

# Pure Monopoly

### Learning Objectives

- LO12.1** List the characteristics of pure monopoly.
- LO12.2** List and explain the barriers to entry that shield pure monopolies from competition.
- LO12.3** Explain how demand is seen by a pure monopoly.
- LO12.4** Explain how a pure monopoly sets its profit-maximizing output and price.
- LO12.5** Discuss the economic effects of monopoly.
- LO12.6** Describe why a monopolist might prefer to charge different prices in different markets.
- LO12.7** Distinguish between the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

We turn now from pure competition to pure monopoly, which is at the opposite end of the spectrum of industry structures listed in Table 10.1. You deal with monopolies more often than you might think. If you see the logo for Microsoft's Windows on your computer, you are dealing with a monopoly (or, at least, a near-monopoly). When you purchase certain prescription drugs, you are buying monopolized products. When you make a local telephone call, turn on your lights, or subscribe to cable TV, you may be patronizing a monopoly, depending on your location.

What precisely do we mean by pure monopoly, and what conditions enable it to arise and survive? How does a pure monopolist determine its profit-maximizing price and output? Does a pure monopolist achieve the efficiency associated with pure competition? If not, what, if anything, should the government do about it? A simplified model of pure monopoly will help us answer these questions. It will be the first of three models of imperfect competition.

## An Introduction to Pure Monopoly

**LO12.1** List the characteristics of pure monopoly.

**Pure monopoly** exists when a single firm is the sole producer of a product for which there are no close substitutes. Here are the main characteristics of pure monopoly:

- **Single seller** A pure, or absolute, monopoly is an industry in which a single firm is the sole producer of a specific good or the sole supplier of a service; the firm and the industry are synonymous.
- **No close substitutes** A pure monopoly's product is unique in that there are no close substitutes. The consumer who chooses not to buy the monopolized product must do without it.
- **Price maker** The pure monopolist controls the total quantity supplied and thus has considerable control over price; it is a *price maker* (unlike a pure competitor, which has no such control and therefore is a *price taker*). The pure monopolist confronts the usual downsloping product demand curve. It can change its product price by changing the quantity of the product it produces. The monopolist will use this power whenever it is advantageous to do so.
- **Blocked entry** A pure monopolist has no immediate competitors because certain barriers keep potential competitors from entering the industry. Those barriers may be economic, technological, legal, or of some other type. But entry is totally blocked in pure monopoly.
- **Nonprice competition** The product produced by a pure monopolist may be either standardized (as



with natural gas and electricity) or differentiated (as with Windows or Frisbees). Monopolists that have standardized products engage mainly in public

relations advertising, whereas those with differentiated products sometimes advertise their products' attributes.

### Examples of Monopoly

Examples of *pure* monopoly are relatively rare, but there are many examples of less pure forms. In most cities,

government-owned or government-regulated public utilities—natural gas and electric companies, the water company, the cable TV company, and the local telephone company—are all monopolies or virtually so.

There are also many “near-monopolies” in which a single firm has the bulk of sales in a specific market. Intel, for example, produces 80 percent of the central microprocessors used in personal computers. First Data Corporation, via its Western Union subsidiary, accounts for 80 percent of the market for money order transfers. Brannock Device Company has an 80 percent market share of the shoe sizing devices found in shoe stores. Wham-O, through its Frisbee brand, sells 90 percent of plastic throwing disks. Google executes nearly 70 percent of all U.S. Internet searches and consequently controls nearly 75 percent of all the revenue generated by search ads in the United States (see this chapter's Last Word).

Professional sports teams are, in a sense, monopolies because they are the sole suppliers of specific services in large geographic areas. With a few exceptions, a single major-league team in each sport serves each large American city. If you want to see a live Major League Baseball game in St. Louis or Seattle, you must patronize the Cardinals or the Mariners, respectively. Other geographic monopolies exist. For example, a small town may be served by only one airline or railroad. In a small, isolated community, the local barber shop, dry cleaner, or grocery store may approximate a monopoly. And in the skies above, airlines control the only Internet access that is available to the passengers flying on on their planes.

Of course, there is almost always some competition. Satellite television is a substitute for cable, and amateur softball is a substitute for professional baseball. The Linux operating system can substitute for Windows, and so on. But such substitutes are typically either more costly or in some way less appealing.

### Dual Objectives of the Study of Monopoly

Monopoly is worth studying both for its own sake and because it provides insights about the more common market structures of monopolistic competition and oligopoly (Chapter 13). These two market structures combine, in differing degrees, characteristics of pure competition and pure monopoly.

### Barriers to Entry

**LO12.2** List and explain the barriers to entry that shield pure monopolies from competition.

The factors that prohibit firms from entering an industry are called **barriers to entry**. In pure monopoly, strong

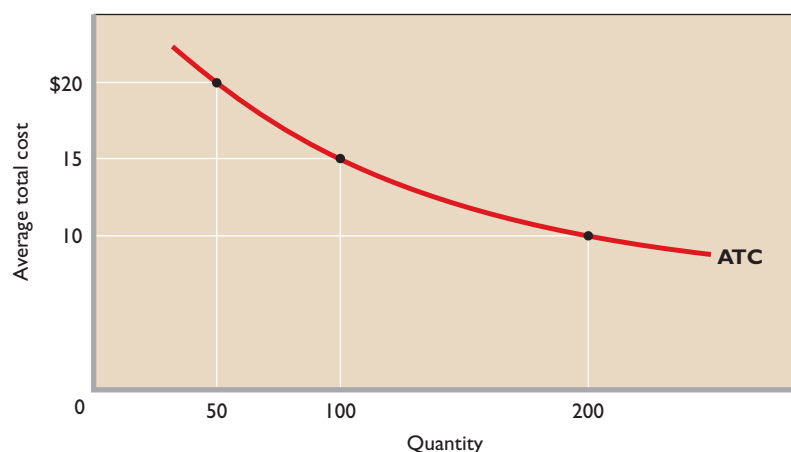
barriers to entry effectively block all potential competition. Somewhat weaker barriers may permit oligopoly, a market structure dominated by a few firms. Still weaker barriers may permit the entry of a fairly large number of competing firms giving rise to monopolistic competition. And the absence of any effective entry barriers permits the entry of a very large number of firms, which provide the basis of pure competition. So barriers to entry are pertinent not only to the extreme case of pure monopoly but also to other market structures in which there are monopoly-like characteristics or monopoly-like behaviors.

We now discuss the four most prominent barriers to entry.

## Economies of Scale

Modern technology in some industries is such that economies of scale—declining average total cost with added firm size—are extensive. In such cases, a firm's long-run average-cost schedule will decline over a wide range of output. Given market demand, only a few large firms or, in the extreme, only a single large firm can achieve low average total costs.

Figure 12.1 indicates economies of scale over a wide range of outputs. If total consumer demand is within that output range, then only a single producer can satisfy demand at least cost. Note, for example, that a monopolist can produce 200 units at a per-unit cost of \$10 and a total cost of \$2,000. If the industry has two firms and each produces 100 units, the unit cost is \$15 and total cost rises to \$3,000 (= 200 units  $\times$  \$15). A still more competitive situation with four firms each producing 50 units would boost unit and total cost to \$20 and \$4,000, respectively. Conclusion: When long-run ATC is declining, only a single producer, a monopolist, can produce any particular amount of output at minimum total cost.



**FIGURE 12.1 Economies of scale: the natural monopoly case.** A declining long-run average-total-cost curve over a wide range of output quantities indicates extensive economies of scale. A single monopoly firm can produce, say, 200 units of output at lower cost (\$10 each) than could two or more firms that had a combined output of 200 units.

If a pure monopoly exists in such an industry, economies of scale will serve as an entry barrier and will protect the monopolist from competition. New firms that try to enter the industry as small-scale producers cannot realize the cost economies of the monopolist. They therefore will be undercut and forced out of business by the monopolist, which can sell at a much lower price and still make a profit because of its lower per-unit cost associated with its economies of scale. A new firm might try to start out big, that is, to enter the industry as a large-scale producer so as to achieve the necessary economies of scale. But the massive expense of the plant facilities along with customer loyalty to the existing product would make the entry highly risky. Therefore, the new and untried enterprise would find it difficult to secure financing for its venture. In most cases the risks and financial obstacles to “starting big” are prohibitive. This explains why efforts to enter such industries as computer operating software, commercial aircraft, and household laundry equipment are so rare.

A monopoly firm is referred to as a *natural monopoly* if the market demand curve intersects the long-run ATC curve at any point where average total costs are declining. If a natural monopoly were to set its price where market demand intersects long-run ATC, its price would be lower than if the industry were more competitive. But it will probably set a higher price. As with any monopolist, a natural monopolist may, instead, set its price far above ATC and obtain substantial economic profit. In that event, the lowest-unit-cost advantage of a natural monopolist

### ORIGIN OF THE IDEA

012.2  
Natural  
monopoly



would accrue to the monopolist as profit and not as lower prices to consumers. That is why the government regulates some natural monopolies, specifying the price they may charge. We will say more about that later.

## Legal Barriers to Entry: Patents and Licenses

Government also creates legal barriers to entry by awarding patents and licenses.

**Patents** A *patent* is the exclusive right of an inventor to use, or to allow another to use, her or his invention. Patents and patent laws aim to protect the inventor from rivals who would use the invention without having shared in the effort and expense of developing it. At the same time, patents provide the inventor with a monopoly position for the life of the patent. The world's nations have agreed on a uniform patent length of 20 years from the time of application. Patents have figured prominently in the growth of modern-day giants such as IBM, Pfizer, Intel, Xerox, General Electric, and DuPont.

Research and development (R&D) is what leads to most patentable inventions and products. Firms that gain monopoly power through their own research or by purchasing the patents of others can use patents to strengthen their market position. The profit from one patent can finance the research required to develop new patentable products. In the pharmaceutical industry, patents on prescription drugs have produced large monopoly profits that have helped finance the discovery of new patentable medicines. So monopoly power achieved through patents may well be self-sustaining, even though patents eventually expire and generic drugs then compete with the original brand. (Chapter 11's Last Word has more on the costs and benefits of patents.)

**Licenses** Government may also limit entry into an industry or occupation through *licensing*. At the national level, the Federal Communications Commission licenses only so many radio and television stations in each geographic area. In many large cities one of a limited number of municipal licenses is required to drive a taxicab. The consequent restriction of the supply of cabs creates economic profit for cab owners and drivers. New cabs cannot enter the industry to drive down prices and profits. In a few instances the government might “license” itself to provide some product and thereby create a public monopoly. For example, in some states only state-owned retail outlets can sell liquor. Similarly, many states have “licensed” themselves to run lotteries.

## Ownership or Control of Essential Resources

A monopolist can use private property as an obstacle to potential rivals. For example, a firm that owns or controls a resource essential to the production process can prohibit the entry of rival firms. At one time the International Nickel Company of Canada (now called Vale Canada Limited) controlled 90 percent of the world's known nickel reserves. A local firm may own all the nearby deposits of sand and gravel. And it is very difficult for new sports leagues to be created because existing professional sports leagues have contracts with the best players and have long-term leases on the major stadiums and arenas.

