After studying this chapter, you will be able to:

- Define perfect competition
- Explain how a firm makes its output decision and why it sometimes shuts down temporarily and lays off its workers
- Explain how price and output are determined in a perfectly competitive market
- Explain why firms enter and leave a competitive market and the consequences of entry and exit
- Predict the effects of a change in demand and of a technological advance
- Explain why perfect competition is efficient

12 PERFECT COMPETITION

An Iowa corn farmer must make many decisions, but figuring out the price to charge for his corn is not one of them. Corn farmers must accept the price determined by supply and demand. The producers of most crops—among them wheat, rice, soybean, sugarbeet, and coffee—must also accept the prices that markets determine.

During the booming economic conditions of 2006 and 2007, crop prices and production soared. Then, following the global financial crisis of 2008 prices sagged, but for many crops production kept rising.

What are the forces that brought these changes in prices and production in the world's markets for farm products?

We're going to answer this question by studying competitive markets and building a model of a market in which competition is as fierce and extreme as possible. We call this situation *perfect* competition.

In *Reading Between the Lines* at the end of the chapter, we'll apply the model to the global market for corn and see how changes in demand and fortunate weather bring changes in prices and quantities produced in this key global agricultural market.

What Is Perfect Competition?

The firms that you study in this chapter face the force of raw competition. We call this extreme form of competition perfect competition. **Perfect competition** is a market in which

- Many firms sell identical products to many buyers.
- There are no restrictions on entry into the market.
- Established firms have no advantage over new ones.
- Sellers and buyers are well informed about prices.

Farming, fishing, wood pulping and paper milling, the manufacture of paper cups and shopping bags, grocery and fresh flower retailing, photo finishing, lawn services, plumbing, painting, dry cleaning, and laundry services are all examples of highly competitive industries.

How Perfect Competition Arises

Perfect competition arises if the minimum efficient scale of a single producer is small relative to the market demand for the good or service. In this situation, there is room in the market for many firms. A firm's *minimum efficient scale* is the smallest output at which long-run average cost reaches its lowest level. (See Chapter 11, p. 265.)

In perfect competition, each firm produces a good that has no unique characteristics, so consumers don't care which firm's good they buy.

Price Takers

Firms in perfect competition are price takers. A **price taker** is a firm that cannot influence the market price because its production is an insignificant part of the total market.

Imagine that you are a wheat farmer in Kansas. You have a thousand acres planted—which sounds like a lot. But compared to the millions of acres in Colorado, Oklahoma, Texas, Nebraska, and the Dakotas, as well as the millions more in Canada, Argentina, Australia, and Ukraine, your thousand acres are a drop in the ocean. Nothing makes your wheat any better than any other farmer's, and all the buyers of wheat know the price at which they can do business.

If the market price of wheat is $4 a bushel, then that is the highest price you can get for your wheat. Ask for $4.10 and no one will buy from you. Offer it for $3.90 and you'll be sold out in a flash and have given away 10¢ a bushel. You take the market price.

Economic Profit and Revenue

A firm's goal is to maximize *economic profit*, which is equal to total revenue minus total cost. Total cost is the *opportunity cost* of production, which includes *normal profit*. (See Chapter 10, p. 228.)

A firm's **total revenue** equals the price of its output multiplied by the number of units of output sold (price × quantity). **Marginal revenue** is the change in total revenue that results from a one-unit increase in the quantity sold. Marginal revenue is calculated by dividing the change in total revenue by the change in the quantity sold.

Figure 12.1 illustrates these revenue concepts. In part (a), the market demand curve, *D*, and market supply curve, *S*, determine the market price. The market price is $25 a sweater. Campus Sweaters is just one of many producers of sweaters, so the best it can do is to sell its sweaters for $25 each.

Total Revenue Total revenue is equal to the price multiplied by the quantity sold. In the table in Fig. 12.1, if Campus Sweaters sells 9 sweaters, its total revenue is $225 (9 × $25).

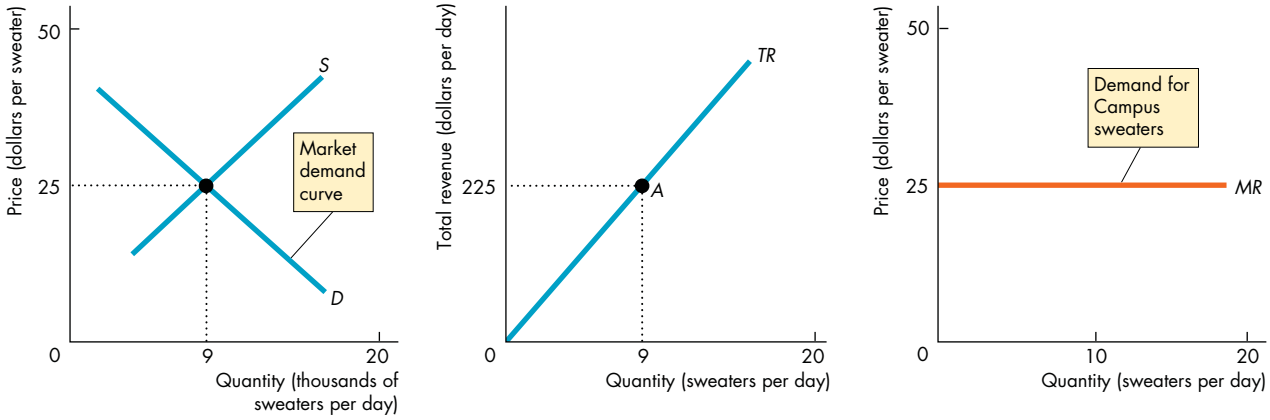
Figure 12.1(b) shows the firm's total revenue curve (*TR*), which graphs the relationship between total revenue and the quantity sold. At point *A* on the *TR* curve, the firm sells 9 sweaters and has a total revenue of $225. Because each additional sweater sold brings in a constant amount—$25—the total revenue curve is an upward-sloping straight line.

Marginal Revenue Marginal revenue is the change in total revenue that results from a one-unit increase in quantity sold. In the table in Fig. 12.1, when the quantity sold increases from 8 to 9 sweaters, total revenue increases from $200 to $225, so marginal revenue is $25 a sweater.

Because the firm in perfect competition is a price taker, the change in total revenue that results from a one-unit increase in the quantity sold equals the market price. *In perfect competition, the firm's marginal revenue equals the market price.* Figure 12.1(c) shows the firm's marginal revenue curve (*MR*) as the horizontal line at the market price.

Demand for the Firm's Product The firm can sell any quantity it chooses at the market price. So the demand curve for the firm's product is a horizontal line at the market price, the same as the firm's marginal revenue curve.

FIGURE 12.1 Demand, Price, and Revenue in Perfect Competition



(a) Sweater market **(b) Campus Sweaters' total revenue** **(c) Campus Sweaters' marginal revenue**

Quantity sold (*Q*) (sweaters per day)	Price (*P*) (dollars per sweater)	Total revenue ($TR = P \times Q$) (dollars)	Marginal revenue ($MR = \Delta TR/\Delta Q$) (dollars per additional sweater)
8	25	200	 25
9	25	225	 25
10	25	250	.....

In part (a), market demand and market supply determine the market price (and quantity). Part (b) shows the firm's total revenue curve (*TR*). Point *A* corresponds to the second row of the table—Campus Sweaters sells 9 sweaters at $25 a sweater, so total revenue is $225. Part (c) shows the firm's marginal revenue curve (*MR*). This curve is also the demand curve for the firm's sweaters. The demand for sweaters from Campus Sweaters is perfectly elastic at the market price of $25 a sweater.

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A horizontal demand curve illustrates a perfectly elastic demand, so the demand for the firm's product is perfectly elastic. A sweater from Campus Sweaters is a *perfect substitute* for a sweater from any other factory. But the *market* demand for sweaters is *not* perfectly elastic: Its elasticity depends on the substitutability of sweaters for other goods and services.

