CHAPTER 11

Monopoly

What price and output should a firm with some monopoly power select?

Chapter Outline

11.1 The Monopolist's Demand and Marginal Revenue Curves
11.2 Profit-Maximizing Output of a Monopoly
Graphical Analysis *The Monopoly Price and Its Relationship to Elasticity of Demand*
Application 11.1 Demand Elasticity and Home Video and DVD Prices
11.3 Further Implications of Monopoly Analysis
Application 11.2 Life Is Not Always a Box of Chocolates
11.4 The Measurement and Sources of Monopoly Power
Measuring Monopoly Power *The Sources of Monopoly Power* *Barriers to Entry*
Application 11.3 Regulatory Barriers in the Philippines
Strategic Behavior by Firms: Incumbents and Potential Entrants
11.5 The Efficiency Effects of Monopoly
A Dynamic View of Monopoly and Its Efficiency Implications
Application 11.4 The Dynamics of Developing an AIDS Vaccine
11.6 Public Policy Toward Monopoly
Application 11.5 What Not to Say to a Rival on the Telephone
Application 11.6 Static Versus Dynamic Views of Monopoly and the Microsoft Antitrust Case
Regulation of Price

Learning Objectives

- Define monopoly and show what a monopolist's demand and marginal revenue curves look like.
- Explain why a monopolist's profit-maximizing output is where marginal revenue equals marginal cost.
- Describe why the extent to which a monopolist's price exceeds marginal cost is larger the more inelastic the demand faced by the monopolist.
- Understand why the shutdown condition applies to monopolies as well as to firms operating in a perfectly competitive market.
- Outline the potential sources of monopoly power: absolute cost advantages, economies of scale, product differentiation, and regulatory barriers.
- Explore the efficiency effects of monopoly from a static as well as a dynamic perspective.
- Overview public policy toward monopoly.

MONOPOLY
a market with a single seller

In perfect competition, firms are price takers. In other words, firms are numerous enough to ensure that no single seller affects the market price.

Monopoly is the polar opposite of perfect competition in that it describes a market with a single seller. A monopoly firm faces the market demand curve for its product because it is

the sole seller of the product. Since it faces the market demand curve, the monopoly firm has control over the market price: it can choose any price–quantity combination on the market demand curve.

What price and output level should a profit-maximizing monopoly firm select? We will see that, relative to perfect competition, monopoly results in a higher price and a lower quantity. This has efficiency implications, and we discuss why it is illegal in the United States to monopolize a market.

MONOPOLY POWER
some ability to set price above marginal cost

Although pure monopoly is rare, markets where a small number of firms compete with one another are common. Chapters 13 and 14 more fully explore the strategic interactions between firms in such markets. In general, however, the firms may have some **monopoly power**: some control over price, some ability to set price above marginal cost. This chapter discusses the determinants of monopoly power, how to measure it, and its implications for product pricing.

11.1 THE MONOPOLIST'S DEMAND AND MARGINAL REVENUE CURVES[1]

A monopoly faces the market demand curve for its product because it is, by definition, the only seller of the product. Thus, a monopoly's demand curve slopes downward. This contrasts sharply with the horizontal demand curve faced by a competitive firm. While a competitive firm is a price taker, a monopoly is a **price maker**. A monopoly supplies the total market and can choose any price along the market demand curve it wants. Since the monopoly faces a downward-sloping demand curve, if it raises price, the amount it sells will fall. Much of the analysis of monopoly and the difference in output and price between a monopoly and a competitive industry stems from this difference in the demand curves.

PRICE MAKER
a monopoly that supplies the total market and can choose any price along the market demand curve that it wants

Let's consider the co-stars of *Friends*, the most popular sitcom on television in recent years. Let's assume that the *Friends* co-stars face the demand curve depicted in Figure 11.1, are interested in maximizing profit, and must charge the same price for each new show produced per month. According to the last assumption, while the *Friends* co-stars can operate on any price–quantity point along the demand curve they face, once they select a price they must charge that same price for all shows sold.[2]

Under these assumptions, what price should the co-stars choose? Is it better to select a very high price, produce little, but make a killing from each unit sold? For instance, if only one show is produced the *Friends* co-stars make $1 million per show. Or is it advisable to select a lower price and sell more shows, even though the price one can charge declines with output? The price the co-stars obtain is only $400,000 if they supply seven shows.

In making its price and output decision, any profit-oriented firm will be concerned with the relationship between output and total revenue. Will more output increase total revenue and, if so, by how much? Recall that marginal revenue equals the change in total revenue associated with a one-unit change in output. Marginal revenue thus indicates how an output change affects total revenue. Understanding the significance of marginal revenue for a firm's output decision and the way marginal revenue is related to the firm's demand curve is central to analyzing monopoly and other noncompetitive market structures.

[1]A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page 567).

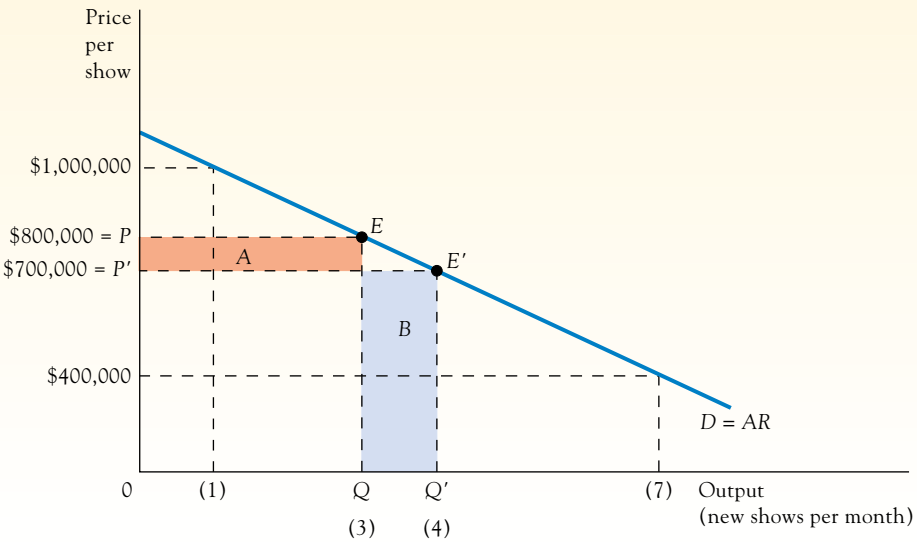
[2]We leave to Chapter 12 the topic of price discrimination and what happens when a monopoly firm can charge different prices for the various units of output that it sells.

For a competitive firm facing a horizontal demand curve, marginal revenue is equal to the product's price (average revenue). With a downward-sloping demand curve, the situation is different: marginal revenue is always less than price. Figure 11.1 shows why. When price is \$800,000, the *Friends* co-stars can sell three shows, and total revenue equals rectangle *PEQ*0, or \$2,400,000. To sell four shows, the co-stars must reduce their price to \$700,000 since the demand curve slopes downward. Total revenue for 4 units sold is *P′E′Q′*0, or \$2,800,000. Note how total revenue changes when output increases from three to four shows. The rectangular measure of total revenue decreases by area *A*: this area indicates how much revenue is lost on the first three shows when they are sold for \$700,000 instead of \$800,000 (area *A* equals \$300,000). The rectangular measure of total revenue, however, also increases by area *B*—the amount added to total revenue from selling the fourth show for \$700,000. Area *B* is equal to the new price the *Friends* co-stars have chosen, \$700,000. When four shows are sold instead of three, total revenue rises by area *B* (the price received for the fourth show) minus area *A* (the reduced revenue from selling the first three shows at a lower price), or by \$700,000 minus \$300,000, or \$400,000. The increase in total revenue is marginal revenue, and it is less than the price (area *B*) because the price of the first three shows must be reduced to sell four shows. This reasoning applies to any downward-sloping demand curve and shows why *marginal revenue is always less than price when the demand curve slopes downward*, except for the first unit sold.[3]

FIGURE 11.1

The Monopolist's (*Friends* co-stars) Demand Curve

The *Friends* co-stars confront a downward-sloping demand curve. Price exceeds marginal revenue with a downward-sloping demand curve. If price falls from \$800,000 to \$700,000, total revenue changes by area *B* (the price at which the fourth unit is sold) minus area *A*.



[3]In Table 11.1, where we assume that output can be produced only in whole units, marginal revenue equals price at an output of one. If we allow for output to be produced in ever-smaller and less than whole units, the marginal revenue and demand curves have the same height only at their intercepts on the vertical axis.

TABLE 11.1

DEMAND AND TOTAL, MARGINAL, AND AVERAGE REVENUES

P	*Q*	*TR*	*MR*	*AR*
$1,100,000	0	$0	—	—
1,000,000	1	1,000,000	$1,000,000	$1,000,000
900,000	2	1,800,000	800,000	900,000
800,000	3	2,400,000	600,000	800,000
700,000	4	2,800,000	400,000	700,000
600,000	5	3,000,000	200,000	600,000
500,000	6	3,000,000	0	500,000
400,000	7	2,800,000	−200,000	400,000

Another way to see the relationship between price and marginal revenue is to recall that the demand curve is the same as the average revenue curve. If four shows are sold for $700,000 each, the average revenue per show is the same as the price. Viewed this way, the demand curve is a declining average revenue curve, and whenever the average is falling, the marginal curve associated with it must lie below the average.

Marginal revenue is not a fixed amount but varies with the quantity sold. Table 11.1 illustrates a hypothetical relationship between the *Friends* co-stars' demand schedule and total revenue (*TR*), marginal revenue (*MR*), and average revenue (*AR*). The first two columns reflect the assumption of a downward-sloping demand curve, with quantity sold (*Q*) rising as price (*P*) declines. $MR = P = AR$ for the first show sold, but for all other outputs price exceeds marginal revenue. When output rises from 1 to 2, for example, total revenue rises from $1,000,000 to $1,800,000. So *MR* for the second show is $800,000, but *P* is $900,000, according to the demand curve.

11.2 PROFIT-MAXIMIZING OUTPUT OF A MONOPOLY[4]

Demand and cost conditions jointly determine the most profitable output for a monopoly, just as they do for a competitive firm. Analytically, the only difference is that a monopoly faces a downward-sloping demand curve while a competitive firm faces a horizontal demand curve. Although the demand curve's slope depends on the market setting, the output-decision rule for maximizing firm profit does not. In other words, both competitive and monopoly firms maximize profit by setting output where marginal revenue (*MR*) equals marginal cost (MC).

To see why the $MR = MC$ decision rule applies to monopolies as well as to competitive firms, consider the demand and cost data for a monopoly firm shown in Table 11.2. We know the firm is a monopoly from the demand data in the first two columns. These columns show that price must be lowered to sell more output, indicating that the firm's demand curve slopes downward. Multiplying price times quantity for each output yields total revenue, as shown in column (3). Column (4) identifies the long-run total cost (*TC*) of producing each output. Since profit (π) is the difference between total revenue and total cost, the firm selects the output where total revenue exceeds total cost by the largest possi-

[4]A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page 567).

TABLE 11.2

PROFIT MAXIMIZATION BY A MONOPOLIST (IN DOLLARS)

P	Q	TR	TC	π	AR	AC	MR	MC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
10.20	0	0	0	0	—	—	—	—	
10.00	1	10.00	8.00	2.00	10.00	8.00	10.00	8.00	
9.80	2	19.60	15.00	4.60	9.80	7.50	9.60	7.00	
9.60	3	28.80	21.00	7.80	9.60	7.00	9.20	6.00	MR > MC
9.40	4	37.60	27.50	10.10	9.40	6.88	8.80	6.50	
9.20	5	46.00	34.50	11.50	9.20	6.90	8.40	7.00	
9.00	6	54.00	41.80	12.20	9.00	6.97	8.00	7.30	
8.80	7	61.60	49.39	12.21	8.80	7.056	7.60	7.59	MR ≈ MC
8.60	8	68.80	57.00	11.80	8.60	7.13	7.20	7.61	
8.40	9	75.60	65.00	10.60	8.40	7.22	6.80	8.00	MR < MC
8.20	10	82.00	74.00	8.00	8.20	7.40	6.40	9.00	

ble amount. This occurs at an output of 7 and a price of $8.80. At that output, profit is $12.21 and $MR \approx MC$.

