2

DEMAND AND SUPPLY

The demand and supply model forms the corner-stone of microeconomic analysis. Sir Arthur Lewis, winner of the Nobel Prize for economics in 1979, went so far as to say that there are few things in economics that cannot be explained by means of demand and supply. The interaction between the forces of demand and supply occurs in numerous markets for goods and services in an economy; this interaction (also known as the market mechanism) forms the central theme of the chapter. Markets play a central role in the determination of prices in a free market economy; consequently they also determine the way in which the factors of production are employed (they indicate for which goods there is significant demand). The chapter begins by explaining exactly what is meant by a market. Then attention is given to the demand side of the market where concepts such as the market demand curve and elasticity are discussed. This will be followed by a discussion of the supply side. The interaction between market demand and market supply and the determination of the equilibrium price and equilibrium quantity of a product will also be studied. Finally, the way in which the equilibrium price and the equilibrium quantity of a product are affected by changes in the demand for and supply of the product will be determined. The demand and supply model (ie the market model) is applicable over a wide field and a sound knowledge of its workings is imperative for someone interested in economics.

After you have studied this chapter, you will be able to

- explain how market demand and market supply are determined
- explain how the equilibrium price comes into being
- describe the effect of changes in demand and supply
- calculate price elasticity of demand and supply by means of formulae
- calculate elasticity using Marshall's method
- explain the relationship between price elasticity and revenue
- calculate income elasticity of demand by means of formulae
- calculate cross elasticity of demand by means of formulae

MARKETS

Because markets play a vital role in determining prices it is important to investigate from the outset exactly what is meant by a market. The concept is not as obvious as it may sound, since markets are often ill defined in terms of geographical space or physical appearance. One definition of a market is that it comprises individuals or groups who come into contact with one another with the aim of buying or selling. Stated more formally: a market is an institution or mechanism which brings together buyers (demanders) and sellers (suppliers) of goods and services. This does not necessarily mean that every person in a market has to be in contact with every other person – a person or a firm can be part of a market even if contact is limited to a section of the other individuals or firms in the market.

Markets

Markets vary considerably in terms of size and operation. The local vegetable or flower market, the filling station on the corner, the kiosk where instant food is sold, a farm stall – these are all examples of markets. The Johannesburg Stock Exchange is an example of a highly sophisticated market where buyers and sellers of shares and equities from all over the world come into contact with one another. Auctioneers also bring together potential buyers and sellers of, inter alia, second-hand goods, works of art and fixed property. Personnel agents bring work seekers and employers into contact with each other. All these examples where buyers and sellers come into contact with each other represent markets. As you can see, some markets are local, others are national, or even international in nature. For some household goods all the consumers of the good will be in the same geographical area, for example within the borders of a town or country. For other goods, for example Van Gogh paintings, only a few collectors, dealers and museums which are spread across the globe form the market. In principle all markets consist of buyers and sellers, although middlemen such as agents and brokers may also form part of the market. Mostly it is the seller who proposes the price of a product, but there may be exceptions.

The assumption of perfect competition

In this chapter we generally accept that a market consists of a large number of buyers and sellers and that none of them has the ability to significantly influence the price. Stated more formally: we assume that markets are perfectly competitive, which means that no individual buyer or seller can influence the price (ie only the interaction between demand and supply determines the market price), products are homogeneous (identical), factors of production are perfectly mobile and buyers and sellers have perfect knowledge about market conditions. In later chapters these assumptions of perfect competition will be relaxed.

THE DEMAND SIDE OF THE MARKET

The market demand curve

The market for any given product has a demand side and a supply side. The demand side can be depicted by means of a table which shows the quantity of the product that will be bought at various prices. Suppose, for example, that the market demand for frozen fish in an area (eg a province) is as depicted in Table 2-1 on a particular day. (The method used for determining the demand curve using the individual demand curves of all the participants in the market is explained in Box 2-1.)

Table 2-1
Market demand for frozen fish

Price per kilogram (Rand)	Quantity demanded ('000 kg per day)
8	0
7	1
6	2
5	3
4	4
3	5
2	6
1	7
0	8

According to Table 2-1 (the figures are imaginary, but are merely used for illustration) no frozen fish will be demanded at a price of R8 per kilogram. At R7 per kilogram 1 000 kilograms will be demanded on that particular day. At R6 per kilogram 2 000 kilograms will be demanded, etc. The table reflects the *law of demand* which states that *the higher the price of a product the lower the quantity demanded (or the lower the price of a product the higher the quantity demanded) provided that all other things remain constant (ceteris paribus).*

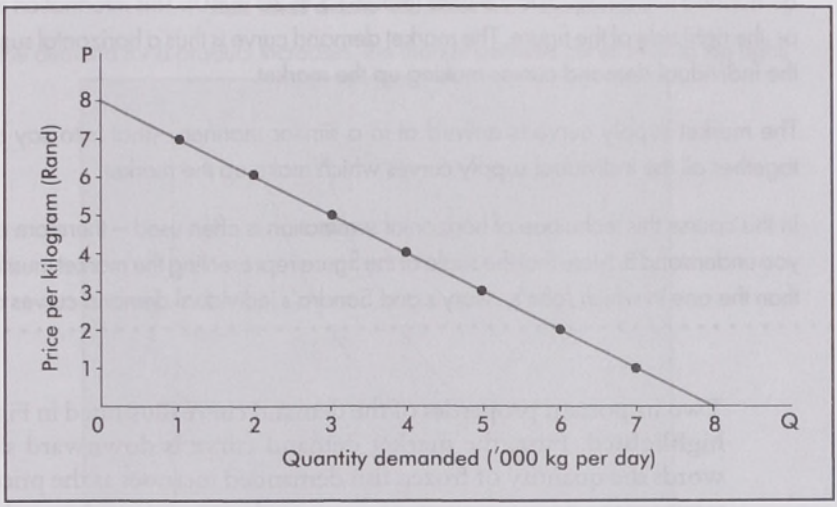
Law of demand

Another way of representing the information in Table 2-1 is by a demand curve on a graph. Price in Rand (per kilogram) is depicted on the vertical axis and the quantity per day on the horizontal axis. Figure 2-1 provides a graphical representation of the market demand for frozen fish given in Table 2-1.

Figure 2–1

The market demand curve

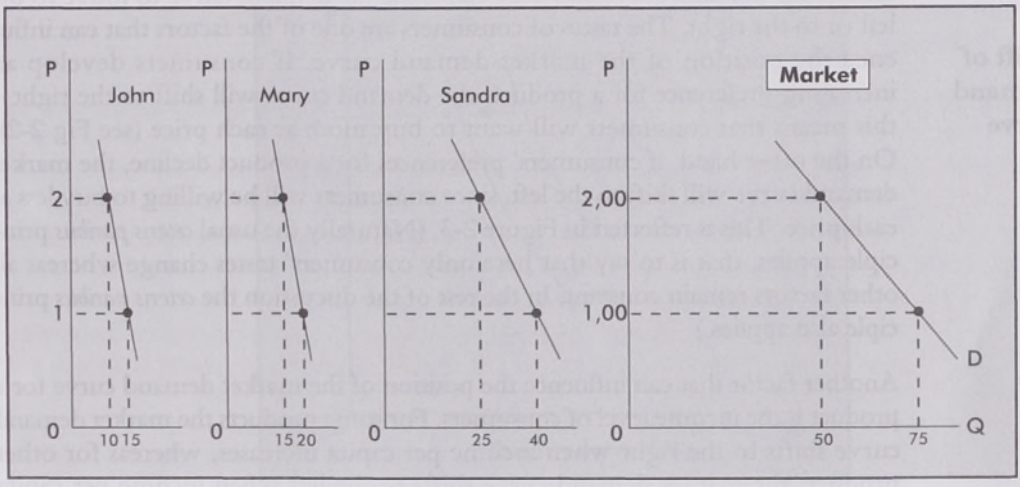
It is obtained by horizontally adding all the individual demand curves of consumers comprising the market. (See Box 2–1.)



Box 2–1

MARKET DEMAND CURVE

The market demand curve for a specific product is obtained by adding horizontally all the individual demand curves which constitute the market.



Refer to the above figure. Suppose that the market consists of only three consumers, namely John, Mary and Sandra, and that the individual demand curves for a certain product are the ones shown above. At a price of R2 the quantity demanded by the whole market will be 50 units (that is 10 + 15 + 25). At a price of R1 the total quantity demanded will be equal to 75 units (that is 15 + 20 + 40). This information is depicted on the right side of the figure. The market demand curve is thus a horizontal summation of the individual demand curves making up the market.

