

PART • THREE

Market Structure and Competitive Strategy



Part 3 examines a broad range of markets and explains how the pricing, investment, and output decisions of firms depend on market structure and the behavior of competitors.

Chapters 10 and 11 examine *market power*: the ability to affect price, either by a seller or a buyer. We will see how market power arises, how it differs across firms, how it affects the welfare of consumers and producers, and how it can be limited by government. We will also see how firms can design pricing and advertising strategies to take maximum advantage of their market power.

Chapters 12 and 13 deal with markets in which the number of firms is limited. We will examine a variety of such markets, ranging from *monopolistic competition*, in which many firms sell differentiated products, to a *cartel*, in which a group of firms coordinates decisions and acts as a monopolist. We are particularly concerned with markets in which there are only a few firms. In these cases, each firm must design its pricing, output, and investment strategies, while keeping in mind how competitors are likely to react. We will develop and apply principles from game theory to analyze such strategies.

Chapter 14 shows how markets for factor inputs, such as labor and raw materials, operate. We will examine the firm's input decisions and show how those decisions depend on the structure of the input market. Chapter 15 then focuses on capital investment decisions. We will see how a firm can value the future profits that it expects an investment to yield and then compare this value with the cost of the investment to determine whether the investment is worthwhile. We will also apply this idea to the decisions of individuals to purchase a car or household appliance, or to invest in education.

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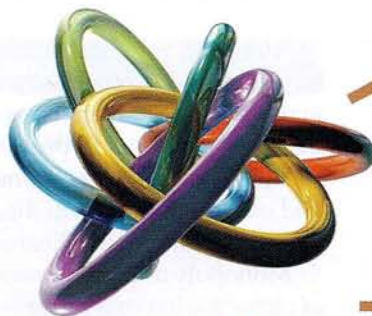
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Market Power: Monopoly and Monopsony



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In a perfectly competitive market, the large number of sellers and buyers of a good ensures that no single seller or buyer can affect its price. The market forces of supply and demand determine price. Individual firms take the market price as a given in deciding how much to produce and sell, and consumers take it as a given in deciding how much to buy.

Monopoly and *monopsony*, the subjects of this chapter, are the polar opposites of perfect competition. A **monopoly** is a market that has only one seller but many buyers. A **monopsony** is just the opposite: a market with many sellers but only one buyer. Monopoly and monopsony are closely related, which is why we cover them in the same chapter.

First we discuss the behavior of a monopolist. Because a monopolist is the sole producer of a product, the demand curve that it faces is the market demand curve. This market demand curve relates the price that the monopolist receives to the quantity it offers for sale. We will see how a monopolist can take advantage of its control over price and how the profit-maximizing price and quantity differ from what would prevail in a competitive market.

In general, the monopolist's quantity will be lower and its price higher than the competitive quantity and price. This imposes a cost on society because fewer consumers buy the product, and those who do pay more for it. This is why antitrust laws exist which forbid firms from monopolizing most markets. When economies of scale make monopoly desirable—for example, with local electric power companies—we will see how the government can increase efficiency by regulating the monopolist's price.

Pure monopoly is rare, but in many markets only a few firms compete with each other. The interactions of firms in such markets can be complicated and often involve aspects of *strategic gaming*, a topic covered in Chapters 12 and 13. In any case, the firms may be able to affect price and may find it profitable to charge a price higher than marginal cost. These firms have *monopoly power*. We will discuss the determinants of monopoly power, its measurement, and its implications for pricing.

Next we will turn to *monopsony*. Unlike a competitive buyer, a monopolist pays a price that depends on the quantity that it purchases. The monopolist's problem is to choose the quantity that maximizes its net benefit from the purchase—the value derived from the good less the money paid for it. By showing how the choice is made, we will demonstrate the close parallel between monopsony and monopoly.

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- **monopoly** Market with only one seller.
- **monopsony** Market with only one buyer.
- **market power** Ability of a seller or buyer to affect the price of a good.

Although pure monopsony is also unusual, many markets have only a few buyers who can purchase the good for less than they would pay in a competitive market. These buyers have *monopsony power*. Typically, this situation occurs in markets for inputs to production. For example, General Motors, the largest U.S. car manufacturer, has monopsony power in the markets for tires, car batteries, and other parts. We will discuss the determinants of monopsony power, its measurement, and its implications for pricing.

Monopoly and monopsony power are two forms of **market power**: the ability—of either a seller or a buyer—to affect the price of a good.¹ Because sellers or buyers often have at least some market power (in most real-world markets), we need to understand how market power works and how it affects producers and consumers.

10.1 MONOPOLY

As the sole producer of a product, a monopolist is in a unique position. If the monopolist decides to raise the price of the product, it need not worry about competitors who, by charging lower prices, would capture a larger share of the market at the monopolist's expense. The monopolist *is* the market and completely controls the amount of output offered for sale.

But this does not mean that the monopolist can charge any price it wants—at least not if its objective is to maximize profit. This textbook is a case in point. Pearson Prentice Hall owns the copyright and is therefore a monopoly producer of this book. So why doesn't it sell the book for \$500 a copy? Because few people would buy it, and Prentice Hall would earn a much lower profit.

To maximize profit, the monopolist must first determine its costs and the characteristics of market demand. Knowledge of demand and cost is crucial for a firm's economic decision making. Given this knowledge, the monopolist must then decide how much to produce and sell. The price per unit that the monopolist receives then follows directly from the market demand curve. Equivalently, the monopolist can determine price, and the quantity it will sell at that price follows from the market demand curve.

Average Revenue and Marginal Revenue

The monopolist's *average revenue*—the price it receives per unit sold—is precisely the market demand curve. To choose its profit-maximizing output level, the monopolist also needs to know its **marginal revenue**: the change in revenue that results from a unit change in output. To see the relationship among total, average, and marginal revenue, consider a firm facing the following demand curve:

$$P = 6 - Q$$

Table 10.1 shows the behavior of total, average, and marginal revenue for this demand curve. Note that revenue is zero when the price is \$6: At that price, nothing is sold. At a price of \$5, however, one unit is sold, so total (and marginal) revenue is \$5. An increase in quantity sold from 1 to 2 increases revenue from \$5 to \$8; marginal revenue is thus \$3. As quantity sold increases from 2 to 3, marginal revenue falls to \$1, and when quantity increases from 3 to 4, marginal revenue

- **marginal revenue** Change in revenue resulting from a one-unit increase in output.

In §8.3, we explain that marginal revenue is a measure of how much revenue increases when output increases by one unit.

¹The courts use the term "monopoly power" to mean significant and sustainable market power, sufficient to warrant particular scrutiny under the antitrust laws. In this book, however, for pedagogic reasons we use "monopoly power" differently, to mean market power on the part of sellers, whether substantial or not.

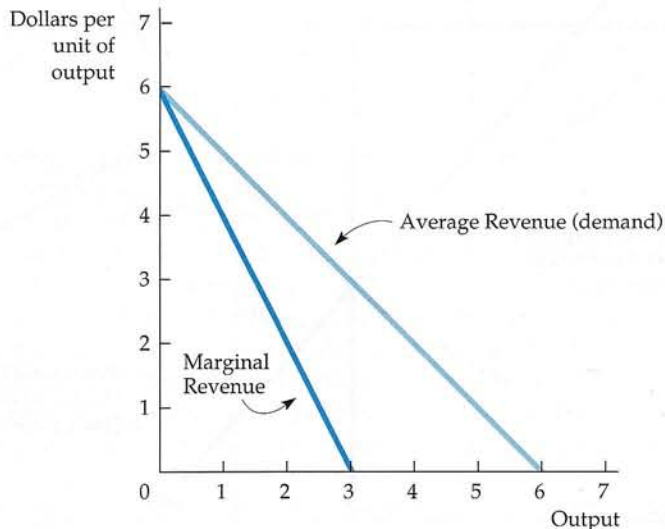
**TABLE 10.1** Total, Marginal, and Average Revenue

Price (P)	Quantity (Q)	Total Revenue (R)	Marginal Revenue (MR)	Average Revenue (AR)
\$6	0	\$0	—	—
5	1	5	\$5	\$5
4	2	8	3	4
3	3	9	1	3
2	4	8	-1	2
1	5	5	-3	1

becomes negative. When marginal revenue is positive, revenue is increasing with quantity, but when marginal revenue is negative, revenue is decreasing.

When the demand curve is downward sloping, the price (average revenue) is greater than marginal revenue because all units are sold at the same price. If sales are to increase by 1 unit, the price must fall. In that case, all units sold, not just the additional unit, will earn less revenue. Note, for example, what happens in Table 10.1 when output is increased from 1 to 2 units and price is reduced to \$4. Marginal revenue is \$3: \$4 (the revenue from the sale of the additional unit of output) less \$1 (the loss of revenue from selling the first unit for \$4 instead of \$5). Thus, marginal revenue (\$3) is less than price (\$4).

Figure 10.1 plots average and marginal revenue for the data in Table 10.1. Our demand curve is a straight line and, in this case, the marginal revenue curve has twice the slope of the demand curve (and the same intercept).²

**FIGURE 10.1** Average and Marginal Revenue

Average and marginal revenue are shown for the demand curve $P = 6 - Q$.

²If the demand curve is written so that price is a function of quantity, $P = a - bQ$, total revenue is given by $PQ = aQ - bQ^2$. Marginal revenue (using calculus) is $d(PQ)/dQ = a - 2bQ$. In this example, demand is $P = 6 - Q$ and marginal revenue is $MR = 6 - 2Q$. (This holds only for small changes in Q and therefore does not exactly match the data in Table 10.1.)



The Monopolist's Output Decision

In §7.1, we explain that marginal cost is the change in variable cost associated with a one-unit increase in output.

What quantity should the monopolist produce? In Chapter 8, we saw that to maximize profit, a firm must set output so that marginal revenue is equal to marginal cost. This is the solution to the monopolist's problem. In Figure 10.2, the market demand curve D is the monopolist's average revenue curve. It specifies the price per unit that the monopolist receives as a function of its output level. Also shown are the corresponding marginal revenue curve MR and the average and marginal cost curves, AC and MC . Marginal revenue and marginal cost are equal at quantity Q^* . Then from the demand curve, we find the price P^* that corresponds to this quantity Q^* .

How can we be sure that Q^* is the profit-maximizing quantity? Suppose the monopolist produces a smaller quantity Q_1 and receives the corresponding higher price P_1 . As Figure 10.2 shows, marginal revenue would then exceed marginal cost. In that case, if the monopolist produced a little more than Q_1 , it would receive extra profit ($MR - MC$) and thereby increase its total profit. In fact, the monopolist could keep increasing output, adding more to its total profit until output Q^* , at which point the incremental profit earned from producing one more

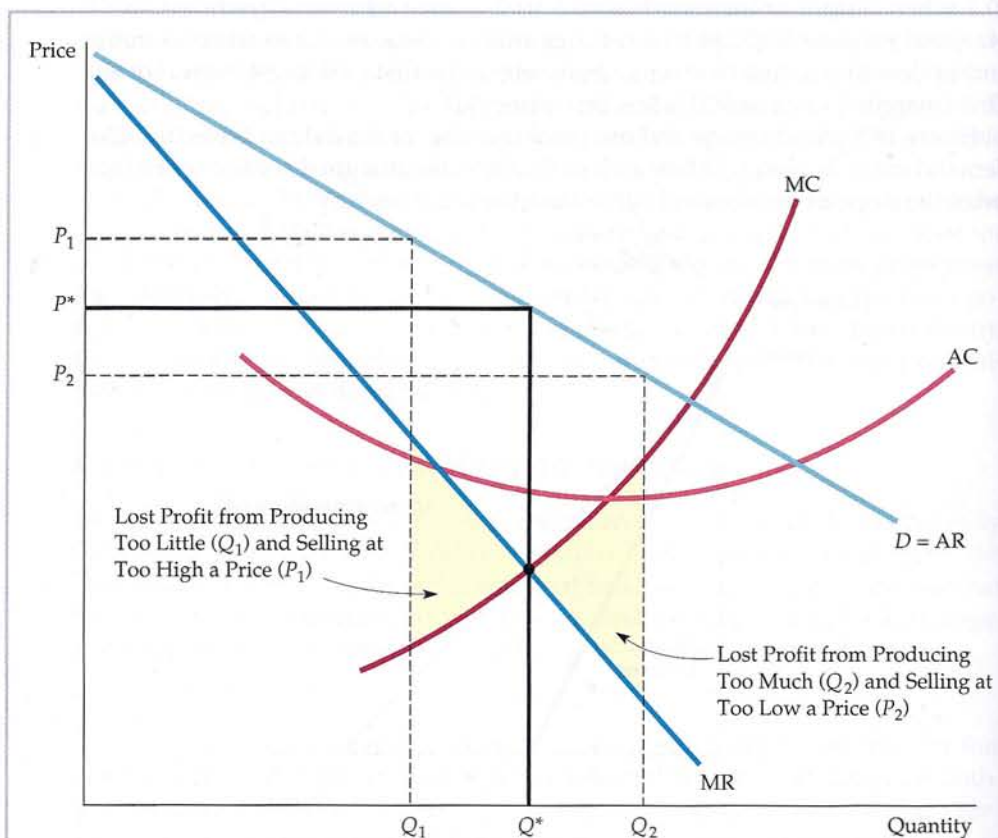


FIGURE 10.2 Profit Is Maximized When Marginal Revenue Equals Marginal Cost

Q^* is the output level at which $MR = MC$. If the firm produces a smaller output—say, Q_1 —it sacrifices some profit because the extra revenue that could be earned from producing and selling the units between Q_1 and Q^* exceeds the cost of producing them. Similarly, expanding output from Q^* to Q_2 would reduce profit because the additional cost would exceed the additional revenue.



unit is zero. So the smaller quantity Q_1 is not profit maximizing, even though it allows the monopolist to charge a higher price. If the monopolist produced Q_1 instead of Q^* , its total profit would be smaller by an amount equal to the shaded area below the MR curve and above the MC curve, between Q_1 and Q^* .

In Figure 10.2, the larger quantity Q_2 is likewise not profit maximizing. At this quantity, marginal cost exceeds marginal revenue. Therefore, if the monopolist produced a little less than Q_2 , it would increase its total profit (by $MC - MR$). It could increase its profit even more by reducing output all the way to Q^* . The increased profit achieved by producing Q^* instead of Q_2 is given by the area below the MC curve and above the MR curve, between Q^* and Q_2 .

We can also see algebraically that Q^* maximizes profit. Profit π is the difference between revenue and cost, both of which depend on Q :

$$\pi(Q) = R(Q) - C(Q)$$

As Q is increased from zero, profit will increase until it reaches a maximum and then begin to decrease. Thus the profit-maximizing Q is such that the incremental profit resulting from a small increase in Q is just zero (i.e., $\Delta\pi/\Delta Q = 0$). Then

$$\Delta\pi/\Delta Q = \Delta R/\Delta Q - \Delta C/\Delta Q = 0$$

But $\Delta R/\Delta Q$ is marginal revenue and $\Delta C/\Delta Q$ is marginal cost. Thus the profit-maximizing condition is that $MR - MC = 0$, or $MR = MC$.