To see that profit is maximized where $MR = MC$, note that marginal revenue exceeds marginal cost at output levels less than 7 units, indicating that the firm can increase profit by expanding output, but to do so, it must lower price. For example, the marginal revenue from selling the fourth unit ($8.80) exceeds the marginal cost ($6.50). Thus, profit will be $2.30 higher if the firm expands output from 3 to 4 units, as shown in the fifth column. At output levels greater than 7 units, marginal cost exceeds marginal revenue, and the firm can increase profit by reducing output and raising its price. For example, the marginal revenue from selling the tenth unit is $6.40, but the marginal cost of producing it is $9.00. Profit will be $2.60 higher if the firm reduces output from 10 to 9 units; that is, cost will fall by $2.60 more than revenue.

Graphical Analysis

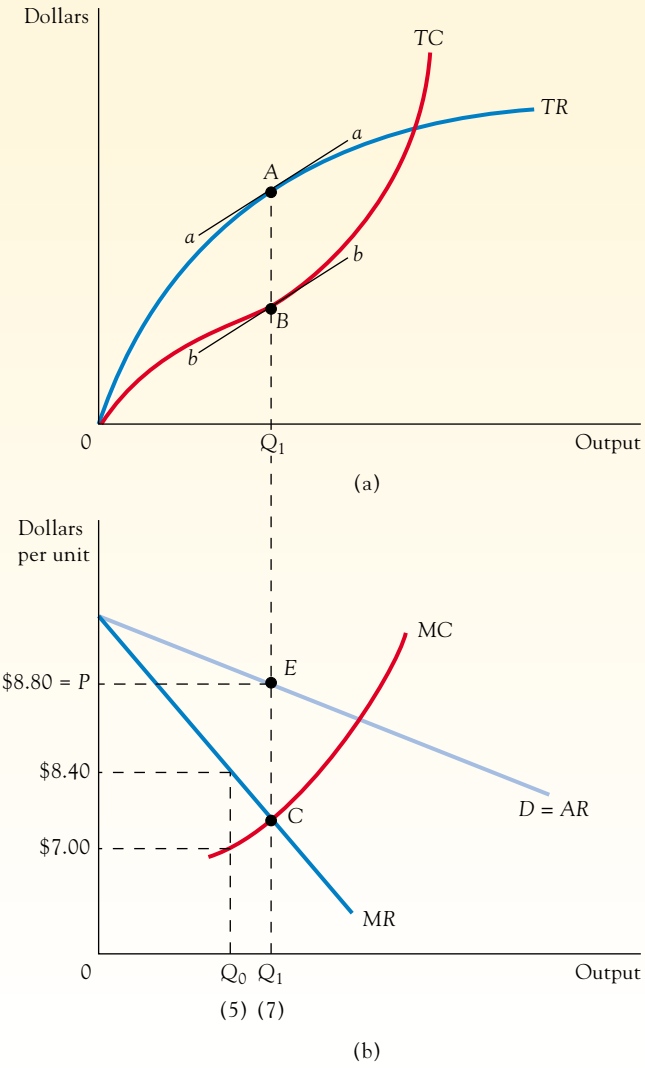
Figure 11.2 depicts the profit-maximizing output for a monopoly. Panel (a) shows the monopoly's total revenue and total cost curves. Profit is maximized at the output where *TR* exceeds *TC* by the largest possible amount. In the figure, the profit-maximizing output is Q_1 (7 units in Table 11.2), where total revenue is AQ_1 ($61.60) and total cost is BQ_1 ($49.39). Total profit is shown by the distance *AB* ($12.21). Profit is smaller at every other output. Marginal cost and marginal revenue at output Q_1 are shown by the slopes of the *TC* and *TR* curves. Marginal cost is the slope of *TC* at point *B* (the slope of the line *bb*), and marginal revenue is the slope of *TR* at point *A* (the slope of the line *aa*). The slopes of the curves at these points are equal to one another since the most profitable output occurs where $MR = MC$.

Figure 11.2b depicts the most profitable output by using the per-unit cost and revenue curves. Because this approach is the more useful one—and the one we will use from now on in the text—we devote more attention to it. It is important to recognize, however, that the total and per-unit curve approaches are equivalent ways of looking at the same problem.

Figure 11.2b shows the monopolist's demand (average revenue) curve and the associated marginal revenue curve. As discussed in Section 11.1, for a negatively-sloped demand curve, marginal revenue is less than price at all output levels.

FIGURE 11.2

Profit Maximization: Total and Per-Unit Curves
(a) Profit is maximized when total revenue exceeds total cost by the largest amount possible. Maximum profit occurs at output Q_1, where the slopes of *TR* and *TC* (*MR* and *MC*) are equal. (b) The per-unit revenue and cost curves illustrate the same situation shown in part (a).

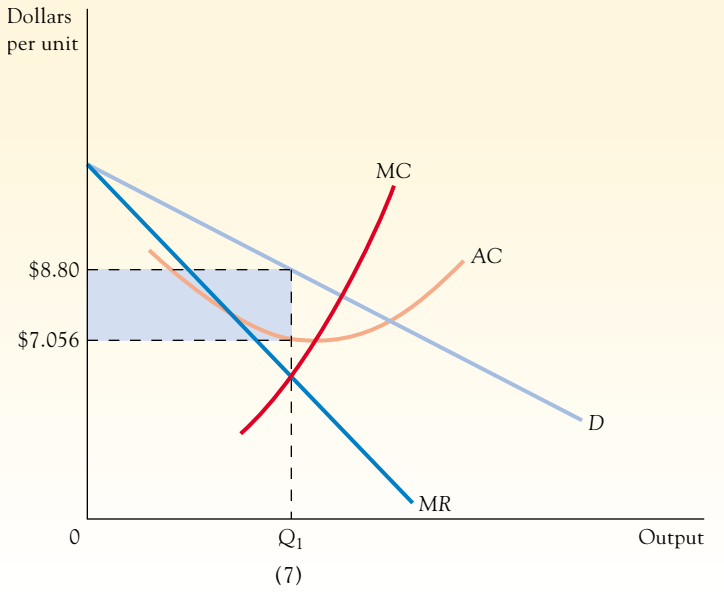


The monopolist's profit-maximizing output, Q_1 (7 units) in Figure 11.2b, is identified by the intersection of the *MR* and MC curves, at point C. The price charged by the monopolist ($8.80 based on the Table 11.2 data) is shown by point *E* on the demand curve. At any other output marginal revenue is not equal to marginal cost, and profit is lower. For example, at output Q_0 (5 units) marginal revenue is $8.40 and marginal cost is $7.00. Selling an additional unit of output thus adds more to revenue ($8.40) than to cost ($7.00), and profit will increase. At any output where marginal revenue exceeds marginal cost, the firm can increase profit by expanding output. So, in Figure 11.2b, output should be increased up to the point where the falling *MR* curve meets the rising MC curve, at point C.

Figure 11.2b identifies the most profitable output, but it does not show exactly how much profit is realized. To show the amount of profit explicitly, we must draw in the average cost

FIGURE 11.3

Profit Maximization
Total profit, the shaded area, is maximized at Q_1 where $MC = MR$.



(AC) curve. We do so in Figure 11.3. The most profitable output is, once more, Q_1, with a price of $8.80 charged. The difference between average revenue ($8.80) and average cost ($7.056) at Q_1 is the average profit per unit—in this case $1.744. Multiplying the average profit by the output, Q_1 (7 units), gives total profit ($12.21), shown in the diagram by the shaded area.

We have been implicitly using long-run cost curves, as shown by the fact that there are no fixed costs. But the same graphical analysis applies when we use short-run cost curves. As in the competitive case, a short-run analysis is appropriate when an unexpected or temporary change occurs in market conditions.

The Monopoly Price and Its Relationship to Elasticity of Demand

Our analysis of monopoly has shown that to maximize profit, output should be at the level where marginal revenue equals marginal cost, with price set above marginal cost as indicated by the demand curve. Suppose that you are a monopolist. How would you put this analysis to use in identifying the profit-maximizing price and output? It is plausible that you would know your marginal cost of production, but how do you find out what the demand curve for your product (and, hence, the marginal revenue curve) looks like? If you were operating in a competitive market, you would have no problem—you could simply observe the price charged by your competitors and recognize that you could sell all you want at that price. As a monopoly, however, you have no competitors and lack this source of information.

One way to proceed is to use your judgment and set a price, then observe the results. You could then experiment with raising and lowering the price, and through trial and error zero in on the profit-maximizing price. Obviously, you would make mistakes, and the mistakes could cost you a lot of money (in the form of sacrificed profit). Thus, you would like to find a way to more quickly arrive at the profit-maximizing price, and economic analysis suggests

one such mechanism. Specifically, a little bit of algebra shows that if you know your marginal cost (MC) and demand elasticity (η), you should set price (P) such that:[5]

$$\frac{(P - \text{MC})}{P} = \frac{1}{\eta}.$$

The left-hand side is the markup of price over marginal cost expressed as a percentage of price. This expression shows that to maximize profit, the price markup should equal the inverse of the demand elasticity. The smaller the demand elasticity, the greater the price markup. The formula can be rewritten to give price directly as a function of marginal cost and the demand elasticity:

$$P = \text{MC}/[1 - (1/\eta)].$$

If you know your demand elasticity and marginal cost, this expression can be used to calculate the profit-maximizing price.[6] For example, take the case of the only seller of gasoline on a particular corner of a major intersection; the seller is a monopolist due to the station's location. Suppose also that the station is located far from the airport (the importance of this assumption will be apparent shortly), marginal cost is \$1 per gallon, and the station's demand elasticity is 20 (a fairly high number due to the nearby presence of other stations) and is constant over all ranges of the demand curve.[7] Based on the inverse elasticity pricing formula, the station should charge a price equal to $\$1/[1 - (1/20)] = \$1/(19/20) = \$(20/19) \approx \$1.05$. With a demand elasticity of 20, in other words, the profit-maximizing price-marginal cost markup is 5 percent.

Why do gas stations located near airports often charge more for gasoline than others who are not? Our inverse elasticity pricing rule suggests an answer. To avoid the hefty refueling charges levied by rental car companies on vehicles returned with a near-empty gas tank (almost double the going price) and because they may have little time to shop around before catching their flight, renters are willing to pay more per gallon if they haven't filled up prior to reaching the airport. These stations thus hold more monopoly power than do non-airport

[5]Refer to Figure 11.1 and note that the change in total revenue (ΔTR) associated with a change in quantity sold (ΔQ) is equal to area B minus area A. Area B equals P (ΔQ) and area A equals $Q(\Delta P)$. Thus:

$$\Delta TR = P(\Delta Q) - Q(\Delta P). \quad (1)$$

Since $\Delta TR/\Delta Q$ is marginal revenue, dividing (1) by ΔQ yields:

$$MR = P - (\Delta P/\Delta Q)Q. \quad (2)$$

Since the elasticity of demand η equals (when it is expressed as a positive number) $-(\Delta Q/Q)/(\Delta P/P)$, $\Delta P/\Delta Q$ equals $(-1/\eta)(P/Q)$. Substituting $(-1/\eta)(P/Q)$ for $\Delta P/\Delta Q$ in equation (2) produces:

$$MR = P + Q[(-1/\eta)(P/Q)] = P - (P/\eta) = P[1 - (1/\eta)]. \quad (3)$$

At the profit-maximizing output, MC = MR, so:

$$\text{MC} = P[1 - (1/\eta)]. \quad (4)$$

Subtracting P from both sides of equation (4) and then multiplying through by $-(1/P)$ yields:

$$(P - \text{MC})/P = 1/\eta. \quad (5)$$

[6]The formula has one difficulty: it holds exactly only at the point of profit maximization, and because marginal cost and elasticity may vary with output, you may need to use this expression repeatedly to locate the profit-maximizing price. However, if marginal cost and elasticity vary only a little over the range of output you are considering, this formula can approximate the profit-maximizing price quite closely.

[7]Demand curves with a constant elasticity have the nonlinear, convex shape depicted in Figure 11.4. As explained in Section 11.3, the elasticity varies along a linear demand curve.

stations. The average consumer at an airport gas station is less price sensitive and the demand elasticity facing the typical airport gas station is smaller.