## Pricing and Other Strategic Barriers to Entry

Even if a firm is not protected from entry by, say, extensive economies of scale or ownership of essential resources, entry may effectively be blocked by the way the monopolist responds to attempts by rivals to enter the industry. Confronted with a new entrant, the monopolist may “create an entry barrier” by slashing its price, stepping up its advertising, or taking other strategic actions to make it difficult for the entrant to succeed.

Some examples of entry deterrence: In 2005 Dentsply, the dominant American maker of false teeth (80 percent market share) was found to have unlawfully precluded independent distributors of false teeth from carrying competing brands. The lack of access to the distributors deterred potential foreign competitors from entering the U.S. market. As another example, in 2001 a U.S. court of appeals upheld a lower court's finding that Microsoft used a series of illegal actions to maintain its monopoly in Intel-compatible PC operating systems (95 percent market share). One such action was charging higher prices for its Windows operating system to computer manufacturers that featured Netscape's Navigator Web browser rather than Microsoft's Internet Explorer.

## Monopoly Demand

**LO12.3** Explain how demand is seen by a pure monopoly. Now that we have explained the sources of monopoly, we want to build a model of pure monopoly so that we can analyze its price and output decisions. Let's start by making three assumptions:

- Patents, economies of scale, or resource ownership secures the firm's monopoly.



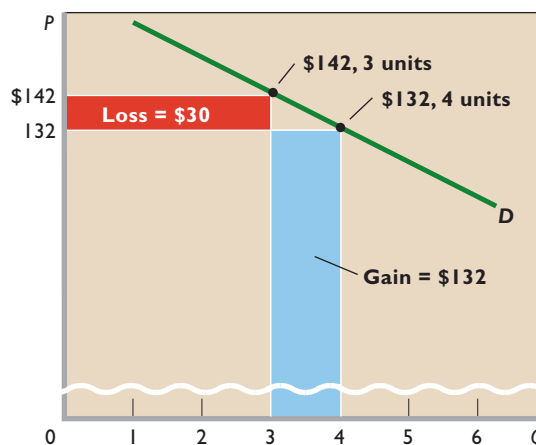
- No unit of government regulates the firm.
- The firm is a single-price monopolist; it charges the same price for all units of output.

The crucial difference between a pure monopolist and a purely competitive seller lies on the demand side of the market. The purely competitive seller faces a perfectly elastic demand at the price determined by market supply and demand. It is a price taker that can sell as much or as little as it wants at the going market price. Each additional unit sold will add the amount of the constant product price to the firm's total revenue. That means that marginal revenue for the competitive seller is constant and equal to product price. (Refer to the table and graph in Figure 10.1 for price, marginal-revenue, and total-revenue relationships for the purely competitive firm.)

The demand curve for the monopolist (and for any imperfectly competitive seller) is quite different from that of the pure competitor. Because the pure monopolist *is* the industry, its demand curve *is* the market demand curve. And because market demand is not perfectly elastic, the monopolist's demand curve is downsloping. Columns 1 and 2 in Table 12.1 illustrate this concept. Note that quantity demanded increases as price decreases.

In Figure 10.7 we drew separate demand curves for the purely competitive industry and for a single firm in such an industry. But only a single demand curve is needed in pure monopoly because the firm and the industry are one and the same. We have graphed part of the demand data in Table 12.1 as demand curve *D* in Figure 12.2. This is the

**FIGURE 12.2 Price and marginal revenue in pure monopoly.** A pure monopolist, or any other imperfect competitor with a downsloping demand curve such as *D*, must set a lower price in order to sell more output. Here, by charging \$132 rather than \$142, the monopolist sells an extra unit (the fourth unit) and gains \$132 from that sale. But from this gain must be subtracted \$30, which reflects the \$10 less the monopolist charged for each of the first 3 units. Thus, the marginal revenue of the fourth unit is \$102 (= \$132 - \$30), considerably less than its \$132 price.



monopolist's demand curve *and* the market demand curve. The downsloping demand curve has three implications that are essential to understanding the monopoly model.

### Marginal Revenue Is Less Than Price

With a fixed downsloping demand curve, the pure monopolist can increase sales only by charging a lower price.

**TABLE 12.1 Revenue and Cost Data of a Pure Monopolist**

Revenue Data				Cost Data			
(1) Quantity of Output	(2) Price (Average Revenue)	(3) Total Revenue, (1) × (2)	(4) Marginal Revenue	(5) Average Total Cost	(6) Total Cost, (1) × (5)	(7) Marginal Cost	(8) Profit [+] or Loss [-]
0	\$172	\$ 0	\$162		\$ 100	\$ 90	\$-100
1	162	162	142	\$190.00	190	80	-28
2	152	304	122	135.00	270	70	+34
3	142	426	102	113.33	340	60	+86
4	132	528	82	100.00	400	70	+128
5	122	610	62	94.00	470	80	+140
6	112	672	42	91.67	550	90	+122
7	102	714	22	91.43	640	110	+74
8	92	736	2	93.75	750	130	-14
9	82	738	-18	97.78	880	150	-142
10	72	720		103.00	1030		-310

Consequently, marginal revenue—the change in total revenue associated with a one-unit change in output—is less than price (average revenue) for every unit of output except the first. Why so? The reason is that the lower price of the extra unit of output also applies to all prior units of output. The monopolist could have sold these prior units at a higher price if it had not produced and sold the extra output. Each additional unit of output sold increases total revenue by an amount equal to its own price less the sum of the price cuts that apply to all prior units of output.

Figure 12.2 confirms this point. There, we have highlighted two price-quantity combinations from the monopolist's demand curve. The monopolist can sell 1 more unit at \$132 than it can at \$142 and that way obtain \$132 (the blue area) of extra revenue. But to sell that fourth unit for \$132, the monopolist must also sell the first 3 units at \$132 rather than \$142. The \$10 reduction in revenue on 3 units results in a \$30 revenue loss (the red area). Thus, the net difference in total revenue from selling a fourth unit is \$102: the \$132 gain from the fourth unit minus the \$30 forgone on the first 3 units. This net gain (marginal revenue) of \$102 from the fourth unit is clearly less than the \$132 price of the fourth unit.

Column 4 in Table 12.1 shows that marginal revenue is always less than the corresponding product price in column 2, except for the first unit of output. Because marginal revenue is the change in total revenue associated with each additional unit of output, the declining amounts of marginal revenue in column 4 mean that total revenue increases at a diminishing rate (as shown in column 3).

We show the relationship between the monopolist's marginal-revenue curve and total-revenue curve in Figure 12.3. For this figure, we extended the demand and revenue data of columns 1 through 4 in Table 12.1, assuming that each successive \$10 price cut elicits 1 additional unit of sales. That is, the monopolist can sell 11 units at \$62, 12 units at \$52, and so on.

Note that the monopolist's MR curve lies below the demand curve, indicating that marginal revenue is less than price at every output quantity but the very first unit. Observe also the special relationship between total revenue (shown in the lower graph) and marginal revenue (shown in the top graph). Because marginal revenue is the change in total revenue, marginal revenue is positive while total revenue is increasing. When total revenue reaches its maximum, marginal revenue is zero. When total revenue is diminishing, marginal revenue is negative.

## The Monopolist Is a Price Maker

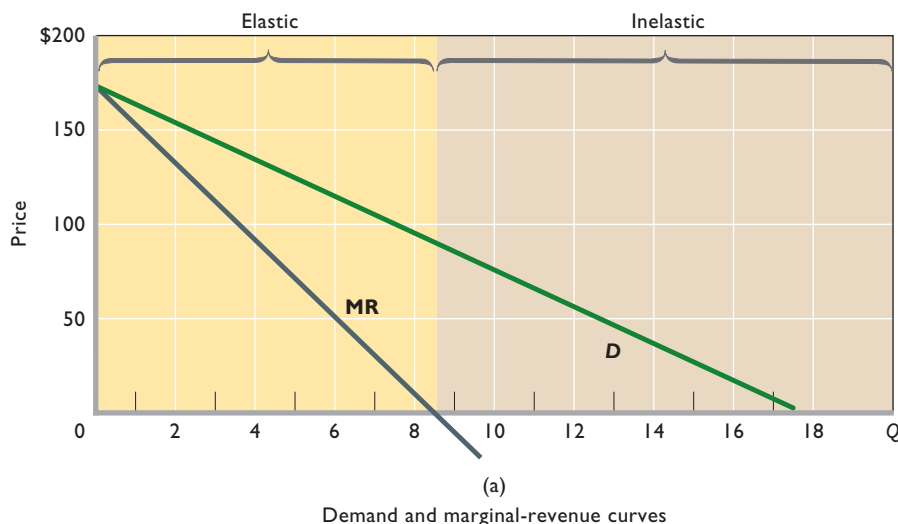
All imperfect competitors, whether pure monopolists, oligopolists, or monopolistic competitors, face downsloping demand curves. As a result, any change in quantity produced causes a movement along their respective demand curves and a change in the price they can charge for their respective products. Economists summarize this fact by saying that firms with downsloping demand curves are *price makers*.

This is most evident in pure monopoly, where an industry consists of a single monopoly firm so that total industry output is exactly equal to whatever the single monopoly firm chooses to produce. As we just mentioned, the monopolist faces a downsloping demand curve in which each amount of output is associated with some unique price. Thus, in deciding on the quantity of output to produce, the monopolist is also determining the price it will charge. Through control of output, it can “make the price.” From columns 1 and 2 in Table 12.1 we find that the monopolist can charge a price of \$72 if it produces and offers for sale 10 units, a price of \$82 if it produces and offers for sale 9 units, and so forth.

## The Monopolist Sets Prices in the Elastic Region of Demand

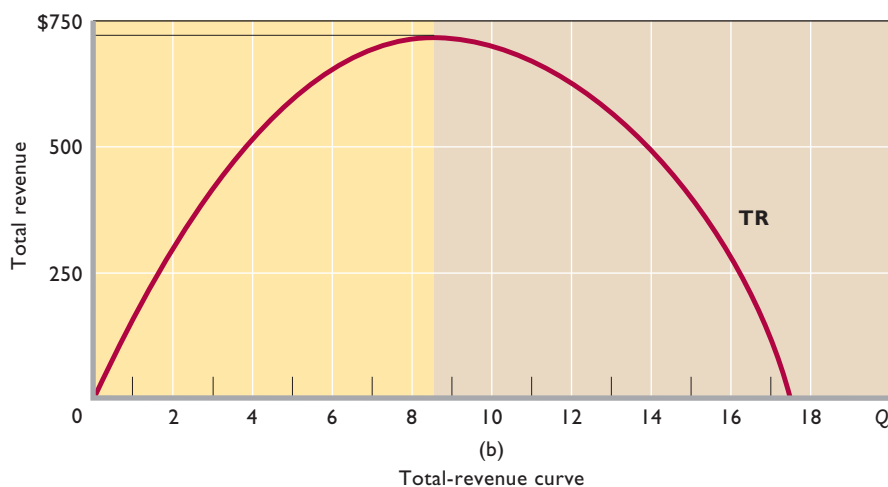
The total-revenue test for price elasticity of demand is the basis for our third implication. Recall from Chapter 6 that the total-revenue test reveals that when demand is elastic, a decline in price will increase total revenue. Similarly, when demand is inelastic, a decline in price will reduce total revenue. Beginning at the top of demand curve *D* in Figure 12.3a, observe that as the price declines from \$172 to approximately \$82, total revenue increases (and marginal revenue therefore is positive). This means that demand is elastic in this price range. Conversely, for price declines below \$82, total revenue decreases (marginal revenue is negative), indicating that demand is inelastic there.