An Example

To grasp this result more clearly, let's look at an example. Suppose the cost of production is

$$C(Q) = 50 + Q^2$$

In other words, there is a fixed cost of \$50, and variable cost is Q^2 . Suppose demand is given by

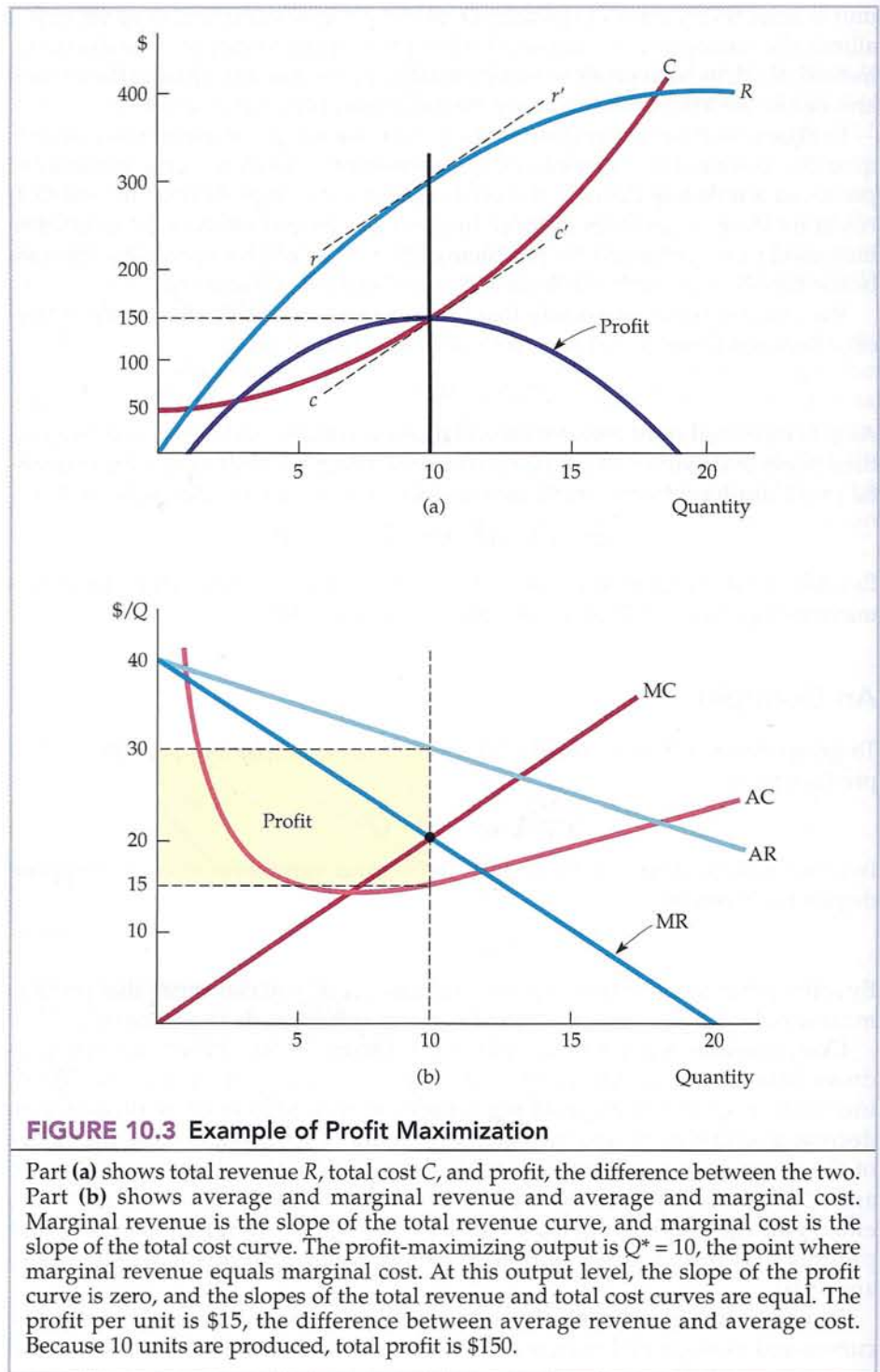
$$P(Q) = 40 - Q$$

By setting marginal revenue equal to marginal cost, you can verify that profit is maximized when $Q = 10$, an output level that corresponds to a price of \$30.³

Cost, revenue, and profit are plotted in Figure 10.3(a). When the firm produces little or no output, profit is negative because of the fixed cost. Profit increases as Q increases, reaching a maximum of \$150 at $Q^* = 10$, and then decreases as Q is increased further. At the point of maximum profit, the slopes of the revenue and cost curves are the same. (Note that the tangent lines rr' and cc' are parallel.) The slope of the revenue curve is $\Delta R/\Delta Q$, or marginal revenue, and the slope of the cost curve is $\Delta C/\Delta Q$, or marginal cost. Because profit is maximized when marginal revenue equals marginal cost, the slopes are equal.

Figure 10.3(b) shows both the corresponding average and marginal revenue curves and average and marginal cost curves. Marginal revenue and marginal cost intersect at $Q^* = 10$. At this quantity, average cost is \$15 per unit and price is \$30 per unit. Thus average profit is $\$30 - \$15 = \$15$ per unit. Because 10 units are sold, profit is $(10)(\$15) = \150 , the area of the shaded rectangle.

³Note that average cost is $C(Q)/Q = 50/Q + Q$ and marginal cost is $\Delta C/\Delta Q = 2Q$. Revenue is $R(Q) = P(Q)Q = 40Q - Q^2$, so marginal revenue is $MR = \Delta R/\Delta Q = 40 - 2Q$. Setting marginal revenue equal to marginal cost gives $40 - 2Q = 2Q$, or $Q = 10$.

**FIGURE 10.3** Example of Profit Maximization

Part (a) shows total revenue R , total cost C , and profit, the difference between the two. Part (b) shows average and marginal revenue and average and marginal cost. Marginal revenue is the slope of the total revenue curve, and marginal cost is the slope of the total cost curve. The profit-maximizing output is $Q^* = 10$, the point where marginal revenue equals marginal cost. At this output level, the slope of the profit curve is zero, and the slopes of the total revenue and total cost curves are equal. The profit per unit is \$15, the difference between average revenue and average cost. Because 10 units are produced, total profit is \$150.

A Rule of Thumb for Pricing

We know that price and output should be chosen so that marginal revenue equals marginal cost, but how can the manager of a firm find the correct price and output level in practice? Most managers have only limited knowledge of



the average and marginal revenue curves that their firms face. Similarly, they might know the firm's marginal cost only over a limited output range. We therefore want to translate the condition that marginal revenue should equal marginal cost into a rule of thumb that can be more easily applied in practice.

To do this, we first write the expression for marginal revenue:

$$MR = \frac{\Delta R}{\Delta Q} = \frac{\Delta(PQ)}{\Delta Q}$$

Note that the extra revenue from an incremental unit of quantity, $\Delta(PQ)/\Delta Q$, has two components:

1. Producing one extra unit and selling it at price P brings in revenue $(1)(P) = P$.
2. But because the firm faces a downward-sloping demand curve, producing and selling this extra unit also results in a small drop in price $\Delta P/\Delta Q$, which reduces the revenue from all units sold (i.e., a change in revenue $Q[\Delta P/\Delta Q]$).

Thus,

$$MR = P + Q \frac{\Delta P}{\Delta Q} = P + P \left(\frac{Q}{P} \right) \left(\frac{\Delta P}{\Delta Q} \right)$$

We obtained the expression on the right by taking the term $Q(\Delta P/\Delta Q)$ and multiplying and dividing it by P . Recall that the elasticity of demand is defined as $E_d = (P/Q)(\Delta Q/\Delta P)$. Thus $(Q/P)(\Delta P/\Delta Q)$ is the reciprocal of the elasticity of demand, $1/E_d$, measured at the profit-maximizing output, and

$$MR = P + P(1/E_d)$$

Now, because the firm's objective is to maximize profit, we can set marginal revenue equal to marginal cost:

$$P + P(1/E_d) = MC$$

which can be rearranged to give us

$$\frac{P - MC}{P} = -\frac{1}{E_d} \quad (10.1)$$

This relationship provides a rule of thumb for pricing. The left-hand side, $(P - MC)/P$, is the markup over marginal cost as a percentage of price. The relationship says that this markup should equal minus the inverse of the elasticity of demand.⁴ (This figure will be a *positive* number because the elasticity of demand is *negative*.) Equivalently, we can rearrange this equation to express price directly as a markup over marginal cost:

$$P = \frac{MC}{1 + (1/E_d)} \quad (10.2)$$

The elasticity of demand is discussed in §§2.4 and 4.3.

⁴Remember that this markup equation applies at the point of a profit maximum. If both the elasticity of demand and marginal cost vary considerably over the range of outputs under consideration, you may have to know the entire demand and marginal cost curves to determine the optimum output level. On the other hand, you can use this equation to check whether a particular output level and price are optimal.



In §8.1, we explain that a perfectly competitive firm will choose its output so that marginal cost equals price.

In §4.3 and Table 4.3, we explain that when price is increased, expenditure—and thus revenue—increases if demand is inelastic, decreases if demand is elastic, and is unchanged if demand has unit elasticity.

For example, if the elasticity of demand is -4 and marginal cost is \$9 per unit, price should be $\$9/(1 - 1/4) = \$9/.75 = \$12$ per unit.

How does the price set by a monopolist compare with the price under competition? In Chapter 8, we saw that in a perfectly competitive market, price equals marginal cost. A monopolist charges a price that exceeds marginal cost, *but by an amount that depends inversely on the elasticity of demand*. As the markup equation (10.1) shows, if demand is extremely elastic, E_d is a large negative number, and price will be very close to marginal cost. In that case, a monopolized market will look much like a competitive one. In fact, when demand is very elastic, there is little benefit to being a monopolist.

Also note that a monopolist will never produce a quantity of output that is on the inelastic portion of the demand curve—i.e., where the elasticity of demand is less than 1 in absolute value. To see why, suppose that the monopolist is producing at a point on the demand curve where the elasticity is -0.5 . In that case, the monopolist could make a greater profit by producing less and selling at a higher price. (A 10-percent reduction in output, for example, would allow for a 20-percent increase in price and thus a 10-percent increase in revenue. If marginal cost were greater than zero, the increase in profit would be even more than 10 percent because the lower output would reduce the firm's costs.) As the monopolist reduces output and raises price, it will move up the demand curve to a point where the elasticity is greater than 1 in absolute value and the markup rule of equation (10.2) will be satisfied.

Suppose, however, that marginal cost is zero. In that case, we cannot use equation (10.2) directly to determine the profit-maximizing price. However, we can see from equation (10.1) that in order to maximize profit, the firm will produce at the point where the elasticity of demand is exactly -1 . If marginal cost is zero, maximizing profit is equivalent to maximizing revenue, and revenue is maximized when $E_d = -1$.

EXAMPLE 10.1

Astra-Merck Prices Prilosec



In 1995, a new drug developed by Astra-Merck became available for the long-term treatment of ulcers. The drug, Prilosec, represented a new generation of antiulcer medication. Other drugs to treat ulcer conditions were already on the market: Tagamet had been introduced in 1977, Zantac in 1983, Pepcid in 1986, and Axid in 1988. As we explained in Example 1.1 (page 10), these four drugs worked in much the same way to reduce the stomach's secretion of acid. Prilosec, however, was based on a very different biochemical mechanism and was much more effective than these earlier drugs. By 1996, it had become the best-selling drug in the world and faced no major competitor.⁵

⁵Prilosec, developed through a joint venture of the Swedish firm Astra and the U.S. firm Merck, was introduced in 1989, but only for the treatment of gastroesophageal reflux disease, and was approved for short-term ulcer treatment in 1991. It was the approval for long-term ulcer treatment in 1995, however, that created a very large market for the drug. In 1998, Astra bought Merck's share of the rights to Prilosec. In 1999, Astra acquired the firm Zeneca and is now called AstraZeneca. In 2001, AstraZeneca earned over \$4.9 billion in sales of Prilosec, which remained the world's best-selling prescription drug. As AstraZeneca's patent on Prilosec neared expiration, the company introduced Nexium, a new (and, according to the company, better) antiulcer drug. In 2006, Nexium was the third-biggest-selling pharmaceutical drug in the world, with sales of about \$5.7 billion.



In 1995, Astra-Merck was pricing Prilosec at about \$3.50 per daily dose. (By contrast, the prices for Tagamet and Zantac were about \$1.50 to \$2.25 per daily dose.) Is this pricing consistent with the markup formula (10.1)? The marginal cost of producing and packaging Prilosec is only about 30 to 40 cents per daily dose. This low marginal cost implies that the price elasticity of demand, E_D , should be in the range of roughly -1.0 to -1.2 . Based on statistical studies of pharmaceutical demand, this is indeed a reasonable estimate for the demand elasticity. Thus, setting the price of Prilosec at a markup exceeding 400 percent over marginal cost is consistent with our rule of thumb for pricing.

Shifts in Demand

In a competitive market, there is a clear relationship between price and the quantity supplied. That relationship is the supply curve, which, as we saw in Chapter 8, represents the marginal cost of production for the industry as a whole. The supply curve tells us how much will be produced at every price.

A monopolistic market has no supply curve. In other words, there is no one-to-one relationship between price and the quantity produced. The reason is that the monopolist's output decision depends not only on marginal cost but also on the shape of the demand curve. As a result, shifts in demand do not trace out the series of prices and quantities that correspond to a competitive supply curve. Instead, shifts in demand can lead to changes in price with no change in output, changes in output with no change in price, or changes in both price and output.

This principle is illustrated in Figure 10.4(a) and (b). In both parts of the figure, the demand curve is initially D_1 , the corresponding marginal revenue curve is MR_1 , and the monopolist's initial price and quantity are P_1 and Q_1 . In Figure 10.4(a), the demand curve is shifted down and rotated. The new demand and marginal revenue curves are shown as D_2 and MR_2 . Note that MR_2 intersects the marginal cost curve at the same point that MR_1 does. As a result, the quantity produced stays the same. Price, however, falls to P_2 .

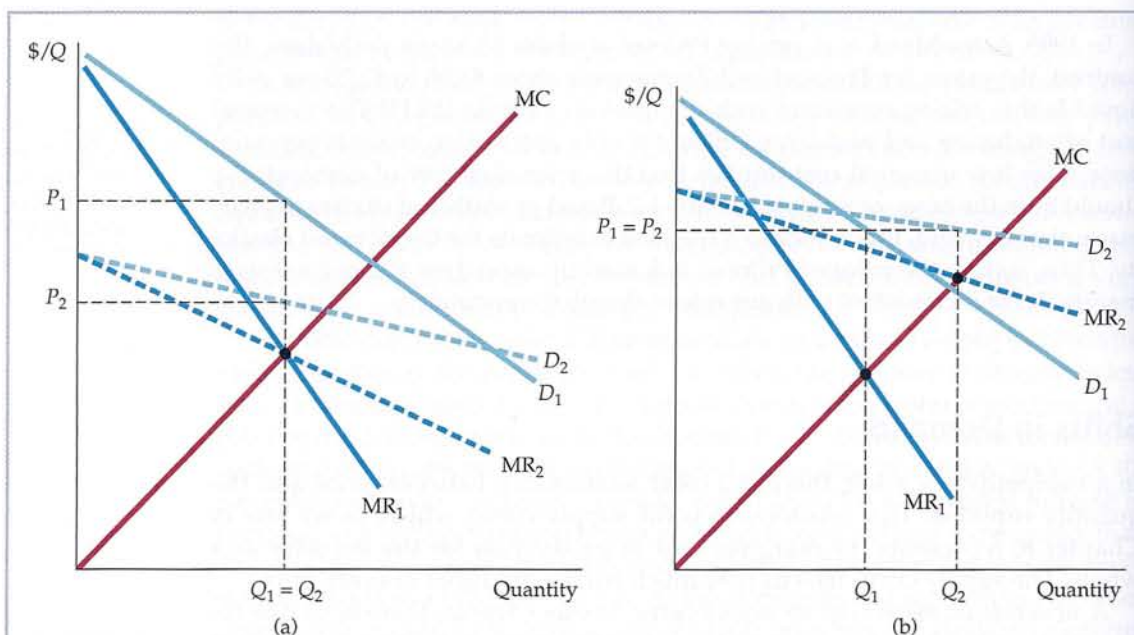
In Figure 10.4(b), the demand curve is shifted up and rotated. The new marginal revenue curve MR_2 intersects the marginal cost curve at a larger quantity, Q_2 instead of Q_1 . But the shift in the demand curve is such that the price charged is exactly the same.

Shifts in demand usually cause changes in both price and quantity. But the special cases shown in Figure 10.4 illustrate an important distinction between monopoly and competitive supply. A competitive industry supplies a specific quantity at every price. No such relationship exists for a monopolist, which, depending on how demand shifts, might supply several different quantities at the same price, or the same quantity at different prices.

The Effect of a Tax

A tax on output can also have a different effect on a monopolist than on a competitive industry. In Chapter 9, we saw that when a specific (i.e., per-unit) tax is imposed on a competitive industry, the market price rises by an amount that is less than the tax, and that the burden of the tax is shared by producers and consumers. Under monopoly, however, price can sometimes rise by *more* than the amount of the tax.

In §9.6, we explain that a specific tax is a tax of a certain amount of money per unit sold, and we show how the tax affects price and quantity.

**FIGURE 10.4** Shifts in Demand

Shifting the demand curve shows that a monopolistic market has no supply curve—i.e., there is no one-to-one relationship between price and quantity produced. In (a), the demand curve D_1 shifts to new demand curve D_2 . But the new marginal revenue curve MR_2 intersects marginal cost at the same point as the old marginal revenue curve MR_1 . The profit-maximizing output therefore remains the same, although price falls from P_1 to P_2 . In (b), the new marginal revenue curve MR_2 intersects marginal cost at a higher output level Q_2 . But because demand is now more elastic, price remains the same.

Analyzing the effect of a tax on a monopolist is straightforward. Suppose a specific tax of t dollars per unit is levied, so that the monopolist must remit t dollars to the government for every unit it sells. Therefore, the firm's marginal (and average) cost is increased by the amount of the tax t . If MC was the firm's original marginal cost, its optimal production decision is now given by

$$MR = MC + t$$

Graphically, we shift the marginal cost curve upward by an amount t , and find the new intersection with marginal revenue. Figure 10.5 shows this. Here Q_0 and P_0 are the quantity and price before the tax is imposed, and Q_1 and P_1 are the quantity and price after the tax.

