6 Costs, revenues, and profit

By the end of this chapter, you should be able to:

- HL define, explain and distinguish between the concepts of the short run and the long run in the context of production
- HL define, explain, illustrate, and calculate total, average, and marginal product
- HL define and explain the law of diminishing returns
- HL define and explain the meaning of economic costs
- HL distinguish between explicit costs and implicit costs
- HL define, explain, illustrate, calculate, and give examples of short run costs
- HL define, explain, illustrate, and give examples of long run costs
- HL define, describe, and give examples of economies and diseconomies of scale
- HL explain the relationship between long run costs and returns to scale
- HL define, explain, illustrate, and calculate total, average, and marginal revenue
- HL explain and illustrate the relationship between average revenue, marginal revenue, total revenue, and price elasticity of demand
- HL define and explain the measurement of profit
- HL distinguish between normal and abnormal profit
- HL define and distinguish between the shut down price in the short and the long run
- HL define, explain, and illustrate the concepts of break-even and profit maximisation
- HL describe alternative goals of firms.

HL In the next six chapters, we address the topic known as "The Theory of the Firm". We look at the different types of behaviour of firms in relation to the markets in which they operate and the nature of competition in different markets. In this first chapter, we cover the fundamental concepts necessary to carry out an analysis of the four different theoretical market structures that exist. These fundamental concepts are costs, revenues, and profits.

Cost theory

The short run and the long run

When a firm is producing, some of its factors of production will be fixed in the short run, i.e. the firm will not be able to quickly increase the quantity of them that it has. Often the fixed factor is some element of capital or land, but this is not always the case. It could be a type of highly skilled labour, such as a specialist machine worker. Therefore, if a firm wishes to increase output in the short run, it may only do so by applying more units of its variable factors to the fixed factors that it possesses, while it plans ahead to change the number of fixed factors that it has.

Definitions

The **short run** is that period of time in which at least one factor of production is fixed. All production takes place in the short run.

The **long run** is that period of time in which all factors of production are variable, but the state of technology is fixed. All planning takes place in the long run.

The length of the short run for a firm will be determined by the time it takes to increase the quantity of the fixed factor. This will vary from industry to industry. For example, a small firm involved in gardening may find that its fixed factor is the number of lawn mowers that it has available and that it takes a week to order and get delivery of a new lawn mower. Thus its short run is one week. On the other hand, a national electricity provider is constrained by its fixed factor, the number of electricity generating plants that it has. Building a new electricity generating plant may take up to two years (more if a nuclear plant is built) and so its short run is a lot longer.

If a firm plans ahead to change its fixed factors then all factors of production are variable as the plans are being made. The firm is planning in the long run. However, as soon as the fixed factors are changed the firm is once again in the short run; it simply has a different number of fixed factors. Once again, the only way that output can be increased is to apply more units of the variable factors to the new quantity of the fixed factors. As we said earlier, all production takes place in the short run and all planning takes place in the long run.

Student workpoint 6.1

Be knowledgeable

Improve your knowledge of the short run and the long run by considering the following scenario.

A small firm sets up a plant making teddy bears. The firm has a small production unit, two teddy bear making machines and two operators. There is one manager, who owns the firm, and carries out all non-production activities. There is also an unlimited amount of the materials needed to make the teddy bears.

Answer the following questions.

1 What are the fixed factors?

2 What is the variable factor?

There is an increase in the demand for teddy bears and the firm decides to satisfy this demand with the existing factors.

3 What will the firm do?

The increase in demand persists and so the firm now decides to expand the production unit, bring in two extra machines and employ two more workers.

4 The planning takes place in which time period?

5 What time period is the firm in once the changes to the plant have taken place and the firm is producing again?

6 What are the fixed factors now?

The following short section provides you with some important definitions and equations. They may initially seem puzzling, but will become clearer when used in an example.

Total, average and marginal product

Total product (TP) is the total output that a firm produces, using its fixed and variable factors in a given time period. As we have already said, output in the short run can only be increased by applying more units of the variable factors to the fixed factors.

Average product (AP) is the output that is produced, on average, by each unit of the variable factor. $AP = \frac{TP}{V}$, where TP is the total output produced and V is the number of units of the variable factor employed. Marginal product (MP) is the extra output that is produced by using an extra unit of the variable factor. $MP = \frac{\Delta TP}{\Delta V}$, where ΔTP is the change in total output and ΔV is the change in the number of units of the variable factor employed.

Take an example. A firm has four machines (fixed factors) and increases its output by using more operators to work the machines. Production figures for each week are given in Table 6.1.

1 Quantity of labour (V)	2 Total product (TP)	3 Average product (AP)	4 Marginal product (MP)
0	0		
			10
1	10	10	
			15
2	25	12.5	
			20
3	45	15	
			25
4	70	17.5	
			20
5	90	18	
			15
6	105	17.5	
			10
7	115	16.43	
			5
8	120	15	

As we add an additional unit of labour, more output (TP) is produced

The extra units of output that are produced when each unit of labour is added

Table 6.1 Total, average, and marginal product per week

Assessment advice:

In HL paper 3, you may be asked to calculate total, average, and marginal product from a set of data and/or diagrams.

Now we can plot these curves.

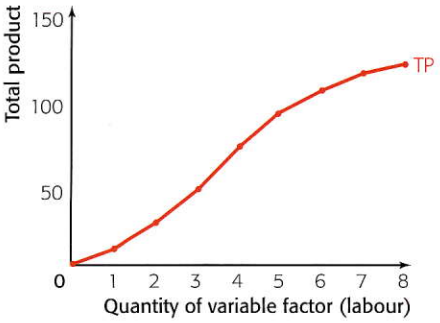


Figure 6.1 The total product curve

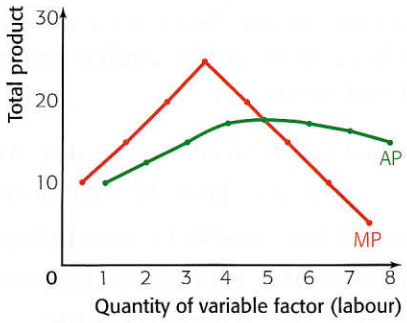


Figure 6.2 Average and marginal product curves

The law of diminishing returns

From the table, we can deduce the following definitions.

Definitions

The hypothesis of eventually diminishing marginal returns	**The hypothesis of eventually diminishing average returns**
As extra units of a variable factor are added to a given quantity of a fixed factor, the output from each additional unit of the variable factor will eventually diminish.	As extra units of a variable factor are added to a given quantity of a fixed factor, the output per unit of the variable factor will eventually diminish.

The two hypotheses look at the same relationship from different angles. The whole concept is really a matter of common sense. Consider an example.

A young entrepreneur named Ben sets up a new business, which is a small hamburger stand on a busy street corner. The stand consists of a very small shop, containing a refrigerator, a grill, and some countertops for preparing the burgers. There are also the implements for making burgers. These are all the fixed factors. When he starts out, Ben works alone and prepares everything himself. He makes the burgers, cuts the onion, lettuce, and tomatoes, heats the buns, and sells the hamburgers to the customers. He can make 20 burgers per hour.

Ben finds demand to be high and he cannot make enough burgers, so he hires his friend, Caroline, to help. They divide up the jobs and manage to produce 50 burgers each hour. The hamburgers become even more popular and Ben and Caroline agree that they need another worker, so Nick joins them. They divide up the work again, with each specialising in a task, and produce 90 burgers each hour. Demand continues to rise, so they bring in Niki. With the four working together, they produce 124 burgers per hour.

