8 PERFECT COMPETITION (HL ONLY)

8.1 Perfect competition: assumptions of the model

Learning outcomes

- Describe, using examples, the assumed characteristics of perfect competition: a large number of firms; a homogeneous product; freedom of entry and exit; perfect information; perfect resource mobility.

Watermelon trucks line the streets of Shanghai, an example of a perfectly competitive market.

Every October, a funny thing happens along the streets leading out of Shanghai, China. This city of 19 million people, China's largest, has a centre of glass skyscrapers, a perimeter of smoke-belching factories, and a hinterland of fertile agricultural fields. It is from these fields that, for two or three weeks every autumn, blue trucks come rumbling in to line up on practically every street corner on the way into downtown Shanghai. The trucks flood into the city by the hundreds, maybe even the thousands, each one loaded down with freshly harvested watermelons.

You can buy watermelons in Shanghai at any time of year, but for 11 months the price of watermelons is higher than the typical Chinese consumer is willing to pay because the watermelons have been transported great distances from the warmer climates to the south or even from abroad. Yet for two or three weeks, during the watermelon harvest in the fields just beyond Shanghai, watermelons are abundant and cheap. For this sweet and juicy period in Shanghai, the watermelon market briefly becomes perfectly competitive.

If you were to hop on a bicycle in Shanghai's factory district and ride 20 kilometres into the city centre during the watermelon harvest, this is what you would see. Every 500 metres or so along the road, there would be a large blue flatbed truck pulled up to the kerb with its tailgate down. In the back of the truck would be hundreds of watermelons, probably picked the day before in a field not far away. If you were to stop and ask the man standing beside the truck the price of a watermelon, chances are he would tell you something in the range

of 12 RMB (around $1.50). If you continued to cycle down the road another 500 metres you'd come to another, very similar, truck also selling watermelons. Ask the price here, and you'd probably be told the same amount. As you continue your journey into the city and stop at another dozen or so blue trucks, chances are you'd find the price of watermelons to be the same at every stop.

The watermelon market in Shanghai during October displays many of the characteristics of a perfectly competitive market: the product on sale is homogeneous and identical from seller to seller. The price the melons sell for, if you do a little bargaining, is nearly the same everywhere, and the barriers to entry into this market are extremely low. Anyone with a flatbed truck and a few hours on their hands could drive out to the countryside and load their truck with melons to sell in the city.

This is one real-world example of a perfectly competitive market, but other examples are hard to find. The model is mostly theoretical but, as you will see, it provides economists with a valuable tool for evaluating the efficiency of more realistic market models – the imperfectly competitive markets discussed in Chapters 9 and 10.

The perfectly competitive model

As you learned in Chapter 2 (page 23), perfectly competitive markets are those in which individual firms produce such a small proportion of the overall supply of the product that altering their own output has no influence over the market price of the product. In this regard, firms in such an industry are price-takers; this means that they find it impossible to charge a price higher than that charged by their competitors, nor can they successfully offer their output at a lower price since competition forces the price down to the producers' lowest average total cost.

A market is perfectly competitive if there are a large number of firms producing identical products facing identical production costs and in which there are no barriers to entry or exit.

In addition to perfectly competitive markets consisting of a large number of identical, price-taking firms, the model also assumes that the firms:

- produce completely identical products; the goods are not differentiated and act as perfect substitutes for each other
- can enter or exit the market very easily, with effectively no barriers to entry or exit.

While perfectly competitive industries are rare in the real world, examples of markets with some of these characteristics do exist in certain industries, including certain agricultural commodities, low-tech manufactured goods, certain types of low-skilled labour, markets in which there are many firms producing nearly identical products or millions of households supplying an identical resource (such as labour). Despite being rare, perfectly competitive markets are worth studying for what they teach us about resource allocation and the efficiency resulting from high levels of competition between firms.

Assuming there are no spillover benefits or costs (externalities) in the production or consumption of the product, perfectly competitive markets result in the most socially optimal level of output and price of any of the four market structures, and are therefore considered allocatively efficient. Shortages and surpluses are non-existent in perfectly competitive markets, wherein the high level of competition ensures that the marginal social benefit of a particular product will align with the marginal social cost and neither too much nor too little will be produced. The perfectly competitive model can be held up as an example of perfect efficiency when compared to less competitive market models in which the price-making market power of individual firms results in a level of output that is lower than and a price that is higher than that achieved under perfect competition. This provides evidence that efficiency decreases as markets become less competitive.

With the assumptions above to guide our analysis, we can begin to examine the behaviour of firms in perfectly competitive industries to determine how such a market adjusts to changes in demand and supply and how output and price are determined in both the short run and the long run.

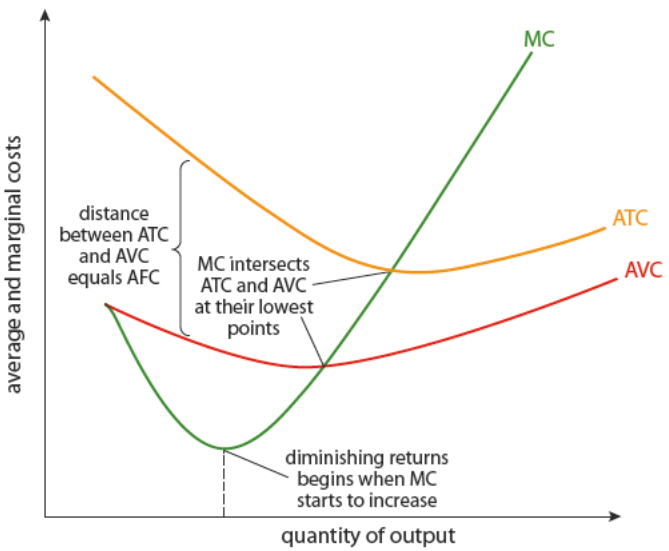
8.2 Cost and revenue curves in a PC market

Learning outcomes

- Explain, using a diagram, the shape of the perfectly competitive firm's average revenue and marginal revenue curves, indicating that the assumptions of perfect competition imply that each firm is a price-taker.
- Explain, using a diagram, that the perfectly competitive firm's average revenue and marginal revenue curves are derived from market equilibrium for the industry.

In Chapter 6, you learned about short-run costs and revenue curves of firms in different market structures, distinctions between the fixed and variable costs firms face in the short run (the fixed-plant period), and the law of diminishing returns and its influence on the shape of a firm's marginal cost curve. You will recall that a firm increasing its output in the short run may alter its variable resources (labour and raw materials) while keeping its land and capital inputs constant. As more labour and raw materials are added to production while the amount of capital and land are fixed, the output attributable to additional labour beyond a certain point begins to decline. This explains why a firm's short-run marginal cost (MC) curve slopes upward beyond the point at which diminishing marginal returns begins (Figure 8.1). If you need to refresh your memory of terms such as ATC and AVC, as well as MR DARP, now is a good time to do so.

Figure 8.1
A firm's short-run costs of production.



A perfectly competitive firm seeking maximum profits must examine both its short-run costs and revenues. The revenue a firm earns depends on two factors: the price it can sell its output for and the quantity of output it sells. Since perfect competitors are price-takers, the price a firm sells its output for is determined by the market supply and market demand for the product it makes.

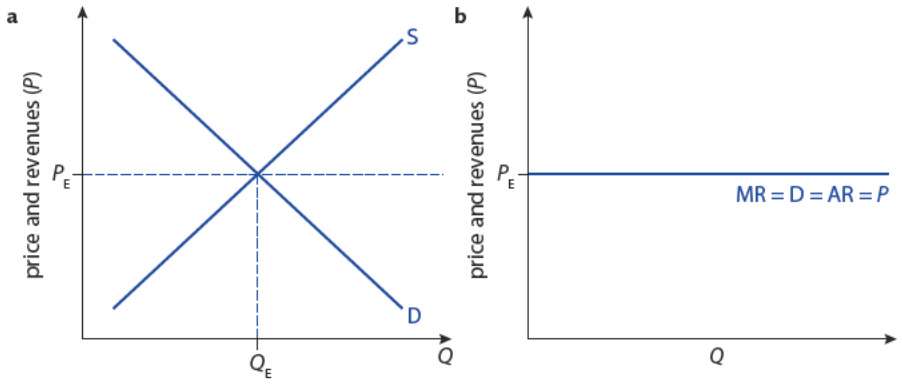


Figure 8.2
a The perfectly competitive market; **b** a single firm in the market.

