5

PERFECT COMPETITION

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In the preceding chapters the emphasis was on the derivation and discussion of impor-
tant theoretical principles which explain the behaviour of consumers and firms. In this
chapter, these principles are used to analyse perfect competition. In Chapter 2 reference
was made to perfect competition, and in practice this assumption has applied through-
out — in this chapter, however, it will be discussed in greater detail.

We shall start this chapter by first briefly discussing the conditions for or assumptions of
perfect competition. Although these assumptions may appear somewhat far-fetched,
perfect competition serves as a norm that firms should strive for and as a measure against
which other market forms can be measured. Some of the concepts encountered in the
previous chapter such as marginal cost and average cost will be used in this chapter,
together with concepts such as marginal revenue to determine at what level of output the
firm will maximise profit, as well as to derive the firm's supply curve and determine the
firm's equilibrium. Initially, the analysis focuses on the short run, where the firm may make
normal profit, economic profit or even a loss. This is followed by an analysis of the firm's
long-run situation. It will be become apparent that in the long run, where all the produc-
tion factors are variable, the firm will set up a plant size that will result in normal profit so
that there will be no reason to leave or enter the industry. Finally, the long-run supply
curve of the industry is derived for constant, increasing and decreasing cost industries.

On completion of this chapter, you should be able to

- define the conditions for perfect competition
- explain the conditions for profit maximisation
- derive the short-run supply curve of the individual firm
- explain long-run profit maximisation and long-run equilibrium
- derive the long-run industrial supply curve for constant, increasing and decreasing
  cost industries

▶MARKET STRUCTURE

In the preceding chapters the behaviour of consumers and firms was discussed. In the following three chapters the focus will be on the price and production decisions of firms. Two key questions in microeconomics are: What determines the price of the product? and What determines the quantity to be produced? These questions will be answered for different market conditions in the following chapters.

Economists distinguish between four different types of markets, namely perfect competition, monopoly, monopolistic competition and oligopoly. The distinction between the groups is based on

- the number of firms in the market
- the nature of the product – that is, whether it is homogeneous or differentiated
- accessibility of the market
- the control that an individual firm has over prices

The table below will help to distinguish the different market forms and their unique characteristics.

Table 5–1

Characteristics of the four main market models

Characteristic	Perfect competition	Monopolistic competition	Oligopoly	Monopoly
Number of firms	Very large number	Very large number	Few	Only one
Type of product	Homogeneous (identical)	Differentiated	Homogeneous or differentiated	Unique without close substitutes
Control over prices	None	Limited	Determined by interdependence	Considerable
Acess to the market	Free. No restriction	Free	There may be restrictions	Limited
Nonprice competition	None	Much emphasis on advertising and trademarks	A great deal, especially product differentiation	Mostly public relations

Although Table 5-1 indicates four market forms, often only two broad groups are distinguished, namely perfect and imperfect competition. In such a case, perfect competition is contrasted with all the other market forms and imperfect competition is regarded as the collective name for monopolistic competition, oligopoly and monopoly.

The characteristics of the different market forms are such that price and production decisions of firms are taken according to circumstances which may differ from one market form to the next. This obviously has significant implications for the behaviour of firms and forms the subject matter to be studied in this and the next two chapters.

▶ PERFECT COMPETITION

The first market form used to study the behaviour of firms is that of perfect competition. In preceding chapters, it appeared that the market consisted of all the buyers (the demand side) and sellers (the supply side) of the specific good or service. There was competition on both sides of the market. In the goods market, buyers compete to obtain the product, while sellers compete to sell the product to buyers.

What does the market form of perfect competition involve? An economist will define perfect competition as a theoretical market form of such a nature that no individual participant (buyer or seller) in the economic process can have any influence on the market price because his or her contribution is too small compared with the market as a whole. The market price is determined by the interaction between demand and supply and all the participants must accept the market price. In a perfectly competitive market, all the participants are price takers – they have to accept the price as given and can only decide what quantities they will offer or request at that price.

An important characteristic of perfect competition is its impersonal nature in terms of which individual participants act completely independently of one another. For example, under perfect competition the individual firm, in its pursuit of maximum profit, will only take into consideration the market price and its own cost structure to determine its output quantity and take no notice whatsoever of the actions of its competitors or be influenced by them in any way. As strange as this may sound, perfect competition is therefore a market form characterised by a total lack of competition between individual firms – not in respect of price, quality, packaging or any other aspect. The meaning of perfect competition, as it is used in economic theory, is exactly the opposite of what it means in conversational speech. In the business world, people use the word 'competition' as a synonym for the word 'rivalry' where each firm is aware of its competitors and all sorts of methods (eg advertising) are used to entice clients away from competitors. In the theoretical world of perfect competition, this does not exist. Because there are so many firms in the industry, and individual firms can supply only a small portion of the market demand, no firm regards another firm as a threat. Selling its products is also no problem for a producer.

Characteristics of perfect competition

Perfect competition exists if the following conditions are met:

- There must be so many buyers and sellers of the product that each market participant is insignificantly small in relation to the market. Thus no individual buyer or seller can influence the market price.

- All the goods sold in the specific market are homogeneous, that is, identical. It makes no difference to the buyer from whom or where he or she buys the product.

- All production factors are completely mobile – in other words, labour, capital and all other production factors can move freely from one market to another.

- All the buyers and sellers have complete knowledge of all market conditions. For example, if one firm increases its price above the market price, all the buyers will immediately know about it and buy from those firms that still ask a lower price. The firm that asks for higher prices will then sell no products. (No firm will allow its price to drop below the market price, because it can sell as much as it likes at the market price.)

- There is total freedom of entry and exit – in other words, buyers and sellers are free to enter or leave the market. There should be no constraints on entry in the form of legal, financial, technological or other obstacles that restrict the freedom of movement of buyers and sellers.

- There is no government intervention to influence buyers and sellers.

- There is no collusion between sellers. Each seller acts independently.

With such strict conditions, it is not surprising that there are so few examples of perfect competition. The individual farmer is often regarded as a prime example of a perfect competitor. Sophisticated markets such as the stock exchange, an international grain exchange or a market for foreign currency, in which the equilibrium price is determined by the interaction between buyers and sellers, can also come close to being classified as a perfectly competitive market. In these markets there are thousands (even millions) of buyers and sellers; entry to and exit from markets are fairly easy; the products are homogeneous; participants are usually well informed about the market conditions; and as a rule large quantities of the product are bought and sold at the prevailing price. No individual has any noticeable power – everyone is a price taker.

▶Applicability

Because it is difficult to find an example of perfect competition in practice, this leads one to ask the following question: Why is it necessary to study the market form in the first place? The following remarks should clear up any doubts you may have:

- It was pointed out in Chapter 1 that a model can be useful, even if some of the assumptions appear somewhat unrealistic. The model of perfect competition leads to conclusions which are valuable in explaining practical events in the economy and making predictions about what may happen in the future.

- The model serves as a frame of reference or norm for studying and comparing markets. In the agricultural sector in particular, or other markets, where almost all the conditions for perfect competition are satisfied, the model has numerous applications when the operation of the markets is analysed.

- Perfect competition is a good point of departure for any analysis of the determination of prices and output.