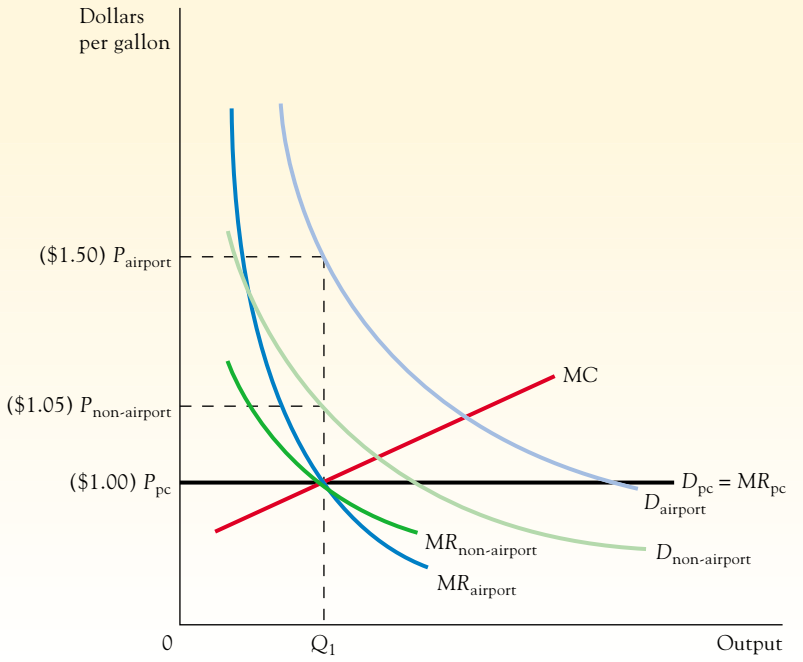
Say that because car renters are less price sensitive and account for a significant portion of airport gas station business, the typical airport gas station has a demand elasticity of 3. According to our inverse elasticity pricing rule, and with a marginal cost of $1 per gallon, the airport station's profit-maximizing price is $1/[1 − (1/3)] = $1/(2/3) = $(3/2) = $1.50. The airport station's price–marginal cost markup is thus 50 percent, 10 times greater than for the non-airport gas station examined earlier facing the same marginal cost but having a higher demand elasticity of 20.

Figure 11.4 illustrates *MC*, *D*, and *MR* curves for the airport and non-airport gas stations that we have just described. Since the non-airport station faces a more elastic demand, its price–marginal cost markup is lower than that of the airport station. In the limiting case, if the demand for non-airport stations was infinitely elastic (instead of equal to 20, as we have assumed), the inverse elasticity pricing formula shows that price equals marginal cost, a conclusion familiar from our analysis of perfectly competitive markets. This is shown in Figure 11.4 through the $D_{pc} = MR_{pc}$ curves. If the elasticity of a firm's demand curve is infinity, the price–marginal cost markup equals zero.

In sum, if you know your marginal cost, the only other thing you need to know is the demand elasticity to determine what price to charge. How can you determine the demand elasticity? One way is to estimate it statistically, as outlined in Chapter 4. Data from surveys or market experiments offer alternative methods. The important point is that you don't need to know the entire demand curve for your product; you need to know just how quantity demanded varies relative to price as summarized by the demand elasticity.

FIGURE 11.4

The Inverse Elasticity Pricing Rule
The more elastic demand is at the profit-maximizing output, the smaller the markup of price over marginal cost.



APPLICATION 11.1 DEMAND ELASTICITY AND HOME VIDEO AND DVD PRICES

The price at which home videos and DVDs are sold has been declining steadily over time but still varies across titles and studios. For example, Disney has maintained among the highest prices in the industry and has been reluctant to reduce the price of its home videos and DVDs much below $19. The thinking behind Disney's strategy appears to be the inverse elasticity pricing rule that we have just outlined. The internal studies conducted by Disney indicate that consumer demand for its videos and DVDs is more inelastic than the demand for other studios' films. Disney is the only brand in home videos and DVDs that customers ask for by name. The Disney reputation for high-quality family entertainment has made its videos and DVDs one of the top-selling products in the industry. Indeed, the internal studies indicate that of the videos and DVDs owned by the average U.S. household, about a quarter are Disney products. Because the demand for Disney videos and DVDs is less elastic than for the videos and DVDs produced by other studios, profit maximization dictates a higher price–marginal cost markup.

11.3 FURTHER IMPLICATIONS OF MONOPOLY ANALYSIS[8]

In this section we extend our discussion of monopoly to clarify several less obvious points:

1. We are so accustomed to analyzing markets in supply and demand terms that it is tempting to apply the same reasoning to a monopoly, but doing so can lead to mistakes. For example, if demand for a monopolist's product rises and the monopolist has an upward-sloping marginal cost curve, we might anticipate that both output and price will rise. Take a look again, however, at Figure 11.4. With demand $D_{\text{non-airport}}$, price is $P_{\text{non-airport}}$, and output is Q_1. When demand increases to D_{airport}, the new marginal revenue curve MR_{airport} intersects the MC curve at the original output. Output remains at Q_1, but price rises to P_{airport}.

To guard against thinking of supply and demand (appropriate for a competitive model but not for a monopoly), we note that a monopoly has no supply curve. A supply curve delineates the unique relationship between price and quantity supplied when firms have no control over price. In perfect competition, where firms are price takers, demand shifts trace out the unique price–quantity combinations (that is, the supply curve). There is no such unique relationship between price and output in monopoly because the output and price selected by a monopolist depend on both marginal cost and demand (the monopolist's marginal revenue curve is determined by the demand curve). A rise in demand can consequently lead to an increase in both price and quantity, an increase in quantity but no increase in price, or an increase in price but no increase in quantity (as in Figure 11.4).

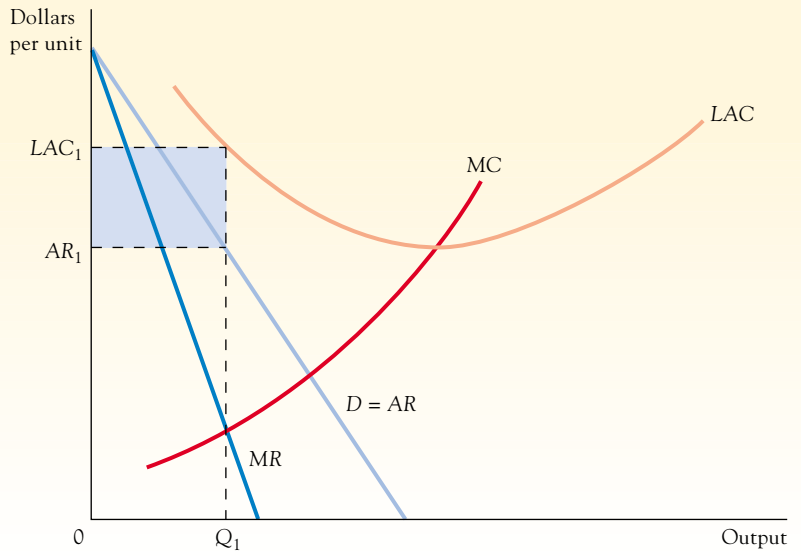
The peculiar outcome shown in Figure 11.4 is not the typical response of a monopoly to increased demand. Instead, it occurs because the higher demand curve is much less elastic at the initial quantity. As a general proposition, we suspect that monopolies find it profitable to expand output when demand increases. For example, if the demand curve shifts outward parallel to the original curve, or if it rotates about the price axis, output will rise, as will price, so long as the marginal cost curve slopes upward.

[8]A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page 567).

FIGURE 11.5

Monopoly and the Shutdown Condition

The shutdown condition applies to monopolies, just as it does to competitive firms. If *LAC* is greater than *AR* at the output, Q_1, where *MR* equals *MC*, zero is the most profitable output.



2. Monopolies are usually thought of as making huge profits, but in fact, they may not make a profit at all. A monopoly can always charge a price above cost, but it cannot force consumers to purchase at that price. The position of the demand curve ultimately limits its money-making ability. If the long-run average cost curve lies entirely above the demand curve, as depicted in Figure 11.5, any output the firm produces will have to be sold at a loss. Since average total cost lies above average revenue (that is, $LAC_1 > AR_1$) at the output (Q_1) where *MR* equals *MC*, the monopoly depicted in Figure 11.5 will do better to produce nothing in the long run. Just as in perfect competition, shutting down may be the best option.

Each year thousands of monopolists find out that monopoly power does not guarantee profits. This group includes those who receive patents on their inventions. Many items granted patents—which give the inventor the exclusive right to sell the product—are never marketed at all because businesses believe that potential customers will not pay enough to cover the production cost. For example, the following items have been given patents and not proven marketable: a chewing gum preserver, a safety coffin (with an escape tunnel and alarm so that people mistakenly buried alive can "on recovery of consciousness, ascend . . . or ring the bell [thus averting] premature death"), and goggles for chickens (to keep them from pecking one another in order to establish flock hierarchy, a pecking order).[9]

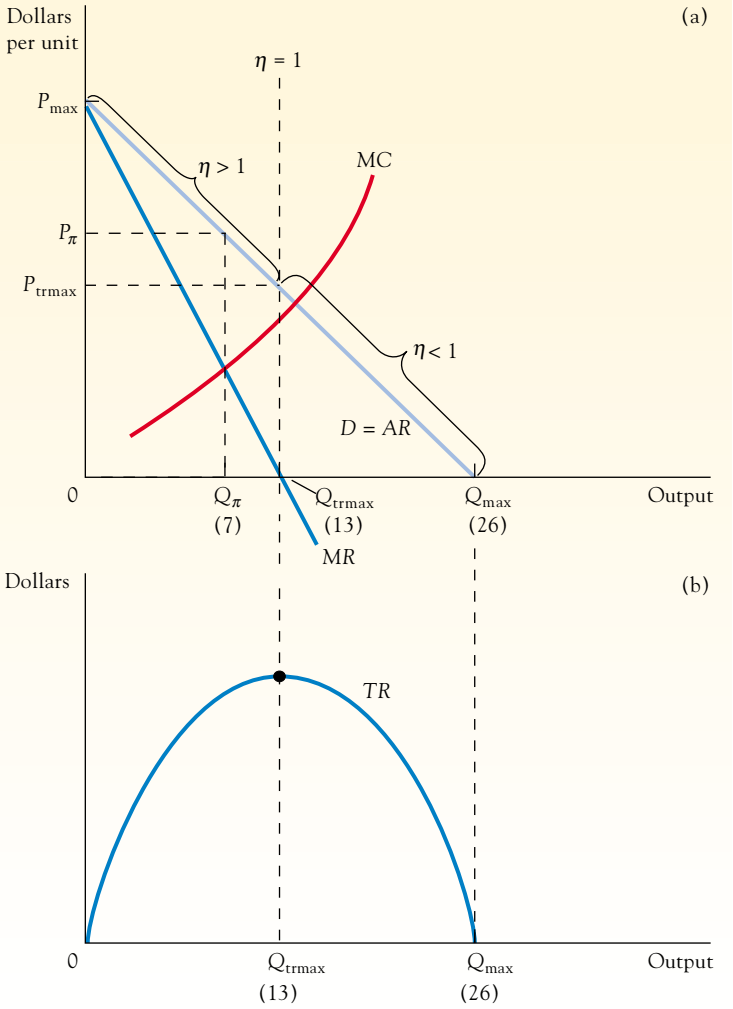
3. A monopoly's demand curve is elastic where marginal revenue is positive. An elastic demand curve means that a decrease in price and the associated increase in output will increase total revenue (total revenue moves in the same direction as output and in the opposite direction as price when demand is elastic) and when marginal revenue is greater than zero, total revenue, by definition increases as output rises. In Figure 11.6, the demand elasticity (η) exceeds unity along the upper portion of the straight-line demand curve (between the outputs of zero and Q_{trmax}) because marginal revenue is positive over this range. When marginal revenue is zero (at Q_{trmax}), total revenue remains constant when an additional unit is sold so demand is unit elastic (the effects of the decrease in price and the associated increase in output on total revenue exactly offset one another in the case where demand is unit elastic and total revenue thus remains unchanged as output increases).

[9]A. E. Brown and H. A. Jeffcott, Jr., *Absolutely Mad Inventions* (New York: Dover, 1960).

FIGURE 11.6

Monopoly Demand, Marginal Revenue, and Total Revenue

At each output, the *MR* curve's height shows how much total revenue changes when one unit more or less is sold. The height of the *MR* curve at any output thus equals the slope of the *TR* curve at that output. The demand elasticity equals unity and total revenue is maximized where marginal revenue is zero. The total-revenue maximizing price, P_{trmax}, is less than the profit-maximizing price, P_{π}.



When marginal revenue is negative (at quantities beyond an output of Q_{trmax} in the graph), a decrease in price and the associated increase in output reduce total revenue so the demand curve is inelastic (the effect of the output increase on total revenue is less than the effect of the price decrease).