The Firm's Decisions

The goal of the competitive firm is to maximize economic profit, given the constraints it faces. To achieve its goal, a firm must decide

1. How to produce at minimum cost
2. What quantity to produce
3. Whether to enter or exit a market

You've already seen how a firm makes the first decision. It does so by operating with the plant that minimizes long-run average cost—by being on its long-run average cost curve. We'll now see how the firm makes the other two decisions. We start by looking at the firm's output decision.

REVIEW QUIZ

1. Why is a firm in perfect competition a price taker?
2. In perfect competition, what is the relationship between the demand for the firm's output and the market demand?
3. In perfect competition, why is a firm's marginal revenue curve also the demand curve for the firm's output?
4. What decisions must a firm make to maximize profit?

You can work these questions in Study Plan 12.1 and get instant feedback. myeconlab

The Firm's Output Decision

A firm's cost curves (total cost, average cost, and marginal cost) describe the relationship between its output and costs (see pp. 257–261). And a firm's revenue curves (total revenue and marginal revenue) describe the relationship between its output and revenue (p. 275). From the firm's cost curves and revenue curves, we can find the output that maximizes the firm's economic profit.

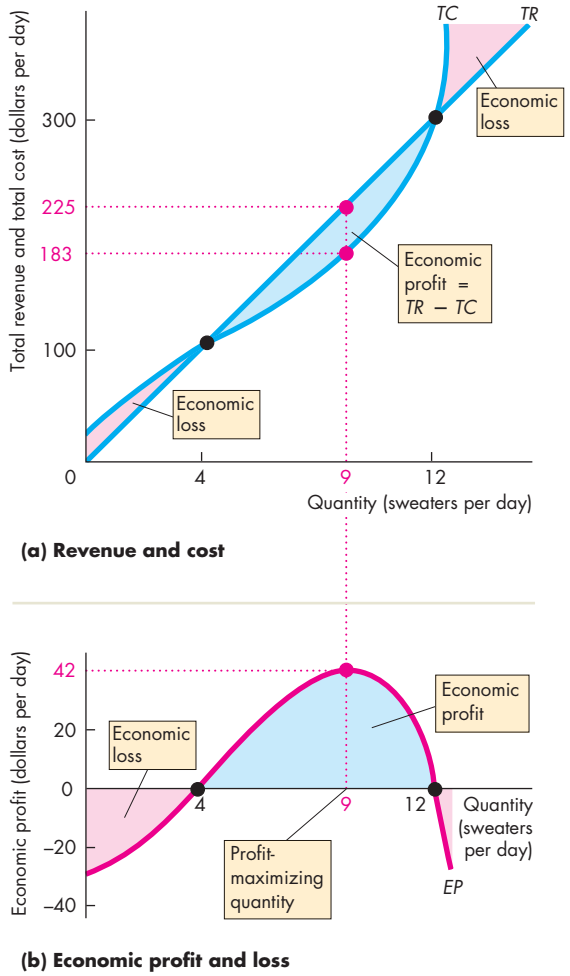
Figure 12.2 shows how to do this for Campus Sweaters. The table lists the firm's total revenue and total cost at different outputs, and part (a) of the figure shows the firm's total revenue curve, *TR*, and total cost curve, *TC*. These curves are graphs of numbers in the first three columns of the table.

Economic profit equals total revenue minus total cost. The fourth column of the table in Fig. 12.2 shows the economic profit made by Campus Sweaters, and part (b) of the figure graphs these numbers as its economic profit curve, *EP*.

Campus Sweaters maximizes its economic profit by producing 9 sweaters a day: Total revenue is $225, total cost is $183, and economic profit is $42. No other output rate achieves a larger profit.

At outputs of less than 4 sweaters and more than 12 sweaters a day, the Campus Sweaters would incur an economic loss. At either 4 or 12 sweaters a day, the Campus Sweaters would make zero economic profit, called a *break-even point*.

FIGURE 12.2 Total Revenue, Total Cost, and Economic Profit



Quantity (*Q*) (sweaters per day)	Total revenue (*TR*) (dollars)	Total cost (*TC*) (dollars)	Economic profit (*TR* – *TC*) (dollars)
0	0	22	–22
1	25	45	–20
2	50	66	–16
3	75	85	–10
4	100	100	0
5	125	114	11
6	150	126	24
7	175	141	34
8	200	160	40
9	**225**	**183**	**42**
10	250	210	40
11	275	245	30
12	300	300	0
13	325	360	–35

The table lists Campus Sweaters' total revenue, total cost, and economic profit. Part (a) graphs the total revenue and total cost curves and part (b) graphs economic profit.

Campus Sweaters makes maximum economic profit, $42 a day ($225 – $183), when it produces 9 sweaters a day. At outputs of 4 sweaters and 12 sweaters a day, Campus Sweaters makes zero economic profit—these are break-even points. At outputs less than 4 sweaters and greater than 12 sweaters a day, Campus Sweaters incurs an economic loss.

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Marginal Analysis and the Supply Decision

Another way to find the profit-maximizing output is to use marginal analysis, which compares marginal revenue, *MR*, with marginal cost, *MC*. As output increases, the firm's marginal revenue is constant but its marginal cost eventually increases.

If marginal revenue exceeds marginal cost (*MR* > *MC*), then the revenue from selling one more unit exceeds the cost of producing it and an increase in output increases economic profit. If marginal revenue is less than marginal cost (*MR* < *MC*), then the revenue from selling one more unit is less than the cost of producing that unit and a *decrease* in output *increases* economic profit. If marginal revenue equals marginal cost (*MR* = *MC*), then the revenue from selling one more unit equals the cost incurred to produce that unit. Economic profit is maximized and either an increase or a decrease in output decreases economic profit.

Figure 12.3 illustrates these propositions. If Campus Sweaters increases its output from 8 sweaters to 9 sweaters a day, marginal revenue ($25) exceeds marginal cost ($23), so by producing the 9th sweater economic profit increases by $2 from $40 to $42 a day. The blue area in the figure shows the increase in economic profit when the firm increases production from 8 to 9 sweaters per day.

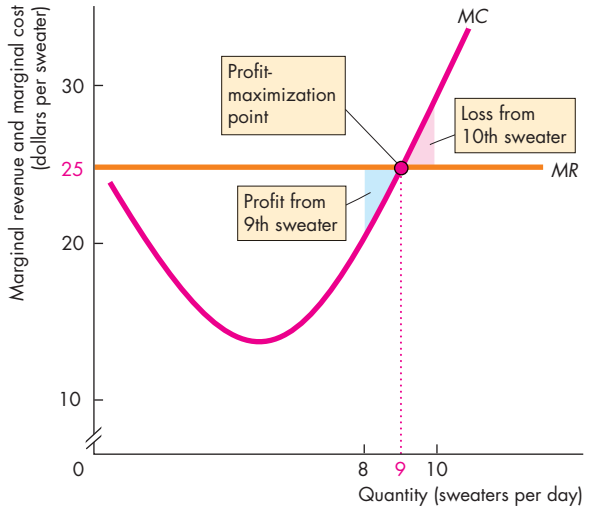
If Campus Sweaters increases its output from 9 sweaters to 10 sweaters a day, marginal revenue ($25) is less than marginal cost ($27), so by producing the 10th sweater, economic profit decreases. The last column of the table shows that economic profit decreases from $42 to $40 a day. The red area in the figure shows the economic loss that arises from increasing production from 9 to 10 sweaters a day.

Campus Sweaters maximizes economic profit by producing 9 sweaters a day, the quantity at which marginal revenue equals marginal cost.

A firm's profit-maximizing output is its quantity supplied at the market price. The quantity supplied at a price of $25 a sweater is 9 sweaters a day. If the price were higher than $25 a sweater, the firm would increase production. If the price were lower than $25 a sweater, the firm would decrease production. These profit-maximizing responses to different market prices are the foundation of the law of supply:

> Other things remaining the same, the higher the market price of a good, the greater is the quantity supplied of that good.