The implication is that a monopolist will never choose a price-quantity combination where price reductions cause total revenue to decrease (marginal revenue to be negative). The profit-maximizing monopolist will always want to avoid the inelastic segment of its demand curve in favor of some price-quantity combination in the elastic region. Here's why: To get into the inelastic region, the monopolist must lower price and increase output. In the inelastic region a lower price means less total revenue. And increased output always means increased total cost. Less total revenue and higher total cost yield lower profit.



**FIGURE 12.3** Demand, marginal revenue, and total revenue for a pure monopolist.

(a) Because it must lower price on all units sold in order to increase its sales, an imperfectly competitive firm's marginal-revenue curve (MR) lies below its downsloping demand curve (D). The elastic and inelastic regions of demand are highlighted. (b) Total revenue (TR) increases at a decreasing rate, reaches a maximum, and then declines. Note that in the elastic region, TR is increasing and hence MR is positive. When TR reaches its maximum, MR is zero. In the inelastic region of demand, TR is declining, so MR is negative.



### QUICK REVIEW 12.1

- A pure monopolist is the sole supplier of a product or service for which there are no close substitutes.
- A monopoly survives because of entry barriers such as economies of scale, patents and licenses, the ownership of essential resources, and strategic actions to exclude rivals.
- The monopolist's demand curve is downsloping and its marginal-revenue curve lies below its demand curve.
- The downsloping demand curve means that the monopolist is a price maker.
- The monopolist will operate in the elastic region of demand since in the inelastic region it can increase total revenue and reduce total cost by reducing output.

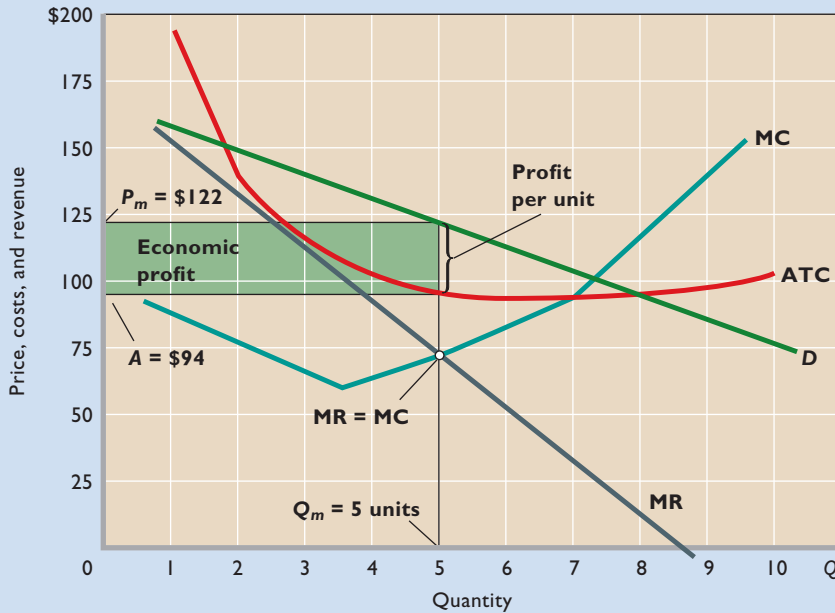
## Output and Price Determination

**LO12.4** Explain how a pure monopoly sets its profit-maximizing output and price.

At what specific price-quantity combination will a profit-maximizing monopolist choose to operate? To answer this question, we must add production costs to our analysis.

### Cost Data

On the cost side, we will assume that although the firm is a monopolist in the product market, it hires resources competitively and employs the same technology and, therefore, has the same cost structure as the purely competitive firm that we studied in Chapters 10 and 11. By using the same cost data that we developed in Chapter 9 and applied to the competitive firm in Chapters 10 and 11, we will be able to



**FIGURE 12.4** Profit maximization by a pure monopolist. The pure monopolist maximizes profit by producing at the  $MR = MC$  output, here  $Q_m = 5$  units. Then, as seen from the demand curve, it will charge price  $P_m = \$122$ . Average total cost will be  $A = \$94$ , meaning that per-unit profit is  $P_m - A$  and total profit is  $5 \times (P_m - A)$ . Total economic profit is thus represented by the green rectangle.

## QUICK QUIZ FOR FIGURE 12.4

- The MR curve lies below the demand curve in this figure because the:
  - demand curve is linear (a straight line).
  - demand curve is highly inelastic throughout its full length.
  - demand curve is highly elastic throughout its full length.
  - gain in revenue from an extra unit of output is less than the price charged for that unit of output.
- The area labeled “Economic profit” can be found by multiplying the difference between  $P$  and ATC by quantity. It also can be found by:
  - dividing profit per unit by quantity.
  - subtracting total cost from total revenue.
  - multiplying the coefficient of demand elasticity by quantity.
  - multiplying the difference between  $P$  and MC by quantity.
- This pure monopolist:
  - charges the highest price that it could achieve.
  - earns only a normal profit in the long run.
  - restricts output to create an insurmountable entry barrier.
  - restricts output to increase its price and total economic profit.
- At this monopolist’s profit-maximizing output:
  - price equals marginal revenue.
  - price equals marginal cost.
  - price exceeds marginal cost.
  - profit per unit is maximized.

Answers: 1. d; 2. b; 3. d; 4. c

directly compare the price and output decisions of a pure monopoly with those of a pure competitor. This will help us demonstrate that the price and output differences between a pure monopolist and a pure competitor are not the result of two different sets of costs. Columns 5 through 7 in Table 12.1 restate the pertinent cost data from Table 9.2.

### MR = MC Rule

A monopolist seeking to maximize total profit will employ the same rationale as a profit-seeking firm in a competitive industry. If producing is preferable to shutting down, it will produce up to the output at which marginal revenue equals marginal cost ( $MR = MC$ ).

A comparison of columns 4 and 7 in Table 12.1 indicates that the profit-maximizing output is 5 units because the fifth unit is the last unit of output whose marginal revenue exceeds its marginal cost. What price will the monopolist charge? The demand schedule shown as columns 1 and 2 in Table 12.1 indicates there is only one price at which 5 units can be sold: \$122.

This analysis is shown in **Figure 12.4 (Key Graph)**, where we have graphed the demand, marginal-revenue, average-total-cost, and marginal-cost data of Table 12.1. The profit-maximizing output occurs at 5 units of output ( $Q_m$ ), where the marginal-revenue (MR) and marginal-cost (MC) curves intersect. There,  $MR = MC$ .



To find the price the monopolist will charge, we extend a vertical line from  $Q_m$  up to the demand curve  $D$ . The unique price  $P_m$  at which  $Q_m$  units can be sold is \$122. In this case, \$122 is the profit-maximizing price. So the monopolist sets the quantity at  $Q_m$  to charge its profit-maximizing price of \$122.

Columns 2 and 5 in Table 12.1 show that at 5 units of output, the product price (\$122) exceeds the average total cost (\$94). The monopolist thus obtains an economic profit of \$28 per unit, and the total economic profit is \$140 (= 5 units  $\times$  \$28). In Figure 12.4, per-unit profit is  $P_m - A$ , where  $A$  is the average total cost of producing  $Q_m$  units. Total economic profit—the green rectangle—is found by multiplying this per-unit profit by the profit-maximizing output  $Q_m$ .

Another way to determine the profit-maximizing output is by comparing total revenue and total cost at each possible level of production and choosing the output with the greatest positive difference. Use

columns 3 and 6 in Table 12.1 to verify that 5 units is the profit-maximizing output. An accurate graphing of total revenue and total cost against output would also show the greatest difference (the maximum

profit) at 5 units of output. Table 12.2 summarizes the process for determining the profit-maximizing output, profit-maximizing price, and economic profit in pure monopoly.

### WORKED PROBLEMS

#### W12.1

Monopoly price and output



## No Monopoly Supply Curve

Recall that  $MR$  equals  $P$  in pure competition and that the supply curve of a purely competitive firm is determined by applying the  $MR (= P) = MC$  profit-maximizing rule. At any specific market-determined price, the purely

competitive seller will maximize profit by supplying the quantity at which  $MC$  is equal to that price. When the market price increases or decreases, the competitive firm produces more or less output. Each market price is thus associated with a specific output, and all such price-output pairs define the supply curve. This supply curve turns out to be the portion of the firm's  $MC$  curve that lies above the average-variable-cost curve (see Figure 10.6).

At first glance we would suspect that the pure monopolist's marginal-cost curve would also be its supply curve. But that is *not* the case. *The pure monopolist has no supply curve.* There is no unique relationship between price and quantity supplied for a monopolist. Like the competitive firm, the monopolist equates marginal revenue and marginal cost to determine output, but for the monopolist marginal revenue is less than price. Because the monopolist does not equate marginal cost to price, it is possible for different demand conditions to bring about different prices for the same output. To understand this point, refer to Figure 12.4 and pencil in a new, steeper marginal-revenue curve that intersects the marginal-cost curve at the same point as does the present marginal-revenue curve. Then draw in a new demand curve that is roughly consistent with your new marginal-revenue curve. With the new curves, the same  $MR = MC$  output of 5 units now means a higher profit-maximizing price. Conclusion: There is no single, unique price associated with each output level  $Q_m$ , and so there is no supply curve for the pure monopolist.

## Misconceptions Concerning Monopoly Pricing

Our analysis exposes two fallacies concerning monopoly behavior.

**Not Highest Price** Because a monopolist can manipulate output and price, people often believe it “will charge

**TABLE 12.2** Steps for Graphically Determining the Profit-Maximizing Output, Profit-Maximizing Price, and Economic Profit (if Any) in Pure Monopoly

- Step 1.** Determine the profit-maximizing output by finding where  $MR = MC$ .
- Step 2.** Determine the profit-maximizing price by extending a vertical line upward from the output determined in step 1 to the pure monopolist's demand curve.
- Step 3.** Determine the pure monopolist's economic profit using one of two methods:
  - Method 1.* Find profit per unit by subtracting the average total cost of the profit-maximizing output from the profit-maximizing price. Then multiply the difference by the profit-maximizing output to determine economic profit (if any).
  - Method 2.* Find total cost by multiplying the average total cost of the profit-maximizing output by that output. Find total revenue by multiplying the profit-maximizing output by the profit-maximizing price. Then subtract total cost from total revenue to determine economic profit (if any).

the highest price possible.” That is incorrect. There are many prices above  $P_m$  in Figure 12.4, but the monopolist shuns them because they yield a smaller-than-maximum total profit. The monopolist seeks maximum total profit, not maximum price. Some high prices that could be charged would reduce sales and total revenue too severely to offset any decrease in total cost.

**Total, Not Unit, Profit** The monopolist seeks maximum *total* profit, not maximum *unit* profit. In Figure 12.4 a careful comparison of the vertical distance between average total cost and price at various possible outputs indicates that per-unit profit is greater at a point slightly to the left of the profit-maximizing output  $Q_m$ . This is seen in Table 12.1, where the per-unit profit at 4 units of output is \$32 (= \$132 – \$100) compared with \$28 (= \$122 – \$94) at the profit-maximizing output of 5 units. Here the monopolist accepts a lower-than-maximum per-unit profit because additional sales more than compensate for the lower unit profit. A monopolist would rather sell 5 units at a profit of \$28 per unit (for a total profit of \$140) than 4 units at a profit of \$32 per unit (for a total profit of only \$128).