The market supply curve is arrived at in a similar manner – that is to say by adding together all the individual supply curves which make up the market.

In this course this technique of horizontal summation is often used – therefore ensure that you understand it. Note that the scale of the figure representing the market must be greater than the one in which John's, Mary's and Sandra's individual demand curves appear.

Two important properties of the demand curve illustrated in Figure 2-1 must be highlighted. First, the market demand curve is downward sloping, in other words the quantity of frozen fish demanded increases as the price decreases. This is true of the demand curves of most products – almost always the demand curve slopes downwards from left to right. (In the following chapter you will come across the exception to the rule, but at this stage you do not have to worry about it.) Second, the market demand curve in Figure 2-1 refers to a specific time period – in our example it is a day. It is important to note that any demand curve refers to a certain time period (day, month, year) and that the length of the period can influence the shape and position of the demand curve.

Shift of demand curve

There are various other factors that can have an important influence on the position of the demand curve and they can cause the demand curve to move to the left or to the right. The tastes of consumers are one of the factors that can influence the position of the market demand curve. If consumers develop an increasing preference for a product, the demand curve will shift to the right – this means that consumers will want to buy more at each price (see Fig 2-2). On the other hand, if consumers' preferences for a product decline, the market demand curve will shift to the left, since consumers will be willing to buy less at each price. This is reflected in Figure 2-3. (Naturally the usual *ceteris paribus* principle applies, that is to say that here only consumers' tastes change whereas all other factors remain constant. In the rest of the discussion the *ceteris paribus* principle also applies.)

Another factor that can influence the position of the market demand curve for a product is the income level of consumers. For some products the market demand curve shifts to the right when income per capita increases, whereas for other products the market demand curve shifts to the left when income per capita

increases. Attention will be paid to this in the next chapter. It is important at this stage to know that changes in per capita income can affect the demand curve.

Figure 2–2

An increase in market demand

If the demand for a product increases, the market demand curve shifts to the right.

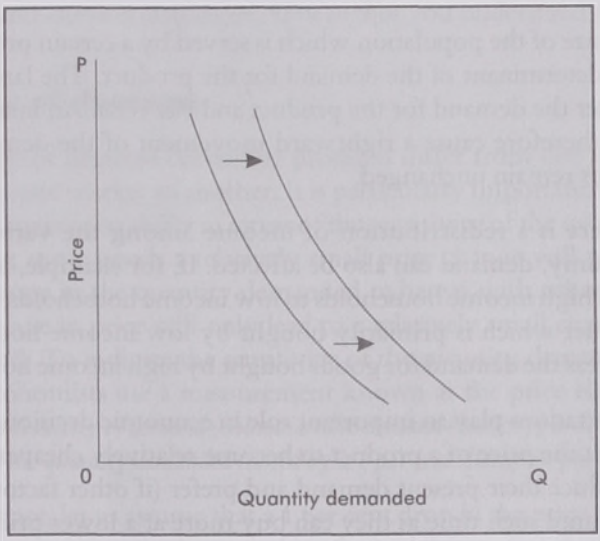
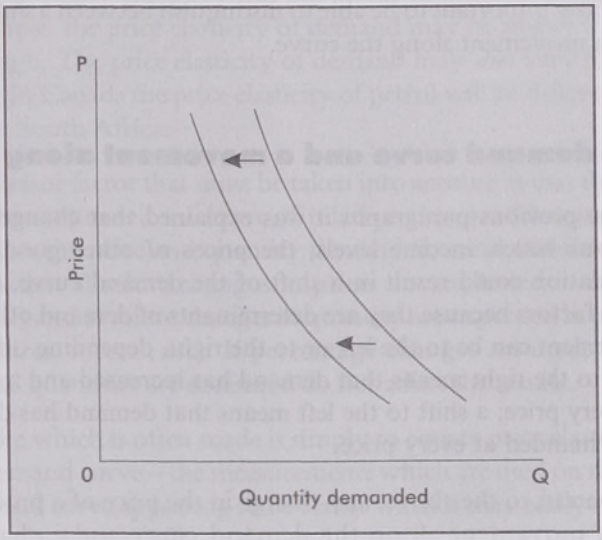


Figure 2–3

A decrease in market demand

If the demand for a product decreases, the market demand curve shifts to the left.



A further factor that can influence the position of a market demand curve is the price level of other goods. For example, because chicken is a substitute for beef, the demand for chicken, to a certain extent, will be influenced by the price of beef. If beef becomes very expensive and consumers do not expect the price to decrease and chicken is cheaper, there will be an increased demand for it – this will result in the market demand curve for chicken shifting to the right. The opposite of course can also occur.

The size of the population which is served by a certain product is also an important determinant of the demand for the product. The larger the population the greater the demand for the product and *vice versa*. An increase in the population will therefore cause a rightward movement of the demand curve if all other factors remain unchanged.

If there is a redistribution of income among the various households in an economy, demand can also be affected. If, for example, income is redistributed from high income households to low income households, then the demand for a product which is primarily bought by low income households will increase, whereas the demand for goods bought by high income households will decrease.

Expectations play an important role in economic decision making. If consumers expect the price of a product to become relatively cheaper, they will be inclined to reduce their present demand and prefer (if other factors remain constant) to wait until such time as they can buy more at a lower price. Similarly, expected price increases can lead to an increase in present demand.

These factors can result in a movement of the demand curve to the left or to the right. There may be other factors, but those discussed above are the most important,

It is now important to be able to distinguish between a shift of the demand curve and a movement along the curve.

A shift of a demand curve and a movement along a demand curve

In the previous paragraphs it was explained that changes in non-price factors such as tastes, income levels, the prices of other goods and the size of the population could result in a shift of the demand curve. (They are called non-price factors because they are determinants of demand other than price.) Such a movement can be to the left or to the right, depending on the circumstances. A shift to the right means that demand has increased and more will be demanded at every price; a shift to the left means that demand has decreased and less will be demanded at every price.

In contrast to the above, any change in the price of a product would result in a mere movement along the demand curve and a change in the quantity

demanded. In Figure 2-1 it can be seen that if the price of frozen fish drops from R7 per kilogram to R6 per kilogram, the quantity demanded increases from 1 000 kilograms to 2 000 kilograms. Consumers will therefore move along the demand curve from the original price-quantity combination to a new price-quantity combination, but the demand curve will not shift.

The differentiation between a shift of the demand curve and a movement along the demand curve is important. Ensure that you understand the difference.

Price elasticity of demand

The shape of demand curves for products differ from one product to another and from one market to another. It is particularly important to note that market demand curves also differ in terms of the sensitivity of the quantity demanded to price. For some goods a relatively small price change will result in a relatively large change in the quantity demanded, whereas with other goods a relatively large change in price will only lead to a relatively small change in the quantity demanded. To indicate the sensitivity of the quantity demanded to a change in price, economists use a measurement known as the price elasticity of demand.

Demand elasticity

The price elasticity of demand (abbreviated to demand elasticity) is defined as the percentage change in the quantity demanded caused by a 1 per cent change in price.

To illustrate, let us assume that a 1 per cent drop in the price of petrol results in a 1,2 per cent increase in the quantity of petrol demanded. According to our definition the price elasticity of demand for petrol is 1,2. It is common practice to reflect the price elasticity as a positive number, although the price change is negative and the change in the quantity demanded is positive. The price elasticity of demand generally changes from one point to the next along a demand curve. For example, the price elasticity of demand may be higher if the price of petrol is very high. The price elasticity of demand may also vary from one market to the next. In Canada the price elasticity of petrol will be different from that in, for example, South Africa.

An important factor that must be taken into account is that the price elasticity of demand is expressed in terms of relative changes (that is to say percentage changes) in the price and quantity demanded – and not absolute changes. The reason is that absolute changes in prices are expressed in money units (rand, dollar, etc) and absolute changes in quantity are expressed in physical units (kilograms, litres, metres, etc). If percentage changes are used, the units in which prices and quantities are measured do not affect the results.

A mistake which is often made is simply to equate price elasticity with the slope of the demand curve – the measurements which are used on the axes can result in the demand curve appearing to be elastic when it may really be inelastic. In addition, the elasticity of a linear demand curve varies from one point to another, as

explained in Box 2-2. It is always safer to calculate the elasticity before arriving at any conclusions about price sensitivity. (See Appendix 1 for the situation in which two demand curves intersect each other, which allows their elasticities to be compared.)

