Introduction

Microeconomics assumes that consumers, in demanding goods, attempt to maximize their satisfaction. Furthermore, we assume that, in supplying goods, firms are concerned with profit maximization. In Chapter 8 we saw how supply and demand for a good determine a market price, given certain conditions (i.e., a supply curve and a demand curve). If either the demand curve or the supply curve shifts, or if both shift, we tend to get a new equilibrium price and quantity in that market.

This chapter uses supply-and-demand analysis and some new tools of economics to examine the decisions that individual firms make about what rate of output to produce—taking into account information from the market for their product and from the markets for the resources they use. We will develop a model of the firm in a competitive market. This model will demonstrate how profit maximization and competition theoretically produce Adam Smith’s “invisible hand.” That is, we will discover how competitive markets operate to allocate resources efficiently (to meet the most important demands of the society with the minimum amount of resources).

Profit Maximization and the Competitive Firm

In this section we will examine a particular market, concentrating our attention on the firm (developing a theory of the firm). This is a theoretical market, so we will state some definitions and make some assumptions about the behavior of the buyers and sellers in the market. As an example we will use the vast and expanding global market for personal computer software,
such as programs for word processing, games, database management, and Internet navigation.

The consumer is the economic unit that demands goods and/or services because they serve some purpose and give the consumer some satisfaction. Consumers in this example include businesses, professionals, homes, elementary/secondary schools and students, colleges and college students, and so on who have a particular need for the host of tasks performed by computers. The invention and development of transistors, miniaturized circuitry, and silicon chips led to the development of computing technology and a boom in the market for personal computers during the last two decades. Along with this market, the market for complementary products, including software, has expanded.

The firm is the economic unit that brings goods to the market. It takes raw materials and other resources and transforms them into final consumer goods. Its motivation, or goal, is to maximize its profits. In our example, the firm would be any company that produces and sells personal computer software. The firm could produce this computer software in the United States or some other country. And its market is truly a global one. Basically, there are two markets for PC software—for Apple’s Macintosh and for IBM PCs and their numerous clones (IBM compatibles).

If we put the firms and the consumers (the sellers and buyers) together, we have a market for personal computer software. We will assume that this is a competitive market, that is, one characterized by perfect competition. We define a perfectly competitive market as one having the following characteristics:

- The product is homogeneous.
- There is a large number of buyers and sellers in the market.
- No one buyer or seller can influence the price of the product. (A seller can’t raise his or her price, because buyers can go to a competitor and buy.)
- There is free entry into the market. (Anyone can be a buyer or seller. There are no constraints on entry.)
- There is no need for advertising (since every seller has the same product and charges the same price).
- Firms have all the information they need on resource prices, markets, and technology to make rational, profit-generating decisions.

In a perfectly competitive market, there is a market equilibrium price. Can you illustrate this market graphically?

1. Are any of these theoretical characteristics absent from the actual market for personal computer software in the United States? Why?

Let’s return to the firm. The firm’s objective is to maximize its profits. Profits equal the revenues the firm earns by selling its products minus the costs it incurs to produce those products:
profit = TR – TC,

where TR equals total revenue and TC equals total cost. **Total revenue** is equal to the quantity sold times the price of the product:

\[ TR = P \times Q. \]

The firm obtains revenues by selling its product. The greater the amount of personal computer software the firm sells, the more money it receives. In producing computer software and bringing it to market, the firm also has certain costs—labor, raw materials, depreciation, rent, interest payments on loans, and the firm’s opportunity cost. **Total cost** is the sum of all the costs of purchasing the necessary resources for production.

As in Chapter 7, we define the firm’s **opportunity cost** as the amount of money the firm could earn by using its facilities and its resources to produce something else profitably (such as computer programming services, business consulting, etc.). It would be the “next best use” of its resources. The firm has some expectation of a “normal profit” from doing business. The producer of personal computer software must earn at least its opportunity cost (a normal profit) to stay in the business of making computer software. Anything above that is **economic profit**.

If the firm’s revenues are just sufficient to cover all of its costs for raw materials, labor, and so on, and its opportunity cost, then the firm will earn no economic profits. For example, if the firm’s revenues were $100,000, its opportunity cost were $20,000, and the costs of all other resources were $80,000, it would earn zero economic profits. Its opportunity costs would be covered by the $20,000 of “normal” profits. If revenues exceed costs, then there will be economic profits; that is, the firm will earn a return over and above its opportunity cost. This gives us the following possibilities for the firm:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Profit Status</th>
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<tbody>
<tr>
<td>TR &gt; TC</td>
<td>Economic profit</td>
</tr>
<tr>
<td>TR = TC</td>
<td>Normal profit</td>
</tr>
<tr>
<td>TR &lt; TC</td>
<td>Economic loss</td>
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</tbody>
</table>

The firm’s revenues exceed all costs, including opportunity costs. The firm’s revenues equal its costs, including opportunity costs. The firm’s revenues do not cover all of its costs.

Profits, revenues, and costs for the firm will vary with the amounts of computer software produced and sold. For a firm in a competitive market, the price is determined by the market and will not vary with the number of units that the firm sells (see the third characteristic of a competitive market in the list given earlier). Costs, on the other hand, do vary with output, as we will see in the next section.

2. A small firm’s “normal profit” is $75,000 for one year. All of its other costs are $200,000. The firm’s revenue in one year is $300,000. What are its economic profits?
To study a typical firm's short-run costs, we will construct a hypothetical example for the costs of a small pizzeria. We will then apply these same concepts to a computer software firm.

Economists define the **short run** as the period in which some resources are fixed and others are variable, whereas in the **long run** all resources are variable. Firms can adjust some (variable) inputs such as labor and materials easily and quickly in the short run, but other (fixed) inputs can be adjusted only with difficulty and time—that is, in the long run. Fixed inputs cannot be changed in the short run in order to increase output. For example, to expand the size of its operations significantly, a pizzeria would need more land, a larger building, more pizza ovens, more delivery vehicles, and more. These inputs take time to purchase, build, and install, a process that cannot be done at a moment's notice. But on a monthly basis, the firm can change some other inputs quite easily. If our firm wants to increase its output of pizzas, it can hire another laborer or pay existing workers to work more hours, and it can purchase more cheese, sauce, and flour to make pizzas. Thus, labor and materials are considered to be variable inputs, since they can be adjusted easily in the short run. Land and capital (including buildings, machinery, and equipment) are considered fixed inputs because they cannot be adjusted in the short run.

With fixed and variable inputs, our firm also has some costs that are fixed and some costs that are variable. Therefore, in the short run, a firm's **total costs** \( TC \) are found by adding together total fixed costs \( TFC \) and total variable costs \( TVC \):

\[
TC = TFC + TVC.
\]

**Fixed Costs**

The **total fixed costs** are the total costs of the fixed inputs—things like rent, capital costs (payments on machinery purchased on credit or the opportunity cost of that machinery), and property taxes that the firm must pay regardless of how much it produces. Our pizzeria's fixed inputs are land and capital (the building, machinery, and equipment needed to produce pizzas, including pizza ovens, a cash register, tables and chairs, and a truck to deliver pizzas). Since fixed costs are, just that, fixed, they do not go up or down as the firm produces more. Thus, total fixed costs do not change.