When Ben worked alone, his output was 20 burgers per hour. When Caroline joined him, the total output was 50 burgers per hour. This means that Caroline's marginal product was 30 burgers. When Nick joined, the total number of burgers per hour rose to 90, so Nick's marginal product was 40 burgers. When Niki joined (we are adding units of a variable factor), the total output of burgers rose to 124 per

hour, making the marginal product 34 burgers. Note that the marginal product fell when Niki was added to the workforce. Why was this? Well, it was efficient to add extra people up to three workers, but because the space in the shop, the counter tops, and the grill, are all fixed, it became less efficient when there were more people. They started to get in each other's way and so could not increase the output of burgers by as great an amount as when the previous worker was added.

Whether we measure it from the amount added by the extra variable factor (marginal product) or the amount added per unit of the variable factor (average product), logic tells us that inefficiency must eventually begin to occur.

Economic cost

The economic cost of producing a good is the opportunity cost of the firm's production. Remember that opportunity cost is the next best alternative foregone when an economic decision is made. In this case it is the opportunity cost of the factors of production (resources) that have been used in producing the good or service.

In order to work out the economic cost of production we separate the factors used by a firm into two categories:

1 Factors that are purchased from others and not already owned by the firm

The opportunity cost of factors of production not owned by the firm is simply the price that is paid for them and the alternative things that could have been bought. For example, if a firm hires a worker for $1,000 a week then the opportunity cost to the firm is the cost of that worker's wage and the other things on which the $1,000 could have been spent. Any costs of this sort are known as **explicit costs**. Explicit costs are any costs to a firm that involve the direct payment of money.

2 Factors that are already owned by the firm

If a firm has factors that it already owns then it will not have to pay out money when it uses them. However, there will still be an opportunity cost involved in their use which needs to be accounted for. Any costs of this sort are known as **implicit costs**. Implicit costs are the earnings that a firm could have had if it had employed its factors in another use or if it had hired out or sold them to another firm.

Implicit costs are best understood through examples:

a The owner of a firm may be able to earn $100 000 per year in her next best alternative job, as a tax accountant. This opportunity cost should be included in the firm's economic costs. Indeed, some would argue that it is the most important cost that a firm needs to cover since, if it is not met, the entrepreneur would presumably close down the firm and take the job as a tax accountant. The very existence of the firm depends upon covering this cost.

b A firm owns buildings that it uses to produce its goods. The buildings could be rented out to other firms for $15 000 per month. The opportunity cost to the firm of using the buildings itself is the rent that is foregone and the things that could have been purchased with that money.

As we can see from above, if economists count these costs and accountants do not, then economists and accountants would report different profit levels for the same firms.

Student workpoint 6.2

Be a thinker – identify the different costs and revenues and calculate the answer.

A small firm has been operating for one year. During the year they have:

- paid $40 000 in wages and salaries
- paid $100 000 for raw materials
- used their own small factory, which could have been rented out for $90 000
- used $40 000 worth of electricity and services
- received $450 000 in total revenue

In addition:

- the firm uses its own machinery, which has reduced in value by $20 000 because of wear and tear and now has a second hand value of $70 000
- the owner of the firm has given up a job with another firm, where he would have been paid $70 000 per year
- The owner has invested $60 000 of his own money into the business (the rate of interest during the year has been 5%)

In light of the facts above:

1 Identify the costs of the firm as explicit or implicit.

2 Calculate and explain the profits/losses made by the firm from the point of view of:

a an accountant
b an economist

Short-run costs

Firms have many different costs when producing whatever good or service they provide. We need to be able to understand the different types of costs that firms face and to understand where those costs originate.

We can start by looking at the example from Table 6.1, and adding some costs. We will assume that the cost of a machine per week is $100 (there are four machines) and that the cost of a worker is $200 per week. The outcome of this on the costs of a firm are shown in Table 6.2.

Using the figures above, we can explain the different ways of measuring costs. We tend to separate costs into two groups:

1 *Total costs:* Total costs are the complete costs of producing output. We use three measures:

a *Total fixed cost (TFC):* TFC is the total cost of the fixed assets that a firm uses in a given time period. Since the number of fixed assets is, by definition, fixed, TFC is a constant amount. It is the same whether the firm produces one unit or one hundred units.

TFC is equal to the number of fixed assets times the cost of each fixed asset. In the example in Table 6.2, TFC per week is $400 (four machines costing $100 each) at every level of output.

1	2	3	4	5	6	7	8	9
Quantity of labour (V)	Total product (TP) or Output (q)	Total fixed cost (TFC)	Total variable cost (TVC)	Total cost (TC)	Average fixed cost (AFC)	Average variable cost (AVC)	Average total cost (ATC)	Marginal cost (MC)
0	0	400	0	400	-	-	-	
								20
1	10	400	200	600	40	20	60	
								13.33
2	25	400	400	800	16	16	32	
								10
3	45	400	600	1,000	8.89	13.33	22.22	
								8
4	70	400	800	1,200	5.71	11.43	17.14	
								10
5	90	400	1,000	1,400	4.44	11.11	15.55	
								13.33
6	105	400	1,200	1,600	3.81	11.43	15.24	
								20
7	115	400	1,400	1,800	3.48	12.17	15.65	
								40
8	120	400	1,600	2,000	3.33	13.33	16.67	

Table 6.2 Total, average, and marginal costs per week

b *Total variable cost (TVC):* TVC is the total cost of the variable assets that a firm uses in a given time period. TVC increases as the firm uses more of the variable factor.

TVC is equal to the number of variable factors times the cost of each variable factor. So in the current example, TVC is \$200 when one worker is being employed and \$1,200 when six workers are being used.

c *Total cost (TC):* TC is the total cost of all the fixed and variable factors used to produce a certain output. It is equal to TFC plus TVC.

So in the current example the total cost of producing 105 units of output per week is \$1,600. It is the fixed cost of \$400 plus the variable cost of \$1,200.

The different total cost curves are shown in Figure 6.3.

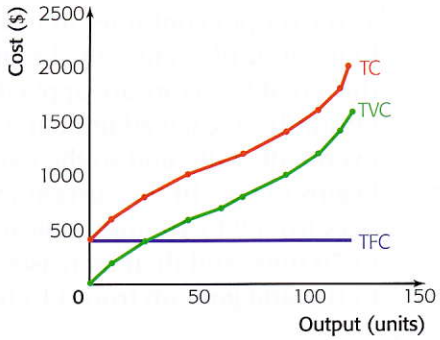


Figure 6.3 Total cost, total variable cost, and total fixed cost

2 *Average costs:* These are costs per unit of output. We use three measures:

a *Average fixed cost (AFC):* AFC is the fixed cost per unit of output. It is calculated by the equation AFC $= \frac{TFC}{q}$, where q is the level of output.

Because TFC is a constant, AFC always falls as output increases. In the current example, AFC is \$40 per unit when output is 10 units and falls to \$3.33 per unit when output increases to 120 units.

b *Average variable cost (AVC):* AVC is the variable cost per unit of output. It is calculated by the equation AVC $= \frac{TVC}{q}$, where q is the level of output.

AVC tends to fall as output increases, and then to start to rise again as the output continues to increase. This is explained by the hypothesis of eventually diminishing average returns. As more of the variable factors are applied to the fixed factors, the output per unit of the variable factor eventually falls, and so the cost per unit of output eventually begins to rise. In the current example AVC is \$20 per unit when output is 10 units, falls to \$11.11 per unit when output rises to 90 units and then increases to \$13.33 when output continues to rise to 120 units.

c *Average total cost (ATC):* ATC is the total cost per unit of output. It is equal to AFC plus AVC. It is calculated by the equation

ATC $= \frac{TC}{q}$, where q is the level of output.

