission.

4.1 MAKING THE CONNECTION



What happens when the price of cereal rises?

LUXURIES VERSUS NECESSITIES

Goods that are luxuries will usually have more elastic demand curves than goods that are necessities. For example, the demand for milk is inelastic because milk is a necessity for most households and the quantity that people buy is not very dependent on its price. Tickets to a concert are a luxury, so the demand for concert tickets is much more elastic than the demand for milk. *The demand curve for a luxury is more elastic than the demand curve for a necessity.*

DEFINITION OF THE MARKET

In a narrowly defined market consumers will have more substitutes available. If the price of Kellogg's Sultana Bran rises many consumers will start buying another brand of sultana bran. If the prices of all brands of sultana bran increase, the responsiveness of consumers will be lower. If the prices of all breakfast cereals rise, the responsiveness of consumers will be even lower. *The more narrowly we define a market, the more elastic demand will be.*

SHARE OF THE GOOD IN THE CONSUMER'S BUDGET

Goods that take only a small fraction of a consumer's budget tend to have less elastic demand than goods that take a large fraction. For example, most people buy salt infrequently and in relatively small quantities. The share of the average consumer's budget that is spent on salt is very low. As a result, even a 50 per cent increase in the price of salt is likely to result in only a small decline in the quantity of salt demanded. In general, *the demand for a good will be less elastic if purchasing the good involves a small share of the average consumer's budget.*

SOLVED PROBLEM 4.2 USING PRICE ELASTICITY TO ANALYSE THE DRUG PROBLEM

An ongoing policy debate concerns whether to legalise the use of drugs such as marijuana and cocaine. Some researchers estimate that legalising cocaine would cause its price to fall by as much as 95 per cent. Proponents of legalisation argue that legalising drug use would lower crime rates by reducing the incentive for drug addicts to commit robberies and burglaries. Opponents of legalisation argue that lower drug prices would lead more people to use drugs.

1. Suppose the price elasticity of demand for cocaine is -2. If legalisation causes the price of cocaine to fall by 95 per cent, what will be the percentage increase in the quantity of cocaine demanded?
2. If the price elasticity is -0.02, what will be the percentage increase in the quantity demanded?
3. Discuss how the size of the price elasticity of demand for cocaine is relevant to the debate over its legalisation.

SOLVING THE PROBLEM

STEP 1: Review the chapter material. This problem deals with applications of the price elasticity of demand formula, so you may want to review the section 'Measuring the price elasticity of demand,' which begins on page 92.

STEP 2: Answer question 1 using the formula for the price elasticity of demand.

$$\text{Price elasticity of demand} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

We can put into this formula the values we are given for the price elasticity and the percentage change in price:

$$-2 = \frac{\text{percentage change in quantity demanded}}{-95\%}$$

Or, rearranging:

$$\text{Percentage change in quantity demanded} = -2 \times -95\% = 190\%$$

STEP 3: Use the same method to answer question 2. We only need to substitute -0.02 for -2 as the price elasticity of demand:

$$\text{Percentage change in quantity demanded} = -0.02 \times -95\% = 1.9\%$$

STEP 4: Answer question 3 by discussing how the size of the price elasticity of demand for cocaine helps us to understand the effects of legalisation. Clearly, the higher the absolute value of the price elasticity of demand for cocaine, the greater the increase in cocaine use that would result from legalisation. If the price elasticity is as high as in question 1, legalisation will lead to a large increase in use. If, however, the price elasticity is as low as in question 2, legalisation will lead to only a small increase in use.

EXTRA CREDIT: One estimate puts this price elasticity at -0.28 , which suggests that even a large fall in the price of cocaine might lead to only a moderate increase in cocaine use. However, even a moderate increase in cocaine use would have its costs. Some studies have shown that cocaine users are more likely to abuse their children, have higher medical expenses, have a greater likelihood of developing mental illnesses and be less productive workers. Moreover, many people object to the use of cocaine and other narcotics on moral grounds and would oppose legalisation even if it led to no increase in use. Further, if cocaine is legalised there would also be the problematic issue of who would supply the drug, and how it would be supplied. For example, would a licence be required, and would the government regulate the price and the quality of the drug? Ultimately, whether the use of cocaine and other drugs should be legalised is a normative issue. Economics can contribute to the discussion but cannot decide the issue.



YOUR TURN

FOR MORE PRACTICE DO RELATED PROBLEMS 4 AND 5 ON PAGES 119 AND 120 AT THE END OF THIS CHAPTER.

LEARNING **3** OBJECTIVE

Understand the relationship between the price elasticity of demand and total revenue.

Total revenue

The total amount of funds received by a seller of a good or service, calculated by multiplying price per unit by the number of units sold.

THE RELATIONSHIP BETWEEN PRICE ELASTICITY AND TOTAL REVENUE

A firm is interested in price elasticity because it allows the firm to calculate how changes in price will affect its **total revenue**, which is the total amount of funds it receives from selling a good or service. Total revenue is calculated by multiplying the price per unit by the number of units sold. When demand is inelastic, price and total revenue move in the same direction: an increase in price raises total revenue, and a decrease in price reduces total revenue. When demand is elastic, price and total revenue move inversely: an increase in price reduces total revenue, and a decrease in price raises total revenue.

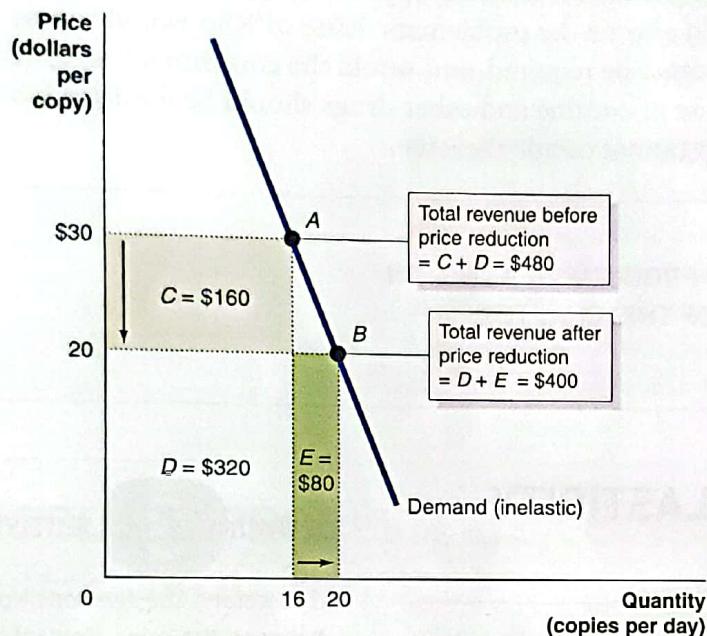
To understand the relationship between price elasticity and total revenue consider Figure 4.2. Panel (a) shows a demand curve for a John Grisham novel (as in Figure 4.1). This demand curve is inelastic between point A and point B. The total revenue received by a bookseller at point A equals the price of \$30 multiplied by the 16 copies sold, or \$480. This amount equals the areas of the rectangles C and D in the figure, because together the rectangles have a height of \$30 and a base of 16 copies. Because this demand curve is inelastic between point A and point B (it was demand curve D_2 in Figure 4.1), reducing the price to \$20 (point B) reduces total revenue. The new total revenue is shown by the areas of rectangles D and E, and it is equal to \$20 multiplied by 20 copies, or \$400. Total revenue falls because the increase in the quantity demanded is not large enough to make up for the decrease in price. As a result, the \$80 increase in revenue gained as a result of the price reduction—dark-green rectangle E—is less than the \$160 in revenue lost—light-green rectangle C.

Panel (b) of Figure 4.2 shows a demand curve that is elastic between point A and point B (it was demand curve D_1 in Figure 4.1). In this case, reducing the price increases total revenue. At point A the areas of rectangles C and D are still equal to \$480, but at point B the areas of rectangles D and E are equal to \$20 multiplied by 28 copies, or \$560. Here, total revenue rises because the increase in the quantity demanded is large enough to offset the lower price. As a result, the \$240 increase in revenue gained as a result of the price reduction—dark-green rectangle E—is greater than the \$160 in revenue lost—light-green rectangle C.

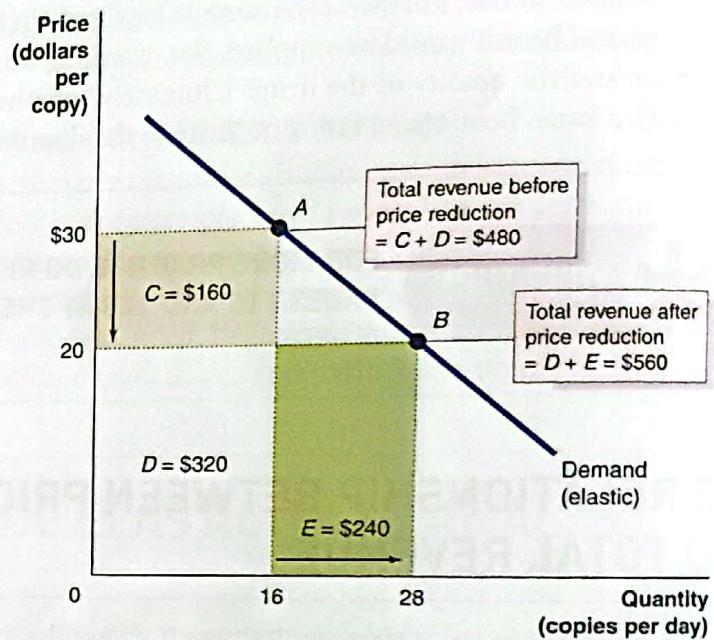
The third, less common possibility is that demand is unit-elastic. In that case a change in price is exactly offset by a proportional change in quantity demanded, leaving revenue unaffected.

FIGURE 4.2 THE RELATIONSHIP BETWEEN PRICE ELASTICITY AND TOTAL REVENUE

When demand is inelastic a reduction in price will decrease total revenue. In panel (a), at point A the price is \$30, 16 copies are sold and total revenue received by the bookseller equals $\$30 \times 16$ copies, or \$480. At point B, reducing the price to \$20 increases the quantity demanded to 20 copies, but the fall in price more than offsets the increase in quantity. As a result, revenue falls to $\$20 \times 20$ copies, or \$400. When demand is elastic a reduction in price will increase total revenue. In panel (b), at point A the area of rectangles C and D is still equal to \$480. But at point B the area of rectangles D and E is equal to $\$20 \times 28$ copies, or \$560. In this case the increase in the quantity demanded is large enough to offset the fall in price, so total revenue increases



(a) Reducing the price when demand is inelastic reduces total revenue



(b) Reducing the price when demand is elastic Increases total revenue

Therefore, when demand is unit-elastic neither a decrease in price nor an increase in price affects revenue. Table 4.2 summarises the relationship between price elasticity and revenue.

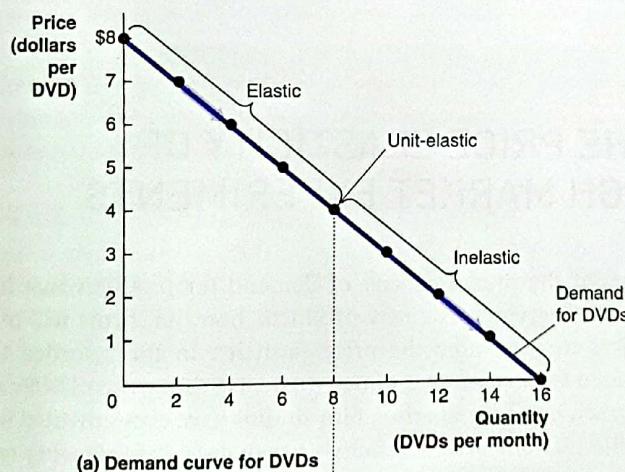
ELASTICITY AND REVENUE WITH A LINEAR DEMAND CURVE

Along most demand curves, elasticity is not constant at every point. For example, a straight-line, or linear, demand curve for rentals of DVDs is shown in panel (a) of Figure 4.3. The numbers from the table are plotted in the graphs. The demand curve shows that when the price falls by \$1 consumers always respond by renting two more DVDs per month. When the price is high and the quantity demanded is low, demand is elastic. This is true because a \$1 fall in price is a smaller percentage change when the price is high, and an increase of two DVD rentals is a larger percentage change when the quantity of DVD rentals is small. By similar reasoning, we can see why demand is inelastic when the price is low and the quantity demanded is high.

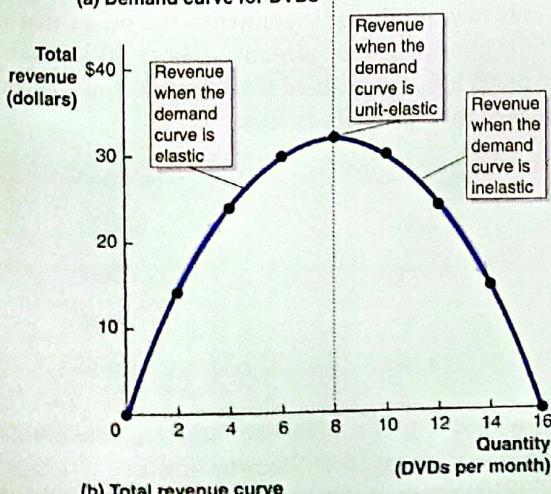
Panel (a) in Figure 4.3 shows that when the rental price is between \$8 and \$4 and quantity demanded is between 0 and 8, demand is elastic. Panel (b) shows that over this same range total revenue will increase as the rental price falls. For example, in panel (a), as price falls from \$7 to \$6, quantity demanded increases from 2 to 4, and in panel (b) total revenue increases from \$14 to \$24. Similarly, when price is between \$4 and zero and quantity demanded is between 8 and 16, demand is inelastic. Over this same range total revenue decreases as price falls. For example, as price falls from \$3 to \$2, quantity demanded increases from 10 to 12 and total revenue decreases from \$30 to \$24.

TABLE 4.2 THE RELATIONSHIP BETWEEN PRICE ELASTICITY AND REVENUE

IF DEMAND IS ...	THEN ...	BECAUSE ...
elastic	an increase in price reduces revenue	the decrease in quantity demanded is proportionally greater than the increase in price
elastic	a decrease in price increases revenue	the increase in quantity demanded is proportionally greater than the decrease in price
inelastic	an increase in price increases revenue	the decrease in quantity demanded is proportionally smaller than the increase in price
inelastic	a decrease in price reduces revenue	the increase in quantity demanded is proportionally smaller than the decrease in price
unit-elastic	an increase in price does not affect revenue	the decrease in quantity demanded is proportionally the same as the increase in price
unit-elastic	a decrease in price does not affect revenue	the increase in quantity demanded is proportionally the same as the decrease in price

FIGURE 4.3 ELASTICITY IS NOT CONSTANT ALONG A LINEAR DEMAND CURVE

The data from the table are plotted in the graphs. Panel (a) shows that as we move down the demand curve for DVD rentals the price elasticity of demand declines. In other words, at higher prices demand is elastic and at lower prices demand is inelastic. Panel (b) shows that as the quantity of DVDs rented increases from zero, revenue will increase until it reaches a maximum of \$32 when eight DVDs are rented. As rentals increase beyond eight DVDs, revenue falls because demand is inelastic on this portion of the demand curve



Price	Quantity demanded	Total revenue
\$8	0	\$0
7	2	14
6	4	24
5	6	30
4	8	32
3	10	30
2	12	24
1	14	14
0	16	0

SOLVED PROBLEM 4.3 PRICE AND REVENUE DON'T ALWAYS MOVE IN THE SAME DIRECTION

Briefly explain whether you agree or disagree with the following statement: 'The only way to increase the revenue from selling a product is to increase the product's price.'

SOLVING THE PROBLEM

STEP 1: Review the chapter material. This problem deals with the effect of a price change on a firm's revenue, so you may want to review the section 'The relationship between price elasticity and total revenue,' which begins on page 101.

STEP 2: Analyse the statement. We have seen that a price increase will increase revenue only if demand is inelastic. In Figure 4.3, for example, increasing the rental price of DVDs from \$1 to \$2 increases revenue from \$14 to \$24 because demand is inelastic along this portion of the demand curve. But increasing the price from \$5 to \$6 decreases revenue from \$30 to \$24 because demand is elastic along this portion of the demand curve. If the price is currently \$5, increasing revenue would require a price reduction, not a price increase. As this example shows, the statement is incorrect and you should disagree with it.



YOUR TURN

FOR MORE PRACTICE DO RELATED PROBLEM 7 ON PAGE 120 AT THE END OF THIS CHAPTER.

4.2

MAKING THE CONNECTION



When DVDs and Blu-ray discs were first introduced movie studios were uncertain of their price elasticity of demand

DETERMINING THE PRICE ELASTICITY OF DEMAND THROUGH MARKET EXPERIMENTS

Firms usually have a good idea of the price elasticity of demand for products that have been on the market for at least a few years. For new products, however, firms will often experiment with different prices to determine the price elasticity. In the recorded film industry new formats have entered the market over time—first VHS tapes, then DVDs and most recently Blu-ray discs. As each new format arose, film studios have experimented with different prices to determine the relevant price elasticity of demand. The following table is from 2001, when DVDs were relatively new products. It compares the prices that film studios suggested retailers charge for four films that were available in both DVD and VHS tape formats. The prices of DVDs were much less standardised than the prices of VHS tapes because the different studios were unsure of their price elasticities.

FILM	DVD PRICE	VHS PRICE
<i>Rugrats in Paris</i>	\$22.46	\$22.99
<i>The Mummy Returns</i>	26.98	22.98
<i>Miss Congeniality</i>	16.69	22.98
<i>The Perfect Storm</i>	24.98	22.99

After several years of market experiments the film studios had more accurate estimates of the price elasticity of DVDs, and the prices of most DVDs became similar.

Both the film studios and retailers engaged in similar experimentation after the introduction of Blu-ray discs in 2006. At first the studios were convinced that consumers would pay substantially more for Blu-ray discs than for DVDs because of the superior image

quality. However, by the end of 2008 it had become clear that the price elasticity of demand for Blu-ray discs was significantly higher than had been expected. At that point Blu-ray discs had captured only 8 per cent of the market with conventional DVDs accounting for the other 92 per cent. By early 2012 the average price of Blu-ray discs had fallen by between \$2 and \$6 and the average market share reached 15 per cent.

SOURCE: Prices from Amazon.com; Home Media Magazine (2012), 'Weekly Sales Report' (various), *Home Media Research*, at <www.homediamagazine.com>, viewed 13 February 2012; Matthew Panton (2008), 'Blu-ray market share on the decline?', *Crave*, 26 September 2008, at Cnet News, at <news.cnet.com/crave>, viewed 18 August 2010.

ESTIMATING PRICE ELASTICITY OF DEMAND

To estimate the price elasticity of demand economists need to know the demand curve for a product. Economists generally use statistical methods to estimate the demand curve for a product and the price elasticity of demand. When trying to calculate the price elasticity of demand for new products, however, firms often rely on market experiments. With market experiments, firms will try different prices and observe the change in quantity demanded that results.

OTHER DEMAND ELASTICITIES

Elasticity is an important concept in economics because it allows us to quantify the responsiveness of one economic variable to changes in another economic variable. In addition to price elasticity, two other demand elasticities are important: *cross-price elasticity of demand* and *income elasticity of demand*.

CROSS-PRICE ELASTICITY OF DEMAND

Suppose you work at Apple and you need to predict the effect of an increase in the price of Microsoft's MP3 players on the quantity of iPods demanded, holding all other factors constant. You can do this by calculating the **cross-price elasticity of demand**, which is the percentage change in the quantity of iPods demanded divided by the percentage change in the price of Microsoft's MP3 players—or, in general:

$$\text{Cross-price elasticity of demand} = \frac{\text{percentage change in quantity demanded of one good}}{\text{percentage change in price of another good}}$$

The cross-price elasticity of demand will be positive or negative depending on whether the two products are substitutes or complements. Recall that substitutes are products that can be used for a similar purpose, such as two brands of digital music players. Complements are products that are used together, such as MP3 players and music downloads from online music sites, or petrol and cars. An increase in the price of a substitute will lead to an increase in quantity demanded of the first good, so the cross-price elasticity of demand will be positive. An increase in the price of a complement will lead to a decrease in the quantity demanded of the first good, so the cross-price elasticity of demand will be negative. Of course, if the two products are unrelated, such as MP3 players and peanut butter, the cross-price elasticity of demand will be zero. Table 4.3 summarises the key points concerning the cross-price elasticity of demand.

Cross-price elasticity of demand is important to managers because it allows them to measure whether products sold by other firms are close substitutes for their products. For example, Dymocks is one of the leading booksellers in Australia. Large stores such as Kmart also sell books but usually only best sellers and at discount prices. We might predict that if Dymocks increases the price of a new John Grisham novel many consumers will buy it from Kmart instead. Therefore the cross-price elasticity between Dymocks books and Kmart's

LEARNING **4** OBJECTIVE

Define cross-price elasticity of demand and income elasticity of demand, and understand their determinants and how they are measured.

Cross-price elasticity of demand

The percentage change in quantity demanded of one good divided by the percentage change in the price of another good.

TABLE 4.3 SUMMARY OF CROSS-PRICE ELASTICITY OF DEMAND

IF THE PRODUCTS ARE ...	THEN THE CROSS-PRICE ELASTICITY OF DEMAND WILL BE ...	EXAMPLE
substitutes	positive	Two brands of digital music players
complements	negative	Digital music players and song downloads from online music stores.
unrelated	zero	Digital music players and peanut butter

books would be high. But some might argue that because of Dymocks' reputation for good customer service and because more customers are familiar with their stores, buying a book from Kmart is not a good substitute for buying a book from Dymocks. In effect, this is arguing that the cross-price elasticity between Dymocks' books and Kmart's books is low.

Cross-price elasticity of demand is also important to managers because it allows them to predict the effect on the demand for their product if the price of a complement for their product changes. For example, if the price of computers increased significantly, software producers would probably find that the demand for software falls. The pricing behaviour of firms producing products complementary to each other is crucial for production decisions and sales levels. In some cases firms will produce both products, which reduces their dependence on the pricing decisions of other firms. For example, Sony Corporation produces DVD and Blu-ray players and the complementary DVDs and Blu-ray discs; MP3 players and music downloads; video games (PlayStation) and televisions, along with a number of other complementary electronic products.

INCOME ELASTICITY OF DEMAND

Income elasticity of demand
A measure of the responsiveness of quantity demanded to changes in income, measured by the percentage change in quantity demanded divided by the percentage change in income.

The **income elasticity of demand** measures the responsiveness of quantity demanded to changes in income. When measuring income we usually use *disposable income*, which is consumer income after income taxation has been paid to the government. Income elasticity of demand is calculated as follows:

$$\text{Income elasticity of demand} = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

As we saw in Chapter 3, if the quantity demanded of a good increases as income increases, then the good is a *normal good*. Normal goods are often further subdivided into *luxury goods* and *necessity goods*. A good is a luxury if the quantity demanded is very responsive to changes in income, so that a 10 per cent increase in income results in more than a 10 per cent increase in quantity demanded. The calculated income elasticity of demand is greater than 1 for luxury goods. Expensive jewellery or holiday homes are examples of luxuries. A good is a necessity if the quantity demanded is not very responsive to changes in income, so that a 10 per cent increase in income results in less than a 10 per cent increase in quantity demanded. The calculated income elasticity of demand is between 0 and 1 for necessity goods. Food and clothing are examples of necessities. A good is *inferior* if the quantity demanded falls when income increases. Beef mince with a high fat content is an example of an inferior good. The calculated income elasticity of demand for an inferior good is negative. We should note that the terms 'normal good', 'inferior good', 'necessity' and 'luxury' are just labels economists use for goods with differing income elasticities; the labels are not intended to be value judgments about the worth of these goods.

Because most goods are normal goods, during periods of economic expansion when consumer income is rising most firms can expect—holding all other factors constant—that the quantity demanded of their products will increase. Sellers of luxuries can expect particularly large increases. During the last two decades strong increases in income for most Australians resulted in large increases in demand for luxuries, such as meals in restaurants, apartments and travel. During recessions or economic downturns, falling consumer income can cause firms to experience increases in demand for inferior goods. Supermarkets will find

that the demand for mince will increase relative to the demand for steak. The demand for local holidays may also increase as consumers cut back on international holidays. Table 4.4 summarises the key points about income elasticity.

TABLE 4.4 SUMMARY OF INCOME ELASTICITY OF DEMAND

IF THE INCOME ELASTICITY OF DEMAND IS ...	THEN THE GOOD IS ...	EXAMPLE
positive, but less than 1	normal and a necessity	milk
positive and greater than 1	normal and a luxury	caviar
negative	inferior	high-fat mince

PRICE ELASTICITY, CROSS-PRICE ELASTICITY AND INCOME ELASTICITY IN THE MARKET FOR ALCOHOLIC BEVERAGES

Many public policy issues are related to the consumption of alcoholic beverages, for example policies relating to under-age drinking, binge drinking and driving while drunk. Australian economists have estimated the relevant elasticities of demand for Australia. Information on price and income elasticities enables policy makers to predict better the impact of new taxes on alcohol or changes in consumer income levels on the quantity of alcoholic beverages consumed.

PRODUCT	ELASTICITY
Price elasticity of demand for beer	-0.82
Price elasticity of demand for wine	-0.82
Cross-price elasticity of demand between beer and wine	-0.54
Income elasticity of demand for beer	1.04
Income elasticity of demand for wine	1.25

The demand for beer and wine are both price inelastic with elasticities of -0.82. The cross-price elasticity of demand between beer and wine is negative showing that beer and wine are complements—as the price of beer goes up demand for both beer and wine go down. Beer has virtually unitary income elasticity of demand but for wine this is greater than 1, indicating that wine is a luxury good.

4.3 MAKING THE CONNECTION



Is wine a luxury good?

USING ELASTICITY TO ANALYSE THE DISAPPEARING FAMILY FARM

The concepts of price elasticity and income elasticity can help us understand many economic issues. For example, some people are concerned that the family farm is becoming an endangered species in Australia. Although food production continues to grow rapidly

LEARNING 5 OBJECTIVE

Use price elasticity and income elasticity to analyse economic issues.

the number of farms continues to dwindle. In 1960 there were approximately 202 800 farms in Australia but by 2012 the number has decreased to approximately 130 000 farms. Rapid productivity growth in farm production has combined with low price and income elasticities for most food products to make family farming difficult in Australia.