You will recall that the demand seen by an individual firm in a perfectly competitive market is perfectly elastic, illustrated graphically as a line horizontal at the equilibrium market price (Figure 8.2, above). Consumers are perfectly responsive to a change in the price by an individual seller. Any change in price by one firm in a market consisting of hundreds of identical firms selling identical products will grab the attention of all the buyers in the market; a price increase will lead to a loss of all customers, while a price decrease will lead all buyers to want to buy from the one firm that lowered its price.

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8.3 Profit maximization in the short run

Learning outcomes

- Explain, using diagrams, that it is possible for a perfectly competitive firm to make economic profit (supernormal profit), normal profit or negative economic profit in the short run based on the marginal cost and marginal revenue profit-maximization rule.

A profit-maximizing firm will produce at the level of output in the short run at which its marginal revenue (MR) equals its marginal cost (MC), following the profit-maximization rule (page 171). To illustrate a firm maximizing its profits, we simply draw a firm diagram with its costs and revenues, with the firm producing at the quantity that corresponds with the intersection of its MC and MR curves (Figure 8.3).

The firm in Figure 8.3b maximizes its profits when producing at the quantity Q_F. At any level of output below Q_F, MR (the revenue earned when selling the next unit produced which, in the case of a perfectly competitive firm, is the equilibrium price, P_E) would exceed MC and the firm's total profits would increase if it produced one more unit. Beyond Q_F, the last unit

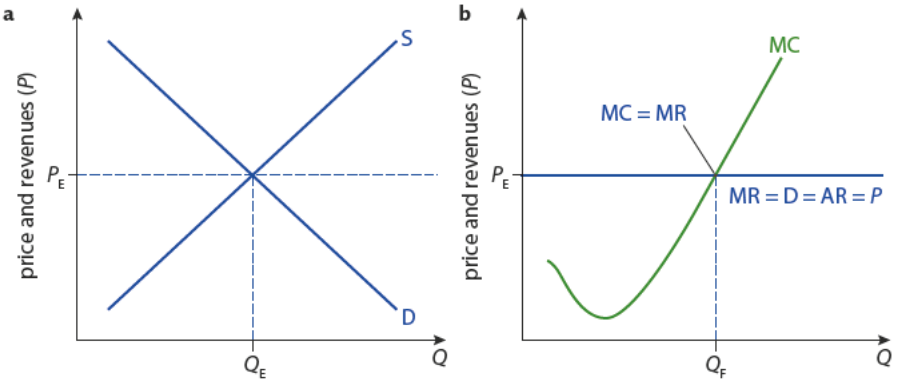

Figure 8.3
A profit-maximizing firm in a perfectly competitive market. **a** Perfectly competitive industry; **b** perfectly competitive firm.

produced costs the firm more than it adds to revenue (MC is greater than MR). The firm is earning losses on the margin and would reduce its losses by reducing its output back to Q_F.

Following the profit-maximization rule does not guarantee a firm will earn economic profits. If, at the MC = MR quantity, a firm's average total cost (ATC) of production is less than its average revenue (AR, the price), then the firm will experience economic profits. If, however, ATC is greater than the price, then the firm may be in a loss-minimizing position, where it cannot possibly earn profits and instead is producing at the quantity at which its losses are minimized. On the other hand, it is also possible that a firm is simply breaking even. If, at the MC = MR quantity, the ATC equals the price, then the firm is earning zero economic profits, and is simply covering its costs of production (and is earning only a normal profit).

To determine whether or not a firm is actually earning profits at its profit-maximizing level of output, we must examine its AR and ATC at that level of output. If ATC is less than AR at the profit-maximizing quantity, then the firm is earning economic profits, meaning it is covering all its explicit and implicit costs, including a normal profit, and earning additional profit beyond all these costs (Figure 8.4).

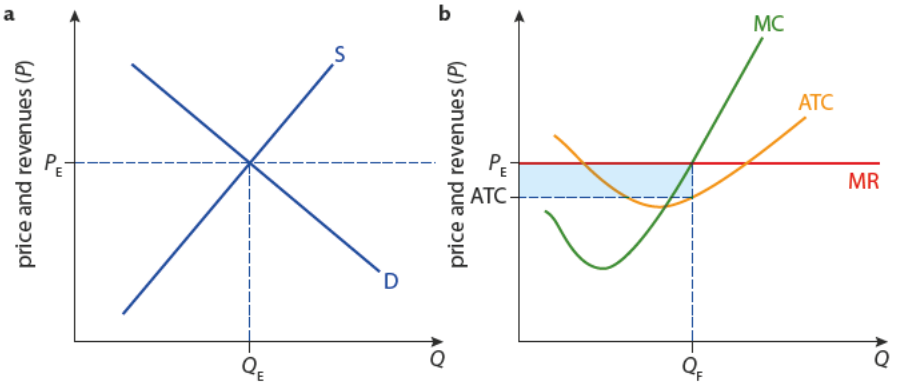

Figure 8.4
A firm earning economic profits in a perfectly competitive market.
a Perfectly competitive industry; **b** perfectly competitive firm.

The firm in Figure 8.4b is producing at the level of output at which MR = MC, at a quantity of Q_F. At this level of output, the firm's average total cost (determined by where the dotted line above Q_F intersects the ATC curve) is less than its average revenue (the MR = D = AR = P line). For its average unit of output, the firm is able to sell for more than its cost of production, indicating that the firm is earning a profit equal to P_E – ATC on each unit it produces.

Since the firm's total output is Q_F, the total amount of profit earned by the firm can be calculated as $(P_E - ATC) \times Q_F$. The area indicated by the blue rectangle in the graph represents the firm's total profits.

Figure 8.5 puts some numerical values into this situation.

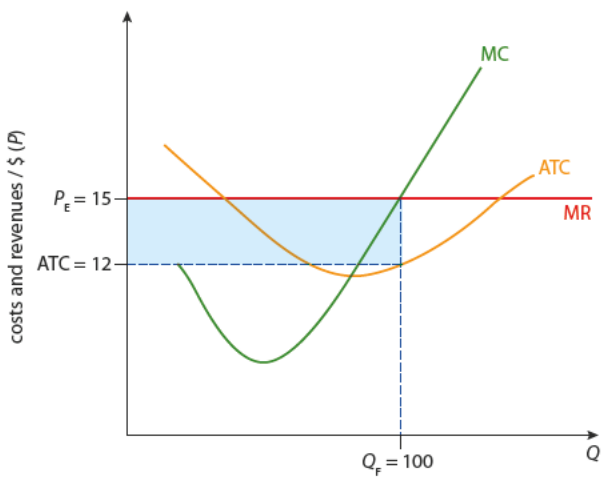

Figure 8.5
Economic profits: when price is greater than average total cost.

HL EXERCISES	
	Study Figure 8.5 and answer the following questions.
1	Why does the firm wish to produce at a level of output equal to 100 units?
2	What is the firm's total revenue when producing 100 units?
3	What is the firm's total cost?
4	Calculate the firm's level of economic profits.
5	Assuming there are no barriers to entry to this perfectly competitive market, how do you think the existence of economic profits will affect the number of firms producing this good in the long run?