As with AVC, ATC tends to fall as output increases, and then to start to rise again as the output continues to increase. In the current example ATC is \$60 per unit when output is 10 units, falls to \$15.24 per unit when output rises to 105 units and then increases to \$16.67 when output continues to rise to 120 units.

3 *Marginal cost (MC):* MC is the increase in total cost of producing an extra unit of output. It is calculated by the equation:

MC $= \frac{\Delta TC}{\Delta q}$, where ΔTC is the change in total cost and Δq is the change in the level of output.

MC tends to fall as output increases, and then to start to rise again as the output continues to increase. This is explained by the hypothesis of eventually diminishing marginal returns. As more of the variable factors are applied to the fixed factors, the extra output from each additional unit of the variable factor added eventually falls, and so the extra cost per unit of output eventually begins to rise. In the current example MC is \$20 when output rises from 0 to 10 units, falls to \$8.00 when output rises from 45 to 70 units and then increases to \$40.00 when output continues to rise and goes up from 115 to 120 units.

The average and marginal cost curves from our example are shown in Figure 6.4.

It is important to recognise the relationship between the ATC, AVC, and MC curves. Quite simply, the MC curve cuts the AVC and ATC curves at their lowest points. This is a mathematical relationship. AFC falls as output increases and, since it is the difference between ATC and AVC, the vertical gap between ATC and AVC gets smaller as output grows.

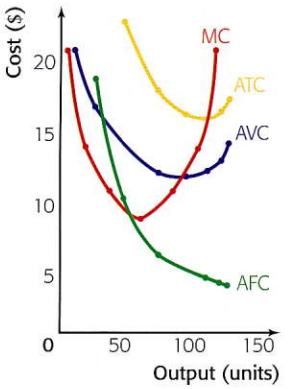


Figure 6.4 Short-run AFC, AVC, ATC, and MC curves

We have seen how to calculate the different types of average and marginal costs and draw the curves that represent the data. When economists draw costs curves to illustrate a general position, they draw them as shown in Figure 6.5:

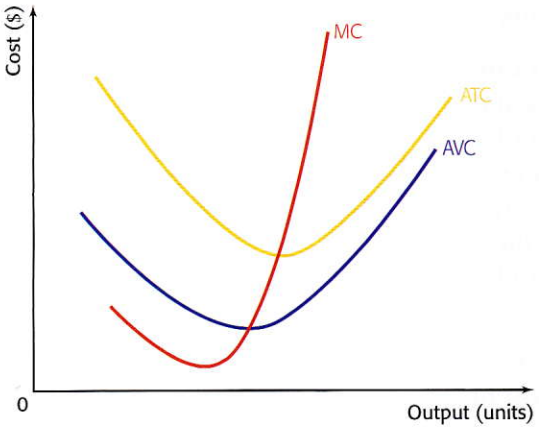


Figure 6.5 A general diagram showing short-run ATC, AVC, and MC

Assessment advice:

In HL paper 3, you may be asked to calculate total, average and marginal costs from a set of data and/or diagrams.

The long run

We have already said that the long run is the planning stage. When planning in the long run, an entrepreneur is free to adjust the quantity of all of the factors of production that are used and is only restrained by the current level of technology.

Definition
The long run is that period of time in which all factors of production are variable, but the state of technology is fixed. All planning takes place in the long run.

This means that in the long-run, we look at what happens to costs when all of the factors of production are increased in order to increase output. What we find is rather different in theory to practice. In theory, the long-run average cost curve (LRAC) is an "envelope" curve, i.e. it envelops an infinite number of short-run average cost (SRAC) curves. This relationship is shown below in Figure 6.6.

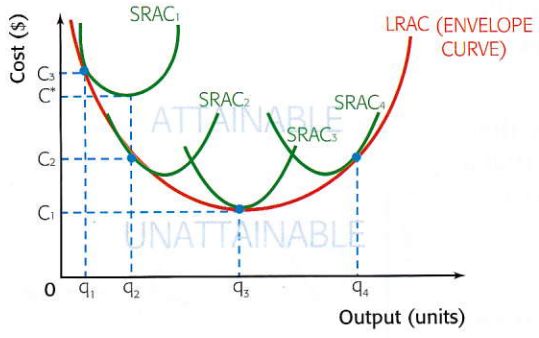


Figure 6.6 The LRAC curve and short run average cost curves

Let us assume that the firm in Figure 6.6 is producing an output of q_1 at a cost per unit of C_3. They are operating on the short-run average cost curve $SRAC_1$. (Remember that all production takes place in the short run.) C_3 is the lowest possible cost of producing the output, since it is a point on the SRAC curve that is tangent to the LRAC curve. Thus this single point from $SRAC_1$ is also a single point on the LRAC curve.

If demand is increased and the firm now wishes to produce q_2, it can do so in the short run by simply employing more variable factors and moving along $SRAC_1$ until q_2 is being produced at a cost per unit of C*. This is a lower cost per unit than before, but the firm will know that they could produce this output even more cheaply if they were able to alter all of their factors of production, i.e. if they were in the long run. Thus they will plan ahead to change all of the factors and will eventually move to $SRAC_2$.

Now they will be producing an output of q_2 at a cost per unit of C_2. They are operating on $SRAC_2$, where C_2 is the lowest possible cost of producing the desired output, q_2, since it is again a point on the SRAC curve that is tangential to the LRAC curve. This single point on $SRAC_2$ is another single point on the LRAC curve.

The whole LRAC curve is made up of an infinite number of single points from SRAC curves. These curves would represent all of the possible combinations of fixed and variable factors that could be used to produce different levels of output for this firm.

The LRAC curve is the boundary between unit cost levels that are attainable by the firm and unit cost levels that are unattainable. If possible, the firm would wish to produce different output levels at points on the LRAC curve in order to minimizes their cost per unit of output. This may not, of course, always be possible in the short run.

When long-run unit costs are falling as output increases, we say that the firm is experiencing increasing returns to scale. This means that a given percentage increase in all factors of production will lead to a greater percentage increase in output, thus reducing long-run average costs.

When long-run average costs are constant as output increases, we say that the firm is experiencing constant returns to scale. This means that a given percentage increase in all factors of production will lead to the same percentage increase in output, thus leaving long-run average costs the same.

When long-run average cost is rising as output increases, we say that the firm is experiencing decreasing returns to scale. This means that a given percentage increase in all factors of production will lead to a smaller percentage increase in output, thus increasing long-run average costs.

We need to consider why the long-run costs may increase or decrease as output increases. There are two factors to be considered:

1 *Economies of scale:* Economies of scale are any decreases in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output. Economies of scale lead to the firm experiencing increasing returns to scale.