Assume we have a market demand schedule (Table 2-1 is an example of one) which depicts the quantity demanded of a product at different prices. How is the elasticity of demand calculated? Let ΔP represent a very small change (in percentage terms) in the price of a product whereas ΔQ_d depicts the change in the quantity demanded (as a result of the change in price.) The formula used to calculate the price elasticity of demand at a point on a demand curve (known as point elasticity of demand in its abbreviated form) is

$$e_d = \frac{\text{percentage change in the quantity demanded}}{\text{percentage change in the price}}$$

$$= \frac{\Delta Q_d}{Q_d} \div \frac{\Delta P}{P}$$

A minus sign should actually be on the right-hand side of the above formula but, as has already been mentioned, it is common practice to reflect elasticity as a positive number — economists are more interested in its absolute value. The practice is therefore followed here also.

Table 2-2 can serve as an example where the data reflects small percentage changes in the price and quantity of a product.

Table 2-2

Quantity demanded at different prices

(small percentage changes in price)

Price (Rand per unit)	Quantity demanded (number of units)
99	1 005
100	1 000
101	995

Should we wish to calculate the price elasticity of demand in the above table if the price increases from R99 to R100, the following result will be obtained (if the minus sign is omitted):

$$e_d = \frac{\Delta Q_d}{Q_d} \div \frac{\Delta P}{P}$$

$$= \frac{5}{1\,005} \div \frac{1}{99}$$

$$= 0{,}49$$

In the above diagram we assumed P to be R99 and Q_d 1 005. If we allow the price to drop from R100 to R99 and therefore take P to be R100 and Q_d to be 1 000 we get almost the same result, namely:

$$e_d = \frac{\Delta Q_d}{Q_d} \div \frac{\Delta P}{P}$$
$$= \frac{5}{1\,000} \div \frac{1}{100}$$
$$= 0{,}5$$

In the above example the price change was very small in percentage terms and for all practical purposes we arrived at the same answer. If, however, we have a table reflecting a large percentage change in price and the percentage change in the quantity demanded is also large, then the answers will vary considerably depending on which values of P and Q_d are used. Take, for example, the demand schedule shown in Table 2-3.

Table 2–3

Quantity demanded at different prices

(large percentage changes in price)

Price (Rand per unit)	Quantity demanded (number of units)
7	1 000
6	2 000
5	3 000

Suppose that the price decreases from R7 to R5 and we take P to be R7 and Q_d to be 1 000. The price elasticity of demand is then:

$$e_d = \frac{\Delta Q_d}{Q_d} \div \frac{\Delta P}{P}$$
$$= \frac{2\,000}{1\,000} \div \frac{2}{7}$$
$$= 7$$

If we do the opposite, namely allow the price to change from R5 to R7 and we therefore take P to be R5 and Q_d to be 3 000, then the price elasticity of demand will be as follows:

$$e_d = \frac{\Delta Q_d}{Q_d} \div \frac{\Delta P}{P}$$
$$= \frac{2\,000}{3\,000} \div \frac{2}{5}$$
$$= 1{,}67$$

The difference between the last two answers is huge. In a case such as this, where the price change is proportionately large, it is advisable to use another method, namely to calculate the arc elasticity of demand. When the arc elasticity of demand is calculated the average values of P and Q_d are used as shown in the following formula:

$$e_d = \frac{\Delta Q_d}{(Q_{d1} + Q_{d2}) / 2} \div \frac{\Delta P}{(P_1 + P_2) / 2}$$

$$= \frac{\Delta Q_d(P_1 + P_2)}{\Delta P(Q_{d1} + Q_{d2})}$$

where P_1 and Q_{d1} are the original values of price and quantity and P_2 and Q_{d2} are the second set of values. If we apply this adapted formula for a price change from R7 to R5 (or *vice versa*) we get:

$$e_d = \frac{2\,000\ (12)}{2\ (4\,000)}$$
$$= 3$$

What the above method actually amounts to is that the elasticity is calculated halfway between the two prices (R7 and R5).

Box 2-2

MARSHALL'S METHOD

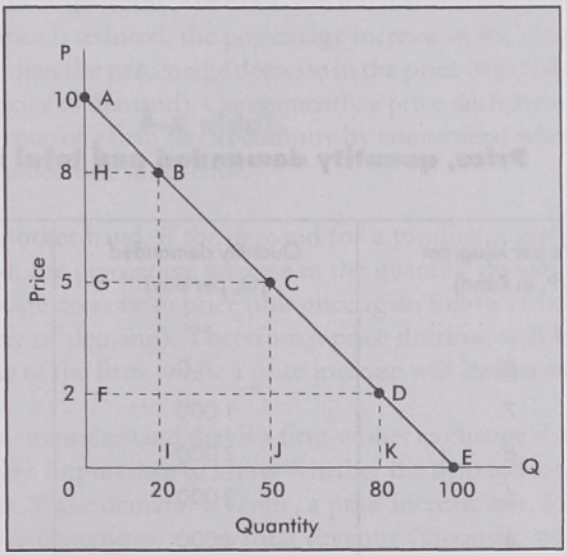
Besides using formulae there is another handy method of calculating elasticity if the demand curve is a straight line which touches both the vertical and horizontal axes. This method was developed by the British economist Alfred Marshall (1842–1924), who incidentally also coined the term 'price elasticity of demand'. Refer to the following diagram. Marshall showed that the price elasticity of demand can be determined at a point such as B by calculating the ratio BE/AB. To determine the elasticity at a point such as D the ratio DE/AD is calculated. It is not even necessary to calculate the distances on the demand curve, because the elasticity coefficient e_d can also be determined by using the corresponding measurements on the price axis or the quantity axis. At B the elasticity coefficient is therefore BE/AB or HO/AH (if the price axis is used) which works out to be 8/2 = 4. If we calculate e_d at B by using the quantity axis, then it works out to be IE/OI which amounts to 80/20 = 4 which is the same as the previous answer.

By using the same method we can calculate the elasticity coefficient at point D. The following result is obtained by using the quantity axis: KE/OK = 20/80 = 0,25. If we were to use the price axis we would arrive at the same answer, namely OF/AF = 2/8 = 0,25.

If we calculate the elasticity coefficient at C which is the midpoint of the demand curve the result is $e_d = 1$ (that is, JE/0J = 50/50 = 1 or 0G/AG = 1).

The above results illustrate an important fact, namely that the elasticity coefficient of a linear demand curve is greater than 1 above the midpoint and less than 1 below the midpoint. At exactly the midpoint the coefficient is equal to 1. This general rule does not apply to demand curves which are not linear (in other words are not straight lines).

Marshall's method can also be used to calculate the elasticity coefficient at any point along a non-linear demand curve. The coefficient can be obtained by drawing a tangent to the demand curve at the point at issue and by using the same technique as the one above.



Price elasticity and total revenue (or expenditure)

Economists say that the demand for a product is elastic if the demand elasticity is greater than 1. If the demand elasticity is less than 1, demand is price inelastic. If the demand elasticity is equal to 1, then unitary elasticity is said to apply. (See Appendix 2 for two more cases of elasticity.)

Important decisions are made in the business world as well as in political circles based on the price elasticity of demand. One reason is that the price elasticity of demand determines whether a change in the price of a product will result in an increase or a decrease in the total expenditure on the product. This is of utmost

importance for firms – or for the authorities who are sometimes in the same position – who need to make decisions as to whether they should increase or decrease the price of their products.

Which aspects of price elasticity should a firm take into account when considering a price change? To illustrate how the elasticity of demand will influence the spending of consumers (and in so doing the income of the firm or the government) on a product, we will use the information supplied in Table 2-4. In the table the different quantities demanded of a product are illustrated for prices that vary between R0 and R8. The total revenue depicted is merely the price multiplied by the quantity demanded – if the price is R8, none of the product is sold and the total revenue is therefore also zero. At a price of R7 the number of units sold is 1 000 and the total revenue is R7 000 (that is R7 × 1 000) etc.

Table 2-4
Price, quantity demanded and total revenue

Price per kilogram (P_x in Rand)	Quantity demanded (Q_x per day)	Total revenue ($P_x \times Q_x$)
8	0	0
7	1 000	7 000
6	2 000	12 000
5	3 000	15 000
4	4 000	16 000
3	5 000	15 000
2	6 000	12 000
1	7 000	7 000
0	8 000	0

The information in Table 2-4 is also provided in Figure 2-4. In Figure 2-4 the elasticity of the demand curve is depicted according to the calculations which were done in Box 2-2: $e_d = 1$ exactly at the midpoint, below the midpoint e_d is less than 1 and above the midpoint e_d is greater than 1. Total revenue (P × Q) is also shown in the bottom section of the figure. The information reflected in the bottom section of Figure 2-4 is very important. Assume that the demand for a certain product of a firm is price elastic, that is to say it is greater than 1 – which

also means that the firm finds itself with a price somewhere along the top half of the demand curve in Figure 2-4. If the firm reduces its price in the elastic section of the demand curve from, say, R7 to R6, the total revenue of the firm will increase from R7 000 to R12 000, as depicted in the bottom section of the diagram (the opposite will also apply: a price increase leads to a decrease in revenue). In fact, price decreases will lead to increases in total revenue up to the midpoint of the demand curve in Figure 2-4 where $e_d = 1$. On the other hand, if the firm reduces the price of a product in the inelastic range of the demand curve from, say, R2 to R1, the total revenue will decrease from R12 000 to R7 000, as depicted in the bottom section of the diagram (once again the opposite also applies).