Figure 8.5 shows a perfectly competitive firm maximizing its profits by producing at its MC = MR level of output. The price of $15 is determined by market supply and demand (the market diagram is not shown). The firm's average total cost is $12 and its output is 100 units. To determine the firm's total economic profit, calculate its total revenue (TR) and subtract its total cost (TC).

- $TR = P \times Q = \$15 \times 100 = \$1500$
- $TC = ATC \times Q = \$12 \times 100 = \$1200$
- Economic profit = TR – TC = $1500 – $1200 = $300

The economic profit of $300 represents the firm's economic, or abnormal profits; the revenue earned above and beyond the firm's explicit and implicit costs of production, including the normal profit needed to keep the firm in business. As stated above, not all firms earn economic profits at all times. Sometimes, a firm producing at its profit-maximizing level of output faces a situation in which it is still earning economic losses.

The loss-minimizing firm

Economic profits, while desired, are not always guaranteed. Competitive firms often find themselves in situations in which economic losses are being earned, even when producing at their profit-maximizing level of output. In other words, a firm doing as well as it can do may still be losing money (Figure 8.6).

The firm in Figure 8.6 is producing at the level of output at which MR = MC, which is the profit-maximizing level. However, its costs appear to be much higher than the firm in Figure 8.4. Therefore; despite doing as well as it can, the firm is earning economic losses equal to the shaded rectangle. The firm's ATC is greater than its AR at the MC = MR point, meaning that it is earning losses on each unit of output it produces and sells. This firm cannot possibly earn economic profits unless one of two things happens: either the price of the product must rise or the firm must reduce its costs.

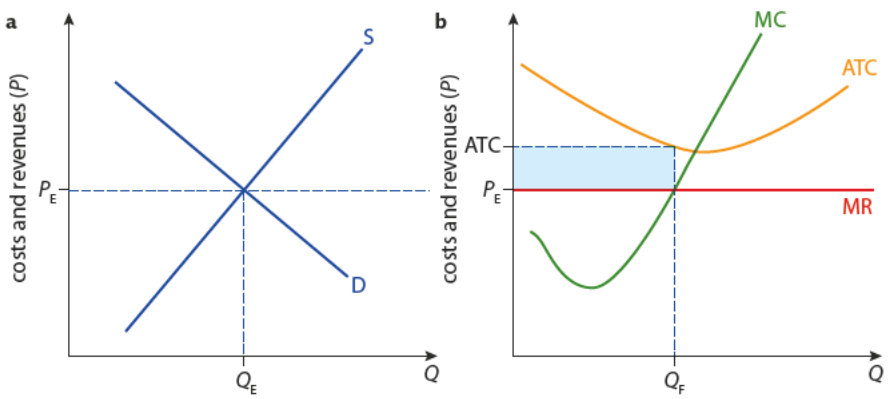

Figure 8.6
A firm minimizing losses in a perfectly competitive market. **a** Perfectly competitive industry; **b** perfectly competitive firm.

Figure 8.7
Economic losses: when price is less than average total cost.

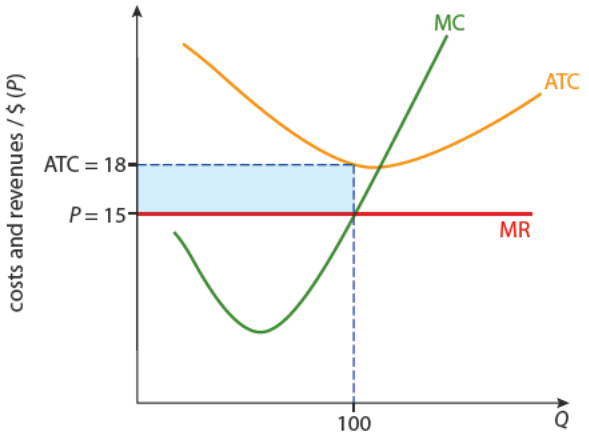

Figure 8.7 puts some numerical values into this situation.

HL EXERCISES	
	Study Figure 8.7 and answer the following questions.
6	Calculate the firm's total revenues when producing 100 units.
7	What is the firm's total cost at this output level?
8	Calculate the level of economic losses being earned by this firm.
9	Identify two things that could have caused a profit-earning firm like that in Figure 8.5, to go to earning economic losses.
10	Assuming no barriers to exit in this market, what will the existence of economic losses cause to happen to the number of firms in the long run?

The firm in Figure 8.7 is producing at its profit-maximizing level of output where MR = MC but at this quantity, it is earning economic profits of negative $300, meaning the firm is earning economic losses of $300. Total losses are found by subtracting the firm's total cost (TC) from its total revenue (TR).

- $TR = P \times Q = \$15 \times 100 = \$1500$
- $TC = ATC \times Q = \$18 \times 100 = \$1800$
- Total profit = TR – TC = $1500 – $1800 = –$300

Producing at the quantity at which MR = MC allows firms to earn the greatest level of economic profit; but a profit is not guaranteed. A firm may also experience economic losses if its costs of production are too high or the equilibrium price in the market is too low. A firm may also break even, which occurs when the firm's ATC = AR.

The break-even firm

A firm producing at the MC = MR level of output may simply be breaking even, which means that its total revenues are equal to its total costs. The break-even firm is earning only a normal profit, which is the minimum profit needed to keep the owner of the firm producing in the market (Figure 8.8).

The firm in Figure 8.8 is producing at its profit-maximizing level of output, Q_F. At this quantity, the firm's ATC = AR. Per-unit economic profits are zero, meaning total profits are zero. The firm is breaking even.

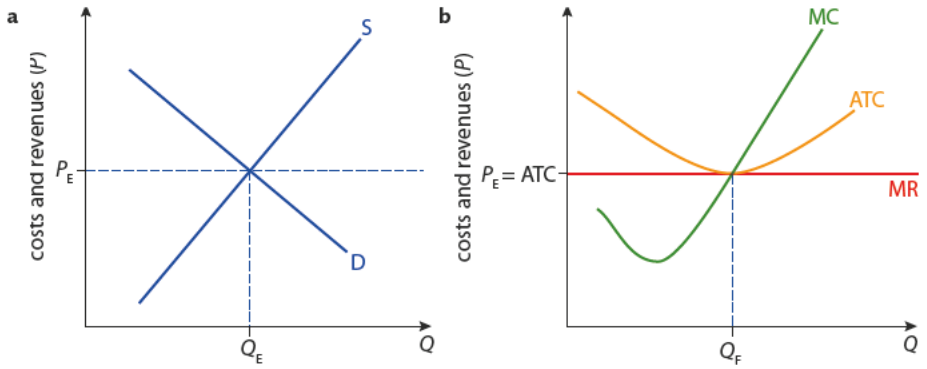

Figure 8.8
A perfectly competitive firm in a perfectly competitive market which is in long-run equilibrium: the firm is breaking even. **a** Perfectly competitive industry; **b** perfectly competitive firm.

Remember that firms in a perfectly competitive market are identical in every way. In addition to producing exactly the same product, perfectly competitive firms also face identical costs of production. Therefore, a diagram illustrating the profits or losses of one firm represents the situation faced by all firms. To understand the behaviour of firms in a perfectly competitive industry, therefore, we can examine the behaviour of a typical firm in response to one of the three scenarios illustrated above (the profit-maximizing firm, the loss-minimizing firm and the break-even firm).

Only when firms in a perfectly competitive market are breaking even is the market said to be in equilibrium. If firms are earning economic profits in the short run, then the market will adjust to a new long-run equilibrium level at which firms are breaking even. Likewise, if the typical firm is earning economic losses, the market will adjust to eliminate those losses until firms are once again breaking even.

8.4 Profit maximization in the long run

Learning outcomes
- Explain, using a diagram, why, in the long run, a perfectly competitive firm will make normal profit.
- Explain, using a diagram, how a perfectly competitive market will move from short-run equilibrium to long-run equilibrium.

Let's now consider how a perfectly competitive market adjusts in the long run to the existence of economic profits or economic losses among firms in the market.