As shown in Figure 11.6b, in the case of a straight-line demand curve, a monopolist's total revenue curve has the shape of an upside-down bowl. Total revenue peaks at the output, Q_{trmax}, where marginal revenue is zero and demand is unit elastic. Total revenue equals zero in two cases: where at least P_{max} is charged and zero units are sold, or when a price of zero is charged and Q_{max} units are sold.

One bit of geometry may be useful to keep in mind when drawing marginal revenue curves for straight-line demand curves: the slope of the *MR* curve is, in absolute value, exactly twice the slope of the demand curve. The *MR* curve falls twice as fast and becomes zero at an output exactly halfway between the origin and the level of output where the demand curve intersects the quantity axis. In Figure 11.6a, marginal revenue becomes zero at Q_{trmax} (13 units) while the demand curve reaches zero at Q_{max} (26 units).

4. Monopolists are frequently thought to make more money if demand for their products is inelastic. Yet we can easily see that a profit-maximizing monopolist will always be selling at a price where demand is elastic. If, for some reason, a monopoly is producing an output where demand is inelastic, it can increase its profit by cutting back output and raising price. Lower output means higher total revenue (when demand is inelastic) and lower total cost, so profit will necessarily increase. The monopoly should reduce output until it is operating somewhere along the elastic portion of its demand curve. Another way to see this is by recalling that profit is maximized when marginal revenue equals marginal cost. Since marginal cost is always greater than zero, marginal revenue must be positive when profit is maximized. But a positive marginal revenue implies an elastic demand curve since it means that greater output (lower price) will increase total revenue.

Simple as this point is, notice how it allows us to see the inconsistency in the following statements: (a) "the oil companies collude with one another, charging a monopoly price for gasoline"; and (b) "gasoline is a virtual necessity that is in highly inelastic demand." These statements cannot both be correct. If gasoline is in inelastic demand at the current price, that price is not a monopoly price. If the price is a monopoly price, the demand must be elastic. Yet many people believe that both statements are correct.

APPLICATION 11.2 LIFE IS NOT ALWAYS A BOX OF CHOCOLATES

Winston Groom, the author whose novel was the basis for the Academy Award-winning film, *Forrest Gump*, sold the rights to his novel to Paramount Pictures in return for 3 percent of the profit generated by the film.[10] Even though the film has generated more than $840 million in total revenue (making it one of the highest-grossing movies of all time), Groom has yet to realize much of a financial return from his literary efforts. According to Paramount's accounting statements, the film actually showed a loss of $62 million as of the end of 1994 (the year in which an overwhelming share of the total revenues were realized).

In 1995, Groom hired an attorney to investigate the legitimacy of Paramount's accounting standards. Because total profit is more easily misrepresented by a studio (by inflating costs), leading actors and directors prefer their contractual payments to be based on the total revenue associated with a movie (total revenue is easier for independent auditors to monitor). Indeed, in the case of *Forrest Gump*, lead actor Tom Hanks negotiated for a percentage of the film's total revenue and earned nearly $40 million from the arrangement.

While actors or directors may prefer to receive a percentage of a film's total revenue, such contractual arrangements create an inherent conflict in determining what price should be charged for a movie ticket. To see why, reconsider Figure 11.6, and think about the price of admission that should be set for a movie such as *Forrest Gump*. The movie studio will, of course, want to select the profit-maximizing price, P_{π}—the height of the demand curve at the quantity, Q_{π}, where MR equals MC. An actor such as Tom Hanks, who has negotiated for a percentage of the film's total revenue, however, will be best served by a lower price, P_{trmax}—the height of the demand curve at the quantity, Q_{trmax}, where total revenue is maximized. Because Tom Hanks' payment is based on total revenue, production cost does not matter to Hanks and he has an incentive to push for a lower-price/higher-output combination than the one preferred by the studio, which is interested in maximizing total profit.

[10]This application is based on " 'Gump' a Smash, But Still in the Red, Paramount Says," *Los Angeles Times*, May 24, 1995, pp. A1 and A16; and **Internet Movie Database Limited**, 2000.

11.4 THE MEASUREMENT AND SOURCES OF MONOPOLY POWER[11]

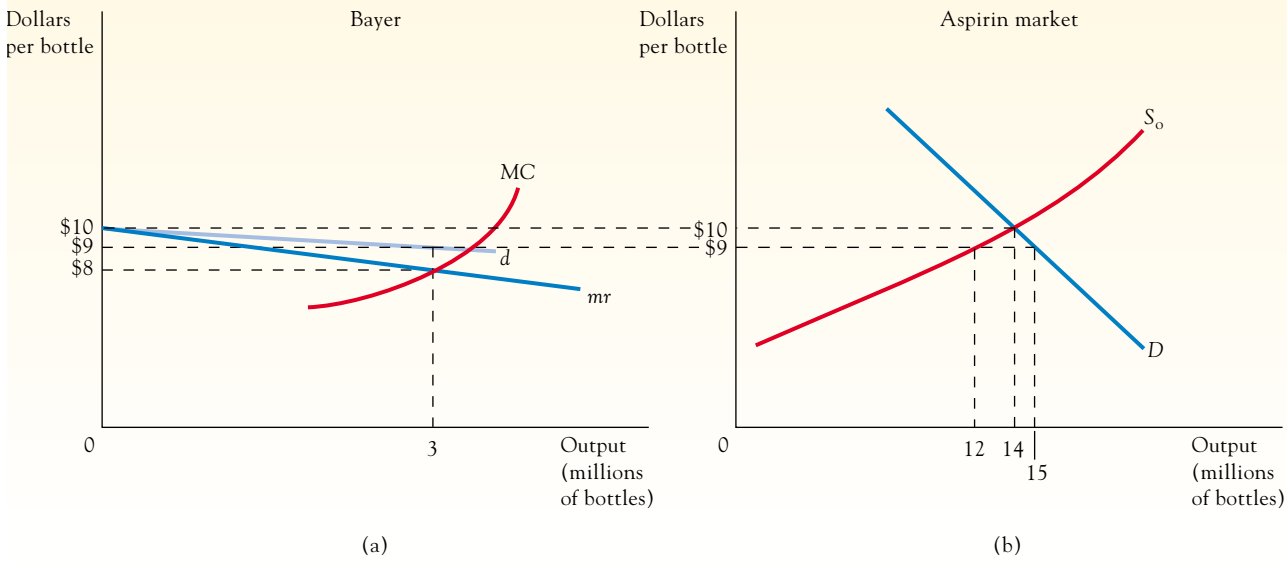
As you might suspect, pure monopoly, in which there is only one supplier, is rare. More common are markets populated by at least several firms selling products that are reasonably close substitutes for one another. Even when there are several firms operating in the same market, however, each firm is likely to face a downward-sloping demand curve and thus have some *monopoly power*: some control over price, some ability to charge a price above marginal cost. In this section we explain why this is the case, as well as how the extent of any individual firm's monopoly power may be measured and the general sources of monopoly power.

Consider the aspirin market and suppose that Bayer is one of five (equal-sized) sellers in it. Suppose also that Bayer assumes that rival suppliers behave as competitive firms in determining their output. The latter assumption is a simplifying one, not meant to downplay other types of strategic behavior in which suppliers may engage when making price and output decisions. Chapters 13 and 14 more fully explore the strategic interactions between firms when the number of firms operating in a market is small. For now, however, we ignore alternative forms of strategic behavior to show that even when rival suppliers behave as competitive firms, an individual firm may have some monopoly power if the number of rivals is not too great.

Under these assumptions, Figure 11.7 shows how Bayer's demand curve, d, can be derived from the market demand curve, D, and the supply curve, S_O, of all *other* firms in the market. In Figure 11.7a, if Bayer produces nothing, the market price will be \$10 per bottle, and Bayer's demand curve will begin at \$10 on the vertical axis. How many bottles can Bayer

FIGURE 11.7

Monopoly Power When There Are Several Suppliers
Under the assumptions made in the text, Bayer's demand curve is *d*. It is derived by subtracting the quantity supplied by other firms (indicated by S_O) from the total amount consumers wish to purchase (shown by *D*) at each price.



[11]A mathematical treatment of some of the material in this section is given in the appendix at the back of the book (page 567).

sell at a price of $9? At $9, other firms will supply 12 million bottles along their supply curve, but consumers are willing to purchase 15 million bottles, so Bayer can sell the difference, 3 million bottles. Now we have a second point on Bayer's demand curve, *d*. It is obviously highly elastic, with a point elasticity of $9 at an output of 3 million bottles. Although Bayer's demand curve is much more elastic than the market demand curve (the latter has a point elasticity of 0.6 at an output of 15 million bottles), the important point is that it is not perfectly elastic. And because its demand elasticity is less than infinity, Bayer has some monopoly power, some ability to set price above its marginal cost.

Given its demand curve, how much should Bayer produce to maximize profit? Once again, output should be set where $mr = MC$ (3 million in Figure 11.7a). Bayer's profit-maximizing price is the height of its demand curve ($9) at the output where $mr = MC$. Note that the price exceeds Bayer's marginal cost ($8) and that Bayer thus has some monopoly power even though it is not a pure monopoly. The presence of four other suppliers limits Bayer's monopoly power but does not eliminate it.

Measuring Monopoly Power

LERNER INDEX
a means of measuring a firm's monopoly power that takes the markup of price over marginal cost expressed as a percentage of a product's price

To measure a firm's monopoly power, economists often rely on the **Lerner index** (named after economist Abba Lerner). The Lerner index is nothing more than the markup of price over marginal cost, expressed as a percentage of a product's price:

$$\text{Lerner index of monopoly power} = (P - MC)/P.$$

We noted before that, at the profit-maximizing output, the price-marginal cost markup equals the inverse of the firm's demand elasticity, $(P - MC)/P = 1/\eta$. Thus, the smaller the firm's demand elasticity at the profit-maximizing output, the greater the price-marginal cost markup, and the larger the firm's degree of monopoly power as measured by the Lerner index.

The Lerner index varies between zero and one. In perfect competition, the elasticity of the firm's demand curve is infinite, and price equals marginal cost, so the Lerner index equals zero. The larger the Lerner index value, the greater a firm's monopoly power. In the aspirin example just discussed, Bayer's demand curve has an elasticity of 9 at the profit-maximizing output. The degree of Bayer's monopoly power, as measured by the Lerner index, thus equals the inverse of the elasticity or 1/9 (roughly 0.11).

The Sources of Monopoly Power

What factors determine the extent to which a firm has monopoly power? Our Bayer example suggests two: the elasticity of the market demand curve and the elasticity of supply by other firms. Note how, in Figure 11.7, as the price is dropped from $10 to $9 per bottle, the expansion of total purchases by consumers (by 1 million bottles) and the reduction in output by other firms (2 million bottles) determine how much Bayer can sell at the lower price. The size of the expansion in total purchases is determined by the elasticity of the market demand curve; the size of the reduction in output by other firms is determined by the elasticity of the other firms' supply curve. Thus, the more elastic D and S_O are, the greater the elasticity of Bayer's demand curve.

If the market demand curve is perfectly elastic, any individual supplier such as Bayer has no monopoly power. This would be the case even if Bayer were the only aspirin supplier and thus a pure monopolist. Even a pure monopolist, that is, would be unable to set price above marginal cost. Any attempt to do so would lead to total purchases equaling zero since consumers are hypersensitive to the price charged by the (albeit pure) monopolist if the market demand curve is perfectly elastic.

The monopoly power possessed by any one firm is also more limited the greater the number of rival firms. This is because as rivals become more numerous, the elasticity of supply by rival firms, as a group, tends to increase and the ability of any one firm to set price above

marginal cost is impeded.[12] In Figure 11.7, for example, if S_O were more elastic such that production by other firms, as a group, falls to 1 million bottles as the price declines from $10 to $9, Bayer's demand curve would be much more price sensitive: the price decline would result in Bayer's sales rising from zero (at $10) to 14 million bottles (at $9).

Barriers to Entry

A **barrier to entry** is any factor that limits the number of firms operating in a market and thereby serves to promote monopoly power on the part of incumbent suppliers. Such factors fall into four general categories: absolute cost advantages, economies of scale, product differentiation, and regulatory barriers.