Perfect competition, like all other models, has to be handled with caution. However, it is always a useful analytical tool. In conclusion, note that the adjective 'perfect' in perfect competition does not mean that it is necessarily the most acceptable form of competition – it merely indicates that it is the purest or highest form of competition.

▶The demand for the product of the perfectly competitive firm

In a perfectly competitive market, the market price is determined by the interaction between market demand and market supply. Since the perfectly competitive firm forms only a fraction of the market supply, it can have no influence on the market price and the firm must accept this price as given. The firm can also offer any quantity on the market and sell it at the prevailing market price. The implication is that the demand curve for the product of the perfectly competitive firm runs horizontal to the market price – in other words, it is perfectly elastic.

Horizontal demand curve This situation is illustrated in Figures 5-1(a) and (b). The market demand and supply curves determine the market price P_1. At this price, the firm can sell as much of its product as it wishes, as shown by the perfectly elastic demand curve in Figure 5-1(b).

Under perfect competition, the firm receives the same price (the market price) per unit for all the units it sells. The firm's average revenue (AR) is therefore equal to the market price, that is OP_1, and the demand curve therefore also

represents the average revenue curve. At the same time, the revenue from any additional unit that the firm sells – that is, the marginal revenue (MR) – is also equal to the market price OP_1 and the demand curve therefore also represents **P=AR=MR** the marginal revenue curve. Hence under perfect competition: Price = AR = MR.

Figure 5–1(a)	**Figure 5–1(b)**
The market price	**The firm's demand curve**
Market demand and market supply curves deter-mine the market price P_1 and the quantity Q_1 which will be offered on the market.	The curve is perfectly elastic and is determined by the market price P_1.
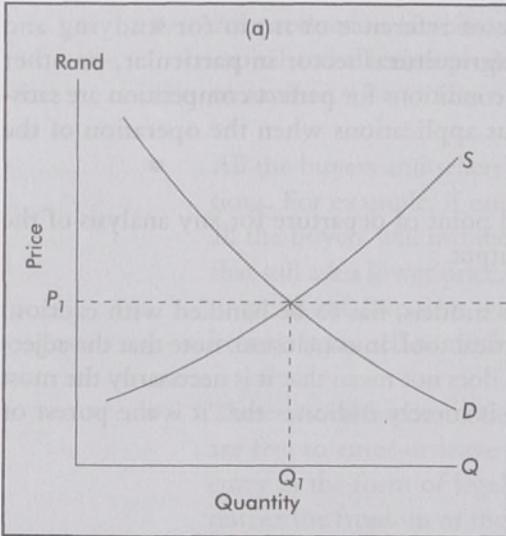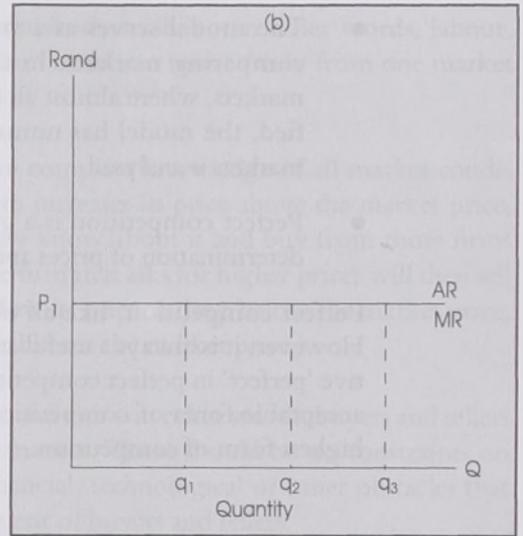
Total revenue, average revenue and marginal revenue

The average revenue and the marginal revenue of the perfectly competitive firm were briefly discussed in the previous section. Here they are stated more formally.

As mentioned earlier, the perfectly competitive firm is a price taker and the price of its product is given (P_1 in Fig 5-2). The firm's total revenue (TR) will there-fore increase by a constant amount for each additional unit sold. The total revenue for the firm from the sale of its product is the quantity sold multiplied by the price: that is, $TR = P \times Q$. The total revenue curve is a straight line from the origin, which indicates that the price is constant.

Average revenue (revenue per unit) equals the total revenue divided by the quantity:

Figure 5-2

Total revenue, average revenue and marginal revenue

The firm's total revenue is indicated by TR. The slope of TR is equal to the price. The individual firm's AR and MR will be the same as the market price P_1.

$$AR = \frac{TR}{Q}$$

$$= \frac{PQ}{Q}$$

$$= P$$
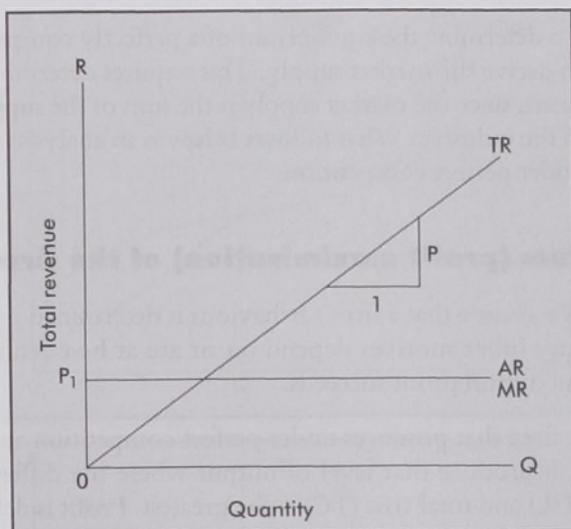
This result is the same as what was stated in the previous section, namely that the price at which the firm sells the product and its average revenue is the same (AR = P).

Marginal revenue (MR), which is the increase in the total revenue from the sale of an additional unit of the product, will also be equal to the price of the product. This is evident from the following:

$$MR = \frac{\Delta TR}{\Delta Q}$$

$$= \frac{\Delta(PQ)}{\Delta Q}$$

$$= P$$

The end result is also the same as that in the previous section, namely that under perfect competition Price = AR = MR applies.

SHORT-RUN EQUILIBRIUM

To determine the equilibrium of a perfectly competitive industry it is necessary to derive the market supply. This requires determining the supply of individual firms, since the market supply is the sum of the supply of all the individual firms in the industry. What follows below is an analysis of the supply of a typical firm under perfect competition.

Equilibrium (profit maximisation) of the firm in the short run

We assume that a firm's behaviour is determined mainly by its pursuit of profit. Any other motives depend on or are at best achieved if the firm's pursuit of maximum profit succeeds.

A firm that produces under perfect competition and wishes to maximise profit will produce that level of output where the difference between total revenue (TR) and total cost (TC) is the greatest. Profit is defined as

Profit = TR – TC

It is important to note once again that economists regard normal profit as part of production costs. In Chapter 4 it was explained that normal profit is a part of implicit cost, which in turn forms part of total cost. When total revenue is exactly equal to total cost, normal profit is made. When total revenue is greater than total cost, economic profit is made.

Equili-
brium
If the firm produces the output that maximises the difference between total revenue and total cost (ie maximises profit), it will be in equilibrium. The equilibrium position of the firm can be represented graphically in two ways: by using the TR and TC curves, or by using the marginal revenue curve (MR) and marginal cost curve (MC). These curves were all discussed earlier.