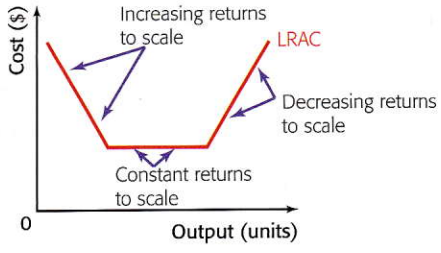


Figure 6.7 Increasing, constant, and decreasing returns to scale

There are a number of different economies of scale that may benefit a firm as it increases the scale of its output.

a *Specialisation:* In small firms there are few, if any, managers and they have to take on many different roles, often roles for which they are not the best candidates. This may lead to higher unit costs. As firms grow they are able to have their management specialise in individual areas of expertise, such as production, finance, or marketing, and thus be more efficient.

b *Division of labour:* This is breaking a production process down into small activities that workers can perform repeatedly and efficiently. As firms get bigger and demand increases, they are often able to start to break down their production processes, use division of labour, and reduce their unit costs. A good example of this would be workers on assembly lines, where they each have a position by a conveyor belt and add parts to a product as it moves down the conveyor belt. Cars and television sets, among other things, have been produced by this sort of method.

c *Bulk buying:* As firms increase in scale they are often able to negotiate discounts with their suppliers that they would not have received when they were smaller. The cost of their inputs is then reduced, which will reduce their unit costs of production.

d *Financial economies:* Large firms can raise financial capital (money) more cheaply than small firms. Banks tend to charge a lower interest rate to larger firms, since the larger firms are considered to be less of a risk than the smaller firms, and are less likely to fail to repay their loans.

e *Transport economies:* Large firms making bulk orders may be charged less for delivery costs than smaller firms. Also, as firms grow they may be able to have their own transport fleet, which will then cost less because they will not be paying other firms, who will include a profit margin, to transport their products.

f *Large machines:* Some machinery is too large to be owned and used by a small producer, for example a combine harvester for a small farmer. In this case, small farmers have to hire the use of the equipment from suppliers who will then charge a price that includes a profit margin for the supplier. However, once a farm can increase to a certain size it becomes feasible to have its own combine harvester, reducing the unit costs of production.

g *Promotional economies:* Almost all firms attempt to promote their products by using advertising, or sales promotion, or personal selling, or publicity, or a combination of the above. The costs of promotion tend not to increase by the same proportion as output. If a firm doubles its output, it is unlikely that it will double its expenditure on promotion methods, such as sales promotion and advertising. Thus the cost of promotion per unit of output falls. This situation also applies to other fixed costs, such as insurance costs or the costs of providing security for the production unit.

2 *Diseconomies of scale:* Diseconomies of scale are any increases in long-run average costs that come about when a firm alters all of its factors of production in order to increase its scale of output. Diseconomies of scale lead to the firm experiencing decreasing returns to scale. There are a number of different diseconomies of scale that may afflict a firm as it increases the scale of its output:

   a *Control and communication problems:* As firms grow in scale, the management will find it harder to control and coordinate the activities of the firm and this is said to lead, eventually, to inefficiency and increases in the unit costs of production. In the same way, greater size leads to a huge increase in the need for effective communication and it is suggested that there will be more communication breakdowns as firms increase in size, eventually causing unit cost increases.

   b *Alienation and loss of identity:* As firms grow, it is suggested that both workers and managers may begin to feel that they are only a very small part of a very big organisation. They begin to think that what they do does not matter and they start to lose a sense of belonging and loyalty. If this happens, then it is likely that the workers and managers will begin to work less hard and become less productive, and this will tend to force up the unit costs of production.

All of the above economies and diseconomies of scale relate to the unit cost decreases or increases that might be encountered by a single firm. They are known as internal economies and diseconomies of scale.

There is another group of economies and diseconomies that come about when the size of the whole industry increases and this has an effect on the unit costs of the individual firms. They are known as external economies and diseconomies of scale.

An example of external economies of scale might be where the growth of an industry in a certain geographical area leads to local universities and colleges starting up courses that relate to the skills required in the industry. The graduates of these courses would be ready trained for the firms in the industry, at no direct cost to the firms, and so would make the firms more efficient, reducing unit costs. An example of this could be colleges offering metallurgy courses in an area like Sheffield in the UK where one of the main industries is the large-scale production of cutlery.

An example of external diseconomies of scale might be where the rapid growth of an industry leads to more competition among individual firms to acquire raw materials, capital and qualified labour. Such competition may force up the prices of the factors so forcing up the unit costs of the firms in the industry.

Final note on cost theory

You should always remember that:

- Short-run cost curves are U-shaped because of the hypothesis of diminishing returns. The existence of eventually diminishing average returns explains the shape of the short-run average variable cost curve and the existence of eventually diminishing marginal returns explains the shape of the short-run marginal cost curve.

Student workpoint 6.3

Be a thinker

On page 80 we looked at a burger stand run by a young entrepreneur called Ben. If demand for the burgers continues to be strong, and Ben is facing diminishing marginal returns, what should be his strategy in terms of the long run?

- Long-run cost curves are U-shaped, in theory, because of the existence of economies and diseconomies of scale.
- In reality, economists have not yet found evidence of a firm becoming so large that the diseconomies of scale start to outweigh the economies of scale in the long run. Actual long-run cost curves may be drawn as shown in Figure 6.8.

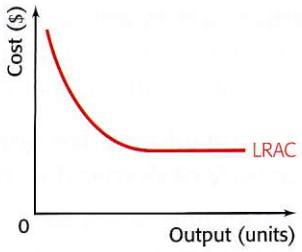


Figure 6.8 A long-run average cost curve in reality

Revenue theory

Revenue is the income that a firm receives from selling its products, goods, and services, over a certain time period.

Measurement of revenue

Revenue may be measured in three ways:

1 Total revenue (TR)

TR is the total amount of money that a firm receives from selling a certain amount of a good or service in a given time period. It is calculated by using the formula:

$$TR = p \times q$$

where p is the price that the good or service sells for and q is the quantity of the good or service sold in the time period being considered.

If a firm sells 400 pizzas per week, at a price of $6 per pizza, then:

$$TR = \$6 \times 400 = \$2{,}400 \text{ per week.}$$

2 Average revenue (AR)

AR is the revenue that a firm receives per unit of its sales. It is calculated using the formula:

$$AR = \frac{TR}{q} = \frac{p \times q}{q} = P$$

As we can see, since TR is (p × q), q is common to the top and bottom of the formula and so AR is the same as p.

Thus, if the firm sells 400 pizzas at a price of $6 per pizza, then:

$$AR = \frac{\$2{,}400}{400} = \$6 \text{(the same as the price per unit)}$$

3 Marginal revenue (MR)

MR is the extra revenue that a firm gains when it sells one more unit of a product in a given time period. It is calculated by using the formula:

$$MR = \frac{\Delta TR}{\Delta q}, \text{ where } \Delta \text{ means "the change in".}$$

Thus, if our pizza firm lowered the price of a pizza to $5 and found that their weekly sales rose to 500 pizzas, then:

$$MR = \frac{\$2500 - \$2400}{100} = \frac{\$100}{100} = \$1$$

The extra revenue gained from selling an extra unit is $1.

Theory of Knowledge

Deductive and inductive logic

Empirical evidence suggests that firms benefit from economies of scale up to a certain level of output. Economies of scale reduce long-run unit costs. *Ceteris paribus*, firms will find that their profit per unit of output rises if they increase the amount of factors of production up to a certain level of output.

1 Distinguish between deductive reasoning and inductive reasoning.

2 Is the example above a piece of deductive reasoning or inductive reasoning?

3 Do you think that most economic reasoning is deductive or inductive? Why?

Revenue curves and output

We now need to consider what happens to a firm's revenue as output increases. We shall consider two different situations.

1 Revenue when price does not change with output (when elasticity of demand is infinite)

If a firm does not have to lower price as output increases and it wishes to sell more of its product, then it faces a perfectly elastic demand curve. This situation only happens in theory, but it is very useful to economists when they are building their models of how markets work and they start with the theoretical market form of perfect competition (see Chapter 7).