In contrast, **average fixed cost**, which is equal to total fixed costs divided by quantity, declines as more is produced:

\[
AFC = \frac{TFC}{Q}.
\]

For example, assume our pizzeria has fixed costs each day of $50. If it produces only one pizza \( Q = 1 \), the average fixed costs would be $50/1 = $50. It would have to sell that pizza for more than $50 to make a profit. (Don’t forget, in addition to fixed costs, it would have to pay for variable costs such as labor, cheese, sauce, and flour.) However, if the firm produces ten pizzas,
then its average fixed costs fall to $50/10 = $5 per pizza. If the firm produces fifty pizzas, then the average fixed cost is $50/50 = $1. This gives us an average fixed cost curve that looks like the one in Figure 9.1. The more the firm produces, the lower its average fixed cost.

### Variable Costs

But our firm has more than just fixed costs to contend with. As we noted above, in addition to its fixed inputs such as land and capital, our firm must purchase variable inputs to produce its pizzas. Variable inputs would include labor and the materials necessary to produce pizzas. We will focus our analysis on labor, because it is the most important variable input. Without labor, no pizzas would get made.

Variable (labor) costs are subject to two basic economic laws: the **law of specialization** and the **law of diminishing returns**. The law of specialization refers to the fact that when laborers specialize in one particular task, they gain in skill and dexterity, and they spend less time switching jobs, which improves their efficiency. However, in the short run, when land and capital are fixed, the process of specialization is limited by the size of the firm. Only a certain number of specialized tasks can be done in a small pizzeria. Once the specialized jobs are filled, increasing the output of pizzas becomes increasingly difficult. This is when the law of diminishing returns sets in. According to the law of diminishing returns, in the production of any commodity, as more units of a variable factor of production are added to a fixed quantity of other factors of production, the amount that each additional unit of the variable factor adds to the total product will eventually begin to diminish. In other words, after the specialized jobs are filled, adding more and more labor while keeping other inputs fixed will result in smaller and smaller increases in output. Each laborer gets less efficient after specialization is exhausted.*

* It is important to note that the law of diminishing returns can apply to any variable input (not just labor), when all other inputs are held fixed. For example, if our pizzeria added more and more delivery trucks while keeping all other inputs the same, what would happen to output? Would adding a second delivery truck increase output per hour? What about a tenth delivery truck? (With the number of laborers constant, would there be anyone to drive it?)
To illustrate these fundamental processes of specialization and diminishing returns, suppose our pizzeria has the following fixed inputs: a small dining room with six tables and twenty-four chairs, one cash register, a small kitchen with two pizza ovens, and one truck to deliver pizzas. Suppose also that our firm has enough cheese, sauce, and flour to make as many pizzas as it wants (consider these to be fixed inputs as well for the time being). What will happen as the firm hires laborers at the going wage rate of $8 per hour?

Table 9.1 illustrates how the law of specialization and the law of diminishing returns affects the firm’s short-run costs. If our firm hires no laborers, then no pizzas will be produced. It will lose a lot of money, since it must still pay its fixed costs. If our firm hires one laborer for one hour, then that one laborer will have to make the pizzas, cook the pizzas, and deliver them to customers. If our one employee works hard, she can make and deliver six pizzas in an hour. Our one laborer \((L = 1)\) has produced six pizzas \((Q = 6)\) in an hour at a cost of $8 (the wage rate for one hour of work). This worker’s marginal product of labor \((MPL)\), the increase in output from hiring an additional laborer for an hour, is six pizzas. The marginal cost \((MC)\) of a pizza is the increase in cost from producing another pizza, which is equal to the change in total variable cost \((TVC)\) divided by the change in quantity:

\[
MC = \frac{\Delta TVC}{\Delta Q}.
\]

Firms are very concerned with marginal cost because once they know what each unit of output (each pizza) costs, they know what price they need to charge to make a profit on it. In this case, the change in total variable costs was $8 (the cost of hiring one employee for an hour), and the increase in the output of pizzas was six (the number of pizzas increased from zero to six). Thus, the marginal cost of each pizza when one laborer is working for an hour is equal to $8/6 = $1.33. Total variable cost is the cost of all variable inputs. Since we are employing one worker for one hour, our current total variable costs are $8.

Now suppose our pizzeria hires a second laborer to work alongside the first one for one hour. The laborers can now specialize in certain tasks. One labor-

<table>
<thead>
<tr>
<th>Number of Laborers ((L))</th>
<th>Quantity of Pizzas ((Q))</th>
<th>Marginal Product of Labor ((MPL = \Delta Q/\Delta L))</th>
<th>Total Variable Cost ((TVC = W \times L))</th>
<th>Marginal Cost of a Pizza ((MC = \Delta TVC/\Delta Q))</th>
<th>Average Variable Cost ((AVC = TVC/Q))</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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<tr>
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<td>8.00</td>
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<tr>
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<td>72.00</td>
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<td>1.60</td>
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<tr>
<td>10</td>
<td>44</td>
<td>—1</td>
<td>80.00</td>
<td>——</td>
<td>1.82</td>
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</tbody>
</table>
er can concentrate on making the pizzas, and the other can take telephone orders and deliver the pizzas. The two employees together can produce fourteen pizzas in an hour, more than double what one employee could produce on her own, because of specialization. The marginal product of the second laborer is 8, because the output of pizzas increased by eight when the second laborer was hired. The marginal cost of a pizza has fallen, due to specialization:

$$MC = \frac{\Delta TVC}{\Delta Q} = \frac{8}{8} = \$1.$$ 

Each pizza is now cheaper to produce because of the efficiency gains from specialization.

Hiring a third laborer will increase specialization (and efficiency) even further. Now one employee can make the pizzas, one person can take the orders and run the cash register, and one employee can deliver pizzas (in the process getting to know the town very well, which will improve delivery time). The output of pizzas increases to twenty-four per hour, and the marginal product of the third laborer is 10, because the output of pizzas increased from fourteen to twenty-four. The marginal cost of a pizza has fallen even further, to $8/10 = \$0.80$ (the $8$ increase in variable cost divided by 10, the increase in quantity).

However, now that the most important specialized tasks are taken, the law of diminishing returns sets in. Hiring additional laborers will increase the output of pizzas, but not by as much. Adding a fourth laborer will increase the output of pizzas to thirty-two, so the marginal product of labor declines back to 8, and the marginal cost of a pizza increases to $1.00. If the firm continues to hire laborers beyond this point, the marginal product of labor declines even further. Eventually, workers start getting in each other’s way, and they spend more time standing around and talking than working. The marginal product of the ninth laborer is 0; with a fixed size of operations (land and capital), there is nothing productive for a ninth laborer to do. Adding laborers beyond this would actually decrease output. Having too many workers in the small kitchen would prevent work from getting done.