Equilibrium according to the total approach (total revenue and total cost)

Figure 5-3(a) represents the total revenue curve (TR) and short-run total cost curve (STC) for a perfectly competitive firm. As shown earlier in this chapter, the TR curve is a straight line through the origin of the graph which indicates that price is constant for all levels of output. The firm is a price taker and can sell any quantity at the market price; hence the TR curve will rise in proportion to its sales. The slope of the TR curve indicates marginal revenue (MR), which is

Figure 5-3
Short-run profit maximisation

The firm will produce the output where the positive difference between TR and TC is the greatest. This will be at Q_2, where MR = SMC, that is, point e in part (c) of the figure.
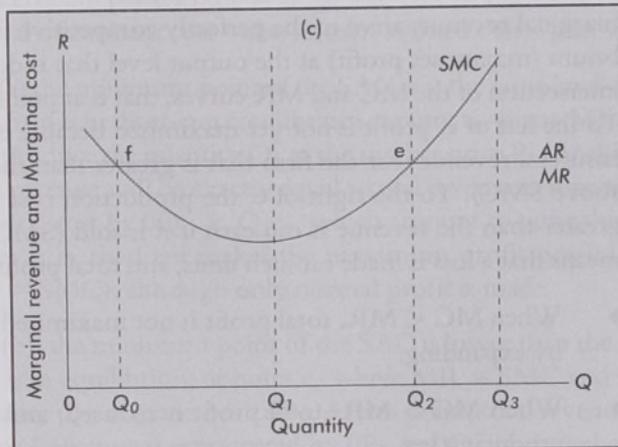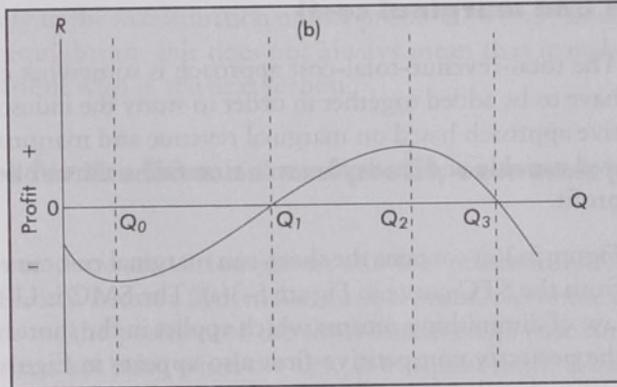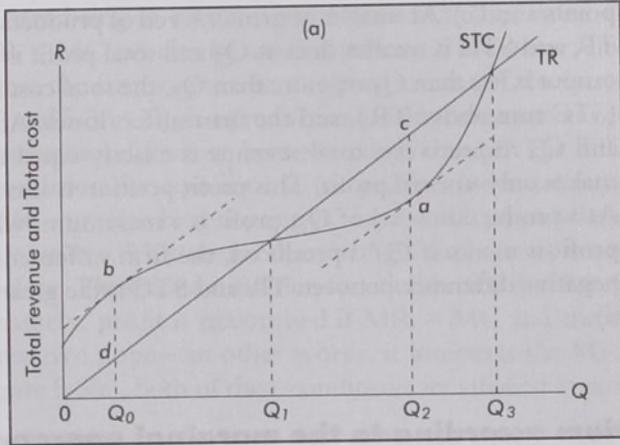
constant and equal to the prevailing market price. The slope of the STC curve indicates the short-run marginal cost (SMC).

The firm will maximise profit at a level of production of Q_2 where the difference between the TR and STC for a given level of production is the greatest (see points a and c). At smaller or greater levels of production, the difference between TR and STC is smaller than at Q_2 and total profit is not maximised. In fact, if output is less than Q_1 or more than Q_3, the total cost is more than total revenue (STC runs above TR), and the firm suffers losses. At a production level of Q_1 and Q_3 respectively, total revenue is exactly equal to total cost and the firm makes only normal profit. This profit position is also reflected in Figure 5-3(b). At a production level of Q_2, profit is a maximum, while at Q_1 and Q_3 normal profit is made. If Q_0 is produced, the firm suffers maximum loss, because the negative difference between TR and STC is the greatest there (see points b and d).

▶Equilibrium according to the marginal approach (marginal revenue and marginal cost)

The total-revenue-total-cost approach is somewhat clumsy to use when firms have to be added together in order to study the industry as a whole. An alternative approach based on marginal revenue and marginal cost uses price expressly as a variable and leads to a rule that firms must follow in order to maximise profit.

Figure 5-3(c) contains the short-run marginal cost curve (SMC) which is derived from the STC curve in Figure 5-3(a). The SMC is U-shaped, which reflects the law of diminishing returns which applies in the short run. The demand curve of the perfectly competitive firm also appears in Figure 5-3(c). It was indicated earlier that the demand curve also represents the average revenue curve and the marginal revenue curve of the perfectly competitive firm. The firm is in equilibrium (maximises profit) at the output level that is determined by the point of intersection of the MC and MR curves, that is at point e in Figure 5-3(c). Why? To the left of e, profit is not yet maximised because each unit to the left of Q_2 ensures a revenue for the firm that is greater than the marginal cost (MR lies above SMC). To the right of e, the production cost of each additional unit is greater than the revenue it can earn if it is sold (SMC lies above MR), which means that a loss is made on such units, and total profit is reduced. To sum up:

- When MC < MR, total profit is not maximised and the firm will benefit by expanding.

- When MC > MR, total profit is reduced, and the firm will benefit by producing less.

●   If MR = MC, short-run profit is maximised and the firm is in equilibrium.

The first condition for the firm to be in equilibrium is therefore that marginal cost should be equal to marginal revenue. This is a necessary condition for equilibrium but it is not sufficient because it is possible to satisfy the condition without the firm being in equilibrium. Figure 5-3(c) seems to show that the condition MR = MC can also be satisfied at point f. However, closer examination shows that the firm cannot be in equilibrium at f. In fact, as shown in Figures 5-3(a) and 5-3(b), Q_0 is a production level where a *maximum* loss is made. What is the important difference between points e and f? The difference is that the second condition for equilibrium (or profit maximisation) for the firm requires the MC curve to have a positive slope at the point where it intersects the MR curve, as at e. This means that the MC curve must intersect the MR curve from below. The second condition for equilibrium can therefore be added to the first, namely, profit is maximised if MR = MC and the marginal cost curve has a positive slope – in other words, it intersects the MR curve from below. In Figure 5-3(c), both of these conditions are satisfied at point e.

Thus far it has been assumed that the firm will make a profit, and reference has been made only to the maximisation of that profit. However, although a firm is in short-run equilibrium this does not always mean that it makes economic profit. This is dealt with in the next section.

▶Three possibilities for the firm: normal profit, economic profit or a loss

In the short run there are various profit and loss possibilities for a perfectly competitive firm. Whether a firm makes normal profit, economic profit or even a loss depends on the position of the short-run average cost curve (SAC) in respect of the market price when the firm is in equilibrium. (Remember here that the SAC curve represents the average *total* cost in the short run – in other words, the total of constant cost – also known as fixed cost – plus variable cost.)

Normal profit
In Figure 5-4(a) the minimum point of the SAC is at the same level as the market price P_1. The firm is in short-run equilibrium at point e_1 where MR = SMC and the firm will produce the quantity Q_1 at the market price P_1. At this point, total cost and total revenue will be exactly equal – total revenue is represented by $0P_1 \times 0Q_1$ and total cost by $0Q_1 \times Q_1e_1$, which amount to same thing. Given its cost structure, at e_1 the firm makes the maximum profit possible at price P_1 (because MR = SMC), although only normal profit is made.