FIGURE 12.3 Profit-Maximizing Output



Quantity (*Q*) (sweaters per day)	Total revenue (*TR*) (dollars)	Marginal revenue (*MR*) (dollars per additional sweater)	Total cost (*TC*) (dollars)	Marginal cost (*MC*) (dollars per additional sweater)	Economic profit (*TR* – *TC*) (dollars)
7	175	25	141	19	34
8	200	25	160	23	40
9	**225**	25	**183**	**27**	**42**
10	250	25	210	35	40
11	275		245		30

The firm maximizes profit by producing the output at which marginal revenue equals marginal cost and marginal cost is increasing. The table and figure show that marginal cost equals marginal revenue and economic profit is maximized when Campus Sweaters produces 9 sweaters a day.
The table shows that if Campus Sweaters increases output from 8 to 9 sweaters, marginal cost is $23, which is less than the marginal revenue of $25. If output increases from 9 to 10 sweaters, marginal cost is $27, which exceeds the marginal revenue of $25. If marginal revenue exceeds marginal cost, an increase in output increases economic profit. If marginal revenue is less than marginal cost, an increase in output decreases economic profit. If marginal revenue equals marginal cost, economic profit is maximized.

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Temporary Shutdown Decision

You've seen that a firm maximizes profit by producing the quantity at which marginal revenue (price) equals marginal cost. But suppose that at this quantity, price is less than average total cost. In this case, the firm incurs an economic loss. Maximum profit is a loss (a minimum loss). What does the firm do?

If the firm expects the loss to be permanent, it goes out of business. But if it expects the loss to be temporary, the firm must decide whether to shut down temporarily and produce no output, or to keep producing. To make this decision, the firm compares the loss from shutting down with the loss from producing and takes the action that minimizes its loss.

Loss Comparisons A firm's economic loss equals total fixed cost, *TFC*, plus total variable cost minus total revenue. Total variable cost equals average variable cost, *AVC*, multiplied by the quantity produced, *Q*, and total revenue equals price, *P*, multiplied by the quantity *Q*. So

$$\text{Economic loss} = TFC + (AVC - P) \times Q.$$

If the firm shuts down, it produces no output ($Q = 0$). The firm has no variable costs and no revenue but it must pay its fixed costs, so its economic loss equals total fixed cost.

If the firm produces, then in addition to its fixed costs, it incurs variable costs. But it also receives revenue. Its economic loss equals total fixed cost—the loss when shut down—plus total variable cost minus total revenue. If total variable cost exceeds total revenue, this loss exceeds total fixed cost and the firm shuts down. Equivalently, if average variable cost *exceeds* price, this loss exceeds total fixed cost and the firm *shuts down*.

The Shutdown Point A firm's **shutdown point** is the price and quantity at which it is indifferent between producing and shutting down. The shutdown point occurs at the price and the quantity at which average variable cost is a minimum. At the shutdown point, the firm is minimizing its loss and its loss equals total fixed cost. If the price falls below minimum average variable cost, the firm shuts down temporarily and continues to incur a loss equal to total fixed cost. At prices above minimum average variable cost but below average total cost, the firm produces the loss-minimizing output and incurs a loss, but a loss that is less than total fixed cost.

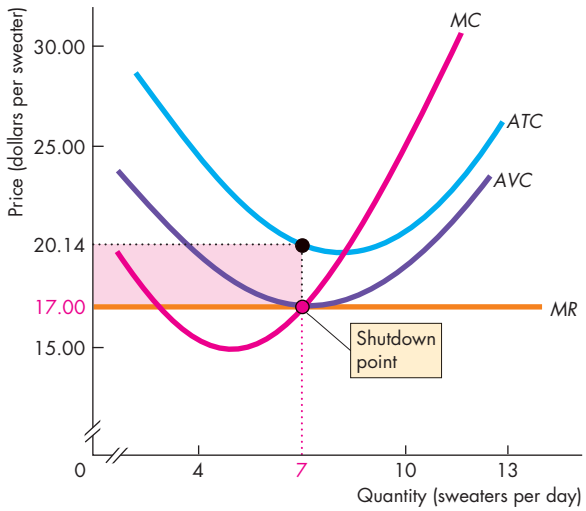
Figure 12.4 illustrates the firm's shutdown decision and the shutdown point that we've just described for Campus Sweaters.

The firm's average variable cost curve is *AVC* and the marginal cost curve is *MC*. Average variable cost has a minimum of $17 a sweater when output is 7 sweaters a day. The *MC* curve intersects the *AVC* curve at its minimum. (We explained this relationship between marginal cost and average cost in Chapter 11; see pp. 258–259.)

The figure shows the marginal revenue curve *MR* when the price is $17 a sweater, a price equal to minimum average variable cost.

Marginal revenue equals marginal cost at 7 sweaters a day, so this quantity maximizes economic profit (minimizes economic loss). The *ATC* curve shows that the firm's average total cost of producing 7 sweaters a day is $20.14 a sweater. The firm incurs a loss equal to $3.14 a sweater on 7 sweaters a day, so its loss is $22 a day, which equals total fixed cost.

FIGURE 12.4 The Shutdown Decision



The shutdown point is at minimum average variable cost. At a price below minimum average variable cost, the firm shuts down and produces no output. At a price equal to minimum average variable cost, the firm is indifferent between shutting down and producing no output or producing the output at minimum average variable cost. Either way, the firm minimizes its economic loss and incurs a loss equal to total fixed cost.

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The Firm's Supply Curve

A perfectly competitive firm's supply curve shows how its profit-maximizing output varies as the market price varies, other things remaining the same. The supply curve is derived from the firm's marginal cost curve and average variable cost curves. Figure 12.5 illustrates the derivation of the supply curve.

When the price *exceeds* minimum average variable cost (more than $17), the firm maximizes profit by producing the output at which marginal cost equals price. If the price rises, the firm increases its output—it moves up along its marginal cost curve.

When the price is *less than* minimum average variable cost (less than $17 a sweater), the firm maximizes profit by temporarily shutting down and producing no output. The firm produces zero output at all prices below minimum average variable cost.

When the price *equals* minimum average variable cost, the firm maximizes profit *either* by temporarily shutting down and producing no output *or* by producing the output at which average variable cost is a minimum—the shutdown point, *T*. The firm never produces a quantity between zero and the quantity at the shutdown point *T* (a quantity greater than zero and less than 7 sweaters a day).

The firm's supply curve in Fig. 12.5(b) runs along the *y*-axis from a price of zero to a price equal to minimum average variable cost, jumps to point *T*, and then, as the price rises above minimum average variable cost, follows the marginal cost curve.

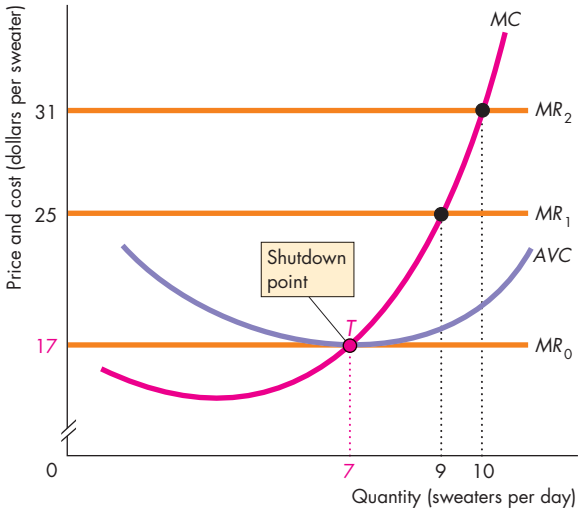
REVIEW QUIZ

1. Why does a firm in perfect competition produce the quantity at which marginal cost equals price?
2. What is the lowest price at which a firm produces an output? Explain why.
3. What is the relationship between a firm's supply curve, its marginal cost curve, and its average variable cost curve?