Specialization and diminishing returns determine the shape of the firm’s marginal cost and average variable cost curves. As you can see from Table 9.1, as workers get more productive and the marginal product of labor increases, the marginal cost of a pizza declines. When diminishing returns set in and the marginal product of labor declines, the marginal cost of a pizza increases.

The shape of the marginal cost curve determines the shape of the average variable cost curve. Average variable cost (AVC) is equal to total variable cost (TVC) divided by quantity ($Q$):

$$AVC = \frac{TVC}{Q}.$$ 

At first, average variable cost is equal to marginal cost; the cost of the first pizza is also equal to the average cost of that pizza. Then, as the marginal cost of each pizza falls below the average variable cost, it pulls the average variable cost of each pizza down as the quantity of pizzas increases. This happens in Table 9.1 as the quantity of pizzas increases from zero to twenty-four; $MC < AVC$, and $AVC$ falls as quantity rises. When the marginal cost of each pizza
exceeds the average variable cost of a pizza, each additional pizza costs more than the average, and this pulls the average cost up. In Table 9.1, this occurs after a quantity of 32 pizzas. At a quantity of 32 pizzas, MC = AVC. After that point, MC > AVC, and AVC increases as more pizzas are produced.

Together, the law of specialization and the law of diminishing returns give us the marginal cost and average variable cost curves depicted in Figure 9.2. The curves decline at first because specialization improves efficiency and lowers costs. Subsequently, the law of diminishing returns kicks in and the curves increase because efficiency declines, resulting in higher costs.

**Average Cost**

Now we’re ready to construct the firm’s average cost curve. Recall that total costs are equal to total fixed costs plus total variable costs (TC = TFC + TVC). Similarly, average cost (AC) is equal to average fixed cost (AFC) plus average variable cost (AVC):

\[ AC = AFC + AVC. \]

If we take the average fixed cost curve from Figure 9.1 and add it to the average variable cost curve in Figure 9.2, we get our firm’s average cost curve, which is shown in Figure 9.3. Note that on the graph we do not need to show the average fixed cost curve. It can always be found by taking the difference between AC and AVC (AC = AVC = AFC). As you can see, the AC curve gets closer and closer to the AVC curve as quantity increases. This is because the difference between the AC curve and the AVC curve is average fixed cost (AFC), and as shown in Figure 9.1, AFC gets smaller and smaller as quantity increases.

The short-run average cost curve has a U shape because the average fixed cost curve declines, the average variable cost curve declines at first due to specialization, and the average variable cost curve increases eventually due to the law of diminishing returns. In Figure 9.3, AC falls quickly from a quantity of zero to a quantity of \( Q_1 \) because as quantity increases, both of its components (AFC and AVC) are falling. From \( Q_1 \) to \( Q_2 \), AC decreases slightly as quantity increases. This is because average fixed cost is falling faster than average.
variable cost is rising (the average variable cost curve increases after $Q_1$). After $Q_2$, AC rises because average variable cost is increasing faster than average fixed cost is falling.

Notice also that the minimum average cost occurs where the average cost curve intersects the marginal cost curve at quantity $Q_2$. The same process applies here as the one that applies to the average variable cost curve: when $MC < AC$, each unit costs less than the average, and the average falls as quantity increases. When $MC > AC$, each unit costs more than the average, so AC increases as quantity increases.

The point where average cost is at a minimum has significance for society as a whole. The level of output that minimizes the average cost of output is the most efficient rate of output. It means that society is minimizing the cost of using its resources with respect to the production of a good. In Figure 9.3, $Q_2$ represents an optimum level of output, because it minimizes the per-unit cost of producing that good. Raising or lowering output would increase average cost.

Now that we’ve analyzed the cost side of the firm, we need to study the revenue side in order to determine how much the firm should produce in any situation.

**The Firm’s Revenues**

Total revenue (TR), you’ll recall, equals the price of the product ($P$) multiplied by the quantity of the product sold ($Q$): $TR = P \times Q$. We can also define average revenue and marginal revenue for the firm. **Average revenue** (AR) is revenue per unit, which is equal to price:

$$AR = TR/Q = (P \times Q)/Q = P.$$  

**Marginal revenue** is the change in total revenue from producing and selling an additional unit of output:

$$MR = \text{(change in TR)/(change in } Q) = \Delta TR/\Delta Q.$$
For a firm in a perfectly competitive market, the price is determined in the market by the forces of supply and demand. The firm is so small a part of the market that it has no influence on the price. Thus, as far as the firm is concerned, the price is fixed, and the firm will earn the same amount of money for each unit sold. For the firm in a perfectly competitive market, \( MR = P \). If we were to draw this line on a graph, it would simply be a horizontal line that does not change as quantity changes, as displayed in Figure 9.4.

**Profit Maximization**

We are now ready to put the cost information and the revenue information together to describe how a typical firm decides to maximize profits in a perfectly competitive market. The firm’s objective is maximum profits (or minimum losses if the business climate is poor). What level of output should the firm produce to get the maximum level of profits? The answer is that the firm should produce as long as marginal revenue is greater than or equal to marginal cost. Therefore, the profit-maximizing quantity will occur where marginal revenue is equal to marginal cost (\( MR = MC \)).

The logic behind the profit maximization rule is quite simple. Every unit that generates more in revenue than it costs will improve the standing of the firm. For example, in Figure 9.5, the firm should produce all units up to \( Q_e \) because each unit adds more to the firm’s revenue than it costs the firm to produce. If the firm were to stop at \( Q_1 \), then it would lose the revenue from the sale of the units between \( Q_1 \) and \( Q_e \). However, the firm should not increase production beyond \( Q_e \). At \( Q_2 \), the firm is producing units that cost more to make than they generate in revenue, which would hurt the firm’s bottom line. The profit-maximizing quantity always occurs where marginal revenue is equal to marginal cost.

Although the quantity \( Q_e \) in Figure 9.5 represents the profit-maximizing or loss-minimizing level of output—the best the firm can possibly do—we don’t know how much the firm is making or losing until we add in the other
cost information for the firm. Specifically, we need to know the firm’s average cost at quantity $Q_e$. Recall that the firm earns a normal profit when total revenue (TR) equals total cost (TC). Since $TR = P \times Q$ and $TC = AC \times Q$, we can solve for $P$ when $TR = TC$:

$$P \times Q = AC \times Q$$

$$P = AC.$$

The firm earns a normal profit when the price of its product equals its average cost (including the cost of all inputs plus opportunity costs). Similarly, the firm earns an economic profit when $P > AC$, and it experiences an economic loss when $P < AC$.