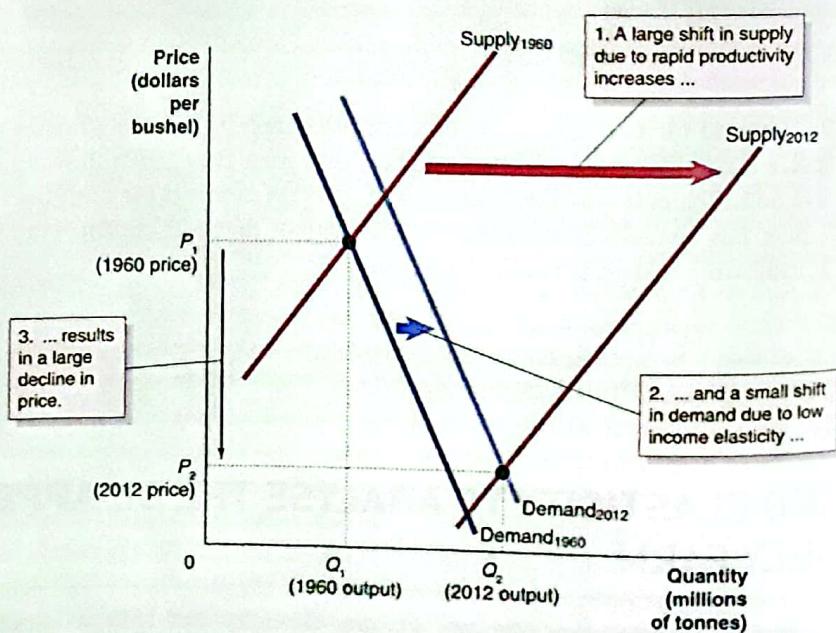
As we saw in Chapter 3, productivity measures the ability of firms to produce goods and services with a given amount of economic inputs, such as workers, machines and land. Productivity has grown very rapidly in agriculture throughout the world. Sources of increased productivity in Australia include improved cultivation practices such as minimum till and direct drill (which conserve moisture in the soil), the development of higher yielding crop varieties, better use of crop rotations, greater and more efficient use of fertiliser, scientific breeding practices and higher owner/operator education levels.

Unfortunately for Australian farmers this increase in production resulted in a substantial decline in prices. As we learned in Chapter 2, an increase in supply shifts the supply curve rightwards, leading to a lower equilibrium price. Two key factors explain this decline in prices: (1) the demand for agricultural products is price inelastic and (2) the income elasticity of demand for agricultural products is low. Even though the world's population has increased greatly since 1960 and the income of most households is much higher than it was in 1960, the demand for agricultural produce has increased only moderately. For all of the additional output to be sold, the price has had to decline. Because the demand for agricultural produce is price inelastic the price decline has been substantial. Figure 4.4 illustrates these points, using the example of the production of wheat in Australia.

A large shift in supply, a small shift in demand and an inelastic demand curve combined to drive down the price of wheat. With low prices, only the most efficiently run farms have been able to remain profitable. Smaller, family-run farms have found it difficult to survive, and many of these farms have disappeared. The markets for most food products are similar to the market for wheat. They are also characterised by rapid output growth, and low income and price elasticities. The result is the paradox of Australian farming: ever more abundant and cheaper food, supplied by fewer and fewer farms. Australian and overseas consumers have benefited, but most family farmers have not.

FIGURE 4.4 ELASTICITY AND THE DISAPPEARING FARM

In 1960 Australian farmers produced a significantly smaller volume of wheat than in 2012. Rapid increases in farm productivity caused a large shift to the right in the supply curve of wheat. The income elasticity of demand for wheat is low, so the demand for wheat increased relatively little over this period. Because the demand for wheat is also price inelastic, the large shift in the supply curve and the small shift in the demand curve resulted in a sharp decline in the price of wheat over this period



THE PRICE ELASTICITY OF SUPPLY AND ITS MEASUREMENT

We can use the concept of elasticity to measure the responsiveness of firms to a change in price, just as we used it to measure the responsiveness of consumers. We know from the law of supply that when the price of a product increases the quantity supplied increases. To measure by how much quantity supplied increases when price increases we use the *price elasticity of supply*. For example, by how much will, or can, the quantity supplied of iron-ore rise if strong overseas demand pushes the price of iron-ore higher? Or, if a restaurant has increased in popularity and can charge higher prices as a result, can the manager supply more customer service through hiring more waiters and kitchen staff?

MEASURING THE PRICE ELASTICITY OF SUPPLY

Just as with the price elasticity of demand, we calculate the **price elasticity of supply** using percentage changes:

$$\text{Price elasticity of supply} = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}}$$

Notice that because supply curves are upward sloping the price elasticity of supply will be a positive number. We categorise the price elasticity of supply the same way we categorised the price elasticity of demand. If the price elasticity of supply is less than 1 then supply is *inelastic*. For example, the supply of many agricultural products in Australia is price inelastic, particularly for time periods of two years or less. If we assume that the price of wool increases by 10 per cent and in response the quantity supplied increases by 2 per cent, then

$$\text{Price elasticity of supply} = \frac{2\%}{10\%} = 0.2$$

and we can conclude that the supply of wool in Australia is *inelastic*.

If the price elasticity of supply is greater than 1 then supply is *elastic*. For example, if the price of petrol increases before the weekend or a holiday period, the quantity supplied by petrol service stations is likely to be price elastic, as they are likely to have fuel in storage tanks or can order further deliveries of fuel from the refineries in a relatively short period of time. If the price elasticity of supply is equal to 1 then supply is *unit-elastic*. As with other elasticity calculations, when we calculate the price elasticity of supply we hold the values of other factors constant.

DETERMINANTS OF THE PRICE ELASTICITY OF SUPPLY

Whether supply is elastic or inelastic depends on the ability and willingness of firms to alter the quantity they produce as price increases. In Chapter 3 we saw that the higher the price the more profitable it is for firms to produce, and therefore the greater the quantity they are willing to supply. The major determinant of the price elasticity of supply is the amount by which production costs rise as output levels rise. It is this determinant that the other key determinants of the price elasticity of supply discussed in this section are largely based upon. If costs increase significantly as a greater quantity is produced, firms will want greater increases in prices in order to induce them to increase quantity supplied. This would therefore be an inelastic supply response. On the other hand, if extra output can be produced for relatively small increases in production costs, firms will only require small increases in price to induce them to supply a greater quantity. Therefore this is an elastic supply response.

LEARNING OBJECTIVE

Define price elasticity of supply, and understand its main determinants and how it is measured.

Price elasticity of supply

The responsiveness of the quantity supplied to a change in price, measured by dividing the percentage change in the quantity supplied of a product by the percentage change in the product's price.

The key determinants of the price elasticity of supply, many of which are interrelated, are as follows:

- Length of time involved
- Type of industry
- Availability of inputs
- Existing capacity
- Inventories held.

LENGTH OF TIME INVOLVED Firms often have difficulty increasing the quantity of the product they supply during any short period of time. For example, a pizza parlour cannot produce more pizzas on any one night than is possible using the ingredients on hand. Within a day or two it can buy more ingredients, and within a few months it can hire more cooks and install additional ovens. A mining company cannot immediately increase the quantity of minerals supplied, as its ability to do so depends on whether it is fully utilising existing equipment, whether it can hire the necessary staff or, in the longer term, whether exploration can discover more minerals. As a result, the supply curve for most products will tend to be inelastic if we measure it over a short period of time, and in the example of minerals perhaps much longer.

TYPE OF INDUSTRY Closely related to the time period involved is the type of industry. The characteristics of some industries enable them to change the quantity supplied quite quickly, while for other industries this is not possible. For example, the quantity of agricultural produce that can be supplied cannot be changed quickly as crops take time to grow and animals take time to breed, whereas some manufacturing industries may be able to increase the quantity supplied relatively quickly by operating machinery for additional hours.

AVAILABILITY OF INPUTS Some goods and services require resources that are themselves in fixed supply. For example, a French winery may rely on a particular variety of grape. If all the land on which that grape can be grown is already planted in vineyards, then the supply of that wine will be price inelastic in the short term and over a long period. In terms of resource availability, some producers may be able to divert resources from the production of one product into the production of another, enabling a more elastic supply response. Or, if new workers can be hired or existing workers can learn new skills, supply may also be relatively price elastic. However, in some industries it takes many years to train workers, such as over six years for doctors, and skilled migration can take years. Therefore supply in these industries will be price inelastic, particularly over the short to medium term. Further, if skilled labour shortages exist, as has often been the case in Australia, or important raw materials become increasingly scarce, firms will be faced with rising input and production costs as they attempt to increase their output levels. This will reduce their willingness and/or ability to increase the quantity supplied even if output prices rise.

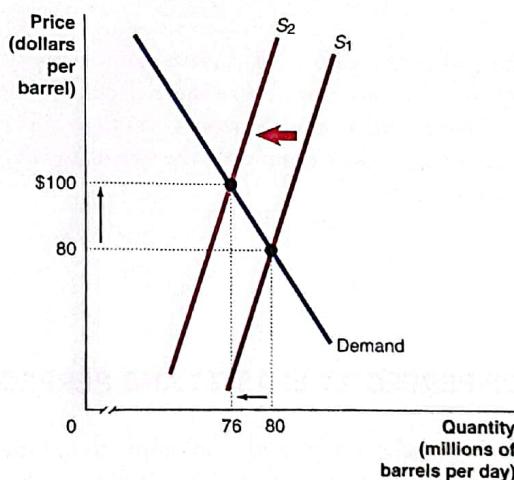
EXISTING CAPACITY Some products are elastic, even in the short run. If a firm has excess production capacity—machines that could be operated for a longer period of time—or has stock in storage, then the quantity supplied may be able to be changed quite quickly. For example, car manufacturers commonly increase or decrease the number of hours their production line machinery operates for, in line with increases or decreases in consumer demand, whereas a mining company that is already operating at full capacity will not be able to increase supply for many years, as this will involve exploration, acquiring legal permits, raising finance and setting up the mining operation.

INVENTORIES HELD Holding inventories is costly, as this involves storage premises and keeping stock that is currently not generating revenue from sales. Further, some firms and industries are able to hold inventories—stocks—in reserve while others cannot. Supermarkets hold stocks in warehouses enabling them to refill store shelves quickly if sales suddenly increase. But if the demand for perishable items such as fresh lettuces and carrots unexpectedly rose, these are not products that can be kept in storage for very long, and a quick supply response is not likely.

WHY ARE OIL PRICES SO UNSTABLE?

Bringing oil to market is a long process. Oil companies hire geologists to search for oil. Once a likely field has been found the company will drill an exploratory well. If the exploratory well indicates that significant amounts of oil are present then full-scale development of the field can begin. The whole process from exploration to pumping significant amounts of oil can take years. Because it takes so long to bring additional quantities of oil to market, the price elasticity of supply for oil is very low (inelastic). Substitutes are limited for oil-based products—such as petrol—so the price elasticity of demand for oil is also low (inelastic).

As the following graph shows, the combination of inelastic supply and inelastic demand results in shifts in supply causing large changes in price. In the graph, a reduction in supply that shifts the market supply curve from S_1 to S_2 causes the equilibrium quantity of oil to fall by 5 per cent, from 80 million barrels per day to 76 million, but the equilibrium price rises by 25 per cent, from US\$80 per barrel to US\$100 per barrel.

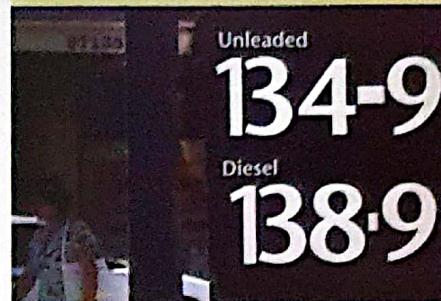


The world oil market is heavily influenced by the Organization of Petroleum Exporting Countries (OPEC). OPEC has 12 members, including Saudi Arabia, Kuwait and other Arab countries, as well as Iran, Venezuela, Nigeria and Indonesia. Together these countries own 75 per cent of the world's proven oil reserves. Periodically, OPEC has attempted to force up the price of oil by reducing the quantity of oil its members supply. However, these attempts have been successful only sporadically: periods during which OPEC members cooperate and reduce supply alternate with periods in which the members fail to cooperate and supply increases. As a result, the supply curve for oil shifts fairly frequently. Combined with the low price elasticities of oil supply and demand, these shifts in supply have caused the price of oil to fluctuate significantly over the past 40 years.

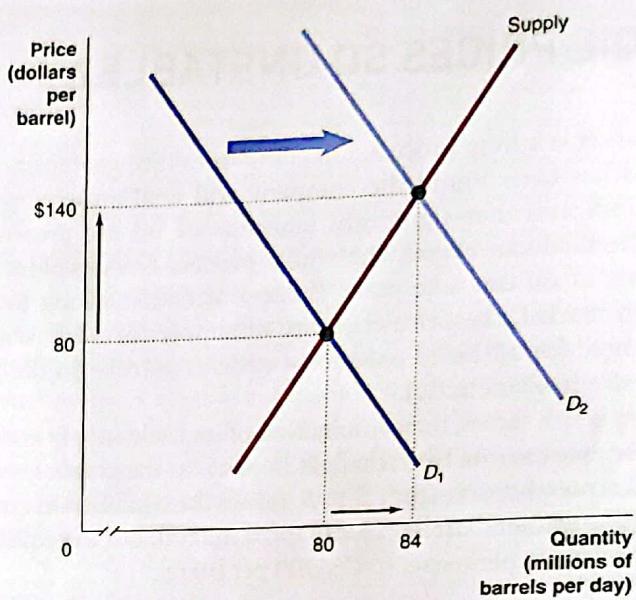
During the period from 2003 to mid-2008, the worldwide demand for oil increased rapidly as India, China and some other developing countries increased both their manufacturing production and their use of motor vehicles. As the following graph shows, when supply is inelastic an increase in demand can cause a large increase in price. In the graph, the shift in demand from D_1 to D_2 causes the equilibrium quantity of oil to increase by only 5 per cent, from 80 million barrels per day to 84 million, but the equilibrium price rises by 75 per cent, from US\$80 per barrel to US\$140 per barrel.

4.4

MAKING THE CONNECTION



Why do oil prices, as reflected in the price of petrol, fluctuate so much?



By mid-2008, the global financial crisis caused many economies to experience severe economic downturns or recessions, and led to a sharp decline in the demand for oil. Within a few months, the equilibrium price of oil fell from US\$140 to US\$40 per barrel! Once again, the extent of the price change reflected not only the size of the decline in demand but also oil's low price elasticity of supply.

POLAR CASES OF PERFECTLY ELASTIC AND PERFECTLY INELASTIC SUPPLY

Although it occurs infrequently, it is possible for supply to fall into one of the polar cases of price elasticity. If a supply curve is a vertical line it is *perfectly inelastic*. In this case the quantity supplied is completely unresponsive to price changes and the price elasticity of supply equals zero. Regardless of how much price may increase or decrease, the quantity remains the same. Over a brief period of time the supply of some goods and services may be perfectly inelastic. For example, a car park may have only a fixed number of parking spaces. If demand increases, the price to park in the car park may rise but no more spaces will become available. Of course, if demand increases permanently, over a longer period of time the owner of the car park may decide to buy more land to add additional spaces. However, in the case of a particular original painting by Claude Monet or Leonardo da Vinci, supply of the painting is perfectly inelastic.

If a supply curve is a horizontal line it is *perfectly elastic*. In this case the quantity supplied is infinitely responsive to price changes and the price elasticity of supply equals infinity. If a supply curve is elastic, a small increase in price causes a large increase in quantity supplied. Just as with demand curves, it is important not to confuse a supply curve being elastic with it being perfectly elastic and not to confuse a supply curve being inelastic with it being perfectly inelastic. Table 4.5 summarises the different price elasticities of supply.

USING PRICE ELASTICITY OF SUPPLY TO PREDICT CHANGES IN PRICE

Figure 4.5 illustrates the important point that, when demand increases, the amount that price increases depends on the price elasticity of supply. The figure shows the demand and supply for parking spaces at a beach resort. In panel (a), on a typical summer weekday,

TABLE 4.5 SUMMARY OF THE PRICE ELASTICITIES OF SUPPLY

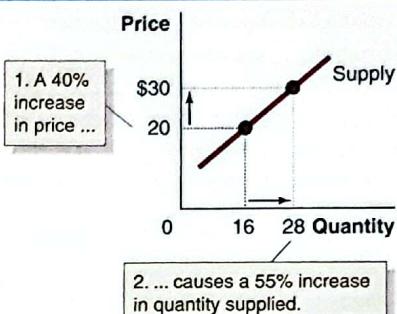
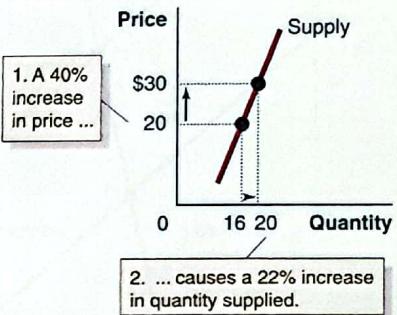
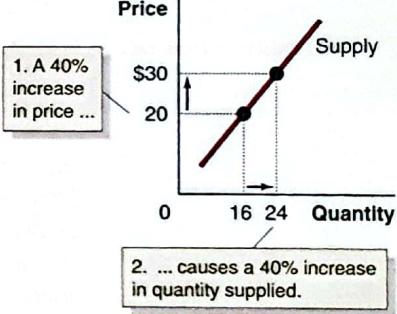
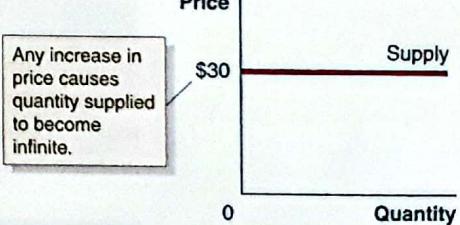
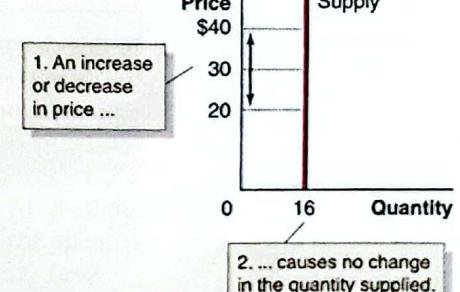
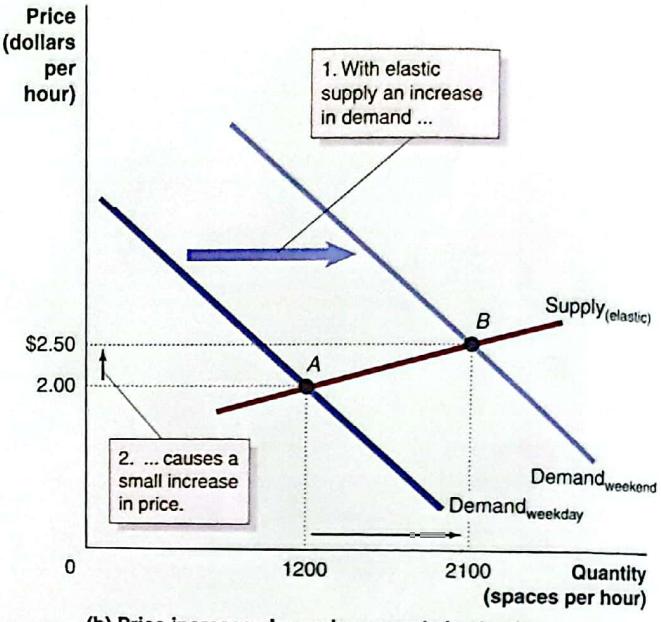
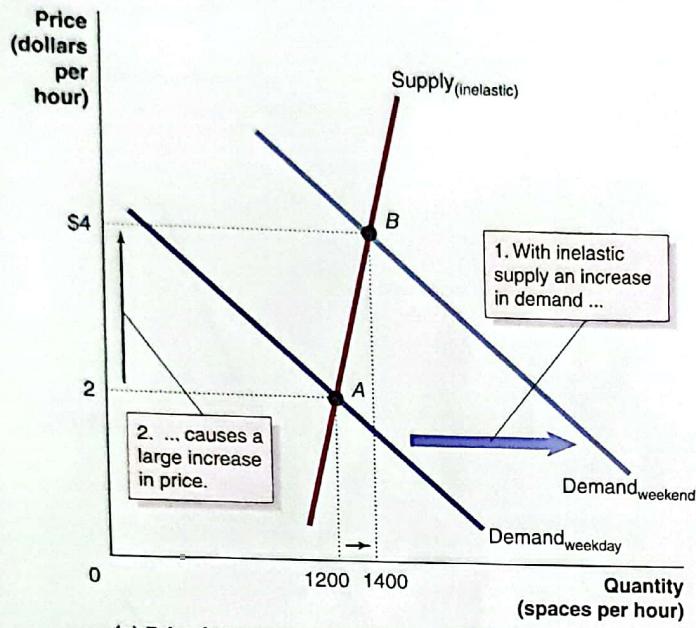
IF SUPPLY IS ...	THEN THE ABSOLUTE VALUE OF PRICE ELASTICITY IS ...	
elastic	greater than 1	 <p>1. A 40% increase in price ...</p> <p>2. ... causes a 55% increase in quantity supplied.</p>
inelastic	less than 1	 <p>1. A 40% increase in price ...</p> <p>2. ... causes a 22% increase in quantity supplied.</p>
unit-elastic	equal to 1	 <p>1. A 40% increase in price ...</p> <p>2. ... causes a 40% increase in quantity supplied.</p>
perfectly elastic	equal to infinity	 <p>Any increase in price causes quantity supplied to become infinite.</p>
perfectly inelastic	equal to 0	 <p>1. An increase or decrease in price ...</p> <p>2. ... causes no change in the quantity supplied.</p>

FIGURE 4.5 CHANGES IN PRICE DEPEND ON THE PRICE ELASTICITY OF SUPPLY

In panel (a), Demand_{weekday} represents the typical demand for parking spaces on a summer weekday at a beach resort. Demand_{weekend} represents demand for parking spaces at the beach resort on weekends. Because supply is inelastic, the shift in equilibrium from point A to point B results in a large increase in price—from \$2.00 per hour to \$4.00—but only a small increase in the quantity of spaces supplied—from 1200 to 1400. In panel (b), supply is elastic. As a result, the shift in equilibrium from point A to point B results in a smaller increase in price and a larger increase in the quantity supplied. An increase in price from \$2.00 per hour to \$2.50 is sufficient to increase the quantity of parking supplied from 1200 to 2100.



equilibrium occurs at point A, where Demand_{weekday} intersects a supply curve that is inelastic. The increase in demand for parking spaces on weekends shifts the demand curve to the right, moving the equilibrium to point B. Because the supply curve is inelastic the increase in demand results in a large increase in price—from \$2.00 per hour to \$4.00—but only a small increase in the quantity of spaces supplied—from 1200 to 1400.

In panel (b), supply is elastic, perhaps because the beach resort has vacant land that can be used for parking during periods of high demand. As a result the shift in equilibrium from point A to point B results in a smaller increase in price and a larger increase in the quantity supplied. An increase in price from \$2.00 per hour to \$2.50 is sufficient to increase the quantity of parking supplied from 1200 to 2100. Knowing the price elasticity of supply makes it possible to predict more accurately how much price will change following an increase or decrease in demand.

CONCLUSION

In this chapter we have explored the important concept of elasticity. Table 4.6 summarises the various elasticities we discuss in this chapter. Calculating elasticities is of importance in economics because it allows us to measure how one variable changes in response to changes in another variable. For example, by calculating the price elasticity of demand for its product, a firm can make a numerical estimate of the effect of a price change on the revenue it receives. Similarly, by calculating the price elasticity of demand for cigarettes, the government can estimate better the effect of an increase in cigarette taxes on smoking.

Read ‘An inside look’ to learn if the increase in tax on sweet alcoholic drink—alcopops—commonly consumed by younger people led to the intended decrease in alcohol consumption.

TABLE 4.6 SUMMARY OF ELASTICITIES

PRICE ELASTICITY OF DEMAND

Formula :
$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

Midpoint formula :
$$\frac{(Q_2 - Q_1)}{\left(\frac{Q_1 + Q_2}{2}\right)} \div \frac{(P_2 - P_1)}{\left(\frac{P_1 + P_2}{2}\right)}$$

	ABSOLUTE VALUE OF PRICE ELASTICITY	EFFECT ON TOTAL REVENUE OF AN INCREASE IN PRICE
Elastic	Greater than 1	Total revenue falls
Inelastic	Less than 1	Total revenue rises
Unit-elastic	Equal to 1	Total revenue unchanged

CROSS-PRICE ELASTICITY OF DEMAND

Formula :
$$\frac{\text{Percentage change in quantity demanded of one good}}{\text{Percentage change in price of another good}}$$

TYPES OF PRODUCTS	VALUE OF CROSS-PRICE ELASTICITY
Substitutes	Positive
Complements	Negative
Unrelated	Zero

INCOME ELASTICITY OF DEMAND

Formula :
$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

TYPES OF PRODUCTS	VALUE OF INCOME ELASTICITY
Normal and a necessity	Positive, but less than 1
Normal and a luxury	Positive and greater than 1
Inferior	Negative

PRICE ELASTICITY OF SUPPLY

Formula :
$$\frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

	VALUE OF PRICE ELASTICITY
Elastic	Greater than 1
Inelastic	Less than 1
Unit-elastic	Equal to 1

SUMMARY

LEARNING 1 OBJECTIVE

Define price elasticity of demand and understand how to measure it.

The *price elasticity of demand* measures how responsive quantity demanded is to changes in price. The price elasticity of demand is equal to the percentage change in quantity demanded divided by the percentage change in price. If the quantity demanded changes more than proportionally when price changes, the price elasticity of demand is greater than 1 in absolute value and demand is *elastic*. If the quantity demanded changes less than proportionally when price changes, the price elasticity of demand is less than 1 in absolute value and demand is *inelastic*. If the quantity demanded changes proportionally when price changes, the price elasticity of demand is equal to 1 in absolute value and demand is *unit-elastic*. Perfectly inelastic demand curves are vertical lines and perfectly elastic demand curves are horizontal lines. Relatively few products have perfectly elastic or perfectly inelastic demand curves.

LEARNING 2 OBJECTIVE

Understand the determinants of the price elasticity of demand.

The main determinants of the price elasticity of demand for a product are the availability of close substitutes, the length of time involved, whether the good is a necessity or a luxury, how narrowly the market for the good is defined and the share of the good in the consumer's budget.

LEARNING 3 OBJECTIVE

Understand the relationship between the price elasticity of demand and total revenue.

Total revenue is the total amount of funds received by a seller of a good or service. When demand is inelastic a decrease in price reduces total revenue and an increase in price increases total revenue. When demand is elastic, a decrease in price increases total revenue and an increase in price decreases total revenue. When demand is unit-elastic an increase or decrease in price leaves total revenue unchanged.

LEARNING 4 OBJECTIVE

Define cross-price elasticity of demand and income elasticity of demand, and understand their determinants and how they are measured.

In addition to the elasticities already discussed, other important demand elasticities are the *cross-price elasticity of demand*, which is equal to the percentage change in quantity demanded divided by the percentage change in the price of another good, and the *income elasticity of demand*, which is equal to the percentage change in the quantity demanded divided by the percentage change in income.