Economic profit
In Figure 5-4(b), the minimum point of the SAC is lower than the market price P_2. The firm is in equilibrium at point e_2 where MR = SMC and the firm will produce quantity Q_2 at market price P_2. At this point, total revenue will exceed total cost – total revenue is represented by $0P_2 \times 0Q_2$, and total cost by $0S \times$

Figure 5-4
Price determination in the short run

Depending on the price, the firm can make normal profit, economic profit or a loss in the short run.
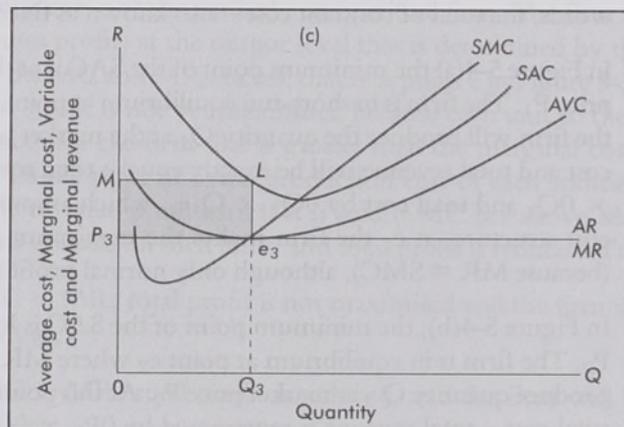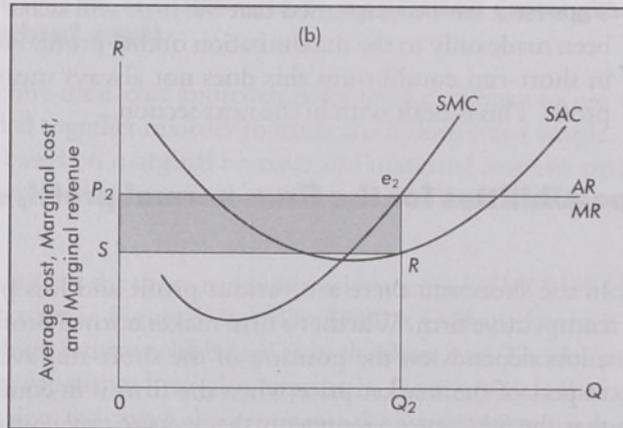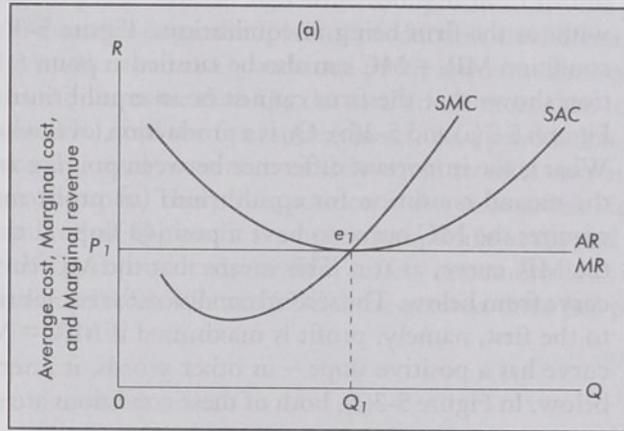
$0Q_2$. Given its cost structure, the firm makes economic profit at e_2 which is represented by the area P_2e_2RS.

Loss In Figure 5-4(c) the minimum point of the SAC is higher than the market price P_3. The firm is in equilibrium (in this case the loss is minimised) at point e_3, where MR = SMC, and the firm will produce the quantity Q_3 at the market price P_3. At this point total cost will exceed total revenue – total cost is represented by $0M \times 0Q_3$ and total revenue by $0P_3 \times 0Q_3$. Given its cost structure, at e_3 the firm makes a loss which is represented by P_3MLe_3. At e_3 the firm covers its variable cost of $0Q_3 \times Q_3e_3$, but the fixed cost of $P_3e_3 \times e_3L$ (which represents the loss) is not covered. Because fixed cost has to be paid regardless of whether the firm produces, at a market price P_3 the firm can choose whether or not to cease production – in both cases the loss is the same (equal to fixed cost). If the price falls below P_3 (ie below the AVC curve), the firm will not even cover its variable cost, and production will stop. In this case the firm will minimise its loss by stopping production, because then variable cost does not have to be paid (besides fixed cost).

Closing-down point The point at which the firm just covers its variable cost, such as e_3 in Figure 5-4(c), is referred to as the closing-down point. As explained above, if the price goes below the closing-down point, the firm does not cover its variable cost, and it would be better to close its doors. This also works the other way round: if the price is lower than the closing-down point and then starts to rise, at this point the firm will consider starting to produce.

Figure 5-5

Derivation of the firm's short-run supply curve

To maximise profit, the firm will produce at each price where MR = MC. If the price falls below the AVC curve, the firm will offer nothing. As price increases, larger quantities are offered.
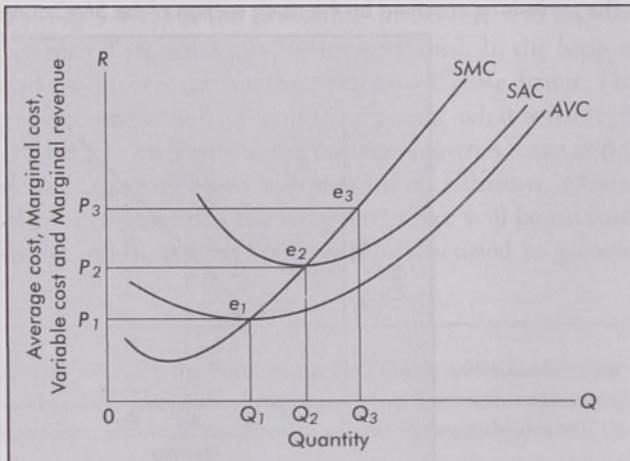
▶The firm's short-run supply curve

In the previous section it appeared that to remain in equilibrium, regardless of the price, the firm will always produce that quantity where MR = MC. Because the (horizontal) demand curve of the firm under perfect competition also represents the marginal revenue (MR), the firm will produce that quantity where the demand curve intersects the MC curve. This information is important in the analysis to follow.

The supply curve of the firm under perfect competition can now be derived by taking different market prices and seeing how much the firm will produce at each price. Assume that the market price increases slowly – in Figure 5-5 this is indicated as an increase from P_1 to P_2 to P_3. This means that the horizontal demand curve for the firm's product shifts upwards. Given the positive slope of the MC curve, each higher demand curve will intersect the given SMC curve at a point that lies to the right of the previous point of intersection such as e_1, e_2 and e_3 indicate in Figure 5-5 (at each of these points MR = MC). This means that the quantity that the firm produces increases as the price increases. We know that the firm will produce nothing if the price falls below e_1 in Figure 5-5 because variable cost is then not covered – thus a point such as e_1 will be the lowest starting point of the firm's supply curve. If the successive points such as e_1, e_2 and e_3, where the demand curve intersects the MC curve, are drawn in a separate graph (see Fig 5–6), the *short-run supply curve of the firm under perfect competition is represented by the section of the SMC curve above the variable cost curve (ie above the closing-down point)*. Below the closing-down point, the firm will offer nothing; as the price rises above the closing-down point, the quantity offered will increase.