Elastic demand

Stated more generally, we can say that if the demand for a product is elastic, then if the price is reduced, the percentage increase in the quantity demanded will be greater than the percentage decrease in the price (this follows from the definition of elasticity of demand). Consequently a price decrease will lead to an increase in the revenue of a firm (ie expenditure by consumers) whereas a price increase will lead to a decrease in revenue.

Inelastic demand

On the other hand, if the demand for a product is inelastic, then if the price is reduced, the percentage increase in the quantity demanded will be less than the percentage decrease in price (this once again follows from the definition of price elasticity of demand). Therefore a price decrease will lead to a decrease in the revenue of the firm, while a price increase will lead to an increase in revenue.

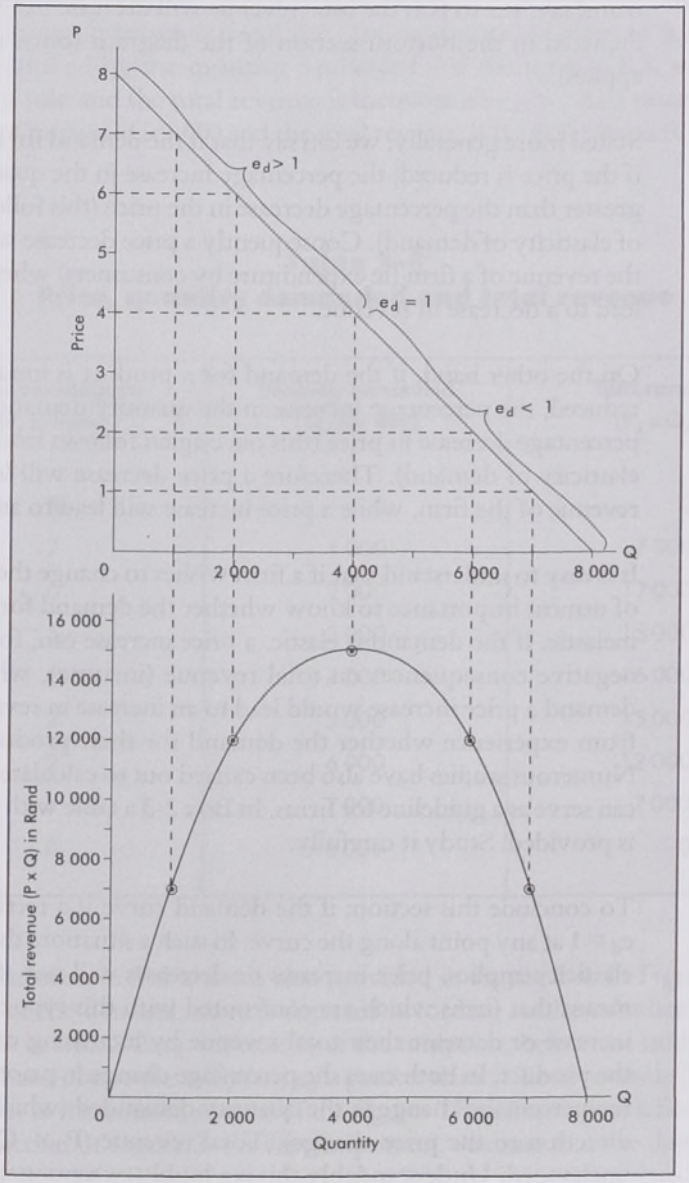
It is easy to understand that if a firm wishes to change the price of its product it is of utmost importance to know whether the demand for the product is elastic or inelastic. If the demand is elastic, a price increase can, for example, have serious negative consequences on total revenue (income), whereas with an inelastic demand a price increase would lead to an increase in revenue. Firms often know from experience whether the demand for their product is elastic or inelastic. Numerous studies have also been carried out to calculate elasticity – these figures can serve as a guideline for firms. In Box 2-3 a table with this type of information is provided. Study it carefully.

To conclude this section: if the demand curve is a rectangular hyperbole, then $e_d = 1$ at any point along the curve. In such a situation, that is to say when unitary elasticity applies, price increases or decreases will not affect total revenue. This means that firms which are confronted with this type of demand curve cannot increase or decrease their total revenue by increasing or decreasing the price of the product. In both cases the percentage change in price will be offset exactly by the percentage change in the quantity demanded (which will be in the opposite direction to the price change). Total revenue ($P \times Q$) will therefore remain unchanged. Understandably this is a highly exceptional instance.

Figure 2–4

The relationship between the price elasticity of demand and total revenue (income)

When demand is elastic, a price drop leads to an increase in TR (total revenue) and a price rise to a decrease in TR. When demand is inelastic, a price decrease leads to a decrease in TR and a price increase to an increase in TR. This applies for all linear demand curves with a negative slope.



Box 2–3

Approximate price elasticities of demand for selected products

(The figures apply to the USA)

Product	Price elasticity
Electricity	1,20
Beef	0,92
Sugar	0,31
Wheat	0,08
Potatoes	0,31
Fish	2,20
Tyres	1,20
Movie tickets	3,70

Source: E Mansfield, 1991, *Microeconomics*, Seventh edition, New York: Norton.

Other demand elasticities

The quantity of a product demanded does not depend only on the price of the product. It is therefore also possible to calculate other demand elasticities. In this section attention is briefly paid to two such demand elasticities, namely the *income elasticity of demand* and the *cross elasticity of demand*.

Income elasticity of demand

The income of consumers also has an important influence on the quantity of a product demanded. Should consumers' income increase, the quantity demanded will usually increase (if all other things remain constant). The question is by how much will it change relative to the change in income? The *income elasticity of demand* (e_y) measures the sensitivity of the quantity demanded to changes in income. By applying the general definition of elasticity, it can be defined as the percentage change in the quantity demanded as a result of a 1 per cent change in consumers' income, that is to say

$$e_y = \frac{\text{percentage change in the quantity demanded}}{\text{percentage change in consumers' income}}$$

The income elasticity of demand can be positive or negative. If the increase in income is accompanied by an increase in the quantity demanded of the product concerned, then the income elasticity of demand is positive (or a decrease in income is accompanied by a decrease in the quantity demanded). Goods with a *positive income elasticity* of demand are referred to as *normal goods*. A negative income elasticity of demand implies that an increase in income will lead to a decrease in the quantity demanded of the product concerned (or that a decrease

in income would lead to an increase in demand). Goods with a *negative income elasticity of demand* are referred to as *inferior goods*. Paraffin and candles for example, are regarded as inferior goods among low income households in South Africa (refer to Box 2-4).

Normal goods are subdivided into luxury goods and necessities. If the *income elasticity is greater than one*, that is to say when the percentage change in quantity demanded is greater than the percentage change in income, the product can be classified as a *luxury product*. Furniture and electrical appliances are typical examples. If the elasticity of demand is *positive but less than one*, that is to say, when the percentage change in the quantity demanded is less than the percentage change in income, the product is referred to as a *necessity*. Staples such as brown bread, maize meal, rice and fresh milk fall into this category (once more refer to Box 2-4).

Box 2-4

Estimated income elasticities of demand in South Africa, 1985

Product	Income elasticity of demand	
	High-income households	Low-income households
Brown/full grain bread	0,25	0,23
Maize meal	0,31	0,00
Rice	0,02	0,60
Cakes and biscuits	0,78	2,27
Meat	0,32	0,90
Biltong	1,36	1,11
Fresh fish	0,51	1,61
Fresh milk	0,21	0,66
Cheese	0,46	2,01
Pure fruit juice	0,83	2,03
Tea	0,21	0,25
Ladies' fashions	0,98	1,14
Men's clothing	0,99	1,26
Paraffin	0,55	-0,51
Candles	0,82	-0,20
Transport	1,26	1,25
Medical care	0,65	0,98
Furniture	1,40	1,30
Electrical appliances	1,06	2,18
Normal radios	0,88	-0,56
Television sets	0,37	1,65

Source: Philip Mohr, Louis Fourie *et al*, 1996, *Economics for South African students*, First edition, Pretoria: Van Schaik.