LEARNING 5 OBJECTIVE

Use price elasticity and income elasticity to analyse economic issues.

Price elasticity and income elasticity can be used to analyse many economic issues. One example is the reduction in the number of family farms in Australia. Because the income elasticity of demand for food is low, the demand for food has not increased proportionally as incomes in Australia and the rest of the world have grown. As farmers have become more productive they have increased the supply of most foods. Because the price elasticity of demand for food is low, increasing supply has resulted in continually falling food prices.

LEARNING 6 OBJECTIVE

Define price elasticity of supply, and understand its main determinants and how it is measured.

The *price elasticity of supply* is equal to the percentage change in quantity supplied divided by the percentage change in price. The supply curves for most goods are inelastic over a short period of time, but they become increasingly elastic over longer periods of time. The main determinants of the price elasticity of supply are the length of time involved, the type of industry, availability of inputs, existing capacity and inventories held. Perfectly inelastic demand curves are vertical lines, and perfectly elastic supply curves are horizontal lines. Relatively few products have perfectly elastic or perfectly inelastic supply curves.

KEY TERMS

cross-price elasticity of demand	105	inelastic demand	93	price elasticity of supply	109
elastic demand	93	perfectly elastic demand	96	total revenue	101
elasticity	92	perfectly inelastic demand	96	unit-elastic demand	93
income elasticity of demand	106	price elasticity of demand	92		

REVIEW QUESTIONS

- Write the formula for the price elasticity of demand. Why isn't elasticity just measured by the slope of the demand curve?
- If a 10 per cent increase in the price of Kellogg's cereal causes a 25 per cent reduction in the number of boxes of cereal demanded, what is the price elasticity of demand for Kellogg's cereal? Is demand for Kellogg's cereal elastic or inelastic?
- What is the midpoint method for calculating price elasticity of demand? How else can the price elasticity of demand be calculated? What is the advantage of the midpoint method?
- Draw a graph of a perfectly inelastic demand curve. Think of a product that would have a perfectly inelastic demand curve. Explain why demand for this product would be perfectly inelastic.
- What are the key determinants of the price elasticity of demand for a product? Which determinant is the most important?
- a. If the demand for orange juice is inelastic, will an increase in the price of orange juice increase or decrease the revenue received by orange juice sellers?
 b. If the price of organic apples falls, and apple growers find that their total revenue increases, is the demand for organic apples elastic or inelastic?
- Define cross-price elasticity of demand. What does it mean if the cross-price elasticity of demand is negative? What does it mean if the cross-price elasticity of demand is positive?
- Define income elasticity of demand. Use income elasticity to distinguish a normal good from an inferior good. Is it possible to tell from the income elasticity of demand whether a product is a luxury good or a necessity good?
- The demand for agricultural products is price inelastic and the income elasticity of demand for agricultural products is low. How do these facts help explain the disappearing family farm?
- Write the formula for the price elasticity of supply. Why is the price elasticity of supply always positive?
- If an increase of 10 per cent in the price of frozen pizzas results in a 9 per cent increase in the quantity of frozen pizzas supplied, what is the price elasticity of supply for frozen pizzas? Is the supply of pizzas elastic or inelastic?
- What are the main determinants of the price elasticity of supply?

PROBLEMS AND APPLICATIONS

Visit MyEconLab to practise similar exercises.

- [Related to Solved problem 4.1] Suppose the following table gives data on the price of wheat and the number of tonnes of wheat sold in 2012 and 2013.

YEAR	PRICE (PER TONNE)	QUANTITY (IN THOUSANDS OF TONNES)
2012	\$310	23 000
2013	\$330	21 000

- Calculate the change in the quantity of wheat demanded divided by the change in the price of wheat. Measure the quantity of wheat in tonnes.
- Calculate the change in the quantity of wheat demanded divided by the change in the price of wheat, but this time measure the quantity of wheat in thousands of tonnes. Compare your answer to the one you calculated in part (a).
- Finally, assuming that the demand curve for wheat did not shift between 2012 and 2013, use the information in the table to calculate the price elasticity of demand for wheat. Use the midpoint formula in your calculation. Compare the

value for the price elasticity of demand to the values you calculated in parts (a) and (b).

- Suppose that increases in the price of milk leads to increases in the retail prices for ice cream by 4 per cent from last year and ice cream consumption is down 3 per cent. Given this information, calculate the price elasticity of demand for ice cream. Will the revenue received by ice cream suppliers have increased or decreased following the price increase? Briefly explain.
- [Related to Making the connection 4.1] Research has estimated that the price elasticity of demand for soft drinks is -0.78, while the price elasticity of demand for Coca-Cola is -1.22. Coca-Cola is a type of soft drink so why isn't its price elasticity of demand the same as the price elasticity for soft drinks as a whole?¹
- [Related to Solved problem 4.2] Suppose the price elasticity of demand for cigarettes is -0.25 and that Australians purchase about 22 billion cigarettes each year.
 - If the tax on cigarettes were increased enough to raise the price of cigarettes by 50 per cent, what would be the effect on the quantity of cigarettes demanded?
 - Is raising the tax on cigarettes a more effective way to reduce smoking if the demand for cigarettes is elastic or if it is inelastic? Briefly explain.

5. [Related to Solved problem 4.2] Suppose the price elasticity of demand for cocaine has been estimated to be equal to -0.28 . Suppose that a successful war on illegal drugs reduces the supply of cocaine in Australia enough to result in a 20 per cent increase in its price. What will be the percentage reduction in the quantity of cocaine demanded?
6. A study of the price elasticities of products sold in supermarkets contained the following data:²

PRODUCT	PRICE ELASTICITY OF DEMAND
Soft drinks	-3.18
Canned soup	-1.62
Cheese	-0.72
Toothpaste	-0.45

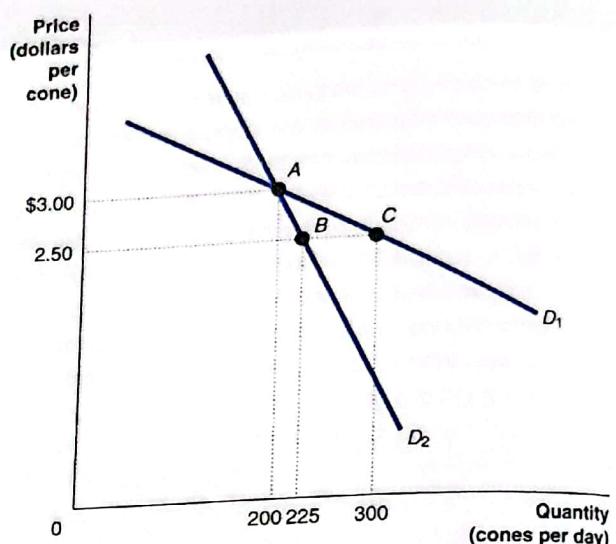
- a. The demand for which products is inelastic? Discuss reasons why the demand for each product is either elastic or inelastic.
- b. Use the information in the table to predict the change in the quantity demanded for each product following a 10 per cent price increase.
7. [Related to Solved problem 4.3] This question relates to the statements by two managers given below. Briefly explain whether you agree or disagree with manager 2's reasoning:

Manager 1: 'The only way we can increase the revenue we receive from selling our frozen pizzas is by reducing the price.'

Manager 2: 'Reducing the price of a product never increases the amount of revenue you receive. If we want to increase revenue, we have to increase price.'

8. Briefly explain whether the demand for each of the following products is likely to be elastic or inelastic.
- Milk
 - Frozen pizza
 - Cola drinks
 - Prescription medicine
9. Despite declining circulation many newspapers have raised their prices. Such increases, while boosting revenue per copy, almost always trigger a readership decline.
- What is a newspaper's 'circulation'?
 - To what is 'revenue per copy' equal?
 - Why would a newspaper's management increase its subscription price if the result was a decline in the quantity of newspapers sold?
10. Use the following graph for Yolanda's Frozen Yoghurt Stand to answer the questions that follow.

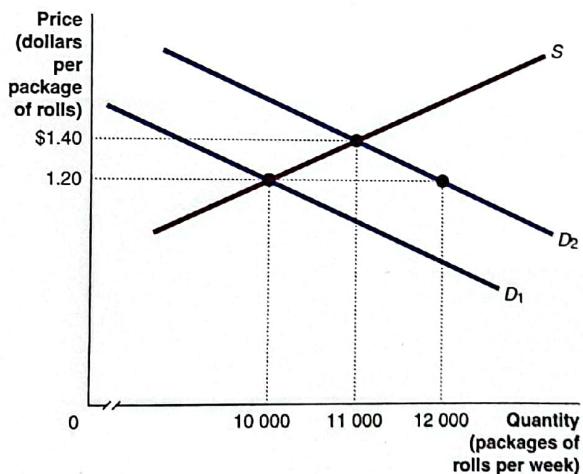
- a. Use the midpoint formula to calculate the price elasticity of demand for D_1 between point A and point C, and the price



- elasticity of demand for D_2 between point A and point B. Which demand curve is more elastic, D_1 or D_2 ? Briefly explain.
- b. Suppose Yolanda is initially selling 200 cones per day at a price of \$3.00 per cone. If she reduces her price to \$2.50 per cone and her demand curve is D_1 , what will be the change in her revenue? What will be the change in her revenue if her demand curve is D_2 ?

11. Assume that the Australian Football League (AFL) reduces the prices of tickets by 50 per cent for tickets to games on Monday nights. The number of Monday night game tickets sold increased by 80 per cent. Is this enough information to allow us to calculate the price elasticity of demand for tickets to football games? Briefly explain.
12. Following the devastating effects of the floods in Queensland in 2011, which among other things damaged many banana plantations, the price of bananas increased significantly, from about \$2.50 per kilogram to about \$12 per kilogram. A typical consumer reaction was:
- I will not buy bananas when they are \$12 per kilogram. I can substitute other fruit for bananas. If the price of milk were to increase to \$5 per litre, we'd still have to buy it. But bananas are not that important in our family.*
- For the above consumer's household, which product has the higher price elasticity of demand: bananas or milk? Briefly explain.
 - Is the cross-price elasticity of demand between bananas and other fruit positive or negative for this consumer? Briefly explain.
13. Are the cross-price elasticities of demand between the following pairs of products likely to be positive or negative? Briefly explain.
- Pepsi and Coca-Cola
 - Fries and tomato sauce
 - Steak and chicken
 - Blu-ray players and Blu-ray discs

- 14.** a. Is the cross-price elasticity of demand between petrol and fuel-efficient, small cars positive or negative? Is the cross-price elasticity of demand between petrol and large not-very-fuel-efficient SUVs positive or negative? Briefly explain.
 b. How can we best describe the relationships between petrol, fuel-efficient small cars and large not-very-fuel-efficient SUVs? Briefly discuss which can be thought of as substitutes and which can be thought of as complements.
- 15.** Rank the following four goods from lowest income elasticity of demand to highest income elasticity of demand. Briefly explain your ranking.
- Bread
 - Pepsi
 - Mercedes-Benz cars
 - Personal computers
- 16.** The price elasticity of demand for most agricultural products is quite low. What impact is this likely to have on how much the prices of these products change from year to year? Illustrate your answer with a supply and demand diagram.
- 17.** In the following graph the demand for hot dog rolls has shifted outwards because the price of hot dog sausages has fallen from \$2.20 to \$1.80 per package.



- a.** Calculate the cross-price elasticity of demand between hot dog sausages and hot dog rolls.
b. Calculate the price elasticity of supply for hot dog rolls.
- 18. [Related to Making the connection 4.4]** Refer to the second graph in Making the connection 4.4. Over long periods of time, high oil prices lead to greater increases in the quantity of oil supplied. In other words, the price elasticity of oil increases. This happens because higher prices provide an economic incentive to recover oil from more costly sources, such as under oceans, from tar sands or at greater depths in the earth. If the supply of oil becomes more elastic, explain how the increase in demand shown in the figure will result in a lower equilibrium price than \$140 per barrel and a higher equilibrium quantity than 84 million barrels per day. Illustrate your answer with a demand and supply graph.
- 19.** On most days the price of a rose is \$1 and 8000 roses are purchased. On Valentine's Day, the price of a rose jumps to \$2 and 30 000 roses are purchased.
- Draw a demand and supply diagram that shows why the price jumps.
 - Based on this information, what do we know about the price elasticity of demand for roses? Calculate values for the price elasticity of demand and the price elasticity of supply or explain why you can't calculate these values.
- 20.** In 2010 severe weather conditions significantly reduced grain crops produced in Russia. In response to this, what do you think happened to the supply of grain provided by Australian farmers on the international market for grain? What do you think happened to the international price of grain?

ENDNOTES

- Kelly D. Brownell and Thomas R. Frieden (2009), 'Ounces of prevention: The public policy case for taxes on sugared beverages', *New England Journal of Medicine*, 30 April, pp. 1805–1808.
- Stephen J. Hoch, Byung-do Kim, Alan L. Montgomery and Peter E. Rossi (1995), 'Determinants of store-level price elasticity', *Journal of Marketing Research*, 32, February, pp. 17–29.

IMAGE CREDITS

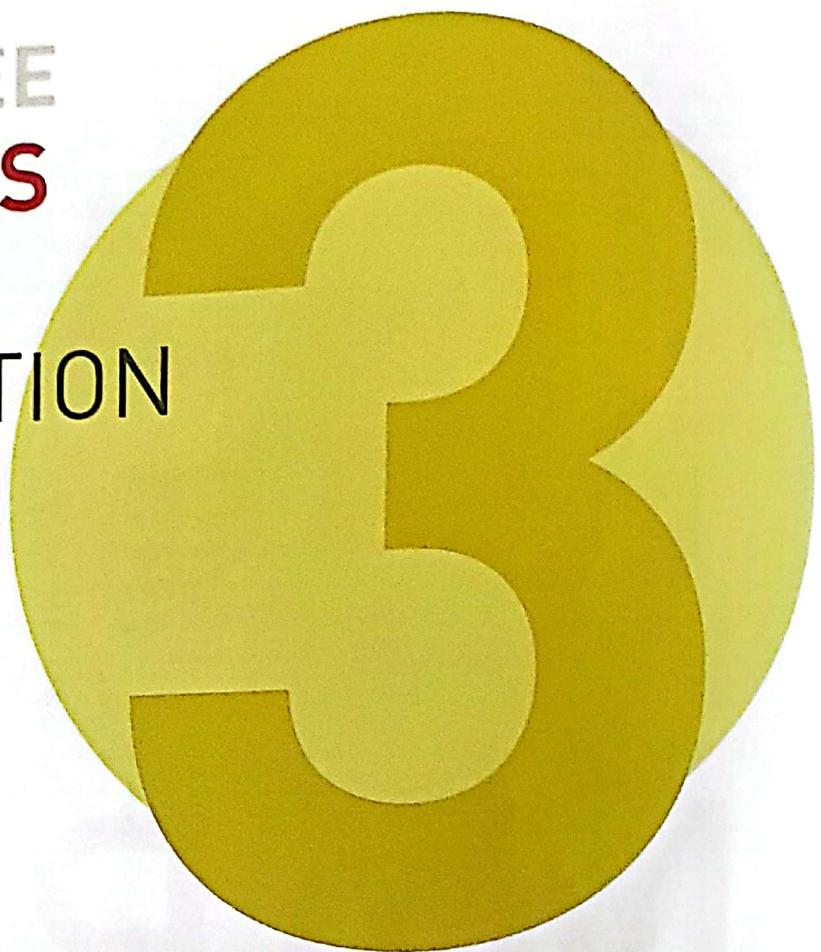
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CHAPTER THREE

WHERE PRICES COME FROM: THE INTERACTION OF DEMAND AND SUPPLY



LEARNING OBJECTIVES

AFTER STUDYING THIS CHAPTER YOU SHOULD BE ABLE TO:

1. Discuss the variables that influence the demand for goods and services.
2. Discuss the variables that influence the supply of goods and services.
3. Explain how equilibrium in a market is reached, and use a graph to illustrate market equilibrium.
4. Use demand and supply graphs to predict changes in prices and quantities.

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IN CHAPTER 1 we explored how economists use models to predict human behaviour. In Chapter 2 we used the model of production possibility frontiers to analyse scarcity and trade-offs. In this chapter we explore the models of demand and supply, which are the most powerful tools in economics, and use them to explain how prices are determined. For example, we could use the models to predict what will happen to the price and demand for alternative fuels when the price of oil rises. Or we could predict what will happen to the price of mobile phones when technology changes. Similarly, if the government decides to build more public housing we can predict the effect on new house prices, the demand for rental accommodation and other related markets.

We begin considering the model of demand and supply by discussing consumers and the demand side of the market, before turning to firms and the supply side. As you will see, we will apply the model of demand and supply again and again throughout this book to understand business and the economy.

LEARNING 1 OBJECTIVE

Discuss the variables that influence the demand for goods and services.

THE DEMAND SIDE OF THE MARKET

Chapters 1 and 2 explained that in a market system consumers ultimately determine which goods and services will be produced. This is termed *consumer sovereignty*. The most successful businesses are generally the ones that respond best to consumer demand. But what determines consumer demand for a product? Certainly, many factors influence the willingness of consumers to buy a particular product. For example, consumers who are considering buying a digital music player (MP3 player) such as Apple's iPod or Sony's Walkman, will make their decisions based on, among other factors, the income they have available to spend, and the effectiveness of the advertising campaigns of the companies that sell MP3 players. The main factor in consumer decisions, though, is the price of the MP3 player. So it makes sense to begin with price when analysing the decisions of consumers to buy a product. It is important to note that when we discuss demand we are considering not what a consumer wants to buy but what the consumer is both willing and *able* to buy.

DEMAND SCHEDULES AND DEMAND CURVES

Tables that show the relationship between the price of a product and the quantity of the product demanded are called **demand schedules**. The table in Figure 3.1 shows the number of MP3 players consumers would be willing to buy in one month at five different prices. The amount of a good or a service that consumers are willing and able to purchase at a particular price is referred to as the **quantity demanded**. The graph in Figure 3.1 plots the numbers from the table as a **demand curve**, a curve that shows the relationship between the price of a product and the quantity of a product demanded.

Note that in this example the numbers in the table have enabled us to draw the demand 'curve' as a straight line. In real markets demand curves are not straight lines but are often drawn as such in economic models for convenience. This is the same for supply curves, which we will study later in this chapter. The demand curve in Figure 3.1 shows the **market demand**, or the demand by all consumers of a given good or service. The market for a product, such as restaurant meals, that is purchased locally would include all the consumers in a city or a relatively small area. The market for products that are sold internationally, such as MP3 players, would include all the consumers in the world.

The demand curve in Figure 3.1 slopes downwards because consumers will buy more MP3 players as the price falls. When the price of players is \$300 consumers will buy 30 million players per month. If the price of players falls to \$250 consumers will buy 35 million players per month. Buyers demand a larger quantity of a product as the price falls because the product becomes less expensive relative to other products and because they can afford to buy more at a lower price.

Demand schedule

A table showing the relationship between the price of a product and the quantity of the product demanded.

Quantity demanded

The amount of a good or service that a consumer is willing and able to purchase at a given price.

Demand curve

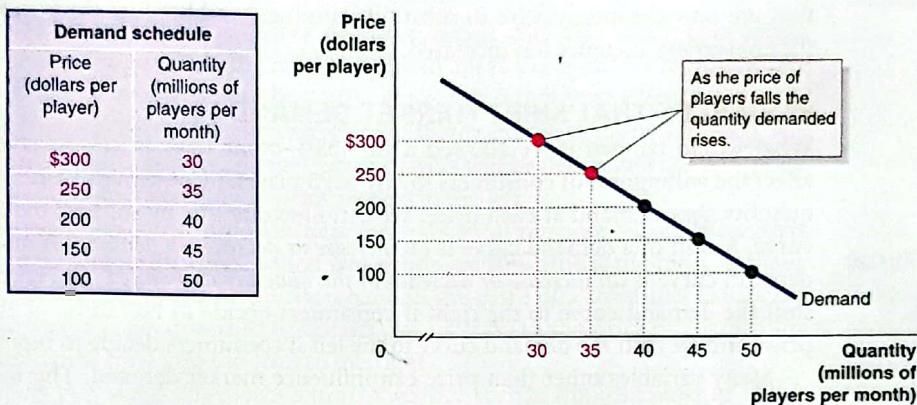
A curve that shows the relationship between the price of a product and the quantity of the product demanded.

Market demand

The demand by all the consumers of a given good or service.

FIGURE 3.1 DEMAND SCHEDULE AND DEMAND CURVE

As the price changes the quantity of MP3 players consumers are willing to buy changes. We can show this as a *demand schedule* in a table, or as a *demand curve* on a graph. The table and graph both show that as the price of players falls the quantity demanded rises. When the price of a player is \$300 consumers buy 30 million. When the price drops to \$250 consumers buy 35 million. Therefore, the demand curve for MP3 players is downward sloping.



THE LAW OF DEMAND

The market demand curve for MP3 players shown in Figure 3.1 is downward sloping; as the price of players falls the quantity of players demanded increases. The inverse relationship between the price of a product and the quantity of the product demanded is known as the **law of demand**: that is, when the price of a product falls the quantity demanded of the product will increase, and when the price of a product rises the quantity demanded of the product will decrease. The law of demand holds for almost any market demand curve.

HOLDING EVERYTHING ELSE CONSTANT: THE *CETERIS PARIBUS* CONDITION

The definition of the law of demand applies when other factors that might affect demand, such as changes in income or changes in advertising, are assumed to be constant or unchanged. In constructing the market demand curve for MP3 players we focused only on the effect that changes in the *price* of players would have on the quantity of players consumers would be willing and able to buy. We were holding constant other variables that might affect the willingness of consumers to buy players. Economists refer to the necessity of holding all variables other than price constant in constructing a demand curve as the *ceteris paribus* condition—*ceteris paribus* is Latin for ‘all else being equal’. We will soon explore what happens when there are changes in the other factors that affect demand.

WHAT EXPLAINS THE LAW OF DEMAND?

It makes sense that consumers will buy more of a good when the price falls and less of a good when the price rises, but let’s look more closely at why this is true. When the price of MP3s falls consumers buy a larger quantity of MP3s because of the *substitution effect* and the *income effect*.

SUBSTITUTION EFFECT The *substitution effect* refers to the change in the quantity demanded of a good that results from a change in price, making the good less expensive *relative* to other goods that are *substitutes*. This change leads consumers to buy more of a good when its price falls—or less of a good when its price rises. When the price of MP3 players falls consumers will substitute buying players for buying other goods such as compact stereos or radios.

Law of demand

Holding everything else constant, when the price of a product falls the quantity demanded will increase, and when the price of a product rises the quantity demanded will decrease.

Ceteris paribus ('all else being equal')

The requirement that when analysing the relationship between two variables—such as price and quantity demanded—other variables must be held constant.

Substitution effect

The change in the quantity demanded of a good or service that results from a change in price, making the good or service more or less expensive relative to other goods or services that are substitutes.

Income effect

The change in the quantity demanded of a good or service that results from the effect of a change in price on consumer purchasing power.

THE INCOME EFFECT The **income effect** of a price change refers to the change in the quantity demanded of a good that results from the effect of a change in the good's price on consumers' purchasing power. Purchasing power refers to the quantity of goods that can be bought with a fixed amount of income. When the price of a good falls the increased purchasing power of consumers' incomes will usually lead them to purchase a larger quantity of the good. When the price of a good rises the decreased purchasing power of consumers' incomes will usually lead them to purchase a smaller quantity of the good.

Thus, a fall in the price of MP3 players leads consumers to buy more players, both because they are now cheaper relative to substitute products and because the purchasing power of the consumers' incomes has increased.

VARIABLES THAT SHIFT MARKET DEMAND

What would happen if we allowed a variable—other than price—to change that might affect the willingness of consumers to buy MP3 players? Consumers would then change the quantity they demand at each price. We can illustrate this by shifting the market demand curve. A shift of a demand curve is *an increase or decrease in demand*. A movement along a demand curve is *an increase or decrease in the quantity demanded*. As Figure 3.2 shows, we shift the demand curve to the right if consumers decide to buy more of the good at each price, and we shift the demand curve to the left if consumers decide to buy less.

Many variables other than price can influence market demand. The following five are the most important:

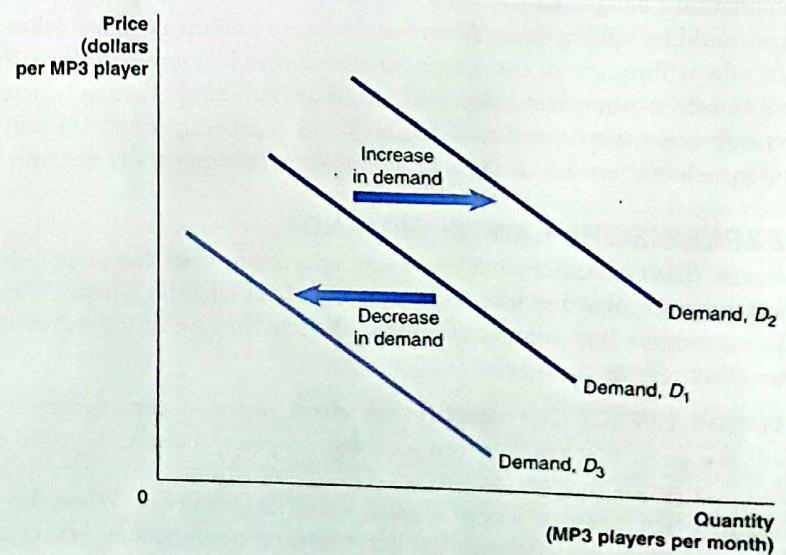
- Income
- Prices of related goods
- Tastes
- Population and demographics
- Expected future prices.

We next discuss how changes in each of these variables affect the market demand curve for MP3 players.

INCOME The income that consumers have available to spend also affects their willingness and ability to buy a good. Suppose that the market demand curve in Figure 3.1 reflects the willingness of consumers to buy MP3 players when average household income is \$55 000. If household income rises to \$60 000, the demand for players will increase, which we show

FIGURE 3.2 SHIFTING THE DEMAND CURVE

When consumers increase the quantity of a product they wish to buy at a given price, the market demand curve shifts to the right, from D_1 to D_2 . When consumers decrease the quantity of a product they wish to buy at any given price, the demand curve shifts to the left, from D_1 to D_3 .



by shifting the demand curve to the right. A good is a **normal good** when demand increases following an increase in income and decreases following a decrease in income. Most goods are normal goods, but the demand for some goods falls when income rises, and rises when income falls. For instance, as your income rises you might buy less canned tuna or fewer sausages, and buy more fresh salmon or steak. A good is an **inferior good** when demand decreases following an increase in income and increases following a decrease in income. So, sausages and tuna would be examples of inferior goods, not because they are necessarily of low quality, but because you buy less of them as your income increases.