Short-run supply curve

Figure 5–6
The short-run supply curve of the firm
The curve is represented by the rising section of the SMC curve above the AVC curve.
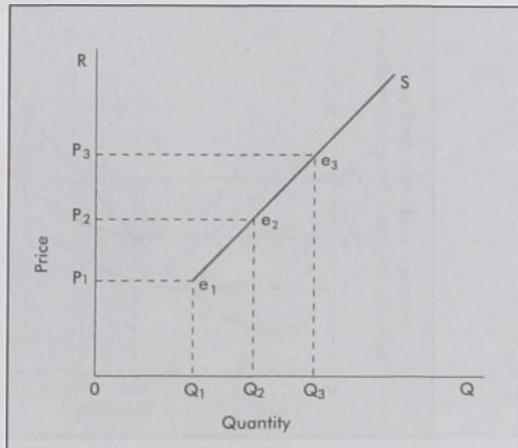
▶ The industry's short-run supply curve

The industry's short-run supply curve (also referred to as the market supply curve) is obtained by horizontally adding together the supply curves of all the individual firms in the industry. (This technique was discussed in Chapter 2.) The underlying assumptions here are that the price of production factors and the technology remain unchanged and that the industry consists of a large number of firms. In these circumstances the total quantity offered at a particular price in the market is the sum of the quantities offered by the individual firms in the industry at that price. *

In Figure 5-7(a), the industry's supply curve is indicated as the straight line SS with a positive slope. The precise shape and position of this supply curve are determined by the technology and the price of production factors, as well as the size of the firms in the industry. Firms are not necessarily all the same size – the size of an individual firm under perfect competition is also determined by the ability of the particular entrepreneur and, of course, different people have different abilities.

▶ Short-run equilibrium of the industry

Given the market demand and the market supply, the industry will be in equilibrium at the price that clears the market – that is, at the price where the quantity demanded is exactly equal to the quantity supplied. In Figure 5-7(a) the market is in equilibrium at the price P_e, in which case the quantity demanded and the quantity supplied are Q_e. However, if firms make an economic profit (Fig 5-7(b)) or loss (Fig 5-7(c)) at the prevailing price, this will only be a short-run equilibrium (which does not apply in the long run). In the long run firms that make a loss and are unable to adapt their plants will close down. Those firms that make an economic profit will expand their plants; what is more, the economic profit will also attract new firms to the industry. Entries, exits and readjustments by the remaining firms will lead to long-run equilibrium, where all the firms make normal profit – once this has happened there will be no further entries to or exits from the industry. This topic will be discussed in greater detail in the next section.

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* The words 'market' and 'industry' are often used synonymously. This is understandable for the total supply of a product on the market is what the industry offers; the total market demand for a product is the demand an industry experiences for the product. Industrial equilibrium and market equilibrium will therefore also have the same meaning.

Figure 5–7(a)
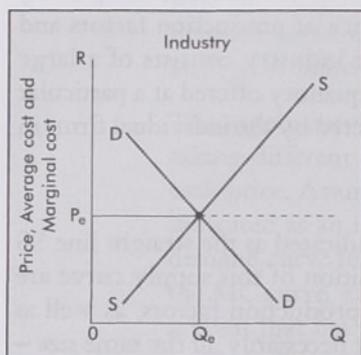## Short-run equilibrium for the industry

Figure 5–7(b)
Short-run equilibrium for a firm (economic profit)
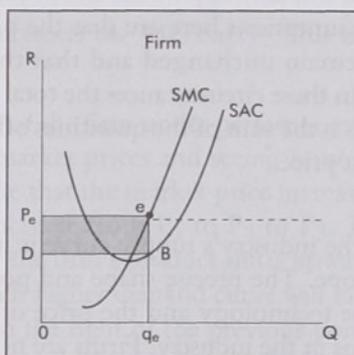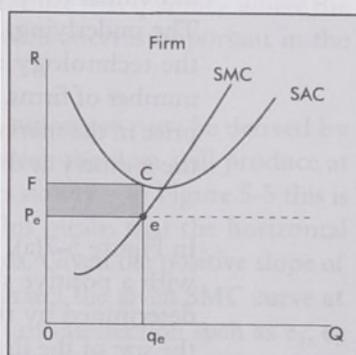
Figure 5–7(c)
Short-run equilibrium for a firm (loss)

LONG-RUN EQUILIBRIUM

Long-run equilibrium of the firm

The principle that a firm can modify its plant size in the long run and that firms can enter or leave an industry plays a vital role in determining the long-run equilibrium of a firm. The way in which this long-run equilibrium is achieved will now be explained – first verbally, and then graphically.

It has already become clear that a firm makes economic profit if the market price, and therefore the demand curve, is higher than the minimum point of its average cost curve (Fig 5-7(b) indicates the short-run case). The previous section also mentioned that economic profit in an industry will attract new firms to that industry. The entry of new firms will increase the product supply and hence lead to a decrease in price, which will shift the horizontal demand curve of the individual firm downwards; but the entry of new firms will result in a greater demand for production factors. Production factors in turn will become more expensive, and this will lead to an upward shift of the cost curves. This dual process will continue until the LAC curve forms a tangent (at its minimum point) with the demand curve defined by the market price. Here the firm makes normal profit because it just covers its total cost (which includes normal profit). In contrast, if firms make losses in the long run (the market price and therefore the demand curve lie lower than the minimum point of the average cost curve), they will leave the industry in due course; this will cause prices to increase (because of the smaller supply) and costs will decrease as the industry becomes smaller and the demand for production factors declines. In this case the process will also continue until the LAC curve forms a tangent with the demand curve

and the firms that remain in the industry just cover their total cost and make normal profit.

Long-run equili-brium To sum up: in both cases (economic profit or loss), the firm achieves long-run equilibrium, when it has adapted the size of its plant in such a way that production occurs at the minimum point of the LAC curve and this point forms a tangent with the horizontal demand curve. At the point of equilibrium in the long run a firm makes only normal profit.

Figure 5–8

Long-run equilibrium of the firm

Under perfect competition, the price, in the long run, will converge on the minimum point of the LAC. At this price, all the firms in the industry make normal profit.
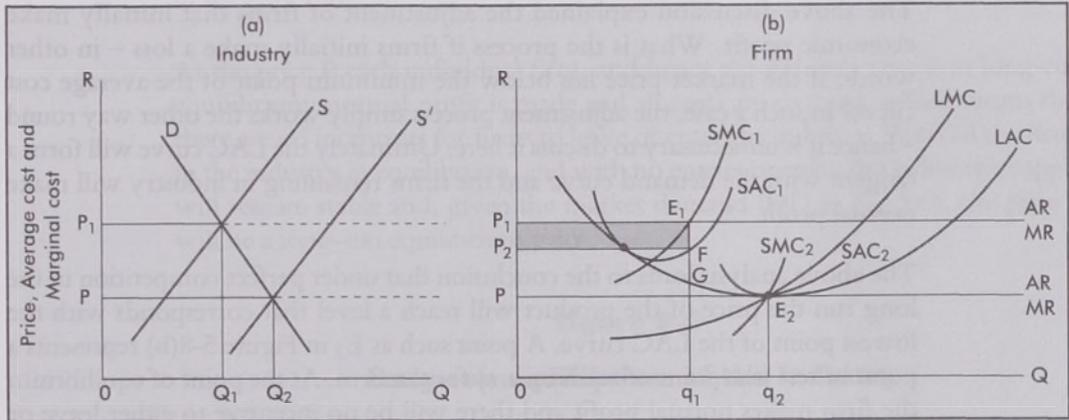
▶Graphic explanation of the firm's long-run equilibrium