### Possibility of Losses by Monopolist

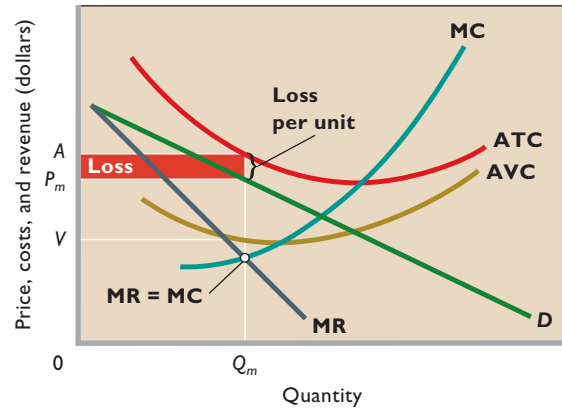
The likelihood of economic profit is greater for a pure monopolist than for a pure competitor. In the long run the pure competitor is destined to have only a normal profit, whereas barriers to entry mean that any economic profit realized by the monopolist can persist. In pure monopoly there are no new entrants to increase supply, drive down price, and eliminate economic profit.

But pure monopoly does not guarantee profit. The monopolist is not immune from changes in tastes that reduce the demand for its product. Nor is it immune from upward-shifting cost curves caused by escalating resource prices. If the demand and cost situation faced by the monopolist is far less favorable than that in Figure 12.4, the monopolist will incur losses in the short run. Consider the monopoly enterprise shown in Figure 12.5. Despite its dominance in the market (as, say, a seller of home sewing machines), it suffers a loss, as shown, because of weak demand and relatively high costs. Yet it continues to operate for the time being because its total loss is less than its fixed cost. More precisely, at output  $Q_m$  the monopolist's price  $P_m$  exceeds its average variable cost  $V$ . Its loss per unit is  $A - P_m$ , and the total loss is shown by the red rectangle.

Like the pure competitor, the monopolist will not persist in operating at a loss. Faced with continuing losses, in the long run the firm's owners will move their resources to alternative industries that offer better profit opportunities.

### FIGURE 12.5 The loss-minimizing position of a pure monopolist.

If demand  $D$  is weak and costs are high, the pure monopolist may be unable to make a profit. Because  $P_m$  exceeds  $V$ , the average variable cost at the  $MR = MC$  output  $Q_m$ , the monopolist will minimize losses in the short run by producing at that output. The loss per unit is  $A - P_m$ , and the total loss is indicated by the red rectangle.



A monopolist such as the one depicted in Figure 12.5 must obtain a minimum of a normal profit in the long run or it will go out of business.

## Economic Effects of Monopoly

**LO12.5** Discuss the economic effects of monopoly.

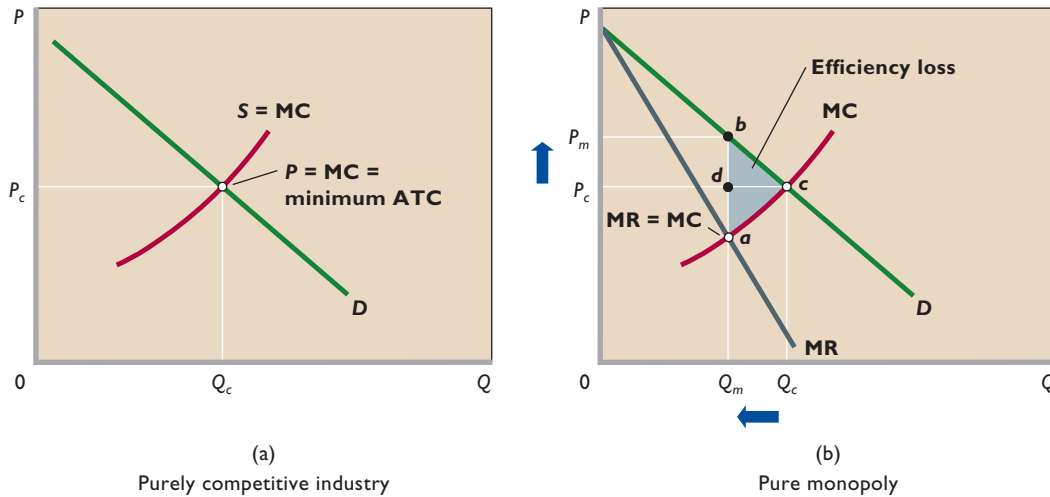
Let's now evaluate pure monopoly from the standpoint of society as a whole. Our reference for this evaluation will be the outcome of long-run efficiency in a purely competitive market, identified by the triple equality  $P = MC = \text{minimum ATC}$ .

### Price, Output, and Efficiency

Figure 12.6 graphically contrasts the price, output, and efficiency outcomes of pure monopoly and a purely competitive industry. The  $S = MC$  curve in Figure 12.6a reminds us that the market supply curve  $S$  for a purely competitive industry is the horizontal sum of the marginal-cost curves of all the firms in the industry. Suppose there are 1,000 such firms. Comparing their combined supply curves  $S$  with market demand  $D$ , we see that the purely competitive price and output are  $P_c$  and  $Q_c$ .

Recall that this price-output combination results in both productive efficiency and allocative efficiency. *Productive efficiency* is achieved because free entry and exit force firms to operate where average total cost is at a minimum. The sum of the minimum-ATC outputs of the 1,000 pure competitors is the industry output, here,  $Q_c$ . Product price is at the lowest level consistent with minimum

**FIGURE 12.6 Inefficiency of pure monopoly relative to a purely competitive industry.** (a) In a purely competitive industry, entry and exit of firms ensure that price ( $P_c$ ) equals marginal cost (MC) and that the minimum average-total-cost output ( $Q_c$ ) is produced. Both productive efficiency ( $P =$  minimum ATC) and allocative efficiency ( $P = MC$ ) are obtained. (b) In pure monopoly, the MR curve lies below the demand curve. The monopolist maximizes profit at output  $Q_m$ , where  $MR = MC$ , and charges price  $P_m$ . Thus, output is lower ( $Q_m$  rather than  $Q_c$ ) and price is higher ( $P_m$  rather than  $P_c$ ) than they would be in a purely competitive industry. Monopoly is inefficient, since output is less than that required for achieving minimum ATC (here, at  $Q_c$ ) and because the monopolist's price exceeds MC. Monopoly creates an efficiency loss (here, of triangle  $abc$ ). There is also a transfer of income from consumers to the monopoly (here, of rectangle  $P_c P_m b d$ ).



average total cost. The *allocative efficiency* of pure competition results because production occurs up to that output at which price (the measure of a product's value or marginal benefit to society) equals marginal cost (the worth of the alternative products forgone by society in producing any given commodity). In short:  $P = MC =$  minimum ATC.

Now let's suppose that this industry becomes a pure monopoly (Figure 12.6b) as a result of one firm acquiring all its competitors. We also assume that no changes in costs or market demand result from this dramatic change in the industry structure. What formerly were 1,000 competing firms is now a single pure monopolist consisting of 1,000 noncompeting branches.

The competitive market supply curve  $S$  has become the marginal-cost curve (MC) of the monopolist, the summation of the individual marginal-cost curves of its many branch plants. (Since the monopolist does not have a supply curve, as such, we have removed the  $S$  label.) The important change, however, is on the demand side. From the viewpoint of each of the 1,000 individual competitive firms, demand was perfectly elastic, and marginal revenue was therefore equal to the market equilibrium price  $P_c$ . So each firm equated its marginal revenue of  $P_c$  dollars per unit with its individual marginal cost curve to maximize profits. But market demand and individual demand are the same to the pure monopolist. The firm *is* the industry, and

thus the monopolist sees the downsloping demand curve  $D$  shown in Figure 12.6b.

This means that marginal revenue is less than price, that graphically the MR curve lies below demand curve  $D$ . In using the  $MR = MC$  rule, the monopolist selects output  $Q_m$  and price  $P_m$ . A comparison of both graphs in Figure 12.6 reveals that the monopolist finds it profitable to sell a smaller output at a higher price than do the competitive producers.

Monopoly yields neither productive nor allocative efficiency. The lack of productive efficiency can be understood most directly by noting that the monopolist's output  $Q_m$  is less than  $Q_c$ , the output at which average total cost is lowest. In addition, the monopoly price  $P_m$  is higher than the competitive price  $P_c$  that we know in long-run equilibrium in pure competition equals minimum average total cost. Thus, the monopoly price exceeds minimum average total cost, thereby demonstrating in another way that the monopoly will not be productively efficient.

The monopolist's underproduction also implies allocative inefficiency. One way to see this is to note that at the monopoly output level  $Q_m$ , the monopoly price  $P_m$  that consumers are willing to pay exceeds the marginal cost of production. This means that consumers value additional units of this product more highly than they do the alternative products that could be produced from the resources that would be necessary to make more units of the monopolist's product.

The monopolist's allocative inefficiency can also be understood by noting that for every unit between  $Q_m$  and  $Q_c$ , marginal benefit exceeds marginal cost because the demand curve lies above the supply curve. By choosing not to produce these units, the monopolist reduces allocative efficiency because the resources that should have been used to make these units will be redirected instead toward producing items that bring lower net benefits to society. The total dollar value of this efficiency loss (or *deadweight loss*) is equal to the area of the gray triangle labeled *abc* in Figure 12.6b.

## Income Transfer

In general, a monopoly transfers income from consumers to the owners of the monopoly. The income is received by the owners as revenue. Because a monopoly has market power, it can charge a higher price than would a purely competitive firm with the same costs. So the monopoly in effect levies a “private tax” on consumers. This private tax can often generate substantial economic profits that can persist because entry to the industry is blocked.

The transfer from consumers to the monopolist is evident in Figure 12.6b. For the  $Q_m$  units of output demanded, consumers pay price  $P_m$  rather than the price  $P_c$  that they would pay to a pure competitor. The total amount of income transferred from consumers to the monopolist is  $P_m - P_c$  multiplied by the number of units sold,  $Q_m$ . So the total transfer is the dollar amount of rectangle  $P_c P_m bd$ . What the consumer loses, the monopolist gains. In contrast, the efficiency loss *abc* is a *deadweight* loss—society totally loses the net benefits of the  $Q_c$  minus  $Q_m$  units that are not produced.

## Cost Complications

Our evaluation of pure monopoly has led us to conclude that, given identical costs, a purely monopolistic industry will charge a higher price, produce a smaller output, and allocate economic resources less efficiently than a purely competitive industry. These inferior results are rooted in the entry barriers characterizing monopoly.

Now we must recognize that costs may not be the same for purely competitive and monopolistic producers. The unit cost incurred by a monopolist may be either larger or smaller than that incurred by a purely competitive firm. There are four reasons why costs may differ: (1) economies of scale, (2) a factor called “X-inefficiency,” (3) the need for monopoly-preserving expenditures, and (4) the “very long run” perspective, which allows for technological advance.

**Economies of Scale Once Again** Where economies of scale are extensive, market demand may not be sufficient to support a large number of competing firms, each producing at minimum efficient scale. In such cases, an industry of one or two firms would have a lower average total cost than would the same industry made up of numerous competitive firms. At the extreme, only a single firm—a natural monopoly—might be able to achieve the lowest long-run average total cost.