PRICES OF RELATED GOODS The prices of other goods can also affect consumers' demand for a product. Suppose that the market demand curve in Figure 3.1 represents the willingness and ability of consumers to buy MP3 players during a year when the average price of compact stereos is \$500. If the average price of these stereo systems falls to \$400, will the market demand for MP3 players change? Fewer players will be demanded at every price. We show this by shifting the demand curve for players to the left.

Goods and services that can be used for the same or a similar purpose—like MP3 players and compact stereos—are **substitutes**. When two goods are substitutes, the more you buy of one, the less you will buy of the other. A decrease in the price of a substitute causes the demand curve for the first good to shift to the left. An increase in the price of a substitute causes the demand curve for a good to shift to the right.

Many consumers play songs downloaded from a website, such as Apple's iTunes or Sony's bandit.fm, on their MP3 players. Suppose the market demand curve in Figure 3.1 represents the willingness of consumers to buy players at a time when the average price to download a song is \$0.99. If the price to download a song falls to \$0.49, consumers will buy more song downloads *and* more MP3 players: the demand curve for MP3 players will shift to the right.

Products that are used together—such as MP3 players and song downloads—are **complements**. When two goods are complements, the more you buy of one the more you will buy of the other. A decrease in the price of a complement causes the demand curve for the first good to shift to the right. An increase in the price of a complement causes the demand curve for a good to shift to the left.

TASTES Consumers can also be influenced by an advertising campaign for a product. If Apple, Microsoft, Sony and other makers of MP3 players begin to advertise their players heavily on television and online, consumers are more likely to buy them at every price, and the demand curve will shift to the right. An economist would say that the advertising campaign has affected consumers' *taste* for MP3 players. Taste is a broad category that refers to the many subjective elements that can enter into a consumer's decision to buy a product. A consumer's taste for a product can change for many reasons. Sometimes trends and fashions play a substantial role. For example, the popularity of low-fat diets caused a decline in demand for some goods, such as burgers and chips, and an increase in demand for chicken and fresh vegetables. Changes in the seasons also affect consumers' tastes, so that in summer, for example, more ice cream is purchased than in winter. In general, when consumers' taste for a product increases the demand curve will shift to the right, and when consumers' taste for a product decreases the demand curve for the product will shift to the left.

POPULATION AND DEMOGRAPHICS Population and demographic factors can affect the demand for a product. As the population of Australia increases so will the number of consumers, and the demand for most products will increase. The **demographics** of a population refers to its characteristics, with respect to age, race and gender. As the demographics of a country or region change, the demand for particular goods and services will increase or decrease because different categories of people tend to have different preferences for those goods. For instance, the demand for baby food will be greatest when the fraction of the population under the age of two is the greatest.

EXPECTED FUTURE PRICES Consumers choose not only which products to buy but also when to buy them. On the one hand, if enough consumers become convinced that MP3 players will be selling for lower prices three months from now, the demand for players will

Normal good

A good for which the demand increases as income rises and decreases as income falls.

Inferior good

A good for which the demand increases as income falls and decreases as income rises.

Substitutes

Goods or services that can be used for the same or a similar purpose.

Complements

Goods and services that are used together.

Demographics

The characteristics of a population with respect to age, race and gender.

decrease now, as consumers postpone their purchases to wait for the expected price decrease. On the other hand, if enough consumers become convinced that the price of players will be higher three months from now, the demand for players will increase now, as consumers try to beat the expected price increase.

Table 3.1 summarises the most important variables that cause market demand curves to shift. You should note that the table shows the shift in the demand curve that results from an *increase* in each of the variables. A *decrease* in these variables would cause the demand curve to shift in the opposite direction.

3.1 MAKING THE CONNECTION

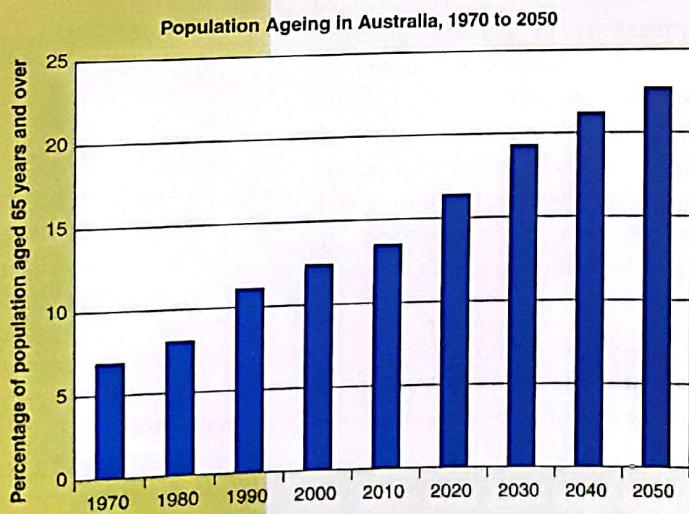


THE AGEING OF THE BABY BOOM GENERATION

The average age of the Australian population is increasing. So is the average age of populations in many countries throughout the world. After World War II ended in 1945, Australia was one of many countries that experienced a 'baby boom' as birth rates rose and remained high until the mid-1960s. Falling birth rates after the mid-1960s mean that the baby boom generation is larger than the generation before it and the generations after it. In addition, average life expectancy has continued to rise significantly. For example, the average life expectancy for females in Australia in the mid-1960s was 74.2 years and this has risen to approximately 82.6 years today; for males this has risen from 67.9 years to 78.9 years over the same time period.

In 2010 the proportion of Australia's population aged 65 years and over was 13.5 per cent. This is similar to Canada (14.1 per cent), Hong Kong (12.9 per cent), New Zealand (13 per cent) and the USA (13 per cent). In a number of other countries population ageing has occurred at an even faster rate. For example, in 2010 the proportion of the population aged 65 years and over was 17 per cent in France, 18.3 per cent in Greece, 20.4 per cent in Italy, 22.6 per cent in Japan, 18.3 per cent in Sweden and 16.6 per cent in the UK.

The following figure uses data and projections from the Australian Bureau of Statistics and the Australian Treasury to show the significance of Australia's ageing population. Between 2010 and 2050 the proportion of the total population aged 65 years and over is estimated to almost double, from 13.5 per cent to about 23 per cent.



What effects will the ageing of the baby boom generation have on the economy? Older people have a greater demand for medical care than do younger people. So in the coming years the demand for doctors, nurses, hospital facilities and aged care facilities should all increase. This will place increased pressure on Medicare and the government's health budget. As the population ages there will also be increased aged pension requirements—a serious concern which led to the introduction of compulsory superannuation in Australia in 1992.

Ageing boomers will also have an effect on the housing market. Older people often 'downsize' their housing by moving from large, family homes, to smaller, more easily maintained homes. This could mean that the demand for large homes may decrease, while the demand for smaller homes and apartments may increase.

SOURCE: Australian Bureau of Statistics (2008), *Australian Historical Population Statistics*, Cat. No. 3105.0.065.001, Table 4.1 and Table 7.1, at <www.abs.gov.au>, viewed 23 May 2010; Australian Bureau of Statistics (2009), *Australian Social Trends, Data Cube—Population*, Cat. No. 4102.0 at <www.abs.gov.au>, viewed 23 May 2010; Australian Government (2010), *Australia to 2050: Future Challenges, Intergenerational Report 2010*, at <www.treasury.gov.au>, viewed 23 May 2010.

TABLE 3.1 VARIABLES THAT SHIFT MARKET DEMAND CURVES

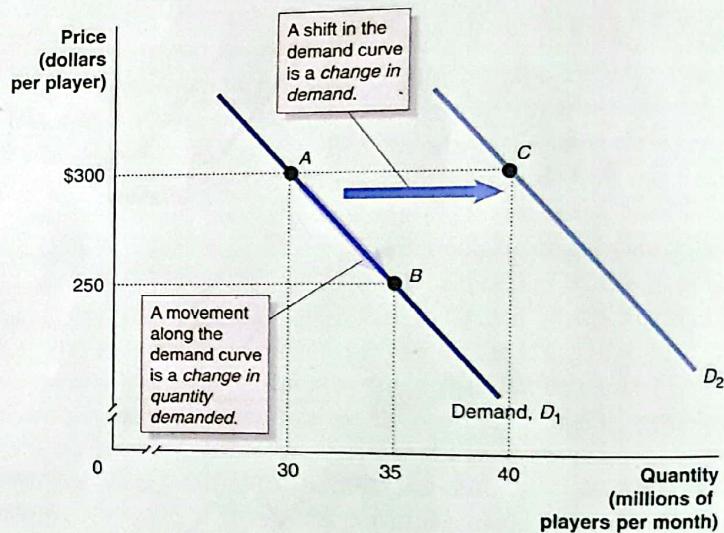
AN INCREASE IN ...	SHIFTS THE DEMAND CURVE ...	BECAUSE ...
income (and the good is normal)	<p>Price</p> <p>Quantity</p>	consumers spend more of their higher income on the good
income (and the good is inferior)	<p>Price</p> <p>Quantity</p>	consumers spend less of their higher income on the good
the price of a substitute good	<p>Price</p> <p>Quantity</p>	consumers buy less of the substitute good and more of this good
the price of a complementary good	<p>Price</p> <p>Quantity</p>	consumers buy less of the complementary good and less of this good
taste for the good	<p>Price</p> <p>Quantity</p>	consumers are willing to buy a larger quantity of the good at every price
population	<p>Price</p> <p>Quantity</p>	additional consumers result in a greater quantity demanded at every price
the expected price of the good in the future	<p>Price</p> <p>Quantity</p>	consumers buy more of the good today to avoid the higher price in the future

A CHANGE IN DEMAND VERSUS A CHANGE IN QUANTITY DEMANDED

It is important to understand the difference between a *change in demand* and a *change in the quantity demanded*. A change in demand refers to a shift of the demand curve. A shift occurs if there is a change in one of the variables, *other than the price of the product*, that affects the willingness of consumers to buy the product. A change in the quantity demanded refers to a movement along the demand curve as a result of a change in the product's price. Figure 3.3 illustrates this important distinction. If the price of MP3 players falls from \$300 to \$250, the result will be a movement along the demand curve from point A to point B—an increase in quantity demanded from 30 million to 35 million. If consumers' incomes increase, or another factor changes that makes consumers want more of the product at every price, the demand curve will shift to the right—an increase in demand. In this case, the increase in demand from D_1 to D_2 causes the quantity of players demanded at a price of \$300 to increase from 30 million at point A to 40 million at point C.

FIGURE 3.3 A CHANGE IN DEMAND VERSUS A CHANGE IN THE QUANTITY DEMANDED

If the price of MP3 players falls from \$300 to \$250, the result will be a movement along the demand curve from point A to point B—an increase in quantity demanded from 30 million to 35 million. If consumers' income increases, or another factor changes that makes consumers want more of the product at every price, the demand curve will shift to the right—an increase in demand. In this case, the increase in demand from D_1 to D_2 causes the quantity of players demanded at a price of \$300 to increase from 30 million at point A to 40 million at point C



LEARNING OBJECTIVE 2

Discuss the variables that influence the supply of goods and services.

Quantity supplied

The amount of a good or service that a firm is willing and able to supply at a given price.

Supply schedule

A table that shows the relationship between the price of a product and the quantity of the product supplied.

Supply curve

A curve that shows the relationship between the price of a product and the quantity of the product supplied.

THE SUPPLY SIDE OF THE MARKET

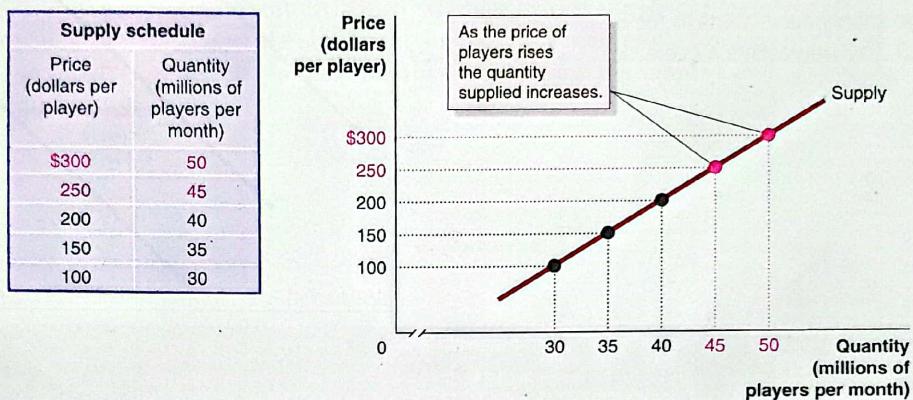
Just as many variables influence the willingness and ability of consumers to buy a particular good or service, so many variables also influence the willingness and ability of firms to sell a good or service. As with the demand side of the market, a very important variable is price. The amount of a good or service that a firm is willing and able to supply at a given price is the **quantity supplied**. Holding other variables constant (i.e. assuming *ceteris paribus*), when the price of a good rises, producing the good is more profitable and the quantity supplied will increase. When the price of a good falls, the good is less profitable and the quantity supplied will decrease.

SUPPLY SCHEDULES AND SUPPLY CURVES

A **supply schedule** is a table that shows the relationship between the price of a product and the quantity of the product supplied. The table in Figure 3.4 is a supply schedule showing the quantity of MP3 players that firms would be willing to supply per month at different prices. The graph in Figure 3.4 plots the numbers from the supply schedule as a supply curve. A **supply curve** shows the relationship between the price of a product and the quantity of the product supplied. The supply schedule and supply curve both show that, as the price of player rises, firms will increase the quantity they supply. At a price of \$250 per player firms will supply 45 million players per month. At the higher price of \$300 they will supply 50 million.

FIGURE 3.4 SUPPLY SCHEDULE AND SUPPLY CURVE

As the price changes, Apple, Sony, Microsoft and other firms producing MP3 players change the quantity they are willing to supply. We can show this as a *supply schedule* in a table, or as a *supply curve* on a graph. The supply schedule and supply curve both show that, as the price of players rises, firms will increase the quantity they supply. At a price of \$250 firms will supply 45 million players. At a price of \$300 per player firms will supply 50 million players.



THE LAW OF SUPPLY

The **market supply** curve in Figure 3.4 is upward sloping. We expect most supply curves to be upward sloping according to the **law of supply**, which states that, holding everything else constant, increases in price cause increases in the quantity supplied, and decreases in price cause decreases in the quantity supplied. The reason for this is that firms plan output, given the price, such that they make as much profit as possible. At a higher price, holding everything else constant, profits will be greater than before and firms will want to sell more. In addition, as we saw in Chapter 2, devoting more and more resources to the production of a good results in increasing marginal costs. So, if for example, Apple and Sony increase production of MP3 players during a given time period, they are likely to find that the cost of producing the additional players increases as they run existing factories for longer hours and pay higher prices for components and higher wages for workers. With higher marginal costs, firms will supply a larger quantity only if the price is higher. Notice that the definition of the law of supply—like the definition of the law of demand—contains the phrase ‘holding everything else constant’. If only the price of the product changes, there is a movement along the supply curve, which is an *increase or decrease in the quantity supplied*.

Market supply

The supply by all firms of a given good or service.

Law of supply

Holding everything else constant, an increase in the price of a product causes an increase in the quantity supplied, and a decrease in the price of a product causes a decrease in the quantity supplied.

VARIABLES THAT SHIFT SUPPLY

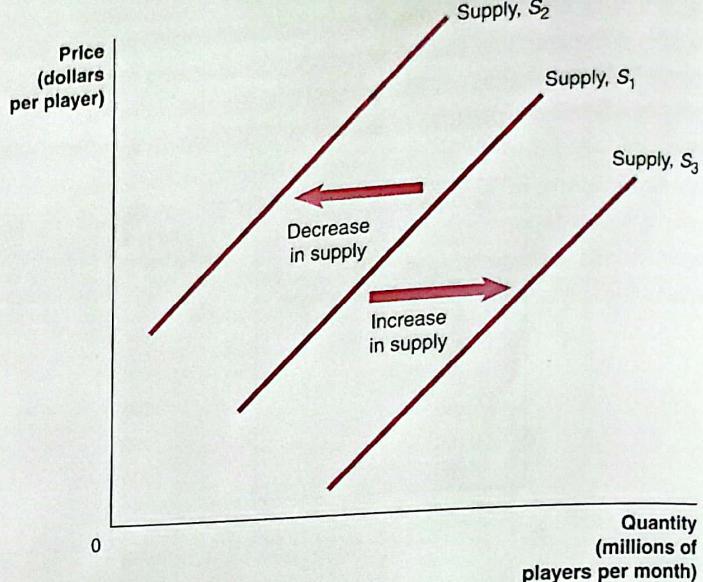
There are many variables other than the product’s own price that affect the willingness of firms to supply goods and services. If any of these other variables change, the supply curve will shift, which is *an increase or decrease in supply*. If, at every price level, firms increase the quantity of a product they wish to sell, the supply curve shifts to the right. In Figure 3.5 the shift from S_1 to S_3 represents an *increase in supply*. If, at every price level, firms decrease the quantity of a product they wish to sell, the supply curve shifts to the left. In Figure 3.5 the shift from S_1 to S_2 represents a *decrease in supply*.

The following are the most important variables that shift supply:

- Prices of inputs
- Technological change
- Prices of substitutes in production
- Number of firms in the market
- Expected future prices.

FIGURE 3.5 SHIFTING THE SUPPLY CURVE

If, at every price level, firms increase the quantity of a product they wish to sell, the supply curve shifts to the right. The shift from S_1 to S_3 represents an increase in supply. If, at every price level, firms decrease the quantity of a product they wish to sell, the supply curve shifts to the left. The shift from S_1 to S_2 represents a decrease in supply.



We will discuss how each of these variables affects the supply of MP3 players.

PRICES OF INPUTS The factor most likely to cause the supply curve for a product to shift is a change in the price of an input. (An input is anything used in the production of a good or service.) For instance, if the price of a component of MP3 players, such as the microprocessor, rises, the cost of producing players will increase and players will be less profitable at every price. The supply of players will decline, and the market supply curve for players will shift to the left. Similarly, if the price of an input falls, the supply of players will increase, and the supply curve will shift to the right.

TECHNOLOGICAL CHANGE A second factor that causes a change in supply is technological change. Technological change is a change in the ability of a firm to produce output with a given quantity of inputs. Technological change occurs whenever a firm is able to produce more output using the same amount of inputs. This shift will happen when the productivity of workers or machines increases. If a firm can produce more output with the same amount of inputs, its costs will be lower and the good will be more profitable to produce at any given price. As a result, when technological change occurs, the firm will increase the quantity supplied at every price and its supply curve will shift to the right. Normally, we expect technological change to have a positive impact on a firm's willingness to supply a product.

PRICES OF SUBSTITUTES IN PRODUCTION Firms choose which goods or services they will produce. Alternative products that a firm could produce are called *substitutes in production*. To this point, we have considered the market for all types of digital music players. But suppose we now consider separate markets for digital music players with screens capable of showing videos and for smaller players, without screens, that only play music. If the price of video music players increases, video music players will become more profitable, and Apple, Sony, Microsoft, and other companies making music players will shift some of their productive capacity away from smaller players and towards video players. The companies will offer fewer music-only players at every price, so the supply curve for music-only players will shift to the left.

NUMBER OF FIRMS IN THE MARKET A change in the number of firms in the market will change supply. When new firms enter a market the supply curve shifts to the right, and when existing firms leave, or exit, a market the supply curve shifts to the left. For instance,

Technological change

A change in the ability of a firm to produce output with a given quantity of inputs.

Productivity

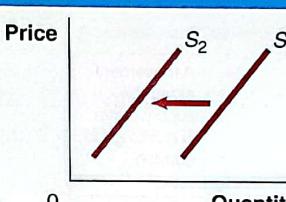
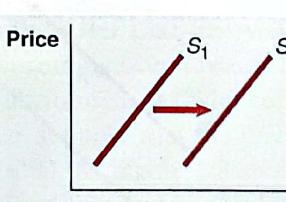
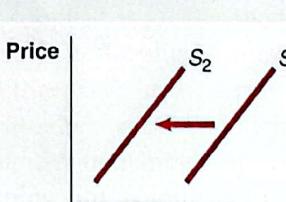
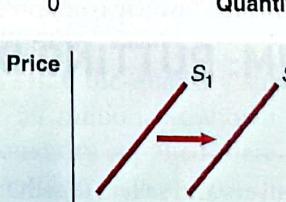
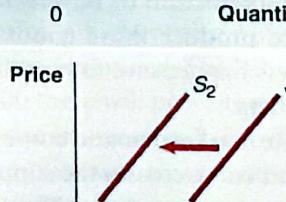
The output produced per unit of input.

when Sony introduced their Walkman MP3 players the market supply curve for MP3 players shifted to the right.

EXPECTED FUTURE PRICES If a firm expects that the price of its product will be higher in the future than it is today, it has an incentive to decrease supply now and increase it in the future. For instance, if Apple believes that prices for MP3 players are temporarily low—perhaps because of a price war between firms making players—it may store some of its production today to sell tomorrow when it expects prices will be higher.

Table 3.2 summarises the most important variables that cause market supply curves to shift. You should note that the table shows the shift in the supply curve that results from an increase in each of the variables. A *decrease* in these variables would cause the supply curve to shift in the opposite direction.

TABLE 3.2 VARIABLES THAT SHIFT MARKET SUPPLY CURVES

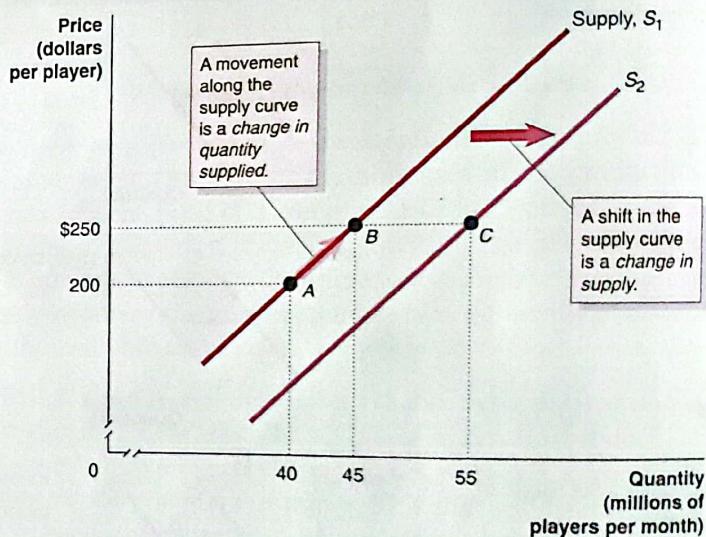
AN INCREASE IN ...	SHIFTS THE SUPPLY CURVE ...	BECAUSE ...
the price of an input		the costs of producing the good rise
productivity		the costs of producing the good fall
the price of a substitute in production		more of the substitute is produced and less of the good is produced
the number of firms in the market		additional firms result in a greater quantity supplied at every price
the expected future price of the product		less of the good will be offered for sale today to take advantage of the higher price in the future

A CHANGE IN SUPPLY VERSUS A CHANGE IN QUANTITY SUPPLIED

We noted earlier that it is important to understand the difference between a change in demand and a change in the quantity demanded. There is a similar difference between a *change in supply* and a *change in the quantity supplied*. A change in supply refers to a shift of the supply curve. The supply curve will shift when there is a change in one of the variables, *other than the price of the product*, that affects the willingness of suppliers to sell the product. A change in the quantity supplied refers to a movement along the supply curve as a result of a change in the product's price. Figure 3.6 illustrates this important distinction. If the price of MP3 players rises from \$200 to \$250 the result will be a movement up the supply curve from point A to point B—an increase in the quantity supplied from 40 million to 45 million. If the price of an input decreases or another factor makes sellers supply more of the product at every price change, the supply curve will shift to the right—an increase in supply. In this case, the increase in supply from S_1 to S_2 causes the quantity of MP3 players supplied at a price of \$250 to increase from 45 million at point B to 55 million at point C.

FIGURE 3.6 A CHANGE IN SUPPLY VERSUS A CHANGE IN THE QUANTITY SUPPLIED

If the price of MP3 players rises from \$200 to \$250 the result will be a movement up the supply curve from point A to point B—an increase in quantity supplied by Apple, Microsoft, Sony and other firms from 40 million to 45 million. If the price of an input decreases or another factor changes that makes sellers supply more of the product at every price, the supply curve will shift to the right—an increase in supply. In this case, the increase in supply from S_1 to S_2 causes the quantity of players supplied at a price of \$250 to increase from 45 million at point B to 55 million at point C



LEARNING OBJECTIVE 3

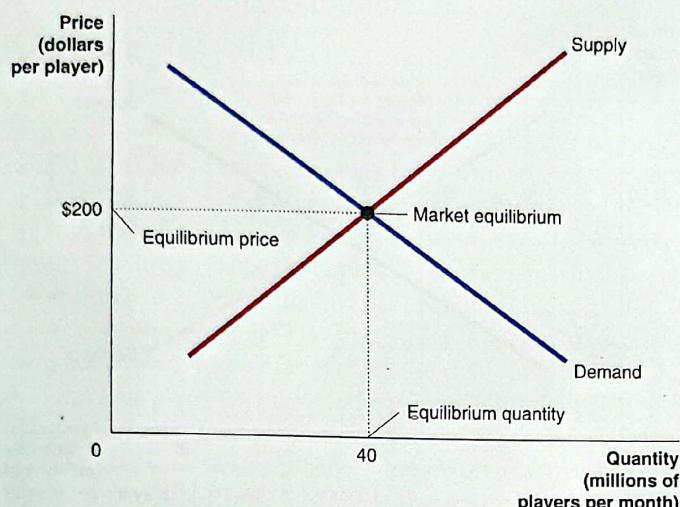
Explain how equilibrium in a market is reached, and use a graph to illustrate market equilibrium.

Market equilibrium
A situation in which quantity demanded equals quantity supplied.

MARKET EQUILIBRIUM: PUTTING DEMAND AND SUPPLY TOGETHER

The purpose of markets is to bring buyers and sellers together. As we saw in Chapter 2, instead of being chaotic and disorderly the interaction of buyers and sellers in markets ultimately usually results in firms being led to produce those goods and services consumers desire most. To understand how this process happens we first need to see how markets manage to reconcile the plans of buyers and sellers.

In Figure 3.7 we bring together the market demand curve for MP3 players and the market supply curve. Notice that the demand curve crosses the supply curve at only one point. This point represents a price of \$200 and a quantity of 40 million MP3 players. Only at this point are willing to sell. This is the point of **market equilibrium**. Only at market equilibrium will the quantity demanded equal the quantity supplied. In this case, the **equilibrium price** is

FIGURE 3.7 MARKET EQUILIBRIUM

Where the demand curve crosses the supply curve determines market equilibrium. In this case, the demand curve for MP3 players crosses the supply curve at a price of \$200 and a quantity of 40 million. Only at this point is the quantity of players consumers are willing to buy equal to the quantity of players firms are willing to sell: the quantity demanded is equal to the quantity supplied.