The income elasticity is important for the suppliers of goods and services. They want to know what will happen to the quantity demanded of goods and services that they produce if consumers' incomes increase. During the post-war economic upheaval, developing countries which exported agricultural products fared relatively badly as a result of the low income elasticity of demand for basic foodstuffs. The demand for basic foodstuffs did not keep pace with the increase in income and the demand for manufactures. On the other hand, countries which exported goods with high income elasticities (eg electronic equipment and cars) fared well because the quantity demanded of these goods increased faster than the income of consumers.

Cross elasticity of demand

The quantity demanded of a particular product also depends on the *price of related products* such as *substitutes* and *complements*. The cross elasticity of demand measures the sensitivity of the quantity demanded of a specific product to changes in the price of a related product. By applying the general definition of elasticity, the cross elasticity of demand e_c can be defined as the percentage change in the quantity of a product demanded as due to a 1 per cent change in the price of a related product, that is to say

$$e_c = \frac{\text{percentage change in the quantity demanded of product A}}{\text{percentage change in the price of product B}}$$

When two products are not related to each other (eg computers and shoes) the cross elasticity of demand is zero. With *substitutes* (eg coffee and tea) the cross elasticity of demand is *positive*. A change in the price of one good (eg coffee) leads to a change in the same direction of the quantity demanded of the substitute product (tea). For example, if the price of coffee rises, more tea will be demanded, *ceteris paribus*, since consumers convert to tea, which is relatively cheaper.

With *complements* (eg cars and petrol) the cross elasticity of demand is *negative*. A change in the price of one product (eg cars) leads to a change in the opposite direction of the quantity demanded of the complementary product (petrol). If the price of cars falls, more cars will be demanded and consequently more petrol will also be demanded.

THE SUPPLY SIDE OF THE MARKET

The market supply curve

Every market has both a supply side and a demand side. The supply side can be represented by means of a market supply schedule, which is a table representing the quantities of a product supplied at various prices. Assume for example that the market supply of frozen fish is represented by Table 2-5.

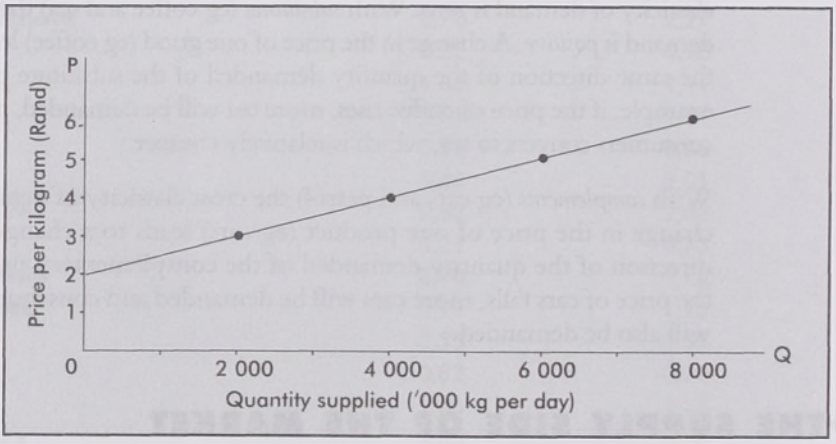
Table 2-5
Market supply for frozen fish

Price per kilogram (Rand)	Quantity supplied ('000 kg per day)
6	8
5	6
4	4
3	2
2	0

At a price of R6 per kilogram 8 000 kilograms will be supplied on the market; at a price of R5 per kilogram 6 000 kilograms will be supplied on the market, etc. The information supplied in Table 2-5 can also be represented by means of a supply curve. The vertical axis of a graph depicts the price of the product, whereas the horizontal axis shows the quantity supplied per time period (month, year,etc). Figure 2-5 shows the market supply curve for frozen fish as reflected in Table 2-5.

Figure 2-5
The market supply curve

It is obtained by horizontally adding all the supply curves of the producers in the market together.



Two important comments must be made about Figure 2-5. First, the market supply curve for frozen fish slopes upwards from left to right; in other words the quantity of frozen fish supplied on the market increases as the price of frozen fish increases. This is because suppliers of frozen fish have a greater incentive to supply their product at a higher price. Empirical studies have shown that the

market supply of most goods has this characteristic, namely that it rises from left to right. (In later chapters the supply curves of various market forms are studied in more detail.) Second, the market supply curve in Figure 2-5 refers to a specific time period – in our example it is a day. Any market supply curve refers to a certain time period (day, month, year) and the shape and position of the curve is affected by the time period. If we determine the market supply curve of frozen fish for, say, the first month of the year, it will look different from that for the year as a whole. This can partly be explained because producers can adapt their supply to price changes if the period under consideration is longer.

Other factors

Besides the length of time for which the supply curve is calculated other factors influence the shape and position of the market supply curve. One important factor is technological change – as new machines and production techniques are developed, it becomes cheaper to manufacture products, which means that firms are often in a position to offer goods at a lower price than before. Technological change, therefore, often gives rise to a rightward shift of the supply curve. If the suppliers of frozen fish, for example, develop better ways of catching, handling and packaging fish, a rightward shift of the supply curve will result, as depicted in Figure 2-6.

Another factor which affects the shape and position of the market supply curve is the price of factors of production (eg labour, capital and land) which are used to produce the product. Decreases in the price of inputs make it cheaper to produce the goods, which puts firms in a position where they are able to offer a certain quantity of goods at a lower price than before. A drop in the price of factors of production will also cause a rightward shift of the supply curve. On the other hand, increases in the price of inputs can cause the supply curve to shift leftwards, as depicted in Figure 2-7.

A shift of the supply curve and a movement along the supply curve

As in the market demand curve it is important to differentiate between a shift of the curve and a movement along the curve. In essence the principle is the same: in the market supply curve factors such as technological change and changes in the price of factors of production will cause the market supply curve to shift to the left or to the right depending on the circumstances (see Figs 2-6 and 2-7). On the other hand, if only the price of the product changes, there will merely be a movement along the supply curve and the quantity supplied will change. In Figure 2-5 it can be seen that if the price of frozen fish increases from R5 per kilogram to R6 per kilogram the quantity supplied will increase from 6 000 kilograms to 8 000 kilograms per day.

Figure 2–6

An increase in market supply

If the supply of a product increases, the market supply curve shifts to the right.

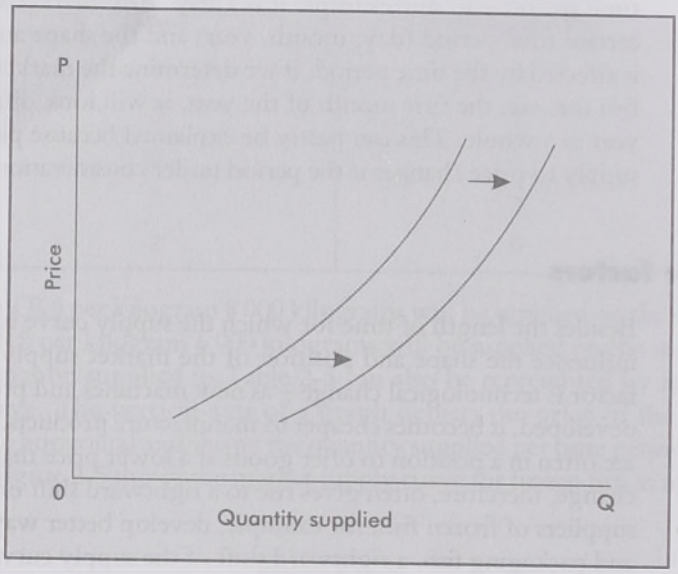
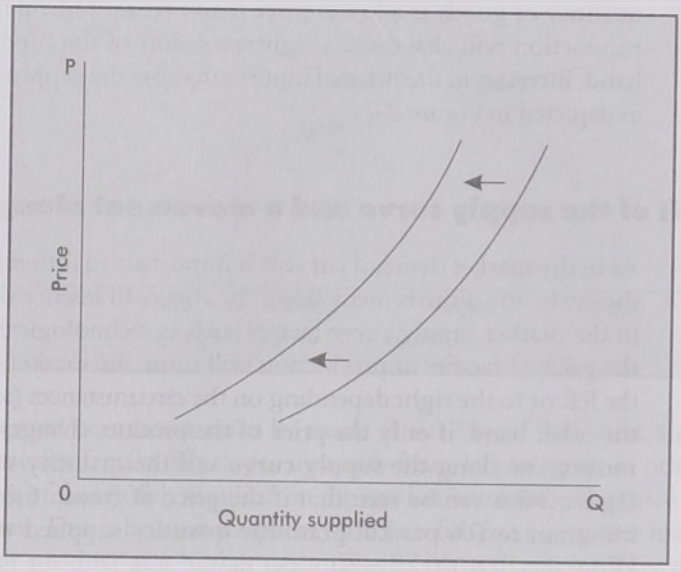


Figure 2–7

A decrease in market supply

If the supply of a good decreases, the market supply curve shifts to the left.