Some firms relating to new information technologies—for example, computer software, Internet service, and wireless communications—have displayed extensive economies of scale. As these firms have grown, their long-run average total costs have declined because of greater use of specialized inputs, the spreading of product development costs, and learning by doing. Also, *simultaneous consumption* and *network effects* have reduced costs.

A product's ability to satisfy a large number of consumers at the same time is called **simultaneous consumption** (or *nonrivalrous consumption*). Dell Computers needs to produce a personal computer for each customer, but Microsoft needs to produce its Windows program only once. Then, at very low marginal cost, Microsoft delivers its program by disk or Internet to millions of consumers. A similarly low cost of delivering product to additional customers is true for Internet service providers, music producers, and wireless communication firms. Because marginal costs are so low, the average total cost of output declines as more customers are added.

**Network effects** are present if the value of a product to each user, including existing users, increases as the total number of users rises. Good examples are computer software, cell phones, and Web sites like Facebook where the content is provided by users. When other people have Internet service and devices to access it, a person can conveniently send e-mail messages to them. And when they have similar software, various documents, spreadsheets, and photos can be attached to the e-mail messages. The greater the number of persons connected to the system, the more the benefits of the product to each person are magnified.

Such network effects may drive a market toward monopoly because consumers tend to choose standard products that everyone else is using. The focused demand for these products permits their producers to grow rapidly and thus achieve economies of scale. Smaller firms, which either have higher-cost “right” products or “wrong” products, get acquired or go out of business.

Economists generally agree that some new information firms have not yet exhausted their economies of scale. But most economists question whether such firms are truly

natural monopolies. Most firms eventually achieve their minimum efficient scale at less than the full size of the market. That means competition among firms is possible.

But even if natural monopoly develops, the monopolist is unlikely to pass cost reductions along to consumers as price reductions. So, with perhaps a handful of exceptions, economies of scale do not change the general conclusion that monopoly industries are inefficient relative to competitive industries.

**X-Inefficiency** In constructing all the average-total-cost curves used in this book, we have assumed that the firm uses the most efficient existing technology. This assumption is only natural

because firms cannot maximize profits unless they are minimizing costs. **X-inefficiency** occurs when a firm produces output at a higher cost than is necessary to produce it. In Figure 12.7 X-inefficiency



is represented by operation at points  $X$  and  $X'$  above the lowest-cost ATC curve. At these points, per-unit costs are  $ATC_X$  (as opposed to  $ATC_1$ ) for output  $Q_1$  and  $ATC_{X'}$  (as opposed to  $ATC_2$ ) for output  $Q_2$ . Producing at any point above the average-total-cost curve in Figure 12.7 reflects inefficiency or “bad management” by the firm.

Why is X-inefficiency allowed to occur if it reduces profits? The answer is that managers may have goals, such as expanding power, an easier work life, avoiding business risk, or giving jobs to incompetent relatives, that conflict with cost minimization. Or X-inefficiency may arise because a firm’s workers are poorly motivated or ineffectively supervised. Or a firm may simply become lethargic

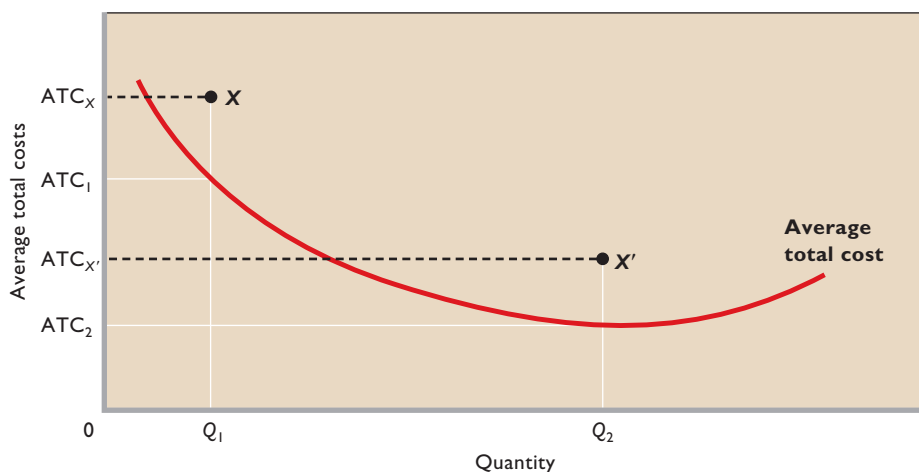
and inert, relying on rules of thumb in decision making as opposed to careful calculations of costs and revenues.

For our purposes the relevant question is whether monopolistic firms tend more toward X-inefficiency than competitive producers do. Presumably they do. Firms in competitive industries are continually under pressure from rivals, forcing them to be internally efficient to survive. But monopolists are sheltered from such competitive forces by entry barriers. That lack of pressure may lead to X-inefficiency.

**Rent-Seeking Expenditures** Rent-seeking behavior is any activity designed to transfer income or wealth to a particular firm or resource supplier at someone else’s, or even society’s, expense. We have seen that a monopolist can obtain an economic profit even in the long run. Therefore, it is no surprise that a firm may go to great expense to acquire or maintain a monopoly granted by government through legislation or an exclusive license. Such rent-seeking expenditures add nothing to the firm’s output, but they clearly increase its costs. Taken alone, rent-seeking implies that monopoly involves even higher costs and even less efficiency than suggested in Figure 12.6b.

**Technological Advance** In the very long run, firms can reduce their costs through the discovery and implementation of new technology. If monopolists are more likely than competitive producers to develop more efficient production techniques over time, then the inefficiency of monopoly might be overstated. Because research and development (R&D) is the topic of optional Web Chapter 13, we will provide only a brief assessment here.

The general view of economists is that a pure monopolist will not be technologically progressive. Although its economic profit provides ample means to finance research



**FIGURE 12.7** X-inefficiency. The average-total-cost curve (ATC) is assumed to reflect the minimum cost of producing each particular level of output. Any point above this “lowest-cost” ATC curve, such as  $X$  or  $X'$ , implies X-inefficiency: operation at greater than lowest cost for a particular level of output.



and development, it has little incentive to implement new techniques (or products). The absence of competitors means that there is no external pressure for technological advance in a monopolized market. Because of its sheltered market position, the pure monopolist can afford to be complacent and lethargic. There simply is no major penalty for not being innovative.

One caveat: Research and technological advance may be one of the monopolist's barriers to entry. Thus, the monopolist may continue to seek technological advance to avoid falling prey to new rivals. In this case technological advance is essential to the maintenance of monopoly. But then it is *potential* competition, not the monopoly market structure, that is driving the technological advance. By assumption, no such competition exists in the pure monopoly model; entry is completely blocked.

### Assessment and Policy Options

Monopoly is a legitimate concern. Monopolists can charge higher-than-competitive prices that result in an underallocation of resources to the monopolized product. They can stifle innovation, engage in rent-seeking behavior, and foster X-inefficiency. Even when their costs are low because of economies of scale, there is no guarantee that the price they charge will reflect those low costs. The cost savings may simply accrue to the monopoly as greater economic profit.

Fortunately, however, monopoly is not widespread in the United States. Barriers to entry are seldom completely successful. Although research and technological advance may strengthen the market position of a monopoly, technology may also undermine monopoly power. Over time, the creation of new technologies may work to destroy monopoly positions. For example, the development of courier delivery, fax machines, and e-mail has eroded the monopoly power of the U.S. Postal Service. Similarly, cable television monopolies are now challenged by satellite TV and by technologies that permit the transmission of audio and video over the Internet.

Patents eventually expire; and even before they do, the development of new and distinct substitutable products often circumvents existing patent advantages. New sources of monopolized resources sometimes are found and competition from foreign firms may emerge. (See Global Perspective 12.1.) Finally, if a monopoly is sufficiently fearful of future competition from new products, it may keep its prices relatively low so as to discourage rivals from developing such products. If so, consumers may pay nearly competitive prices even though competition is currently lacking.



## GLOBAL PERSPECTIVE 12.1

### Competition from Foreign Multinational Corporations

Competition from foreign multinational corporations diminishes the market power of firms in the United States. Here are just a few of the hundreds of foreign multinational corporations that compete strongly with U.S. firms in certain American markets.

Company (Country)	Main Products
Bayer (Germany)	chemicals
Daimler (Germany)	automobiles
Michelin (France)	tires
Lenovo (China)	electronics
Nestlé (Switzerland)	food products
Nokia (Finland)	wireless phones
Panasonic (Japan)	electronics
Petrobras (Brazil)	gasoline
Royal Dutch Shell (Netherlands)	gasoline
Samsung (South Korea)	electronics
Toyota (Japan)	automobiles

Source: Compiled from the Fortune 500 listing of the world's largest firms, "FORTUNE Global 500," [www.fortune.com](http://www.fortune.com). © 2012 Time Inc. All rights reserved.

So what should government do about monopoly when it arises in the real world? Economists agree that government needs to look carefully at monopoly on a case-by-case basis. Three general policy options are available:

- If the monopoly is achieved and sustained through anticompetitive actions, creates substantial economic inefficiency, and appears to be long-lasting, the government can file charges against the monopoly under the antitrust laws. If found guilty of monopoly abuse, the firm can either be expressly prohibited from engaging in certain business activities or be broken into two or more competing firms. An example of the breakup approach was the dissolution of Standard Oil into several competing firms in 1911. In contrast, in 2001 an appeals court overruled a lower-court decision to divide Microsoft into two firms. Instead, Microsoft was prohibited from engaging in a number of specific anticompetitive business activities. (We discuss the antitrust laws and the Microsoft case in Chapter 19.)

- If the monopoly is a natural monopoly, society can allow it to continue to expand. If no competition emerges from new products, government may then decide to regulate its prices and operations. (We discuss this option later in this chapter and also in Chapter 19.)
- If the monopoly appears to be unsustainable because of emerging new technology, society can simply choose to ignore it. In such cases, society simply lets the process of creative destruction (discussed in Chapter 11) do its work. In Web Chapter 13, we discuss in detail the likelihood that real-world monopolies will collapse due to creative destruction and competition brought on by new technologies.

### QUICK REVIEW 12.2

- The monopolist maximizes profit (or minimizes loss) at the output where  $MR = MC$  and charges the price that corresponds to that output on its demand curve.
- The monopolist has no supply curve, since any of several prices can be associated with a specific quantity of output supplied.
- Assuming identical costs, a monopolist will be less efficient than a purely competitive industry because it will fail to produce units of output for which marginal benefits exceed marginal costs.
- The inefficiencies of monopoly may be offset or lessened by economies of scale and, less likely, by technological progress, but they may be intensified by the presence of X-inefficiency and rent-seeking expenditures.

## Price Discrimination

**LO12.6** Describe why a monopolist might prefer to charge different prices in different markets.

We have assumed in this chapter that the monopolist charges a single price to all buyers. But under certain conditions the monopolist can increase its profit by charging different prices to different buyers. In so doing, the monopolist is engaging in **price discrimination**, the practice of selling a specific product at more than one price when the price differences are not justified by cost differences. Price discrimination can take three forms:

- Charging each customer in a single market the maximum price she or he is willing to pay.