Figure 5-8(b) illustrates graphically how under perfect competition firms that make economic profit adapt their equilibrium position in the long run. If the market price is P_1, the firm makes economic profit ($P_1E_1FP_2$) with the short-run plant represented by SAC_1. At a price of P_1 the firm will maximise profit in the short run at point E_1 where the principle for profit maximisation (MR = MC) applies; the quantity q_1 will be produced. At a production level of q_1 the total cost per unit amounts to q_1F in the short run (point F lies on SAC_1 and therefore represents average *total* cost); however, in the long run, the firm can produce at a lower total cost of q_1G per unit. Because of economies of scale, levels of output greater than q_1 can be produced at an even lower total cost in the long run, as indicated by the decreasing slope of the LAC between points G and E_2. Hence the firm will be spurred on by the possibility of greater profit to build a larger plant. The firm will not be interested in producing output levels

greater than those represented by the minimum point of the LAC, since such levels of output are possible only at a higher cost – internal diseconomies of scale make the LAC rise to the right of point E_2. At the same time, the economic profit will entice new firms to enter the industry. Because the quantity offered on the market increases as a result of expansion of existing firms and the entry of new ones, the market supply curve will shift to the right (from S to S′ in Fig 5–8(a)) and the price will decrease until it reaches P. At this price, which is at the same level as the minimum point of the LAC, total revenue ($0P \times 0q_2$) is equal to total cost ($0q_2 \times q_2E_2$), and the firm makes normal profit because it just covers its total cost (which includes normal profit). In time, all the firms in the industry will make normal profit and be in long-run equilibrium. (The LAC curve in Fig 5–8(b) includes any increases in cost as a result of the increase in the price of production factors if the industry expands.)

The above discussion explained the adjustment of firms that initially make economic profit. What is the process if firms initially make a loss – in other words, if the market price lies below the minimum point of the average cost curve? In such a case, the adjustment process simply works the other way round – hence it is unnecessary to discuss it here. Ultimately the LAC curve will form a tangent with the demand curve and the firms remaining in industry will make normal profit.

The above analysis leads to the conclusion that under perfect competition in the long run the price of the product will reach a level that corresponds with the lowest point of the LAC curve. A point such as E_2 in Figure 5–8(b) represents a point of rest (the point of equilibrium) for the firm. At the point of equilibrium the firm makes normal profit and there will be no incentive to either leave or enter the industry.

A long-run point of equilibrium such as E_2 in Figure 5–8(b) can also be defined in terms of symbols. An important fact about this point is that in the short run as well as the long run the firm reaches equilibrium because not only is marginal revenue (ie price) equal to short-run marginal cost (ie $P = MR = SMC$), but marginal revenue is also equal to long-run marginal cost (ie $P = MR = LMC$). Thus the following will apply:

$$P = MR = SMC = LMC$$

Furthermore, at a point of equilibrium such as E_2 in Figure 5–8(b), $LAC = SAC$ because both these curves (LAC and SAC_2) will be at their minimum points. Because the point of equilibrium lies at the same level as the market price, LAC $= SAC = P$. The full condition that applies at the long-run point of equilibrium for the firm is therefore

$$P = MR = SMC = LMC = LAC = SAC$$

▶**Long-run equilibrium of the industry**

When a market price arises (in perfect competition) at such a level that each firm is in equilibrium at the minimum point of its LAC curve (which is the same for all firms) and only normal profit is made, the industry will also be in long-run equilibrium. If the long-run equilibrium situation is achieved, there will be no further entries or exits of firms provided that the technology and prices of production factors do not change.

The long-run equilibrium situation is indicated in Figure 5-9. At the market price P firms produce at the lowest possible cost at E and make only normal profit. Each firm is in equilibrium because it produces at a point where marginal cost is equal to marginal revenue (MR = MC), not only in the short run, but also in the long run.

At the price P each individual firm, and hence the industry too, is in long-run equilibrium: normal profit is made and all costs are covered, which means that there are no incentives for firms to leave or enter the industry. With all the firms in the industry in equilibrium, and with no entries or exits, the industry's supply will remain stable and, given the market demand (DD in Fig 5-9), the price P will be a long-run equilibrium price.

Figure 5-9

Long-run equilibrium of the industry

When each firm is in equilibrium at the minimum point of the LAC, the industry is also in equilibrium.
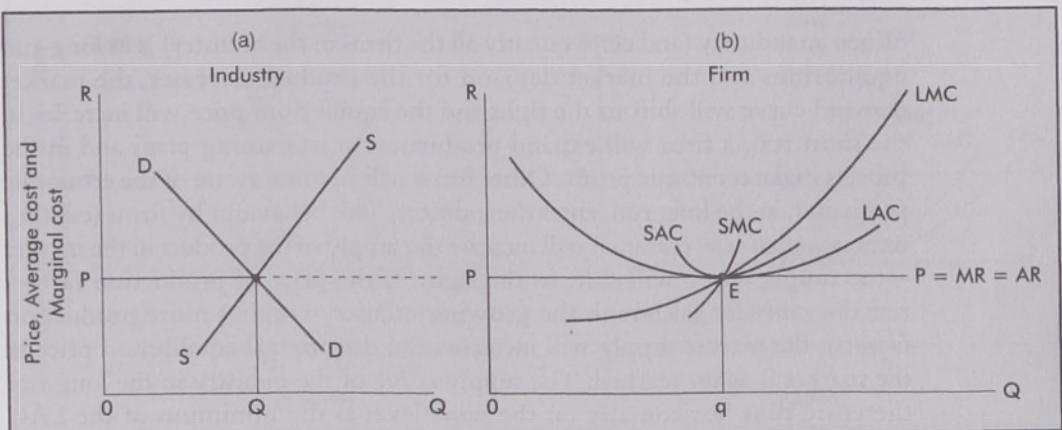
▶Optimal application of resources

On the basis of the above analyses, one can say that under perfect competition in the long run the market mechanism will lead to an optimal application of production factors. This is so because the following apply:

- The output is produced at the lowest possible cost (at the minimum point of the LAC).

- Consumers pay the lowest possible price for the product (the price is equal to the lowest cost at which the product can be produced).

- The price of the product equals the opportunity cost to produce the product.

- All firms make only normal profit.

▶DERIVATION OF LONG-RUN INDUSTRY SUPPLY CURVE UNDER CONDITIONS OF PERFECT COMPETITION

The previous section contained an analysis of the way a firm and an industry in a perfectly competitive environment achieve long-run equilibrium. With a situation of long-run equilibrium as the basic point of departure, it is now possible to examine how a perfectly competitive firm and industry react in the long run when the market demand for a particular product increases. This analysis also makes it possible to define a constant cost industry, an increasing cost industry, and a decreasing cost industry and explain their actions graphicallly.