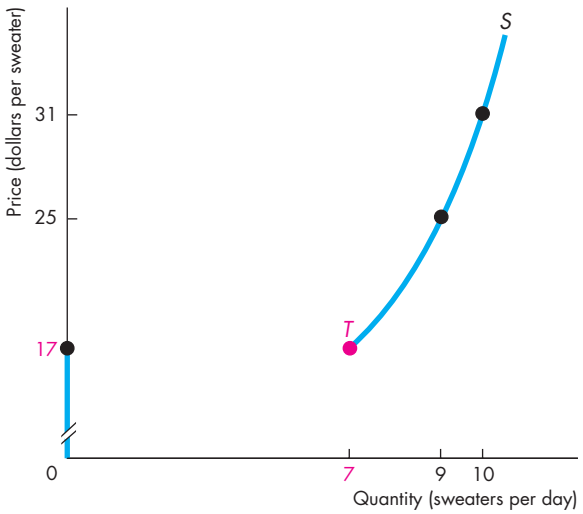
You can work these questions in Study Plan 12.2 and get instant feedback. myeconlab

So far, we've studied a single firm in isolation. We've seen that the firm's profit-maximizing decision depends on the market price, which it takes as given. How is the market price determined? Let's find out.

FIGURE 12.5 A Firm's Supply Curve



(a) Marginal cost and average variable cost



(b) Campus Sweaters' short-run supply curve

Part (a) shows the firm's profit-maximizing output at various market prices. At $25 a sweater, it produces 9 sweaters, and at $17 a sweater, it produces 7 sweaters. At all prices below $17 a sweater, Campus Sweaters produces nothing. Its shutdown point is *T*. Part (b) shows the firm's supply curve—the quantity of sweaters it produces at each price. Its supply curve is made up of the marginal cost curve at all prices above minimum average variable cost and the vertical axis at all prices below minimum average variable cost.

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Output, Price, and Profit in the Short Run

To determine the price and quantity in a perfectly competitive market, we need to know how market demand and market supply interact. We start by studying a perfectly competitive market in the short run. The short run is a situation in which the number of firms is fixed.

Market Supply in the Short Run

The **short-run market supply curve** shows the quantity supplied by all the firms in the market at each price when each firm's plant and the number of firms remain the same.

You've seen how an individual firm's supply curve is determined. The market supply curve is derived from the individual supply curves. The quantity supplied by the market at a given price is the sum of the quantities supplied by all the firms in the market at that price.

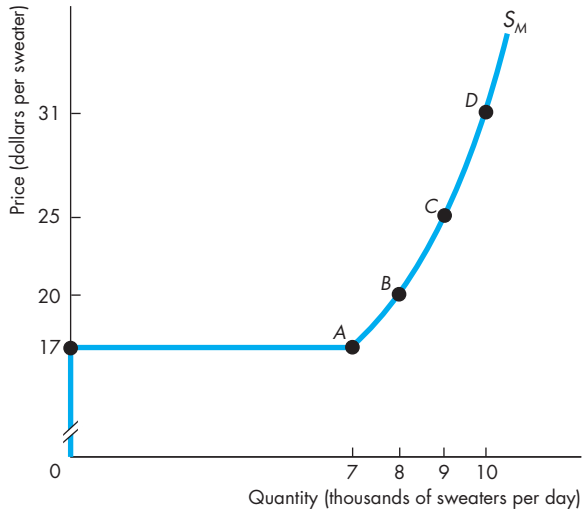
Figure 12.6 shows the supply curve for the competitive sweater market. In this example, the market consists of 1,000 firms exactly like Campus Sweaters. At each price, the quantity supplied by the market is 1,000 times the quantity supplied by a single firm.

The table in Fig. 12.6 shows the firm's and the market's supply schedules and how the market supply curve is constructed. At prices below $17 a sweater, every firm in the market shuts down; the quantity supplied by the market is zero. At $17 a sweater, each firm is indifferent between shutting down and producing nothing or operating and producing 7 sweaters a day. Some firms will shut down, and others will supply 7 sweaters a day. The quantity supplied by each firm is *either* 0 or 7 sweaters, and the quantity supplied by the market is *between* 0 (all firms shut down) and 7,000 (all firms produce 7 sweaters a day each).

The market supply curve is a graph of the market supply schedules and the points on the supply curve *A* through *D* represent the rows of the table.

To construct the market supply curve, we sum the quantities supplied by all the firms at each price. Each of the 1,000 firms in the market has a supply schedule like Campus Sweaters. At prices below $17 a sweater, the market supply curve runs along the *y*-axis. At $17 a sweater, the market supply curve is horizontal—supply is perfectly elastic. As the price rises above $17 a sweater, each firm increases its quantity supplied and the quantity supplied by the market increases by 1,000 times that of one firm.

FIGURE 12.6 Short-Run Market Supply Curve



	Price (dollars per sweater)	Quantity supplied by Campus Sweaters (sweaters per day)	Quantity supplied by market (sweaters per day)
A	17	0 or 7	0 to 7,000
B	20	8	8,000
C	25	9	9,000
D	31	10	10,000

The market supply schedule is the sum of the supply schedules of all the individual firms. A market that consists of 1,000 identical firms has a supply schedule similar to that of one firm, but the quantity supplied by the market is 1,000 times as large as that of the one firm (see the table). The market supply curve is S_M. Points *A*, *B*, *C*, and *D* correspond to the rows of the table. At the shutdown price of $17 a sweater, each firm produces either 0 or 7 sweaters a day and the quantity supplied by the market is between 0 and 7,000 sweaters a day. The market supply is perfectly elastic at the shutdown price.

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Short-Run Equilibrium

Market demand and short-run market supply determine the market price and market output. Figure 12.7(a) shows a short-run equilibrium. The short-run supply curve, *S*, is the same as S_M in Fig. 12.6. If the market demand curve is D_1, the market price is $20 a sweater. Each firm takes this price as given and produces its profit-maximizing output, which is 8 sweaters a day. Because the market has 1,000 identical firms, the market output is 8,000 sweaters a day.

A Change in Demand

Changes in demand bring changes to short-run market equilibrium. Figure 12.7 shows these changes.

If demand increases and the demand curve shifts rightward to D_2, the market price rises to $25 a sweater. At this price, each firm maximizes profit by increasing its output to 9 sweaters a day. The market output increases to 9,000 sweaters a day.

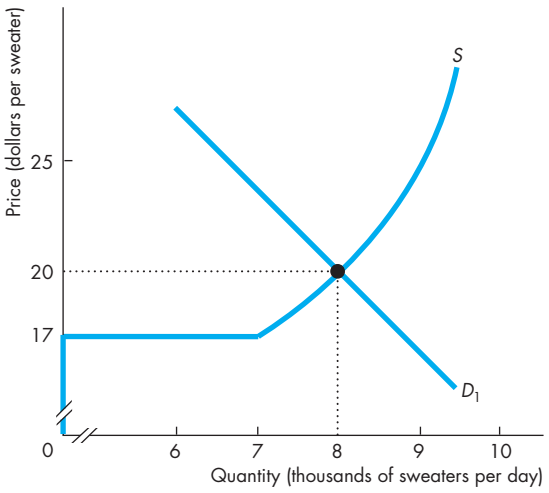
If demand decreases and the demand curve shifts leftward to D_3, the market price falls to $17. At this price, each firm maximizes profit by decreasing its output. If each firm produces 7 sweaters a day, the market output decreases to 7,000 sweaters a day.

If the demand curve shifts farther leftward than D_3, the market price remains at $17 a sweater because the market supply curve is horizontal at that price. Some firms continue to produce 7 sweaters a day, and others temporarily shut down. Firms are indifferent between these two activities, and whichever they choose, they incur an economic loss equal to total fixed cost. The number of firms continuing to produce is just enough to satisfy the market demand at a price of $17 a sweater.