Price elasticity of supply

Like market demand curves, market supply curves have various shapes. They also differ in particular in respect of the sensitivity of the quantity supplied to price. For some products, a small change in the price will result in a large change in the quantity supplied, whereas with other products a large change in price will only lead to a small change in the quantity supplied. As with demand, economists make use of the elasticity principle when it comes to supply in order to calculate the elasticity of supply. The price elasticity of supply (abbreviated to supply elasticity) is defined as the percentage change in the quantity supplied which results from a 1 per cent change in price. Therefore if a 1 per cent change in the price of coffee leads to a 0,75 per cent increase in the amount of coffee supplied, then the price elasticity of supply is 0,75.

Elasticity of supply

It should be clear that the price elasticity of supply has a lot in common with the price elasticity of demand. Like the latter, supply elasticity is expressed in terms of relative changes and not absolute changes in price and quantity and should therefore not merely be equated with the slope of the supply curve. Price elasticity of supply also usually differs from one point to the next along the supply curve – for example the supply elasticity of coffee may be higher when the price of coffee is very low compared to when the price is high. (At high prices coffee producers are probably already offering most of their production on the market, with the result that they cannot react very much if the price increases by another 1 per cent.) In general we can assume that the price elasticity of supply will increase if the period of time which the supply curve represents increases. The reason is the same as was noted in a previous section – if the time period is longer, producers of products will be in a better position to adjust their production to price changes.

If we have a table which shows the quantity of a product supplied at various prices, then the price elasticity of supply can be calculated. Let ΔP represent a very small change (in percentage terms) in the price of the product whereas ΔQ_s represents the change in the quantity supplied (as a result of the price change). The formula for the price elasticity of supply at a point on a supply curve is therefore:

$$e_s = \frac{\text{percentage change in the quantity supplied}}{\text{percentage change in the price}}$$

$$= \frac{\Delta Q_s}{Q_s} \div \frac{\Delta P}{P}$$

If ΔP is not very small in percentage terms, the arc elasticity of supply should be calculated by using the average values of P and Q_s. The calculation is done in the same way as the arc elasticity of demand. The formula is as follows:

$$e_s = \frac{\Delta Q_s}{(Q_{s1} + Q_{s2}) / 2} \div \frac{\Delta P}{(P_1 + P_2) / 2}$$

$$= \frac{\Delta Q_s (P_1 + P_2)}{\Delta P (Q_{s1} + Q_{s2})}$$

PRICE DETERMINATION

The equilibrium price

In a free market economy prices are important determinants of what is going to be produced, how it is to be produced and who is going to buy it. In the previous two sections we noted two basic concepts which form the basis of the market mechanism, namely supply and demand. Logically speaking, the next step would be to see how prices are determined in a free market economy. In order to do this it is important to define the equilibrium price of a product. You will often encounter the equilibrium concept in this book; it is an important concept in economics (as in many other study fields).

Equilibrium price

Equilibrium is a situation where there is no tendency towards change; in other words it is a condition which can continue existing. Equilibrium can also be described as a situation of balance, that is a situation where all opposing forces cancel each other out. An equilibrium price is therefore a price that can be maintained. Any price that is not an equilibrium price cannot be maintained for very long, because there will be basic forces in operation which will give rise to a change in price. To illustrate this, in Table 2-6 we combine the information on the market demand for and supply of frozen fish which we have already come across (see Tables 2-1 and 2-5). The same information also appears in Figure 2-8, which you will recognise as the market demand and supply curves discussed earlier in the chapter (see Figs 2-1 and 2-5).

Table 2-6
Market demand for and supply of frozen fish

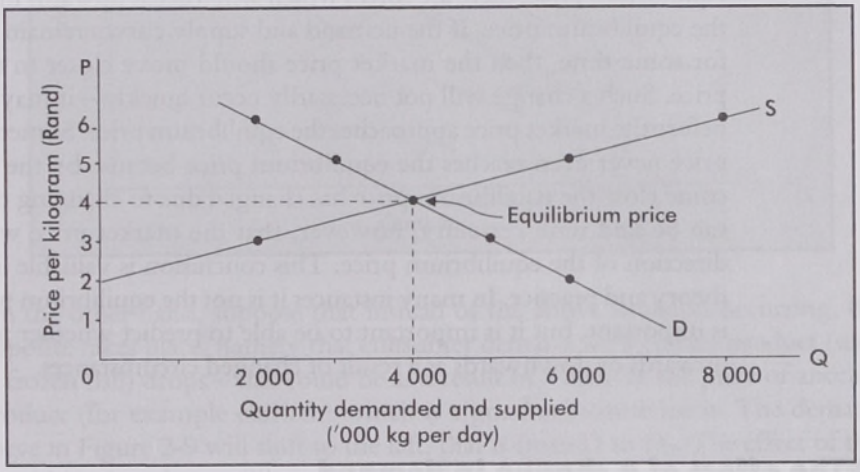
Price per kilogram (Rand)	Quantity demanded ('000 kg per day)	Quantity supplied ('000 kg per day)
6	2	8
5	3	6
4	4	4
3	5	2
2	6	0

From Table 2-6 as well as Figure 2-8 it can be seen that 6 000 kilograms of frozen fish are supplied at a price of R5 per kilogram, whereas 3 000 kilograms are

demanded. There is therefore disequilibrium between the quantity demanded and the quantity supplied – in this instance, at a price of R5 per kilogram there is an excess supply of 3 000 kilograms of frozen fish per day. A portion of the frozen fish will therefore not be sold and as the producers' stocks increase, they will be inclined to decrease their price in order to get rid of their superfluous stock. A price of R5 will therefore not be maintained for very long and therefore cannot be regarded as the equilibrium price.

Figure 2–8
Equilibrium price

It is the price at which the quantity demanded is equal to the quantity supplied.



At a price of R3 per kilogram the opposite applies. The quantity demanded by consumers will be 5 000 kilograms per day whereas 2 000 kilograms will be supplied by producers per day. At R3 per kilogram there is therefore an excess demand of 3 000 kilograms per day on the market. Some consumers will be left empty-handed because there is not enough to cater to their demands. Producers will therefore find it profitable to increase their prices. This, accompanied by competition among consumers, will push prices up. A price of R3 per kilogram will therefore not last for very long either and cannot be regarded as an equilibrium price.

The equilibrium price can be defined as the price at which the quantity demanded is equal to the quantity supplied. It is obvious that it is the only price at which there is no disequilibrium between the quantity supplied and the quantity demanded – as a result it is the only price which can be maintained for some time. In Figure 2-8 a price of R4 is the price at which the quantity demanded is equal to the quantity supplied, that is where the demand and supply curves intersect each other. Under the given circumstances R4 per kilogram is the equilibrium price of frozen fish, whereas 4 000 kilograms is the equilibrium quantity.

Prices in practice

The prices which are encountered in practice are market prices or real prices. Our aim in the explanation of demand and supply is not to determine the equilibrium price as such, but to explain how market prices change in practice. In general economists accept that the market price will move in the direction of the equilibrium price because the underlying forces will propel it in that direction.

In the previous section we saw that if the market price is above the equilibrium price, then the forces will operate in such a way that it will move downwards in the direction of the equilibrium price. Likewise, if the market price is below the equilibrium price, there are forces which will force it upwards in the direction of the equilibrium price. If the demand and supply curves remain relatively stable for some time, then the market price should move closer to the equilibrium price. Such a change will not necessarily occur quickly – it may take some time before the market price approaches the equilibrium price. Sometimes the market price never even reaches the equilibrium price because by the time that it has come close the equilibrium price has changed due to changing circumstances. It can be said with certainty, however, that the market price will move in the direction of the equilibrium price. This conclusion is valuable in terms of both theory and practice. In many instances it is not the equilibrium price itself which is important, but it is important to be able to predict whether prices will move upwards or downwards as a result of changed circumstances.