▶Constant cost industry

When an industry (and consequently all the firms in the industry) is in long-run equilibrium and the market demand for the product increases, the market demand curve will shift to the right and the equilibrium price will increase. In the short run, a firm will expand production in its existing plant and in the process make economic profit. Other firms will become aware of the economic profit and, in the long run, enter the industry. This behaviour by firms (existing ones as well as new entrants) will increase the supply of the product in the market – the supply curve will shift to the right. If the price of production factors remains constant (although the growing industry requires more production factors), the market supply will increase until the original equilibrium price in the market is again reached. The supply curve of the industry in the long run therefore runs horizontally (at the same level as the minimum of the LAC curve). Such an industry is known as a constant cost industry.

Graphically, this analysis can be explained as follows:

Points E and e in Figures 5-10(a) and (b) show the long-run equilibrium position of the industry and the firm respectively before demand and supply change. The market demand now increases from D to D′ – in the short run this leads to an increase in the price from P to P_1. Each of the firms in the industry will apply the profit-maximisation principle (MR = MC) at the higher price P_1, and in the short run expand the production of its existing plant and produce at point e′, which means that its production increases from q_1 to q_2. The initial point of equilibrium of the industry as a whole moves in the short run from E to E′ and total output increases from Q_1 to Q_2.

At a price P_1, in the short run, each firm in the industry makes an economic profit of fe′ per unit, which in the long run will attract other firms (also requiring production factors) to the industry; this will cause the supply curve S to shift to the right. If the price of production factors remains constant, S shifts to S′ and the initial equilibrium price P comes into effect once again – the price is determined by the point of intersection of D′ and S′ at E″. At the price P, each firm produces at the minimum point of its LAC and makes only normal profit (see point e). By joining points E and E″ we obtain the supply curve (LS) of the industry in the long run. Since EE″ runs horizontally, it is a constant cost industry. The initial increase in demand has caused the number of firms in the industry to increase, which has caused the total production quantity to increase to Q_3. However, in the final instance, the equilibrium price is again at its original level.

Figure 5–10

Constant cost industry

If the industry expands, the price of production factors remains constant. The long–run supply curve of the industry runs horizontally.
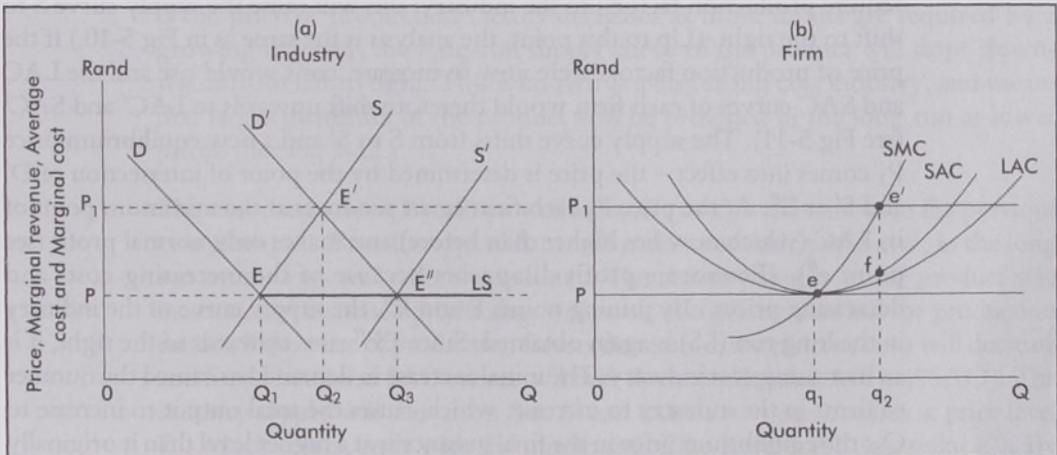
A constant cost industry will in all probability use production factors that are reasonably freely available; such an industry's demand for production factors will also constitute only a small portion of the total quantity applied in the economy. This will enable the industry to use more production factors without an increase in their price.

▶Increasing cost industry

If the price of production factors increases when firms enter a perfectly competitive industry in the long run and the total production of the industry increases, this is known as an increasing cost industry. The long-run supply curve of such an industry will run upwards from left to right – which means that in the long run greater quantities of the product will only be supplied at higher prices.

Graphically, the analysis initially proceeds exactly as the previous case. Points E and e in Figures 5-11(a) and (b) once again show the long-run equilibrium position of the industry and the firm respectively, before supply or demand change. Market demand now increases from D to D' – in the short run, this leads to an increase in the price from P to P_2. Each of the firms in the industry will apply the profit-maximisation principle (MR = MC) at the higher price P_2, and in the short run increase its existing plant's production and produce at point e', which means that its output will increase from q_1 to q_2. In the short run, the industry's initial point of equilibrium shifts from E to E' and total output increases from Q_1 to Q_2.

At a price P_2, in the short run, each firm in the industry makes an economic profit of fe' per unit, which in the long run attracts other firms (which also require production factors) to the industry; this will cause the supply curve S to shift to the right. (Up to this point, the analysis is the same as in Fig 5-10.) If the price of production factors were now to increase, costs would rise and the LAC and SAC curves of each firm would therefore shift upwards to LAC' and SAC' (see Fig 5-11). The supply curve shifts from S to S' and a new equilibrium price P_1 comes into effect – the price is determined by the point of intersection of D' and S' at E''. At the price P_1 each firm again produces at the minimum point of its LAC (which now lies higher than before) and makes only normal profit (see point e''). (Economic profit disappears because of the increasing costs and decreasing prices.) By joining points E and E'', the supply curve of the industry in the long run (LS) is again obtained. Since EE'' runs upwards to the right, it is an increasing cost industry. The initial increase in demand has caused the number of firms in the industry to increase, which causes the total output to increase to Q_3; the equilibrium price in the final instance is at a higher level than it originally was.

An increasing cost industry will probably use specialised inputs, for instance labour with particular skills (such as highly trained laboratory technicians) or custom-made machinery that performs special tasks (an oil drill at sea). In such a case, the industry will probably have to pay higher prices if it requires larger quantities of inputs – this will result in an increasing cost industry.

Figure 5–11

Increasing cost industry

If the industry expands, the price of production factors increases. The long-run supply curve of the industry has a positive slope.
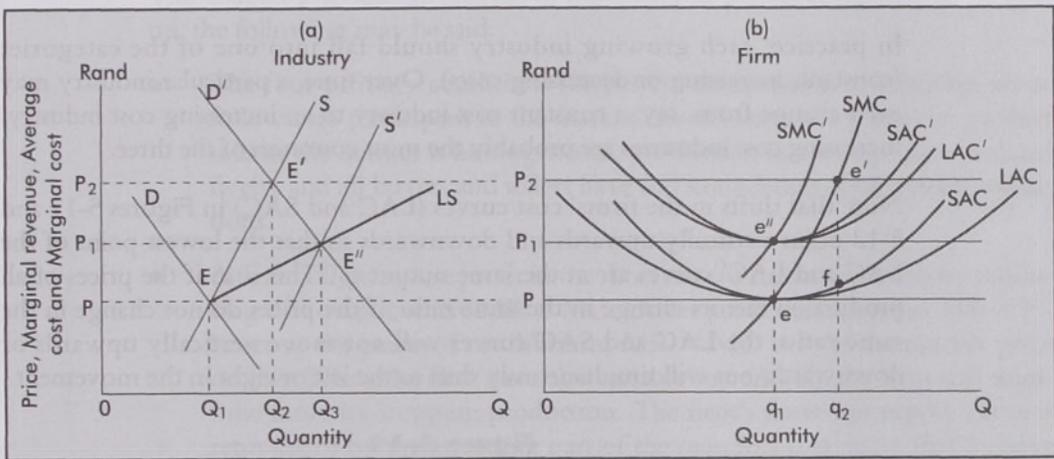
Decreasing cost industry

If the price of production factors decreases as more inputs are required by a growing industry, the long-run supply curve of the product will slope downwards from left to right. This is known as a decreasing cost industry, and means that larger quantities of the product will be provided in the long run at lower prices. (See Fig 5-12.)