A firm that has a perfectly elastic demand curve might have the revenue figures shown in Table 6.3.

Price ($)	Quantity demanded	Total revenue ($)	Average revenue ($)	Marginal revenue ($)
5	1	5	5	5
5	2	10	5	5
5	3	15	5	5
5	4	20	5	5
5	5	25	5	5
5	6	30	5	5
5	7	35	5	5

Table 6.3 Possible revenue figures for a firm with a perfectly elastic demand curve

We can assume that the firm is very small in terms of the size of the whole industry, and that they can increase their output without affecting total industry supply, and thus price, in any significant way. Therefore the firm can sell all that it produces at the same price.

If we graph the revenues, we will get the curves shown in Figure 6.9(a) and (b).

In these graphs, we can see that, when price elasticity of demand is perfectly elastic, then price, average revenue, marginal revenue, and demand are all the same. In this case, they are all $5.

Total revenue increases at a constant rate as output increases, since each extra sale adds $5 to total revenue. Marginal revenue is constant at $5.

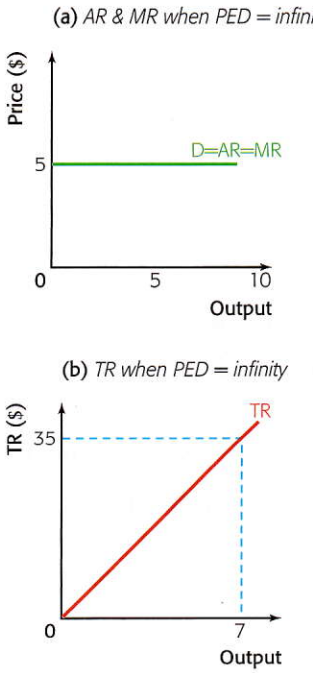


Figure 6.9 Curves for PED 5 infinity

2 Revenue when price falls as output increases (when the demand curve is downward sloping, i.e. when elasticity of demand falls as output increases)

When we look at what happens to TR, AR, and MR as price falls when output decreases we get a very different set of curves from the ones above. If a firm wishes to sell more of its output and it can control the price at which it sells, then it will have to lower the price if it wants to increase demand. In simpler terms, it will face a downward-sloping demand curve. An example of this, and the revenue figures relating to it, is shown in Table 6.4.

Price ($)	Quantity demanded	Total revenue ($)	Average revenue ($)	Marginal revenue ($)	PED
50	0	0			
				45	
45	2	90	45		9.00
				35	
40	4	160	40		4.00
				25	
35	6	210	35		2.33
				15	
30	8	240	30		1.50
				5	
25	10	250	25		1.00
				−5	
20	12	240	20		0.67
				−15	
15	14	210	15		0.43
				−25	
10	16	160	10		0.25
				−35	
5	18	90	5		0.11
				−45	
0	20	0			

Table 6.4 Output, revenue, and PED figures for a firm with a normal demand curve

As we would expect, AR is equal to price and so it falls as output increases, since the price has to be lowered in order to sell more products. This is shown clearly in Figure 6.10, where the demand curve is now labelled D = AR.

MR also falls as output increases, but at a greater rate than AR. In fact, as we can see in Figure 6.10, the MR curve is twice as steeply sloping as the AR curve and also goes below the x-axis. This is a relationship that holds for all downward-sloping AR curves and the MR curves that relate to them.

MR is below AR because in order to sell more products the firm has to lower the price of all products sold, losing revenue on the ones that could have been sold at a higher price in order to get the revenue from the extra sales.

For example, in Table 6.4, when price is dropped from $40 to $35, the quantity demanded increases from 4 units to 6. Before the price drop, the TR was $160 ($40 × 4). After the price drop, TR becomes $210 ($35 × 6).

The MR is $25 $\left(\frac{\Delta TR}{\Delta q} = \frac{50}{2} = 25\right)$.

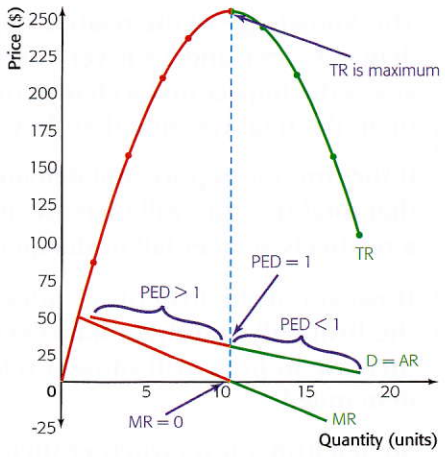


Figure 6.10 The relationship between D, AR, MR, TR, and PED for a normal demand curve

There are two events affecting the TR. First, two extra units of the product are sold at a price of $35 and so TR rises by $70. However, in order to do this, the price of the 4 units that could have been sold for $40 has been dropped to $35 and so there is a loss of revenue of $20 ($4 \times \$5$). The overall effect is an increase in revenue of $\$70 - \$20 = \$50$.

For a normal, downward-sloping demand curve, TR rises at first but will eventually start to fall as output increases. This is because the extra revenue gained from dropping price and selling more units is outweighed by the loss in revenue from the units that were being sold at a higher price and now have to be sold at the lower price.

For example, in Table 6.4, when price is dropped from $15 to $10, the quantity demanded increases from 14 units to 16. Before the price drop, the TR was $210 ($\$15 \times 14$). After the price drop, TR becomes $160 ($\$10 \times 16$).

The MR is $-\$25$ $\left(\frac{\Delta TR}{\Delta q} = \frac{-50}{2} = -25\right)$.

The negative MR means that TR will fall. MR is negative because, when the price is lowered, two extra units of the product are sold at a price of $10 each, but the price of the 14 units that could have been sold for $15 has been dropped to $10, and so there is a loss of revenue of $70 ($14 \times \$5$). The overall effect is a fall in total revenue of $\$20 - \$70 = -\$50$.

There are some very important relationships between price elasticity of demand, MR, AR, and TR that we can identify from Figure 6.10. They are most easily explained by a logic tree, using information already discovered in the study of price elasticity and revenue.

This knowledge of the relationship between the value of PED for a demand curve and TR is very useful for firms when they are trying to assess the impact that a change in the price of their product will have upon the total revenue that they receive.

If the firm raises price and demand is inelastic then the firm will find that total revenue will increase, because the increase in price will see a relatively smaller fall in the quantity demanded.

However, if the firm raises price and demand is inelastic then the firm will find that total revenue will decrease, because the increase in price will cause a relatively larger fall in the quantity demanded.

So, if a firm knows whether their demand is elastic or inelastic, they will know what pricing policy to adopt to increase their revenue.