BARRIER TO ENTRY
any factor that limits the number of firms operating in a market and thereby serves to promote monopoly power

ABSOLUTE COST ADVANTAGE
a situation in which an incumbent firm's production cost (its long-run average total cost) is lower than potential rivals' production costs at all relevant output levels

ECONOMIES OF SCALE
a situation in which the long-run average total cost curve for all firms slopes downward over the entire range of market output

NATURAL MONOPOLY
an industry in which production cost is minimized if one firm supplies the entire output

PRODUCT DIFFERENTIATION
a means by which consumers may perceive the product sold by an incumbent firm to be superior to that offered by prospective rivals

REGULATORY BARRIERS
barriers to entry created by the government through vehicles such as patents, copyrights, franchises, and licenses

An **absolute cost advantage** occurs where an incumbent firm's production cost (its long-run average total cost) is lower than potential rivals' production costs at all relevant output levels. This cost disparity may be due to unique access to a production technique or an essential input. For example, KFC has a proprietary recipe for "finger-lickin' good" chicken.[13] The Aluminum Company of America (Alcoa) was the sole producer of aluminum in the United States from the late nineteenth century until the 1940s, because it controlled all domestic sources of bauxite—the ore from which aluminum is made. In the field of music, Garth Brooks and Britney Spears have unique access to their personal singing abilities. Cisco is the leading maker of networks that use the Internet on account of the superior design technology for routers and servers that the company has proprietary access to.

All firms (incumbents as well as potential entrants) may have the same cost curves but the production technology may be such that one large firm can supply an entire market at a lower per-unit cost than several smaller firms that share the market. In other words, the long-run average total cost curve for all firms may slope downward over the entire range of market output. Consequently, to have more than one firm operating is wasteful since production cost is minimized if one firm supplies the entire output. The industry is thus characterized by **economies of scale** and is termed a **natural monopoly**.

Natural monopoly is common in the local distribution of power, water, and telephone services. It is cheaper, that is, to have one electric company serve an entire neighborhood than to have each home in the neighborhood rely on a separate company with its own distinct transmission lines. The single electric company dictated by economies of scale, however, has the potential to exercise monopoly pricing power.

Product differentiation is a third type of barrier to entry. Consumers may perceive the product sold by an incumbent firm to be superior to that offered by prospective rivals. Based on this perception, consumers are willing to pay more for the incumbent firm's product. For example, Ray-Ban sunglasses may be sufficiently differentiated in consumers' eyes to give the company some pricing latitude over potential competitors—even though the competitors have access to the same production technology.

Finally, a firm may have a limited number of rivals due to **regulatory barriers** such as government-granted patents, copyrights, franchises, and licenses. A patent, for example, grants the exclusive right to use some productive technique or to produce a certain product for a period of 17 years. Patents thus amount to the legal right to a temporary monopoly. Although patents are an instance of government-created monopoly power, there is an economic rationale for their use—namely, that firms and individuals will be less inclined to invest in the research and development of new products if others can immediately copy the results. As we will see in Chapter 20, this rationale is generally regarded as a valid argument

[12]We continue to ignore, for now, the strategic behavior in which firms may engage when selecting their price and output. As we will see in Chapters 13 and 14, it is possible for a large number of firms to collude in setting a monopoly price and a small number of firms to interact in such a manner as to ensure the competitive outcome. We will also see, however, why collusion tends to be less likely as the number of firms in a market grows.

[13]Reportedly, only two company officials know the recipe.

for granting some protection to inventors. But some economists believe that 17 years is too long; others believe that given the length of time needed to develop and market a product, 17 years is not long enough.

Governments also occasionally block entry by requiring firms to have a public operating license or franchise. Licensing is sometimes defended as a method of ensuring minimum standards of competency, but it can be (and many feel has been) used as a barrier to entry that insulates existing holders of licenses from new competition. For example, one cannot enter the mail delivery, broadcasting, public utility, or trucking markets without a public license. Similarly, hundreds of occupations require licenses, among them hair stylists, funeral directors, taxi drivers, contractors, bartenders, and tailors. Often these licenses are granted by state government boards composed largely of existing license holders.

In the case of cable television, the ability to provide service to any given community requires a franchise from the local city government. Until recently, these franchises were typically exclusive. Under exclusive franchising, no more than one operator is allowed to serve a community. Exclusive franchising is often predicated on the belief that economies of scale exist in local cable television distribution. However, studies have found that any such economies of scale are relatively minor, while the pricing power conferred by exclusive franchises appears to be substantial.[14] The average monthly basic service rate charged in "overbuild" communities (communities served by more than one operator) is 20 to 35 percent lower than in comparable communities served by only one cable operator.

Regulatory barriers can also take the form of the government making its purchases from particular firms or limiting nonprice forms of competition such as advertising. Restrictions on advertising exist in many states for products such as legal services, prescription drugs, health care, and eyeglasses. In general, prices are higher where there are limits on advertising. For example, researchers find that eyeglass prices are 25 to 30 percent higher in states with total advertising bans than in states with weak or no restrictions on advertising.[15]

APPLICATION 11.3 REGULATORY BARRIERS IN THE PHILIPPINES

During the time that the late Ferdinand Marcos was president of the Philippines, being his friend or relative tended to confer significant business advantages.[16] President Marcos used his power to benefit certain businesses over others, often to the detriment of foreign investors and most Filipinos. A golfing buddy's firm was awarded nearly every major government construction project. A domestic firm supplying cigarette filters won 90 percent of the local market when Marcos issued a decree slapping a 100 percent tax on a raw material used in filters by the company's domestic and international rivals. The company was owned by a relative of President Marcos. The domestic conglomerate buying 70 percent of the Philippine coconut crop was able, through government sanction, to effect a reduction of roughly 25 percent in its payments to the millions of coconut farmers in the country—farmers who are among the poorest of Filipinos. The president of the conglomerate was godfather to Marcos' son and grandsons. The flagrant favoritism displayed by the Marcos government in construction, cigarette filter, and coconut markets, among many others, helped lead to the president's downfall.

[16]"In Philippines, to be President's Pal Can be Boon for a Businessman," *Wall Street Journal*, November 4, 1983, pp. 1 and 12.

[14]Thomas Hazlett, "Duopolistic Competition in Cable Television: Implications for Public Policy," *Yale Journal on Regulation*, 7 No. 1 (Winter 1990), pp. 65–119.

[15]Lee Benham, "The Effect of Advertising on the Price of Eyeglasses," *Journal of Law and Economics*, 15 No. 2 (October 1972), pp. 337–352.

Strategic Behavior by Firms: Incumbents and Potential Entrants

A common belief is that the degree of monopoly power exercised by firms in any market is related to the number of firms: the more firms there are, the less monopoly power each has. From our earlier discussion of the determination of Bayer's demand curve, it is easy to see why some such relationship might be expected. For instance, if there were four (equal-sized) firms instead of five in our example, then each firm would have a less elastic demand curve, and therefore more monopoly power. However, the relationship is not exact, and sometimes focusing on the number of firms can be misleading. The elasticity of each firm's demand curve depends not only on the number of competing firms, but also on the elasticity of the market demand, the elasticity of the supply curve for other firms, the extent to which the products produced by the various firms in the industry are homogeneous, and the nature of the competition among the firms. As we will see in Chapter 13, firms might choose not to compete perfectly in terms of the prices they charge. At the extreme, an industry's firms might even opt to form a cartel and behave in a collusive manner.

Another factor is likely to be of even greater importance: the possibility of entry by new firms into the market. After all, it is not only the number of firms already operating in a market that matters. The potential for entry and the elasticity of supply of such potential entrants can also play an influential role.

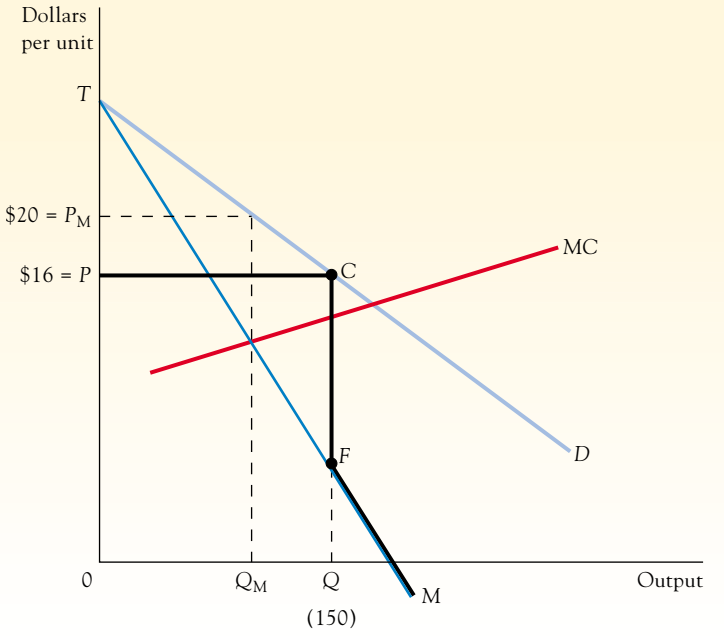
The possibility of entry by new firms can greatly constrain the exercise of monopoly power. To see how, suppose that you possess some monopoly power by virtue of ownership of a patent that enables you to produce CD-ROMs at a lower cost than other firms. Your marginal cost curve is shown as MC in Figure 11.8, and the market demand curve is shown as *TD*. If no other firms could sell CD-ROMs, you would maximize your profit by charging $20 per CD-ROM, and producing Q_M. However, suppose that other firms could sell them at a price of $16. At that price, they will sell whatever quantity consumers wish to purchase. How will this affect your price and output?

Obviously, if you try to charge a price higher than $16, other firms will enter the market and you will be undercut; you would not be able to sell any at a price above $16. The de-

FIGURE 11.8

Potential Entry and Monopoly

The possibility of entry can affect a monopoly's price and output. If other firms are willing to sell the product at a price of *P*, then the monopoly's demand curve is *PCD*, and the monopoly will sell *Q* units at a price of *P* rather than Q_M units at a price of P_M.



mand curve you confront in this situation is basically horizontal at $16 out to the market demand curve. Any output between zero and Q units can be sold for a price of $16, but no higher, so the relevant demand curve is the horizontal line *PC* over that range of output. Higher levels of output beyond Q can still be sold for prices lower than $16, so the *CD* segment of the market demand curve is still relevant. As a result, your monopoly demand curve effectively becomes *PCD* on account of the threat of entry.[17]

When the demand curve changes, so does your marginal revenue curve. Over the range where the demand curve is horizontal, $P = MR$ since you can sell additional CD-ROMs without lowering price. Thus, *PC* is also your marginal revenue curve up to an output of Q. At greater output levels the original demand curve is unchanged, so the *FM* segment of the original marginal revenue curve associated with the *CD* portion of the demand curve is still relevant. The entire marginal revenue curve is therefore *PCFM*. The curve is discontinuous at an output of Q. Think about what the discontinuous (*CF*) segment of the new marginal revenue curve means. Suppose that Q is 150 units. If output increases one unit from 149 to 150, then the marginal revenue of the 150th unit is $16 (equal to CQ) since both the 149th and 150th units can be sold for $16. To sell 151 units, however, your firm must reduce price, say to $15.90. Thus, the marginal revenue of the 151st unit is only about $1 (equal to *FQ*).[18] Marginal revenue drops abruptly from $16 to $1 at an output of Q.

Once we recognize how the threat of entry affects the demand and marginal revenue curves, the rest of the analysis is straightforward. (However, note that we have not drawn in the average cost curve. For the analysis to be correct, we must assume that average cost is low enough for it to be profitable for the monopolist to continue to operate.) With the threat of entry, Q_M is no longer the profit-maximizing output; at this output marginal revenue (now $16) exceeds the unchanged marginal cost. This means that profit can be increased by expanding production. Note that marginal revenue exceeds marginal cost until output has increased to 150 units, implying that profit rises as output is expanded up to Q. But the marginal revenue associated with the sale of the 151st unit, *FQ*, is less than the marginal cost, so it does not pay to produce that unit. The new profit-maximizing output is Q.

Reflect carefully on the implications of the foregoing analysis. You are the only seller in this market, but your pricing power is rather limited. The threat of entry leads you to charge a lower price than you would if you could be assured entry would not occur. In general, depending on the conditions that would attract entry, you may have very little monopoly power—as suggested in the graph where your price is only slightly above marginal cost.

The example illustrates the important point that the threat of entry, as well as actual entry, can have a significant impact on the pricing behavior of firms. In addition, it shows why the number of firms operating in a market does not always have a direct relationship with the amount of monopoly power exercised.