3. Why do total costs and total variable costs increase at a decreasing rate at relatively low levels of output?

An Example of Profit Maximization in the Short Run

Let’s take a simple example of a small firm engaged in the production of computer software and use it to explore how firms maximize profits. The software firm is run by a group of individuals, leases a building outside of Chicago, and owns all of the furniture and equipment in its office. It has borrowed money from BankChicago to finance its business. In this sense, then, it has a certain size of operation for its short-run production expectations. Within this fixed plant size, it can expand its output of software by using more variable resources—that is, more raw materials and more labor. These variable resources can use the fixed plant more or less intensively to produce more or less output. (In the long run, as we will see shortly, all of the
resources that the firm uses in production can be expanded or contracted. That is, the firm can change the size of its operation.)

**Fixed and Variable Costs.** As we saw above, in the short run, the firm incurs both fixed and variable costs. Total fixed costs are the costs that the firm must pay for the fixed resources of production involved in the firm’s particular short-run plant size. These costs do not vary with the rate of output that the firm produces. The firm has a monthly mortgage payment that it gives to the bank to repay the loan it used to purchase its equipment for producing software. The owners of the firm also have an opportunity cost for their participation in the firm’s activities. In other words, the owners will get salaries based on what they could earn in some other activity. If these salaries weren’t paid, the owners would seek some other job in which they could earn their opportunity cost (e.g., as computer programmers). All of these costs are fixed costs; they are incurred by the firm regardless of the level of output in any particular month. Even if output is zero in the short run, fixed costs are still positive.

Let’s assume that the monthly fixed costs of a software firm are $10,000. Figure 9.6 illustrates total fixed costs (TFC), with costs measured on the vertical axis and output measured on the horizontal axis. It shows that as output (measured on the horizontal axis) increases, total fixed costs remain constant.
This firm’s total variable costs are the expenses for using varying amounts of raw materials and labor to expand output within a fixed-size plant (in the short run). To get greater amounts of output, the firm uses more and more variable resources; consequently, total variable costs increase as output increases. However, given the law of specialization, we know that at first, relatively few added resources will achieve expanded output, and that later, given the law of diminishing returns, the firm will have to add greater amounts of resources to get equivalent additions to output. Therefore, total variable costs will normally increase first at a decreasing rate, then at an increasing rate. Figure 9.6 illustrates what happens to total variable costs (TVC), measured on the vertical axis, as output increases. At rates of output below a quantity of 300, total variable costs increase at a decreasing rate, and at rates of output greater than 300, diminishing returns to the use of variable resources set in, and total variable costs increase at an increasing rate. At a rate of output of zero, total variable costs are zero.

If we add total fixed costs and total variable costs together, we again get the total costs (TC) of production:

\[
TC = TFC + TVC.
\]

Table 9.2 presents different possible levels of output during a one-month period for our software firm and the total fixed costs, total variable costs, and total costs of each level of output. Figure 9.6 illustrates total costs. Notice that when output is zero, total costs equal total fixed costs.

**Average and Marginal Costs.** We can also use this cost information to derive average and marginal costs. As we saw earlier, these cost measures will prove useful in analyzing the firm’s profit maximization decisions. Average cost takes the various total costs of production and averages them over each unit of output. For example, at 100 units of output, total fixed costs are
$10,000. The average fixed cost for each unit of output is $100. Recall that for each different level of output, average fixed cost is defined as follows:

$$\text{AFC} = \frac{\text{TFC}}{Q}.$$ 

In the same way, average variable cost is

$$\text{AVC} = \frac{\text{TVC}}{Q},$$

and average cost is

$$\text{AC} = \frac{\text{TC}}{Q}.$$ 

Since $\text{TC} = \text{TFC} + \text{TVC}$, then $\text{AC} = \text{AFC} + \text{AVC}$.

Marginal cost, again, is the additional cost of producing one additional unit of output. It indicates the amount of change in total costs as a result of additional output:

$$\text{MC} = \frac{\Delta \text{TC}}{\Delta Q} = \frac{\text{change in TC}}{\text{change in } Q}.$$ 

Since fixed costs do not change with the level of output, marginal costs can also be defined as the change in total variable costs as output changes. For example, when the firm moves from producing 100 units of output to 200 units of output, total costs increase from $20,000 to $28,000 (and total variable costs increase from $10,000 to $18,000). Consequently,

$$\text{MC} = \frac{28,000 - 20,000}{200 - 100} = \frac{8,000}{100} = 80.$$ 

The marginal cost of producing 100 more units of software (expanding to 200 from 100) is $8,000, or $80 for each unit. In essence, marginal cost equals the slope of the total costs (or total variable costs) curve in Figure 9.6. Since total costs first increase at a decreasing rate and then begin increasing at an increasing rate, MC will first decrease and then begin increasing.

As shown in Table 9.3, we can use the information in Table 9.2 to derive data on average fixed costs, average variable costs, average costs, and marginal costs. Figure 9.7 graphs the resulting data. AFC, AVC, AC, and MC all vary with the rate of output. In each case, costs are measured in per-unit or marginal terms. The horizontal axis always measures output, and the vertical axis measures average or marginal costs. Average fixed cost in Figure 9.7(a) constantly decreases, since it is total fixed cost divided by increasing rates of output. Average variable cost, shown in Figure 9.7(b), is generally U-shaped, reflecting the laws of specialization and diminishing returns. Over a range of output,
AVC decreases at first, reaches a minimum at $Q_1$, and then begins to increase for greater levels of output. At first, when there are increasing returns to the use of variable resources, the per-unit cost of production decreases as output increases. The per-unit amount of resources needed to produce increasing amounts of output decreases. However, beyond $Q_1$, AVC begins to increase as each unit of output requires the use of increasing amounts of variable resources. This, again, is the result of diminishing returns to the use of variable resources.

Average cost, also shown in Figure 9.7(b), is also U-shaped because of the laws of specialization and diminishing returns. Since AC is the sum of AFC and AVC, and AFC is positive and constantly decreasing, AC is above AVC, but the difference between them is constantly decreasing. AC reaches a minimum at the rate of output of $Q_2$. This is a slightly higher rate of output than

**TABLE 9.3** Software Firm’s Average and Marginal Costs

<table>
<thead>
<tr>
<th>Output</th>
<th>AFC = TFC/Q</th>
<th>AVC = TVC/Q</th>
<th>AC = TC/Q</th>
<th>MC = ∆TC/∆Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>100</td>
<td>$100</td>
<td>$100</td>
<td>$200</td>
<td>$100</td>
</tr>
<tr>
<td>200</td>
<td>50</td>
<td>90</td>
<td>140</td>
<td>80</td>
</tr>
<tr>
<td>300</td>
<td>33</td>
<td>80</td>
<td>113</td>
<td>60</td>
</tr>
<tr>
<td>400</td>
<td>25</td>
<td>85</td>
<td>110</td>
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<td>92</td>
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<td>120</td>
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<tr>
<td>600</td>
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<td>100</td>
<td>117</td>
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<td>14</td>
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<td>180</td>
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<tr>
<td>900</td>
<td>11</td>
<td>127</td>
<td>138</td>
<td>200</td>
</tr>
<tr>
<td>1,000</td>
<td>10</td>
<td>146</td>
<td>156</td>
<td>220</td>
</tr>
</tbody>
</table>

Figure 9.7 Average Fixed Costs (a), Average Variable Costs (b), Average Costs (b), and Marginal Costs (b)
AVC is increasing, but because AFC is constantly decreasing, it takes a higher level of output for AC to begin increasing (where the effects of increasing AVC begin to outweigh the effects of decreasing AFC).