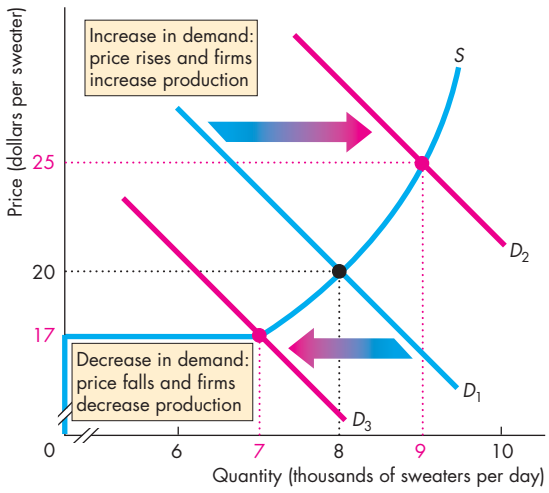
Profits and Losses in the Short Run

In short-run equilibrium, although the firm produces the profit-maximizing output, it does not necessarily end up making an economic profit. It might do so, but it might alternatively break even or incur an economic loss. Economic profit (or loss) per sweater is price, *P*, minus average total cost, *ATC*. So economic profit (or loss) is $(P - ATC) \times Q$. If price

FIGURE 12.7 Short-Run Equilibrium



(a) Equilibrium



(b) Change in equilibrium

In part (a), the market supply curve is *S* and the market demand curve is D_1. The market price is $20 a sweater. At this price, each firm produces 8 sweaters a day and the market produces 8,000 sweaters a day.

In part (b), if the market demand increases to D_2, the price rises to $25 a sweater. Each firm produces 9 sweaters a day and market output is 9,000 sweaters. If market demand decreases to D_3, the price falls to $17 a sweater and each firm decreases its output. If each firm produces 7 sweaters a day, the market output is 7,000 sweaters a day.

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equals average total cost, a firm breaks even—the entrepreneur makes normal profit. If price exceeds average total cost, a firm makes an economic profit. If price is less than average total cost, a firm incurs an economic loss. Figure 12.8 shows these three possible short-run profit outcomes for Campus Sweaters. These outcomes correspond to the three different levels of market demand that we've just examined.

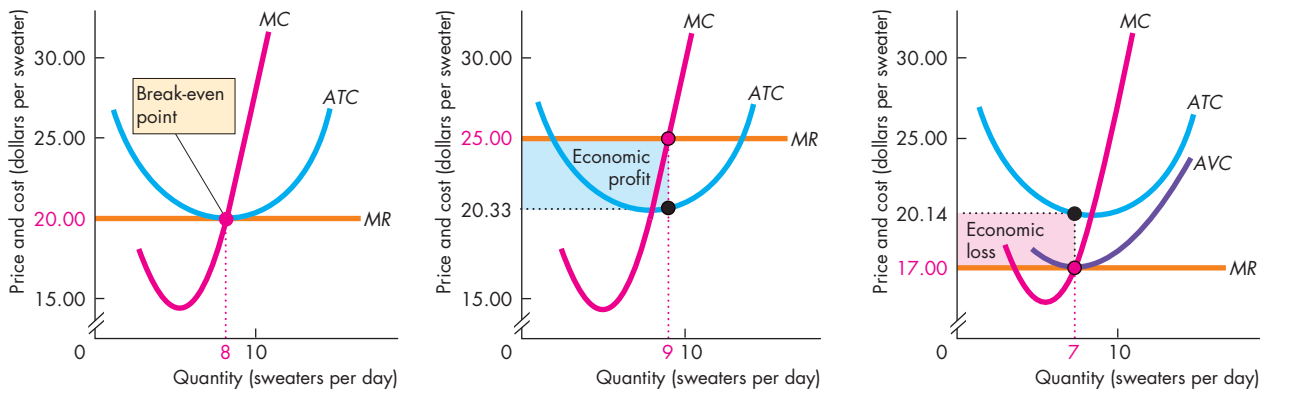
Three Possible Short-Run Outcomes

Figure 12.8(a) corresponds to the situation in Fig. 12.7(a) where the market demand is D_1. The equilibrium price of a sweater is $20 and the firm produces 8 sweaters a day. Average total cost is $20 a sweater. Price equals average total cost (*ATC*), so the firm breaks even (makes zero economic profit).

Figure 12.8(b) corresponds to the situation in Fig. 12.7(b) where the market demand is D_2. The equilibrium price of a sweater is $25 and the firm produces 9 sweaters a day. Here, price exceeds average total cost, so the firm makes an economic profit. Its economic profit is $42 a day, which equals $4.67 per sweater ($25.00 – $20.33) multiplied by 9, the profit-maximizing number of sweaters produced. The blue rectangle shows this economic profit. The height of that rectangle is profit per sweater, $4.67, and the length is the quantity of sweaters produced, 9 a day. So the area of the rectangle is economic profit of $42 a day.

Figure 12.8(c) corresponds to the situation in Fig. 12.7(b) where the market demand is D_3. The equilibrium price of a sweater is $17. Here, the price is less than average total cost, so the firm incurs an economic loss. Price and marginal revenue are $17 a sweater, and the profit-maximizing (in this case, loss-minimizing) output is 7 sweaters a day. Total revenue is $119 a day (7 × $17). Average total cost is $20.14 a sweater, so the economic loss is $3.14 per sweater ($20.14 – $17.00). This loss per sweater multiplied by the number of sweaters is $22. The red rectangle shows this economic loss. The height of that rectangle is economic loss per sweater, $3.14, and the length is the quantity of sweaters produced, 7 a day. So the area of the rectangle is the firm's economic loss of $22 a day. If the price dips below $17 a sweater, the firm temporarily shuts down and incurs an economic loss equal to total fixed cost.

FIGURE 12.8 Three Short-Run Outcomes for the Firm



(a) Break even **(b) Economic profit** **(c) Economic loss**

In the short run, the firm might break even (make zero economic profit), make an economic profit, or incur an economic loss. In part (a), the price equals minimum average total cost. At the profit-maximizing output, the firm breaks even and makes zero economic profit. In part (b), the market price is $25 a sweater. At the profit-maximizing output, the price exceeds average total cost and the firm makes an economic profit equal to the area of the blue rectangle. In part (c), the market price is $17 a sweater. At the profit-maximizing output, the price is below minimum average total cost and the firm incurs an economic loss equal to the area of the red rectangle.

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Economics in Action

Production Cutback and Temporary Shutdown

The high price of gasoline and anxiety about unemployment and future incomes brought a decrease in the demand for luxury goods including high-end motorcycles such as Harley-Davidsons.

Harley-Davidson's profit-maximizing response to the decrease in demand was to cut production and lay off workers. Some of the production cuts and layoffs were temporary and some were permanent.

Harley-Davidson's bike production plant in York County, Pennsylvania, was temporarily shut down in the summer of 2008 because total revenue was insufficient to cover total variable cost.

The firm also permanently cut its workforce by 300 people. This permanent cut was like that at Campus Sweaters when the market demand for sweaters decreased from D_1 to D_3 in Fig. 12.7(b).

REVIEW QUIZ

1. How do we derive the short-run market supply curve in perfect competition?
2. In perfect competition, when market demand increases, explain how the price of the good and the output and profit of each firm changes in the short run.
3. In perfect competition, when market demand decreases, explain how the price of the good and the output and profit of each firm changes in the short run.

You can work these questions in Study Plan 12.3 and get instant feedback.

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Output, Price, and Profit in the Long Run

In short-run equilibrium, a firm might make an economic profit, incur an economic loss, or break even. Although each of these three situations is a short-run equilibrium, only one of them is a long-run equilibrium. The reason is that in the long run, firms can enter or exit the market.