11.5 THE EFFICIENCY EFFECTS OF MONOPOLY

The way a market structure affects the functioning of a market has always been a major concern in economics. Having examined competitive and monopoly markets separately, we should now turn to a careful comparison of the two market forms. To do so, we need to determine how a change in market structure—from competition, for example, to pure monopoly—will affect price and industry output.

[17]We are assuming that other firms effectively have a supply curve that is horizontal at $16. If their supply curve is upward-sloping, the *PC* portion of your demand curve will be negatively-sloped but more elastic than the market demand curve.

[18]Total revenue from selling 150 units at $16 each is $2,400. Total revenue from selling 151 units at $15.90 each is $2,400.90. Thus, marginal revenue from selling the 151st unit is $0.90.

To make the comparison, let's reexamine the aspirin industry and assume that it is initially perfectly competitive and constant-cost. The constant-cost assumption means that input prices are the same under competition and monopoly and allows us to isolate more easily the impact of monopoly in the output market. In Figure 11.9, the market demand and supply curves are *D* and *LS*, so the competitive outcome is a price of *P* ($11) and output of *Q* (10 million bottles). The marginal revenue curve associated with the market demand curve is *MR*, but it plays no role in determining the competitive output since each firm adjusts to its own marginal revenue curve. With perfect competition, each of the numerous firms faces a horizontal marginal revenue curve at the market-determined price.

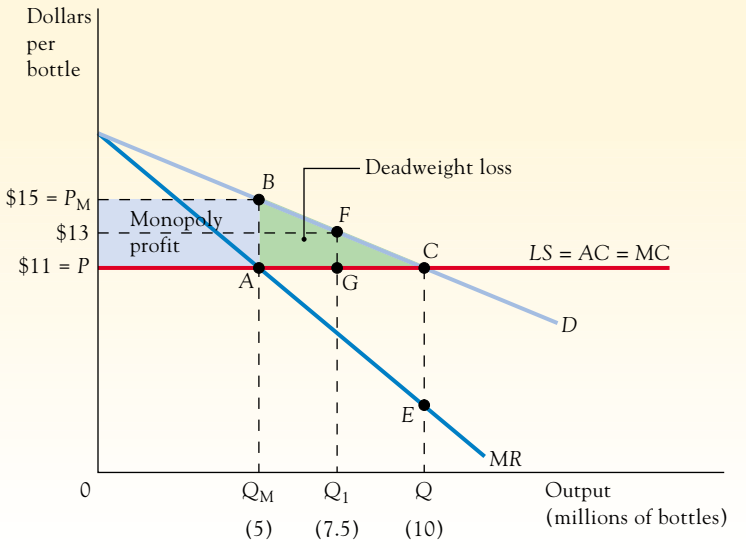
Now suppose that the aspirin industry becomes a pure monopoly. The monopoly faces the *industry's* demand and marginal revenue curves, but what about the monopoly's cost curves? If we assume that the monopoly can operate the separate plants at the same costs as those of the individual competitive firms, the competitive supply curve is the monopoly's average cost curve. Because this curve is horizontal, implying constant average cost regardless of output, marginal cost equals average cost. Thus, the horizontal competitive supply curve is the same as the monopoly's average and marginal cost curves.

At the initial competitive output Q, the monopoly's marginal cost (CQ) is greater than marginal revenue (*EQ*), so the monopolist is in a position to increase profit (from the zero-profit level of the competitive equilibrium) by reducing output. By restricting output, the monopolist is able to charge a higher price. The profit-maximizing output occurs where *MR* = MC at an output Q_M (5 million bottles). The monopoly will produce Q_M, charge a price of P_M ($15), and realize an economic profit of P_MBAP. *For the same demand and cost conditions, price will be higher and output lower under monopoly than under competition.* This is one of the most important and best-known conclusions of microeconomic theory.

Because a monopoly reduces the output of aspirin, from Q to Q_M in Figure 11.9, a net loss in total surplus results. The net loss is, of course, the *deadweight loss* of monopoly. To see why there is a net loss, note that at the monopoly output of Q_M, price ($15 per bottle) is above marginal cost ($11). Thus, consumers value additional aspirin bottles more than it costs the monopolist to produce. (Remember that the height of the demand curve at any quantity reflects the marginal value of a good.) If output is 5 million bottles, the incremental bottle is

FIGURE 11.9

The Deadweight Loss of Monopoly
The competitive long-run supply curve is *LS*; if the industry is competitively organized, output is *Q* and price is *P*. With monopoly, *LS* is assumed to be the same as the monopolist's long-run *AC* and *MC* curves, and the profit-maximizing output is Q_M at a price of P_M. Price is higher and output lower under monopoly. The shaded rectangular area shows monopoly profit. Triangular area *BCA* is the deadweight loss associated with the reduced output under monopoly.



worth \$15 to consumers, but it uses resources that can produce other goods worth only \$11 (marginal cost). Consequently, a gain of \$4, or *BA*, results if an additional bottle is produced. Each successive unit of output yields a smaller net benefit than the previous one until output reaches 10 million, where price equals marginal cost. For example, when the monopoly chooses not to produce the 7.5 millionth bottle, consumers lose a product worth FQ_1 (\$13) to them; not producing that bottle permits the production of other goods to increase, but these goods are worth only GQ_1 to consumers (\$11, equal to marginal cost), so a net loss of *FG*, or \$2, on that bottle results.

The excess of value over cost associated with increasing output from 5 to 10 million is triangular area *BCA*. Area *BCA* is the sum of the loss in net benefits for all the aspirin bottles from 5 to 10 million. *This area is a measure of the deadweight loss due to the monopoly restriction of output*. The aspirin monopoly chooses not to produce these bottles, so consumers are unable to realize the potential net gain. Under competition, output expands to 10 million, where price is equal to marginal cost.

Another way to see that area *BCA* is a net loss is through the use of consumer and producer surplus. When the price rises from \$11 to \$15, consumer surplus falls by area P_MBCP. This area measures the loss to consumers from the monopoly price; it is *not* the deadweight loss because there is a corresponding gain in producer surplus accruing to the monopoly firm. The gain in producer surplus equals area P_MBAP, the difference between the monopoly price and marginal cost over the range of output (5 million) produced by the monopoly. However, the loss to consumers from the monopoly price, P_MBCP, is larger than the producer surplus gain to the monopoly, P_MBAP, by the area *BCA*. Consumers lose more than the monopoly gains, and the difference—area *BCA*—is the deadweight loss of monopoly.

The deadweight loss of monopoly, then, is due to an inappropriate level of production. Monopolies produce an inefficient (too low) level of output, and the triangular area *BCA* is a dollar measure of the net loss involved. Consumers bear this cost in addition to the cost they bear from paying the higher monopoly price for the product.

STATIC ANALYSIS
a form of economic analysis that looks at the efficiency of a market at any one point in time

A Dynamic View of Monopoly and Its Efficiency Implications

The preceding comparison of monopoly and perfect competition employs what economists term a **static analysis**. Basically we took a snapshot at one point in time. We started from a perfectly competitive outcome and assumed no changes in market demand and production cost. We then investigated what would happen if the industry moved from being perfectly competitive to monopolized. As we saw, price ended up being higher, output fell, and a deadweight loss was generated in the process.

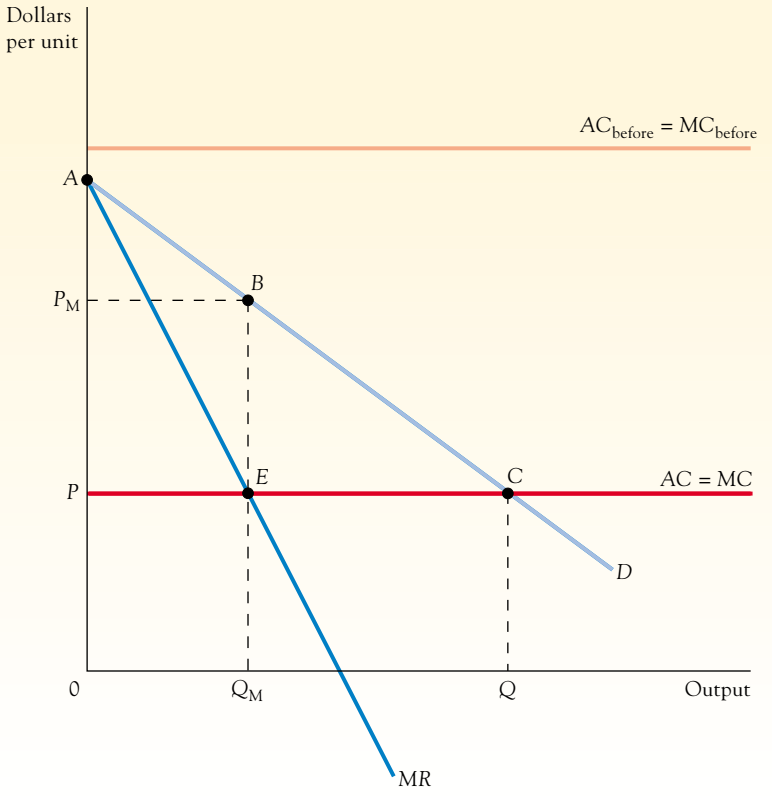
While our static analysis indicates that, relative to perfect competition, monopoly imposes a deadweight loss on society, there is another important way of evaluating the efficiency effects of monopoly. This other way relies on **dynamic analysis**: looking over time at why monopolies are created in the first place. In contrast to the static analysis, dynamic analysis suggests an important reason why the existence of certain monopolies should be viewed more favorably from a social welfare perspective. Specifically, monopoly power may stem from firms generating better products through either devising ways to lower production cost (creating absolute cost advantages) or differentiating the product in consumers' eyes (product differentiation). If this is in fact the case, monopoly serves to enhance social welfare from a dynamic perspective since it reflects the creation of better products.

DYNAMIC ANALYSIS
a form of economic analysis that looks, over time, at the efficiency of a market

Figure 11.10 shows the market for personal computers and contrasts the dynamic view with the static perspective on monopolies that we have previously outlined. In the early 1970s, the market for personal computers was virtually nonexistent. The absence of a market at that time reflected the cost of producing such a good ($AC_{before} = MC_{before}$) being greater than the amount consumers were willing to pay for it. In other words, even though it was technologically possible to manufacture computers for personal use in the early 1970s,

FIGURE 11.10

A Dynamic View of Monopoly
Relative to a world where production cost ($AC_{before} = MC_{before}$) exceeds the value consumers place on a good (the height of the *D* curve) and output is zero, a firm possessing monopoly pricing power because it has figured out a way to lower production cost to *AC* = *MC* serves to increase total surplus by its actions. The cost-reducing innovation increases consumer surplus by ABP_M and producer surplus by P_MBEP.



the minimum cost producers would have had to be paid to produce computers (as measured by the height of the $AC_{before} = MC_{before}$ curve) exceeded the maximum price consumers were willing to pay (as measured by the height of the demand curve) for them.

According to the dynamic perspective, a monopoly is created in this market when a company figures out a way to lower the production cost of personal computers—say, to a level of AC = MC. With this innovation, total surplus increases relative to the early 1970s outcome of no personal computers being marketed. There are two reasons for this. First, the company developing the lower-cost production method will be rewarded for its innovation by being able to exercise monopoly pricing power, charging a price of P_M and earning producer surplus equal to area P_MBEP. Second, consumers also benefit from the innovation. Relative to a world without personal computers, the monopoly outcome of Q_M increases consumer surplus from zero to an area equal to ABP_M. The increase in total surplus (producer plus consumer surplus) is *ABEP*.

Of course, once the lower-cost production technique is developed, the static perspective on monopolies still applies since competition would serve to further increase total surplus. That is, suppose that there are 20 firms with access to the same cost-reducing technology (AC = MC) as the innovating company, and 20 firms is sufficient to ensure the perfectly competitive price of *P* and output of *Q*. In this situation, relative to the monopoly price of P_M and output of Q_M, consumer surplus increases by P_MBCP, producer surplus decreases by P_MBEP, and total surplus increases by triangular area *BCE*. Just as from a dynamic perspective, innovation and pure monopoly are better than no firms possessing the lower-cost production technology, 20 firms and a perfectly competitive outcome are preferable, from the static perspective, to pure monopoly, once the lower-cost production method exists.