\$200 and the *equilibrium quantity* is 40 million. Markets that have many buyers and many sellers are *competitive markets*, and equilibrium in these markets is a **competitive market equilibrium**.

Competitive market equilibrium

A market equilibrium with many buyers and many sellers.

HOW MARKETS ELIMINATE SURPLUSES AND SHORTAGES

A market that is not in equilibrium moves towards equilibrium. Once a market is in equilibrium it remains in equilibrium. To see why consider what happens if a market is not in equilibrium. For instance, suppose that the price for MP3 players was \$250 rather than the equilibrium price of \$200. As Figure 3.8 shows, at a price of \$250 the quantity of players supplied would be 45 million and the quantity of players demanded would be 35 million. When the quantity supplied is greater than the quantity demanded, there is a **surplus** in the market. In this case, the surplus is equal to 10 million players ($45\text{ million} - 35\text{ million} = 10\text{ million}$). When there is a surplus firms have unsold goods piling up, which gives them an incentive to increase their sales by reducing the price. Reducing the price will simultaneously increase the quantity demanded and decrease the quantity supplied. This adjustment will reduce the surplus, but as long as the price is above \$200 there will be a surplus and downward pressure on the price will continue. Only when the price has fallen to \$200 will the market be in equilibrium.

If, however, the price were \$100, the quantity supplied would be 30 million and the quantity demanded would be 50 million, as shown in Figure 3.8. When the quantity demanded is greater than the quantity supplied there is a **shortage** in the market. In this case, the shortage is equal to 20 million players ($50\text{ million} - 30\text{ million} = 20\text{ million}$). When a shortage occurs, some consumers will be unable to obtain the product and will be willing to buy the product at a higher price. A higher price will simultaneously increase the quantity supplied and decrease the quantity demanded. This adjustment will reduce the shortage, but as long as the price is below \$200 there will be a shortage and upward pressure on the price will continue. Only when the price has risen to \$200 will the market be in equilibrium.

At a competitive market equilibrium all consumers willing to pay the market price will be able to buy as much of the product as they want, and all firms willing to accept the market price will be able to sell as much of the product as they want. As a result there will be no reason for the price to change unless either the demand curve or the supply curve shifts.

Surplus

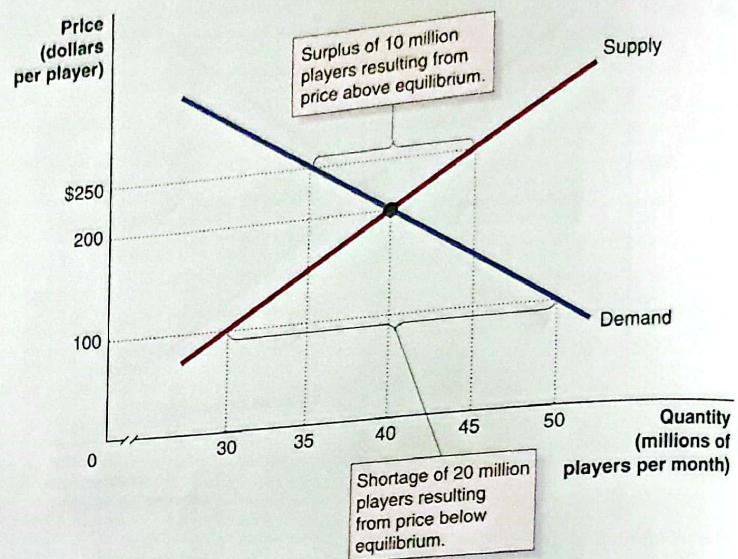
A situation in which the quantity supplied is greater than the quantity demanded.

Shortage

A situation in which the quantity demanded is greater than the quantity supplied.

FIGURE 3.8 THE EFFECT OF SURPLUSES AND SHORTAGES ON THE MARKET PRICE

When the market price is above equilibrium there will be a *surplus*. In the figure, a price of \$250 for MP3 players results in 45 million being supplied, but only 35 million being demanded, or a surplus of 10 million. As firms cut the price to dispose of the surplus, the price will fall to the equilibrium of \$200. When the market price is below equilibrium there will be a *shortage*. A price of \$100 results in 50 million players being demanded, but only 30 million being supplied, or a shortage of 20 million. As consumers who are unable to buy a player offer to pay higher prices, the price will rise to the equilibrium of \$200.



DEMAND AND SUPPLY BOTH COUNT

Always keep in mind that it is the interaction of demand and supply that determines the equilibrium price. Neither consumers nor firms can dictate what the equilibrium price will be. No firm can sell anything at any price unless it can find a willing buyer, and no consumer can buy anything at any price without finding a willing seller.

SHIFTS IN A CURVE VERSUS MOVEMENTS ALONG A CURVE

When analysing markets using demand and supply curves it is important to remember that *when a shift in a demand or supply curve causes a change in equilibrium price, the change in price does not cause a further shift in demand or supply*. For instance, suppose an increase in supply causes the price of a good to fall, while everything else that affects the willingness of consumers to buy the good is constant. The result will be an increase in the quantity demanded, but not an increase in demand. For demand to increase the whole curve must shift. The point is the same for supply: if the price of the good falls but everything else that affects the willingness of sellers to supply the good is constant, the quantity supplied decreases but not the supply. For supply to decrease the whole curve must shift.

LEARNING OBJECTIVE 4

Use demand and supply graphs to predict changes in prices and quantities.

THE EFFECT OF DEMAND AND SUPPLY SHIFTS ON EQUILIBRIUM

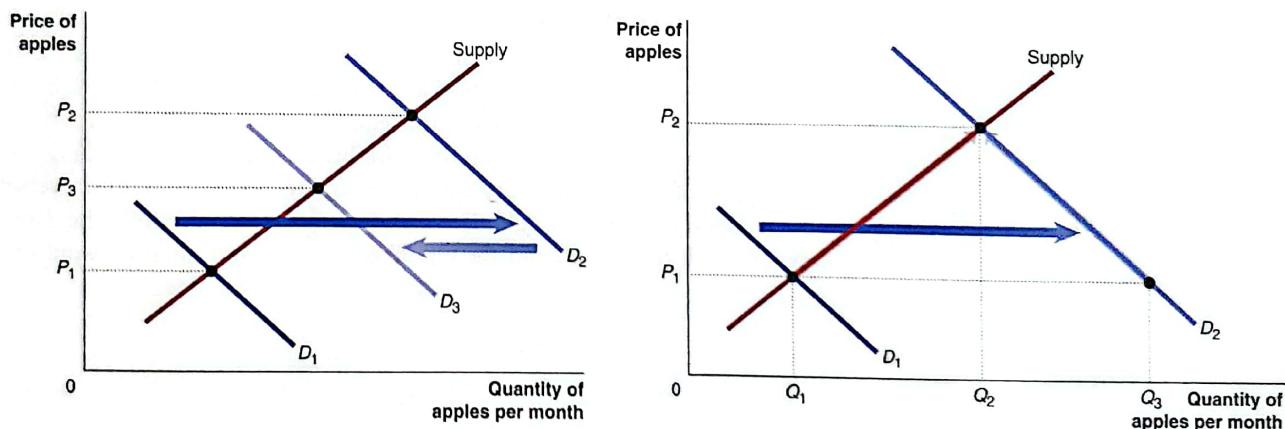
We have seen that the interaction of demand and supply in markets determines the quantity of a good that is produced and the price at which it sells. We have also seen that several variables cause demand curves to shift, and other variables cause supply curves to shift. As a result, demand and supply curves in most markets are constantly shifting, and the prices and quantities that represent equilibrium are constantly changing. In this section we see how shifts in demand and supply curves affect equilibrium price and quantity.

DON'T LET THIS HAPPEN TO YOU REMEMBER: A CHANGE IN A GOOD'S PRICE DOES NOT CAUSE THE DEMAND OR SUPPLY CURVE TO SHIFT

Suppose a student is asked to draw a demand and supply graph to illustrate how an increase in the price of oranges would affect the market for apples, other things being constant. He draws the graph on the left below and explains it as follows. 'Because apples and oranges are substitutes, an increase in the price of oranges will cause an initial shift to the right in the demand curve for apples from D_1 to D_2 . However, because this initial shift in the demand curve for apples results in a higher price for apples, P_2 , consumers will find apples less desirable and the demand curve will shift to the left from D_2 to D_3 , resulting in a final equilibrium price of P_3 .' Do you agree or disagree with the student's analysis?

You should disagree. The student has correctly understood that an increase in the price of oranges will cause the demand curve for apples to shift to the right. But the second demand curve shift the student describes, from D_2 to D_3 , will not take place. Changes in the price of a product do not result in shifts in the product's demand curve. Changes in the price of a product result only in movements along a demand curve.

The graph on the right shows the correct analysis. The increase in the price of oranges causes the demand curve for apples to increase from D_1 to D_2 . At the original price, P_1 , the increase in demand initially results in a shortage of apples equal to $Q_3 - Q_1$. But, as we have seen, a shortage causes the price to increase until the shortage is eliminated. In this case, the price will rise to P_2 , where the quantity demanded and the quantity supplied are both equal to Q_2 . Notice that the increase in price causes a decrease in the *quantity demanded*, from Q_3 to Q_2 , but does *not* cause a decrease in demand.



YOUR TURN

TEST YOUR UNDERSTANDING BY DOING RELATED PROBLEMS 10 AND 18 ON PAGES 81 AND 82 AT THE END OF THIS CHAPTER.

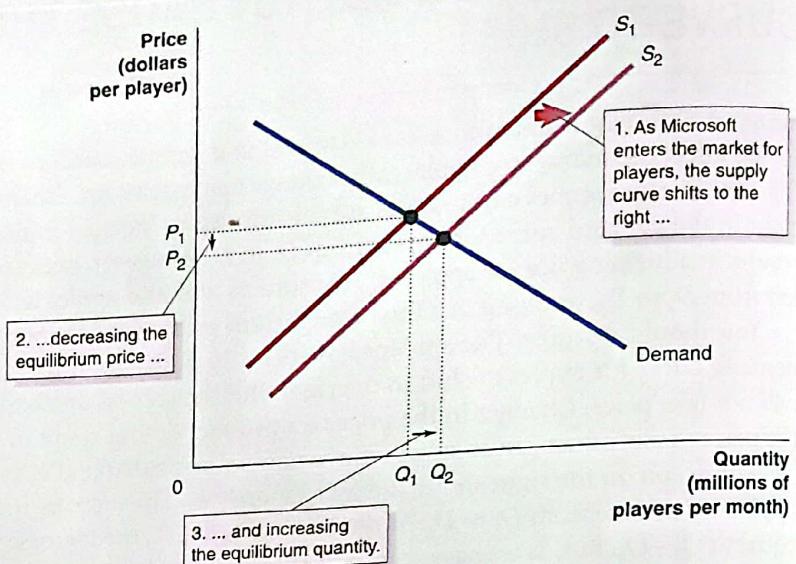
THE EFFECT OF SHIFTS IN SUPPLY ON EQUILIBRIUM

When Sony decided to start selling Walkman MP3 players the market supply curve for MP3 players shifted to the right. Figure 3.9 shows the supply curve shifting from S_1 to S_2 . When the supply curve shifts to the right, there will be a surplus at the original equilibrium price, P_1 . The surplus is eliminated as the equilibrium price falls to P_2 , and the equilibrium quantity rises from Q_1 to Q_2 . If some existing firms decide to exit the market the supply curve will shift to the left, causing the equilibrium price to rise and the equilibrium quantity to fall.

FIGURE 3.9 THE EFFECT OF AN INCREASE IN SUPPLY ON EQUILIBRIUM

If a firm enters a market, as Sony did in the market for MP3 players, the equilibrium price will fall and the equilibrium quantity will rise.

1. As Sony enters the market for players a larger quantity of players will be supplied at every price, so the market supply curve shifts to the right, from S_1 , to S_2 , which causes a surplus of players at the original price, P_1 .
2. The equilibrium price falls from P_1 to P_2 .
3. The equilibrium quantity rises from Q_1 to Q_2 .



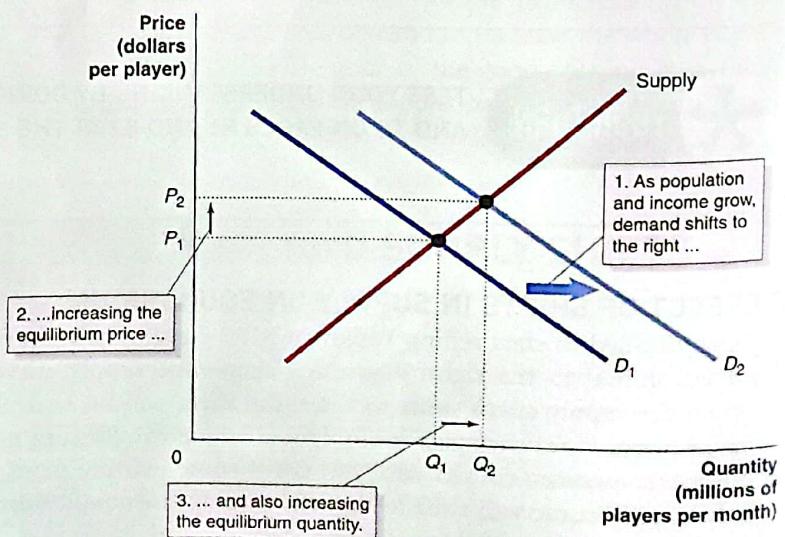
THE EFFECT OF SHIFTS IN DEMAND ON EQUILIBRIUM

When population growth and income growth occur, the market demand for MP3 players shifts to the right. Figure 3.10 shows the effect of a demand curve shifting to the right, from D_1 to D_2 . This shift causes a shortage at the original equilibrium price, P_1 . To eliminate the shortage the equilibrium price rises to P_2 , and the equilibrium quantity rises from Q_1 to Q_2 . By contrast, if the price of a complementary good, such as downloads from music websites, were to rise, the demand for players would decrease. This change would cause the demand curve for players to shift to the left, and the equilibrium price and quantity would both decrease.

FIGURE 3.10 THE EFFECT OF AN INCREASE IN DEMAND ON EQUILIBRIUM

Increases in income and population will cause the equilibrium price and quantity to rise.

1. As population and income grow the quantity demanded increases at every price, and the market demand curve shifts to the right, from D_1 to D_2 , which causes a shortage of MP3 players at the original price, P_1 .
2. The equilibrium price rises from P_1 to P_2 .
3. The equilibrium quantity rises from Q_1 to Q_2 .



THE EFFECT OF SHIFTS IN DEMAND AND SUPPLY OVER TIME

Whenever only demand or only supply shifts, we can easily predict the effect on equilibrium price and quantity. But what happens if *both* curves shift? For instance, in many markets the demand curve shifts to the right over time, as population and income grow. The supply curve also often shifts to the right as new firms enter the market and technological change occurs. Whether the equilibrium price in a market rises or falls over time depends on whether demand shifts to the right more than does supply. Figure 3.11(a) shows that when demand shifts to the right more than supply the equilibrium price rises. However, as Figure 3.11(b) shows, when supply shifts to the right more than demand the equilibrium price falls.

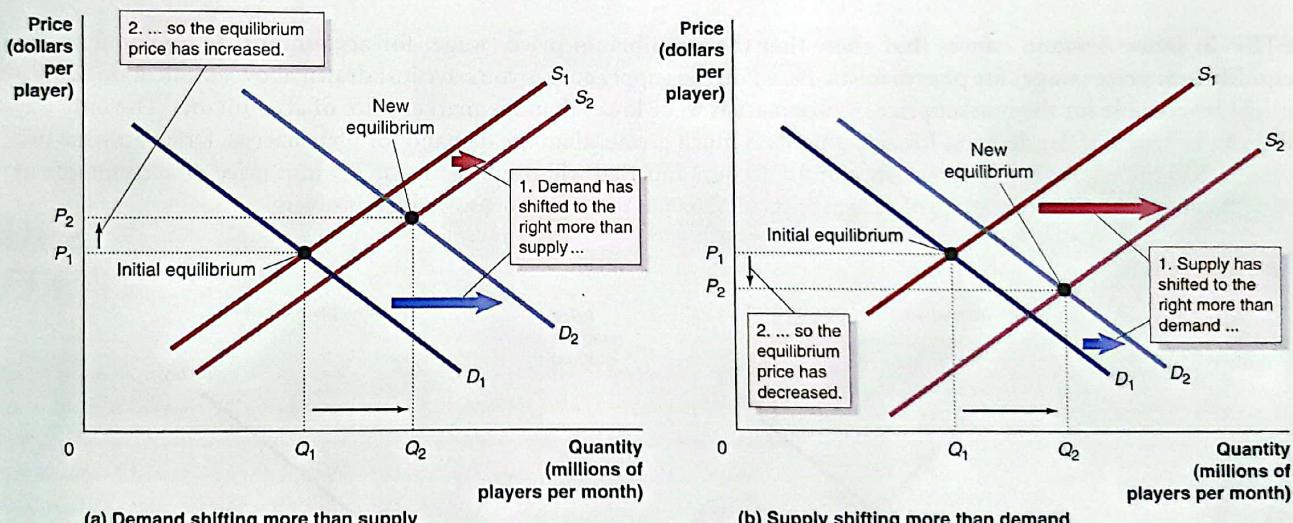
FIGURE 3.11 SHIFTS IN DEMAND AND SUPPLY OVER TIME

Whether the price of a product rises or falls over time depends on whether or not demand shifts to the right more than supply. In Figure 3.11(a), demand shifts to the right more than supply and the equilibrium price rises.

1. Demand shifts to the right more than supply.
2. Equilibrium price rises from P_1 to P_2 .

In Figure 3.11(b), supply shifts to the right more than demand and the equilibrium price falls.

1. Supply shifts to the right more than demand.
2. Equilibrium price falls from P_1 to P_2 .



SOLVED PROBLEM 3.1 DEMAND AND SUPPLY BOTH COUNT: PHARMACISTS AND ACCOUNTANTS

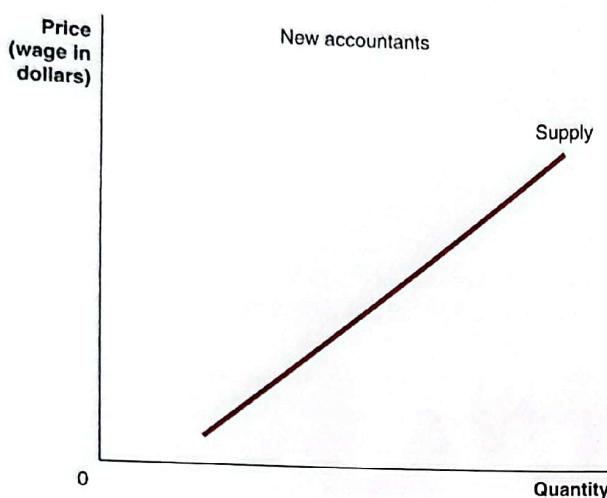
In Australia there are more than three times more new graduates in accountancy than there are in pharmacy. Graduate Careers Australia conducts a survey of students each year soon after graduation and in 2011 this survey revealed that new accountancy graduates earned, on average, \$45 000 per year compared to new pharmacy graduates who earned, on average, \$36 000 per year. Why do these salaries differ?

SOLVING THE PROBLEM

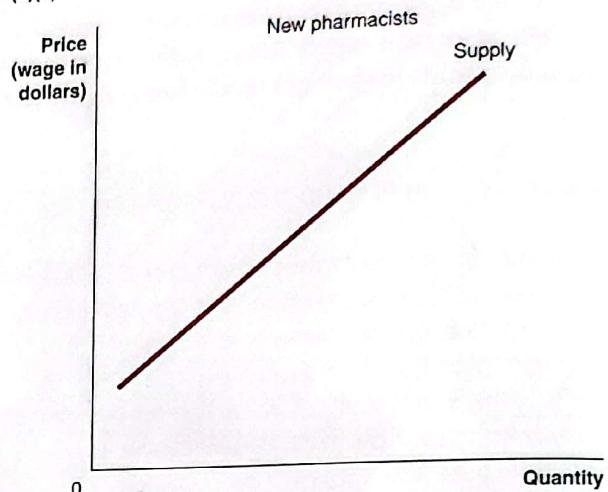
STEP 1: Review the chapter material. This problem is about prices being determined at market equilibrium, so you may want to review the section 'Market equilibrium: Putting demand and supply together', which begins on page 66.

STEP 2: Draw supply curves for new pharmacy and new accountancy graduates that illustrate the greater supply of new accountancy graduates. Begin by drawing two graphs. Label one 'new accountants' and the other 'new pharmacists'. Make sure that the accountants supply curve is much further to the right than the pharmacists supply curve, illustrating the relatively greater supply of accounting graduates.

(a)(i)

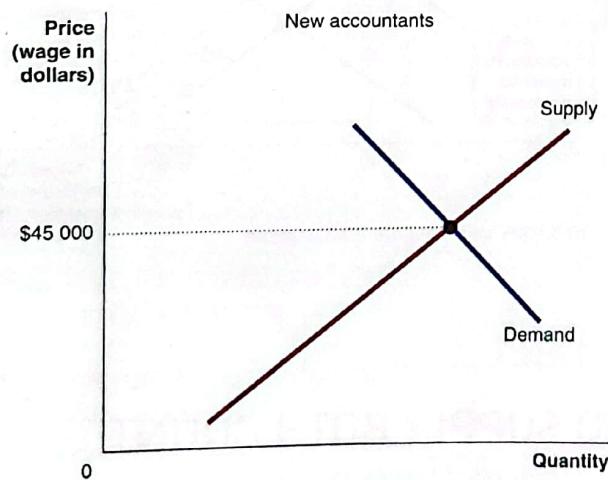


(a)(ii)

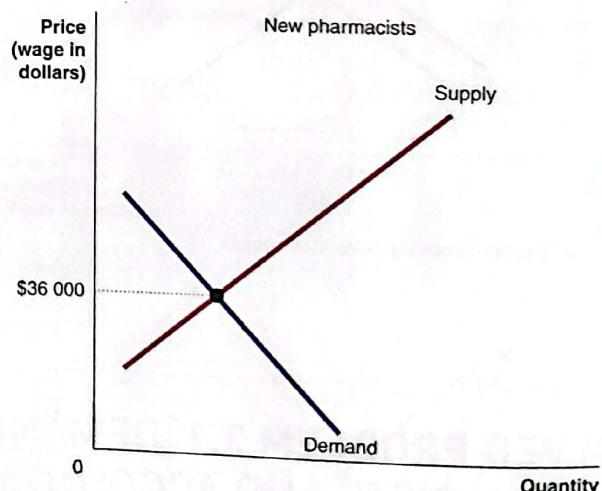


STEP 3: Draw demand curves that show that the equilibrium price (wage) for accountants is higher than the equilibrium price (wage) for pharmacists. Based on the supply curves you have just drawn above, think about how it might be possible for the market price of pharmacists to be lower than the market price of accountants. The only way this can be true is if the demand for accountants is much greater than the demand for pharmacists. Draw on your two graphs demand curves for pharmacists and for accountants that will result in an equilibrium price of accountants of \$45 000 and an equilibrium price of pharmacists of \$36 000. You have now solved the problem.

(b)(i)



(b)(ii)



EXTRA CREDIT: The explanation for this puzzle is that both demand and supply count when determining market price. The demand for accountancy graduates is much greater than the demand for pharmacy graduates, although the supply of accountancy graduates is greater. The upward slope of the supply curves occurs because the higher the wage in a profession the larger the number of students wishing to qualify for that profession.



YOUR TURN

TEST YOUR UNDERSTANDING BY DOING RELATED PROBLEM 12
ON PAGE 81 AT THE END OF THIS CHAPTER.

Table 3.3 summarises all possible combinations of shifts in demand and supply over time and the effects of the shifts on equilibrium price (P) and quantity (Q). For example, the entry in bold in the table shows that if the demand curve shifts to the right and the supply curve also shifts to the right, then the equilibrium quantity will increase, while the equilibrium price may increase, decrease or remain unchanged.

TABLE 3.3 HOW SHIFTS IN DEMAND AND SUPPLY AFFECT EQUILIBRIUM PRICE (P) AND QUANTITY (Q)

	SUPPLY CURVE UNCHANGED	SUPPLY CURVE SHIFTS TO THE RIGHT	SUPPLY CURVE SHIFTS TO THE LEFT
DEMAND CURVE UNCHANGED	Q unchanged P unchanged	Q increases P decreases	Q decreases P increases
DEMAND CURVE SHIFTS TO THE RIGHT	Q increases P increases	Q increases P increases or decreases	Q increases or decreases P increases
DEMAND CURVE SHIFTS TO THE LEFT	Q decreases P decreases	Q increases or decreases P decreases	Q decreases P increases or decreases

HUGE WORLDWIDE SALES GROWTH IN LCD TELEVISIONS

Research on flat-screen televisions using liquid crystal displays (LCDs) began in the 1960s. However, it was surprisingly difficult to use this research to produce a television priced low enough for many consumers to purchase. One researcher noted: 'In the 1960s, we used to say "In ten years, we're going to have the television on the wall". We said the same thing in the seventies and then in the eighties.' A key technical problem in manufacturing LCD televisions was making glass sheets large enough, thin enough and clean enough to be used as LCD screens. Finally, in 1999, Corning Inc. developed a process to manufacture glass less than one millimetre thick that was very clean because it was produced without being touched by machinery.

Corning's breakthrough led to what the *Wall Street Journal* described as a 'race to build new, better factories'. For years the leading firms were Korea's Samsung Electronics and LG Philips LCD, Taiwan's AU Optronics and Japan's Sharp Corporation. But in recent years new firms, such as Vizio in California, have entered the market, and existing firms, such as Matsushita, which sells televisions under the Panasonic brand, have greatly expanded production. Matsushita's new factory in Japan is able to produce as many as 15 million LCD screens per year. The increase in supply had a dramatic effect on the price of LCD televisions, driving the price of a typical LCD television from US\$4000 in 2004 to less than US\$1000 by 2012.

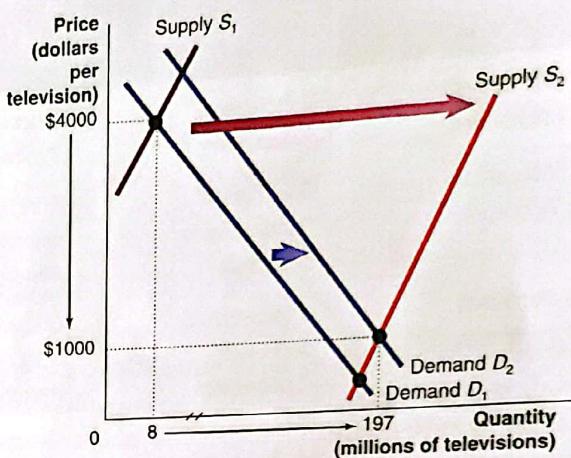
Over the same time period the emerging markets in Asia began demanding LCD televisions. Further, the development of LED backlighting, 3D and Internet connectivity increased demand in mature markets such as Australia, Japan, western Europe and the USA.