Entry and Exit

Entry occurs in a market when new firms come into the market and the number of firms increases. Exit occurs when existing firms leave a market and the number of firms decreases.

Firms respond to economic profit and economic loss by either entering or exiting a market. New firms enter a market in which existing firms are making an economic profit. Firms exit a market in which they are incurring an economic loss. Temporary economic profit and temporary economic loss don't trigger entry and exit. It's the prospect of persistent economic profit or loss that triggers entry and exit.

Entry and exit change the market supply, which influences the market price, the quantity produced by each firm, and its economic profit (or loss).

If firms enter a market, supply increases and the market supply curve shifts rightward. The increase in supply lowers the market price and eventually eliminates economic profit. When economic profit reaches zero, entry stops.

If firms exit a market, supply decreases and the market supply curve shifts leftward. The market price rises and economic loss decreases. Eventually, economic loss is eliminated and exit stops.

To summarize:

- New firms enter a market in which existing firms are making an economic profit.
- As new firms enter a market, the market price falls and the economic profit of each firm decreases.
- Firms exit a market in which they are incurring an economic loss.
- As firms leave a market, the market price rises and the economic loss incurred by the remaining firms decreases.
- Entry and exit stop when firms make zero economic profit.

A Closer Look at Entry

The sweater market has 800 firms with cost curves like those in Fig. 12.9(a). The market demand curve is *D*, the market supply curve is S_1, and the price is $25 a sweater in Fig. 12.9(b). Each firm produces 9 sweaters a day and makes an economic profit.

This economic profit is a signal for new firms to enter the market. As entry takes place, supply increases and the market supply curve shifts rightward toward S^*. As supply increases with no change in demand, the market price gradually falls from $25 to $20 a sweater. At this lower price, each firm makes zero economic profit and entry stops.

Entry results in an increase in market output, but each firm's output *decreases*. Because the price falls, each firm moves down its supply curve and produces less. Because the number of firms increases, the market produces more.

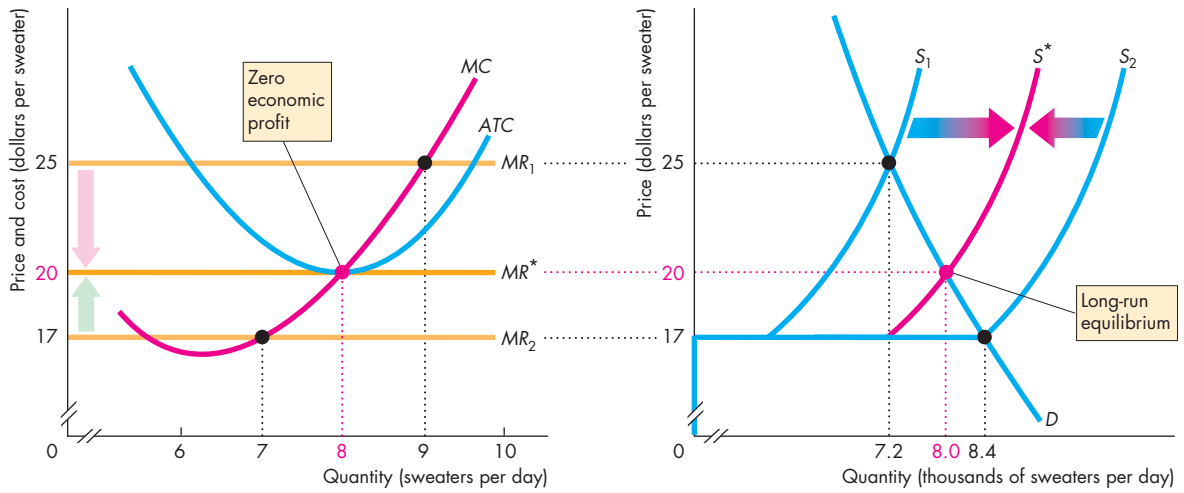
A Closer Look at Exit

The sweater market has 1,200 firms with cost curves like those in Fig. 12.9(a). The market demand curve is *D*, the market supply curve is S_2, and the price is $17 a sweater in Fig. 12.9(b). Each firm produces 7 sweaters a day and incurs an economic loss.

This economic loss is a signal for firms to exit the market. As exit takes place, supply decreases and the market supply curve shifts leftward toward S^*. As supply decreases with no change in demand, the market price gradually rises from $17 to $20 a sweater. At this higher price, losses are eliminated, each firm makes zero economic profit, and exit stops.

Exit results in a decrease in market output, but each firm's output *increases*. Because the price rises, each firm moves up its supply curve and produces more. Because the number of firms decreases, the market produces less.

FIGURE 12.9 Entry, Exit, and Long-Run Equilibrium



(a) Campus Sweaters

Each firm has cost curves like those of Campus Sweaters in part (a). The market demand curve is *D* in part (b).

When the market supply curve in part (b) is S_1, the price is $25 a sweater. In part (a), each firm produces 9 sweaters a day and makes an economic profit. Profit triggers the entry of new firms and as new firms enter, the market supply curve shifts rightward, from S_1 toward S^*. The price falls from $25 to $20 a sweater, and the quantity produced increases from 7,200 to 8,000 sweaters. Each firm's output decreases to 8 sweaters a day and economic profit falls to zero.

(b) The sweater market

When the market supply curve is S_2, the price is $17 a sweater. In part (a), each firm produces 7 sweaters a day and incurs an economic loss. Loss triggers exit and as firms exit, the market supply curve shifts leftward, from S_2 toward S^*. The price rises from $17 to $20 a sweater, and the quantity produced decreases from 8,400 to 8,000 sweaters. Each firm's output increases from 7 to 8 sweaters a day and economic profit rises to zero.

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Economics in Action

Entry and Exit

An example of entry and falling prices occurred during the 1980s and 1990s in the personal computer market. When IBM introduced its first PC in 1981, IBM had little competition. The price was $7,000 (about $16,850 in today's money) and IBM made a large economic profit selling the new machine.

Observing IBM's huge success, new firms such as Gateway, NEC, Dell, and a host of others entered the market with machines that were technologically identical to IBM's. In fact, they were so similar that they came to be called "clones." The massive wave of entry into the personal computer market increased the market supply and lowered the price. The economic profit for all firms decreased.

Today, a $400 computer is vastly more powerful than its 1981 ancestor that cost 42 times as much.

The same PC market that saw entry during the 1980s and 1990s has seen some exit more recently. In 2001, IBM, the firm that first launched the PC, announced that it was exiting the market. The intense competition from Gateway, NEC, Dell, and others that entered the market following IBM's lead has lowered the price and eliminated the economic profit. So IBM now concentrates on servers and other parts of the computer market.

IBM exited the PC market because it was incurring economic losses. Its exit decreased market supply and made it possible for the remaining firms in the market to make zero economic profit.

International Harvester, a manufacturer of farm equipment, provides another example of exit. For decades, people associated the name "International Harvester" with tractors, combines, and other farm machines. But International Harvester wasn't the only maker of farm equipment. The market became intensely competitive, and the firm began to incur economic losses. Now the firm has a new name, Navistar International, and it doesn't make tractors any more. After years of economic losses and shrinking revenues, it got out of the farm-machine business in 1985 and started to make trucks.

International Harvester exited because it was incurring an economic loss. Its exit decreased supply and made it possible for the remaining firms in the market to break even.

Long-Run Equilibrium

You've now seen how economic profit induces entry, which in turn eliminates the profit. You've also seen how economic loss induces exit, which in turn eliminates the loss.

When economic profit and economic loss have been eliminated and entry and exit have stopped, a competitive market is in *long-run equilibrium.*

You've seen how a competitive market adjusts toward its long-run equilibrium. But a competitive market is rarely *in* a state of long-run equilibrium. Instead, it is constantly and restlessly evolving toward long-run equilibrium. The reason is that the market is constantly bombarded with events that change the constraints that firms face.