- Charging each customer one price for the first set of units purchased and a lower price for subsequent units purchased.
- Charging some customers one price and other customers another price.

### Conditions

The opportunity to engage in price discrimination is not readily available to all sellers. Price discrimination is possible when the following conditions are met:

- **Monopoly power** The seller must be a monopolist or, at least, must possess some degree of monopoly power, that is, some ability to control output and price.
- **Market segregation** At relatively low cost to itself, the seller must be able to segregate buyers into distinct classes, each of which has a different willingness or ability to pay for the product. This separation of buyers is usually based on different price elasticities of demand, as the examples below will make clear.
- **No resale** The original purchaser cannot resell the product or service. If buyers in the low-price segment of the market could easily resell in the high-price segment, the monopolist's price-discrimination strategy would create competition in the high-price segment. This competition would reduce the price in the high-price segment and undermine the monopolist's price-discrimination policy. This condition suggests that service industries such as the transportation industry or legal and medical services, where resale is impossible, are good candidates for price discrimination.

### Examples of Price Discrimination

Price discrimination is widely practiced in the U.S. economy. For example, we noted in Chapter 6's Last Word that airlines charge high fares to business travelers, whose demand for travel is inelastic, and offer lower, highly restricted, nonrefundable fares to attract vacationers and others whose demands are more elastic.

Electric utilities frequently segment their markets by end uses, such as lighting and heating. The absence of reasonable lighting substitutes means that the demand for electricity for illumination is inelastic and that the price per kilowatt-hour for such use is high. But the availability of natural gas and petroleum for heating makes the demand for electricity for this purpose less inelastic and the price lower.

#### ORIGIN OF THE IDEA

O12.4

Price discrimination



conditions the monopolist can increase its profit by charging different prices to different buyers. In so doing, the monopolist is engaging in **price discrimination**, the practice of selling a specific product at more than one price

Movie theaters and golf courses vary their charges on the basis of time (for example, higher evening and weekend rates) and age (for example, lower rates for children, senior discounts). Railroads vary the rate charged per ton-mile of freight according to the market value of the product being shipped. The shipper of 10 tons of television sets or refrigerators is charged more than the shipper of 10 tons of gravel or coal.

The issuance of discount coupons, redeemable at purchase, is a form of price discrimination. It enables firms to give price discounts to their most price-sensitive customers who have elastic demand. Less price-sensitive consumers who have less elastic demand are not as likely to

take the time to clip and redeem coupons. The firm thus makes a larger profit than if it had used a single-price, no-coupon strategy.

Finally, price discrimination often occurs in international trade. A Russian aluminum producer, for example, might sell aluminum for less in the United States than in Russia. In the United States, this seller faces an elastic demand because several substitute suppliers are available. But in Russia, where the manufacturer dominates the market and trade barriers impede imports, consumers have fewer choices and thus demand is less elastic.

### CONSIDER THIS ...



#### Some Price Differences at the Ballpark

*Take me out to the ball game...*

*Buy me some peanuts and Cracker Jack...*

Professional baseball teams earn substantial revenues through ticket sales. To maximize profit, they offer significantly lower ticket prices for children (whose demand is elastic) than for adults (whose demand is inelastic). This discount may be as much as 50 percent.

If this type of price discrimination increases revenue and profit, why don't teams also price discriminate at the concession stands? Why don't they offer half-price hot dogs, soft drinks, peanuts, and Cracker Jack to children?

The answer involves the three requirements for successful price discrimination. All three requirements are met for game tickets: (1) The team has monopoly power; (2) it can segregate ticket buyers by age group, each group having a different elasticity of demand; and (3) children cannot resell their discounted tickets to adults.

It's a different situation at the concession stands. Specifically, the third condition is *not* met. If the team had dual prices, it could not prevent the exchange or "resale" of the concession goods from children to adults. Many adults would send children to buy food and soft drinks for them: "Here's some money, Billy. Go buy six hot dogs." In this case, price discrimination would reduce, not increase, team profit. Thus, children and adults are charged the same high prices at the concession stands. (These prices are high relative to those for the same goods at the local convenience store because the stadium sellers have a captive audience and thus considerable monopoly power.)

### Graphical Analysis

Figure 12.8 demonstrates graphically the most frequently seen form of price discrimination—charging different prices to different classes of buyers. The two side-to-side graphs are for a single pure monopolist selling its product, say, software, in two segregated parts of the market. Figure 12.8a illustrates demand for software by small-business customers; Figure 12.8b, the demand for software by students. Student versions of the software are identical to the versions sold to businesses but are available (1 per person) only to customers with a student ID. Presumably, students have lower ability to pay for the software and are charged a discounted price.

The demand curve  $D_b$  in the graph to the left indicates a relatively inelastic demand for the product on the part of business customers. The demand curve  $D_s$  in the right-hand graph reflects the more elastic demand of students. The marginal revenue curves ( $MR_b$  and  $MR_s$ ) lie below their respective demand curves, reflecting the demand–marginal revenue relationship previously described.

For visual clarity we have assumed that average total cost (ATC) is constant. Therefore marginal cost (MC) equals average total cost (ATC) at all quantities of output. These costs are the same for both versions of the software and therefore appear as the identical straight lines labeled "MC = ATC."

What price will the pure monopolist charge to each set of customers? Using the  $MR = MC$  rule for profit maximization, the firm will offer  $Q_b$  units of the software for sale to small businesses. It can sell

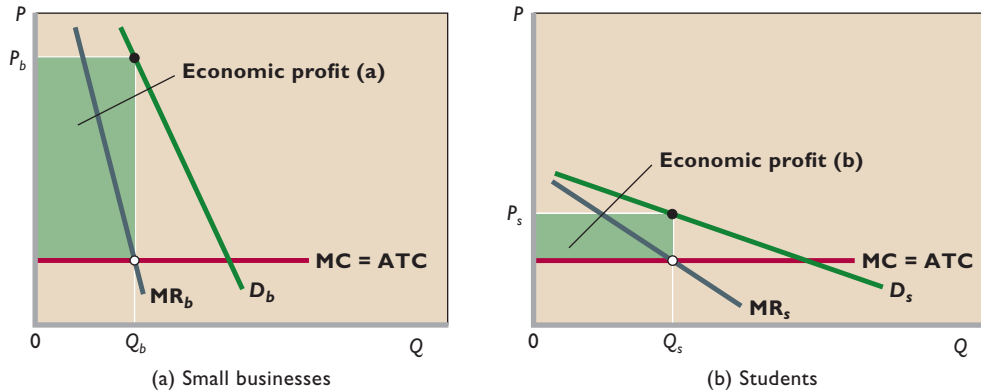
that profit-maximizing output by charging price  $P_b$ . Again using the  $MR = MC$  rule, the monopolist will offer  $Q_s$  units of software to students. To sell those  $Q_s$  units, the firm will charge students the lower price  $P_s$ .

### WORKED PROBLEMS

**W12.2**  
Price  
discrimination



**FIGURE 12.8 Price discrimination to different groups of buyers.** The price-discriminating monopolist represented here maximizes its total profit by dividing the market into two segments based on differences in elasticity of demand. It then produces and sells the  $MR = MC$  output in each market segment. (For visual clarity, average total cost (ATC) is assumed to be constant. Therefore, MC equals ATC at all output levels.) (a) The price-discriminating monopolist charges a high price (here  $P_b$ ) to small-business customers because they have a relatively inelastic demand curve for the product. (b) The firm charges a low price (here  $P_s$ ) to students because their demand curve is relatively elastic. The firm's total profit from using price discrimination (here, the sum of the two green rectangles) exceeds the profit (not shown) that would have occurred if the monopolist had charged the same price to all customers.



Firms engage in price discrimination because it enhances their profit. The numbers (not shown) behind the curves in Figure 12.8 would clearly reveal that the sum of the two profit rectangles shown in green exceeds the single profit rectangle the firm would obtain from a single monopoly price. How do consumers fare? In this case, students clearly benefit by paying a lower price than they would if the firm charged a single monopoly price; in contrast, the price discrimination results in a higher price for business customers. Therefore, compared to the single-price situation, students buy more of the software and small businesses buy less.

Such price discrimination is widespread in the economy and is illegal only when it is part of a firm's strategy to lessen or eliminate competition. We will discuss illegal price discrimination in Chapter 19, which covers antitrust policy.

## Regulated Monopoly

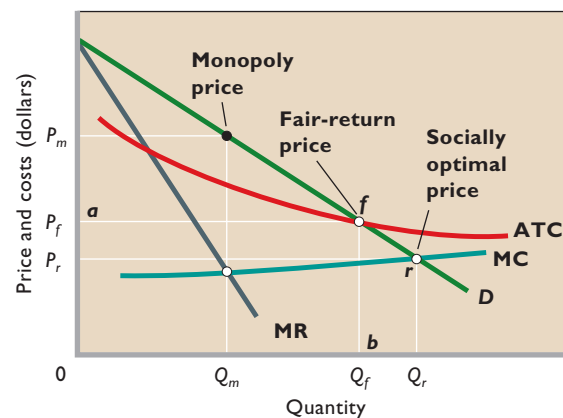
**LO12.7** Distinguish between the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

Natural monopolies traditionally have been subject to *rate regulation* (price regulation), although the recent trend has been to deregulate wherever competition seems possible. For example, long-distance telephone calls, natural gas distribution, wireless communications, cable television, and long-distance electricity transmission have been, to one degree or another, deregulated over the past several decades. And regulators in some states are beginning to

allow new entrants to compete with existing local telephone and electricity providers. Nevertheless, state and local regulatory commissions still regulate the prices that most local natural gas distributors, regional telephone companies, and local electricity suppliers can charge. These locally regulated monopolies are commonly called “public utilities.”

Let's consider the regulation of a local natural monopoly. Our example will be a single firm that is the only seller of natural gas in the town of Springfield. Figure 12.9

**FIGURE 12.9 Regulated monopoly.** The socially optimal price  $P_r$ , found where  $D$  and  $MC$  intersect, will result in an efficient allocation of resources but may entail losses to the monopoly. The fair-return price  $P_f$  will allow the monopolist to break even but will not fully correct the underallocation of resources.





shows the demand and the long-run cost curves facing our firm. Because of extensive economies of scale, the demand curve cuts the natural monopolist's long-run average-total-cost curve at a point where that curve is still falling. It would be inefficient to have several firms in this industry because each would produce a much smaller output, operating well to the left on the long-run average-total-cost curve. In short, each firm's lowest average total cost would be substantially higher than that of a single firm. So efficient, lowest-cost production requires a single seller.

We know by application of the  $MR = MC$  rule that  $Q_m$  and  $P_m$  are the profit-maximizing output and price that an unregulated monopolist would choose. Because price exceeds average total cost at output  $Q_m$ , the monopolist enjoys a substantial economic profit. Furthermore, price exceeds marginal cost, indicating an underallocation of resources to this product or service. Can government regulation bring about better results from society's point of view?

### Socially Optimal Price: $P = MC$

One sensible goal for regulators would be to get the monopoly to produce the allocatively efficient output level. For our monopolist in Figure 12.9, this is output level  $Q_r$ , determined by where the demand curve  $D$  intersects the MC curve.  $Q_r$  is the allocatively efficient output level because for each unit of output up to  $Q_r$ , the demand curve lies above the MC curve, indicating that for all of these units marginal benefits exceed marginal costs.