Which approach, the static or the dynamic, is the most appropriate to employ in analyzing monopoly? It turns out that both approaches have merit. As we will see in Chapter 20 regarding the debate on patents and the length of time for which they should be granted, monopolies should be encouraged to the extent that they result from the development of innovative products. *Ex post* monopoly pricing power provides an *ex ante* incentive to innovate. Exactly how much incentive should be provided to induce innovation, however, is an open question. The static perspective informs us that, relative to monopoly, competition increases total surplus once an innovation has been made. And the longer monopolies retain their pricing power, the more the total-surplus-enhancing benefits of competition are forestalled—even though such delays serve to induce innovation from a dynamic perspective.

The decision about which approach to employ in analyzing monopoly not only is of academic interest, but also has considerable policy relevance. Section 11.6 offers a brief overview of the role public policy has taken toward monopoly in the United States.

APPLICATION 11.4 THE DYNAMICS OF DEVELOPING AN AIDS VACCINE

The dynamic perspective on monopolies suggests that government policymakers walk a fine line if they attempt to spur competition in markets where firms either already have or will have monopoly pricing power. The pursuit of an AIDS vaccine provides a telling case in point.[19] Since U.S. policymakers have proposed reviewing the prices of "breakthrough drugs" and stimulating competition by ensuring that any know-how acquired by an innovating pharmaceutical company is shared quickly with competitors, some firms have either dropped out of or chosen not to enter the race to develop an AIDS vaccine.

[19]This application is based on "Nog," *Wall Street Journal*, April 21, 1987, p. 38; and Robert J. Barro, "Attention Consumers: Creativity Never Comes Cheap," *Business Week*, October 2, 2000, p. 36.

11.6 PUBLIC POLICY TOWARD MONOPOLY

U.S. policy toward monopoly has been largely guided by the static view of monopoly. According to the static view, a monopoly results in an inefficient resource allocation by producing too low an output level. In comparison with a competitive market structure, it also transfers income from consumers to the monopoly owners. For both these reasons, it has been deemed desirable to use public policy to limit the acquisition and exercise of monopoly power. In the United States, the primary means to achieve these goals have been **antitrust laws**, a series of codes and amendments intended to promote a competitive market environment.

ANTITRUST LAWS
a series of codes and amendments intended to promote a competitive market environment

There are three major statutes governing antitrust policy. The first is the Sherman Act, passed in 1890. The Sherman Act makes illegal any activities "in restraint of trade or commerce among the several States." An example of forbidden activities is price fixing, whereby firms attempt to secure prices above the competitive level. The Sherman Act also states that "every person who shall monopolize, or attempt to monopolize . . . shall be deemed guilty of a felony." Although this appears to make being a monopolist illegal, this is not how the courts have actually interpreted the provision. Instead, being a monopolist is a crime only when certain practices are employed.

Partly because of vagueness in the Sherman Act's wording, Congress passed two more important pieces of antitrust legislation in 1914. The *Clayton Act* explicitly outlaws specific

business practices believed to be monopolistic, such as price discrimination (examined in Chapter 12) and *predatory pricing* (pricing designed to drive competing firms out of business and/or deter prospective entrants so that the incumbent firm engaging in such behavior can eventually charge higher prices). However, these actions are illegal only if they "substantially lessen competition, or tend to create a monopoly." The *Federal Trade Commission Act* was also passed in 1914, creating a new federal agency charged with enforcing the antitrust laws (a duty it shares with the Justice Department) and having the authority to prohibit "unfair" methods of competition, such as deceptive advertising.

These laws form the cornerstone of antitrust policy. How well they have worked is a matter of some dispute, and assessing the evidence is beyond the scope of this book. Moreover, over the past two decades, the extent to which the antitrust laws have been applied to deter monopolies has diminished with the notable exception of some recent cases against Microsoft and Intel.

Part of the decline in the use of antitrust statutes is accounted for by the growing influence of the dynamic view of monopoly in the policymaking area. With international competition growing and the pace of technological change accelerating, any control by a supplier of a market at a given point in time is rendered more vulnerable, from a dynamic perspective, with the passing of time. For example, it is much harder for policymakers to attempt to prosecute General Motors or Ford today for having too large a share of domestic output given the stiff competition these companies now face from international rivals. An antitrust case against semiconductor chip manufacturer Intel is nowadays all the more difficult to prosecute given both the vigorousness of the competition Intel faces from overseas firms and the rapidity of technological innovation in the market for semiconductor chips (see Application 11.6).

Of course, the election and tenure of some conservative presidents over the 1980 to 1992 time period and more middle-of-the-road presidents since 1992 also partially explain the decline in the use of antitrust statutes. Well-publicized cases against companies such as IBM, AT&T, and the top four ready-to-eat cereal manufacturers were dropped during the 1980s following the election of Republican Ronald Reagan in 1980.

APPLICATION 11.5 WHAT NOT TO SAY TO A RIVAL ON THE TELEPHONE

One of the practices explicitly forbidden by the antitrust statutes is talking with one's rivals in a market about fixing prices. The following conversation in 1982 between the CEOs of American (Robert Crandall) and Braniff (Howard Putnam) Airlines, who were engaged at the time in a fierce competition for passengers into and out of Dallas, provides an example of what one should *not* say to one's rival about prices:[20]

> *Crandall:* I think it's dumb as hell . . . to sit here and pound the (deleted) out of each other and neither one of us making a (deleted) dime. . . .
>
> We can both live here and there ain't no room for Delta. But there's, ah, no reason to put both companies out of business.
>
> *Putnam:* Do you have a suggestion for me?
>
> *Crandall:* Yes, I have a suggestion for you. Raise your (deleted) fares 20 percent. I'll raise mine the next morning. . . . You'll make more money and I will, too.
>
> *Putnam:* We can't talk about pricing!
>
> *Crandall:* Oh (deleted), Howard. We can talk about any (deleted) thing we want to talk about.

This conversation, secretly taped and turned over to the Justice Department by Putnam, led to price-fixing charges against Crandall and American Airlines,

[20] "American Air Accused of Bid to Fix Prices," *Wall Street Journal*, February 24, 1983, pp. 3 and 22.

charges Crandall vigorously and successfully fought (on the basis of no price having actually been agreed to) in federal court.

Whereas talking directly to one's rivals about fixing prices is explicitly forbidden by the Sherman Act, an airline industry tradition whose competitive implications are more difficult for antitrust authorities to assess is the practice of publishing fares with the Airline Tariff Publishing Company, a collectively owned computer network.[21] Centralizing the price data made it easier for airlines to convey information to travel agents about the over 100,000 domestic fare changes occurring daily in the industry. Critics of the system contended, however, that it enabled airlines to communicate pricing intentions to one another. According to these critics, the most questionable practice involved one airline that was typically not the dominant provider of service in a particular city trying to increase its passenger traffic by lowering its fares. The lower fares were entered in the computer system. The dominant carrier at the affected airport not only matched the new fares but also lowered its fares in other markets served by the carrier initiating the fare decrease. The dominant carrier sometimes even attached special codes to the new fares to emphasize its message. For example, certain carriers prefixed their new fares with the impolite code letters "FU" to convey their displeasure. In the end, the carrier initiating the fare reduction often canceled the change and consumers ended up the losers. While airline officials denied any wrongdoing, the Justice Department scrutinized such fare games for their anticompetitive consequences and eventually found them to be in violation of antitrust statutes.

[21]"Airlines May be Using a Price-Data Network to Lessen Competition," *Wall Street Journal,* June 28, 1990, pp. A1 and A6.

APPLICATION 11.6 STATIC VERSUS DYNAMIC VIEWS OF MONOPOLY AND THE MICROSOFT ANTITRUST CASE

The static versus dynamic views of monopoly were at the heart of the recent Microsoft antitrust case.[22] The Justice Department, which brought the antitrust case on behalf of the U.S. government, alleged that Microsoft monopolized the market for personal computer (PC) operating systems. As of the late 1990s, Microsoft accounted for more than 90 percent of the U.S. market for PC operating systems through the dominance of its Windows product. The Justice Department further alleged that Microsoft had attempted to extend its monopoly power from the PC operating system market to the market for Internet browsers by tying its Internet Explorer to Windows, at the expense of the rival Navigator product produced by Netscape.

In its defense, Microsoft pointed to the dynamic nature of competition in the market for computer hardware and software products. For example, manufacturers boast that they will have newer, faster models of their computers out every five months, and none nowadays would dare think of guaranteeing, as IBM did with its AT (Advanced Technology) desktop model in 1985, that a product will remain state-of-the-art for five years. Craig Barrett, CEO of leading chip manufacturer Intel, acknowledges that more than 90 percent of his company's multibillion-dollar annual product line becomes obsolete in less than a year. And software that may dominate a market at any given moment is constantly vulnerable to being overthrown by superior versions produced by rival suppliers. Take the case of WordStar, the leading word-processing software program in the early 1980s. WordStar lost its position of preeminence to WordPerfect in the late 1980s. WordPerfect, in turn, lost its market-leading position to Word by the mid-1990s. Likewise, Lotus 1-2-3, the leading electronic spreadsheet software program throughout most of the 1980s, lost its position to Excel in the 1990s.

[22]This application is based on David S. Evans, Franklin M. Fisher, Daniel L. Rubinfeld, and Richard L. Schmalensee, *Did Microsoft Harm Consumers? Two Opposing Views* (Washington, D.C.: AEI Press, 2000); Thomas L. Friedman, *The Lexus and the Olive Tree* (New York: Farrar, Straus, Giroux, 1999); Bill Gates; "We're Defending Our Right to Innovate," *Wall Street Journal,* May 20, 1998, p. A14; and Thomas W. Hazlett and George Bittlingmayer, "As Goes Microsoft, So Goes the Computer Industry," *Wall Street Journal,* May 26, 1998, p. A18.

On account of the dynamic nature of competition in PC hardware and software markets, Microsoft argued that, over time, consumers stand to gain a great deal (in terms of consumer surplus) from the innovations that result from intense competition between rival suppliers. Tying Internet Explorer to Windows, according to Microsoft, is but one example of such innovation that makes consumers better off. For example, numerous reviews from the trade press (*PC Magazine*, *PC Computing*, *Business Week*, and so on) praised Microsoft when it integrated Internet Explorer into Windows because of the benefits that were likely to accrue to consumers.

Moreover, Microsoft argued that government intervention against the exercise of monopoly power at any given point in time by a supplier who has brought a superior product to market hurts the producer of the product, as well as discourages other firms from innovation, and thereby harms consumers. Indeed, in a study by George Bittlingmayer and Tom Hazlett, the stock market valuation of a broad portfolio of computer companies is, in general, adversely affected by judicial and regulatory decisions against Microsoft.

The Justice Department's reasoning in the recent Microsoft antitrust case would predict the opposite effect. Microsoft's actions, according to the Justice Department, diminished competition in the software market and thereby harmed consumers. The stock prices of computer companies thus should *rise* when Microsoft is restrained by government intervention. The Bittlingmayer and Hazlett results, however, suggest that antitrust restraints against Microsoft may end up deterring competition and innovation in computer software markets and thereby diminishing consumer welfare.

Regulation of Price

Besides antitrust statutes, policymakers also rely on price regulation to deal with monopoly. In the case of local cable television distribution, for example, policymakers have relied on rate controls to limit the prices that can be charged by firms, of which there is typically only one per community. For example, whereas the profit-maximizing price might be $20, policymakers can impose a ceiling, say $16, on the rate a local cable monopoly charges its customers for monthly basic service.

We have already analyzed the effects of a price ceiling in a competitive market and have seen that the results include reduced output, a shortage at the controlled price, and nonprice rationing. A monopoly, however, may not respond to a price ceiling in the same way. Indeed, under certain conditions a mandatory price reduction for a monopoly may lead to increased output.