The movement from E to E′ (as well as from e to e′) is the same as in the previous two examples. Since the typical firm will make economic profit at e′, in the long run more firms will enter the industry. The industry supply of the product will increase, and increased production will result in a greater demand for production factors. If the price of production factors decreases in the process, costs will decrease and firms' LAC and SAC curves will shift downwards (see LAC′ and SAC′). The industry supply will shift from S to S′ and cause a new equilibrium at price level P₂, which corresponds with the minimum of the lower LAC (see point e″). By joining points E and E″ the supply curve (LS) of the industry in the long run is

again obtained. Since EE″ slopes downwards to the right, it is a decreasing cost industry. The initial increase in demand has caused the number of firms in the industry to increase, which causes the total output to increase to Q_3; in the final instance, the equilibrium price is at a lower level than it originally was.

Decreasing costs in a growing industry may be caused by factors such as the following: the creation of training institutions to provide the kind of labour the industry requires at a lower cost than before; the establishment of enterprises to supply equipment to the industry that was previously manufactured at a high cost by the firms themselves; and the exploitation of cheaper natural resources, which previously could not be economically utilised when the demand for them was smaller.

In practice, each growing industry should fall into one of the categories (constant, increasing or decreasing costs). Over time, a particular industry may even change from, say, a constant cost industry to an increasing cost industry. Increasing cost industries are probably the most common of the three.

Note that shifts in the firms' cost curves (LAC and SAC) in Figures 5–11 and 5–12 occur vertically upwards and downwards so that the lowest point of the LAC and LAC′ curves are at the same output q_1. This is so if the prices of all production factors change in the same ratio; if the prices do not change in the same ratio, the LAC and SAC curves will not move vertically upwards or downwards, but will simultaneously shift to the left or right in the movement.

Figure 5–12

Decreasing cost industry

If the industry expands, the price of production factors will decrease. The long-run supply curve of the industry has a negative slope.
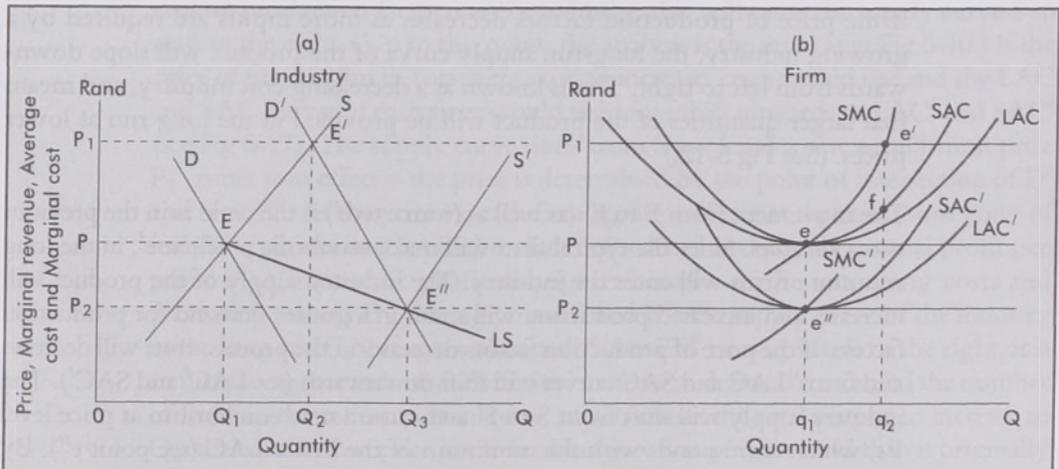
The downward shift of a firm's average cost curves (because of a decrease in input prices) when the industry becomes larger is known as external economies of scale; the upward shift of a firm's average cost curves (because of an increase in input prices) when the industry becomes larger is known as external diseconomies of scale. These should be clearly distinguished from internal economies or diseconomies of scale, which refer to a movement along a given LAC curve when a firm increases its production and builds a larger plant.

▶CONCLUDING REMARKS

This chapter provided an analysis of the theory of perfect competition. To sum up, the following may be said:

- The four primary conditions for perfect competition in a market are as follows: no participant in the market can influence the price; the product sold in the market is homogeneous; production factors can move around freely; and all buyers and sellers have full knowledge of all market conditions.

- A firm will maximise profit in the short run (or minimise losses) by producing that output where MR = MC. Under perfect competition MR = P - hence at the point of equilibrium, MR = MC = P. If the market price declines below the firm's average variable cost (AVC), the firm will minimise losses by stopping production. The firm's short-run supply curve is represented by the ascending part of the marginal cost curve (MC) above the AVC curve.

- The short-run price of a product is determined by the interaction between demand and supply in the market. The short-run supply curve of the industry is obtained by horizontally summing the supply curves of the firms in the industry. (The latter applies if the price of production factors and technology does not change.)

- In the short run, the equilibrium price is that price where the quantity supplied and the quantity demanded are the same in the short run. At the equilibrium price, MR = MC = P.

- In the long run, firms can change the size of their plants and enter or leave the industry. In the long run, the equilibrium price will be at the same level as the minimum point of the LAC.

- Industries can be divided into three groups: constant cost industries, increasing cost industries and decreasing cost industries. The long-run supply curves of the industries run horizontally, ascend from left to right, and slope downwards from left to right, respectively.

▶**IMPORTANT CONCEPTS**

- Homogeneous products
- Mobility of production factors
- Perfect knowledge
- Marginal revenue
- Market period
- Economic profit
- Short-run loss
- Industry
- Short-run equilibrium
- Long-run equilibrium
- Constant, increasing and decreasing cost industries

▶**QUESTIONS**

(1) Briefly discuss the conditions for perfect competition. (16)

(2) Compare perfect competition and monopolistic competition in table form in respect of the following:
   (a) number of firms
   (b) type of product
   (c) control over prices
   (d) path of the demand curve (8)

(3) Discuss the relationship between TR, AR and MR in perfectly competitive firms. (9)

(4) Why does the demand curve for the product of a perfectly competitive firm run horizontally? (4)

(5) Derive the short-run supply curve of the perfectly competitive firm. (Use only one figure.) (15)

(6) Explain why the perfectly competitive firm will maximise profits where SMC = MR. (10)

(7) Give the long-run equilibrium condition for the perfectly competitive firm and explain why each element is included therein. (12)

(8) Explain the difference between a constant cost industry and an increasing cost industry. (8)

(9) Derive the long-term industry supply curve for an increasing cost industry. (20)