In Figure 9.7(b), marginal cost is also U-shaped due to the laws of specialization and diminishing returns. Since marginal costs register the additional costs of producing greater rates of output, rather than the per-unit costs, marginal costs will more dramatically illustrate the effects first of increasing returns and then of decreasing returns to the use of variable resources.

4. Explain how the law of diminishing returns causes the MC curve to be increasing beyond some rate of output.

5. Why is marginal cost equal to the slope of the total cost curve? What is the slope of the total cost curve?

6. If the Los Angeles Dodgers have a team batting average of .275 (that is, on the average they get 275 hits every 1,000 times they come to bat) and they acquire a new outfielder whose batting average is .298, what happens to the team batting average? What if they trade away two players with averages of .260 and .274 for one player with an average of .278?

7. Explain why the minimum point on the AC curve represents an optimum rate of output.

**Price and Profit.** Recall that, for a firm in a perfectly competitive market, the price is determined in the market by the forces of supply and demand. The firm gets the price of the product for every unit that it sells, so \( P = MR = AR \). If the price of a software program is $120, then the firm’s revenues per unit are $120, and its marginal revenues also are $120. Figure 9.8(a) illustrates total revenues,
and Figure 9.8(b) shows price and marginal revenue. These graphs show what happens to revenues, measured on the vertical axis, as output expands.

We are now ready to put the cost information and the revenue information together to describe the profit maximization decision of the PC software firm. Table 9.4 and Figure 9.9 provide information and an illustration of the firm’s profit maximization decision. Recall that we have assumed that the firm’s objective is to maximize its profits, that in the short run it has a fixed-size plant, that it has access to certain production techniques and technical knowl-

### Table 9.4 Data for a Firm’s Profit Maximization Decision

<table>
<thead>
<tr>
<th>Output</th>
<th>TC</th>
<th>AC</th>
<th>MC</th>
<th>TR</th>
<th>MR (and P)</th>
<th>Profit (or Loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$10,000</td>
<td>—</td>
<td>—</td>
<td>0</td>
<td>0</td>
<td>$–10,000</td>
</tr>
<tr>
<td>100</td>
<td>20,000</td>
<td>$200</td>
<td>$100</td>
<td>$12,000</td>
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<tr>
<td>200</td>
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<td>140</td>
<td>80</td>
<td>24,000</td>
<td>120</td>
<td>$–4,000</td>
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<tr>
<td>300</td>
<td>34,000</td>
<td>113</td>
<td>60</td>
<td>36,000</td>
<td>120</td>
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<tr>
<td>400</td>
<td>44,000</td>
<td>110</td>
<td>100</td>
<td>48,000</td>
<td>120</td>
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<tr>
<td>500</td>
<td>56,000</td>
<td>112</td>
<td>120</td>
<td>60,000</td>
<td>120</td>
<td>4,000</td>
</tr>
<tr>
<td>600</td>
<td>70,000</td>
<td>117</td>
<td>140</td>
<td>72,000</td>
<td>120</td>
<td>2,000</td>
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<tr>
<td>700</td>
<td>86,000</td>
<td>123</td>
<td>160</td>
<td>84,000</td>
<td>120</td>
<td>$–2,000</td>
</tr>
<tr>
<td>800</td>
<td>104,000</td>
<td>129</td>
<td>180</td>
<td>96,000</td>
<td>120</td>
<td>$–8,000</td>
</tr>
<tr>
<td>900</td>
<td>124,000</td>
<td>138</td>
<td>200</td>
<td>108,000</td>
<td>120</td>
<td>$–16,000</td>
</tr>
<tr>
<td>1,000</td>
<td>146,000</td>
<td>156</td>
<td>220</td>
<td>120,000</td>
<td>120</td>
<td>$–26,000</td>
</tr>
</tbody>
</table>

**Figure 9.9** Profit Maximization
edge, and that it can buy resources in markets for certain prices. What level of output could the firm produce to get the maximum level of profits? The answer is that the software firm will produce that rate of output at which the difference between TR and TC is greatest. This also happens to be the rate of output at which MC and MR are equal. When the marginal cost of producing one more unit of output is equal to the marginal revenue from selling one more unit, the firm maximizes its profits. This occurs at a quantity of 500 in Figure 9.9.

Table 9.4 and Figure 9.9 demonstrate why profits (or TR – TC) are maximized when MC = MR at 500 units of output. (In this numerical example, because we are increasing output in increments of 100, the marginal cost figure is actually an average of the marginal cost of producing each added 100 units of software. As a result, profits are maximized at both 400 and 500 units of output. The firm could pick either rate of output and maximize its profits—at $4,000. But since MR > MC at 400 units of output, the firm will expand to 500.) At higher rates of output, marginal costs are larger than marginal revenues, and profits decrease. At lower rates of output, marginal revenues exceed marginal costs, and the firm can increase its profits by producing and selling larger levels of output.

Notice that at a quantity of 500 in Figure 9.9, the price of the software is greater than the average cost of producing each unit. That is, for each unit, the revenue that the firm earns exceeds its cost. This is, in fact, profit per unit, since profit = TR – TC:

\[
\frac{\text{profit}}{Q} = \frac{\text{TR}}{Q} - \frac{\text{TC}}{Q}
\]

profit per unit = \( P - AC \).

As long as price exceeds average cost, the firm earns economic profits of \( Q(P - AC) \). Total profits are equal to the area of the shaded rectangle in Figure 9.9. If the price is below the average cost, however, the firm experiences losses. Does this conclusion fit the information in Table 9.4?

What we have just shown summarizes one of the most important results of the economic theory of the firm. A firm will maximize its profits when it produces a rate of output at which its marginal revenues equal its marginal costs. This is its equilibrium rate of output. If a firm expands its output to a point at which MC > MR, its profits decrease. What will it do in response? It will probably reduce its rate of output. The theoretical conclusion would seem to be borne out by what we would expect firms in the real world to do. They will tend to produce that rate of output at which MC = MR.

Figure 9.10 shows examples of a firm earning an economic profit, earning a normal profit, and incurring an economic loss. In each case, the equilibrium (profit-maximizing or loss-minimizing) level of output is found at the quantity where MR = MC. The profit or loss per unit is measured by the area between the price (or marginal revenue) curve and the average cost curve for the quantity produced. In Figure 9.10(a), \( P > AC \), and the shaded area represents an economic profit. In Figure 9.10(b), \( P = AC \), and the firm earns a normal profit. The graph has no shaded area for profit or loss, because a
Figure 9.10 A Perfectly Competitive Firm Earning an Economic Profit (a), Earning a Normal Profit (b), and Incurring an Economic Loss (c)
normal profit is already included in the costs of production. In Figure 9.10(c), \( P < AC \), and the firm earns an economic loss equal to the shaded area.