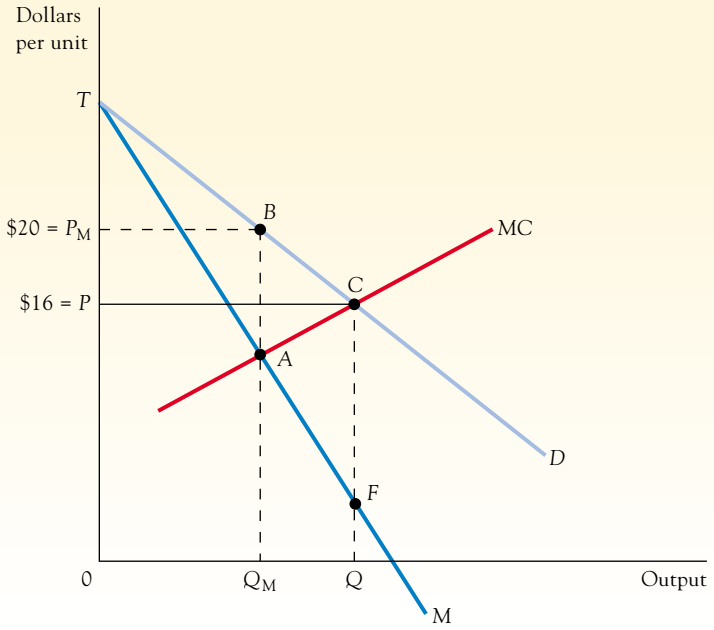
How can a lower price lead to greater output? Recall that a monopoly restricts output in order to charge a higher price. A price ceiling means that a restriction in output cannot result in a higher price, so the price ceiling eliminates the monopolist's reason for restraining output.

We can better understand the problem by focusing on how a price ceiling affects the profit-maximizing output of a local cable monopoly. In Figure 11.11, the demand curve is *TD* and the marginal revenue curve is *TM*. In the absence of any regulation, the most profitable output is Q_M, since marginal revenue and marginal cost are equal at that output, and the firm charges a $20 price. Now the government imposes a maximum price of $16. As a result, *the monopoly demand and marginal revenue curves effectively become* PCD *and* PCFM—as in the case of a monopoly confronting a threat of entry that we examined in Section 11.4. Once we recognize the way price regulation affects the demand and marginal revenue curves, the remainder of the analysis is straightforward.[23] With the price regulation, Q_M is no longer the profit-maximizing output; at this output, marginal revenue (now $16) is greater than the unchanged marginal cost. What this means is that the monopoly can recoup some of the lost profit by expanding production. Note that marginal revenue exceeds marginal cost until output has been increased from Q_M to Q, implying that profit rises as output expands over that range. The new profit-maximizing output is Q.

[23]We again assume that average cost is low enough for it to be profitable for the monopolist to continue to operate.

FIGURE 11.11

Price Ceiling Applied to Monopoly
When a price ceiling of *P* is applied to the monopoly, the demand curve becomes *PCD*, and the marginal revenue curve becomes *PCFM*. The most profitable output is *Q*, the efficient level of output.



In this case, the mandatory lower price leads to greater output and reduced profit for the monopoly. Although the firm recoups some of the initial loss in profit by expanding output from Q_M to Q, the net result is still a loss in profit. We can see this even without using the average cost curve, by noting that the monopoly could have chosen to produce Q at a price of $16 before the price control, but did not because profit was higher at Q_M and a price of $20. (In fact, profit is higher by the area *ACF*. Can you see why?) The regulation essentially confronts the monopoly with a horizontal demand curve over the zero-to-Q range of output, just like the demand curve facing a competitive firm, and therefore eliminates the reason for restricting output.

Thus, this price regulation reduces monopoly profit and benefits consumers by lowering price. But in this case it also does more: it increases output to the efficient level, eliminating the deadweight loss (from a static perspective) of monopoly! At the initial monopoly output, the deadweight loss is area *BCA*, the sum of the excess of the marginal value of units from Q_M to Q over their marginal cost. (This assumes that the monopoly marginal cost curve shows the relevant opportunity cost of the resources, which may not always be the case—but we will assume to be true here.[24]) By inducing an expansion in output to Q, the price regulation results in the monopoly reaching a level of production where the marginal value of the good is equal to marginal cost, as required for efficiency.

Of course, this beneficial outcome is not as easy to achieve as our analysis suggests. First, the outcome depends on where the price ceiling is set. In the diagram, if the price is set at either a higher or lower level than $16, the monopolist will choose to produce less. (You may want to confirm this.) From the point of view of promoting efficiency, the price should be set where the marginal cost curve intersects the demand curve, but because the government doesn't know the monopolist's marginal cost curve that outcome may not be achieved. Second, the price must not be lowered to the point where the monopolist suffers losses and

[24]For a discussion of the case when the monopoly's marginal cost curve is upward-sloping, see Edgar K. Browning, "Comparing Monopoly and Competition: The Increasing-Cost Case," *Economic Inquiry*, 25 No. 3 (July 1987), pp. 535–542.

goes out of business. Third, the monopoly has an incentive to skirt the price ceiling by reducing the quality of its product. Producing a lower-quality, lower-cost product is one way the monopolist can avoid the drop in profit that the price control otherwise causes. If the monopolist can pursue this strategy, a price ceiling will not achieve efficiency since the wrong-quality product will be produced.

SUMMARY

- A monopoly is the sole seller of some product without close substitutes.
- A monopoly confronts the market demand curve for the product it sells, and the demand curve will generally be downward-sloping.
- With a downward-sloping demand curve the monopoly's marginal revenue is less than price, because price must be reduced to sell a larger output.
- If a monopoly can select any price–quantity combination on its downward-sloping demand curve but must charge the same price to all customers, profit is maximized by producing the output for which marginal cost equals marginal revenue. The price of the product will be higher and its output lower under monopoly than under competitive conditions.
- From a static perspective, the output restriction characteristic of monopoly represents a misallocation of resources and involves a deadweight loss. Because price is above marginal cost, greater output would be worth more to consumers than it would cost to produce.
- The size of the deadweight loss due to restricted output is shown by the triangular area between the demand and marginal cost curves from the monopoly output to the competitive output (where price equals marginal cost).
- Antitrust laws and price regulation are two policies that can, in principle, reduce monopoly's static deadweight loss.

REVIEW QUESTIONS AND PROBLEMS

Questions and problems marked with an asterisk have solutions given in Answers to Selected Problems at the back of the book (page 577).

11.1. Because they result in higher prices than perfect competition, monopolies are often blamed by policymakers for causing inflation, where inflation is a persistent increase in the general price level. Is it appropriate to assign such blame to monopolies? Explain.

11.2. Suppose that we, as consumers, have the option of having an AIDS vaccine produced by a monopoly or of not having the vaccine produced at all. Under which option would we be better off? Why?

11.3. "Because a monopoly is the only source of supply, consumers are entirely at its mercy. There is no limit to the price the monopoly can charge." Evaluate this statement.

11.4. Why will Disneyland never set its admission price at a level where its demand curve is inelastic? Use the total revenue and total cost curves to illustrate your answer.

11.5. At the profit-maximizing output the price of Tommy jeans is twice as high as marginal cost. What is the elasticity of demand? (*Hint:* Solve $MR = P[1-(1/\eta)]$ for η, and remember $MC = MR$.)

11.6. When a ski resort with some monopoly power is maximizing profit, price is greater than marginal cost. Thus, consumers are willing to pay more for additional lift tickets than the tickets cost to produce. So why does the ski resort not charge a lower price per lift ticket and increase output?

11.7. "A competitive firm will never operate where marginal cost is declining, but a monopoly may." True or false? Explain.

***11.8.** Show how the most profitable output and price are determined for a monopoly that can produce its product at zero cost ($MC = AC = 0$). Explain the deadweight loss that exists in this case.

11.9. Draw a diagram to show the deadweight loss of a monopoly with a marginal cost curve that is vertical at the profit-maximizing output level.

***11.10.** "The concept of opportunity cost teaches us that producing more of any good, including a good produced by a monopoly, means that we must produce less of other goods. Thus, there is no objective basis for saying that an increase in a monopolist's output is worthwhile." Evaluate this statement.

11.11. Suppose that there is a single seller of gasoline in a particular town. Suppose that policymakers, outraged by the prices charged by this monopoly seller, impose a price ceiling. Will the seller's output increase? Explain your answer.

11.12. "Since the shutdown condition applies only to competitive firms, it is not a relevant factor when considering what profit-

maximizing output level a monopolist such as Amazon.com should produce." Explain why you agree or disagree with this statement.

11.13. Suppose that the MC faced by Skechers is a constant $10 per shoe. If the demand elasticity for Skechers shoes is also constant and is equal to 5, what price should Skechers charge for its shoes?

11.14. Suppose that the (inverse) market demand curve for a new drug, Adipose-Off, designed to painlessly reduce body fat, is represented by the equation $P = 100 - 2Q$, where P is the price in dollars per dose and Q is the annual output. (The marginal revenue curve is thus given by the equation $MR = 100 - 4Q$.) Suppose also that there is a single supplier of the drug who faces a marginal cost, as well as average cost, of producing the drug, equal to a constant $20 per dose. What are the monopolist's profit-maximizing output and price? What is the resulting deadweight loss relative to the competitive outcome?

11.15. Suppose that in the preceding problem, the government levies an excise tax of $5 per dose on the monopolist. What would happen to the monopolist's profit-maximizing output and price? What would happen to consumer and producer surplus? How much money would the government collect due to the tax? What would be the size of the resulting deadweight loss relative to the competitive outcome?

11.16. Address all the questions in the preceding problem but assume that instead of a tax of $5 per dose the government offers a subsidy of $5 per unit.

11.17. "A monopolist like Spago (a famous Hollywood restaurant frequented by movie stars) can fully pass on all marginal cost increases to its diners through higher prices since it is a price maker and can charge any price it wishes." Do you agree or disagree with this statement? Explain your answer.

11.18. Calculate the Lerner index for the monopoly described in question 11.14 above. How would the value of this index change when the tax described in question 11.15 is imposed on the monopolist? If the subsidy in question 11.16 is imposed instead?

11.19. "A monopoly's marginal cost curve is the monopoly's supply curve." True or false? Explain your answer.

11.20. Explain the determinants of a firm's monopoly power. How can a firm have monopoly power if it is not the sole supplier of a product?

11.21. Suppose that a monopoly is producing at an output where its average total cost of production is minimized and equals $50 per unit. If marginal revenue equals $60, is the monopoly producing at the profit-maximizing output level? Explain why or why not.

11.22. Provide an example of a firm with a Lerner index value of (a) zero and (b) unity. Why does the Lerner index take on a value between these two extremes? Explain why the Lerner index measures a firm's monopoly power.

11.23. Marin County Enterprises has a monopoly on the production of lunar-powered homes and has the normal U-shaped average cost curve. At its present profit-maximizing output and price, it is able to earn a positive economic profit. Show graphically the effects in the product market (output, price, profit, and so on) of each of the following changes:

a. Lunar-powered homes become a nationwide fad.
b. The cost of labor (a variable factor of production) rises.
c. The rent for the firm's office space (a fixed factor of production) rises.

If the Federal Alternative Power Commission can regulate the prices of lunar-powered homes and the promotion of efficiency is the commission's goal, what price should it set? What will happen to the output and profit of Marin County Enterprises as a result?

11.24. The City of Berkeley is currently considering alternative ways of providing cable service to its citizens. Based on an econometric analysis of several recently awarded cable franchises in other cities, economists have determined that the total cost, TC, and inverse demand curves for a cable company in Berkeley would be:

$$TC = 2Q - 0.1Q^2 + 0.005Q^3 \text{ and}$$

$$P = 20 - 0.5Q;$$

where output, Q, is measured in thousands and P is the monthly basic tier price.

a. Given this information, what are the equations for the total and marginal revenue curves and what do these curves look like on a graph?
b. City Councilor A believes the city should own and operate a cable system for the purpose of making as much profit as possible. The profit would be used to lower the city government's deficit. If Councilor A gets her way, what will be the price and output of cable and by how much will the city-owned system be able to reduce the city's deficit?
c. Councilor B believes the city should produce as much cable service as possible without losing money (that is, the city should provide cable to its citizens on a nonprofit basis). If Councilor B gets his way, what output and price will result?
d. Councilor C believes that the private sector should provide cable to the city but that the single, private firm that gets the city's franchise should pay 10 percent of its total revenue back to the city in the form of an annual franchise fee. If Councilor C gets her way and the franchise is awarded to the firm promising to pay the largest franchise fee, what price and output will result? What will be the size of the annual franchise fee?

11.25. Suppose that the Berkeley City Council takes 10 years to award its first cable television franchise for the sake of ensuring that the price the franchised operator charges is as close to average cost as possible. Explain why such a strategy may do less to promote consumer surplus than the alternative strategy of awarding the franchise right away to an operator who will charge a monopoly price.

11.26. The prices of seats on major financial exchanges have plummeted dramatically in recent years. For example, at the Chicago Board of Trade, the world's biggest futures exchange, a membership seat sold for $286,000 in 2002, down 66 percent from a record of $858,000 in 1997. Explain, using a graph, why the decline in the value of such seats may be related to the growth of electronic trading.