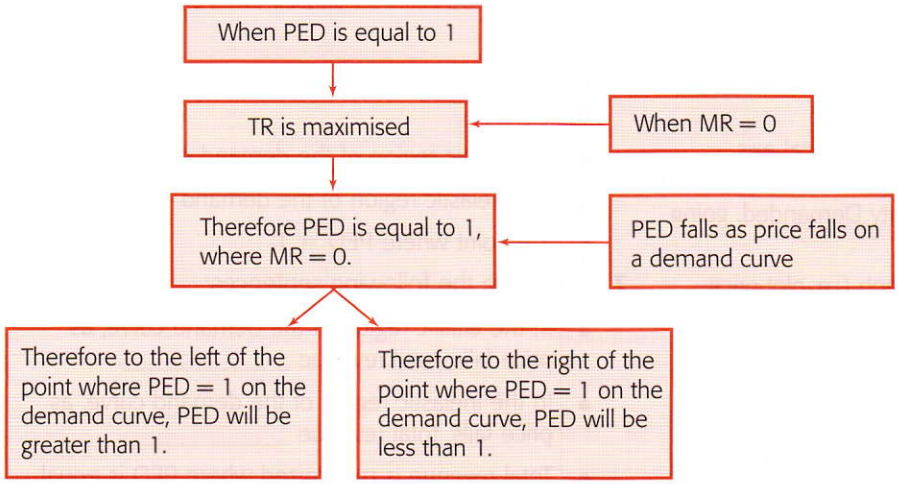


Figure 6.11 A logic tree explaining the varying values of PED on a demand curve

The basic rules are:

1. When PED is elastic any firm wishing to increase revenue should lower its price.
2. When PED is inelastic any firm wishing to increase revenue should raise its price.
3. When PED is unity then any firm wishing to increase revenue should leave the price unchanged, since revenue is already maximised.

Student workpoint 6.4

Be a thinker—solve the problems and illustrate the outcomes

Here are some figures for the price and quantity demanded of a product:

Price ($)	Quantity demanded	Total revenue ($)	Average revenue ($)	Marginal revenue ($)	PED
20	1				
				+16	
18	2				
16	3				
14	4				
12	5		12		
10	6				
8	7				
6	8				
4	9	36			

1 Copy out the table and fill in the missing values in the other columns.

2 On a piece of graph paper, draw a vertical axis, labelled Price ($), going from −12 to +60. Then add a horizontal axis, labelled Quantity Demanded, going from 0 to 10.

3 Plot the demand curve on the graph (i.e. plot price against quantity demanded). Label the curve D. Plot the Average Revenue curve. What do you notice? Now add "= AR".

4 Plot the Total Revenue curve.

5 Plot the Marginal Revenue curve, remembering to plot it at the half-way marks on the horizontal axis.

6 Using the PED figures that you have calculated, try to identify:

- the elastic region of the demand curve
- the inelastic region of the demand curve
- the point where PED = 1.

7 Complete the following sentences:

- In the elastic region of the demand curve, as price falls, total revenue _____.
- In the inelastic region of the demand curve, as price falls, total revenue _____.
- Total revenue is maximized where PED is equal to _____ and where the marginal revenue is _____.

Assessment advice: the use of diagrams

In workpoint 6.4, you drew an important diagram showing the relationship between demand, average revenue, marginal revenue, total revenue, and PED. It should look much like Figure 6.10.

It is very helpful if you are confident in your understanding of these relationships and if you can draw the diagram showing the relationships without any figures. This is worth practising! However, you also have to be able to use and interpret the data and you may be asked, on HL paper 3, to calculate total average and marginal revenue from a set of data and/or diagrams.

Profit theory

An economist and an accountant were talking about the accounts of a company. The accountant said that the owner of the firm, Nermin, would be very happy because the profit for the year was $80 000. The economist, however, looked at the same set of figures and said that the owner would be satisfied, but only just.

"Why is that?" said the accountant. "Profit is total revenue minus total cost and when I work that out the profit figure is very healthy."

"Yes," said the economist, "I agree with your definition of profit, but what you need to understand is that we do not take the same view on how to calculate costs. As an economist I would say that profit is total revenue minus economic cost. Economic cost includes explicit costs (costs that involve the direct payment of money) and implicit costs (earnings that the firm could have had if it employed its factors of production in other ways). In Nermin's case there is only one implicit cost that I would include that you do not include, but it is the most important cost that the firm faces."

"Which cost is that?" asked the accountant.

"I include the opportunity cost of the owner of the firm, the entrepreneur," said the economist. "If an owner does not manage to cover his or her opportunity cost in the long run then they will close the firm down and move on to their next best alternative occupation.

Thus, the opportunity cost is the most important one for the firm to cover. It is the difference between survival and non-survival. In Nermin's case," said the economist, "I know that she expects to make $80 000 per year, since she could earn the same amount if she closed down the firm and went back to her old job as a marketing manager. That means that she is satisfied with what she has made this year, but no more."

The conversation above explains how economists measure profit.

> Total profit = Total revenue − economic cost (explicit and implicit costs)

From this point forward we will assume that we are now economists and that when we say total cost we are including explicit costs and implicit costs.

If total revenue is equal to total cost we say that a firm is making normal profit (or zero economic profit). If total revenue is greater than total cost then we say that the firm is making abnormal profit (also known as economic profit). If total revenue is less than total cost then we say that the firm is making a loss (or negative economic profit).

In Table 6.5 we can see these three situations.

	Firm A	Firm B	Firm C
Total revenue	200000	200000	200000
Total fixed cost	40000	40000	40000
Total variable cost	80000	100000	120000
Implicit cost	60000	60000	60000
Total cost	180000	200000	220000

Table 6.5 Revenue and cost information for one year for firms A, B and C

Firm A is making an abnormal profit (economic profit) of $20 000. This means that the revenue earned by the firm is not only covering all the economic costs but is in fact $20 000 more. This will make the entrepreneur happy as she was expecting to cover her implicit costs, including opportunity costs, of $60 000 but exceeds her expectations by $20 000.

Firm B is making normal profit (zero economic profit). The revenue earned by the firm exactly covers all of the economic costs. The entrepreneur will be satisfied.

Firm C is making losses. Although an accountant would say that the firm is making a profit of $40 000 ($200 000 - $160 000), the entrepreneur will not be happy since fixed and variable costs (explicit costs) are covered, but implicit costs are not being covered. The entrepreneur will close the firm down and move on to his or her next best occupation.

For the remainder of this companion we will use the terms abnormal profit, normal profit, and loss, but you must remember that these are the same as economic profit, zero economic profit, and negative economic profit.

We now need to consider three different scenarios:

1 the shut-down price
2 the break-even price
3 the profit-maximising level of output.

The shut-down price

It is not unusual to see firms continue to operate, in the short run, even if they are making a loss. It is also not unusual to see firms shut down for a short period of time and then open up again. Let us look at these two situations.

If it wants to, a firm may close down, temporarily, in the short run and produce nothing. If it does this, then it will only lose its total fixed costs, the costs that are unavoidable, such as rent or interest repayments on loans. To make things easier, we will now include opportunity cost as a fixed cost and not show it on its own, so it is also not being covered. This may be better than producing and not getting enough revenue to cover the variable costs, thus losing the fixed costs and the part of the variable costs that have not been covered.

This can be best explained by using an example. Suppose that there are three firms, all producing comics, and all making losses at the moment. The firms are called Archie, Batcat, and Charlie. Their monthly revenue and cost figures are given in Table 6.6.

	Archie	Batcat	Charlie
Total revenue ($)	80000	120000	150000
Total fixed cost (inc opportunity cost) ($)	100000	100000	100000
Total variable cost ($)	100000	120000	140000
Total cost	200000	220000	240000
Loss ($)	120000	100000	90000

Table 6.6 Revenue and cost figures for Archie, Batcat, and Charlie

Archie would be better not producing at all in the short run and closing down temporarily. This is because the revenue gained has failed to cover all of the variable costs, so Archie loses the $20 000 of variable costs that are not covered by the total revenue and all of the $100 000 of fixed costs. So by producing, Archie has lost $120 000, whereas it would only lose $100 000 of fixed costs if it did not produce.