In the short run, you will recall, the amount of capital employed by firms in an industry is fixed. The short run is the fixed-plant period, in which firms are neither able to increase nor decrease the amount of capital or land resources employed in the production of their output. In the short run, labour is the only variable resource to increase or decrease output. A firm can hire more workers or ask existing workers to work longer hours in response to an increase in price, or lay off workers and cut back on hours in response to a fall in price. This explains why firms' output is only able to vary by small amounts in response to changes in the market price.

In the long run, however, firms are able to vary their output by much more in response to changes in price. In addition, the number of firms in an industry can vary in the long run in response to the existence of economic profits and losses. When the market price rises, some firms will build new plants and employ more resources in their production,

and new firms will enter the industry, attracted by the prospect of economic profits. When the demand for a product and its equilibrium price fall in a perfectly competitive industry, some of the existing firms will reduce their plant sizes and others will exit the industry altogether to avoid earning economic losses.

No barriers to entry

To understand how perfectly competitive industries adjust from a short-run equilibrium in which firms may be earning economic profits or losses to the long-run condition in which all firms are breaking even, we must remember one of the main characteristics of perfectly competitive markets: the lack of barriers to entry or exit. Because it is easy to enter or exit a perfectly competitive industry, the existence of economic profits or losses acts as a powerful incentive to attract new firms or repel existing ones.

The lack of barriers to entry in perfectly competitive markets allows for the easy entry and exit of firms in response to the existence of profits or losses. If firms in a particular industry are earning profits, other firms will wish to enter the market to enjoy the profits to be had. Entry is easy and cheap, allowing entrepreneurs to produce the product with relative ease. Likewise, if firms in a perfectly competitive industry are facing losses, some of those firms will leave the market. Firms can reduce their output or shut down altogether and face no barriers to exit.

Entry eliminates profits

To illustrate the long-run adjustment that takes place in a perfectly competitive industry in which economic profits are being earned, let's imagine a market for brownies in which a large number of identical firms are each producing an identical quantity of the same brownies. There are 100 producers, each producing 200 dozen brownies per week. The market for brownies and the costs and revenues of a typical producer are shown in Figure 8.9.

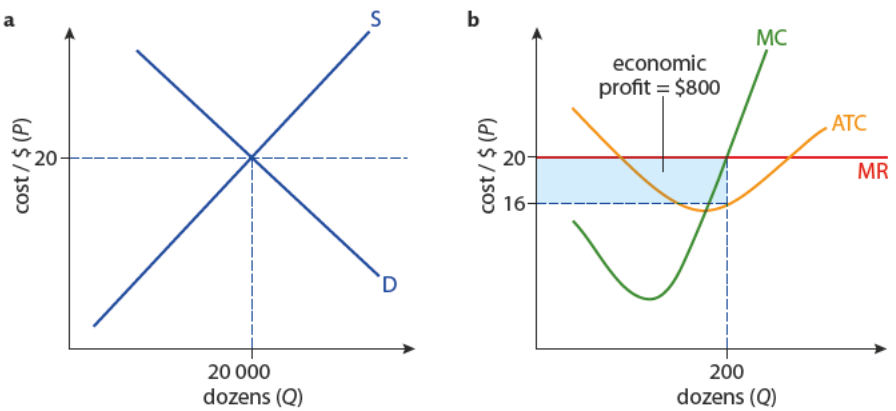

Figure 8.9
If perfectly competitive firms are earning economic profits, new firms will be attracted to the market. **a** Market for brownies; **b** single firm in the brownie market.

The 20 000 dozen brownies produced each week in the entire industry is the sum of all 100 producers' individual outputs of 200 dozen each. Total output equals the individual output of each firm multiplied by the number of firms: $200 \times 100 = 20\,000$.

As you can see in Figure 8.9, brownie producers are doing rather well. The typical producer earns a profit of $4 per dozen produced and sold at the market price of $20. Each week, the typical producer earns an economic profit of $800. These profits, however, will only be enjoyed in the short run. In the short run, the number of brownie producers and the plant size of those producers are fixed. So how will the market and the costs and revenues of the firms in the market change in the long run?

The long run is the variable-plant period, meaning that the profit-earning brownie producers have time to expand their operations in response to the high profits being earned. Additionally, since barriers to entry in the brownie market are practically non-existent, the number of firms in the market will increase. As new firms enter, we see the situation in Figure 8.10 occur.

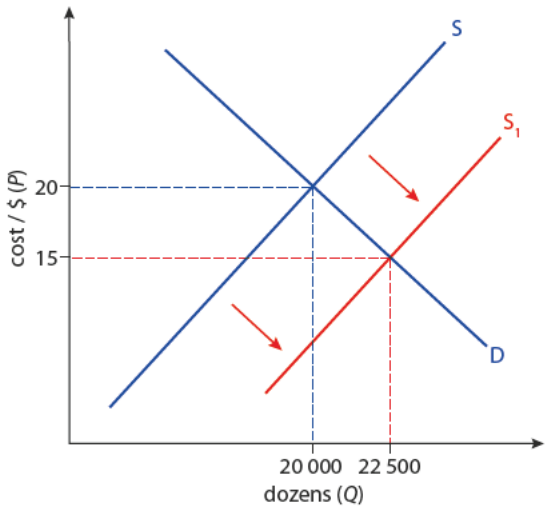

Figure 8.10
The entry of new firms increases the market supply.

The economic profits earned by brownie producers attract new firms to the industry, causing the market supply curve to shift to the right, the equilibrium price to fall and the total output of brownies to increase.

Since firms are price-takers, the marginal revenue faced by brownie producers decreases and, in response, the existing firms reduce their output to the level at which marginal. cost equals the new marginal revenue of $15 (Figure 8.11).

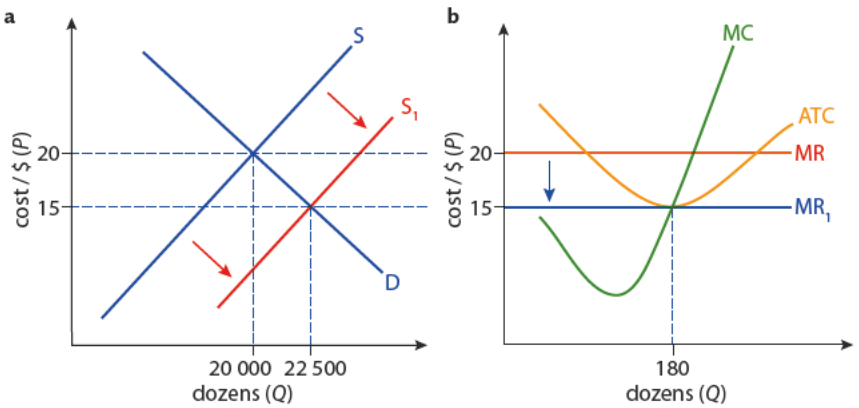

Figure 8.11
The entry of new firms reduces the MR and demand as seen by the existing firms, eliminating economic profits.
a Market for brownies;
b single firm in the brownie market.

Total output of brownies increases because of the existence of economic profits and the entrance of new firms. Meanwhile, the increased competition gives the existing firms a smaller share of the total brownie market and their individual output falls correspondingly, to 180 dozen. The market is now made up of 125 firms, up from the original 100, each producing 180 dozen brownies for a total output of 22 500 dozen.

In Chapter 2 you learned about the role that prices play in allocating resources in a market economy. The above illustration is a perfect example of the allocating power of prices. The price of $20 in the brownie market meant firms were earning profits, a signal to other entrepreneurs that society values brownies and would be better off with more of them. Resources are correspondingly re-allocated from other sectors of the economy (perhaps from bagels or croissants or cookies) into the production of brownies, meeting the demands

of consumers and reducing the profits of brownie producers to the 'normal' level, where price equals average total cost. The brownie market moves to its long-run equilibrium level of output and price, at which individual firms are only breaking even. At this point, there is neither an incentive for firms to enter nor exit the market, hence equilibrium is achieved.