3.2 MAKING THE CONNECTION



Corning's breakthrough spurred the manufacture of LCD televisions and an eventual decline in price

In 2011 the demand for these new technologies in LCD televisions was estimated to be responsible for 14 per cent of the total growth in worldwide sales of LCD televisions. The following figure shows the increase in supply driving the average price of LCD televisions lower, leading to a significant increase in quantity demanded. The figure also shows the increase in demand due to rising income levels in emerging Asian economies and changes in tastes towards the new technologies in mature markets, with the demand curve shifting rightwards. These combined effects increased total annual worldwide sales of LCD televisions from 8 million in 2004 to an estimated 197 million in 2011.



SOURCE: Consumer Electronics Association (2011), *Digital World – 2011 Global CE Sales and Forecast*, at <www.CE.org>, viewed 11 February 2012; Daisuke Wakabayashi and Christopher Lawton (2009), 'Television makers confront a shakeout', *Wall Street Journal*, 20 January; David Richards (2007), 'Sony and Panasonic flat screen kings', *Smarthouse.com*, 13 February; Evan Ramstad (2004), 'Big display: once a footnote, flat screens grow into huge industry', *Wall Street Journal*, 30 August, p. A1.

SOLVED PROBLEM 3.2 DEMAND AND SUPPLY BOTH COUNT: THE AUSTRALIAN HOUSING MARKET

Historically, property values in Australia follow cycles, from peak to slowing down to a flat period then up to a new peak.

During a period of strongly rising values a number of things happen, but mainly the rate of construction of new property increases. This is because developers and speculators are constantly monitoring the profitability of an investment. They look at land costs, construction costs and other costs such as wages, and they sell for a price higher than these costs on completion, the difference being the profit margin. When values are rising strongly there is greater potential return, hence more developers will commit to development and therefore the rate of construction increases dramatically.

Nobody tells builders, developers or speculators when to stop. They keep building as values are rising, to take advantage of the strong market. Then, at some point in time, there will be more dwellings built and placed on the total market than there are people to occupy them.

How can values rise any further when there is a surplus of property and not enough buyers in the market to buy or rent them? Accordingly the market will stall. Values tend simply to level off. So the developers and speculators withdraw from the market and the rate of new construction declines over time.

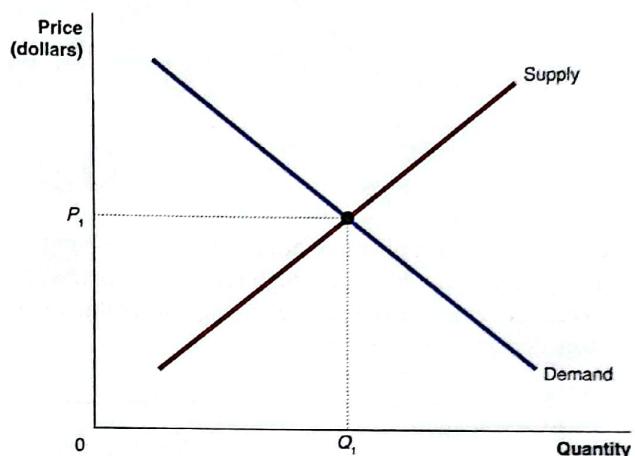
However, the population continues to increase, and as children leave home they enter the market in their own right. After a while the excess property is slowly absorbed. And so the pendulum of supply and demand tilts again.¹

SOURCE: Jude Watson (2006), 'The property cycle—where are we now?', Quartile Research, September.

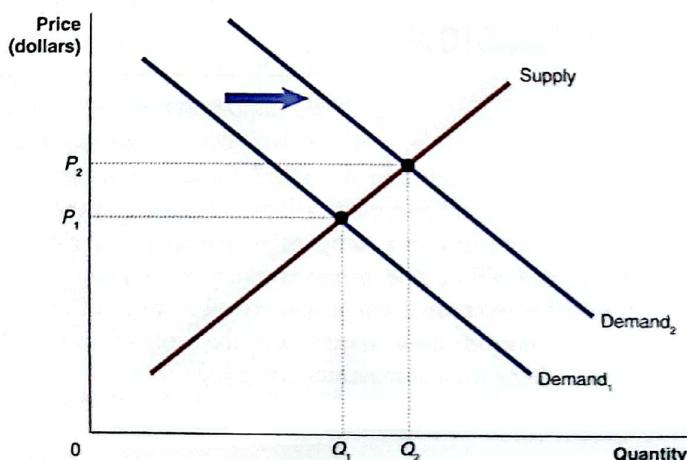
Show the effects on the housing market of (a) a growing population and (b) a shortage of rental vacancies.

SOLVING THE PROBLEM

STEP 1: Review the chapter material. This problem is about how shifts in demand and supply curves affect the equilibrium price, so you may want to review the section 'The effects of shifts in demand and supply over time', which begins on page 71.



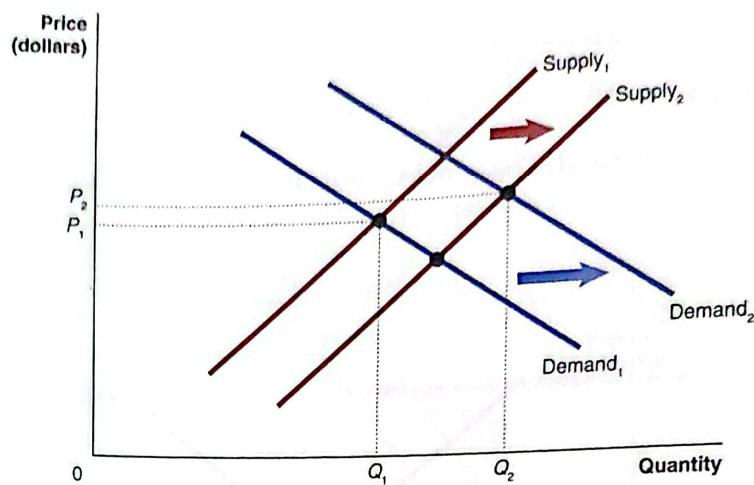
STEP 2: Draw the demand and supply graph. Draw a demand and supply graph, showing equilibrium in the housing market.



STEP 3: Show the shift in the demand curve caused by an increasing population and explain the effect on housing prices.

Shift the demand curve to the right such that the new equilibrium price is higher than before. Show that the new equilibrium is at a higher price than before and there is an increase in the number of houses bought and sold.

STEP 4: Show the shift in the supply curve and the demand curve in the housing market following a shortage of rental vacancies.



Shift the supply curve to the right as developers supply more houses in *anticipation* of an increase in house prices due to an increase in demand for houses by investors who expect high returns in the rental market. There may also be an expectation by developers of an increase in demand from people buying houses due to the shortage of rentals. Shift the demand curve to the right as investors demand more houses.



YOUR TURN

FOR MORE PRACTICE DO RELATED PROBLEMS 13, 14 AND 15
ON PAGE 81 AT THE END OF THIS CHAPTER.

CONCLUSION

The interaction of demand and supply determines market equilibrium. The model of demand and supply provides us with a powerful tool for predicting how changes in the actions of consumers and firms will cause changes in equilibrium prices and quantities. When many buyers and many sellers participate in the market, the result is a competitive market equilibrium. In a competitive market equilibrium all consumers willing to pay the market price will be able to buy as much of the good as they want, and all firms willing to accept the market price will be able to sell as much of the product as they want.

Read 'An inside look' to learn how the profit strategies of printer manufacturers involve selling higher priced complementary goods.

SUMMARY

<p>The types and quantities of goods and services produced ultimately depend on the desires of consumers. A <i>demand curve</i> is a graph showing the relationship between the price of a good and the quantity of the good consumers are willing and able to buy over a period of time. The <i>law of demand</i> states that <i>ceteris paribus</i>—holding everything else constant—the quantity of a product demanded increases when the price falls and decreases when the price rises. Changes in income, the prices of related goods, tastes, population and demographics and expected future prices all cause the demand curve to shift. Demand curves always slope downwards. A <i>change in demand</i> refers to a shift of the demand curve. A <i>change in quantity demanded</i> refers to a movement along the demand curve as a result of a change in the product's price.</p>	LEARNING 1 OBJECTIVE Discuss the variables that influence the demand for goods and services.
<p>When the price of a product rises, producing the product is more profitable and a greater amount will be supplied. The <i>law of supply</i> states that, holding everything else constant, the quantity of a product supplied increases when the price rises and decreases when the price falls. Changes in the prices of inputs, technology, the prices of substitutes in production, expected future prices and the number of firms in a market all cause the supply curve to shift. A <i>change in supply</i> refers to a shift of the supply curve. A <i>change in quantity supplied</i> refers to a movement along the supply curve as a result of a change in the product's price.</p>	LEARNING 2 OBJECTIVE Discuss the variables that influence the supply of goods and services.
<p><i>Market equilibrium</i> occurs where the supply curve intersects the demand curve. A <i>competitive market equilibrium</i> has a market equilibrium with many buyers and many sellers. Only at this point is the quantity supplied equal to the quantity demanded. Prices above equilibrium result in <i>surpluses</i>, with the quantity supplied being greater than the quantity demanded. Surpluses cause the market price to fall. Prices below equilibrium result in <i>shortages</i>, with the quantity demanded being greater than the quantity supplied. Shortages cause the market price to rise.</p>	LEARNING 3 OBJECTIVE Explain how equilibrium in a market is reached, and use a graph to illustrate market equilibrium.
<p>In most markets demand and supply curves shift frequently, causing changes in equilibrium prices and quantities. Over time, if demand increases more than supply equilibrium price will rise. If supply increases more than demand equilibrium price will fall.</p>	LEARNING 4 OBJECTIVE Use demand and supply graphs to predict changes in prices and quantities.

KEY TERMS

<i>ceteris paribus</i> ('all else being equal') <i>competitive market equilibrium</i> <i>complements</i> <i>demand curve</i> <i>demand schedule</i> <i>demographics</i> <i>income effect</i> <i>inferior good</i>	57 67 59 56 56 59 58 59	<i>law of demand</i> <i>law of supply</i> <i>market demand</i> <i>market equilibrium</i> <i>market supply</i> <i>normal good</i> <i>productivity</i> <i>quantity demanded</i> <i>quantity supplied</i>	57 63 56 66 63 59 64 56 62	<i>shortage</i> <i>substitutes</i> <i>substitution effect</i> <i>supply curve</i> <i>supply schedule</i> <i>surplus</i> <i>technological change</i>	67 59 57 62 62 67 64
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REVIEW QUESTIONS

- What is a demand schedule? What is a demand curve?
- What do economists mean when they use the Latin expression *ceteris paribus*?
- What is the difference between a change in demand and a change in quantity demanded?
- What is the law of demand? What are the main variables that will cause the demand curve to shift? Give an example of each.
- What is a supply schedule? What is a supply curve?
- What is the law of supply? What are the main variables that will cause a supply curve to shift? Give an example of each.
- What do economists mean by 'market equilibrium'?
- What happens in a market if the current price is above the equilibrium price? What will happen if the current price is below the equilibrium price?
- Draw a demand and supply curve to show the effect on the equilibrium price in a market in the following situations:
 - The demand curve shifts to the right.
 - The supply curve shifts to the left.
- If, over time, the demand curve for a product shifts to the right more than the supply curve does, what will happen to the equilibrium price? What will happen to the equilibrium price if the supply curve shifts to the right more than the demand curve? For each case, draw a demand and supply graph to illustrate your answer.

PROBLEMS AND APPLICATIONS

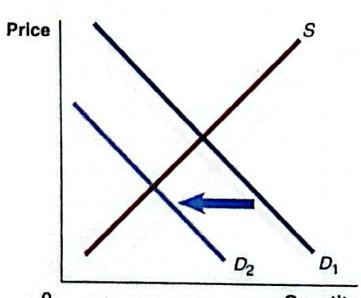
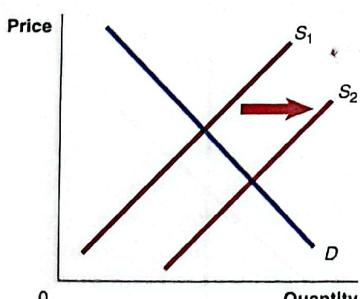
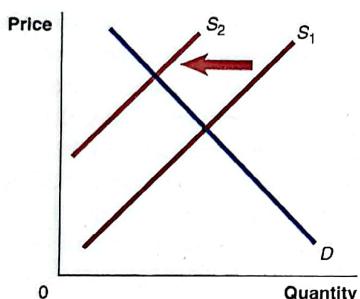
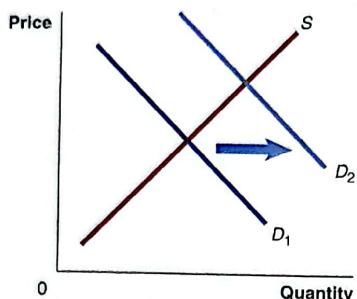
Visit MyEconLab to practise similar exercises.

- For each of the following pairs of products, state which are complements, which are substitutes and which are unrelated.
 - Pepsi and Coke
 - Hot dog sausages and soft bread rolls
 - Vegemite and strawberry jam
 - MP3 players and graphics calculators
- [Related to the opening case]. Suppose Apple discovers that it is selling relatively few downloads of television programs on iTunes. Are downloads of television programs substitutes or complements for downloads of music? For downloads of movies? How might the answers to these questions affect Apple's decision about whether to continue offering downloads of television programs on iTunes?
- State whether each of the following events will result in a movement along the demand curve for McDonald's Big Mac burgers or whether it will cause the curve to shift. If the demand curve shifts, indicate whether it will shift to the left or to the right and draw a graph to illustrate the shift.
 - The price of Hungry Jack's Whopper burgers declines.
 - McDonald's distributes vouchers for \$1.00 off on a purchase of a Big Mac.
 - A shortage of potatoes causes the price of fries to increase.
 - KFC raises the price of a bucket of fried chicken.
- During times of economic downturns and recessions, when unemployment rates are rising, it has been observed that sales of cheap chocolates and other sweets increase. If this is true, are chocolates and sweets normal goods or inferior goods? Briefly explain what characteristics of chocolates and sweets relative to other goods might make them normal goods or inferior goods.
- [Related to Making the Connection 3.1] Name three goods or services whose demand is likely to increase rapidly if the following demographic groups increase at a faster rate than the population as a whole:
 - Teenagers
 - Children under the age of five years
 - People over the age of 65 years
- Is it possible for a good to be an inferior good for one person and a normal good for another person? If it is possible, can you give some examples?
- Suppose that the data in the following table shows the price and quantity of base model Holden Commodore vehicles. Do these data indicate that the demand curve for Commodores is upward sloping? Explain.

YEAR	PRICE	QUANTITY
2010	\$35 000	50 000
2011	\$35 700	51 000
2012	\$36 600	52 500

- The Japanese company Panasonic Corporation—one of the largest electronic companies in the world, manufacturing televisions, cameras, audio equipment, telephones and home appliances—reported in May 2010 that its net annual income was 50 billion yen, which was less than half that forecast by financial analysts.² What factors do you think contributed to the inaccuracy of the analysts' forecast? Briefly explain.

9. Below are four graphs and four market scenarios, each of which would cause either a movement along the supply curve for Pepsi or a shift of the supply curve. Match each scenario with the appropriate diagram.
- A decrease in the supply of Coca-Cola
 - Average household income rises
 - An improvement in soft-drink bottling technology
 - An increase in the price of sugar



10. [Related to Don't let this happen to you] A student writes the following: 'Increased production leads to a lower price, which in turn increases demand.' Do you agree with his reasoning? Briefly explain.

11. A study³ indicated that 'stricter university alcohol policies, such as raising the price of alcohol or banning alcohol on campus, decrease the number of students who use marijuana'.

- On the basis of this information, are alcohol and marijuana substitutes or complements?
- Suppose that campus authorities reduce the supply of alcohol on campus. Use demand and supply graphs to illustrate the impact on the campus alcohol and marijuana markets.

12. [Related to Solved problem 3.1] The demand for watermelons is highest during summer and lowest during winter. Yet watermelon prices are normally lower in summer than in winter. Use a demand and supply graph to demonstrate how this is possible. Carefully label the curves in your graph and clearly indicate the equilibrium summer price and the equilibrium winter price.

13. [Related to Solved problem 3.2] During a number of years in the 2000s Australia experienced severe droughts, causing the production levels of wheat to fall significantly. Draw a demand and supply graph to show the effect of a drought on the price of bread in Australia.

14. [Related to Solved problem 3.2] The average price of high-definition plasma and LCD flat-screen televisions fell significantly during the 2000s. During that period Sharp, Matsushita Electric Industrial, Samsung and other companies all began producing plasma and LCD televisions. Use a demand and supply graph to explain what happened to the quantity of plasma and LCD televisions sold during this period.

15. [Related to Solved problem 3.2] Some time ago chocolate lovers were horrified by reports of a pending chocolate shortage.

Manufacturers had met in Panama to discuss ways of averting a projected shortfall in cocoa production in the wake of a poor season. The vulnerability to pests and plant diseases of the cocoa tree, which can only grow in tropical regions within 20 degrees of the equator, and the failure of cocoa production to keep up with growth in consumption, added to concerns. Predictions of a serious shortage within 10 years were widely reported.

The Confectionary Manufacturers of Australasia told CHOICE that efforts are being made to develop disease-resistant plants, and the plant is being grown in different regions in the hope of increasing production. In Australia, for example, the Federal Government and the departments of agriculture in Queensland, the NT and WA have teamed up with 'a leading chocolate manufacturer' to fund trial plantations in Broome, Darwin and Innesfail.⁴

From the above article, illustrate the following using demand and supply graphs for each of the below.

- The effect on the supply of cocoa if the diseases affecting the cocoa tree become worse.
- The effect on the demand curve of cocoa if worldwide chocolate consumption continues to rise.
- The effect on the world equilibrium price and quantity of cocoa if Australia can successfully cultivate cocoa trees.
- The effect on the equilibrium price of chocolate if all first-year students rush out and purchase chocolate for their economics lecturers.

16. The telecommunications industry in Australia was fully deregulated in July 1997, allowing new competitors into the market. In addition there have been dramatic changes in the types of technology available to customers, with the rapid development of mobile networks and Internet technology.

Explain and illustrate, using demand and supply graphs, the effect on the equilibrium price and quantity of telecommunications services of:

- the full deregulation of the telecommunications industry.
- the development of new technology.

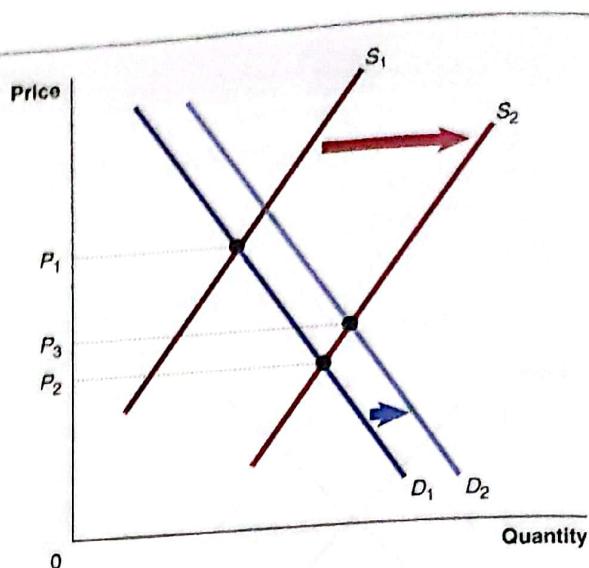
17. Briefly explain whether each of the following statements is true or false.

- If the demand for and supply of a product both increase, the equilibrium quantity of the product must also increase.
- If the demand for and supply of a product both increase, the equilibrium price of the product must also increase.
- If the demand for a product decreases and the supply of the product increases, the equilibrium price of the product may increase or decrease, depending on whether supply or demand has shifted more.

18. [Related to Don't let this happen to you] A student was asked to draw a demand and supply graph to illustrate the effect on the personal computer (PC) market of a fall in the price of computer hard drives, *ceteris paribus*. She drew the graph below and explained it as follows:

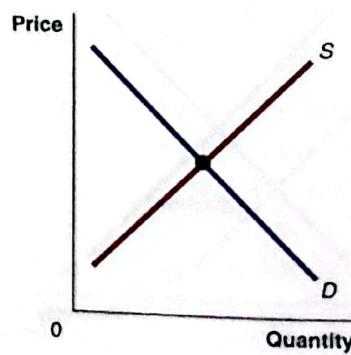
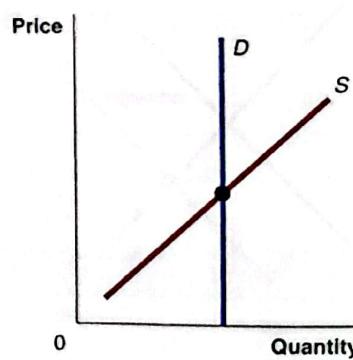
Hard drives are an input to PCs, so a fall in the price of hard drives will cause the supply curve for PCs to shift to the right (from S_1 to S_2). Because this shift in the supply curve results in a lower price (P_2), consumers will want to buy more PCs and the demand curve will shift to the right (from D_1 to D_2). We know that more PCs will be sold, but we can't be sure whether the price of PCs will rise or fall. That depends on whether the supply curve or the demand curve has shifted further to the right. I assume that the effect on supply is greater than the effect on demand, so I show the final equilibrium price (P_3) as being lower than the initial equilibrium price (P_1).

Explain whether you agree or disagree with the student's analysis. Be careful to explain exactly what—if anything—you find wrong with her analysis.



19. New government regulations in Australia on the educational qualifications of those working in child care centres now require higher levels of formal training. Suppose that these regulations increase the quality of child care and cause the demand for child care services to increase. At the same time, assume that complying with the new government regulations increases the costs of child care businesses. Draw a demand and supply graph to illustrate the effects of these changes in the market for child care services. Briefly explain whether the total quantity of child care services purchased will increase or decrease as a result of the new regulations.

20. The following are the supply and demand graphs for two markets. One of the markets is for Porsche cars, and the other is for a potentially life-saving cancer-fighting drug. Briefly explain which diagram is most likely to represent which market.



CHAPTER TWO

CHOICES AND TRADE-OFFS IN THE MARKET



LEARNING OBJECTIVES

AFTER STUDYING THIS CHAPTER YOU SHOULD BE ABLE TO:

1. Use a production possibility frontier to analyse opportunity costs and trade-offs.
2. Understand comparative advantage and explain how it is the basis for trade.
3. Explain the basic idea of how a market system works.
4. Understand why property rights are necessary for a well-functioning market.

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Scarcity

The situation in which unlimited wants exceed the limited resources available to fulfil those wants.

IN A MARKET system, managers at most firms must make decisions like those made by BMW's managers. The decisions managers face reflect the key fact of economic life: **scarcity** requires trade-offs. As we learned in Chapter 1, scarcity exists because we have unlimited wants but only limited resources available to fulfil those wants. Goods and services are scarce. So, too, are the economic resources, or factors of production—workers, capital and machinery, natural resources and entrepreneurial ability—used to make them. Your time is scarce, which means you face trade-offs: if you spend an hour studying for an economics exam you have one less hour to spend studying for a management exam or going to the movies. If your university decides to use some of its scarce budget to buy new computers for the computer labs, those funds will not be available to buy new books for the library or to resurface the student car park. If BMW decides to devote some of the scarce workers and machinery in its Regensburg plant to producing more Z4 Roadster sports cars, those resources will not be available to produce more 3 Series cars.

Many of the decisions of households and firms are made in markets. One key activity that takes place in markets is trade. By engaging in trade, people can raise their standard of living. Trade involves the decisions of millions of households and firms spread around the world. In this chapter we provide an overview of how the market system coordinates the independent decisions of these millions of households and firms. We begin our analysis of the economic consequences of scarcity and the working of the market system by introducing an important economic model: the *production possibility frontier*.

LEARNING 1 OBJECTIVE

Use a production possibility frontier to analyse opportunity costs and trade-offs.

Production possibility frontier

A curve showing the maximum attainable combinations of two products that may be produced with available resources.

PRODUCTION POSSIBILITY FRONTIERS AND REAL-WORLD TRADE-OFFS

As we saw in the opening case to this chapter, BMW operates a car factory in Regensburg, Germany, where it produces a number of models, including Z4 Roadster sports cars and the 3 Series car range. Because the firm's resources—workers, machinery, materials and entrepreneurial skills—are limited, BMW faces a trade-off: resources devoted to producing Z4s are not available for producing 3 Series, and vice versa. Chapter 1 explained that economic models can be useful in analysing many questions. We can use a simple model called the *production possibility frontier* to analyse the trade-offs BMW faces in its Regensburg plant. A **production possibility frontier** is a curve showing the maximum attainable combinations of two products that may be produced with available resources. We will use an example of two BMW products—Z4 Roadsters and 3 Series convertibles. The resources are BMW's workers, materials, robots and other machinery.

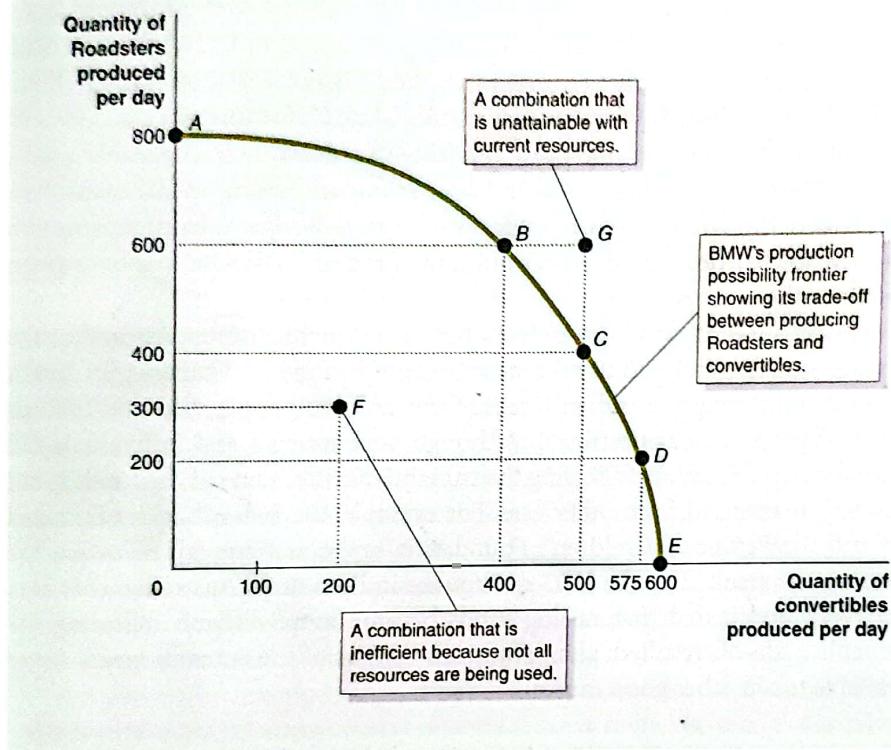
GRAPHING THE PRODUCTION POSSIBILITY FRONTIER

Figure 2.1 uses a production possibility frontier to illustrate the trade-offs facing BMW. The numbers from the table are plotted on the graph. The curve in the graph is BMW's production possibility frontier. If BMW uses all its resources efficiently to produce Roadsters it can produce 800 per day—point A at one end of the production possibility frontier. If BMW uses all its resources to produce convertibles it can produce 600 per day—point E at the other end of the production possibility frontier. If BMW devotes resources to producing both vehicles it could be at a point like B, where it produces 600 Roadsters and 400 convertibles.