Batcat loses $100 000 whether it produces or not. The revenue gained means that the variable costs are just covered, so they will lose the fixed costs, $100 000, whether they produce or not. In this situation, it is likely that Batcat will continue to produce in order to maintain the continuity of production, thus pleasing customers, and to maintain the employment of workers and the usage of inputs, thus pleasing the workforce and the suppliers.

Charlie loses $90 000 by producing, since their total revenue covers their variable costs and also contributes $10 000 towards their fixed costs. If they did not produce then Charlie would lose their fixed costs of $100 000. So Charlie will produce in the short run.

However, all three firms are making losses in the short run and they cannot do this for ever. Whether they produce or not in the short run, the firms need to plan ahead in the long run in order to change their combinations of factors and to devise a situation where they are able to cover all of their costs and make normal profits. If they cannot do this then they will have to close down permanently.

From this example, we can derive a definition for the shut-down price.

In Figure 6.12, the shut-down price is P. At this price, the firm is able to cover its variable costs in the short run, because P = AVC, and so is only losing its fixed costs. At any price below P, the firm will shut down in the short run.

Although this may seem like theory, there are in fact many real examples of this behaviour. In Vienna, Austria, there is an ice cream store that shuts down each October, because the demand for its products is low over the winter and so the revenue earned would not be enough to cover even its variable costs. In April each year, it opens up again, when demand is beginning to rise and it makes impressive profits until the end of September. The act of temporarily closing down, because it cannot cover its variable costs, is a good example of a firm that is not reaching its shut-down price in the short run.

Definition
The shut-down price is the level of price that enables a firm to cover its variable costs in the short run, i.e. it is the price where price = average variable costs. If price does not cover average variable costs, then the firm will shut down in the short run.

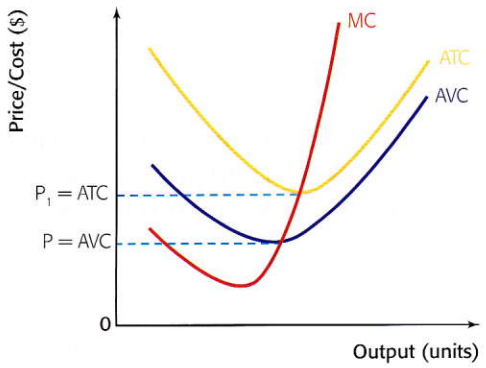


Figure 6.12 A general diagram showing short run ATC, AVC, and MC

The break-even price

The break-even price is the price at which a firm is able to make normal profit in the long run. This means that it will break even, covering all of its costs, including the opportunity cost.

The break-even price is the level of price that enables a firm to cover all of its costs in the long run, i.e. it is the price where price = average total costs. If price does not cover average total costs in the long run, then the firm will shut down for good.

In Figure 6.12, the break-even price is P_1. At this price, the firm is able to cover its total costs, because P_1 = ATC, and so all costs are covered.

The profit-maximising level of output

Economists usually assume that the main aim of a firm is to maximise profits. If this is the case, then firms need to know what level of output they have to produce in order to achieve maximum profits.

If a firm finds that at its present level of output the cost of producing another unit (MC) is less than the revenue that the unit would bring in (MR), it is clear that the firm could increase its profits by producing more. Wherever the firm finds that MR>MC, it should increase production.

We can see the marginal cost and marginal revenue situation for a firm with a perfectly elastic demand curve in Figure 6.13.

As we can see in Figure 6.13(a), the MC curve cuts the MR curve at two points. The first point where MC = MR, q_1, is the point of profit minimisation (loss maximisation). The firm has made a loss on every unit produced up to this level of output, because MC is greater than

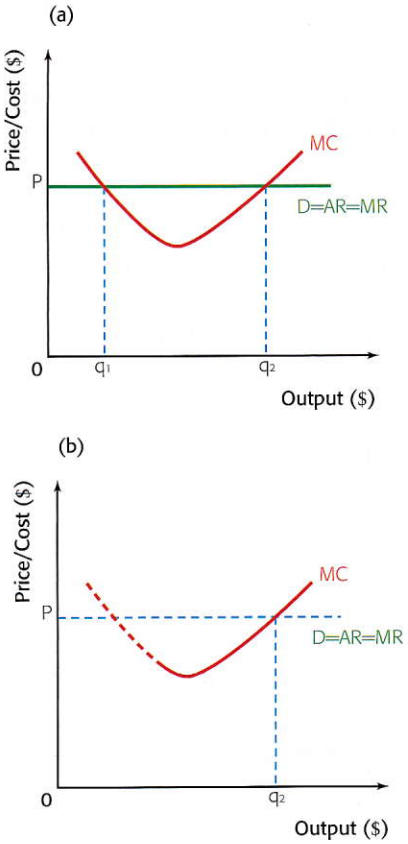


Figure 6.13 Revenue and costs for a firm with a perfectly elastic demand curve

MR. From q_1 to q_2, the firm makes a profit on every extra unit produced, because the MR is greater than the MC. As long as the profit made between q_1 and q_2 is greater than the loss made on the first q_1 units, then the firm will be making abnormal profits. Any unit that is produced beyond q_2 will make a loss, because MC would again be above MR. So if the firm produces more than q_2, the level of abnormal profit will begin to fall. It is at q_2 where profits are maximised.

Because profit minimisation is not what a firm would want, to avoid confusion the left hand part of the MC curve is normally omitted in diagrams. This means that only the profit maximising output, q_2, is shown, as in Figure 6.13(b). As a general rule, we can say that:

If a firm wishes to maximise its profits, it should produce at the level of output where Marginal Cost (MC) cuts Marginal Revenue (MR) from below.

The profit-maximising output for a normal demand and MR curve is shown in Figure 6.14.

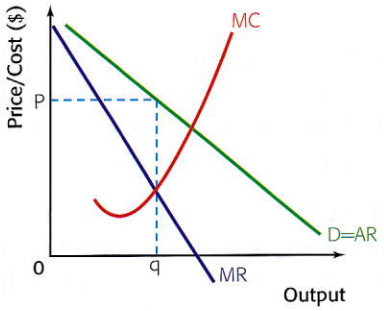


Figure 6.14 The profit-maximising level of output for a normal demand curve

Profit is maximised by producing where MC = MR, at a level of output of q. To find the price, we look at what consumers are willing to pay for this quantity. This is shown on the demand curve. It is found by going from q up to the demand curve and then across to the y-axis.

In order to show a measurable amount of profit on a diagram, i.e. a simple shape like a rectangle, the average cost curve (AC) is added to the diagram.

You must remember to make sure that the MC curve cuts the AC curve at the lowest point on the AC.

This is shown in Figure 6.15.

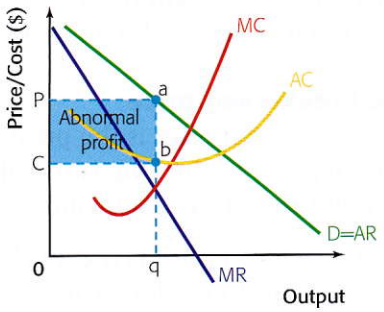


Figure 6.15 Showing an area of profit using the AC curve

The profit-maximising output is q and the price is p. The profit per unit of producing q is the difference between AR and AC. Thus the profit per unit is a − b. Since q units are produced, the total abnormal profit is the shaded area, ab × 0Q.

Whether an abnormal profit is made will depend upon the position of the AC curve. The AC curve is a student's best friend! This is because it can be moved around to show what we want, i.e. abnormal profit, normal profit, or losses. This is shown in Figure 6.16.