Exit eliminates losses

In the same way that the existence of profits sends the signal to entrepreneurs that more of a good is demanded and therefore leads to a re-allocation of resources towards the production of that good, the existence of economic losses sends the opposite message. In Figure 8.12, the demand for brownies is low and the equilibrium price is just $12 per dozen. The typical profit-maximizing firm (Figure 8.12b) is earning economic losses because its average total cost is greater than the price of $12.

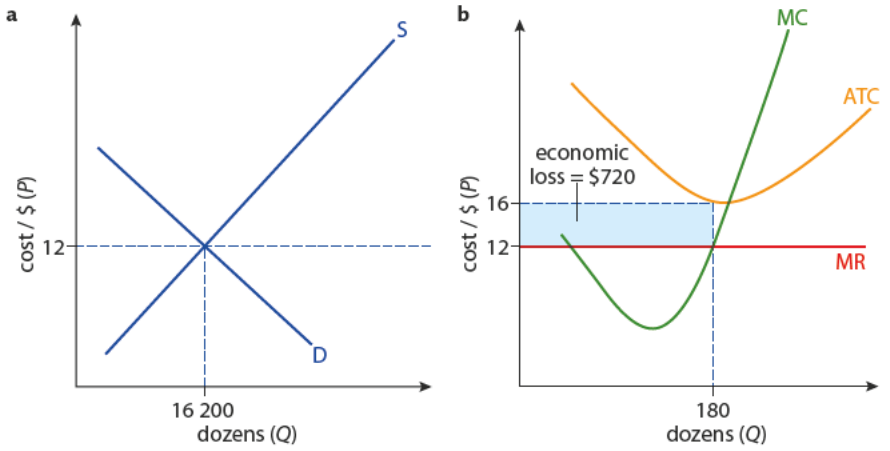

Figure 8.12
If perfectly competitive firms are earning economic losses, some firms will wish to leave the market. **a** Market for brownies; **b** single firm in the brownie market.

The total losses of the typical firm in the brownie market are equal to the per-unit loss ($12 – $16 = –$4) multiplied by the firm's output (–$4 × 180 = –$720). There are 90 firms in the market producing a total output of 16 200 dozen brownies per week.

As firms earn economic losses, some will decide that the costs of remaining in this industry outweigh the benefits and will choose to leave the market to seek profits in another industry. As firms exit the industry, the market supply curve shifts to the left and the equilibrium price of brownies rises once again (Figure 8.13).

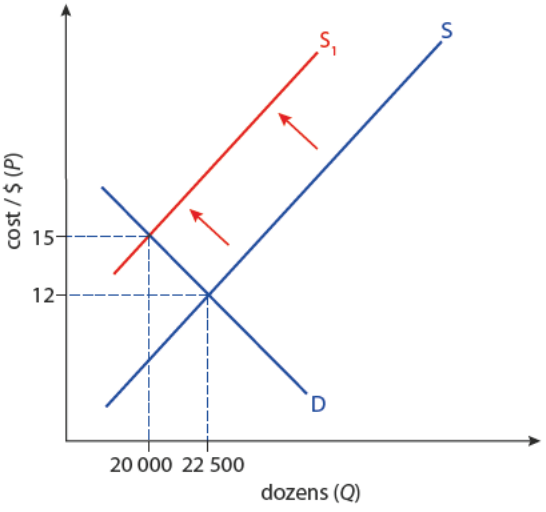

Figure 8.13
The exit of some firms reduces the market supply and increases the equilibrium price.

The economic losses experienced by brownie producers leads some firms to shut down and exit the brownie market, causing the supply curve to shift to the left, increasing the equilibrium price of brownies. The firms that remained in the brownie market now see their losses eliminated because of the higher price of brownies (Figure 8.14).

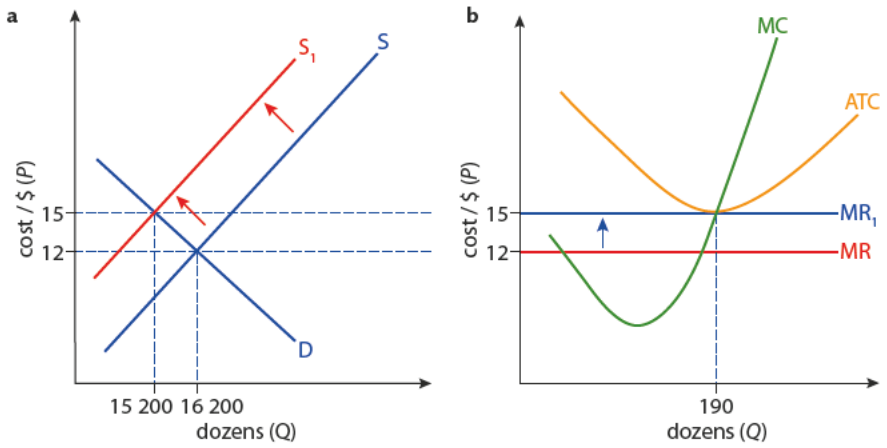

Figure 8.14
The exit of some firms raises the MR and demand of remaining firms, eliminating the economic losses. **a** Market for brownies; **b** single firm in the brownie market.

The exit of firms from the brownie market shifts supply to the left and causes the equilibrium price of brownies to rise. Firms that remained in the market increase their output since they suddenly face a larger share of the total market demand than previously. The higher price allows remaining firms to increase their output until the point at which MR = MC which, in this case, is at 190 dozen brownies. Each firm now produces 10 more brownies than before but there are fewer firms in the market.

Before firms exited to avoid losses, there were 90 firms producing 180 dozen brownies each, for a total market output of 16 200 dozen. Following the exit of firms fleeing losses, there are 80 firms remaining, each producing 190 dozen for a total market output of 15 200 dozen.

The weak demand for brownies caused firms to earn economic losses, which created the incentive to leave the market. Some firm-owners sought to allocate their resources towards other industries in which the prospects of economic profits were greater. Others chose to remain in the market, which ultimately meant they would break even once the long-run adjustments took place and the price rose to a level where it equalled the firms' minimum average total cost (the break-even level).

Once again, we have demonstrated the allocating power of prices in a free market economy. The equilibrium price of brownies sends a message from the buyers to the sellers regarding how much output is truly demanded. When firms were earning profits, the incentive among entrepreneurs was to enter the market, satisfy the demands of consumers, earn economic profits in the short run until those profits are eliminated and the allocation of resources towards brownies is efficient once again. Weak demand forced the price down, which caused firms to earn losses. This encouraged some firms to leave the market, leading to a fall in supply and a decrease in the total output of brownies. Eventually, long-run equilibrium is restored at a level of output that is allocatively efficient, meaning the right amount of resources are allocated towards brownies where the marginal cost of producing brownies is exactly equal to their price.

● Examiner's hint

Breaking even does not mean a firm is doing poorly. Remember, a break-even firm is still earning normal profits, so the business owner is earning a level of profit high enough to remain in business. If normal profits are not being earned, then a firm is earning economic losses and may very well shut down and leave the market.

To access Worksheet 8.1 on economic concepts, please visit www.pearsonbacconline.com and follow the onscreen instructions.

Entry eliminates profits and exit eliminates losses. Because of the ease of entry and exit in a perfectly competitive market, any economic profits will be eliminated in the long run as new firms attracted to the profits enter the industry, forcing the price down until all firms break even. If losses are being earned, firms will exit the market, reducing supply of the good until the price increases to the break-even level.

To access Worksheet 8.2 on profit maximization, please visit www.pearsonbacconline.com and follow the onscreen instructions.

To learn more about profit maximization, visit www.pearsonhotlinks.com, enter the title or ISBN of this book and select weblink 8.2.