Shifting the marginal cost curve upward results in a smaller quantity and higher price. Sometimes price increases by less than the tax, but not always—in Figure 10.5, price increases by *more* than the tax. This would be impossible in a competitive market, but it can happen with a monopolist because the relationship between price and marginal cost depends on the elasticity of demand. Suppose, for example, that a monopolist faces a constant elasticity demand curve, with elasticity -2 , and has constant marginal cost MC . Equation (10.2) then tells us that price will equal twice marginal cost. With a tax t , marginal cost increases to $MC + t$, so price increases to $2(MC + t) = 2MC + 2t$; that is, it rises by twice the amount of the tax. (However, the monopolist's profit nonetheless falls with the tax.)

In §8.2, we explain that a firm maximizes its profit by choosing the output at which marginal revenue is equal to marginal cost.

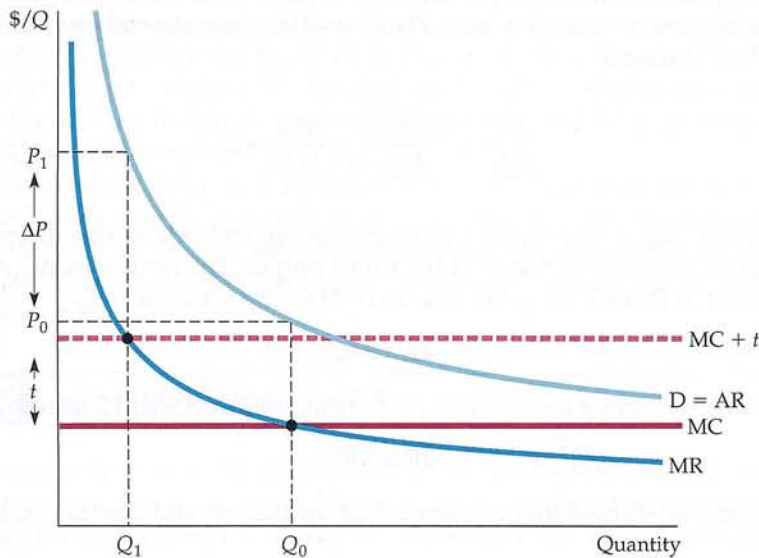


FIGURE 10.5 Effect of Excise Tax on Monopolist

With a tax t per unit, the firm's effective marginal cost is increased by the amount t to $MC + t$. In this example, the increase in price ΔP is larger than the tax t .

*The Multiplant Firm

We have seen that a firm maximizes profit by setting output at a level where marginal revenue equals marginal cost. For many firms, production takes place in two or more different plants whose operating costs can differ. However, the logic used in choosing output levels is very similar to that for the single-plant firm.

Suppose a firm has two plants. What should its total output be, and how much of that output should each plant produce? We can find the answer intuitively in two steps.

- **Step 1.** Whatever the total output, it should be divided between the two plants so that *marginal cost is the same in each plant*. Otherwise, the firm could reduce its costs and increase its profit by reallocating production. For example, if marginal cost at Plant 1 were higher than at Plant 2, the firm could produce the same output at a lower total cost by producing less at Plant 1 and more at Plant 2.
- **Step 2.** We know that total output must be such that *marginal revenue equals marginal cost*. Otherwise, the firm could increase its profit by raising or lowering total output. For example, suppose marginal costs were the same at each plant, but marginal revenue exceeded marginal cost. In that case, the firm would do better by producing more at both plants because the revenue earned from the additional units would exceed the cost. Because marginal costs must be the same at each plant, and because marginal revenue must equal marginal cost, we see that profit is maximized when *marginal revenue equals marginal cost at each plant*.

We can also derive this result algebraically. Let Q_1 and C_1 be the output and cost of production for Plant 1, Q_2 and C_2 be the output and cost of production for Plant 2, and $Q_T = Q_1 + Q_2$ be total output. Then profit is

$$\pi = PQ_T - C_1(Q_1) - C_2(Q_2)$$



The firm should increase output from each plant until the incremental profit from the last unit produced is zero. Start by setting incremental profit from output at Plant 1 to zero:

$$\frac{\Delta\pi}{\Delta Q_1} = \frac{\Delta(PQ_T)}{\Delta Q_1} - \frac{\Delta C_1}{\Delta Q_1} = 0$$

Here $\Delta(PQ_T)/\Delta Q_1$ is the revenue from producing and selling one more unit—i.e., *marginal revenue*, MR, for all of the firm's output. The next term, $\Delta C_1/\Delta Q_1$, is *marginal cost* at Plant 1, MC_1 . We thus have $MR - MC_1 = 0$, or

$$MR = MC_1$$

Similarly, we can set incremental profit from output at Plant 2 to zero,

$$MR = MC_2$$

Putting these relations together, we see that the firm should produce so that

$$MR = MC_1 = MC_2 \quad (10.3)$$

Figure 10.6 illustrates this principle for a firm with two plants. MC_1 and MC_2 are the marginal cost curves for the two plants. (Note that Plant 1 has higher marginal costs than Plant 2.) Also shown is a curve labeled MC_T . This is the firm's total marginal cost and is obtained by horizontally summing MC_1 and MC_2

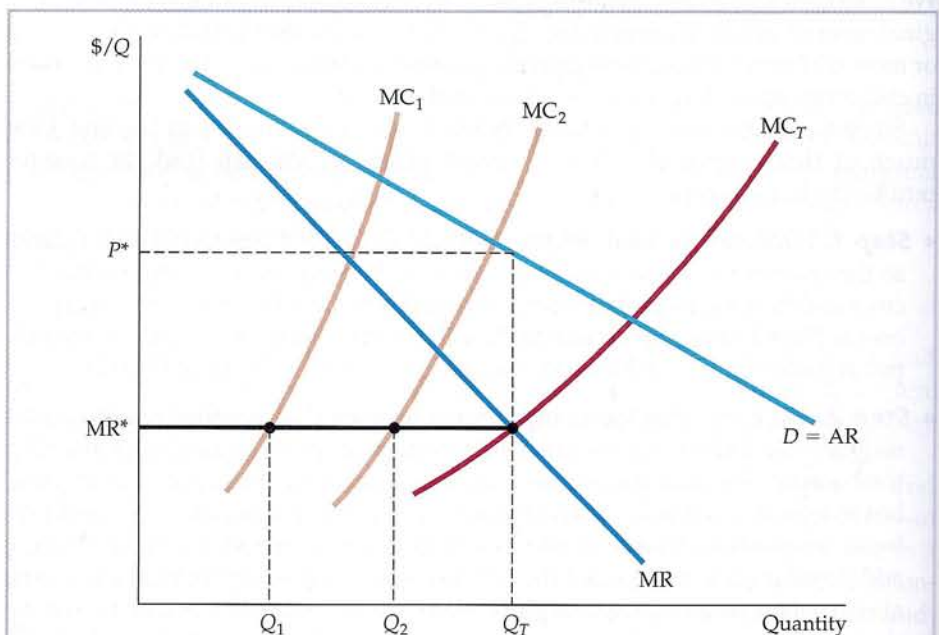


FIGURE 10.6 Production with Two Plants

A firm with two plants maximizes profits by choosing output levels Q_1 and Q_2 so that marginal revenue MR (which depends on *total* output) equals marginal costs for each plant, MC_1 and MC_2 .



MC_2 . Now we can find the profit-maximizing output levels Q_1 , Q_2 , and Q_T . First, find the intersection of MC_T with MR ; that point determines total output Q_T . Next, draw a horizontal line from that point on the marginal revenue curve to the vertical axis; point MR^* determines the firm's marginal revenue. The intersections of the marginal revenue line with MC_1 and MC_2 give the outputs Q_1 and Q_2 for the two plants, as in equation (10.3).

Note that total output Q_T determines the firm's marginal revenue (and hence its price P^*). Q_1 and Q_2 , however, determine marginal costs at each of the two plants. Because MC_T was found by horizontally summing MC_1 and MC_2 , we know that $Q_1 + Q_2 = Q_T$. Thus these output levels satisfy the condition that $MR = MC_1 = MC_2$.

Note the similarity to the way we obtained a competitive industry's supply curve in §8.5 by horizontally summing the marginal cost curves of the individual firms.

10.2 MONOPOLY POWER

Pure monopoly is rare. Markets in which several firms compete with one another are much more common. We say more about the forms that this competition can take in Chapters 12 and 13. But we should explain here why each firm in a market with several firms is likely to face a downward-sloping demand curve and, as a result, to produce so that price exceeds marginal cost.

Suppose, for example, that four firms produce toothbrushes and have the market demand curve $Q = 50,000 - 20,000P$, as shown in Figure 10.7(a). Let's assume that these four firms are producing an aggregate of 20,000 toothbrushes per day (5000 each per day) and selling them at \$1.50 each. Note that market demand is relatively inelastic; you can verify that at this \$1.50 price, the elasticity of demand is -1.5 .

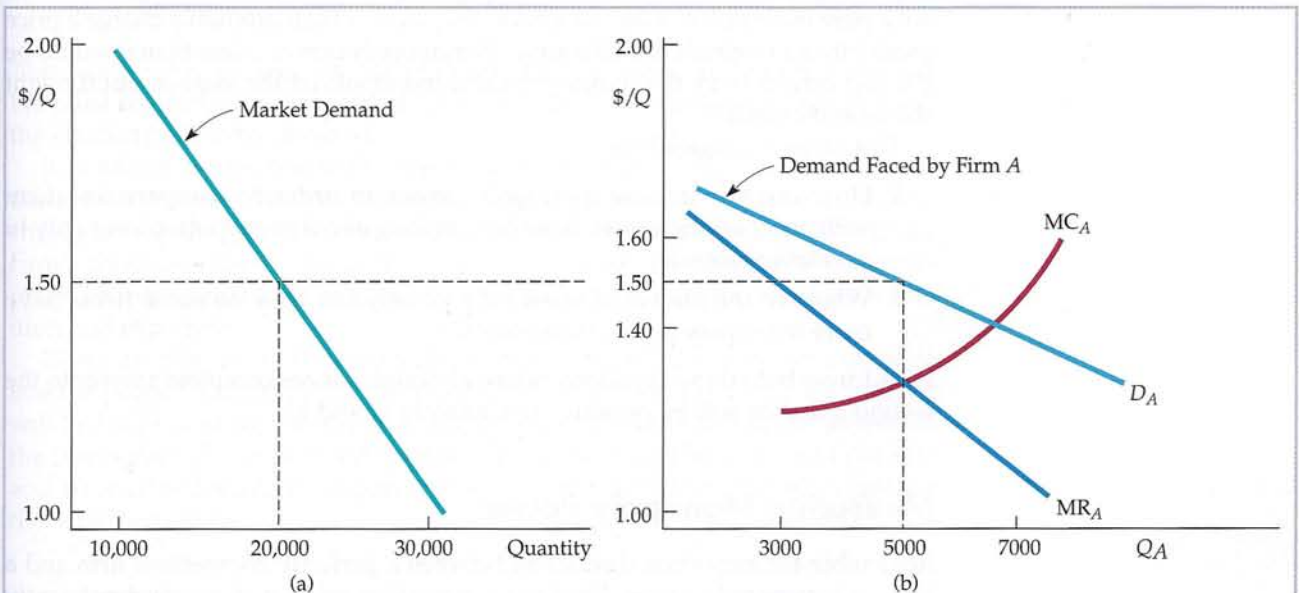


FIGURE 10.7 The Demand for Toothbrushes

Part (a) shows the market demand for toothbrushes. Part (b) shows the demand for toothbrushes as seen by Firm A. At a market price of \$1.50, elasticity of market demand is -1.5 . Firm A, however, sees a much more elastic demand curve D_A because of competition from other firms. At a price of \$1.50, Firm A's demand elasticity is -6 . Still, Firm A has some monopoly power: Its profit-maximizing price is \$1.50, which exceeds marginal cost.



Now suppose that Firm A is deciding whether to lower its price to increase sales. To make this decision, it needs to know how its sales would respond to a change in its price. In other words, it needs some idea of the demand curve it faces, as opposed to the *market* demand curve. A reasonable possibility is shown in Figure 10.7(b), where the firm's demand curve D_A is much more elastic than the market demand curve. (At the \$1.50 price the elasticity is -6.0 .) The firm might predict that by raising the price from \$1.50 to \$1.60, its sales will drop—say, from 5000 units to 3000—as consumers buy more toothbrushes from other firms. (If *all* firms raised their prices to \$1.60, sales for Firm A would fall only to 4500.) For several reasons, sales won't drop to zero as they would in a perfectly competitive market. First, if Firm A's toothbrushes are a little different from those of its competitors, some consumers will pay a bit more for them. Second, other firms might also raise their prices. Similarly, Firm A might anticipate that by lowering its price from \$1.50 to \$1.40, it can sell more toothbrushes—perhaps 7000 instead of 5000. But it will not capture the entire market: Some consumers might still prefer the competitors' toothbrushes, and competitors might also lower their prices.

Thus, Firm A's demand curve depends both on how much its product differs from its competitors' products and on how the four firms compete with one another. We will discuss product differentiation and interfirm competition in Chapters 12 and 13. But one important point should be clear: *Firm A is likely to face a demand curve which is more elastic than the market demand curve, but which is not infinitely elastic like the demand curve facing a perfectly competitive firm.*

Given knowledge of its demand curve, how much should Firm A produce? The same principle applies: The profit-maximizing quantity equates marginal revenue and marginal cost. In Figure 10.7(b), that quantity is 5000 units. The corresponding price is \$1.50, which exceeds marginal cost. Thus, although Firm A is not a pure monopolist, *it does have monopoly power*—it can profitably charge a price greater than marginal cost. Of course, its monopoly power is less than it would be if it had driven away the competition and monopolized the market, but it might still be substantial.

This raises two questions.

1. How can we *measure* monopoly power in order to compare one firm with another? (So far we have been talking about monopoly power only in *qualitative* terms.)
2. What are the *sources* of monopoly power, and why do some firms have more monopoly power than others?

We address both these questions below, although a more complete answer to the second question will be provided in Chapters 12 and 13.

Measuring Monopoly Power

Remember the important distinction between a perfectly competitive firm and a firm with monopoly power: *For the competitive firm, price equals marginal cost; for the firm with monopoly power, price exceeds marginal cost.* Therefore, a natural way to measure monopoly power is to examine the extent to which the profit-maximizing price exceeds marginal cost. In particular, we can use the markup ratio of price minus marginal cost to price that we introduced earlier as part of a rule of thumb for pricing. This measure of monopoly power, introduced by economist Abba



Lerner in 1934, is called the **Lerner Index of Monopoly Power**. It is the difference between price and marginal cost, divided by price. Mathematically:

$$L = (P - MC)/P$$

The Lerner index always has a value between zero and one. For a perfectly competitive firm, $P = MC$, so that $L = 0$. The larger is L , the greater is the degree of monopoly power.

This index of monopoly power can also be expressed in terms of the elasticity of demand facing the firm. Using equation (10.1), we know that

$$L = (P - MC)/P = -1/E_d \quad (10.4)$$

Remember, however, that E_d is now the elasticity of the *firm's* demand curve, not the market demand curve. In the toothbrush example discussed previously, the elasticity of demand for Firm A is -6.0 , and the degree of monopoly power is $1/6 = 0.167$.⁶

Note that considerable monopoly power does not necessarily imply high profits. Profit depends on *average* cost relative to price. Firm A might have more monopoly power than Firm B but earn a lower profit because of higher average costs.

• **Lerner Index of Monopoly Power** Measure of monopoly power calculated as excess of price over marginal cost as a fraction of price.



The Rule of Thumb for Pricing

In the previous section, we used equation (10.2) to compute price as a simple markup over marginal cost:

$$P = \frac{MC}{1 + (1/E_d)}$$

This relationship provides a rule of thumb for *any* firm with monopoly power. We must remember, however, that E_d is the elasticity of demand for the *firm*, not the elasticity of *market* demand.

It is harder to determine the elasticity of demand for the firm than for the market because the firm must consider how its competitors will react to price changes. Essentially, the manager must estimate the percentage change in the firm's unit sales that is likely to result from a 1-percent change in the firm's price. This estimate might be based on a formal model or on the manager's intuition and experience.

Given an estimate of the firm's elasticity of demand, the manager can calculate the proper markup. If the firm's elasticity of demand is large, this markup will be small (and we can say that the firm has very little monopoly power). If the firm's elasticity of demand is small, this markup will be large (and the firm will have considerable monopoly power). Figures 10.8(a) and 10.8(b) illustrate these two extremes.

⁶There are three problems with applying the Lerner index to the analysis of public policy toward firms. First, because marginal cost is difficult to measure, average variable cost is often used in Lerner index calculations. Second, if the firm prices below its optimal price (possibly to avoid legal scrutiny), its potential monopoly power will not be noted by the index. Third, the index ignores dynamic aspects of pricing such as effects of the learning curve and shifts in demand. See Robert S. Pindyck, "The Measurement of Monopoly Power in Dynamic Markets," *Journal of Law and Economics* 28 (April 1985): 193–222.