Markets are constantly adjusting to keep up with changes in tastes, which change demand, and changes in technology, which change costs.

In the next sections, we're going to see how a competitive market reacts to changing tastes and technology and how it guides resources to their highest-valued use.

REVIEW QUIZ

1 What triggers entry in a competitive market? Describe the process that ends further entry.

2 What triggers exit in a competitive market? Describe the process that ends further exit.

You can work these questions in Study Plan 12.4 and get instant feedback.

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Changing Tastes and Advancing Technology

Increased awareness of the health hazards of smoking has decreased the demand for tobacco products. The development of inexpensive automobile and air transportation during the 1990s decreased the demand for long-distance trains and buses. Solid-state electronics has decreased the demand for TV and radio repair. The development of good-quality inexpensive clothing has decreased the demand for sewing machines. What happens in a competitive market when there is a permanent decrease in the demand for its product?

Microwave food preparation has increased the demand for paper, glass, and plastic cooking utensils and for plastic wrap. The Internet has increased the demand for personal computers and the widespread use of computers has increased the demand for high-speed connections and music downloads. What happens in a competitive market when the demand for its output increases?

Advances in technology are constantly lowering the costs of production. New biotechnologies have dramatically lowered the costs of producing many food and pharmaceutical products. New electronic technologies have lowered the cost of producing just about every good and service. What happens in a competitive market for a good when technological change lowers its production costs?

Let's use the theory of perfect competition to answer these questions.

A Permanent Change in Demand

Figure 12.10(a) shows a competitive market that initially is in long-run equilibrium. The demand curve is D_0, the supply curve is S_0, the market price is P_0, and market output is Q_0. Figure 12.10(b) shows a single firm in this initial long-run equilibrium. The firm produces q_0 and makes zero economic profit.

Now suppose that demand decreases and the demand curve shifts leftward to D_1, as shown in Fig. 12.10(a). The market price falls to P_1, and the quantity supplied by the market decreases from Q_0 to Q_1 as the market moves down along its short-run supply curve S_0. Figure 12.10(b) shows the situation facing a firm. The market price is now below the firm's minimum average total cost, so the firm incurs an economic loss. But to minimize its loss, the firm adjusts its output to keep marginal cost equal to price. At a price of P_1, each firm produces an output of q_1.

The market is now in short-run equilibrium but not long-run equilibrium. It is in short-run equilibrium because each firm is maximizing profit; it is not in long-run equilibrium because each firm is incurring an economic loss—its average total cost exceeds the price.

The economic loss is a signal for some firms to exit the market. As they do so, short-run market supply decreases and the market supply curve gradually shifts leftward. As market supply decreases, the price rises. At each higher price, a firm's profit-maximizing output is greater, so the firms remaining in the market increase their output as the price rises. Each firm moves up along its marginal cost or supply curve in Fig. 12.10(b). That is, as some firms exit the market, market output decreases but the output of the firms that remain in the market increases.

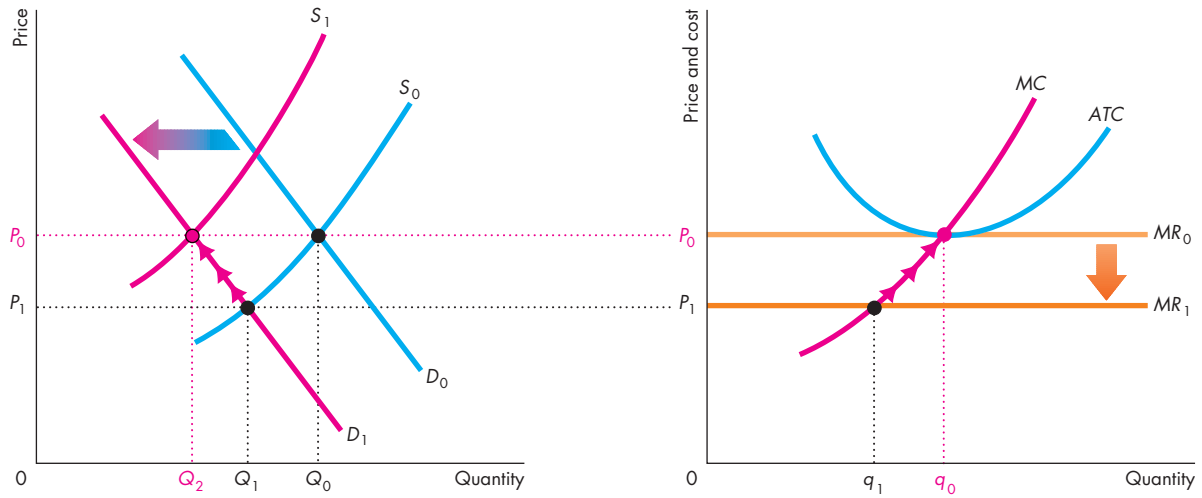
Eventually, enough firms have exited the market for the market supply curve to have shifted to S_1 in Fig. 12.10(a). The market price has returned to its original level, P_0. At this price, the firms remaining in the market produce q_0, the same quantity that they produced before the decrease in demand. Because firms are now making zero economic profit, no firm has an incentive to enter or exit the market. The market supply curve remains at S_1, and market output is Q_2. The market is again in long-run equilibrium.

The difference between the initial long-run equilibrium and the final long-run equilibrium is the number of firms in the market. A permanent decrease in demand has decreased the number of firms. Each firm remaining in the market produces the same output in the new long-run equilibrium as it did initially and makes zero economic profit. In the process of moving from the initial equilibrium to the new one, firms incur economic losses.

We've just worked out how a competitive market responds to a permanent *decrease* in demand. A permanent increase in demand triggers a similar response, except in the opposite direction. The increase in demand brings a higher price, economic profit, and entry. Entry increases market supply and eventually lowers the price to its original level and economic profit to zero.

The demand for Internet service increased permanently during the 1990s and huge profit opportunities arose in this market. The result was a massive rate

FIGURE 12.10 A Decrease in Demand



(a) Industry **(b) Firm**

A market starts out in long-run competitive equilibrium. Part (a) shows the market demand curve D_0, the market supply curve S_0, the market price P_0, and the equilibrium quantity Q_0. Each firm sells its output at the price P_0, so its marginal revenue curve is MR_0 in part (b). Each firm produces q_0 and makes zero economic profit.

Market demand decreases permanently from D_0 to D_1 in part (a) and the market price falls to P_1. Each firm decreases its output to q_1 in part (b), and the market output decreases to Q_1 in part (a). Firms now incur economic losses. Some firms exit the market, and as they do so, the market supply curve gradually shifts leftward, from S_0 toward S_1. This shift gradually raises the market price from P_1 back to P_0. While the price is below P_0, firms incur economic losses and some firms exit the market. Once the price has returned to P_0, each firm makes zero economic profit and has no incentive to exit. Each firm produces q_0, and the market output is Q_2.

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of entry of Internet service providers. The process of competition and change in the Internet service market is similar to what we have just studied but with an increase in demand rather than a decrease in demand.

We've now studied the effects of a permanent change in demand for a good. In doing so, we began and ended in a long-run equilibrium and examined the process that takes a market from one equilibrium to another. It is this process, not the equilibrium points, that describes the real world.

One feature of the predictions that we have just generated seems odd: In the long run, regardless of whether demand increases or decreases, the market price returns to its original level. Is this outcome inevitable? In fact, it is not. It is possible for the equilibrium market price in the long run to remain the same, rise, or fall.

External Economies and Diseconomies

The change in the long-run equilibrium price depends on external economies and external diseconomies. **External economies** are factors beyond the control of an individual firm that lower the firm's costs as the *market* output increases. **External diseconomies** are factors outside the control of a firm that raise the firm's costs as the *market* output increases. With no external economies or external diseconomies, a firm's costs remain constant as the market output changes.