8. For our software firm, what happens to its profits if it reduces output from 500 to 300? What is the relationship between \( P \) and AC at this rate of output? What is the relationship between MC and MR?

9. For Figure 9.9, explain why profits increase if the firm moves from a quantity of 700 to lower levels of output.

10. Construct an AC curve with its own MC curve. What would the firm do if the price of its product passed through the point at which MC = AC? What level of output would it produce? What would its profits be? Would this firm be earning its opportunity costs?

11. From Table 9.4, if the firm produces 800 units of output, what are its profits? What is the relationship between \( P \) and AC? Between MR and MC?

The Firm in the Long Run

In the long run, the firm always has more options than in the short run. It can alter the size of its plant. It can change the technology it uses to produce its good or service. For PC software firms, if the market for the product expands or the firm thinks that it will, it can seek a larger factory to buy

Interior of a computer software store. (Mark Richards/PhotoEdit)
or rent, borrow more money so that it can purchase more machinery and equipment, hire more programmers, take on partners to expand the size of its operation, or relocate its operations to Mexico or elsewhere in the world. In the long run, the firm can vary all of its production resources; there are no fixed resources.

The long run is no specific period of time; rather, it is that time frame in which people make decisions based on the future. If a PC software firm expects its market to expand in the future, it will adjust for the long run. Or if it expects the market to begin to contract, it can make a different long-run adjustment. In addition, in the long run, firms can enter or leave the industry. The decision to enter or leave is a long-run investment decision for individuals and firms.

In essence, the firm can pick an infinite number of different possible short-run plant sizes in the long run. At any moment in time, the firm is in the short run; it has a fixed-size plant with fixed resources, and it has a corresponding short-run average cost curve. Given the long-run option of different possible plant sizes, the firm will obviously pick the plant size that minimizes the average cost of producing every different possible level of output. For example, in Figure 9.11, there are three different short-run average cost curves representing different possible plant sizes for different ranges of output. AC₁ represents the first size plant, AC₂ the second size plant, and AC₃ the third size plant. For Q₁, AC₁ minimizes the average cost of production. So if the firm wanted to produce Q₁, it would pick plant size 1. But if the firm wanted to produce Q₂, it would pick plant size 2, since this minimizes the average cost of that rate of output. Similarly, if it wanted to produce an even larger rate of output, say Q₃, it would pick plant size 3. Notice that this represents a long-run decision. The firm makes a choice of a plant size based on its expectations of or experiences with the market. The decision requires time to make arrangements for physical facilities, new and larger equipment, borrowing, and so forth. The firm generates its long-run average cost curve by picking the plant size that minimizes the cost of producing every possible rate of output. It is the heavy line in Figure 9.11.
When we assume that there is an infinite number of possible plant sizes for the firm to choose from, the firm’s typical long-run AC curve looks like the one in Figure 9.12. It is U-shaped just like the short-run AC curve (and has its own long-run marginal cost curve, LMC), but for different reasons. The short-run curve was U-shaped because of the laws of specialization and diminishing returns, which assumed that a firm increased output by applying variable resources to fixed resources. In the long run, however, there are no fixed resources; a firm expands output by using more of all resources. If that is the case, then why would long-run average costs (LAC) decrease over a range of output, reach a minimum at $Q_0$, and then begin to increase?

Economists attribute the shape of the LAC curve to economies and diseconomies of scale. As the firm adjusts its plant size, it alters the scale of its operations. At first, as the firm expands at relatively low levels of output, by building a larger plant, it can take greater advantage of specialization, division of labor, and more advanced technology. (If the pizzeria we analyzed earlier had a much larger kitchen, there would be many more specialized jobs.) The result is lower average costs. The firm experiences **economies of scale**. However, beyond some rate of output ($Q_0$ in Figure 9.12), the firm encounters difficulties in organizing the now larger operation. Coordination and communication make efficient production more difficult. Average costs begin to increase; it costs more to produce each unit of output. **Diseconomies of scale** have set in. As in the short run, the long-run marginal cost curve (LMC) in Figure 9.12 is below LAC while LAC is decreasing and above it while it is increasing.

The shape of the long-run average cost curve defines an optimum plant size. At the rate of output at which LAC is at a minimum, the firm picks the plant size that produces the rate of output at lowest average cost. The firm expands output and plant size throughout the range of economies of scale. At higher rates of output, LAC begins to increase because of diseconomies of scale. At $Q_0$, the firm produces a rate of output that minimizes the per-unit cost of production.
In fact, in the long run, in competitive industries, firms tend to produce a rate of output that minimizes long-run average costs. Competition forces them to do so.

12. If a firm experienced economies of scale over some range of output and then LAC was constant, what would its LAC curve look like? Does it seem reasonable to you that a firm could keep expanding and not encounter diseconomies of scale? If this happened, what would the optimum size plant be?

13. In Figure 9.12, \( Q_0 \) represents the optimum rate of output and the optimum plant size. Does the firm earn its opportunity costs if it gets a price equal to this level of average costs?

Competitive Markets in the Long Run

In this section, using the model that we developed for the individual firm, we will formulate a general model of the behavior of a competitive market. The analysis focuses on the long-run equilibrium for the firms in the industry and for the entire industry. Although we have concentrated on a single example, the model of a competitive market is intended to be generalizable to all competitive markets or to an entire economy that is competitive. We will also interpret the results of the long-run equilibrium for competitive markets.

In Figure 9.13, with a price of \( P_1 \), the firm will produce \( Q_1 \), since it is at this rate of output that \( MR = MC \). The price is determined in the competitive market for the firm’s product. This price is constant, and the firm has no effect on it. Hence, \( P = MR \), and the firm can produce as much as it wants at that price. The firm, of course, will produce \( Q_1 \), since that is where its profits are maximized. At \( Q_1 \), price exceeds \( AC \), so we know that the firm is earning economic profits.

But in the long run, if resources can earn above their opportunity costs, new firms will enter the industry in pursuit of economic profits. In other words, the existence of economic profits provides an incentive for other firms to enter the industry. If economic profits can be made, given the price in the
market for PC software and the average costs of production, new firms will enter that market and begin to produce and market their own products.

As new firms enter the market, however, the market supply curve shifts out to the right. There is an increase in supply because one of the determinants of supply has changed. This increase in supply, assuming the demand does not change, produces a lower price for software, say $P_2$ (see Figure 9.14). At $P_2$, the firm will pick a new rate of output, $Q_2$, at which MR = MC. But $P$ still exceeds AC, firms will continue to make economic profits (albeit smaller than before), and other new firms will enter the market. This further increases market supply and drives down the price of the product.