HL EXERCISES

11 Assume the market for good A is perfectly competitive and firms are earning economic profits. Draw a side-by-side diagram showing the market for good A and a typical firm in the market.

12 Identify one factor that could have led to the existence of economic profits for the firms producing good A.

13 Explain the process by which the market will move towards a new long-run equilibrium.

14 Why would firms wish to produce good A if, in the long run, they are only breaking even?

8.5 The shut-down rule

Learning outcomes

- Distinguish between the short-run shut-down price and the break-even price.
- Explain, using a diagram, when a loss-making firm would shut down in the short run.
- Explain, using a diagram, when a loss-making firm would shut down and exit the market in the long run.
- Calculate the short-run shut-down price and the break-even price from a set of data.

Our analysis so far of the brownie industry in which firms were experiencing losses fails to explain which firms will choose to exit the industry and which firms will stay. To determine if it should shut down or not when faced with economic losses, a firm must compare its total losses to its total fixed costs. If total losses exceed total fixed costs, then losses would be minimized by shutting down. In this case, the firm will lose its fixed costs (those costs which must be paid regardless of the level of output) but the amount lost will be less than if the firm continues to operate.

To illustrate the shut-down scenario, we must imagine a situation in which the equilibrium price of a product is so low that the typical firm cannot cover its average variable costs of production when producing at the MR = MC point (Figure 8.15).

As you can see in Figure 8.15, the price of brownies is so low that the typical firm is not even able to cover its AVC of production. Recall that variable costs include the wages for workers and the costs of other variable inputs such as raw materials (in this case, ingredients

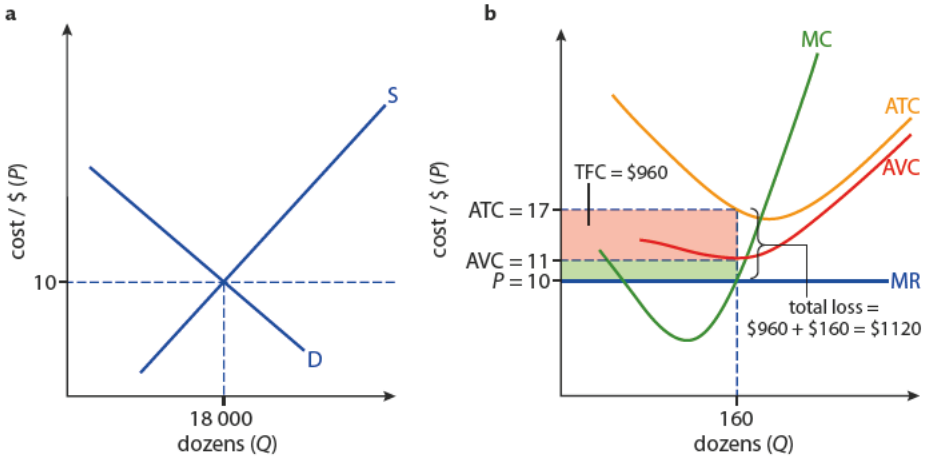

Figure 8.15
If the firm's total loss is greater than its total fixed cost, the firm should shut down to minimize losses. **a** Market for brownies; **b** single firm in the brownie market.

for brownies). With the price this low, the brownie producer cannot afford to continue producing brownies. Its costs of production are simply too high and the price is too low.

Another way to look at the firm's situation is to look at its total loss and its total fixed costs (TFC). The area of total loss (the red and green rectangles; (ATC – AR) × Q)) is greater than its TFC (the red rectangle; (ATC – AVC × Q)). Recall that the distance between a firm's ATC curve and its AVC curve represents the firm's AFC. Therefore, the red rectangle shows the firm's TFC (ATC – AVC) × Q)). This firm will minimize its total losses by shutting down and sacrificing the costs already sunk into capital and land, rather than by continuing to operate and experiencing losses exceeding its fixed costs.

Why doesn't a firm shut down as soon as $P <$ ATC?

It may seem strange that a firm earning economic losses would continue to operate at all. To understand why a firm will only shut down when $P <$ AVC, we must look at the options facing a firm earning a small economic loss (one that is less than the firm's fixed costs).

Basically, business owners are always trying to do one of two things: maximize profits or minimize losses. When price falls below the average cost of production, a firm goes into loss-minimizing mode. At any point, losses will be minimized by producing at the MC = MR quantity, unless at that level of output the total loss exceeds the TFC.

Remember, fixed costs must be paid whether the firm produces zero units or a million units. For this reason, a firm will actually minimize its losses by producing at a loss as long as that loss is less than TFC. Only when the losses experienced while operating at the MC = MR quantity become larger than the TFC should a firm close its doors and shut down.

A firm will minimize its total losses by shutting down if the price of its output is less than its average variable cost of production. In other words, if the firm's total losses exceed its total fixed costs, the firm will minimize its losses by shutting down.

Different levels of normal profit and the shut-down rule

The analysis so far presents a puzzle: if our assumptions about firms in a perfectly competitive market are true, and all firms face identical costs of production as the model suggests, then won't all firms begin experiencing losses that exceed their fixed costs simultaneously and thus choose to shut down all at once? This is a very good question, and the answer requires us to step outside our rigid assumptions of the perfectly competitive model and discuss this issue in a more real-world context.

In reality, firms in a perfectly competitive market do not face identical costs of production. Even if all firms pay the same hourly wages for workers, face the same costs for raw materials, rents and interest on land and capital, there is still one cost that will vary between any one producer and all others: the opportunity cost of the entrepreneur who runs the business. In economics, the opportunity cost of running a business is known as the normal profit. Some owners of brownie businesses will incorporate a higher expected level of normal profit into their costs of production than others. For this reason, firms that expect to earn higher normal returns in a particular market are more likely to shut down when earning losses than firms with a lower level of normal profit.

The firms whose owners value their time, energy and skills more than others will be the firms that exit an industry first in the face of economic losses. Firm-owners who believe their skills and energy would be less likely to earn profits in other industries are those most likely to ride out the storm of weak demand in the hope that, in the long run, the

equilibrium price of their product returns to a level at which a normal profit can be earned.

HL EXERCISES

15 Assume a firm in a perfectly competitive market is currently producing at a level of output at which it experiences the following costs and revenues:

- MC = 16
- P = 20
- ATC = 22
- AVC = 18
- Q = 50

At its current level of output, calculate this firm's economic profit or loss.

16 The firm is considering its options. For each of the following possibilities, explain whether the firm should or should not do it and why:

a keep output constant

b reduce output

c shut down

d increase output.

17 Assume that, at the profit-maximizing quantity, this firm's ATC = 21. Is the market in long-run equilibrium? Why or why not?

8.6 Efficiency in the perfectly competitive market

Learning outcomes

- Explain the meaning of the term allocative efficiency.
- Explain that the condition for allocative efficiency is P = MC (or, with externalities, MSB = MSC).
- Explain, using a diagram, why a perfectly competitive market leads to allocative efficiency in both the short run and the long run.
- Explain the meaning of the term productive/technical efficiency.
- Explain that the condition for productive efficiency is that production takes place at minimum average total cost.
- Explain, using a diagram, why a perfectly competitive firm will be productively efficient in the long run, though not necessarily in the short run.

Efficiency in economics is defined in two ways.

- **Productive efficiency**. This requires that the resources used to produce a good or service are used in the least-cost manner. A firm is productively efficient when it produces at its minimum ATC. Any level of output that corresponds with an ATC of production that is greater than the minimum ATC is indication that a firm is not achieving productive efficiency, since it is not producing in the least-cost manner.