Figure 12.11 illustrates these three cases and introduces a new supply concept: the long-run market supply curve.

A **long-run market supply curve** shows how the quantity supplied in a market varies as the market price varies after all the possible adjustments have been made, including changes in each firm's plant and the number of firms in the market.

Figure 12.11(a) shows the case we have just studied—no external economies or diseconomies. The long-run market supply curve (LS_A) is perfectly elastic. In this case, a permanent increase in demand from D_0 to D_1 has no effect on the price in the long run. The increase in demand brings a temporary increase in price to P_S and in the short run the quantity increases from Q_0 to Q_S. Entry increases short-run supply from S_0 to S_1, which lowers the price from P_S back to P_0 and increases the quantity to Q_1.

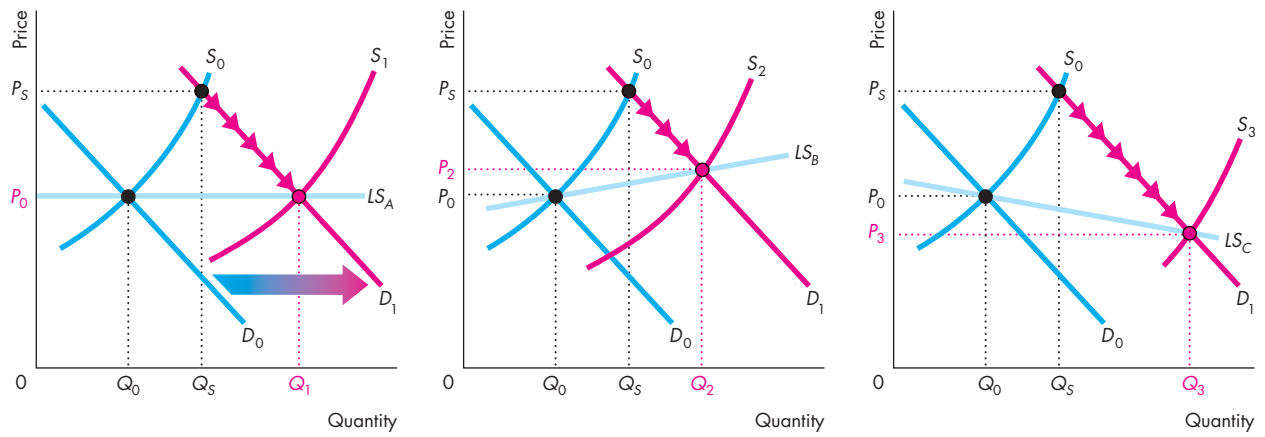
Figure 12.11(b) shows the case of external diseconomies. The long-run market supply curve (LS_B) slopes upward. A permanent increase in demand from D_0 to D_1 increases the price in both the short run and the long run. The increase in demand brings a temporary increase in price to P_S and in the short run the quantity increases from Q_0 to Q_S. Entry increases short-run supply from S_0 to S_2, which lowers the price from P_S to P_2 and increases the quantity to Q_2.

One source of external diseconomies is congestion. The airline market provides a good example. With bigger airline market output, congestion at both airports and in the air increases, resulting in longer delays and extra waiting time for passengers and airplanes. These external diseconomies mean that as the output of air transportation services increases (in the absence of technological advances), average cost increases. As a result, the long-run market supply curve is upward sloping. A permanent increase in demand brings an increase in quantity and a rise in the price. (Markets with external diseconomies might nonetheless have a falling price because technological advances shift the long-run supply curve downward.)

Figure 12.11(c) shows the case of external economies. The long-run market supply curve (LS_C) slopes downward. A permanent increase in demand from D_0 to D_1 increases the price in the short run and lowers it in the long run. Again, the increase in demand brings a temporary increase in price to P_S and in the short run the quantity increases from Q_0 to Q_S. Entry increases short-run supply from S_0 to S_3, which lowers the price to P_3 and increases the quantity to Q_3.

An example of external economies is the growth of specialist support services for a market as it expands.

FIGURE 12.11 Long-Run Changes in Price and Quantity



(a) Constant-cost industry **(b) Increasing-cost industry** **(c) Decreasing-cost industry**

Three possible changes in price and quantity occur in the long run. When demand increases from D_0 to D_1, entry occurs and the market supply curve shifts rightward from S_0 to S_1. In part (a), the long-run market supply curve, LS_A, is horizontal. The quantity increases from Q_0 to Q_1, and the price remains constant at P_0.

In part (b), the long-run market supply curve is LS_B; the price rises to P_2, and the quantity increases to Q_2. This case occurs in industries with external diseconomies. In part (c), the long-run market supply curve is LS_C; the price falls to P_3, and the quantity increases to Q_3. This case occurs in a market with external economies.

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As farm output increased in the nineteenth and early twentieth centuries, the services available to farmers expanded. New firms specialized in the development and marketing of farm machinery and fertilizers. As a result, average farm costs decreased. Farms enjoyed the benefits of external economies. As a consequence, as the demand for farm products increased, the output increased but the price fell.

Over the long term, the prices of many goods and services have fallen, not because of external economies but because of technological change. Let's now study this influence on a competitive market.

Technological Change

Industries are constantly discovering lower-cost techniques of production. Most cost-saving production techniques cannot be implemented, however, without investing in new plant and equipment. As a consequence, it takes time for a technological advance to spread through a market. Some firms whose plants are on the verge of being replaced will be quick to adopt the new technology, while other firms whose plants have recently been replaced will continue to operate with an old technology until they can no longer cover their average variable cost. Once average variable cost cannot be covered, a firm will scrap even a relatively new plant (embodying an old technology) in favor of a plant with a new technology.

New technology allows firms to produce at a lower cost. As a result, as firms adopt a new technology, their cost curves shift downward. With lower costs, firms are willing to supply a given quantity at a lower price or, equivalently, they are willing to supply a larger quantity at a given price. In other words, market supply increases, and the market supply curve shifts rightward. With a given demand, the quantity produced increases and the price falls.

Two forces are at work in a market undergoing technological change. Firms that adopt the new technology make an economic profit, so there is entry by new-technology firms. Firms that stick with the old technology incur economic losses. They either exit the market or switch to the new technology.

As old-technology firms disappear and new-technology firms enter, the price falls and the quantity produced increases. Eventually, the market arrives at a long-run equilibrium in which all the firms use the new technology and make a zero economic profit. Because in the long run competition eliminates economic profit, technological change brings only temporary gains to producers. But the lower prices and better products that technological advances bring are permanent gains for consumers.

The process that we've just described is one in which some firms experience economic profits and others experience economic losses. It is a period of dynamic change in a market. Some firms do well, and others do badly. Often, the process has a geographical dimension—the expanding new-technology firms bring prosperity to what was once the boondocks, and traditional industrial regions decline. Sometimes, the new-technology firms are in a foreign country, while the old-technology firms are in the domestic economy. The information revolution of the 1990s produced many examples of changes like these. Commercial banking, which was traditionally concentrated in New York, San Francisco, and other large cities now flourishes in Charlotte, North Carolina, which has become the nation's number three commercial banking city. Television shows and movies, traditionally made in Los Angeles and New York, are now made in large numbers in Orlando.

Technological advances are not confined to the information and entertainment industries. Even food production is undergoing a major technological change because of genetic engineering.

REVIEW QUIZ

1. Describe the course of events in a competitive market following a permanent decrease in demand. What happens to output, price, and economic profit in the short run and in the long run?
2. Describe the course of events in a competitive market following a permanent increase in demand. What happens to output, price, and economic profit in the short run and in the long run?
3. Describe the course of events in a competitive market following the adoption of a new technology. What happens to output, price, and economic profit in the short run and in the long run?

You can work these questions in Study Plan 12.5 and get instant feedback. myeconlab

We've seen how a competitive market operates in the short run and the long run, but is a competitive market efficient?