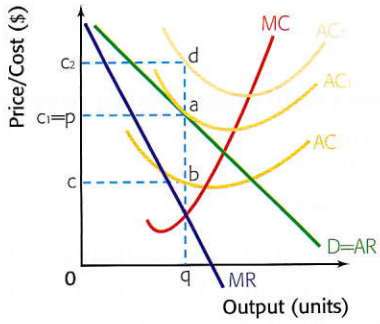


Figure 6.16 Using AC to show different profit and loss situations

If the average cost is at AC, then the diagram shows an abnormal profit of pabc. If the average cost is represented by AC_1, then normal profit is being made, because $p = c_1$ and so there is no abnormal profit rectangle. If average cost is shown by AC_2, then a loss is being made and it is represented by the rectangle pc_2da.

Assessment Advice

In HL paper 3 you may be asked to calculate different profit levels from a set of data and/or diagrams.

You may also be asked to calculate the shut down price and the break-even price from a set of data.

Final note on profit theory

In reality firms may not always have the main aim of maximising profits. Not everyone has studied economics! Other aims followed by entrepreneurs may be:

- *Revenue maximisation:* entrepreneurs often measure success by the amount of revenue that they make. If this is the case then they may attempt to maximise their sales revenue by producing where the marginal revenue is zero. They will actually produce above the profit maximising level of output. (See Figure 6.8).
- *Growth maximisation:* companies may set their target to achieve growth in the short run, rather than profits, in order to gain a large market share and then dominate the market in the long run. Growth may be measured in a number of ways, such as the quantity of sales, sales revenue, employment or the percentage of market share.
- *Satisficing:* there are now economic theories that doubt whether entrepreneurs ever, in reality, attempt to maximise profits. They claim that what entrepreneurs actually do is to "satisfice". Satisficing is where an economic agent aims to perform satisfactorily rather than to a maximum level, in order to be able to pursue other goals. For example, if people own firms they will work hard enough to make a reasonable living (cover their opportunity costs), but will not really push themselves further, preferring to follow other goals, such as the pursuit of leisure. In many cases firms are run by people who do not actually own them. An example of this would be a firm owned by shareholders who are not involved in running the company and are therefore managed by employed non-owners. In this case the managers do not have a great deal to gain if the firm makes maximum profits. It is likely that the managers will make enough profit to keep the owners of the firm happy, thereby keeping their jobs, but no more. They will "satisfice".
- *Corporate social responsibility (CSR):* this is where a business includes the "public interest" in its decision making. It adopts an ethical code that accepts responsibility for the impact of its activities on areas such as the workforce, consumers, the local community, and the environment. Different businesses may adopt different approaches to CSR. Some may concentrate on encouraging development in the workforce and the local community through educational projects and fair trade projects. Some may concentrate on reducing their negative effect on the environment by cutting emissions and the use of sustainable resources. Some may make the provision of aid to less developed communities a priority. In some cases businesses may adopt all of the above approaches to some extent.

There are a number of advantages to adopting a CSR approach such as attracting and keeping a better workforce, building up reputation and developing brand loyalty for being an ethical business. If companies adopt appropriate corporate social responsibility policies and are active in addressing social and environmental issues it can also reduce the need for government intervention in business

activities. There has been a solid increase in "ethical consumerism" and CSR since the mid-1980s. As consumers become more aware of global and environmental issues they are more likely to favour businesses that promote ethical considerations.

However, there have been concerns regarding CSR. Some economists have argued that companies may be adopting a CSR approach to gain a good reputation in order to take people's attention away from their main product. This has especially been suggested for companies that produce cigarettes and alcohol.

Student workpoint 6.5

Be an inquirer

Consider the impact of a company on others and the environment.

Using the internet, research the corporate social responsibility policy of a large multinational company. References to the company's policies are often found on the company's homepage under the title "Corporate Social Responsibility" or "Sustainability".

Make a display poster or a powerpoint presentation to illustrate your company's approach to CSR.

It is highly likely that the company will only present the expected positive outcomes of its actions. As you investigate try to think critically about these policies, both the extent to which the company fulfils its commitments and the reasons for doing so. Doing a bit more research might even uncover some negative consequences of the company's behaviour that its homepage would not reveal.

Debate the following topic with your classmates:

What are the real motivations behind corporate social responsibility?

EXAMINATION QUESTIONS

Paper 1, part (a) questions

1 Distinguish between the concepts of the short run and the long run. *[10 marks]*

2 Using an appropriate diagram, explain the concept of diminishing marginal returns. *[10 marks]*

3 Distinguish between an economist's definition of profit and an accountant's definition of profit. *[10 marks]*

4 Using a diagram, explain how a firm might be able to stay in business in the short run, even if it is not covering all of its costs. *[10 marks]*

5 Explain three sources of economies of scale. *[10 marks]*

6 Explain two goals of firms other than to maximise profits. *[10 marks]*

There are no examples of longer essay questions at this point as there is little evaluation that is possible at this stage.

HL paper 3 question

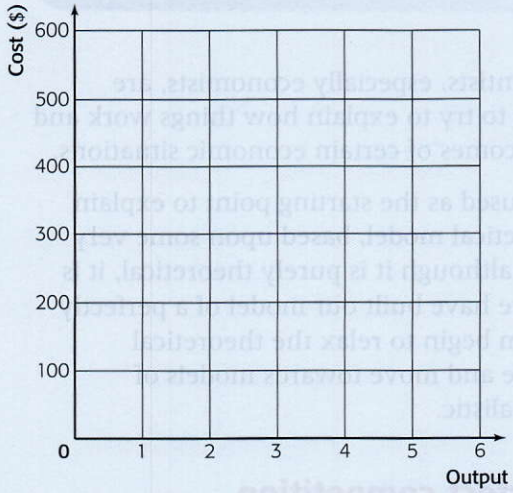
The total cost information for a firm, in dollars ($), is given in the table below:

Output (q)	Total cost (TC)	Total fixed cost (TFC)	Total variable cost (TVC)	Average fixed cost (AFC)	Average variable cost (AVC)	Average total cost (ATC)	Marginal cost (MC)
0	40			–			
1	90			40			
2	130			20			
3	160			13.33			
4	200			10			
5	250			8			
6	320			6.67			

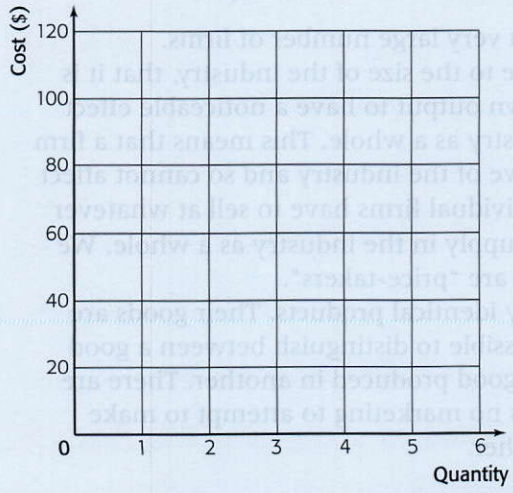
a Complete the cost information in the table above for all levels of output. *[9]*

b Explain why the AFC values fall as output increases. *[4]*

c On the graph below plot and label TFC, TVC and TC. *[4]*



d On the graph below plot and label MC, AVC and ATC. *[4]*



e Explain the theory that accounts for the shape of the three curves in the graph above (in question d). *[4]*