But how can the regulatory commission actually motivate the monopoly to produce this output level? The trick is to set the regulated price  $P_r$  at a level such that the monopoly will be led by its profit-maximizing rule to voluntarily produce the allocatively efficient level of output. To see how this works, note that because the monopoly will receive the regulated price  $P_r$  for all units that it sells,  $P_r$  becomes the monopoly's marginal revenue per unit. Thus, the monopoly's MR curve becomes the horizontal white line moving rightward from price  $P_r$  on the vertical axis.

The monopoly will at this point follow its usual rule for maximizing profits or minimizing losses: It will produce where marginal revenue equals marginal cost. As a result, the monopoly will produce where the horizontal white MR ( $= P_r$ ) line intersects the MC curve at point  $r$ . That is, the monopoly will end up producing the socially optimal output  $Q_r$ , not because it is socially minded but because  $Q_r$  happens to be the output that either maximizes profits or minimizes losses when the firm is forced by the regulators to sell all units at the regulated price  $P_r$ .

The regulated price  $P_r$  that achieves allocative efficiency is called the **socially optimal price**. Because it is determined by where the MC curve intersects the demand curve, this type of regulation is often summarized by the equation  $P = MC$ .

### Fair-Return Price: $P = ATC$

The socially optimal price suffers from a potentially fatal problem.  $P_r$  may be so low that average total costs are not covered, as is the case in Figure 12.9. In such situations, forcing the socially optimal price on the regulated monopoly would result in short-run losses and long-run exit. In our example, Springfield would be left without a gas company and its citizens without gas.

What can be done to rectify this problem? One option is to provide a public subsidy to cover the loss that the socially optimal price would entail. Another possibility is to condone price discrimination, allow the monopoly to charge some customers prices above  $P_r$ , and hope that the additional revenue that the monopoly gains from price discrimination will be enough to permit it to break even.

In practice, regulatory commissions in the United States have often pursued a third option that abandons the goal of producing every unit for which marginal benefits exceed marginal costs but that guarantees that regulated monopolies will be able to break even and continue in operation. Under this third option, regulators set a regulated price that is high enough for monopolists to break even and continue in operation. This price has come to be referred to as a **fair-return price** because of a ruling in which the Supreme Court held that regulatory agencies must permit regulated utility owners to enjoy a "fair return" on their investments.

In practice, a fair return is equal to a normal profit. That is, a fair return is an accounting profit equal in size to what the owners of the monopoly would on average receive if they entered another type of business.

The regulator determines the fair-return price  $P_f$  by where the average total cost curve intersects the demand curve at point  $f$ . As we will explain, setting the regulated price at this level will cause the monopoly to produce  $Q_f$  units while guaranteeing that it will break even and not wish to exit the industry. To see why the monopoly will voluntarily produce  $Q_f$  units, note that because the monopoly will receive  $P_f$  dollars for each unit it sells, its marginal revenue per unit becomes  $P_f$  dollars so that the horizontal line moving rightward from  $P_f$  on the vertical axis becomes the regulated monopoly's MR curve. Because this horizontal MR curve is always higher than the monopoly's MC



## Monopoly Power in the Internet Age

**Network Effects and Economies of Scale Have Driven the Monopolistic Growth of Several Internet Giants, Including Google, Facebook, and Amazon.**

In the early 1990s, when the Internet was young, many analysts predicted that it would foster pure competition across a wide range of activities. Because the Internet allowed any user to publish text and images that could be read for free by any other user, they assumed that the Internet would create a level playing field for all types of media, communications, and commerce.

These predictions turned out to be wrong. One mistake was in not understanding that in a world awash in information, finding what you want becomes a huge problem. When the Internet started, there was no directory and there were no search engines. So it was nearly impossible to find what you were looking for.

Google solved that problem by creating the first effective search engine. Thanks to Google, people could easily locate what they were looking for. But this meant that anyone wishing to be found was now dependent on Google or some other search engine to be found.

If you were an advertiser, you would want to spend your money placing keyword ads on the most popular search engine so that your ads would reach as many potential customers as



possible. And if you were a customer who found ads helpful in finding what you were looking for, you would also want to utilize the most popular search engine so that you could be exposed to the greatest number of helpful ads. Thus, Google

curve, it is obvious that marginal revenues will exceed marginal costs for every possible level of output shown in Figure 12.9. Thus, the monopoly should be willing to supply whatever quantity of output is demanded by consumers at the regulated price  $P_f$ . That quantity is, of course, given by the demand curve. At price  $P_f$  consumers will demand exactly  $Q_f$  units. Thus, by setting the regulated price at  $P_f$ , the regulator gets the monopoly to voluntarily supply exactly  $Q_f$  units.

Even better, the regulator also guarantees that the monopoly firm will earn exactly a normal profit. This can be seen in Figure 12.9 by noting that the rectangle  $0afb$  is equal to both the monopoly's total cost and its total revenue. Its economic profit is therefore equal to zero, implying that it must be earning a normal accounting profit for its owners.

One final point about allocative efficiency: By choosing the fair-return price  $P_f$ , the regulator leads the monopoly to produce  $Q_f$  units. This is less than the socially optimal quantity  $Q_m$ , but still more than the  $Q_m$  units that

the monopolist would produce if left unregulated. So while fair-return pricing does not lead to full allocative efficiency, it is still an improvement on what the monopoly would do if left to its own devices.

### Dilemma of Regulation

Comparing results of the socially optimal price ( $P = MC$ ) and the fair-return price ( $P = ATC$ ) suggests a policy dilemma, sometimes termed the *dilemma of regulation*. When its price is set to achieve the most efficient allocation of resources ( $P = MC$ ), the regulated monopoly is likely to suffer losses. Survival of the firm would presumably depend on permanent public subsidies out of tax revenues. On the other hand, although a fair-return price ( $P = ATC$ ) allows the monopolist to cover costs, it only partially resolves the underallocation of resources that the unregulated monopoly price would foster. Despite this dilemma, regulation can improve on the results of monopoly from the social point of view. Price regulation (even at the

quickly came to dominate search as the result of network effects by which the value of Google to any one particular user increased with the total number of users.

Those network effects also created a barrier to entry that protects Google from competitors because both those searching for information and as well as those wanting to provide it have an interest in sticking with whatever search engine has the most users. There are in fact many smaller search engines, but nobody wants to use them very much for the simple reason that almost nobody else is using them. Consequently, Google controls nearly 70 percent of the U.S. search market and receives about 75 percent of the revenue generated by search ads.

The network effects that help Google dominate search also drive the dominance that just a handful of firms hold over other parts of the Internet. Consider Facebook. It is a well-run Web site with lots of interesting things to do. But most people come back for the wall posts and other content generated by fellow users. If there were no fellow users, there would be little content and little reason to visit the site.

That makes it hard for smaller social-networking sites to compete with Facebook. If interacting with others is the whole point of joining a networking site, why would you want to join a site that has very few people to interact with? As a result, Facebook has come to dominate social media. With over a billion users, it enjoys the largest network effect and grows even bigger thanks to already being big.

The early predictions that the Internet would create a level playing field for all types of media, communications, and commerce have also been doomed by economies of scale. Consider Amazon. To the public, Amazon is the world's largest online retailer, with over \$50 billion in annual sales. But behind the scenes, its success is driven by two activities that each enjoys massive economies of scale: data and logistics.

In terms of data, Amazon runs some of the world's largest server farms. These giant buildings are stacked top to bottom with tens of thousands of networked computers that store customer data, process payments, and keep track of inventory. The cost of building and running these server farms runs into the billions of dollars each year—including massive electricity bills. But because a larger server farm generates a lower cost per sale than a smaller server farm, Amazon enjoys economies of scale that allow it to undersell any rival operating on a smaller scale with smaller server farms.

The story with logistics is much the same. Amazon operates dozens of massive distribution warehouses that benefit from economies of scale because a warehouse that is twice as big costs less than twice as much to operate.

We should note, however, that Google, Facebook, and Amazon are not full-on monopolies. Each faces robust competition. While network effects and economies of scale benefit them greatly, those factors are not strong enough to guarantee them permanent dominance or even large profits. Amazon's 2011 profit was only 1.3 percent.

fair-return price) can simultaneously reduce price, increase output, and reduce the economic profit of monopolies.

That said, we need to provide an important caution: "Fair-price" regulation of monopoly looks rather simple in theory but is amazingly complex in practice. In the actual economy, rate regulation is accompanied by large, expensive rate-setting bureaucracies and maze-like sets of procedures. Also, rate decisions require extensive public input via letters and through public hearings. Rate decisions are subject to lengthy legal challenges. Further, because regulatory commissions must set prices sufficiently above costs to create fair returns, regulated monopolists have little incentive to minimize average total costs. When these costs creep up, the regulatory commissions must set higher prices.

Regulated firms therefore are noted for higher-than-competitive wages, more managers and staff than necessary, nicer-than-typical office buildings, and other forms of X-inefficiency. These inefficiencies help explain the trend of federal, state, and local governments abandoning price regulation where the possibility of competition looks promising.

### QUICK REVIEW 12.3

- Price discrimination occurs when a firm sells a product at different prices that are not based on cost differences.
- The conditions necessary for price discrimination are (a) monopoly power, (b) the ability to segregate buyers on the basis of demand elasticities, and (c) the inability of buyers to resell the product.
- Compared with single pricing by a monopolist, perfect price discrimination results in greater profit and greater output. Many consumers pay higher prices, but other buyers pay prices below the single price.
- Monopoly price can be reduced and output increased through government regulation.
- The socially optimal price ( $P = MC$ ) achieves allocative efficiency but may result in losses; the fair-return price ( $P = ATC$ ) yields a normal profit but fails to achieve allocative efficiency.

# SUMMARY

## LO12.1 List the characteristics of pure monopoly.

A pure monopolist is the sole producer of a commodity for which there are no close substitutes.

## LO12.2 List and explain the barriers to entry that shield pure monopolies from competition.

The existence of pure monopoly and other imperfectly competitive market structures is explained by barriers to entry in the form of (a) economies of scale, (b) patent ownership and research, (c) ownership or control of essential resources, and (d) pricing and other strategic behavior.

## LO12.3 Explain how demand is seen by a pure monopoly.

The pure monopolist's market situation differs from that of a competitive firm in that the monopolist's demand curve is downsloping, causing the marginal-revenue curve to lie below the demand curve. Like the competitive seller, the pure monopolist will maximize profit by equating marginal revenue and marginal cost. Barriers to entry may permit a monopolist to acquire economic profit even in the long run. However, (a) the monopolist does not charge "the highest price possible"; (b) the price that yields maximum total profit to the monopolist rarely coincides with the price that yields maximum unit profit; (c) high costs and a weak demand may prevent the monopolist from realizing any profit at all; and (d) the monopolist avoids the inelastic region of its demand curve.

## LO12.4 Explain how a pure monopoly sets its profit-maximizing output and price.

With the same costs, the pure monopolist will find it profitable to restrict output and charge a higher price than would sellers in a purely competitive industry. This restriction of output causes resources to be misallocated, as is evidenced by the fact that price exceeds marginal cost in monopolized markets. Monopoly creates an efficiency loss (or deadweight loss) for society.