  Productive efficiency is achieved when P = minimum ATC

- **Allocative efficiency**. This requires that the MC of production is equal to the price of the output. Prices, you will recall, are signals from consumers of the marginal benefit they derive from goods to the producers of those goods. If the price of a good is higher than the MC of firms producing it, the message is that society benefits more from the product than it costs firms to produce it. A greater quantity is demanded by the market when price exceeds MC. If the price of a product is less than the firms' MC of production, the message being sent by the market is that less output is desired. Only when a product's price is equal to the MC of producers is a market said to be allocatively efficient, meaning that the right amount of the good or service and the marginal benefit enjoyed by society are equal to the marginal cost incurred in its production.

  Allocative efficiency is achieved when $P = MC$

Productive efficiency in perfectly competitive markets

Firms in perfectly competitive markets are productively efficient when the market is in its long-run equilibrium state. This is due to the nature of competitive markets – competition forces price down to the firms' minimum ATC. Firms that are not productively efficient face one of two choices:

- produce in a manner that reduces the average cost of production to the lowest level possible (i.e. improve efficiency of production)
- experience economic losses and eventually be forced to shut down.

For illustration, let's examine a perfectly competitive industry and a firm in that industry when economic profits are being earned (Figure 8.16).

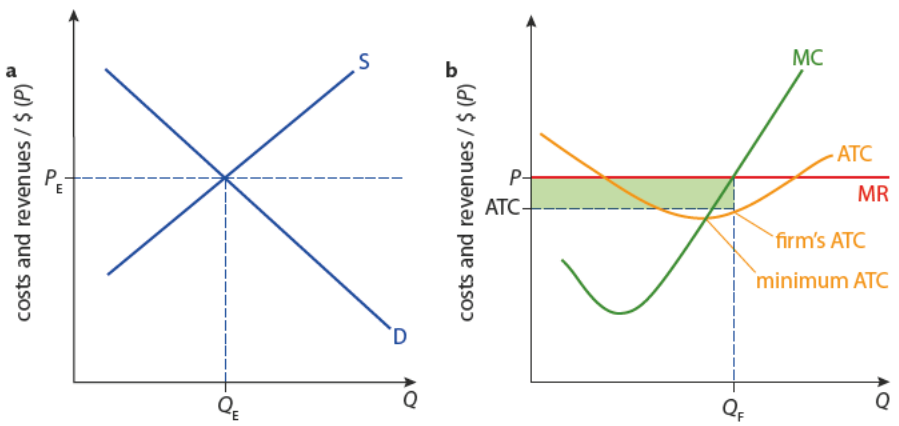

Figure 8.16
If profits are being earned, the firms are not productively efficient because price is greater than minimum ATC. **a** Perfectly competitive industry; **b** perfectly competitive firm.

The typical firm in Figure 8.16 is earning economic profits represented by the green rectangle. The firm is maximizing its profits by producing at the quantity at which its MC = MR. At Q_F this firm is *not* producing at maximum efficiency, since its ATC is greater than the minimum ATC of production. The high price and the existence of economic profits allow this firm to produce at a level greater than that required for productive efficiency, where its costs are minimized.

The industry is not in its long-run equilibrium, however, because economic profits are being earned. In the short run, firms in this industry can get away with producing at a productively inefficient level of output (Q_F). In the long run, however, the existence of profits will attract new firms, and due to the easy entry in this market, the market supply eventually increases and the equilibrium price falls. Figure 8.17 (overleaf) shows the effect on total market output and the output and profits for an individual firm.

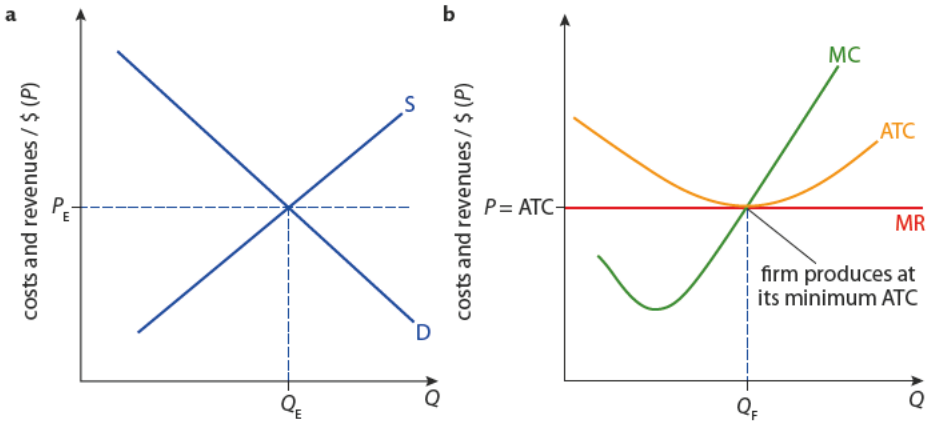

Figure 8.17
When firms are breaking even, they achieve productive efficiency because the price equals the minimum ATC. **a** perfectly competitive industry; **b** perfectly competitive firm.

Competition forces the price in the market down to the firm's minimum ATC. As MR and price fall, the firm reduces its output to maintain the profit-maximizing quantity where MR = MC. Once the market achieves its long-run equilibrium, at which individual firms are breaking even, the average total cost of the typical firm is minimized. The result is that due to the ease of entry and the existence of economic profits, perfect competition forces the price down to firms' minimum ATC, ensuring that, in the long run, firms in perfectly competitive markets are productively efficient.

If the firms were to continue to enter the market, the supply would increase again and price would fall below the firms' minimum ATC. In this case, economic losses would force some firms to exit until the price increased back to the break-even level. Only when economic profits are zero and the price of the product is equal to the typical firm's minimum ATC is a perfectly competitive industry in equilibrium.

Allocative efficiency in perfectly competitive markets

Efficiency means more than just producing in the least-cost manner. To be efficient, a market must also allocate the right amount of resources towards the production of the good or service it provides. Allocative efficiency occurs when land, labour and capital are allocated towards the production of goods and services in combinations that are socially optimal. In other words, the right amount of output of various products is being produced given the demands of consumers in the economy and the costs faced by firms.

Because of firms' profit-maximizing behaviour, perfectly competitive markets allocate resources efficiently, neither over nor under-producing the goods consumers demand.

Under the conditions of perfect competition, a market will be allocatively efficient as long as the firms in that market produce at the P = MC level of output. Price is a signal from buyers to sellers, and the price seen by firms signals the marginal benefit of consumers in the market. If the price consumers pay for a product is greater than the marginal cost to firms of producing it, then the message sent to producers is that more output is demanded. In the pursuit of profits, more resources will be allocated towards the production of the product until the MC and the price are equal. At the P = MC point, firms maximize their profits and resources are said to be efficiently allocated (Figure 8.18).

Assume that the firm in Figure 8.18b represents the typical firm in a perfectly competitive market. When firms produce at Q_1 level of output, resources are under-allocated towards this good, since the price consumers are willing to pay (P_E, determined by market supply