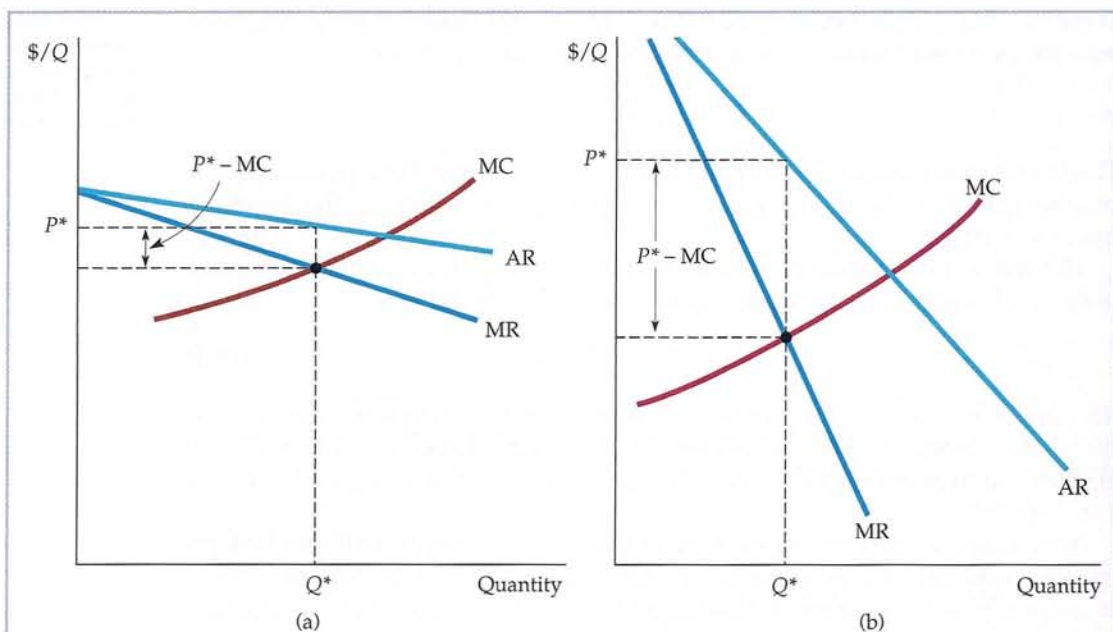


FIGURE 10.8 Elasticity of Demand and Price Markup

The markup $(P - MC)/P$ is equal to minus the inverse of the elasticity of demand facing the firm. If the firm's demand is elastic, as in (a), the markup is small and the firm has little monopoly power. The opposite is true if demand is relatively inelastic, as in (b).

EXAMPLE 10.2

Markup Pricing: Supermarkets to Designer Jeans



Three examples should help clarify the use of markup pricing. Consider a supermarket chain. Although the elasticity of market demand for food is small (about -1), several supermarkets usually serve most areas. Thus no single supermarket can raise its prices very much without losing customers to other stores. As a result, the elasticity of demand for any one supermarket is often as large as

-10 . Substituting this number for E_d in equation (10.2), we find $P = MC / (1 - 0.1) = MC / (0.9) = (1.11)MC$. In other words, the manager of a typical supermarket should set prices about 11 percent above marginal cost. For a reasonably wide range of output levels (over which the size of the store and the number of its employees will remain fixed), marginal cost includes the cost of purchasing the food at wholesale, plus the costs of storing the food, arranging it on the shelves, etc. For most supermarkets, the markup is indeed about 10 or 11 percent.

Small convenience stores, which are often open 7 days a week and even 24 hours a day, typically charge higher prices than supermarkets. Why? Because a convenience store faces a less elastic demand curve. Its customers are generally less price sensitive. They might need a quart of milk or a loaf of bread late at night or may find it inconvenient to drive to the supermarket. Because the



elasticity of demand for a convenience store is about -5 , the markup equation implies that its prices should be about 25 percent above marginal cost, as indeed they typically are.

The Lerner index, $(P - MC)/P$, tells us that the convenience store has more monopoly power, but does it make larger profits? No. Because its volume is far smaller and its average fixed costs are larger, it usually earns a much smaller profit than a large supermarket despite its higher markup.

Finally, consider a producer of designer jeans. Many companies produce jeans, but some consumers will pay much more for jeans with a designer label. Just how much more they will pay—or more exactly, how much sales will drop in response to higher prices—is a question that the producer must carefully consider because it is critical in determining the price at which the clothing will be sold (at wholesale to retail stores, which then mark up the price further). With designer jeans, demand elasticities in the range of -2 to -3 are typical for the major labels. This means that price should be 50 to 100 percent higher than marginal cost. Marginal cost is typically \$15 to \$20 per pair, and depending on the brand, the wholesale price is in the \$20 to \$40 range. In contrast, “mass-market” jeans will typically wholesale for \$18 to \$25 per pair. Why? Because without the designer label, they are far more price elastic.

EXAMPLE 10.3

The Pricing of Videos

During the mid-1980s, the number of households owning videocassette recorders (VCRs) grew rapidly, as did the markets for rentals and sales of prerecorded cassettes. Although at that time many more videocassettes were rented through small retail outlets than sold outright, the market for sales was large and growing. Producers, however, found it difficult to decide what price to charge for cassettes. As a result, in 1985 popular movies were selling for vastly different prices, as you can see from the data in Table 10.2.

Note that while *The Empire Strikes Back* was selling for nearly \$80, *Star Trek*, a film that appealed to the same audience and was about as popular, sold for only about \$25. These price differences reflected uncertainty and a wide divergence of

TABLE 10.2 Retail Prices of VHS and DVDs

1985		2007	
Title	Retail Price VHS	Title	Retail Price DVD
<i>Purple Rain</i>	\$29.98	<i>Pirates of the Caribbean</i>	\$19.99
<i>Raiders of the Lost Ark</i>	\$24.95	<i>The Da Vinci Code</i>	\$19.99
<i>Jane Fonda Workout</i>	\$59.95	<i>Mission: Impossible III</i>	\$17.99
<i>The Empire Strikes Back</i>	\$79.98	<i>King Kong</i>	\$19.98
<i>An Officer and a Gentleman</i>	\$24.95	<i>Harry Potter and the Goblet of Fire</i>	\$17.49
<i>Star Trek: The Motion Picture</i>	\$24.95	<i>Ice Age</i>	\$19.99
<i>Star Wars</i>	\$39.98	<i>The Devil Wears Prada</i>	\$17.99

Source (2007): Based on <http://www.amazon.com>. Suggested retail price.

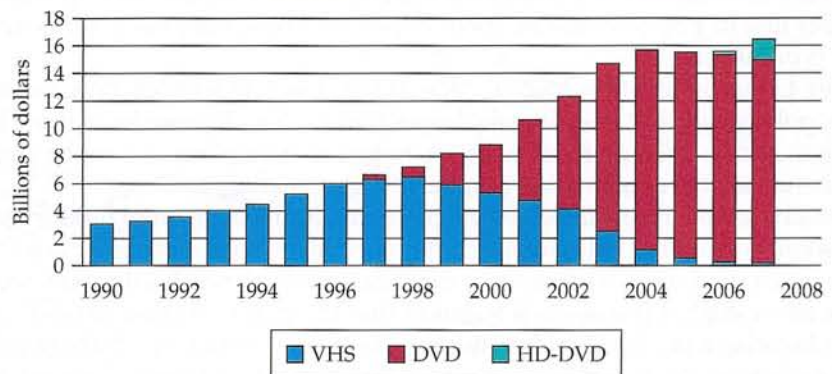


FIGURE 10.9 Video Sales

Between 1990 and 1998, lower prices induced consumers to buy many more videos. By 2001, sales of DVDs overtook sales of VHS videocassettes. High-definition DVDs were introduced in 2006, and are expected to displace sales of conventional DVDs.

views on pricing by producers. The issue was whether lower prices would induce consumers to buy videocassettes rather than rent them. Because producers do not share in the retailers' revenues from rentals, they should charge a low price for cassettes only if that will induce enough consumers to buy them. Because the market was young, producers had no good estimates of the elasticity of demand, so they based prices on hunches or trial and error.⁷

As the market matured, however, sales data and market research studies put pricing decisions on firmer ground. Those studies strongly indicated that demand was price elastic and that the profit-maximizing price was in the range of \$15 to \$30. By the 1990s, most producers had lowered prices across the board. When DVDs were first introduced in 1997, the prices of top-selling DVDs were much more uniform. Since that time, prices of popular DVDs have remained fairly uniform and continued to fall. As Table 10.2 shows, by 2007, prices were typically \$20 or less. As a result, video sales have steadily increased, as shown in Figure 10.9. With the introduction of high-definition (HD) DVDs in 2006, sales of conventional DVDs are expected to fall as consumers gradually switch to the new format.

10.3 SOURCES OF MONOPOLY POWER

Why do some firms have considerable monopoly power while other firms have little or none? Remember that monopoly power is the ability to set price above marginal cost and that the amount by which price exceeds marginal cost depends inversely on the elasticity of demand facing the firm. As equation (10.4) shows, *the less elastic its demand curve, the more monopoly power a firm has*. The ultimate determinant of monopoly power is therefore the firm's elasticity of demand. Thus we should rephrase our question: Why do some firms (e.g., a

⁷"Video Producers Debate the Value of Price Cuts," *New York Times*, February 19, 1985. For a study of videocassette pricing, see Carl E. Enomoto and Soumendra N. Ghosh, "Pricing in the Home-Video Market" (working paper, New Mexico State University, 1992).



supermarket chain) face demand curves that are more elastic than those faced by others (e.g., a producer of designer clothing)?

Three factors determine a firm's elasticity of demand.

1. *The elasticity of market demand.* Because the firm's own demand will be at least as elastic as market demand, the elasticity of market demand limits the potential for monopoly power.
2. *The number of firms in the market.* If there are many firms, it is unlikely that any one firm will be able to affect price significantly.
3. *The interaction among firms.* Even if only two or three firms are in the market, each firm will be unable to profitably raise price very much if the rivalry among them is aggressive, with each firm trying to capture as much of the market as it can.

Let's examine each of these three determinants of monopoly power.

The Elasticity of Market Demand

If there is only one firm—a pure monopolist—its demand curve is the market demand curve. In this case, the firm's degree of monopoly power depends completely on the elasticity of market demand. More often, however, several firms compete with one another; then the elasticity of market demand sets a lower limit on the magnitude of the elasticity of demand for each firm. Recall our example of the toothbrush producers illustrated in Figure 10.7 (page 361). The market demand for toothbrushes might not be very elastic, but each firm's demand will be more elastic. (In Figure 10.7, the elasticity of market demand is -1.5 , and the elasticity of demand for each firm is -6 .) A particular firm's elasticity depends on how the firms compete with one another. But no matter how they compete, the elasticity of demand for each firm could never become smaller in magnitude than -1.5 .

Because the demand for oil is fairly inelastic (at least in the short run), OPEC could raise oil prices far above marginal production cost during the 1970s and early 1980s. Because the demands for such commodities as coffee, cocoa, tin, and copper are much more elastic, attempts by producers to cartelize these markets and raise prices have largely failed. In each case, the elasticity of market demand limits the potential monopoly power of individual producers.

The Number of Firms

The second determinant of a firm's demand curve—and thus of its monopoly power—is the number of firms in its market. Other things being equal, the monopoly power of each firm will fall as the number of firms increases: As more and more firms compete, each firm will find it harder to raise prices and avoid losing sales to other firms.

What matters, of course, is not just the total number of firms, but the number of "major players"—firms with significant market share. For example, if only two large firms account for 90 percent of sales in a market, with another 20 firms accounting for the remaining 10 percent, the two large firms might have considerable monopoly power. When only a few firms account for most of the sales in a market, we say that the market is highly *concentrated*.⁸

⁸A statistic called the *concentration ratio*, which measures the percentage of sales accounted for by, say, the four largest firms, is often used to describe the concentration of a market. Concentration is one, but not the only, determinant of market power.



■ **barrier to entry** Condition that impedes entry by new competitors.

In §7.4, we explain that a firm enjoys economies of scale when it can double its output with less than a doubling of cost.

It is sometimes said (not always jokingly) that the greatest fear of American business is competition. That may or may not be true. But we would certainly expect that when only a few firms are in a market, their managers will prefer that no new firms enter. An increase in the number of firms can only reduce the monopoly power of each incumbent firm. An important aspect of competitive strategy (discussed in detail in Chapter 13) is finding ways to create **barriers to entry**—conditions that deter entry by new competitors.

Sometimes there are natural barriers to entry. For example, one firm may have a *patent* on the technology needed to produce a particular product. This makes it impossible for other firms to enter the market, at least until the patent expires. Other legally created rights work in the same way—a *copyright* can limit the sale of a book, music, or a computer software program to a single company, and the need for a government *license* can prevent new firms from entering the markets for telephone service, television broadcasting, or interstate trucking. Finally, *economies of scale* may make it too costly for more than a few firms to supply the entire market. In some cases, economies of scale may be so large that it is most efficient for a single firm—a *natural monopoly*—to supply the entire market. We will discuss scale economies and natural monopoly in more detail shortly.

The Interaction Among Firms

The ways in which competing firms interact is also an important—and sometimes the most important—determinant of monopoly power. Suppose there are four firms in a market. They might compete aggressively, undercutting one another's prices to capture more market share. This could drive prices down to nearly competitive levels. Each firm will fear that if it raises its price it will be undercut and lose market share. As a result, it will have little monopoly power.

On the other hand, the firms might not compete much. They might even collude (in violation of the antitrust laws), agreeing to limit output and raise prices. Because raising prices in concert rather than individually is more likely to be profitable, collusion can generate substantial monopoly power.

We will discuss the interaction among firms in detail in Chapters 12 and 13. Now we simply want to point out that, other things being equal, monopoly power is smaller when firms compete aggressively and is larger when they cooperate.

Remember that a firm's monopoly power often changes over time, as its operating conditions (market demand and cost), its behavior, and the behavior of its competitors change. Monopoly power must therefore be thought of in a dynamic context. For example, the market demand curve might be very inelastic in the short run but much more elastic in the long run. (Because this is the case with oil, the OPEC cartel enjoyed considerable short-run but much less long-run monopoly power.) Furthermore, real or potential monopoly power in the short run can make an industry more competitive in the long run: Large short-run profits can induce new firms to enter an industry, thereby reducing monopoly power over the longer term.

10.4 THE SOCIAL COSTS OF MONOPOLY POWER

In a competitive market, price equals marginal cost. Monopoly power, on the other hand, implies that price exceeds marginal cost. Because monopoly power results in higher prices and lower quantities produced, we would expect it to make consumers worse off and the firm better off. But suppose we value the



welfare of consumers the same as that of producers. In the aggregate, does monopoly power make consumers and producers better or worse off?

We can answer this question by comparing the consumer and producer surplus that results when a competitive industry produces a good with the surplus that results when a monopolist supplies the entire market.⁹ (We assume that the competitive market and the monopolist have the same cost curves.) Figure 10.10 shows the average and marginal revenue curves and marginal cost curve for the monopolist. To maximize profit, the firm produces at the point where marginal revenue equals marginal cost, so that the price and quantity are P_m and Q_m . In a competitive market, price must equal marginal cost, so the competitive price and quantity, P_c and Q_c are found at the intersection of the average revenue (demand) curve and the marginal cost curve. Now let's examine how surplus changes if we move from the competitive price and quantity, P_c and Q_c to the monopoly price and quantity, P_m and Q_m .

Under monopoly, the price is higher and consumers buy less. Because of the higher price, those consumers who buy the good lose surplus of an amount given by rectangle *A*. Those consumers who do not buy the good at price P_m but who would buy at price P_c also lose surplus—namely, an amount given by triangle *B*. The total loss of consumer surplus is therefore $A + B$. The producer, however, gains rectangle *A* by selling at the higher price but loses triangle *C*, the additional profit it would have earned by selling $Q_c - Q_m$ at price P_c . The total gain in producer surplus is therefore $A - C$. Subtracting the loss of consumer surplus from the gain in producer surplus, we see a net loss of surplus given by

In §9.1, we explain that consumer surplus is the total benefit or value that consumers receive beyond what they pay for a good; producer surplus is the analogous measure for producers.

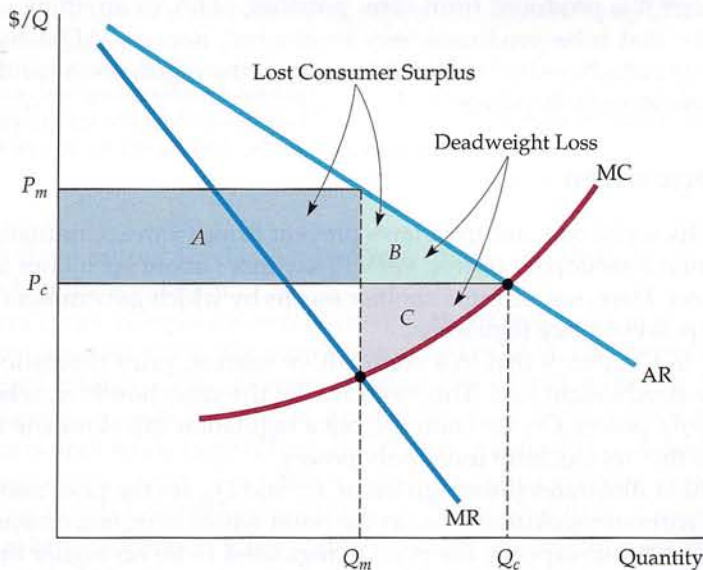


FIGURE 10.10 Deadweight Loss from Monopoly Power

The shaded rectangle and triangles show changes in consumer and producer surplus when moving from competitive price and quantity, P_c and Q_c , to a monopolist's price and quantity, P_m and Q_m . Because of the higher price, consumers lose $A + B$ and producer gains $A - C$. The deadweight loss is $B + C$.