The effect of a change in demand

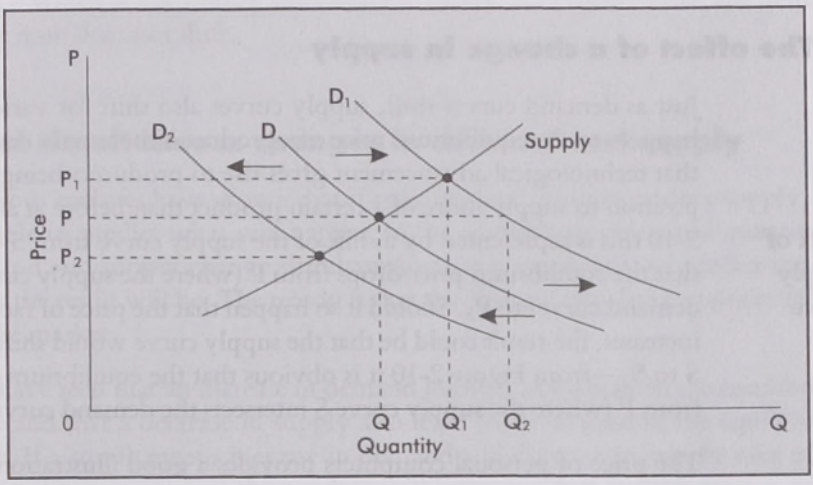
It has already been shown that the demand for a product changes in reaction to changes in tastes, income and the prices of other products. Any supply and demand diagram, such as Figure 2-8, is a representation of a situation during a specific time period, for example a day, a week, a month or a year. The question now is what will happen to the equilibrium price of a product if the demand curve changes?

Assume that consumers' tastes change in favour of a product such as the frozen fish in our example – this will cause a rightward shift of the demand curve. Such a situation is depicted in Figure 2-9 where the demand curve shifts from D to D_1. It is easy to see the resultant effect on the equilibrium price. When D is the demand curve, the equilibrium price is P, but when the demand curve shifts to D_1 there is a shortage of $Q_2 - Q$ at a price of P. This means that at a price of P demand exceeds supply by a quantity of $Q_2 - Q$; consumers will therefore be prepared to pay more for the product. Suppliers of the product will therefore increase their price and see how the market reacts to this – after a few adjustments back and forth the price will be inclined to settle at P_1, the new equilibrium price, whereas the quantity will settle at Q_1.

Figure 2-9

A change in demand and the equilibrium price

If all other things remain constant, a shift of the demand curve to the right results in a price increase; a shift to the left (D_2) results in a price decrease.



On the other hand, suppose that instead of the above situation occurring, the opposite takes place, namely that consumer demand for a certain product (such as frozen fish) drops – this could be as a result of a drop in the price of another product (for example chicken) which is a good substitute for it. The demand curve in Figure 2-9 will shift to the left, that is from D to D_2. The effect of this would be that the equilibrium price will drop to P_2 where the new demand curve now intersects the supply curve.

This model can be illustrated by numerous practical examples. One of the most dramatic examples in South African history is the big change in the demand for ostrich feathers in the first quarter of the 20th century. There was an enormous global demand for ostrich feathers around 1900, mainly in the fashion world, with the result that ostrich farmers in the Outshoorn district became extremely wealthy. A few years later fashions changed dramatically and in addition the First World War broke out, which just about wiped out the world demand for ostrich feathers. This resulted in many ostrich farmers going bankrupt. Theoretically speaking the demand curve initially moved far to the right, which resulted in high prices, then the curve shifted so far to the left that farmers could not sell their product at prices at which they could economically continue. (Many years later the industry came back on track and today it is an important part of the farming activity in the Outshoorn district.)

In general a rightward shift of the demand curve will lead to an increase in the equilibrium price, whereas a shift to the left would lead to a decrease in the equi-

librium price. This is obvious from Figure 2-9. The conclusion, of course, depends on the assumption that the supply curve rises from left to right which, as has already been noted, is usually so. Furthermore, the supply curve itself does not shift as a result of the change in demand.

The effect of a change in supply

Shift of supply curve

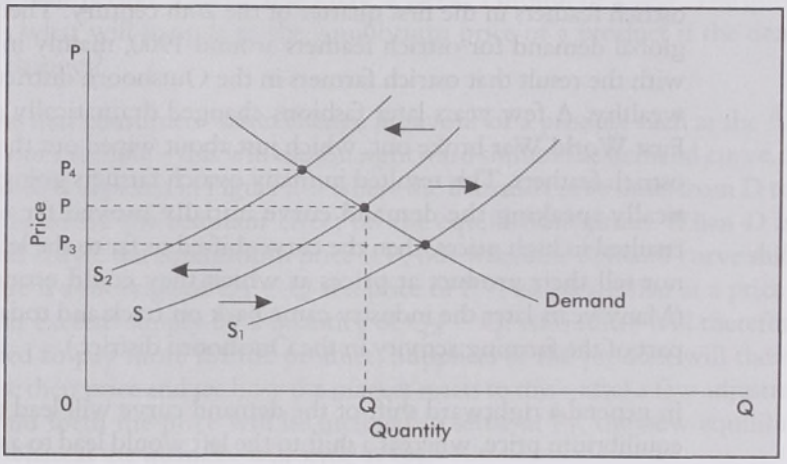
Just as demand curves shift, supply curves also shift for various reasons. What happens to the equilibrium price of a product if the supply curve shifts? Suppose that technological advancement gives rise to producers being prepared and in a position to supply more of a certain product than before at any price. In Figure 2-10 this is represented by a shift of the supply curve from S to S_1. The result is that the equilibrium price drops from P (where the supply curve S intersects the demand curve) to P_3. Should it so happen that the price of factors of production increases, the result could be that the supply curve would shift from the original S to S_2 – from Figure 2-10 it is obvious that the equilibrium price will increase from P (where the supply curve S intersects the demand curve) to P_4.

The price of personal computers provides a good illustration of the result of a rightward shift of the supply curve. When personal computers came onto the market in the early eighties, their prices were relatively high. New producers, however, entered the market quickly and this, together with technological advancement, resulted in the price of personal computers falling. Today's personal computers are not only more powerful but, if inflation is eliminated, they cost a lot less than the models of yesteryear.

Figure 2-10

A change in supply and the equilibrium price

A shift of the supply curve to the right (other things remaining the same) leads to a price decrease; a shift to the left (S_2) leads to a price increase.



In general a shift to the right of the supply curve will lead to a drop in the equilibrium price, whereas a shift to the left would lead to an increase in the equilibrium price. This is also illustrated in Figure 2-10. This conclusion is naturally based on the assumption that the demand curve slopes downwards from left to right – which as has already been noted is usually so. Furthermore, the demand curve itself does not shift.

The effect of simultaneous changes in demand and supply

Previous analyses have shown that if only demand changes or only supply, it is possible to predict what will happen to the equilibrium price and quantity. If demand and supply change simultaneously it is impossible to predict exactly what the result will be. The reason is that the changes may have opposite effects on the market.

We have seen that an increase in demand leads to an increase in the equilibrium price and that a decrease in supply also leads to an increase in the equilibrium price. If a simultaneous increase in demand and decrease in supply take place, the equilibrium price of the product will increase – but exactly what is going to happen to the equilibrium quantity cannot be said with certainty. An increase in demand increases the equilibrium quantity, *ceteris paribus*, whereas a decrease in supply will reduce the equilibrium quantity, *ceteris paribus*. In so far as the equilibrium quantity is concerned the two forces are working in opposite directions and the result will depend on the relative size of the changes in demand and supply.

Simultaneous change

To illustrate the uncertainty when demand and supply change simultaneously, we look at the situation when demand increases and supply decreases at the same time. Assume that D and S are the original supply and demand curves in Figure 2-11. If demand increases from D to D_1 and supply decreases by the same amount from S to S_1, the equilibrium price will increase from P_0 to P_1, whereas the equilibrium quantity will stay the same, namely Q_0. If demand shows a larger increase (D to D_2) than the decrease in supply (S to S_1), however, then both the equilibrium price and quantity will increase (see the price and quantity represented by point B). On the other hand, if demand shows a smaller increase (D to D_1) than the decrease in the supply (S to S_2) then the equilibrium price will increase, but the equilibrium quantity will decrease (see point C). It is clear that the result will depend on the relative sizes of the changes in demand and supply.