Monopoly transfers income from consumers to monopolists because a monopolist can charge a higher price than would a purely competitive firm with the same costs. So monopolists in effect levy a "private tax" on consumers and, if demand is strong enough, obtain substantial economic profits.

## LO12.5 Discuss the economic effects of monopoly.

The costs monopolists and competitive producers face may not be the same. On the one hand, economies of scale may make lower unit costs available to monopolists but not to competitors. Also, pure monopoly may be more likely than pure competition to reduce costs via technological advance because of the monopolist's ability to realize economic profit, which can be used to finance research. On the other hand, X-inefficiency—the failure to produce with the least costly combination of inputs—is more common among monopolists than among competitive firms. Also, monopolists may make costly expenditures to maintain monopoly privileges that are conferred by government. Finally, the blocked entry of rival firms weakens the monopolist's incentive to be technologically progressive.

## LO12.6 Describe why a monopolist might prefer to charge different prices in different markets.

A monopolist can increase its profit by practicing price discrimination, provided (a) it can segregate buyers on the basis of elasticities of demand and (b) its product or service cannot be readily transferred between the segregated markets.

## LO12.7 Distinguish between the monopoly price, the socially optimal price, and the fair-return price of a government-regulated monopoly.

Price regulation can be invoked to eliminate wholly or partially the tendency of monopolists to underallocate resources and to earn economic profits. The socially optimal price is determined where the demand and marginal-cost curves intersect; the fair-return price is determined where the demand and average-total-cost curves intersect.

# TERMS AND CONCEPTS

pure monopoly

barriers to entry

simultaneous consumption

network effects

X-inefficiency

rent-seeking behavior

price discrimination

socially optimal price

fair-return price

The following and additional problems can be found in **connect**  
ECONOMICS

## DISCUSSION QUESTIONS

1. "No firm is completely sheltered from rivals; all firms compete for consumer dollars. If that is so, then pure monopoly does not exist." Do you agree? Explain. How might you use

Chapter 6's concept of cross elasticity of demand to judge whether monopoly exists? **LO12.1**

2. Discuss the major barriers to entry into an industry. Explain how each barrier can foster either monopoly or oligopoly. Which barriers, if any, do you feel give rise to monopoly that is socially justifiable? **LO12.2**
3. How does the demand curve faced by a purely monopolistic seller differ from that confronting a purely competitive firm? Why does it differ? Of what significance is the difference? Why is the pure monopolist's demand curve not perfectly inelastic? **LO12.3**
4. Assume that a pure monopolist and a purely competitive firm have the same unit costs. Contrast the two with respect to (a) price, (b) output, (c) profits, (d) allocation of resources, and (e) impact on income transfers. Since both monopolists and competitive firms follow the  $MC = MR$  rule in maximizing profits, how do you account for the different results? Why might the costs of a purely competitive firm and those of a monopolist be different? What are the implications of such a cost difference? **LO12.5**
5. Critically evaluate and explain each statement: **LO12.5**
  - a. Because they can control product price, monopolists are always assured of profitable production by simply charging the highest price consumers will pay.
  - b. The pure monopolist seeks the output that will yield the greatest per-unit profit.
  - c. An excess of price over marginal cost is the market's way of signaling the need for more production of a good.
  - d. The more profitable a firm, the greater its monopoly power.
  - e. The monopolist has a pricing policy; the competitive producer does not.
- f. With respect to resource allocation, the interests of the seller and of society coincide in a purely competitive market but conflict in a monopolized market.
6. Assume a monopolistic publisher has agreed to pay an author 10 percent of the total revenue from the sales of a text. Will the author and the publisher want to charge the same price for the text? Explain. **LO12.5**
7. U.S. pharmaceutical companies charge different prices for prescription drugs to buyers in different nations, depending on elasticity of demand and government-imposed price ceilings. Explain why these companies, for profit reasons, oppose laws allowing reimportation of drugs to the United States. **LO12.6**
8. Explain verbally and graphically how price (rate) regulation may improve the performance of monopolies. In your answer distinguish between (a) socially optimal (marginal-cost) pricing and (b) fair-return (average-total-cost) pricing. What is the "dilemma of regulation"? **LO12.7**
9. It has been proposed that natural monopolists should be allowed to determine their profit-maximizing outputs and prices and then government should tax their profits away and distribute them to consumers in proportion to their purchases from the monopoly. Is this proposal as socially desirable as requiring monopolists to equate price with marginal cost or average total cost? **LO12.7**
10. **LAST WORD** How do networking effects help Facebook fend off smaller social-networking rivals? Could an online retailer doing half as much business compete on an equal footing with Amazon in terms of costs? Explain.

## REVIEW QUESTIONS

1. Which of the following could explain why a firm is a monopoly? Select one or more answers from the choices shown. **LO12.2**
  - a. Patents.
  - b. Economies of scale.
  - c. Inelastic demand.
  - d. Government licenses.
  - e. Downsloping market demand.
2. The MR curve of a perfectly competitive firm is horizontal. The MR curve of a monopoly firm is: **LO12.3**
  - a. Horizontal, too.
  - b. Upsloping.
  - c. Downsloping.
  - d. It depends.
3. Use the nearby demand schedule to calculate total revenue and marginal revenue at each quantity. Plot the demand, total-revenue, and marginal-revenue curves, and explain the relationships between them. Explain why the marginal revenue of the fourth unit of output is \$3.50, even though its price is \$5. Use Chapter 6's total-revenue test for price elasticity to designate the elastic and inelastic segments of your graphed demand curve. What generalization can you make

as to the relationship between marginal revenue and elasticity of demand? Suppose the marginal cost of successive units of output was zero. What output would the profit-seeking firm produce? Finally, use your analysis to explain why a monopolist would never produce in the inelastic region of demand. **LO12.3**

Price (P)	Quantity		
	Demanded (Q)	Quantity Demanded (Q)	
\$7.00	0	\$4.50	5
6.50	1	4.00	6
6.00	2	3.50	7
5.50	3	3.00	8
5.00	4	2.50	9

4. How often do *perfectly competitive* firms engage in price discrimination? **LO12.6**
  - a. Never.
  - b. Rarely.
  - c. Often.
  - d. Always.

5. Suppose that a monopolist can segregate his buyers into two different groups to which he can charge two different prices. In order to maximize profit, the monopolist should charge a higher price to the group that has: **LO12.6**
  - a. The higher elasticity of demand.
  - b. The lower elasticity of demand.
  - c. Richer members.
6. The socially optimal price ( $P = MC$ ) is socially optimal because: **LO12.7**
  - a. It reduces the monopolist's profit.
  - b. It yields a normal profit.
  - c. It minimizes ATC.
  - d. It achieves allocative efficiency.
7. The main problem with imposing the socially optimal price ( $P = MC$ ) on a monopoly is that the socially optimal price: **LO12.7**
  - a. May be so low that the regulated monopoly can't break even.
  - b. May cause the regulated monopoly to engage in price discrimination.
  - c. May be higher than the monopoly price.

## PROBLEMS

1. Suppose a pure monopolist is faced with the demand schedule shown below and the same cost data as the competitive producer discussed in problem 4 at the end of Chapter 10. Calculate the missing total-revenue and marginal-revenue amounts, and determine the profit-maximizing price and profit-maximizing output for this monopolist. What is the monopolist's profit? Verify your answer graphically and by comparing total revenue and total cost. **LO12.4**

Price	Quantity Demanded	Total Revenue	Marginal Revenue
\$115	0	\$ _____	\$ _____
100	1	_____	_____
83	2	_____	_____
71	3	_____	_____
63	4	_____	_____
55	5	_____	_____
48	6	_____	_____
42	7	_____	_____
37	8	_____	_____
33	9	_____	_____
29	10	_____	_____

2. Suppose that a price-discriminating monopolist has segregated its market into two groups of buyers. The first group is described by the demand and revenue data that you developed for problem 1. The demand and revenue data for the second group of buyers is shown in the following table. Assume that  $MC$  is \$13 in both markets and  $MC = ATC$  at all output levels. What price will the firm charge in each market? Based solely on these two prices, which market has the higher price elasticity of demand? What will be this monopolist's total economic profit? **LO12.6**

Price	Quantity Demanded	Total Revenue	Marginal Revenue
\$71	0	\$ 0	
63	1	63	\$63
55	2	110	47
48	3	144	34
42	4	168	24
37	5	185	17
33	6	198	13
29	7	203	5

3. Assume that the most efficient production technology available for making vitamin pills has the cost structure given in the following table. Note that output is measured as the number of bottles of vitamins produced per day and that costs include a normal profit. **LO12.6**

Output	TC	MC
25,000	\$100,000	\$0.50
50,000	150,000	1.00
75,000	187,500	2.50
100,000	275,500	3.00

- a. What is ATC per unit for each level of output listed in the table?
- b. Is this a decreasing-cost industry? (Answer yes or no).
- c. Suppose that the market price for a bottle of vitamins is \$2.50 and that at that price the total market quantity demanded is 75,000,000 bottles. How many firms will there be in this industry?
- d. Suppose that, instead, the market quantity demanded at a price of \$2.50 is only 75,000. How many firms do you expect there to be in this industry?
- e. Review your answers to parts *b*, *c*, and *d*. Does the level of demand determine this industry's market structure?



4. A new production technology for making vitamins is invented by a college professor who decides not to patent it. Thus, it is available for anybody to copy and put into use. The TC per bottle for production up to 100,000 bottles per day is given in the following table. **LO12.6**

Output	TC
25,000	\$50,000
50,000	70,000
75,000	75,000
100,000	80,000

- What is ATC for each level of output listed in the table?
  - Suppose that for each 25,000-bottle-per-day increase in production above 100,000 bottles per day, TC increases by \$5,000 (so that, for instance, 125,000 bottles per day would generate total costs of \$85,000 and 150,000 bottles per day would generate total costs of \$90,000). Is this a decreasing-cost industry?
  - Suppose that the price of a bottle of vitamins is \$1.33 and that at that price the total quantity demanded by consumers is 75,000,000 bottles. How many firms will there be in this industry?
  - Suppose that, instead, the market quantity demanded at a price of \$1.33 is only 75,000. How many firms do you expect there to be in this industry?
- Review your answers to parts *b*, *c*, and *d*. Does the level of demand determine this industry's market structure?
    - Compare your answer to part *d* of this problem with your answer to part *d* of problem 3. Do both production technologies show constant returns to scale?
  - Suppose you have been tasked with regulating a single monopoly firm that sells 50-pound bags of concrete. The firm has fixed costs of \$10 million per year and a variable cost of \$1 per bag no matter how many bags are produced. **LO12.7**
    - If this firm kept on increasing its output level, would ATC per bag ever increase? Is this a decreasing-cost industry?
    - If you wished to regulate this monopoly by charging the socially optimal price, what price would you charge? At that price, what would be the size of the firm's profit or loss? Would the firm want to exit the industry?
    - You find out that if you set the price at \$2 per bag, consumers will demand 10 million bags. How big will the firm's profit or loss be at that price?
    - If consumers instead demanded 20 million bags at a price of \$2 per bag, how big would the firm's profit or loss be?
    - Suppose that demand is perfectly inelastic at 20 million bags, so that consumers demand 20 million bags no matter what the price is. What price should you charge if you want the firm to earn only a fair rate of return? Assume as always that TC includes a normal profit.

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