⁹If there were two or more firms, each with some monopoly power, the analysis would be more complex. However, the basic results would be the same.



$B + C$. This is the *deadweight loss from monopoly power*. Even if the monopolist's profits were taxed away and redistributed to the consumers of its products, there would be an inefficiency because output would be lower than under conditions of competition. The deadweight loss is the social cost of this inefficiency.

Rent Seeking

• **rent seeking** Spending money in socially unproductive efforts to acquire, maintain, or exercise monopoly.

In practice, the social cost of monopoly power is likely to exceed the deadweight loss in triangles B and C of Figure 10.10. The reason is that the firm may engage in **rent seeking**: spending large amounts of money in socially unproductive efforts to acquire, maintain, or exercise its monopoly power. Rent seeking might involve lobbying activities (and perhaps campaign contributions) to obtain government regulations that make entry by potential competitors more difficult. Rent-seeking activity could also involve advertising and legal efforts to avoid antitrust scrutiny. It might also mean installing but not utilizing extra production capacity to convince potential competitors that they cannot sell enough to make entry worthwhile. We would expect the economic incentive to incur rent-seeking costs to bear a direct relation to the gains from monopoly power (i.e., rectangle A minus triangle C .) Therefore, the larger the transfer from consumers to the firm (rectangle A), the larger the social cost of monopoly.¹⁰

Here's an example. In 1996, the Archer Daniels Midland Company (ADM) successfully lobbied the Clinton administration for regulations requiring that the ethanol (ethyl alcohol) used in motor vehicle fuel be produced from corn. (The government had already planned to add ethanol to gasoline in order to reduce the country's dependence on imported oil.) Ethanol is chemically the same whether it is produced from corn, potatoes, grain, or anything else. Then why require that it be produced only from corn? Because ADM had a near monopoly on corn-based ethanol production, so the regulation would increase its gains from monopoly power.

Price Regulation

Because of its social cost, antitrust laws prevent firms from accumulating excessive amounts of monopoly power. We will say more about such laws at the end of the chapter. Here, we examine another means by which government can limit monopoly power—price regulation.

We saw in Chapter 9 that in a competitive market, price regulation always results in a deadweight loss. This need not be the case, however, when a firm has monopoly power. On the contrary, price regulation can eliminate the deadweight loss that results from monopoly power.

Figure 10.11 illustrates price regulation. P_m and Q_m are the price and quantity that result without regulation—i.e., at the point where marginal revenue equals marginal cost. Now suppose the price is regulated to be no higher than P_1 . To find the firm's profit-maximizing output, we must determine how its average and marginal revenue curves are affected by the regulation.

Because the firm can charge no more than P_1 for output levels up to Q_1 , its new average revenue curve is a horizontal line at P_1 . For output levels greater than Q_1 , the new average revenue curve is identical to the old average revenue

¹⁰The concept of rent seeking was first developed by Gordon Tullock. For more detailed discussions, see Gordon Tullock, *Rent Seeking* (Brookfield, VT: Edward Elgar, 1993), or Robert D. Tollison and Roger D. Congleton, *The Economic Analysis of Rent Seeking* (Brookfield, VT: Edward Elgar, 1995).

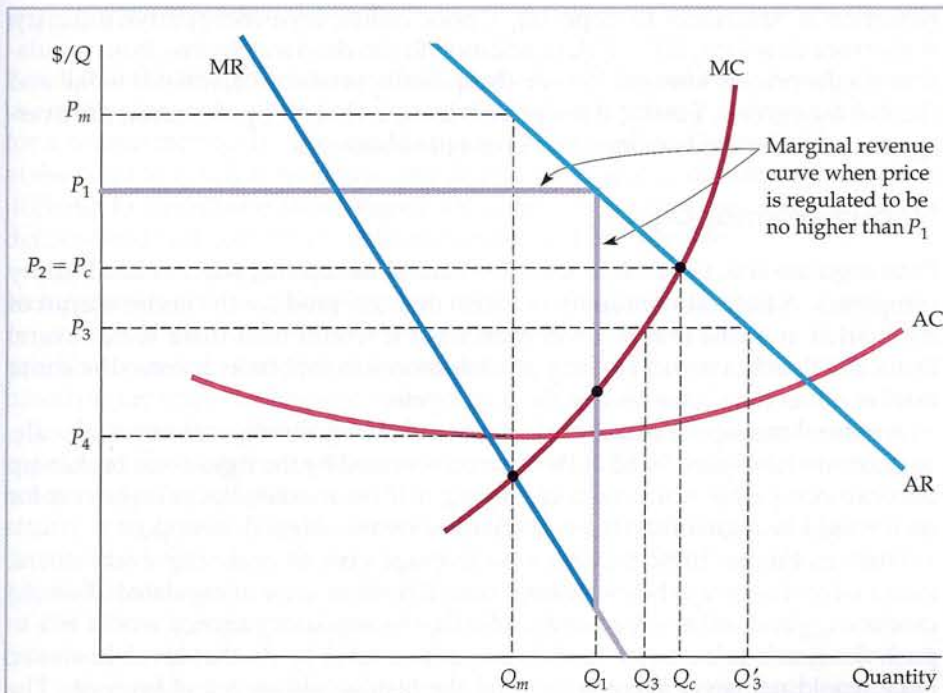


FIGURE 10.11 Price Regulation

If left alone, a monopolist produces Q_m and charges P_m . When the government imposes a price ceiling of P_1 the firm's average and marginal revenue are constant and equal to P_1 for output levels up to Q_1 . For larger output levels, the original average and marginal revenue curves apply. The new marginal revenue curve is, therefore, the dark purple line, which intersects the marginal cost curve at Q_1 . When price is lowered to P_c , at the point where marginal cost intersects average revenue, output increases to its maximum Q_c . This is the output that would be produced by a competitive industry. Lowering price further, to P_3 reduces output to Q_3 and causes a shortage, $Q'_3 - Q_3$.

curve: At these output levels, the firm will charge less than P_1 and so will be unaffected by the regulation.

The firm's new marginal revenue curve corresponds to its new average revenue curve and is shown by the purple line in Figure 10.11. For output levels up to Q_1 , marginal revenue equals average revenue. (Recall that, as with a competitive firm, if average revenue is constant, average revenue and marginal revenue are equal.) For output levels greater than Q_1 , the new marginal revenue curve is identical to the original curve. Thus the complete marginal revenue curve now has three pieces: (1) the horizontal line at P_1 for quantities up to Q_1 ; (2) a vertical line at the quantity Q_1 connecting the original average and marginal revenue curves; and (3) the original marginal revenue curve for quantities greater than Q_1 .

To maximize its profit, the firm should produce the quantity Q_1 because that is the point at which its marginal revenue curve intersects its marginal cost curve. You can verify that at price P_1 and quantity Q_1 , the deadweight loss from monopoly power is reduced.

As the price is lowered further, the quantity produced continues to increase and the deadweight loss to decline. At price P_c where average revenue and marginal cost intersect, the quantity produced has increased to the competitive level; the deadweight loss from monopoly power has been eliminated. Reducing the price even more—say, to P_3 —results in a *reduction* in quantity. This



reduction is equivalent to imposing a price ceiling on a competitive industry. A shortage develops, $(Q'_3 - Q_3)$, in addition to the deadweight loss from regulation. As the price is lowered further, the quantity produced continues to fall and the shortage grows. Finally, if the price is lowered below P_4 , the minimum average cost, the firm loses money and goes out of business.

Natural Monopoly

• **natural monopoly** Firm that can produce the entire output of the market at a cost lower than what it would be if there were several firms.

Price regulation is most often used for *natural monopolies*, such as local utility companies. A **natural monopoly** is a firm that can produce the entire output of the market at a cost that is lower than what it would be if there were several firms. If a firm is a natural monopoly, it is more efficient to let it serve the entire market rather than have several firms compete.

A natural monopoly usually arises when there are strong economies of scale, as illustrated in Figure 10.12. If the firm represented by the figure was broken up into two competing firms, each supplying half the market, the average cost for each would be higher than the cost incurred by the original monopoly.

Note in Figure 10.12 that because average cost is declining everywhere, marginal cost is always below average cost. If the firm were unregulated, it would produce Q_m and sell at the price P_m . Ideally, the regulatory agency would like to push the firm's price down to the competitive level P_c . At that level, however, price would not cover average cost and the firm would go out of business. The best alternative is therefore to set the price at P_r , where average cost and average revenue intersect. In that case, the firm earns no monopoly profit, while output remains as large as possible without driving the firm out of business.

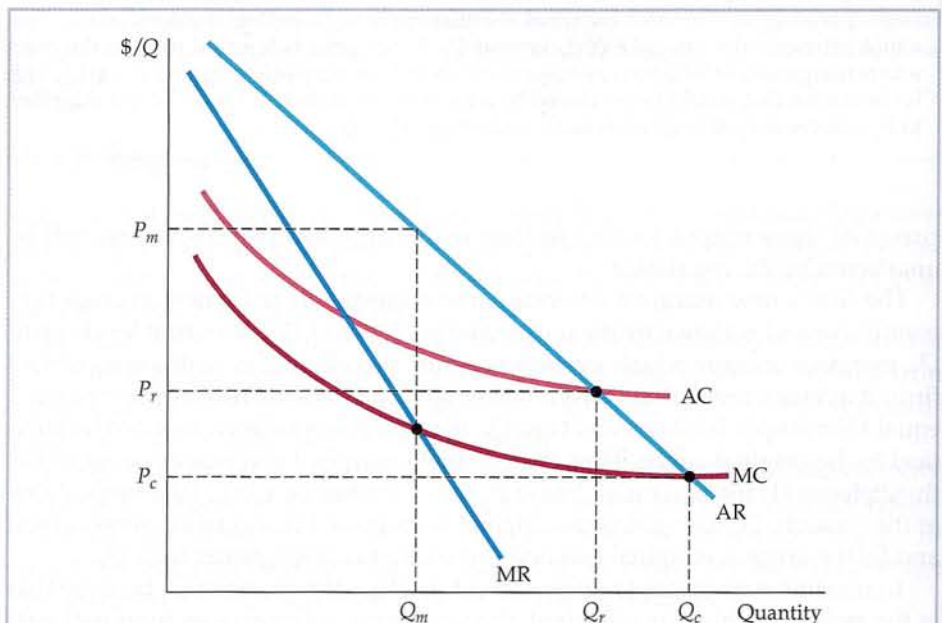


FIGURE 10.12 Regulating the Price of a Natural Monopoly

A firm is a natural monopoly because it has economies of scale (declining average and marginal costs) over its entire output range. If price were regulated to be P_c the firm would lose money and go out of business. Setting the price at P_r yields the largest possible output consistent with the firm's remaining in business; excess profit is zero.



Regulation in Practice

Recall that the competitive price (P_c in Figure 10.11) is found at the point at which the firm's marginal cost and average revenue (demand) curves intersect. Likewise for a natural monopoly: The minimum feasible price (P_r in Figure 10.12) is found at the point at which average cost and demand intersect. Unfortunately, it is often difficult to determine these prices accurately in practice because the firm's demand and cost curves may shift as market conditions evolve.

As a result, the regulation of a monopoly is sometimes based on the rate of return that it earns on its capital. The regulatory agency determines an allowed price, so that this rate of return is in some sense "competitive" or "fair." This practice is called **rate-of-return regulation**: The maximum price allowed is based on the (expected) rate of return that the firm will earn.¹¹

Unfortunately, difficult problems arise when implementing rate-of-return regulation. First, although it is a key element in determining the firm's rate of return, a firm's capital stock is difficult to value. Second, while a "fair" rate of return must be based on the firm's actual cost of capital, that cost depends in turn on the behavior of the regulatory agency (and on investors' perceptions of what allowed rates of return will be in the future).

The difficulty of agreeing on a set of numbers to be used in rate-of-return calculations often leads to delays in the regulatory response to changes in cost and other market conditions (not to mention long and expensive regulatory hearings). The major beneficiaries are usually lawyers, accountants, and, occasionally, economic consultants. The net result is *regulatory lag*—the delays of a year or more usually entailed in changing regulated prices.

Another approach to regulation is setting price caps based on the firm's variable costs, past prices, and possibly inflation and productivity growth. A price cap can allow for more flexibility than rate-of-return regulation. Under price cap regulation, for example, a firm would typically be allowed to raise its prices each year (without having to get approval from the regulatory agency) by an amount equal to the actual rate of inflation, minus expected productivity growth. Price cap regulation of this sort has been used to control prices of long distance and local telephone service.

By the 1990s, the regulatory environment in the United States had changed dramatically. Many parts of the telecommunications industry had been deregulated, as had electric utilities in many states. Because scale economies had been largely exhausted, there was no reason to regard these firms as natural monopolies. In addition, technological change made entry by new firms relatively easy.

• rate-of-return regulation

Maximum price allowed by a regulatory agency is based on the (expected) rate of return that a firm will earn.

10.5 MONOPSONY

So far, our discussion of market power has focused entirely on the seller side of the market. Now we turn to the *buyer* side. We will see that if there are not too many buyers, they can also have market power and use it profitably to affect the price they pay for a product.

¹¹Regulatory agencies often use a formula like the following to determine price:

$$P = AVC + (D + T + sK)/Q$$

where AVC is average variable cost, Q is output, s is the allowed "fair" rate of return, D is depreciation, T is taxes, and K is the firm's current capital stock.



• **oligopsony** Market with only a few buyers.

• **monopsony power** Buyer's ability to affect the price of a good.

• **marginal value** Additional benefit derived from purchasing one more unit of a good.

In §4.1, we explain that as we move down along a demand curve, the value the consumer places on an additional unit of the good falls.

• **marginal expenditure** Additional cost of buying one more unit of a good.

• **average expenditure** Price paid per unit of a good.

First, a few terms.

- **Monopsony** refers to a market in which there is a single buyer.
- An **oligopsony** is a market with only a few buyers.
- With one or only a few buyers, some buyers may have **monopsony power**: a buyer's ability to affect the price of a good. Monopsony power enables the buyer to purchase a good for less than the price that would prevail in a competitive market.

Suppose you are trying to decide how much of a good to purchase. You could apply the basic marginal principle—keep purchasing units of the good until the last unit purchased gives additional value, or utility, just equal to the cost of that last unit. In other words, on the margin, additional benefit should just be offset by additional cost.

Let's look at this additional benefit and additional cost in more detail. We use the term **marginal value** to refer to the additional benefit from purchasing one more unit of a good. How do we determine marginal value? Recall from Chapter 4 that an individual demand curve determines marginal value, or marginal utility, as a function of the quantity purchased. Therefore, your *marginal value schedule* is your *demand curve* for the good. An individual's demand curve slopes downward because the marginal value obtained from buying one more unit of a good declines as the total quantity purchased increases.

The additional cost of buying one more unit of a good is called the **marginal expenditure**. What that marginal expenditure is depends on whether you are a competitive buyer or a buyer with monopsony power. Suppose you are a competitive buyer—in other words, you have no influence over the price of the good. In that case, the cost of each unit you buy is the same no matter how many units you purchase; it is the market price of the good. Figure 10.13(a) illustrates this principle. The price you pay per unit is your **average expenditure** per unit, and it is the same for all units. But what is your *marginal expenditure* per unit? As a competitive buyer, your marginal expenditure is equal to your average expenditure, which in turn is equal to the market price of the good.

Figure 10.13(a) also shows your marginal value schedule (i.e., your demand curve). How much of the good should you buy? You should buy until the marginal value of the last unit is just equal to the marginal expenditure on that unit. Thus you should purchase quantity Q^* at the intersection of the marginal expenditure and demand curves.

We introduced the concepts of marginal and average expenditure because they will make it easier to understand what happens when buyers have monopsony power. But before considering that situation, let's look at the analogy between competitive buyer conditions and competitive seller conditions. Figure 10.13(b) shows how a perfectly competitive seller decides how much to produce and sell. Because the seller takes the market price as given, both average and marginal revenue are equal to the price. The profit-maximizing quantity is at the intersection of the marginal revenue and marginal cost curves.

Now suppose that you are the *only* buyer of the good. Again you face a market supply curve, which tells you how much producers are willing to sell as a function of the price you pay. Should the quantity you purchase be at the point where your marginal value curve intersects the market supply curve? No. If you want to maximize your net benefit from purchasing the good, you should purchase a smaller quantity, which you will obtain at a lower price.