All the combinations either on the frontier—like A, B, C, D and E—or inside the frontier—like point F—are *attainable* with the resources available. Combinations on the frontier are *efficient* because all available resources are being fully utilised, and the fewest possible resources are being used to produce a given amount of output. Combinations inside the frontier—like point F—are *inefficient* because maximum output is not being obtained from the available resources—perhaps because the assembly line is not operating at capacity. For example, at point F only 300 Roadsters and 200 convertibles

FIGURE 2.1 BMW'S PRODUCTION POSSIBILITY FRONTIER

BMW's production choices per day		
Choice	Quantity of Roadsters produced	Quantity of convertibles produced
A	600	0
B	600	400
C	400	500
D	200	575
E	0	600



BMW faces a trade-off: to build more Roadsters it must build fewer convertibles. The production possibility frontier illustrates the trade-off BMW faces. Combinations on the production possibility frontier—like points A, B, C, D and E—are efficient because the maximum output is being obtained from the available resources. Combinations inside the frontier—like point F—are inefficient because some resources are not being used or are not being used efficiently. Combinations outside the frontier—like point G—are unattainable with the current amount of resources.

are being produced, but if the resources were combined efficiently more of both vehicles could be produced, as shown by points on the frontier, such as point B. BMW might like to be beyond the frontier—at a point like G where it would be producing 600 Roadsters and 500 convertibles—but points beyond the production possibility frontier are *unattainable* given the firm's current resources. To produce the combination at G BMW would need more machines or more workers.

Notice that if BMW is producing efficiently and is on the production possibility frontier the only way to produce more of one vehicle is to produce less of the other vehicle. Recall from Chapter 1 that the **opportunity cost** of any activity is the highest-valued alternative that must be given up to engage in that activity. For BMW, the opportunity cost of producing one additional 3 Series convertible is the number of Z4 Roadsters the company will not be able to produce because it has already devoted those resources to producing convertibles. For example, in moving from point B to point C, the opportunity cost of producing 100 more convertibles per day (from 400 to 500 vehicles) is the 200 fewer Roadsters that can be produced (from 600 down to 400).

What point on the production possibility frontier is best? We can't tell without further information. If consumer demand for 3 Series convertibles is greater than demand for Z4 Roadsters the company is likely to choose a point closer to E. If demand for Roadsters is greater than demand for convertibles the company is likely to choose a point closer to A.

Opportunity cost

The highest-valued alternative that must be given up to engage in an activity.

2.1 MAKING THE CONNECTION



More funds for emergency relief can mean fewer funds for other charities

TRADE-OFFS AND EMERGENCY AID RELIEF

When natural disasters such as earthquakes, hurricanes, floods and droughts strike populated areas substantial amounts of emergency aid from individuals and governments throughout the world are donated. However, both governments and individuals face limited budgets, and funds used for one purpose are unavailable to be used for another purpose.

In January 2010 a massive earthquake struck the island of Haiti, killing more than 230 000 people and causing massive destruction of homes and infrastructure. Non-government aid organisations received substantial donations from individuals and businesses to assist the Haitian people. However, when a devastating earthquake hit Chile just over one month later, non-government aid agencies reported that donations were less than hoped for. The Red Cross and the aid programs of churches reported that their regular donation levels to their other causes fell in the months following the two earthquakes. Unfortunately, the trade-off of an increase in charitable giving to one cause resulting in a decrease in charitable giving to other causes is common following a disaster. This is not surprising as charities often experience what is sometimes referred to as 'budget exhaustion'. Budget exhaustion suggests that people who give to charities put aside a certain sum of money to donate, and once given there is no more for other causes.

This trade-off was also seen following the December 2004 tsunami disaster. An earthquake caused a tidal wave—or tsunami—to flood coastal areas of Indonesia, Thailand, Sri Lanka and other countries bordering the Indian Ocean. Over 280 000 people died and billions of dollars worth of property was destroyed. Although governments and individuals did increase their total charitable giving following the tsunami disaster, some of the funds spent on tsunami relief were diverted from other uses. For example, the Swiss charities Emmaus Leprosy Relief and the Pestalozzi Children's Foundation saw donations fall following the tsunami, mirroring the result after the 2003 earthquake in Bam, Iran. Australian charities, such as United Way, also stated that raising funds became more difficult following the tsunami. A difficult trade-off resulted: giving funds to victims of the tsunami meant fewer funds were available to aid other good causes.

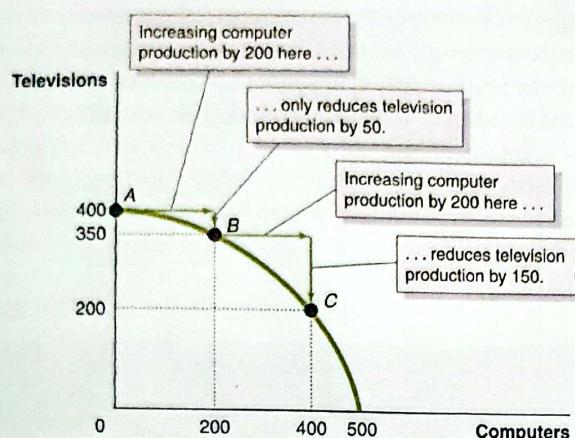
SOURCE: 'Donations to Haiti might deprive local charities', 26 January 2010, AllBusiness, at <www.allbusiness.com>, viewed 11 January 2012; 'Charities fear post-tsunami donor fatigue', 12 February 2005, SwissInfo.ch, at <www.swissinfo.ch>, viewed 19 May 2010.

INCREASING MARGINAL OPPORTUNITY COSTS

We can also use the production possibility frontier to explore issues concerning the economy as a whole. For example, suppose we assume that an economy produces just two types of goods: televisions and computers. Figure 2.2 shows a production possibility frontier for these two goods. If all the country's resources are devoted to producing televisions, 400 can be produced in one year. If all resources are devoted to producing computers, 500 can be produced in one year. Devoting resources to producing both goods results in the economy being at other points along the production possibility frontier.

Notice that the production possibility frontier is bowed outwards from the origin. Because the curve is bowed out (concave) the opportunity cost of computers in terms of televisions depends upon where the economy currently is on the production possibility frontier. For example, to increase computer production from zero to 200—moving from point A to point B—the economy only has to give up 50 televisions. But to increase computer production by another 200—moving from point B to point C—the economy has to give up 150 televisions.

As the economy moves down the production possibility frontier it experiences increasing marginal opportunity costs because increasing computer production by 200 televisions.

FIGURE 2.2 INCREASING MARGINAL OPPORTUNITY COST

As the economy moves down the production possibility frontier it experiences increasing marginal opportunity costs because increasing computer production by a given quantity requires larger and larger decreases in television production. For example, to increase computer production from 0 to 200—moving from point A to point B—the economy only has to give up 50 televisions. But to increase computer production by another 200—moving from point B to point C—the economy has to give up 150 televisions

given quantity requires larger and larger decreases in television production. Increasing marginal opportunity costs occur because some workers, machines and other resources are better suited to one use than to another. At point A some resources that are well suited to producing computers are being forced to produce televisions. Shifting these resources into producing computers by moving from point A to point B allows a substantial increase in computer production without much loss of television production. But as the economy moves down the production possibility frontier more and more resources that are better suited to television production are switched into computer production. As a result, the increases in computer production become increasingly smaller while the decreases in television production become increasingly larger.

The idea of increasing marginal opportunity costs illustrates an important economic concept: *the more resources already devoted to an activity, the smaller the payoff to devoting additional resources to that activity*. The more hours you have already spent studying economics, the smaller the increase in your test grade from each additional hour you spend—and the greater the opportunity cost of using the hour in that way. The more funds a firm has devoted to research and development during a given year, the smaller the amount of useful knowledge it receives from each additional dollar—and the greater the opportunity cost of using the funds in that way.

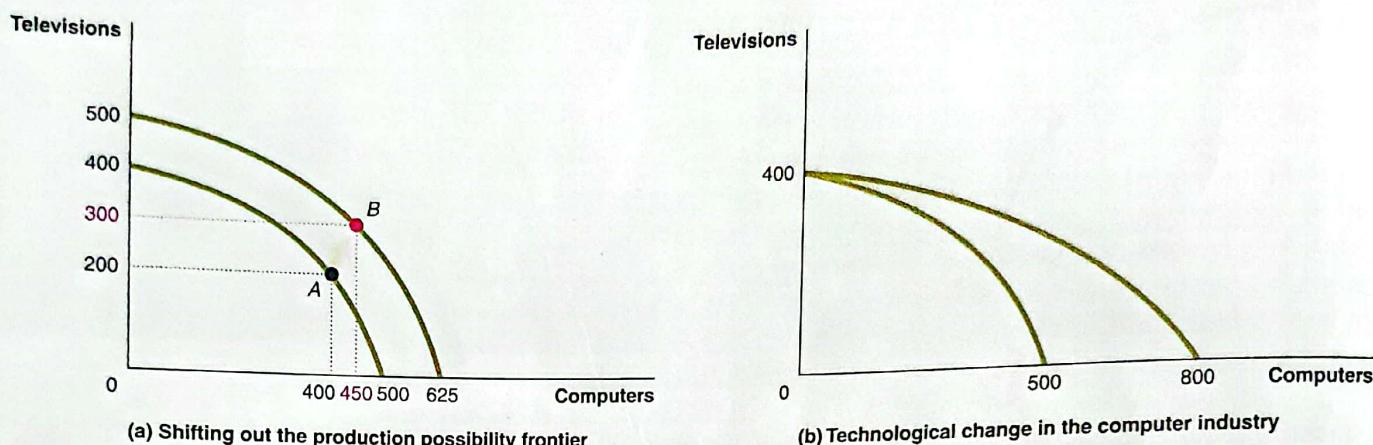
ECONOMIC GROWTH

At any given time the total resources available to any economy are fixed. Therefore, if Australia produces more computers it must produce less of something else—televisions in our example. Over time, though, the resources available to an economy may increase. For example, both the labour force and the capital stock—the amount of physical capital available in the country—may increase. The increase in the available labour force and the capital stock shifts the production possibility frontier outwards for the Australian economy and makes it possible to produce both more computers and more televisions. Figure 2.3(a) shows that the economy can move from point A to point B, producing more televisions and more computers.

Similarly, technological advance makes it possible to produce more goods with the same number of workers and the same amount of machinery, which also shifts the production possibility frontier outwards. Technological advance need not affect all sectors equally. Figure 2.3(b) shows the results of technological advance in the computer industry that increases the quantity of computers that workers can produce per year, while leaving unchanged the quantity of televisions that can be produced.

FIGURE 2.3 ECONOMIC GROWTH

Figure 2.3(a) shows that as more economic resources become available and technological change occurs, the economy can move from point A to point B, producing more televisions and more computers. Figure 2.3(b) shows the results of technological advance in the computer industry that increases the quantity of computers that workers can produce per year, while leaving the maximum quantity of televisions that can be produced unchanged. Shifts in the production possibility frontier represent economic growth.



Outward shifts in the production possibility frontier represent economic growth because they allow the economy to increase the production of goods and services, which ultimately raises the standard of living. In Australia and other high-income countries the market system has aided the process of economic growth, which over the past 200 years has greatly increased the health and wellbeing of the average person.

It is also possible for a production possibility frontier to shift inwards. This would occur if an economy experienced a reduction in its productive resources, causing the maximum amount of output that could be produced to fall. Disasters such as earthquakes, floods, fire or wars can lead to an inward shift of the production possibility frontier.

LEARNING **2** OBJECTIVE

Understand comparative advantage and explain how it is the basis for trade.

Trade

The act of buying or selling a good or service in a market.

COMPARATIVE ADVANTAGE AND TRADE

Having discussed the important ideas of production possibility frontiers and opportunity cost, we can use them to understand the basic economic activity of trade. Markets are fundamentally about **trade**, which is the act of buying and selling. Many of the trades in which we engage take place indirectly. We sell our labour services as, say, an accountant, salesperson or nurse for money, and then use the money to buy goods and services. Ultimately an accountant, salesperson or nurse is trading their services for food, clothing and other goods and services. One of the great benefits of trade is that it makes it possible for people to become better off by increasing both their production and their consumption.

SPECIALISATION AND GAINS FROM TRADE

Consider the following situation: you and your neighbour both have fruit trees on your property. Initially, suppose that you only have apple trees and your neighbour only has cherry trees. In this situation, if you both like apples and cherries there is an obvious opportunity for both of you to gain from trade: you trade some of your apples for some of your neighbour's cherries, making you both better off. But what if there are apple and cherry trees growing on both of your properties? In that case there can still be gains from trade. For example, your neighbour might be very good at picking apples and you might be very good at picking cherries.

cherries. Therefore, it makes sense that you both can benefit if your neighbour concentrates on picking apples and you concentrate on picking cherries. You can then trade some of your cherries for some of your neighbour's apples. But what if your neighbour is actually better at picking both apples and cherries than you are? It might not seem that in this case your neighbour has anything to gain from trading with you, but in fact they do.

Table 2.1 shows how many apples and how many cherries you and your neighbour can pick in one month. If you devote all your time to picking apples and none of your time to picking cherries, you can pick 20 kilograms of apples per month. If you devote all your time to picking cherries, you can pick 20 kilograms per month. Table 2.1 also shows that if your neighbour devotes all their time to picking apples they can pick 30 kilograms. If they devote all their time to picking cherries they can pick 60 kilograms.

TABLE 2.1 FRUIT PICKED EACH MONTH WITHOUT TRADE

	YOU		YOUR NEIGHBOUR	
	APPLES	CERRIES	APPLES	CERRIES
All time devoted to picking apples	20 kg	0 kg	30 kg	0 kg
All time devoted to picking cherries	0 kg	20 kg	0 kg	60 kg

Suppose that when you don't trade with your neighbour you pick and consume 8 kilograms of apples and 12 kilograms of cherries per month. When they don't trade with you your neighbour picks and consumes 9 kilograms of apples and 42 kilograms of cherries per month. After years of picking and consuming your own apples and cherries suppose your neighbour comes to you one day with the following proposition: they offer next month to trade you 15 kilograms of their cherries for 10 kilograms of your apples. Should you accept this offer? You will have more apples and more cherries to consume if you do.

To take advantage of their offer, first, rather than splitting your time between picking apples and picking cherries, you should specialise in picking apples only. We know this will allow you to pick 20 kilograms of apples. You can trade 10 of those 20 kilograms of apples to your neighbour for 15 kilograms of their cherries. The result is that you will be able to consume 10 kilograms of apples and 15 kilograms of cherries. You are clearly better off as a result of trading with your neighbour: you now can consume two more kilograms of apples and three more kilograms of cherries than you were consuming without trading.

Your neighbour has also benefited. By specialising in picking only cherries, they can pick 60 kilograms. They trade 15 kilograms of cherries to you for 10 kilograms of apples. The result is that they can consume 10 kilograms of apples and 45 kilograms of cherries. This is one more kilogram of apples and three more kilograms of cherries than they were consuming before trading with you. Table 2.2 summarises the changes in production and consumption that result from your trade with your neighbour.

TABLE 2.2 A SUMMARY OF THE GAINS FROM TRADE

	YOU		YOUR NEIGHBOUR	
	APPLES (kg)	CERRIES (kg)	APPLES (kg)	CERRIES (kg)
Production and consumption without trade	8	12	9	42
Production with trade	20	0	0	60
Consumption with trade	10	15	10	45
Gains from trade (increased consumption)	2	3	1	3

Absolute advantage

The ability of an individual, firm or country to produce more of a good or service than competitors using the same amount of resources.

ABSOLUTE ADVANTAGE VERSUS COMPARATIVE ADVANTAGE

Perhaps the most remarkable aspect of the preceding example is that your neighbour benefits from trading with you even though they are better at picking both apples and cherries than you are. **Absolute advantage** is the ability to produce more of a good or service than competitors using the same amount of resources. Your neighbour has an absolute advantage over you in producing both apples and cherries because they can pick more of each fruit than you can in the same amount of time. This observation seems to suggest that your neighbour should pick their own apples *and* their own cherries. We have just seen, however, that they are better off if they specialise in cherry picking and leave the apple picking to you.

We can consider further why both you and your neighbour benefit from specialising in picking only one fruit. First, think about the opportunity cost to each of you of picking the two fruits. We saw from Table 2.1 that if you devoted all your time to picking apples you would be able to pick 20 kilograms of apples per month. As you shift time away from picking apples to picking cherries, you have to give up one kilogram of apples for each kilogram of cherries you pick. Therefore, your opportunity cost of picking one kilogram of cherries is one kilogram of apples. By the same reasoning, your opportunity cost of picking one kilogram of apples is one kilogram of cherries. Your neighbour faces a different trade-off. As they shift their time from picking apples to picking cherries, they have to give up 0.5 kilogram of apples for every one kilogram of cherries they pick. As they shift their time from picking cherries to picking apples, they give up two kilograms of cherries for every one kilogram of apples they pick. Therefore, their opportunity cost of picking one kilogram of apples is two kilograms of cherries, and their opportunity cost of picking one kilogram of cherries is 0.5 kilogram of apples.

Table 2.3 summarises the opportunity costs for you and your neighbour of picking apples and cherries. Note that even though your neighbour can pick more apples in a month than you can, the *opportunity cost* of picking apples is higher for them than for you because when they pick apples they give up more cherries than you do. So, even though they have an absolute advantage over you in picking apples, it is more costly for them to pick apples than it is for you. The table also shows us that their opportunity cost of picking cherries is lower than your opportunity cost of picking cherries.

TABLE 2.3 OPPORTUNITY COST OF PICKING APPLES AND CHERRIES

	OPPORTUNITY COST OF PICKING 1 KG OF APPLES	OPPORTUNITY COST OF PICKING 1 KG OF CHERRIES
You	1 kg of cherries	1 kg of apples
Your neighbour	2 kg of cherries	0.5 kg of apples

Comparative advantage

The ability of an individual, firm or country to produce a good or service at a lower opportunity cost than other producers.

Comparative advantage is the ability of an individual, firm or country to produce a good or service at a lower opportunity cost than other producers. In apple picking, your neighbour has an *absolute advantage* over you, but you have a *comparative advantage* over them. Your neighbour has both an absolute and a comparative advantage over you in picking cherries. As we have seen, you are better off specialising in picking apples, and your neighbour is better off specialising in picking cherries. Another way of thinking about it would be costly for your neighbour to spend time picking apples is that even though they can pick 1.5 times as many apples in a month as you can—30 kilograms per month for them versus 20 kilograms per month for you—they can pick three times as many cherries as you can—60 kilograms per month for them versus 20 kilograms for you. So, by specialising in picking cherries they are spending their time in the activity where their absolute advantage over you is the greatest.

DON'T LET THIS HAPPEN TO YOU DON'T CONFUSE ABSOLUTE ADVANTAGE AND COMPARATIVE ADVANTAGE

First, make sure you know the definitions:

1. *Absolute advantage*: The ability of an individual, firm or country to produce more of a good or service than competitors using the same amount of resources. In our example, your neighbour has an absolute advantage over you both in picking apples and in picking cherries.
2. *Comparative advantage*: The ability of an individual, firm or country to produce a good or service at a lower opportunity cost than other producers. In our example, your neighbour has a comparative advantage in picking cherries, but you have a comparative advantage in picking apples.

Keep these two key points in mind:

1. It is possible to have an absolute advantage in producing a good or service without having a comparative advantage. This would be the case with your neighbour picking apples.
2. It is possible to have a comparative advantage in producing a good or service without having an absolute advantage. This would be the case with you picking apples.



YOUR TURN

TEST YOUR UNDERSTANDING BY DOING RELATED PROBLEM 10
ON PAGE 50–51 AT THE END OF THIS CHAPTER.

COMPARATIVE ADVANTAGE AND THE GAINS FROM TRADE

We have just derived an important economic principle: *the basis for trade is comparative advantage, not absolute advantage*. The fastest apple pickers do not necessarily do much apple picking. If the fastest apple pickers have a comparative advantage in some other activity—picking cherries, playing professional tennis or being industrial engineers—they are better off specialising in that other activity. Individuals, firms and countries are better off if they specialise in producing goods and services for which they have a comparative advantage and obtain the other goods and services they need by trading.

SOLVED PROBLEM 2.1 COMPARATIVE ADVANTAGE AND THE GAINS FROM TRADE

Consider this simple problem. Suppose that Australia and New Zealand both produce cheese and honey. These are the combinations of the two goods that each country can produce in one day:

AUSTRALIA		NEW ZEALAND	
HONEY (TONNES)	CHEESE (TONNES)	HONEY (TONNES)	CHEESE (TONNES)
0	60	0	50
10	45	20	40
20	30	20	30
30	15	30	20
40	0	40	10
		50	0

- Who has a comparative advantage in producing cheese? Who has a comparative advantage in producing honey?
- Suppose that Australia is currently producing 30 tonnes of honey and 15 tonnes of cheese and New Zealand is currently producing 10 tonnes of honey and 40 tonnes of cheese. Demonstrate that Australia and New Zealand can both be better off if they specialise in producing only one good and then engaging in trade.

SOLVING THE PROBLEM

STEP 1: Review the chapter material. This problem concerns comparative advantage, so you may want to review the section 'Absolute advantage versus comparative advantage', which begins on page 38.

STEP 2: Answer question 1 by calculating who has a comparative advantage in each activity. Remember that a country has a comparative advantage in producing a good if it can produce the good at the lowest opportunity cost. When Australia produces one more tonne of honey, it produces 1.5 fewer tonnes of cheese. On the one hand, when New Zealand produces one more tonne of honey, it produces one less tonne of cheese. Therefore, New Zealand's opportunity cost of producing honey—one tonne of cheese—is lower than Australia's—1.5 tonnes of cheese. On the other hand, when Australia produces one more tonne of cheese, it produces two-thirds less of a tonne of honey. When New Zealand produces one more tonne of cheese, it produces one less tonne of honey. Therefore, Australia's opportunity cost of producing cheese—two-thirds of a tonne of honey—is lower than that of New Zealand's—one tonne of honey. We can conclude that New Zealand has a comparative advantage in the production of honey and Australia has a comparative advantage in the production of cheese.

STEP 3: Answer question 2 by showing that specialisation makes Australia and New Zealand better off. We know that Australia should specialise where it has a comparative advantage and New Zealand should specialise where it has a comparative advantage. If both countries specialise, Australia will produce 60 tonnes of cheese and 0 tonnes of honey, and New Zealand will produce 0 tonnes of cheese and 50 tonnes of honey. After both countries specialise, New Zealand could then trade 30 tonnes of honey to Australia (keeping the other 20 tonnes of honey itself) in exchange for 40 tonnes of cheese from Australia (which keeps the other 20 tonnes of cheese itself). Note that other mutually beneficial trades are possible as well. We can summarise the results in a table:

	BEFORE TRADE		AFTER TRADE	
	HONEY (TONNES)	CHEESE (TONNES)	HONEY (TONNES)	CHEESE (TONNES)
Australia	30	15	30	20
New Zealand	10	40	20	40

New Zealand is better off after trade because it can consume the same amount of cheese and 10 more tonnes of honey. Australia is better off after trade because it can consume the same amount of honey and five more tonnes of cheese.



YOUR TURN

FOR MORE PRACTICE DO RELATED PROBLEMS 11 AND 12 ON PAGE 51 AT THE END OF THIS CHAPTER.

LEARNING OBJECTIVE 3

Explain the basic idea of how a market system works.

THE MARKET SYSTEM

We have seen that households, firms and the government face trade-offs and incur opportunity costs because of the scarcity of resources. We have also seen that trade allows people to specialise according to their comparative advantage. By engaging in trade, people can raise their standard of living. Of course, trade in the modern world is much more complex than the examples we have considered so far. Trade today involves the decisions of billions of people around the world. But how does an economy make trade possible and how are the decisions of these billions of people coordinated? In Australia and most other countries trade is carried out in markets. Markets also determine the answers to the three fundamental questions discussed in Chapter 1:

What goods and services will be produced? *How* will the goods and services be produced?
Who will receive the goods and services that are produced?

Recall that the definition of a **market** is a group of buyers and sellers of a good or service and the institution or arrangement by which they come together to trade. Markets take many forms, such as the local fruit and vegetable market, the stock exchange or eBay. In a market the buyers are demanders of goods or services, and the sellers are suppliers of goods or services. Households and firms interact in two types of markets: *product markets* and *factor markets*. **Product markets** are markets for goods—such as computers—and services—such as medical treatment. In product markets, households are demanders and firms are suppliers. **Factor markets** are markets for the *factors of production*. **Factors of production** are the inputs used to make goods and services. Factors of production are divided into four broad categories:

- *Labour*. This includes all types of work, from the part-time labour of teenagers working at McDonald's to the work of top managers in large corporations.
- *Capital*. This refers to physical capital, such as machines, tools and computers, that is used to produce other goods.
- *Natural resources*. These include land, water, oil, minerals and other raw materials that are used in producing goods.
- *Entrepreneurial ability*. An entrepreneur is someone who operates a business. Entrepreneurial ability is the ability to bring together the other factors of production to produce and sell goods and services successfully.

In factor markets, households are suppliers and firms are demanders. Most people earn most of their income by selling their labour services to firms in the labour market.

Market

A group of buyers and sellers of a good or service and the institution or arrangement by which they come together to trade.

Product markets

Markets for goods—such as computers—and services—such as medical treatment.

Factor markets

Markets for the factors of production, such as labour, capital, natural resources and entrepreneurial ability.

Factors of production

Labour, capital, natural resources and entrepreneurial ability used to produce goods and services.

THE GAINS FROM FREE MARKETS

As we learned in Chapter 1, a **free market** exists when the government places few restrictions on how a good or a service can be produced or sold, or on how a factor of production can be employed. Relatively few government restrictions are placed on economic activity in Australia, the USA, Hong Kong and Singapore. In countries such as Cuba and North Korea the free market system has been rejected in favour of centrally planned economies with extensive government control over product and factor markets. Countries that come closest to the free market system have been more successful than countries with centrally planned economies in providing their people with rising living standards.