This process will continue until economic profits no longer exist to provide an incentive for new firms to enter the industry. This occurs at a price of $P_3$ in Figure 9.15. At this price, the firm picks $Q_3$, since that is where MR = MC. At this rate of output $P = AC$, so there are no economic profits. The firm is in equilibrium because it is producing the rate of output that maxi-
mizes its profits—even though this means zero economic profits. But the firm does earn what we called, at the beginning of this chapter, normal profits—that is, it covers all of its opportunity costs. The firm collects enough revenues to pay opportunity costs to all of its variable and fixed resources, including a return to the owners of the business equivalent to their opportunity costs. The firm earns as much from its involvement in this activity as it could earn doing anything else. If a firm cannot earn normal profits in the long run, it will exit the market.

**Competition and Efficiency**

The existence of economic profits encourages new firms to enter the industry until economic profits are eliminated. Firms choose a rate of output that maximizes their profits, which in long-run equilibrium equals zero economic profits, or normal profits. The industry is in equilibrium because there is no incentive for firms to enter or exit the industry. What are the consequences of this result in terms of a society's use of its scarce resources?

**Efficiency in production** occurs when the per-unit cost of production is minimized. The firm produces at the rate of output that minimizes AC. This means that the amount of resources used to produce each unit of output is minimized. Given resource scarcity, this is an attractive result of the operation of competitive markets. But note how this has happened. Because of competition and free entry, the firm has been forced to produce at the level of output that minimizes average cost! Competition, through the forces that we have analyzed, tends over time to result in efficient production. Firms tend to produce at the optimum level of output, minimizing the per-unit cost of production. So competition tends to produce efficiency.

What assumptions have we made? We assumed that $D$ stayed constant and that the cost curves did not change. With these simplifying assumptions, our analysis showed the tendency toward efficiency. Obviously, changes in the real world would make our analysis a bit more complicated, but the essential conclusion remains: Competitive markets tend to result in efficiency in the use of scarce resources.

14. Explain and show in an illustration what happens in our competitive market when the market price goes below $P_1$ in Figure 9.15. What happens to profits? What do the firms in the industry do? What happens to market supply? To market price? What is the new equilibrium?

15. Do you think that the model of long-run equilibrium—wherein profits attract entry, prices fluctuate, exit of firms is possible, and there is a tendency toward efficiency in production—applies to the example we have been using, the market for PC software? Why or why not? Can you think of some other markets that have demonstrated some of these same characteristics in recent years?

16. In the PC market itself, IBM and Apple have faced increasing competition from other PC producers. What has happened to the price of a PC over the past twenty years? What factors explain the price trend?
Another type of efficiency results from long-run equilibrium in competitive markets: **efficiency in resource allocation**. At the long-run equilibrium in Figure 9.15, $P_3$ equals minimum AC. But $P_3$ also equals MC at the equilibrium rate of output, $Q_3$. This is an important result. The price of a product measures the amount of money that people are just willing to spend to purchase one more unit of that good. In other words, the price provides a measure of the marginal benefit that people derive from purchasing a unit of the good or service. The MC of the good (shown by the LMC curve) measures the cost to society of getting additional units of the good. To get one more unit, resources must be paid their opportunity costs. A rate of output that equals the marginal cost to society of getting one more unit of a good with the marginal benefit that people get from consuming one more unit maximizes social welfare (with respect to the production of that good). It also implies that resources have been allocated efficiently, given the opportunity costs of resources and given consumers’ valuations of goods as shown by their prices.

To demonstrate this, let’s consider different rates of output in Figure 9.15. First, take any rate of output lower than $Q_3$. At all rates of output lower than $Q_3$, the price of the product exceeds LMC. As output expands, the marginal benefit from getting one more unit of the good is larger than the marginal cost to society of producing it. Expanding output, then, makes a positive contribution to the society’s welfare. The additional benefit exceeds the additional cost, so social welfare increases. More resources should be allocated to producing the good.

On the other hand, any rate of output greater than $Q_3$ results in MC exceeding $P$. The additional cost of producing one more unit is larger than the extra benefit from getting one more unit for consumers. Consequently, at rates of output above $Q_3$, social welfare decreases. To increase social welfare requires reducing the rate of output and allocating fewer resources to its production. Therefore, social welfare is maximized at a rate of output of $Q_3$ at which $P = MC$. This represents efficiency in resource allocation.

The long-run equilibrium tendency of competitive markets is to produce exactly this result! Competitive markets tend to produce efficiency in resource allocation.

Zero economic profits, production at lowest AC, and efficiency in resource allocation are all theoretical results of competitive markets. These results are brought about by the pursuit of profit by firms within the market and by the force of competition itself—the free entry and exit of firms to and from the market and in competition with one another for consumers.

Notice that we have again been using the phrase *tends to* in our analysis of the long-run equilibrium for a competitive market. We have been constructing a model of competition, a theory about how competitive markets work. Given the assumptions that we have made and the concepts that we have defined, we have determined the equilibrium result for competition. This does not mean that such equilibrium exists all the time for every competitive market, or that there won’t ever be any economic profits in competitive markets. What it does suggest, though, is that without disturbances (given our assumptions), there are some general tendencies in the operation of compe-
The system tends toward equilibrium. And even if it is disturbed—for example, by a change in consumers’ incomes or tastes and preferences, by a change in resource prices, or by technological advances—the model that we have developed will allow us to follow through the effects to determine what the new equilibrium will be. In fact, competition encourages adaptability and responsiveness to changes in consumers’ behavior.

The “Invisible Hand” and Consumer Sovereignty

What does all this have to do with the “invisible hand” and consumer sovereignty? Remember, Adam Smith’s notion of the invisible hand was that the market tends to promote social welfare. Consumer sovereignty means that the market follows the “dictates” of consumers, in terms of their tastes and preferences.

Markets and prices indicate to potential producers where profits can be made in the economy. If producers can produce a product at a lower average cost than the price at which they can sell it, then they can earn a profit. In addition, producers will attempt to maximize their profits. We can see immediately, then, that producers will probably try to lower their costs, because that increases their profits. Consumers also benefit from this because the price of the product will eventually be lowered due to the cost reduction.

The price reduction following a cost reduction may not be intuitively obvious, so let’s examine this theoretical conclusion in more detail. Suppose we have a software producer with an MC and MR graph that looks like Figure 9.16. MC represents the firm’s costs, and MR is determined by the market price for software. This firm then discovers a new and cheaper method of making its products. As a result, MC falls from MC1 to MC2 (each successive unit can now be brought to market for a lower marginal cost).

With the change in costs, the firm makes a new decision about the level of output to produce. Originally, profits were maximized at Q1; with the new marginal cost curve, the profit-maximizing level of production increases to Q2. (Since average costs also decrease, the firm also will make larger profits, since price is still the same and the firm is now producing more.) At first, the price stays the
same; the firm is so small in relation to the market that the additional amount brought to market is not noticeable and has no effect on market price. However, the firm does have larger profits (the AC curve would also shift down).

Eventually, other participants in the market notice the improvement this firm made and the extra profits it is earning as a result. These other suppliers begin to use the same or similar cost-reducing methods of production. In addition, the lure of economic profits (a return to the firm over and above opportunity costs) may induce some new firms to enter the market as sellers. (Again, a characteristic of a competitive market is free entry.) What does this do to market supply? It increases it; more software will be brought to market. Graphically, in Figure 9.17, we get a new supply curve, $S_2$; more units of software are brought to market at each possible price.