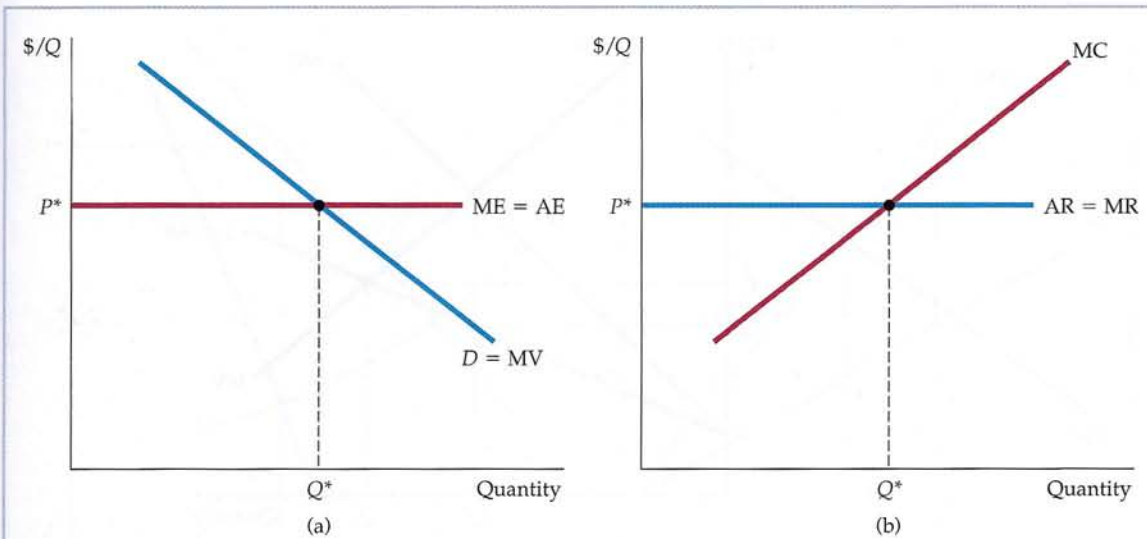


FIGURE 10.13 Competitive Buyer Compared to Competitive Seller

In (a), the competitive buyer takes market price P^* as given. Therefore, marginal expenditure and average expenditure are constant and equal; quantity purchased is found by equating price to marginal value (demand). In (b), the competitive seller also takes price as given. Marginal revenue and average revenue are constant and equal; quantity sold is found by equating price to marginal cost.

To determine how much to buy, set the marginal value from the last unit purchased equal to the marginal expenditure on that unit.¹² Note, however, that the market supply curve is not the marginal expenditure curve. The market supply curve shows how much you must pay *per unit*, as a function of the total number of units you buy. In other words, the supply curve is the *average expenditure* curve. And because this average expenditure curve is upward sloping, the marginal expenditure curve must lie above it. The decision to buy an extra unit raises the price that must be paid for *all* units, not just the extra one.¹³

Figure 10.14 illustrates this principle. The optimal quantity for the monopsonist to buy, Q_m^* , is found at the intersection of the demand and marginal expenditure curves. The price that the monopsonist pays is found from the supply curve: It is the price P_m^* that brings forth the supply Q_m^* . Finally, note that this quantity Q_m^* is less, and the price P_m^* is lower, than the quantity and price that would prevail in a competitive market, Q_c and P_c .

¹²Mathematically, we can write the net benefit NB from the purchase as $NB = V - E$, where V is the value to the buyer of the purchase and E is the expenditure. Net benefit is maximized when $\Delta NB / \Delta Q = 0$. Then

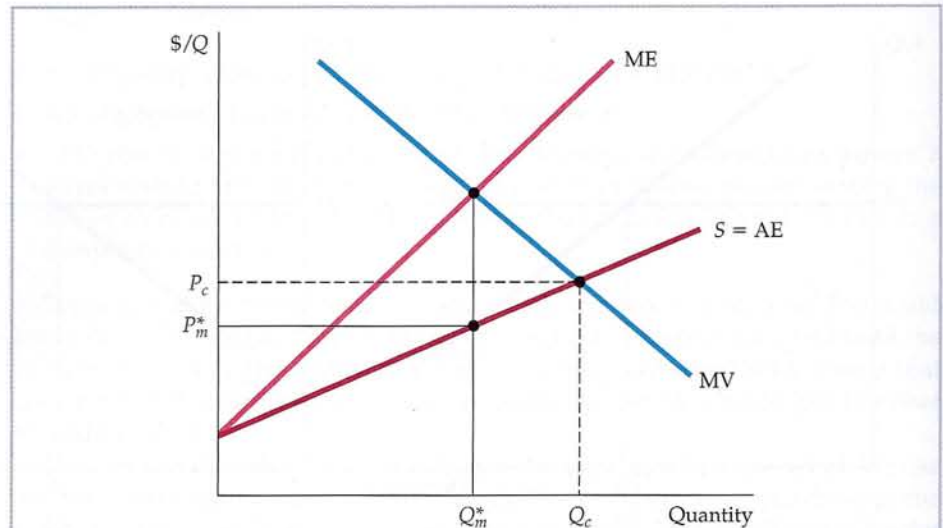
$$\Delta NB / \Delta Q = \Delta V / \Delta Q - \Delta E / \Delta Q = MV - ME = 0$$

so that $MV = ME$.

¹³To obtain the marginal expenditure curve algebraically, write the supply curve with price on the left-hand side: $P = P(Q)$. Then total expenditure E is price times quantity, or $E = P(Q)Q$, and marginal expenditure is

$$ME = \Delta E / \Delta Q = P(Q) + Q(\Delta P / \Delta Q)$$

Because the supply curve is upward sloping, $\Delta P / \Delta Q$ is positive, and marginal expenditure is greater than average expenditure.

**FIGURE 10.14 Monopsonist Buyer**

The market supply curve is monopsonist's average expenditure curve AE. Because average expenditure is rising, marginal expenditure lies above it. The monopsonist purchases quantity Q_m^* , where marginal expenditure and marginal value (demand) intersect. The price paid per unit P_m^* is then found from the average expenditure (supply) curve. In a competitive market, price and quantity, P_c and Q_c , are both higher. They are found at the point where average expenditure (supply) and marginal value (demand) intersect.

Monopsony and Monopoly Compared

Monopsony is easier to understand if you compare it with monopoly. Figures 10.15(a) and 10.15(b) illustrate this comparison. Recall that a monopolist can charge a price above marginal cost because it faces a downward-sloping demand, or average revenue curve, so that marginal revenue is less than average revenue. Equating marginal cost with marginal revenue leads to a quantity Q^* that is less than what would be produced in a competitive market, and to a price P^* that is higher than the competitive price P_c .

The monopsony situation is exactly analogous. As Figure 10.15(b) illustrates, the monopsonist can purchase a good at a price below its marginal value because it faces an upward-sloping supply, or average expenditure, curve. Thus for a monopsonist, marginal expenditure is greater than average expenditure. Equating marginal value with marginal expenditure leads to a quantity Q^* that is less than what would be bought in a competitive market, and to a price P^* that is lower than the competitive price P_c .

10.6 MONOPSONY POWER

Much more common than pure monopsony are markets with only a few firms competing among themselves as buyers, so that each firm has some monopsony power. For example, the major U.S. automobile manufacturers compete with one another as buyers of tires. Because each of them accounts for a large share of the tire market, each has some monopsony power in that market. General

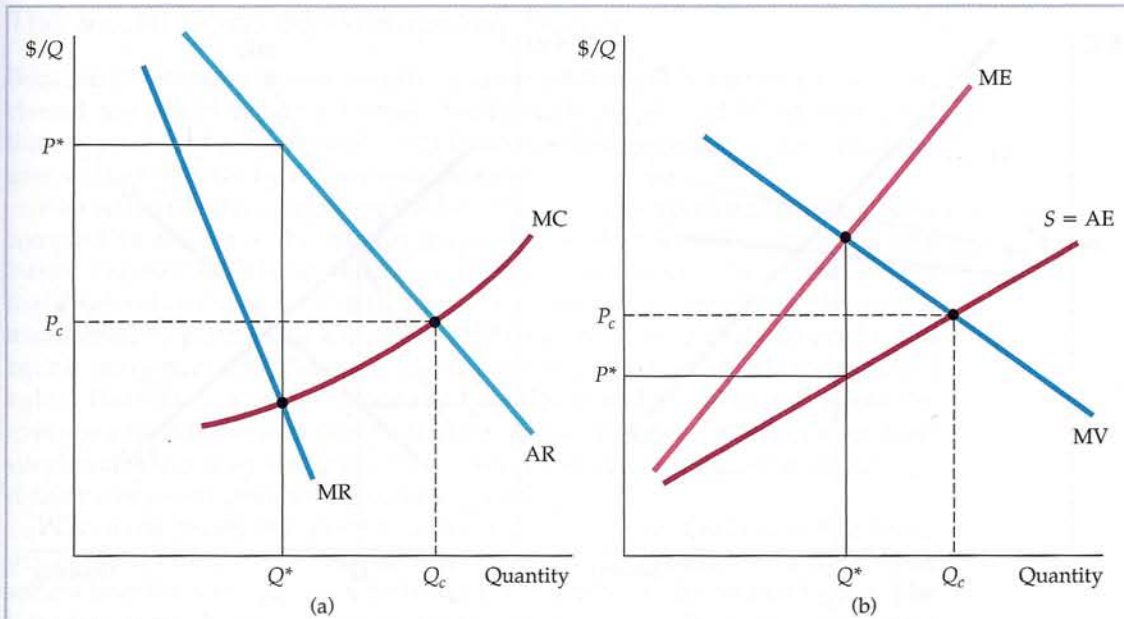


FIGURE 10.15 Monopoly and Monopsony

These diagrams show the close analogy between monopoly and monopsony. **(a)** The monopolist produces where marginal revenue intersects marginal cost. Average revenue exceeds marginal revenue, so that price exceeds marginal cost. **(b)** The monopsonist purchases up to the point where marginal expenditure intersects price value. Marginal expenditure exceeds average expenditure, so that marginal value exceeds price.

Motors, the largest, might be able to exert considerable monopsony power when contracting for supplies of tires (and other automotive parts).

In a competitive market, price and marginal value are equal. A buyer with monopsony power, however, can purchase a good at a price below marginal value. The extent to which price is marked down below marginal value depends on the elasticity of supply facing the buyer.¹⁴ If supply is very elastic (E_s is large), the markdown will be small and the buyer will have little monopsony power. Conversely, if supply is very inelastic, the markdown will be large and the buyer will have considerable monopsony power. Figures 10.16(a) and 10.16(b) illustrate these two cases.

Sources of Monopsony Power

What determines the degree of monopsony power in a market? Again, we can draw analogies with monopoly and monopoly power. We saw that monopoly power depends on three things: the elasticity of market demand, the number of sellers in the market, and the way those sellers interact. Monopsony power depends on three similar things: The elasticity of market supply, the number of buyers in the market, and the way those buyers interact.

Elasticity of Market Supply A monopsonist benefits because it faces an upward-sloping supply curve, so that marginal expenditure exceeds average

¹⁴The exact relationship (analogous to equation (10.1)) is given by $(MV - P)/P = 1/E_s$. This equation follows because $MV = ME$ and $ME = \Delta(PQ)/\Delta Q = P + Q(\Delta P/\Delta Q)$.

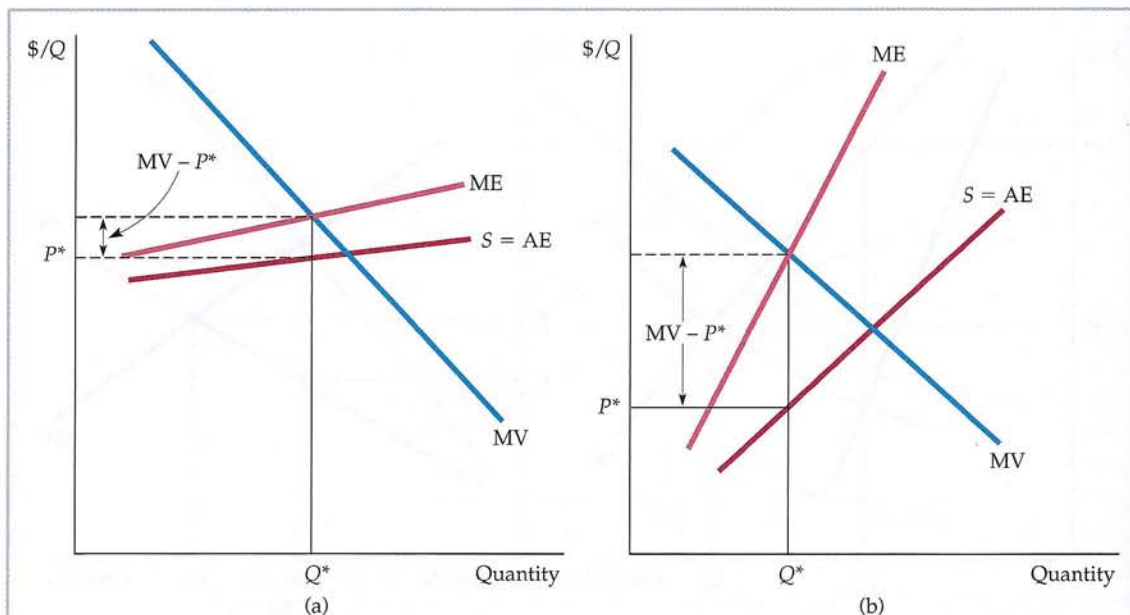


FIGURE 10.16 Monopsony Power: Elastic versus Inelastic Supply

Monopsony power depends on the elasticity of supply. When supply is elastic, as in (a), marginal expenditure and average expenditure do not differ by much, so price is close to what it would be in a competitive market. The opposite is true when supply is inelastic, as in (b).

expenditure. The less elastic the supply curve, the greater the difference between marginal expenditure and average expenditure and the more monopsony power the buyer enjoys. If only one buyer is in the market—a pure monopsonist—its monopsony power is completely determined by the elasticity of market supply. If supply is highly elastic, monopsony power is small and there is little gain in being the only buyer.

Number of Buyers Most markets have more than one buyer, and the number of buyers is an important determinant of monopsony power. When the number of buyers is very large, no single buyer can have much influence over price. Thus each buyer faces an extremely elastic supply curve, so that the market is almost completely competitive. The potential for monopsony power arises when the number of buyers is limited.

Interaction Among Buyers Finally, suppose three or four buyers are in the market. If those buyers compete aggressively, they will bid up the price close to their marginal value of the product, and will thus have little monopsony power. On the other hand, if those buyers compete less aggressively, or even collude, prices will not be bid up very much, and the buyers' degree of monopsony power might be nearly as high as if there were only one buyer.

So, as with monopoly power, there is no simple way to predict how much monopsony power buyers will have in a market. We can count the number of buyers, and we can often estimate the elasticity of supply, but that is not enough. Monopsony power also depends on the interaction among buyers, which can be more difficult to ascertain.



The Social Costs of Monopsony Power

Because monopsony power results in lower prices and lower quantities purchased, we would expect it to make the buyer better off and sellers worse off. But suppose we value the welfare of buyers and sellers equally. How is aggregate welfare affected by monopsony power?

We can find out by comparing the buyer and seller surplus that results from a competitive market to the surplus that results when a monopsonist is the sole buyer. Figure 10.17 shows the average and marginal expenditure curves and marginal value curve for the monopsonist. The monopsonist's net benefit is maximized by purchasing a quantity Q_m at a price P_m such that marginal value equals marginal expenditure. In a competitive market, price equals marginal value. Thus the competitive price and quantity, P_c and Q_c , are found where the average expenditure and marginal value curves intersect. Now let's see how surplus changes if we move from the competitive price and quantity, P_c and Q_c , to the monopsony price and quantity, P_m and Q_m .

With monopsony, the price is lower and less is sold. Because of the lower price, sellers lose an amount of surplus given by rectangle A . In addition, sellers lose the surplus given by triangle C because of the reduced sales. The total loss of producer (seller) surplus is therefore $A + C$. By buying at a lower price, the buyer gains the surplus given by rectangle A . However, the buyer buys less, Q_m instead of Q_c , and so loses the surplus given by triangle B . The total gain in surplus to the buyer is therefore $A - B$. Altogether, there is a net loss of surplus given by $B + C$. This is the *deadweight loss from monopsony power*. Even if the monopsonist's gains were taxed away and redistributed to the producers, there would be an inefficiency because output would be lower than under competition. The deadweight loss is the social cost of this inefficiency.

Note the similarity with the deadweight loss from monopoly power discussed in §10.4.