The Scottish philosopher Adam Smith is considered to be the father of modern economics because one of his books, *An Inquiry into the Nature and Causes of the Wealth of Nations*, published in 1776, was an early and very influential argument for the free market system. Smith was writing at a time when extensive government restrictions on markets were still very common. In many parts of Europe the guild system still prevailed. Under this system governments would give guilds, or organisations of producers, the authority to control the production of a good. For example, the shoemakers' guild controlled who was allowed to produce shoes, how many shoes they could produce and what price they could charge. In France, the cloth makers' guild even dictated the number of threads that were allowed in the weave of the cloth.

Smith argued that such restrictions reduced the income or wealth of a country and its people by restricting the quantity of goods produced. Some people at the time supported the restrictions of the guild system because it was in their financial interest to do so. If you were a member of a guild the restrictions served to reduce the competition you would face. But other people sincerely believed that the alternative to the guild system was economic chaos. Smith argued that these people were wrong and that a country could enjoy a smoothly functioning economic system if firms were freed from guild restrictions.

Free market

A market with few government restrictions on how a good or service can be produced or sold, or on how a factor of production can be employed.

THE MARKET MECHANISM

In Smith's day defenders of the guild system worried that if, for instance, the shoemakers' guild did not control shoe production either too many or too few shoes would be produced. Smith argued that prices would do a better job of coordinating the activities of buyers and sellers than the guilds could. A key to understanding Smith's argument is the assumption that

individuals usually act in a rational, self-interested way. In particular, individuals take those actions most likely to make themselves better off financially. This assumption of rational, self-interested behaviour underlies nearly all economic analysis. Adam Smith understood—as economists today understand—that people's motives can be complex. But in analysing people in the act of buying and selling, the motivation of financial reward usually provides the best explanation for the actions people take.

For example, suppose that a significant number of consumers switch from buying sedan cars to buying four-wheel drives (4WDs), as in fact happened in Australia during the 1990s.

2.2 MAKING THE CONNECTION

STORY OF THE MARKET SYSTEM IN ACTION: I, PENCIL

The pencil appears to be a very simple product. In fact, its production requires the coordinated activities of many different people, spread around the world. The economist Leonard Read showed how markets achieve this coordination by writing an 'autobiography' of a pencil sold by the Eberhard Faber Pencil Company of California. It is one of the most famous accounts of how the market system works. The pencil writes that:

My family tree begins with a [cedar] tree that grows in Northern California and Oregon. Now contemplate all the saws and trucks and rope and the countless other gear used in harvesting and carting the cedar logs to the railroad siding ...

The logs are shipped to a mill in San Leandro, California ... The cedar logs are cut into small, pencil-length slats less than one-fourth of an inch in thickness ... Once in the pencil factory ... each slat is given eight grooves by a complex machine, after which another machine lays leads in every other slat ...

My 'lead' itself—it contains no lead at all—is complex. The graphite is mined in Ceylon ... [and] is mixed with clay from Mississippi in which ammonium hydroxide is used in the refining process ... To increase their strength and smoothness the leads are then treated with a hot mixture which includes candelilla wax from Mexico, paraffin wax, and hydrogenated natural fats.

My cedar receives six coats of lacquer. Do you know all the ingredients of lacquer? Who would think that the growers of castor beans and the refiners of castor oil are a part of it? They are.

My bit of metal—the ferrule—is brass. Think of all the persons who mine zinc and copper and those who have the skills to make shiny sheet brass from these products of nature.

Then there's my crowning glory ... the part man uses to erase the errors he makes with me ... It is a rubber-like product made by reacting rape-seed oil from the Dutch East Indies with sulfur chloride ... Then, too, there are numerous vulcanizing and accelerating agents. The pumice comes from Italy; and the pigment which gives [the eraser] its color is cadmium sulfide.

[M]illions of human beings have had a hand in my creation, no one of whom even knows more than a very few of the others ... There isn't a single person in all these millions, including the president of the pencil company, who contributes more than a tiny, infinitesimal bit of know-how ...

There is a fact still more astounding: the absence of a master mind, of anyone dictating or forcibly directing these countless actions which bring me into being. No trace of such a person can be found. Instead, we find the Invisible Hand at work.

Firms will find that they can charge higher prices for 4WDs than they can for sedans. The self-interest of these firms will lead them to respond to consumers' wishes by producing more 4WDs and fewer sedans. Or suppose that consumers decide that they want to eat less bread, pasta and other foods high in carbohydrates, as many did following the increase in popularity of the Atkins diet. Then the prices firms can charge for bread and pasta will fall. The self-interest of firms will lead them to produce less bread and pasta, which in fact is what happened in the late 1990s and early 2000s.

In the case where consumers want more of a product, and in the case where they want less of a product, the market system responds without a guild or anyone else giving orders about how much to produce or what price to charge. In a famous phrase, Smith said that firms would be led by the 'invisible hand' of the market to provide consumers with what they wanted. Firms would respond to changes in prices by making decisions that ended up satisfying the wants of consumers. The effect that price changes have on the behaviour of firms and consumers is referred to in economics as the **price mechanism**.

THE ROLE OF THE ENTREPRENEUR

Entrepreneurs are central to the working of the market system. An **entrepreneur** is someone who operates a business. Entrepreneurs must first determine what goods and services they believe consumers want, and then decide how those goods and services might be produced most profitably. Entrepreneurs bring together the factors of production—labour, capital and natural resources—to produce goods and services. They put their own funds at risk when they start businesses. If they are wrong about what consumers want or about the best way to produce goods and services, they can lose those funds. In fact, it is not unusual for entrepreneurs who eventually achieve great success to fail at first. For instance, early in their careers both Henry Ford of the Ford Motor Company and Sakichi Toyoda, whose company eventually became the Toyota Motor Corporation, started earlier companies that quickly failed.

Price mechanism

The system in a free market where price changes lead to producers changing production in accordance with the level of consumer demand.

Entrepreneur

Someone who operates a business, bringing together the factors of production—labour, capital and natural resources—to produce goods and services.

THE LEGAL BASIS OF A SUCCESSFUL MARKET SYSTEM

In a free market government does not restrict how firms produce and sell goods and services, or how they employ factors of production, but the absence of government intervention is not enough for the market system to work well. Government has to provide secure rights to private property for the market system to work at all. In addition, government can aid the working of the market by enforcing contracts between private individuals through an independent court system. Many economists would also say that the government has a role in facilitating the development of an efficient financial system as well as systems of education, transportation and communication. The protection of private property and the existence of an independent court system to enforce the law impartially provide a legal environment that will allow a market system to succeed.

LEARNING **4** OBJECTIVE

Understand why property rights are necessary for a well-functioning market.

PROTECTION OF PRIVATE PROPERTY

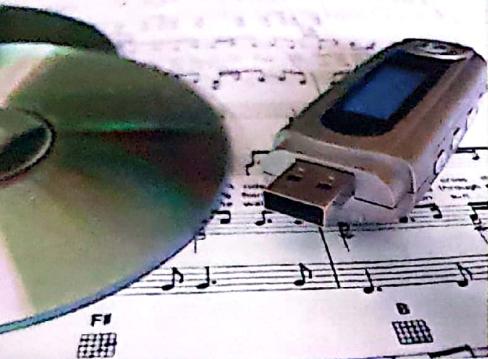
For the market system to work well individuals must be willing to take risks. Someone with \$250 000 can be cautious and keep it safely in a bank—or even in cash if the person doesn't trust the banking system. But the market system won't work unless a significant number of people are willing to risk their funds by investing them in businesses. Investing in businesses is risky in any country. Many businesses fail every year in Australia and other high-income countries. But in high-income, market-based countries someone who starts a new business or invests in an existing business usually doesn't have to worry that the government, the military or criminal gangs might decide to seize the business or demand payments in return for not destroying the business. Unfortunately, in many poor countries owners of businesses are not well protected from having their businesses seized by the government or from having their profits or assets taken by criminals. Where these problems exist, opening a business can be extremely risky. Cash can be concealed easily, but a business is difficult to conceal and difficult to move.

Property rights

The rights individuals or firms have to the exclusive use of their property, including the right to buy or sell it.

Property rights refer to the rights individuals or firms have to the exclusive use of their property, including the right to buy or sell it. Property can be tangible, physical property, such as a shop or factory. Property can also be intangible, such as the right to an idea. Guarantees exist in every high-income country. Unfortunately, in many developing countries such guarantees do not exist or are poorly enforced.

2-3

MAKING THE CONNECTION

Recording studios, movie studios and artists worry that the copyrights for their music and films are not being protected on the Internet

ILLEGAL DOWNLOADS FROM CYBERSPACE

The development of the Internet has led to new problems in protecting intellectual property rights. People can copy and email songs, newspaper and magazine articles and even entire motion pictures and television programs, or post them on websites. Controlling unauthorised copying is more difficult today than it was when 'copying' meant making a physical copy of a book, CD or DVD.

Music companies have attempted to combat free downloads of music by offering inexpensive legal downloads. Some of these legal websites, such as Apple's iTunes and Sony's bandit.fm, have been very successful. In fact, global digital music trade revenue rose by 8 per cent during 2011 reaching around US\$5.2 billion, with digital channels generating around 32 per cent of worldwide music sales. Just eight years earlier, in 2003, revenue from digital sales of music was almost zero.

However, according to the International Federation of the Phonographic Industry (IFPI), a very large proportion of music downloads are illegal. The inability to protect the property rights in the music industry fully has not only led to revenue falls for recording studios and music retailers, but has also been linked to reduced investment in potential new artists.

It is not just the music industry that is experiencing problems with unauthorised copying. For example, in 2008 seven million unauthorised copies of the movie *Batman: The Dark Knight* were downloaded, and in 2009 a leaked copy of the movie *Wolverine* was downloaded 100 000 times within one day. Illegal electronic copies of books also appear regularly on the Internet.

Music companies and movie studios have been lobbying governments to place legal responsibility on Internet Service Providers (ISPs), requiring them to warn users who download illegally, and then to suspend temporarily the accounts of people who continue with illegal downloads and file-sharing. This is known as the 'graduated response' approach. Currently, a few countries, including France, South Korea, Taiwan, New Zealand and Ireland, have implemented legislation requiring some responsibility from ISPs. In July 2011, ISPs in the USA agreed to establish a copyright alert system to notify subscribers of illegal downloading occurring on their Internet accounts. However, in Australia in 2010 the Australian film and television industry lost a large legal case against ISP iiNet for failing to stop illegal downloading of movies and television programs. The companies in the case against iiNet included Disney, Paramount Pictures, the Seven Network, Sony Pictures Entertainment, Village Roadshow, Warner Bros, Universal Pictures and 20th Century Fox. iiNet argued that they could not reasonably be expected to investigate the thousands of alleged copyright violations (up to 3000 in one week), and that they were required to meet privacy and freedom of speech laws. The issues raised in the lawsuit demonstrate the complexities and difficulties in protecting intellectual property rights.

SOURCE: International Federation of the Phonographic Industry (IFPI) (2012), *IFPI Digital Music Report 2012*, at <www.ifpi.org>, viewed 11 February 2012; Australian Broadcasting Commission (ABC) (2010), ABC News, 'Film industry loses \$1.5 billion in illegal downloads', 4 February 2010, at <www.abc.net.au/news>, viewed 7 May 2010.

In any modern economy *intellectual property* rights are very important. Intellectual property includes books, films, music, software and ideas for new products or new ways of producing products. To protect intellectual property the federal government will grant a patent that gives an inventor—which is often a firm—the exclusive right to produce and sell a new product for a period of years from the date the product was invented. For instance, because Microsoft has a patent on the Windows operating system, other firms cannot sell their own versions of Windows. The government grants patents to encourage firms to spend money on the research and development necessary to create new products. If other companies could freely copy Windows, Microsoft would not have spent the funds necessary to develop it. Just as a new product or a new method of making a product receives patent protection, so books, films, music and software receive copyright protection. Under Australian law the creator of a book, film, software or piece of music has the exclusive right to use the creation during the creator's lifetime, after which the creator's heirs retain this exclusive right for another 50 years.

ENFORCEMENT OF CONTRACTS AND PROPERTY RIGHTS

Much business activity involves someone agreeing to carry out some action in the future. For example, you may borrow \$20 000 to buy a car and promise the bank—by signing a loan contract—that you will pay back the money over the next five years. Or Microsoft may sign a licensing agreement with a small technology company, agreeing to use that company's technology for a period of several years in return for a fee. Usually these agreements take the form of legal contracts. For the market system to work businesses and individuals have to rely on these contracts being carried out. If one party to a legal contract does not fulfil its obligations—perhaps the small company had promised Microsoft exclusive use of its technology but then began licensing it to other companies—the other party can go to court to have the agreement enforced.

But going to court to enforce a contract or private property rights will only be successful if the court system is independent and judges are able to make impartial decisions on the basis of the law. In Australia and many other high-income countries the court systems have enough independence from other parts of the government and enough protection from intimidation by outside forces—such as criminal gangs—to enable them to make their decisions based on the law. In many developing countries the court systems lack this independence and may not provide a remedy if the government violates private property rights or if a person with powerful political connections decides to violate a business contract.

If property rights are not well enforced the production of goods and services will be reduced. This reduces economic efficiency, leaving the economy inside its production possibility frontier.

CONCLUSION

We have seen that the key role of markets is to facilitate trade. In fact, the market system is a very effective means of coordinating the decisions of millions of consumers, workers and firms. At the centre of the market system is the consumer. To be successful, firms must respond to the desires of consumers. These desires are communicated to firms through prices. To explore how markets work we must study the behaviour of consumers and firms. We continue this exploration of markets in Chapter 3 when we develop the model of demand and supply.

Before moving on to Chapter 3, read the following 'An inside look' to learn how BMW has expanded its PPF over time and how it allocates its scarce resources between the production of different models.

SUMMARY

LEARNING 1 OBJECTIVE

Use a production possibility frontier to analyse opportunity costs and trade-offs.

The *production possibility frontier* is a curve showing the maximum attainable combinations of two products that may be produced with available resources. It is used to illustrate the trade-offs that arise from scarcity. Points on the frontier are efficient. Points inside the frontier are inefficient and points outside the frontier are unattainable. Because of increasing marginal opportunity costs, production possibility frontiers are usually bowed out, or concave, rather than straight lines. This illustrates the important economic concept that the more resources that are already devoted to any activity, the smaller the payoff from devoting additional resources to that activity is likely to be.

LEARNING 2 OBJECTIVE

Understand comparative advantage and explain how it is the basis for trade.

Fundamentally, markets are about *trade*, which is the act of buying or selling. People trade on the basis of comparative advantage. An individual, firm or country has a *comparative advantage* in producing a good or service if it can produce the good or service at the lowest *opportunity cost*. People are usually better off specialising in the activity for which they have a comparative advantage and trading for the other goods and services they need. It is important not to confuse comparative advantage with absolute advantage. An individual, firm or country has an *absolute advantage* in producing a good or service if it can produce more of that good or service from the same amount of resources. It is possible to have an absolute advantage in producing a good or service without having a comparative advantage.

LEARNING 3 OBJECTIVE

Explain the basic idea of how a market system works.

A *market* is a group of buyers and sellers of a good or service and the institution or arrangement by which they come together to trade. *Product markets* are markets for goods and services, such as computers and medical treatment. *Factor markets* are markets for the *factors of production*, such as labour, capital, natural resources and entrepreneurial ability. Adam Smith argued in his 1776 book *The Wealth of Nations* that in a free market, where the government does not control the production of goods and services, changes in prices lead firms to produce the goods and services most desired by consumers. If consumers demand more of a good its price will rise. Firms respond to rising prices by increasing production. If consumers demand less of a good its price will fall. Firms respond to falling prices by producing less of a good. A market system will only work well if there is protection for *property rights*, which are the rights of individuals and firms to use their property.

LEARNING 4 OBJECTIVE

Understand why property rights are necessary for a well-functioning market.

If firms are to risk their investment to develop a new product they must be awarded some form of protection from competitors copying their product, in order to reap the rewards and returns on their investment. If the law cannot guarantee this, or the enforcement of the law cannot ensure the protection of property rights, there will be little incentive for firms to invest in research and development of new products. Therefore if property rights do not exist, or are not well enforced, the production of goods and services will be reduced. This reduces economic efficiency, leaving the economy inside its production possibility frontier.

KEY TERMS

absolute advantage	38	free market	41	production possibility frontier	32
comparative advantage	38	market	41	property rights	44
entrepreneur	43	opportunity cost	33	scarcity	32
factor markets	41	price mechanism	43	trade	36
factors of production	41	product markets	41		

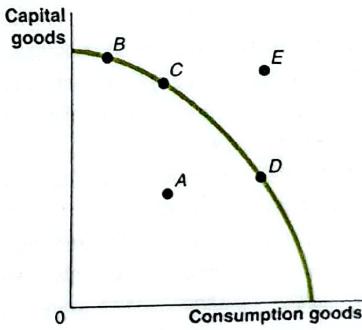
REVIEW QUESTIONS

- What do economists mean by scarcity? Can you think of anything that is not scarce according to the economic definition?
- What is a production possibility frontier? How can we show economic efficiency on a production possibility frontier? How can we show inefficiency? What causes a production possibility frontier to shift outward?
- What is meant by increasing marginal opportunity costs? What are the implications of this idea for the shape of the production possibility frontier?
- What is absolute advantage? What is comparative advantage? Is it possible for a country to have a comparative advantage in producing a good without also having an absolute advantage? Briefly explain.
- What is the basis for trade? What advantages are there to specialisation?
- What are the two main categories of participants in markets? Which participants are of greatest importance in determining what goods and services are produced?
- What is a free market? In what ways does a free market economy differ from a centrally planned economy?
- What is an entrepreneur? Why do entrepreneurs play a key role in a market system?
- Under what circumstances are firms likely to produce more of a good or service? Under what circumstances are firms likely to produce less of a good or service?
- What are private property rights? What role do they play in the working of a market system? Why are independent courts important for a well-functioning economy?

PROBLEMS AND APPLICATIONS

Visit MyEconLab to practise similar exercises.

- Draw a production possibility frontier showing the trade-off between the production of wheat and the production of barley.
 - Show the effect that a prolonged drought would have on the initial production possibility frontier.
 - Suppose genetic modification makes barley resistant to insects, allowing yields to double. Show the effect of this technological change on the initial production possibility frontier.
- [Related to the opening case]** One of the trade-offs faced by BMW is between safety and fuel economy. For example, adding steel to a car makes it safer but also heavier, which results in higher fuel consumption. Draw a hypothetical production possibility frontier facing BMW engineers that shows this trade-off.
- Suppose you win free tickets to a movie plus all you can eat at the snack bar for free. Would there be a cost to you to attend this movie? Explain.
- Suppose we can divide all the goods produced by an economy into two types: consumption goods and capital goods. Capital goods, such as machinery, equipment and computers, are goods used to produce other goods.
 - Use a production possibility frontier graph to illustrate the trade-off to an economy between producing consumption goods and producing capital goods. Briefly explain why the curve is likely to be concave.
 - Suppose that a technological advance occurs that affects
- the production of capital goods but not consumption goods. Show the effect on the production possibility frontier.
- Suppose that country A and country B currently have identical production possibility frontiers, but that country A devotes only 5 per cent of its resources to producing capital goods over each of the next 10 years, whereas country B devotes 30 per cent. Which country is likely to experience more rapid economic growth in the future? Illustrate using a production possibility frontier graph. Your graph should include production possibility frontiers for country A today and in 10 years, and for country B today and in 10 years.
- Use the following production possibility frontier for a country to answer the questions.



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- Which point(s) are unattainable? Briefly explain why.
 - Which point(s) are efficient? Briefly explain why.
 - Which point(s) are inefficient? Briefly explain why.
 - At which point is the country's future growth rate likely to be the highest? Briefly explain why.
6. You have exams in economics and statistics coming up and five hours available for studying. The table shows the trade-offs you face in allocating the time you will spend in studying each subject.

CHOICE	HOURS SPENT STUDYING		EXAM SCORE	
	ECONOMICS	STATISTICS	ECONOMICS	STATISTICS
A	5	0	95	70
B	4	1	93	78
C	3	2	90	84
D	2	3	86	88
E	1	4	81	90
F	0	5	75	91

- Use the data in the table to draw a production possibility frontier graph. Label your vertical axis 'Score on economics exam' and label your horizontal axis 'Score on statistics exam'. Make sure you label the values where your production possibility frontier intersects the vertical and horizontal axes.
 - Label the points representing choice C and choice D. If you are at choice C, what is your opportunity cost of increasing your statistics score?
 - Under what circumstances would A be a sensible choice?
7. Suppose that the federal government is deciding which of one out of two different cancer treatments it will fund: Treatment A, which will prolong the average lifespan of patients receiving the treatment by 2 years and will cost \$750 000 per patient treated; and Treatment B, which will prolong the average lifespan of patients receiving the treatment by 1½ years and will cost \$25 000 per patient treated. What factors should the federal government take into account in making its decision?
8. During his 2007 election campaign, the soon to be Prime Minister of Australia, Kevin Rudd (now former Prime Minister), stated that climate change was:

the greatest moral, economic and environmental challenge of our generation.¹

In 2009 he stated that only 'political cowards' argue that a country shouldn't act on climate change until other countries do. However, in 2010 he announced he would delay the government's legislation on major environmental policy until at least 2013, when other countries decide what they will do.

A director within President Obama's government in the USA, and former secretary of the treasury in the Clinton government, Lawrence Summers, has been quoted as giving the following moral defence of the economic approach to climate change:

*I don't think there is anything immoral about seeking to achieve environment benefits at the lowest possible costs.*²

Given that debate on climate change is often argued on moral grounds, would it be more moral to reduce pollution without worrying about the cost or by taking the cost into account? Explain. 9. In *The Wonderful Wizard of Oz* and his other books about the Land of Oz, L. Frank Baum³ observed that if people's wants were modest enough most goods would not be scarce. According to Baum, this was the case in Oz:

There were no poor people in the Land of Oz, because there was no such thing as money. Each person was given freely by his neighbors whatever he required for his use, which is as much as anyone may reasonably desire. Some tilled the lands and raised great crops of grain, which was divided equally among the whole population, so that all had enough. There were many tailors and dressmakers and shoemakers and the like, who made things that any who desired them might wear. Likewise there were jewelers who made ornaments which pleased and beautified the people, and these ornaments also were free to those who asked for them. Each man and woman, no matter what he or she produced for the good of the community, was supplied by the neighbors with food and clothing and a house and furniture and ornaments and games. If by chance the supply ever ran short, more was taken from the great storehouses of the Ruler, which were afterward filled up again when there was more of any article than people needed . . .

You will know, by what I have told you here, that the Land of Oz was a remarkable country. I do not suppose such an arrangement would be practical with us.

Do you agree with Baum that the economic system in Oz wouldn't work in modern developed economies? Briefly explain why or why not.

10. [Related to Don't let this happen to you] Using the same amount of resources, Australia and New Zealand can both produce apples and oranges as shown in the following table, measured in thousands of tonnes.

	AUSTRALIA		NEW ZEALAND	
	APPLES	ORANGES	APPLES	ORANGES
12	0	6	0	0
3	3	3	3	3
0	4	0	6	6

- a. Who has a comparative advantage in producing apples? Who has a comparative advantage in producing oranges? Explain your reasoning.
- b. Does either country have an absolute advantage in producing both goods? Explain.
- c. Suppose that both countries are currently producing 3000 tonnes of apples and 3000 tonnes of oranges. Show that both can be better off if they specialise in producing one good and then engage in trade.
- 11. [Related to Solved problem 2.1]** Suppose Iran and Iraq both produce oil and olive oil. The table shows combinations of both goods that each country can produce in a day, measured in thousands of barrels.
- | IRAN | | IRAQ | |
|------|-----------|------|-----------|
| OIL | OLIVE OIL | OIL | OLIVE OIL |
| 0 | 8 | 0 | 4 |
| 2 | 6 | 1 | 3 |
| 4 | 4 | 2 | 2 |
| 6 | 2 | 3 | 1 |
| 8 | 0 | 4 | 0 |
- a. Who has the comparative advantage in producing oil? Explain.
- b. Can these two countries gain from trading oil and olive oil? Explain.
- 12. [Related to Solved problem 2.1]** Suppose that France and Germany both produce schnitzel and wine. The following table shows combinations of the goods that each country can produce in a day.
- | FRANCE | | GERMANY | |
|-------------------|-------------------|-------------------|-------------------|
| WINE
(BOTTLES) | SCHNITZEL
(kg) | WINE
(BOTTLES) | SCHNITZEL
(kg) |
| 0 | 8 | 0 | 15 |
| 1 | 6 | 1 | 12 |
| 2 | 4 | 2 | 9 |
| 3 | 2 | 3 | 6 |
| 4 | 0 | 4 | 3 |
| | | 5 | 0 |
- a. Who has a comparative advantage in producing wine? Who has a comparative advantage in producing schnitzel?
- b. Suppose that France is currently producing one bottle of wine and 6 kg of schnitzel and Germany is currently producing three bottles of wine and 6 kg of schnitzel. Demonstrate that France and Germany can both be better off if they specialise in producing only one good and then engage in trade.
- 13.** In the early colonial days of Australia the population was spread thinly over a large area and transportation costs between the colonies (states) were very high because it was difficult to transport products by road for more than short distances. As a result, most of the population very rarely bought or sold anything from another state. Explain why the incomes of people were likely to rise as transportation costs fell.
- 14.** During the global financial crisis, which began in late 2007, some countries, including the European Union and the USA, passed legislation that encouraged or required the reduction of imported goods in some industries. Do you think that this was good policy? Explain.
- 15.** Identify whether each of the following transactions will take place in the factor market or in the product market, and whether households or firms are supplying the good or service, or demanding the good or service.
- George buys a BMW X5 SUV.
 - BMW increases employment at its Spartanburg plant.
 - George works 20 hours per week at McDonald's.
 - George sells land he owns to McDonald's so that it can build a new restaurant.
- 16.** In *The Wealth of Nations* Adam Smith wrote the following (Book I, Chapter II):
- It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest.*
- Briefly discuss what he meant by this.
 - Explain what Adam Smith meant when he referred to the 'invisible hand' of the market.
- 17.** Evaluate the following argument: 'Adam Smith's analysis is based on a fundamental flaw: he assumes that people are motivated by self-interest. But this isn't true. I'm not selfish, and most people I know aren't selfish.'
- 18.** Do you agree that self-interest is an 'ignoble human trait'? What incentives does a market system provide to encourage self-interest?
- 19.** The International Property Rights Index (IPRI) is an annual ranking of the strength of physical and intellectual property rights across 125 countries, representing 97 per cent of the world's GDP. It is produced by the Property Rights Alliance, who argue that:
- ... there is an intrinsic relationship between property rights and the economic prosperity of any given country. On average, countries in the top quintile of IPRI scores enjoy a per capita income of eight times that of their counterparts in the bottom quintile ... and tend to attract more foreign direct investment. Developing countries with*