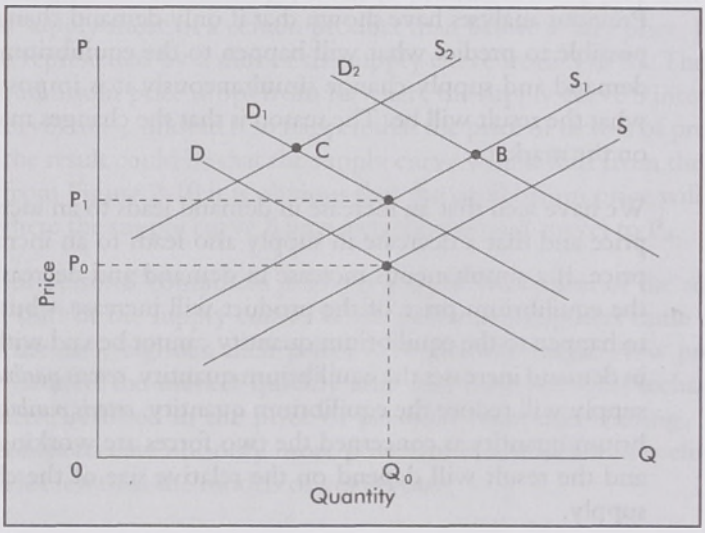
Similar problems are encountered under other circumstances. For example, if demand and supply both decrease it is possible to predict what will happen to the equilibrium quantity (it will decrease), because both forces have the same effect on the equilibrium quantity. The combined effect on the equilibrium price however, is uncertain, because a decrease in demand will decrease the price,

ceteris paribus, whereas a decrease in supply will increase the price, *ceteris paribus*. The equilibrium price can therefore increase, stay the same or decrease, depending on the relative sizes of the changes in demand and supply.

Figure 2-11

Simultaneous changes in demand and supply

Equilibrium price can increase, remain the same or decrease, depending on the relative sizes of the changes in demand and supply.



There are a few possibilities whereby simultaneous changes in demand and supply can occur: both can increase, both can decrease, demand can increase while supply decreases, or demand can decrease while supply increases. You can show the different combinations by means of your own diagrams based on the example in Figure 2-11. The following table is a summary of the results you should obtain.

Table 2-7

Simultaneous changes in demand and supply

Change in demand	Change in supply	Change in price	Change in quantity
Increase	Decrease	Rise	Uncertain
Decrease	Decrease	Uncertain	Drop
Increase	Increase	Uncertain	Rise
Decrease	Increase	Drop	Uncertain

IMPORTANT CONCEPTS

- Perfect competition
- Market demand
- Changes in market demand
- Price elasticity of demand
- Marshall's method
- Price elasticity and revenue
- Income elasticity of demand
- Cross elasticity of demand
- Market supply
- Changes in market supply
- Price elasticity of supply
- Equilibrium price
- Effects of changes in demand/supply
- Simultaneous changes in demand/supply

QUESTIONS

(1) Define a market. (2)

(2) Define the law of demand. (3)

(3) Name four factors that may influence the shape and location of a market demand curve. (4)

(4) Define the price elasticity of demand. (3)

(5) Use a demand curve with numerical values to explain that the price elasticity of demand differs at two different points on the curve. (10)

(6) Explain what will happen to total revenue if the price of the product is increased in the elastic part of the demand curve. (5)

(7) Explain what will happen to total revenue if the price of the product is increased in the inelastic part of the demand curve. (5)

(8) Define cross elasticity of demand. (3)

(9) Name four factors that influence the shape and location of the market supply curve. (4)

(10) Define price elasticity of supply. (3)

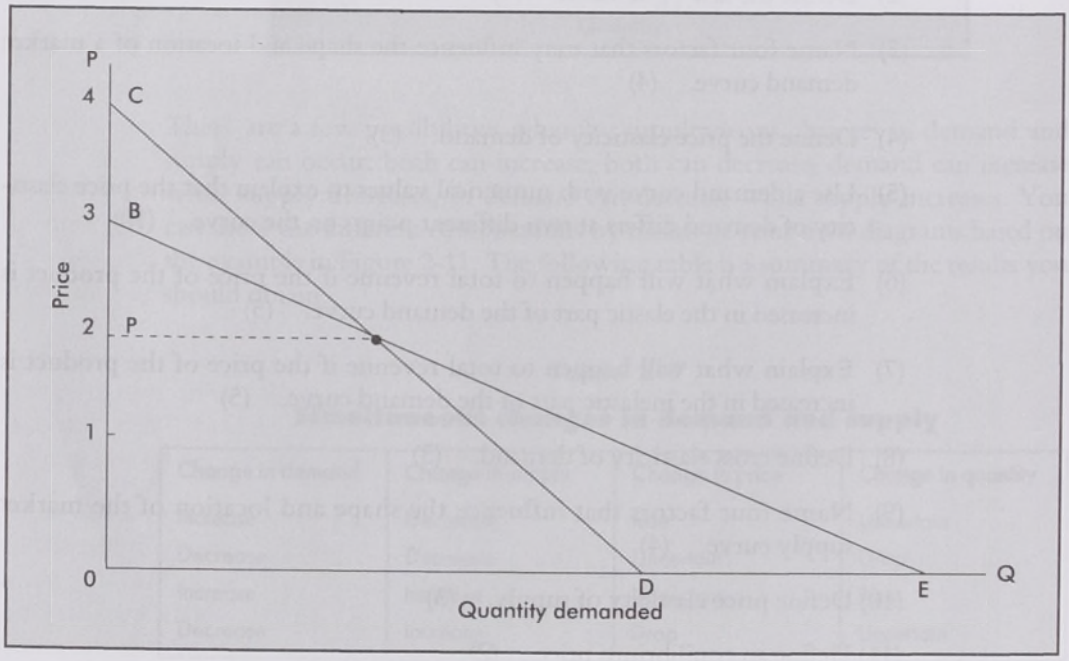
(11) Define an equilibrium price. (2)

(12) Explain what will happen if there is a temporary surplus demand in a market. (5)

(13) Explain, with the aid of a figure, what will happen to the equilibrium price and quantity if there is a decrease in demand and an increase in supply. (8)

APPENDIX 1

We referred to the fact that price elasticity of demand cannot merely be equated with the slope of a demand curve. When two demand curves intersect each other, however, it is possible to determine the relative elasticities of the curves at the point of intersection by looking at the slopes. For example, you can refer to the diagram below and calculate the elasticities using Marshall's method. At a price of P the elasticity of the demand curve BE is equal to 0P/PB = 2/1 = 2. In contrast the elasticity of demand curve CD at a price of P is equal to 0P/PC = 2/2 = 1. At a price of P the flatter demand curve BE is therefore more elastic than the steeper demand curve CD. In general it can be said that the demand curve which intersects the vertical axis closest to the origin (ie the flatter one) is more elastic at any price. It is important to note that the demand curves *must intersect each other* to be able to compare the two.

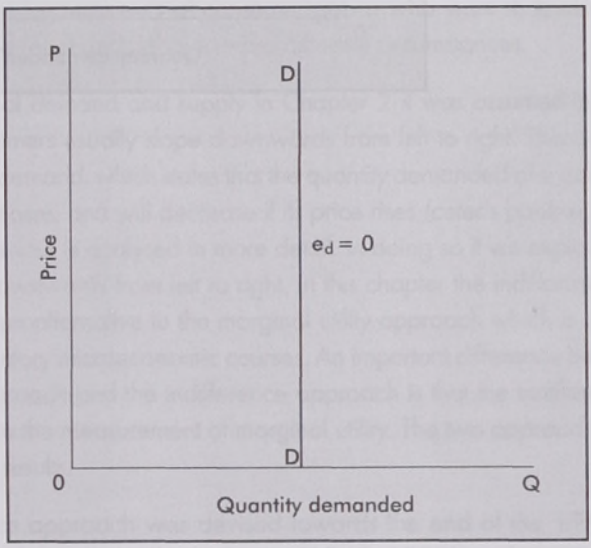


APPENDIX 2

Besides the three types of elasticity (elastic, inelastic and unitary elastic) which have already been mentioned, there are two other types.

Perfectly inelastic demand is represented by a vertical demand curve, that is to say a straight line parallel to the price axis, such as DD in the figure below. The quantity demanded of the product remains unchanged when the price of the product changes, that is to say a fixed amount is demanded irrespective of the price. In such a situation the price elasticity of demand is equal to zero. A practical example is life-supporting medicine – the consumer will have to buy the product irrespective of the price.

Perfectly inelastic demand



If the demand for a product is perfectly inelastic, producers can increase their incomes by increasing the price of the product. As has already been explained, producers' total revenue is equal to P × Q. When P increases and Q remains the same, total revenue will increase.

Perfectly elastic demand is represented by a horizontal demand curve like D′D′ in the next figure. Such a demand curve has an elasticity coefficient of infinity. A producer can sell any quantity at a price of P_1, but if the price of the product is increased slightly, nothing will be sold. An example of perfectly elastic demand is provided in Chapter 5, where the position of an individual firm in a perfectly competitive market is analysed.

Perfectly elastic demand