Consequently (note we have assumed that $D$ stays the same), the market price will decrease from $P_1$ to $P_2$. The cost reduction ended up also reducing the market price! This was brought about through the market and by competition. The market showed that profits could be made, and competition allowed new firms to enter the market. (Note that each producer's profits are lowered because of the price decrease, although each producer will still bring to market the amount that maximizes its profits. Show this using MR, MC, and AC curves.)

Although each producer (firm) is out to maximize its own profits, the market and competition have brought about a situation in which there is an incentive to lower costs and whereby prices are reduced when costs are. Consumers benefit as a result; they get their product for a lower price. The “invisible hand” lives (at least theoretically)! (Go back to Chapter 4 and review what Adam Smith had to say about the “invisible hand.”)

In addition, the market responds to consumers’ demands. This response is referred to as consumer sovereignty. For example, let’s assume that consumers come to regard PCs and software as necessities. This change in tastes and preferences (and the increase in the number of consumers in the market) tends to increase the demand for software. What effect do these changes have on the market price for software? Figure 9.18 shows that the price of software tends to increase. What assumption have we made in this illustra-
tion? (And is this a realistic assumption? What has happened in recent years in the software market on both sides of the market?)

With this increased price, the profits of software producers should increase, and they will produce increasing amounts of software. Consequently, the desires of consumers show up in the market and indicate to producers what to do with respect to production. If consumers want more software, the market will indicate that, and the producers will respond by producing more. This is consumer sovereignty. By extension, this process also has implications for resource use in the economy. When production of any good or service is expanded or contracted, the use of resources for that purpose will also increase or decrease.

17. Using Figure 9.18, if a reduction in resource costs allowed a software firm to lower its long-run average costs, show what the new long-run equilibrium would be for the firm and for the industry.

**Conclusion**

The competitive market model has some attractive results. Firms earn normal profits. There is a tendency toward an equilibrium at which entry and exit cease. The firms in the market produce a rate of output that minimizes average costs; there is efficiency in production. Output takes place at a rate that maximizes social welfare; when \( P = MC \), there is efficiency in resource allocation. If products are homogeneous, then there is no need to allocate resources to advertising. Competitive markets are adaptable. Whenever costs change, or supply and demand conditions change, firms register these changes and take them into account in making decisions in pursuit of maximizing their own profits. Since technological change can lower the firm’s costs, the firm always has an incentive to try to lower costs, because profits will increase (at least for a while). Competitive markets register the desires of consumers, and those desires guide production and the allocation of resources. The “invisible hand” will bring about cost and price reductions for consumers.
The competitive market system also links the interdependence of all economic agents in the whole economy. Markets for resources and products provide prices that people use as information in all of the decisions they make about what work they will do, what goods and services they will consume, what business activities they will pursue, and what resources firms will use. As a result of all of these decisions linked by the operation of markets, the scarce resources of society are allocated to meet the needs of people in that society. The competitive market system thus operates to solve the questions of what to produce, how to produce it, and how to distribute it. All of this occurs because of the existence of markets and of competition. Competition and markets guide resource allocation.

If every market were competitive (remember our definition of what that means), then the whole economy would be characterized by efficiency, the “invisible hand,” and consumer sovereignty in the long run. Stated differently, the competitive market model in theory produces efficiency, consumer sovereignty, and the “invisible hand.” As a result, there is no need for the government to be involved in the economy. If the competitive markets are allowed to operate freely and individuals are allowed to follow their maximizing opportunities, the best economic results are achieved. The competitive model, then, justifies a policy of laissez-faire.

Unfortunately, however, the model of competitive markets is not the same thing as the real economy. The theoretical results of the model of competition we have developed are certainly attractive. In fact, this theory is the basis of the argument that the capitalist system is the best economic system possible. It can be seen in innumerable advertisements from corporate America as well as the ideas of chambers of commerce and the National Association of Manufacturers. Many politicians use the argument to demonstrate their version of patriotism in search of support and votes. But the real world doesn’t always duplicate theory, and the results of the model cannot uncritically or without qualification be ascribed to the real world.

It is important to recognize the various ways in which the operation of the real economy departs from the model of competitive markets. Not all markets are, in fact, competitive. Corporations and labor unions, for example, have market power, can influence prices, and have been able to limit the effects of competition. Sometimes markets do not work at all; no one can make profits putting up street signs, for example. The calculation of profits by the firm does not take into account the external costs of production (such as pollution), an omission that can interfere with efficient resource allocation. The operation of resource markets can result in an unfair distribution of income. All of these results of the operation of the real economy limit the extent to which it produces the attractive results of the theoretical model of competition.

In the next four chapters, we will develop some economic theory that analyzes these problems in the operation of the real market system. We will also explore the response of public policy to the existence of these problems connected with the operation of the economy.
Review Questions

1. How accurate is this competitive model with respect to the current U.S. economy? Are its conclusions generally applicable to our economy? Why or why not?

2. Why are profits maximized when MR = MC? Can you explain this logically?

3. Do you think firms really do try to maximize their profits? Do they have other goals? Which are most important?

4. Give some examples of the law of diminishing returns in production. Specify which resources are variable and which ones are fixed.

5. Explain why economic profits cease to exist in competition in the long run (as a tendency). What is the implication of this? Why do firms stay in a market in which there are no profits?

6. In Table 9.4, show what happens if the price of software increases to $180. Fill in new TR, MR, and Profit columns. What rate of output will the firm choose? Why?

7. Illustrate (with cost and revenue curves) a firm making economic profits in the long run. Show the corresponding market-determined price.
   a. Assume (show) an increase in demand for the product (e.g., rugs imported from India). What happens to market price? What adjustments do the firms in the industry make?
   b. How will long-run equilibrium develop? Illustrate long-run equilibrium for the firm and the industry.

Web Links

- The only market that closely matches the model of perfect competition is that of agriculture. To see how a competitive market works in reality, visit the Economic Research Service of the U.S. Department of Agriculture, www.ers.usda.gov

- Instead of competing with each other, dairy farmers have banded together behind the “Got Milk?” advertising campaign. Using the analysis of competitive markets in this chapter, analyze why milk farmers advertise as a group instead of individually. Do you think this campaign is effective? Why or why not? To see some of this ad campaign, visit www.got-milk.com/ and www.whymilk.com

- The National Association of Manufacturers is a business group that consistently argues that unregulated markets function in ways similar to perfectly competitive markets. For their views on economic topics, visit www.nam.org

- You can investigate whether “consumer sovereignty” is actually the case in most markets by exploring the consumer resources available at www.consumer.gov

- E-commerce is becoming more competitive in some sectors as additional businesses develop a Web presence. Much of this is facilitated by the Electronic Commerce Resource Center, sponsored by the Department of Defense Joint Electronic Commerce Program Office. Visit their Web site at www.ecrc.ctc.com