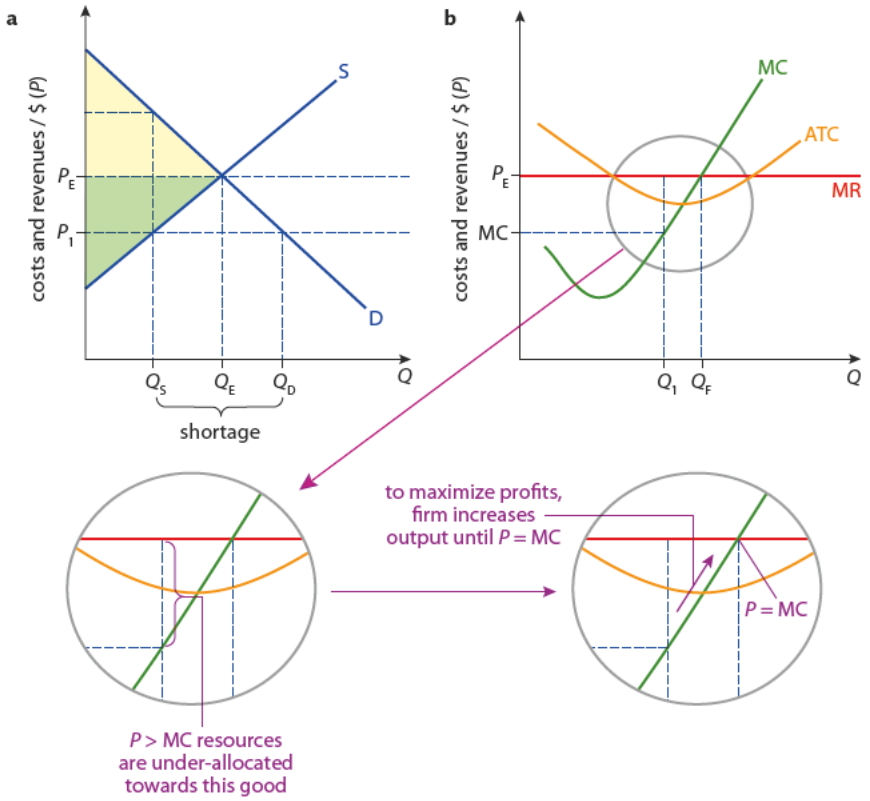

Figure 8.18
Profit-maximizing behaviour leads to allocative efficiency since firms produce where MR = MC = *P*. **a** Perfectly competitive industry; **b** perfectly competitive firm.

and demand) is greater than firms' marginal cost of production. Notice that when individual firms produce Q_1 units, the market supply of Q_S is less than the market demand of Q_D; there is a shortage in the industry as long as firms produce only Q_1 units.

However, firms are unlikely to produce at this socially undesirable level for long because in their pursuit of profits they will increase their output to the quantity at which marginal cost equals the price. When they increase their output to Q_F, firms maximize their profits and as a result the shortage in the market that existed when firms produced at Q_1 is eliminated, improving social welfare and maximizing the total amount of consumer and producer surplus (the combined areas of the yellow and green triangles in Figure 18.18a).

Because of the profit-maximizing behaviour of self-interested business managers in the competitive market above, resources are more efficiently allocated than they would be otherwise. The price determined by supply and demand in the market signals the benefit society derives from this good, and as long as the price is greater than the marginal cost, the message sent from buyers to seller is *'we want more!'* On the other hand, if at a given level of output marginal cost exceeds the price, resources are over-allocated towards the good. The message sent in such a market is that consumers value the product less than it costs firms to produce, so firms will reduce their output to maximize profits, correcting the over-allocation of resources and restoring a socially optimal level of output.

Allocative efficiency is achieved in a perfectly competitive market precisely because firms will always wish to maximize their profits by producing the quantity of goods at which their marginal cost equals the price.

To be efficient, the market price of a good must be equal to firms' marginal cost (allocative efficiency) and the minimum average total cost (productive efficiency). If price is greater than either of these, then firms in the market do not have the incentive to produce the socially optimal quantity of output nor to produce at the level at which their average total costs are minimized, thus resources will be under-allocated towards the good and resources will be used inefficiently by producers.

To learn more about efficiency, visit www.pearsonhotlinks.com, enter the title or ISBN of this book and select weblink 8.3.

In their pursuit of economic profits, firms in a competitive market will, through their collective pursuit of self-interest, inadvertently achieve an allocation of society's scarce resources that is socially optimal. Discuss the view that allocative efficiency as defined in this chapter is a socially desirable outcome. Is it accurate to say that goodness can be achieved through greediness in a market economic system?

CASE STUDY

Crops left to rot due to labour shortage

Thousands of acres of farm crops are being left to rot in fields due to a shortage of immigrant labour, forcing some farmers to consider switching crops.

From asparagus to berries and nuts, crops are going unpicked across the United States as tough anti-immigration laws have kept immigrant workers away.

Farmers across the country are turning away from growing fruit and vegetables to produce far less labour-intensive crops such as corn that is ripe for industrial farming.

Besides the crackdown on immigrant workers in states from Arizona to Alabama and South Carolina, the labour shortage appears to be systemic. Mexico has long been the primary provider of low-wage agricultural workers in the US, supplying nearly 70 per cent of the workforce. But, for a host of economic and educational reasons, many rural Mexicans are turning their backs on farm work.

The American Farm Bureau Federation (AFBF) blames the strict anti-immigration laws for multi-billion dollar losses to the agricultural industry each year. Fruit growers in particular are bearing the brunt of the labour shortage and are increasingly having to face up to a stark realisation: go out of business or switch from a berry harvest to an industrial crop such as corn that can be harvested by machine.

According to the California Farm Bureau, 71 per cent of tree fruit growers and nearly 80 per cent of raisin and berry growers were unable to find enough employees in 2014 to prune trees and vines or pick crops.

"The time is long overdue for our nation to have a comprehensive agricultural labour plan that works for all sectors of agriculture and across all regions of our nation," AFBF President Bob Stallman said.

To access Worksheet 8.3 on competition and farmers, please visit www.pearsonbacconline.com and follow the onscreen instructions.

HL EXERCISES

18 Assuming the market for berries is perfectly competitive, illustrate the effects of the shortage of immigrant workers on the short-run production costs and profits of berry growers in the American Southwest.

19 Based on your answer to question 1, explain how the berry market will change in the long run in response to the shortage of immigrant workers. How will the market for corn and other capital-intensive agricultural commodities be affected?

20 Assume the US berry market reaches a new long-run equilibrium following the shortage of immigrant labour. Now demand for berries increases. Use a diagram to illustrate how the profit-maximizing behaviour of berry grower farmers assures that there will not be a shortage of berries following the increase in consumers' demand.

As you learned at the beginning of this chapter, the existence of perfectly competitive markets in the real world is rare. Only certain industries fit the characteristics of the model, which requires a very large number of firms selling an identical commodity with easy entry and exit. The value in studying perfect competition lies in the lessons the model teaches us about the impact that competition has on efficiency in product markets. Although rare, perfectly competitive markets represent the most efficient models of competition. Because easy entry and exit allows for the number of firms, supply, and equilibrium price to adjust in the long run (based on the existence of economic profits or losses), perfect competition will always result in both allocative and productive efficiency.

In Chapters 9 and 10, you will examine the three remaining market structures: monopoly, monopolistic competition and oligopoly. Each of these has characteristics that differ from perfect competition, most significantly the number of firms is fewer and the barriers to entry are greater. These two characteristics mean that the less competitive markets are also less efficient, both productively and allocatively. Without the ease of entry and exit that characterizes perfectly competitive markets, the existence of economic profits will not necessarily lead to an increase in the output of the product in imperfectly competitive markets. This means that an under-allocation of resources towards such goods will not automatically be corrected. Furthermore, without the incentive to produce in the least-cost manner that the large number of firms in perfect competition creates, imperfectly competitive firms may find it in their best interest to produce at a level of output where the average total cost is not minimized, which means they are not productively efficient.

PRACTICE QUESTIONS

1 **a** Using a suitable diagram, explain the difference between short-run equilibrium and long-run equilibrium in perfect competition. (10 marks) [AO2]

b To what extent is the perfectly competitive market likely to exist in the real world? (15 marks) [AO3]

2 **a** Using a diagram, explain how allocative and productive efficiency will be achieved in long-run equilibrium in perfect competition. (10 marks) [AO2], [AO4]

b Evaluate the view that consumers, not producers, are the main beneficiaries of perfectly competitive market structures. (15 marks) [AO3]

3 **a** A firm in perfect competition is producing at the profit-maximizing output, but making a loss. Using diagrammatic analysis, explain how this is possible. (10 marks) [AO2], [AO4]

b Discuss the claim that all costs are identical among different firms in a perfectly competitive market. If this claim is correct, then why do some firms shut down before others when earning economic losses? (15 marks) [AO3]

To access Quiz 8, an interactive, multiple-choice quiz on this chapter, please visit www.pearsonbacconline.com and follow the onscreen instructions.