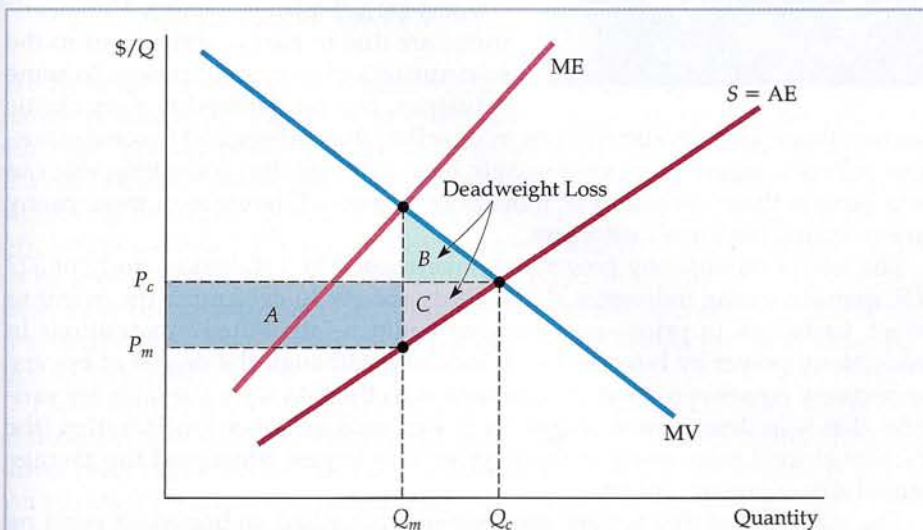


FIGURE 10.17 Deadweight Loss from Monopsony Power

The shaded rectangle and triangles show changes in buyer and seller surplus when moving from competitive price and quantity, P_c and Q_c , to the monopsonist's price and quantity, P_m and Q_m . Because both price and quantity are lower, there is an increase in buyer (consumer) surplus given by $A - B$. Producer surplus falls by $A + C$, so there is a deadweight loss given by triangles B and C .



- **bilateral monopoly**

Market with only one seller and one buyer.

Bilateral Monopoly

What happens when a monopolist meets a monopsonist? It's hard to say. We call a market with only one seller and only one buyer a **bilateral monopoly**. If you think about such a market, you'll see why it is difficult to predict the price and quantity. Both the buyer and the seller are in a bargaining situation. Unfortunately, no simple rule determines which, if either, will get the better part of the bargain. One party might have more time and patience, or might be able to convince the other party that it will walk away if the price is too low or too high.

Bilateral monopoly is rare. Markets in which a few producers have some monopoly power and sell to a few buyers who have some monopsony power are more common. Although bargaining may still be involved, we can apply a rough principle here: *Monopsony power and monopoly power will tend to counteract each other.* In other words, the monopsony power of buyers will reduce the effective monopoly power of sellers, and vice versa. This tendency does not mean that the market will end up looking perfectly competitive; if, for example, monopoly power is large and monopsony power small, the residual monopoly power would still be significant. But in general, monopsony power will push price closer to marginal cost, and monopoly power will push price closer to marginal value.

EXAMPLE 10.4

Monopsony Power in U.S. Manufacturing



Monopoly power, as measured by the price-cost margin $(P - MC)/P$, varies considerably across manufacturing industries in the United States. Some industries have price-cost margins close to zero, while in others margins are as high as 0.4 or 0.5. These variations are due in part to differences in the determinants of monopoly power: In some industries, market demand is more elastic

than in others; some industries have more sellers than others; and in some industries, sellers compete more aggressively than in others. But something else can help explain these variations in monopoly power—differences in monopsony power among the firms' customers.

The role of monopsony power was investigated in a statistical study of 327 U.S. manufacturing industries.¹⁵ The study sought to determine the extent to which variations in price—cost margins could be attributed to variations in monopsony power by buyers in each industry. Although the degree of buyers' monopsony power could not be measured directly, data were available for variables that help determine monopsony power, such as buyer concentration (the fraction of total sales going to the three or four largest firms) and the average annual size of buyers' orders.

The study found that buyers' monopsony power had an important effect on the price—cost margins of sellers and could significantly reduce any monopoly power that sellers might otherwise have. Take, for example, the concentration of buyers, an important determinant of monopsony power. In industries where

¹⁵The study was by Steven H. Lustgarten, "The Impact of Buyer Concentration in Manufacturing Industries," *Review of Economics and Statistics* 57 (May 1975): 125–32.



only four or five buyers account for all or nearly all sales, the price-cost margins of sellers would on average be as much as 10 percentage points lower than in comparable industries with hundreds of buyers accounting for sales.

A good example of monopsony power in manufacturing is the market for automobile parts and components, such as brakes and radiators. Each major car producer in the United States typically buys an individual part from at least three, and often as many as a dozen, suppliers. In addition, for a standardized product, such as brakes, each automobile company usually produces part of its needs itself, so that it is not totally reliant on outside firms. This puts companies like General Motors and Ford in an excellent bargaining position with respect to their suppliers. Each supplier must compete for sales against five or 10 other suppliers, but each can sell to only a few buyers. For a specialized part, a single auto company may be the *only* buyer. As a result, the automobile companies have considerable monopsony power.

This monopsony power becomes evident from the conditions under which suppliers must operate. To obtain a sales contract, a supplier must have a track record of reliability, in terms of both product quality and ability to meet tight delivery schedules. Suppliers are also often required to respond to changes in volume as auto sales and production levels fluctuate. Finally, pricing negotiations are notoriously difficult; a potential supplier will sometimes lose a contract because its bid is a penny per item higher than those of its competitors. Not surprisingly, producers of parts and components usually have little or no monopoly power.

10.7 LIMITING MARKET POWER: THE ANTITRUST LAWS

We have seen that market power—whether wielded by sellers or buyers—harms potential purchasers who could have bought at competitive prices. In addition, market power reduces output, which leads to a deadweight loss. Excessive market power also raises problems of equity and fairness: If a firm has significant monopoly power, it will profit at the expense of consumers. In theory, a firm's excess profits could be taxed away and redistributed to the buyers of its products, but such a redistribution is often impractical. It is difficult to determine what portion of a firm's profit is attributable to monopoly power, and it is even more difficult to locate all the buyers and reimburse them in proportion to their purchases.

How, then, can society limit market power and prevent it from being used anticompetitively? For a natural monopoly, such as an electric utility company, direct price regulation is the answer. But more generally, the answer is to prevent firms from acquiring excessive market power in the first place, and to limit the use of that power if it is acquired. In the United States, this is done via the **antitrust laws**: a set of rules and regulations designed to promote a competitive economy by prohibiting actions that restrain, or are likely to restrain, competition, and by restricting the forms of allowable market structure.

Monopoly power can arise in a number of ways, each of which is covered by the antitrust laws. Section 1 of the Sherman Act (which was passed in 1890) prohibits contracts, combinations, or conspiracies in restraint of trade. One obvious example of an illegal combination is an explicit agreement among producers

• **antitrust laws** Rules and regulations prohibiting actions that restrain, or are likely to restrain, competition.



to restrict their outputs and/or “fix” price above the competitive level. There have been numerous instances of such illegal combinations. For example:

- In 1996, Archer Daniels Midland Company (ADM) and two other major producers of lysine (an animal feed additive) pleaded guilty to criminal charges of price fixing. In 1999, three ADM executives were sentenced to prison terms ranging from two to three years for their roles in the price-fixing scheme.¹⁶
- In 1999, four of the world’s largest drug and chemical companies—Roche A.G. of Switzerland, BASF A.G. of Germany, Rhone-Poulenc of France, and Takeda Chemical Industries of Japan—were charged by the U.S. Department of Justice with taking part in a global conspiracy to fix the prices of vitamins sold in the United States. The companies pleaded guilty to price fixing and agreed to pay fines totaling more than \$1 billion.¹⁷
- In 2002, the U.S. Department of Justice began an investigation of price fixing by DRAM (dynamic access random memory) producers. By 2006, five manufacturers—Hynix, Infineon, Micron Technology, Samsung, and Elpida—had pled guilty for participating in an international price-fixing scheme. As part of these pleas, the companies agreed to pay fines totaling close to \$1 billion to the DOJ, and several executives received prison sentences.

• **parallel conduct** Form of implicit collusion in which one firm consistently follows actions of another.

Two firms need not meet or talk on the telephone to violate Section 1 of the Sherman Act; *implicit* collusion in the form of **parallel conduct** can also be construed as violating the law. For example, if Firm B consistently follows Firm A’s pricing (parallel pricing), and if the firm’s conduct is contrary to what one would expect companies to do in the absence of collusion (such as raising prices in the face of decreased demand and over-supply), an implicit understanding may be inferred.¹⁸

• **predatory pricing** Practice of pricing to drive current competitors out of business and to discourage new entrants in a market so that a firm can enjoy higher future profits.

Section 2 of the Sherman Act makes it illegal to monopolize or to attempt to monopolize a market and prohibits conspiracies that result in monopolization. The Clayton Act (1914) did much to pinpoint the kinds of practices that are likely to be anticompetitive. For example, the act makes it unlawful for a firm with a large market share to require the buyer or lessor of a good not to buy from a competitor. It also makes it illegal to engage in **predatory pricing**—pricing designed to drive current competitors out of business and to discourage new entrants (so that the predatory firm can enjoy higher prices in the future).

Monopoly power can also be achieved by a merger of firms into a larger and more dominant firm, or by one firm acquiring or taking control of another firm by purchasing its stock. The Clayton Act prohibits mergers and acquisitions if they “substantially lessen competition” or “tend to create a monopoly.”

¹⁶In the lysine case, proof of the conspiracy came in part from tapes of meetings at which prices were set and market shares divided up. At one meeting with executives from Ajinomoto Company of Japan, another lysine producer, James Randall, then the president of ADM, said, “We have a saying at this company. Our competitors are our friends and our customers are our enemies.” See “Video Tapes Take Star Role at Archer Daniels Trial,” *New York Times*, August 4, 1998; “Three Sentenced in Archer Daniels Midland Case,” *New York Times*, July 10, 1999. In 1993, ADM and three other firms were also charged with fixing carbon dioxide prices.

¹⁷“Tearing Down the Facades of ‘Vitamins Inc.’,” *New York Times*, October 10, 1999.

¹⁸The Sherman Act applies to all firms that do business in the United States (to the extent that a conspiracy to restrain trade could affect U.S. markets). However, foreign governments (or firms operating under their government’s control) are not subject to the act, so OPEC need not fear the wrath of the Justice Department. Also, firms can collude with respect to exports. The Webb-Pomerene Act (1918) allows price fixing and related collusion with respect to export markets, as long as domestic markets are unaffected by such collusion. Firms operating in this manner must form a “Webb-Pomerene Association” and register it with the government.



The antitrust laws also limit possible anticompetitive conduct by firms in other ways. For example, the Clayton Act, as amended by the Robinson-Patman Act (1936), makes it illegal to discriminate by charging buyers of essentially the same product different prices if those price differences are likely to injure competition. Even then, firms are not liable if they can show that the price differences were necessary to meet competition. (As we will see in the next chapter, price discrimination is a common practice. It becomes the target of antitrust action only when buyers suffer economic damages and competition is reduced.)

Another important component of the antitrust laws is the Federal Trade Commission Act (1914, amended in 1938, 1973, 1975), which created the Federal Trade Commission (FTC). This act supplements the Sherman and Clayton acts by fostering competition through a whole set of prohibitions against unfair and anticompetitive practices, such as deceptive advertising and labeling, agreements with retailers to exclude competing brands, and so on. Because these prohibitions are interpreted and enforced in administrative proceedings before the FTC, the act provides broad powers that reach further than those of other antitrust laws.

The antitrust laws are actually phrased vaguely in terms of what is and what is not allowed. They are intended to provide a general statutory framework to give the Justice Department, the FTC, and the courts wide discretion in interpreting and applying them. This approach is important because it is difficult to know in advance what might be an impediment to competition. Such ambiguity creates a need for common law (i.e., the practice whereby courts interpret statutes) and supplemental provisions and rulings (e.g., by the FTC or the Justice Department).

Enforcement of the Antitrust Laws

The antitrust laws are enforced in three ways:

1. *Through the Antitrust Division of the Department of Justice.* As an arm of the executive branch, its enforcement policies closely reflect the view of the administration in power. Responding to an external complaint or an internal study, the department can institute a criminal proceeding, bring a civil suit, or both. The result of a criminal action can be fines for the corporation and fines or jail sentences for individuals. For example, individuals who conspire to fix prices or rig bids can be charged with a felony and, if found guilty, may be sentenced to jail—something to remember if you are planning to parlay your knowledge of microeconomics into a successful business career! Losing a civil action forces a corporation to cease its anticompetitive practices and often to pay damages.
2. *Through the administrative procedures of the Federal Trade Commission.* Again, action can result from an external complaint or from the FTC's own initiative. Should the FTC decide that action is required, it can either request a voluntary understanding to comply with the law or seek a formal commission order requiring compliance.
3. *Through private proceedings.* Individuals or companies can sue for *treble (three-fold) damages* inflicted on their businesses or property. The prospect of treble damages can be a strong deterrent to would-be violators. Individuals or companies can also ask the courts for injunctions to force wrongdoers to cease anticompetitive actions.

U.S. antitrust laws are more stringent and far-reaching than those of most other countries. In fact, some people have argued that they have prevented American



industry from competing effectively in international markets. The laws certainly constrain American business and may at times have put American firms at a disadvantage in world markets. But this criticism must be weighed against their benefits: Antitrust laws have been crucial for maintaining competition, and competition is essential for economic efficiency, innovation, and growth.

Antitrust in Europe

As the European Union has grown, its methods of antitrust enforcement have evolved. The responsibility for the enforcement of antitrust concerns that involve two or more member states resides in a single entity, the Competition Directorate, located in Brussels. Separate and distinct antitrust authorities within individual member states are responsible for those issues whose effects are felt largely or entirely within particular countries.

At first glance, the antitrust laws of the European Union are quite similar to those of the United States. Article 81 of the Treaty of the European Community concerns restraints of trade, much like Section 1 of the Sherman Act. Article 82, which focuses on abuses of market power by *dominant* firms, is similar in many ways to Section 2 of the Sherman Act. Finally, with respect to mergers, the European Merger Control Act is similar in spirit to Section 7 of the Clayton Act.

Nevertheless, there remain a number of procedural and substantive differences between antitrust laws in Europe and the United States. Merger evaluations typically are conducted more quickly in Europe, and it is easier in practice to prove that a European firm is dominant than it is to show that a U.S. firm has monopoly power. Both the European Union and the U.S. have been actively enforcing laws against price fixing, but Europe imposes only civil penalties, whereas the U.S. can impose prison sentences as well as fines.

EXAMPLE 10.5

A Phone Call About Prices

In 1981 and early 1982, American Airlines and Braniff Airways were competing fiercely with each other for passengers. A fare war broke out as the firms undercut each other's prices to capture market share. On February 21, 1982, Robert Crandall, president and CEO of American, made a phone call to Howard Putnam, president and chief executive of Braniff. To Crandall's later surprise, the call had been taped. It went like this:¹⁹

Crandall: I think it's dumb as hell for Christ's sake, all right, to sit here and pound the @!#\$%&! out of each other and neither one of us making a @!#\$%&! dime.

Putnam: Well . . .

Crandall: I mean, you know, @!#\$%&!, what the hell is the point of it?

Putnam: But if you're going to overlay every route of American's on top of every route that Braniff has—I just can't sit here and allow you to bury us without giving our best effort.

Crandall: Oh sure, but Eastern and Delta do the same thing in Atlanta and have for years.

Putnam: Do you have a suggestion for me?

¹⁹According to the *New York Times*, February 24, 1983.



Crandall: Yes, I have a suggestion for you. Raise your @!#\$%&! fares 20 percent. I'll raise mine the next morning.

Putnam: Robert, we. . .

Crandall: You'll make more money and I will, too.

Putnam: We can't talk about pricing!

Crandall: Oh @!#\$%&!, Howard. We can talk about any @!#\$%&! thing we want to talk about.

Crandall was wrong. Corporate executives cannot talk about anything they want. Talking about prices and agreeing to fix them is a clear violation of Section 1 of the Sherman Act. Putnam must have known this because he promptly rejected Crandall's suggestion. After learning about the call, the Justice Department filed a suit accusing Crandall of violating the antitrust laws by proposing to fix prices.

However, *proposing* to fix prices is not enough to violate Section 1 of the Sherman Act: For the law to be violated, the two parties must *agree* to collude. Therefore, because Putnam had rejected Crandall's proposal, Section 1 was not violated. The court later ruled, however, that a proposal to fix prices could be an attempt to monopolize part of the airline industry and, if so, would violate Section 2 of the Sherman Act. American Airlines promised the Justice Department never again to engage in such activity.

EXAMPLE 10.6

The United States versus Microsoft



Over the past decade, Microsoft Corporation has grown to become the largest computer software company in the world. Its Windows operating system has over 94 percent of the worldwide market for personal computer operating systems. Microsoft also dominates the office productivity market: Its Office Suite, which includes Word (word processing), Excel (spreadsheets), and Powerpoint

(presentations), held over a 95-percent worldwide market share in 2006.

Microsoft's incredible success has been due in good part to the creative technological and marketing decisions of the company and its CEO, Bill Gates. Is there anything wrong as a matter of either economics or law with being so successful and dominant? It all depends. Under the antitrust laws, efforts by firms to restrain trade or to engage in activities that inappropriately maintain monopolies are illegal. Did Microsoft engage in anticompetitive, illegal practices?

The U.S. Government said yes; Microsoft disagreed. In October 1998, the Antitrust Division of the U.S. Department of Justice (DOJ) put Microsoft's behavior to the test: It filed suit, raising a broad set of issues that created the most significant antitrust law suit of the past two decades. The ensuing trial ended in June 1999, but it wasn't until early in 2003 that a settlement between the government and Microsoft was finalized. Here is a brief road map of some of the DOJ's major claims and Microsoft's responses.



- **DOJ claim:** Microsoft has a great deal of market power in the market for PC operating systems—enough to meet the legal definition of monopoly power.
MS response: Microsoft does not meet the legal test for monopoly power because it faces significant threats from potential competitors that offer or will offer platforms to compete with Windows.
- **DOJ claim:** Microsoft viewed Netscape's Internet browser (Netscape Navigator) as a threat to its monopoly over the PC operating system market. The threat existed because Netscape's browser includes Sun's Java software, which can run programs that have been written for *any* operating system, including those that compete with Windows, such as Apple, Unix, and Linux. In violation of Section 1 of the Sherman Act, Microsoft entered into exclusionary agreements with computer manufacturers and Internet service providers with the objective of raising the cost to Netscape of making its browser available to consumers. This action impaired Netscape's ability to compete fairly with Microsoft's Internet Explorer for the browser business.
MS response: The contracts were not unduly restrictive. In any case, Microsoft unilaterally agreed to stop most of them.
- **DOJ claim:** In violation of Section 2 of the Sherman Act, Microsoft engaged in practices designed to maintain its monopoly in the market for desktop PC operating systems. Most importantly, it tied its browser to the Windows 98 operating system, even though doing so was technically unnecessary and provides little or no benefit to consumers. This action was predatory because it made it difficult or impossible for Netscape and other firms to successfully offer competing products.
MS response: There are benefits to incorporating the browser functionality into the operating system. Not being allowed to integrate new functionality into an operating system will discourage innovation. Offering consumers a choice between separate or integrated browsers would cause confusion in the marketplace.
- **DOJ claim:** In violation of Section 2 of the Sherman Act, Microsoft attempted to divide the browser business with Netscape and engaged in similar conduct with both Apple Computer and Intel.
MS response: Microsoft's meetings with Netscape, Apple, and Intel were for valid business reasons. Indeed, it is useful for consumers and firms to agree on common standards and protocols in developing computer software.

These are some of the highlights of an eight-month trial that was hard-fought on a range of economic issues. The District Court reached its findings regarding the facts of the case in November 1999 and the legal conclusions in April 2000. It found that Microsoft did have monopoly power in the market for PC operating systems. The Court concluded further that Microsoft had viewed Netscape as a threat and that in responding to that threat, it had engaged in a series of anticompetitive acts to protect and extend its operating system monopoly. The court deemed these actions to violate Section 2 of the Sherman Act. However, the Court also found that the exclusionary agreements with computer manufacturers and Internet service providers had not foreclosed competition sufficiently to violate Section 1 of the Sherman Act. Microsoft's appeal to the Circuit Court of



Appeals for the District of Columbia was decided in June 2001. The Appellate Court supported the District Court's conclusions that Microsoft was a monopoly and had engaged in anticompetitive practices to protect that monopoly. However, the Court left undecided whether including Internet Explorer in the operating system was itself illegal.

Since this decision, the DOJ and Microsoft agreed to settle the case. Among other things, the agreement required Microsoft (1) to give computer manufacturers the ability to offer its operating system without Internet Explorer and (2) to include competing browser programs when loading the Windows operating system onto the machines they sell. Microsoft also agreed to a program that would monitor its compliance with the terms of the settlement. Despite opposition from critics who believed the remedy insufficient, the settlement was approved by the Appellate Court in 2004, putting an end to this landmark antitrust case in the United States.

Microsoft's problems did not end with the U.S. settlement, however. In 2004, the European Commission ordered Microsoft to pay \$610 million in fines for its anticompetitive practices and to produce a version of Windows without the Windows Media Player to be sold alongside its standard editions. In addition, numerous private lawsuits were brought in the United States, with most settling for substantial sums of money.

SUMMARY

1. Market power is the ability of sellers or buyers to affect the price of a good.
2. Market power comes in two forms. When sellers charge a price that is above marginal cost, we say that they have monopoly power, which we measure by the extent to which price exceeds marginal cost. When buyers can obtain a price below their marginal value of the good, we say they have monopsony power, which we measure by the extent to which marginal value exceeds price.
3. Monopoly power is determined in part by the number of firms competing in a market. If there is only one firm—a pure monopoly—monopoly power depends entirely on the elasticity of market demand. The less elastic the demand, the more monopoly power the firm will have. When there are several firms, monopoly power also depends on how the firms interact. The more aggressively they compete, the less monopoly power each firm will have.
4. Monopsony power is determined in part by the number of buyers in a market. If there is only one buyer—a pure monopsony—monopsony power depends on the elasticity of market supply. The less elastic the supply, the more monopsony power the buyer will have. When there are several buyers, monopsony power also depends on how aggressively they compete for supplies.
5. Market power can impose costs on society. Because monopoly and monopsony power both cause production to fall below the competitive level, there is a deadweight loss of consumer and producer surplus. There can be additional social costs from rent seeking.
6. Sometimes, scale economies make pure monopoly desirable. But the government will still want to regulate price to maximize social welfare.
7. More generally, we rely on the antitrust laws to prevent firms from obtaining excessive market power.

QUESTIONS FOR REVIEW

1. A monopolist is producing at a point at which marginal cost exceeds marginal revenue. How should it adjust its output to increase profit?
2. We write the percentage markup of price over marginal cost as $(P - MC)/P$. For a profit-maximizing monopolist, how does this markup depend on the elasticity of demand? Why can this markup be viewed as a measure of monopoly power?
3. Why is there no market supply curve under conditions of monopoly?
4. Why might a firm have monopoly power even if it is not the only producer in the market?



5. What are some of the different types of barriers to entry that give rise to monopoly power? Give an example of each.
6. What factors determine the amount of monopoly power an individual firm is likely to have? Explain each one briefly.
7. Why is there a social cost to monopoly power? If the gains to producers from monopoly power could be redistributed to consumers, would the social cost of monopoly power be eliminated? Explain briefly.
8. Why will a monopolist's output increase if the government forces it to lower its price? If the government wants to set a price ceiling that maximizes the monopolist's output, what price should it set?
9. How should a monopsonist decide how much of a product to buy? Will it buy more or less than a competitive buyer? Explain briefly.
10. What is meant by the term "monopsony power"? Why might a firm have monopsony power even if it is not the only buyer in the market?
11. What are some sources of monopsony power? What determines the amount of monopsony power an individual firm is likely to have?
12. Why is there a social cost to monopsony power? If the gains to buyers from monopsony power could be redistributed to sellers, would the social cost of monopsony power be eliminated? Explain briefly.
13. How do the antitrust laws limit market power in the United States? Give examples of major provisions of these laws.
14. Explain briefly how the U.S. antitrust laws are actually enforced.

EXERCISES

1. Will an increase in the demand for a monopolist's product always result in a higher price? Explain. Will an increase in the supply facing a monopsonist buyer always result in a lower price? Explain.
2. Caterpillar Tractor, one of the largest producers of farm machinery in the world, has hired you to advise it on pricing policy. One of the things the company would like to know is how much a 5-percent increase in price is likely to reduce sales. What would you need to know to help the company with this problem? Explain why these facts are important.
3. A monopolist firm faces a demand with constant elasticity of -2.0 . It has a constant marginal cost of \$20 per unit and sets a price to maximize profit. If marginal cost should increase by 25 percent, would the price charged also rise by 25 percent?
4. A firm faces the following average revenue (demand) curve:

$$P = 120 - 0.02Q$$

where Q is weekly production and P is price, measured in cents per unit. The firm's cost function is given by $C = 60Q + 25,000$. Assume that the firm maximizes profits.

- a. What is the level of production, price, and total profit per week?
- b. If the government decides to levy a tax of 14 cents per unit on this product, what will be the new level of production, price, and profit?
5. The following table shows the demand curve facing a monopolist who produces at a constant marginal cost of \$10:

Price	Quantity
18	0
16	4
14	8
12	12
10	16
8	20
6	24
4	28
2	32
0	36

- a. Calculate the firm's marginal revenue curve.
- b. What are the firm's profit-maximizing output and price? What is its profit?
- c. What would the equilibrium price and quantity be in a competitive industry?
- d. What would the social gain be if this monopolist were forced to produce and price at the competitive equilibrium? Who would gain and lose as a result?
6. Suppose that an industry is characterized as follows:

$C = 100 + 2q^2$	each firm's total cost function
$MC = 4q$	firm's marginal cost function
$P = 90 - 2Q$	industry demand curve
$MR = 90 - 4Q$	industry marginal revenue curve



- a. If there is *only one firm* in the industry, find the monopoly price, quantity, and level of profit.
 - b. Find the price, quantity, and level of profit if the industry is competitive.
 - c. Graphically illustrate the demand curve, marginal revenue curve, marginal cost curve, and average cost curve. Identify the difference between the profit level of the monopoly and the profit level of the competitive industry in two different ways. Verify that the two are numerically equivalent.
7. Suppose a profit-maximizing monopolist is producing 800 units of output and is charging a price of \$40 per unit.
- a. If the elasticity of demand for the product is -2 , find the marginal cost of the last unit produced.
 - b. What is the firm's percentage markup of price over marginal cost?
 - c. Suppose that the average cost of the last unit produced is \$15 and the firm's fixed cost is \$2000. Find the firm's profit.
8. A firm has two factories, for which costs are given by:

$$\text{Factory \#1: } C_1(Q_1) = 10Q_1^2$$

$$\text{Factory \#2: } C_2(Q_2) = 20Q_2^2$$

The firm faces the following demand curve:

$$P = 700 - 5Q$$

where Q is total output—i.e., $Q = Q_1 + Q_2$.

- a. On a diagram, draw the marginal cost curves for the two factories, the average and marginal revenue curves, and the total marginal cost curve (i.e., the marginal cost of producing $Q = Q_1 + Q_2$). Indicate the profit-maximizing output for each factory, total output, and price.
 - b. Calculate the values of Q_1 , Q_2 , Q , and P that maximize profit.
 - c. Suppose that labor costs increase in Factory 1 but not in Factory 2. How should the firm adjust (i.e., raise, lower, or leave unchanged) the following: Output in Factory 1? Output in Factory 2? Total output? Price?
9. A drug company has a monopoly on a new patented medicine. The product can be made in either of two plants. The costs of production for the two plants are $MC_1 = 20 + 2Q_1$ and $MC_2 = 10 + 5Q_2$. The firm's estimate of demand for the product is $P = 20 - 3(Q_1 + Q_2)$. How much should the firm plan to produce in each plant? At what price should it plan to sell the product?
10. One of the more important antitrust cases of the 20th century involved the Aluminum Company of America (Alcoa) in 1945. At that time, Alcoa controlled about 90 percent of primary aluminum production in the United States, and the company had been accused of monopolizing the aluminum market. In its defense,

Alcoa argued that although it indeed controlled a large fraction of the primary market, secondary aluminum (i.e., aluminum produced from the recycling of scrap) accounted for roughly 30 percent of the total supply of aluminum and that many competitive firms were engaged in recycling. Therefore, Alcoa argued, it did not have much monopoly power.

- a. Provide a clear argument *in favor* of Alcoa's position.
 - b. Provide a clear argument *against* Alcoa's position.
 - c. The 1945 decision by Judge Learned Hand has been called "one of the most celebrated judicial opinions of our time." Do you know what Judge Hand's ruling was?
11. A monopolist faces the demand curve $P = 11 - Q$, where P is measured in dollars per unit and Q in thousands of units. The monopolist has a constant average cost of \$6 per unit.
- a. Draw the average and marginal revenue curves and the average and marginal cost curves. What are the monopolist's profit-maximizing price and quantity? What is the resulting profit? Calculate the firm's degree of monopoly power using the Lerner index.
 - b. A government regulatory agency sets a price ceiling of \$7 per unit. What quantity will be produced, and what will the firm's profit be? What happens to the degree of monopoly power?
 - c. What price ceiling yields the largest level of output? What is that level of output? What is the firm's degree of monopoly power at this price?
12. Michelle's Monopoly Mutant Turtles (MMMT) has the exclusive right to sell Mutant Turtle t-shirts in the United States. The demand for these t-shirts is $Q = 10,000/P^2$. The firm's short-run cost is $SRTC = 2000 + 5Q$, and its long-run cost is $LRTC = 6Q$.
- a. What price should MMMT charge to maximize profit in the short run? What quantity does it sell, and how much profit does it make? Would it be better off shutting down in the short run?
 - b. What price should MMMT charge in the long run? What quantity does it sell and how much profit does it make? Would it be better off shutting down in the long run?
 - c. Can we expect MMMT to have lower marginal cost in the short run than in the long run? Explain why.
13. You produce widgets for sale in a perfectly competitive market at a market price of \$10 per widget. Your widgets are manufactured in two plants, one in Massachusetts and the other in Connecticut. Because of labor problems in Connecticut, you are forced to raise wages there, so that marginal costs in that plant increase. In response to this, should you shift production and produce more in your Massachusetts plant?
14. The employment of teaching assistants (TAs) by major universities can be characterized as a monopsony. Suppose the demand for TAs is $W = 30,000 - 125n$,

where W is the wage (as an annual salary) and n is the number of TAs hired. The supply of TAs is given by $1000 + 75n$.

If the university takes advantage of its monopsonist position, how many TAs will it hire? What wage will it pay?

If, instead, the university faced an infinite supply of TAs at the annual wage level of \$10,000, how many TAs would it hire?

Donna's Doorstops, Inc. (DD) is a monopolist in the doorstop industry. Its cost is $C = 100 - 5Q + Q^2$, and demand is $P = 55 - 2Q$.

What price should DD set to maximize profit? What output does the firm produce? How much profit and consumer surplus does DD generate?

What would output be if DD acted like a perfect competitor and set $MC = P$? What profit and consumer surplus would then be generated?

What is the deadweight loss from monopoly power in part (a)?

Suppose the government, concerned about the high price of doorstops, sets a maximum price at \$27. How does this affect price, quantity, consumer surplus, and DD's profit? What is the resulting deadweight loss?

Now suppose the government sets the maximum price at \$23. How does this decision affect price, quantity, consumer surplus, DD's profit, and deadweight loss?

Finally, consider a maximum price of \$12. What will this do to quantity, consumer surplus, profit, and deadweight loss?

There are 10 households in Lake Wobegon, Minnesota, with a demand for electricity of $Q = 50 - P$. Lake Wobegon Electric's (LWE) cost of producing electricity is $C = 500 + Q$.

If the regulators of LWE want to make sure that there is no deadweight loss in this market, what price will they force LWE to charge? What will output be in that case? Calculate consumer surplus and LWE's profit with that price.

b. If regulators want to ensure that LWE doesn't lose money, what is the lowest price they can impose? Calculate output, consumer surplus, and profit. Is there any deadweight loss?

c. Kristina knows that deadweight loss is something that this small town can do without. She suggests that each household be required to pay a fixed amount just to receive any electricity at all, and then a per-unit charge for electricity. Then LWE can break even while charging the price calculated in part (a). What fixed amount would each household have to pay for Kristina's plan to work? Why can you be sure that no household will choose instead to refuse the payment and go without electricity?

17. A certain town in the Midwest obtains all of its electricity from one company, Northstar Electric. Although the company is a monopoly, it is owned by the citizens of the town, all of whom split the profits equally at the end of each year. The CEO of the company claims that because all of the profits will be given back to the citizens, it makes economic sense to charge a monopoly price for electricity. True or false? Explain.

18. A monopolist faces the following demand curve:

$$Q = 144/P^2$$

where Q is the quantity demanded and P is price. Its average variable cost is

$$AVC = Q^{1/2}$$

and its fixed cost is 5.

- What are its profit-maximizing price and quantity? What is the resulting profit?
- Suppose the government regulates the price to be no greater than \$4 per unit. How much will the monopolist produce? What will its profit be?
- Suppose the government wants to set a ceiling price that induces the monopolist to produce the largest possible output. What price will accomplish this goal?

Price Ma

As we explore industries in monopoly or specialized markets for these firms, decide how mine output.

Management who manage competitive industries, result, its operations, the management, the character of the firm's output, the level of demand (level) shown a more complex prices to demand, agents need.

This chapter begins with consumer surplus, we discuss charging a product and price discrimination, important.

Next, we advance for additional where customers ride. Although the market, the a Gillette razor, Gillette razor, and then a cost of long, nity to make.

We will products to personal comp