CHAPTER 10

Market Power: Monopolu and Monopsony

In a perfectly competitive market, there are enough sellers and buyers of a good so that no single seller or buyer can affect its price. Price is determined by the market forces of supply and demand. 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.

We first discuss the behavior of a monopolist. Because a monopolist is the sole producer of a product, the 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 the antitrust laws 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 then 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, the price that a monopsonist pays depends on the quantity that it purchases. The monopsonist'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.

Pure monopsony is also unusual. But 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 occurs in markets for inputs to production. For example, the three large U.S. car manufacturers have 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.* Market power refers to the ability-by a seller or a buyer-to affect the price of a good.[1] Since sellers or buyers have at least some market power (in most real-, world markets), we need to understand how market power works and its implications for firms 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 a lower price, would capture a larger share of the market at the monopolist's expense. The monopolist *is* the market and has complete control over the amount of output offered for sale.

But this does not mean that the monopolist can charge as high a price as it wants-at least not if its objective is to maximize profit. This textbook is a case in point. Prentice Hall, Inc. owns the copyright and is therefore a monopoly producer of this book. Then why doesn't it sell the book for $350 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 the characteristics of market demand, as well as its costs. Knowledge of demand and cost is crucial for a firm's economic decision making. Given this knowledge, the

[1] The courts often use the term "monopoly power" to mean a substantial amount of market power, and in particular enough to warrant scrutiny under the antitrust laws. In this book, however, we use "monopoly power" to mean market power on the part of sellers, whether substantial or not,

monopolist must then decide how much to produce and sell. The price per unit 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 just the market demand curve. To choose its profit-maximizing output level, the monopolist also needs to know its *marginal revenue,* that is, 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 because at that price nothing is sold. However, at a price of $5 one unit is sold, and then total (and marginal) revenue is $5. An increase in quantity sold from 1 to 2 increases revenue 'from $5 to $8, so that marginal revenue is $3. As quantity sold increases from 2 to 3, marginal revenue falls to $1, and when it increases from 3 to 4, marginal revenue 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. To increase sales by 1 unit, the price must fall, so that all units sold, not just the additional unit, earn less revenue. Note 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).

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

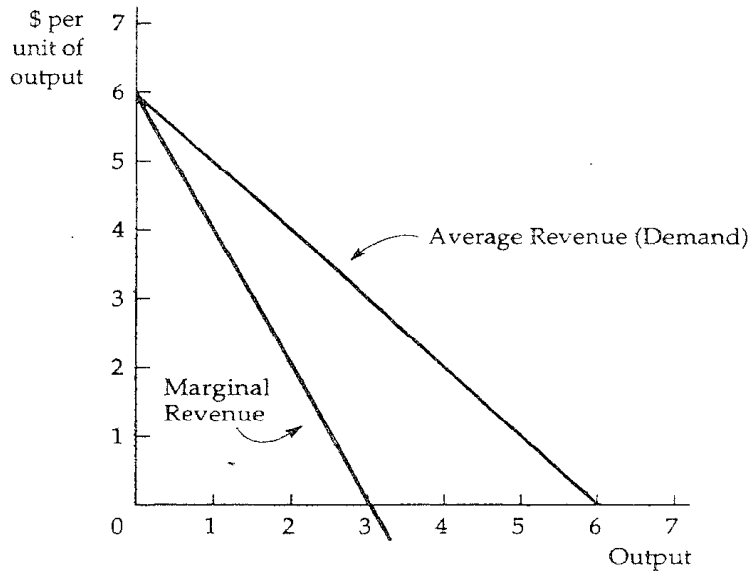

FIGURE 10.1 Average and Marginal Revenue. Average and marginal revenue are shown for the demand curve $P = 6 - Q$.

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]

The Monopolist's Output Decision

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

[2] If 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.)

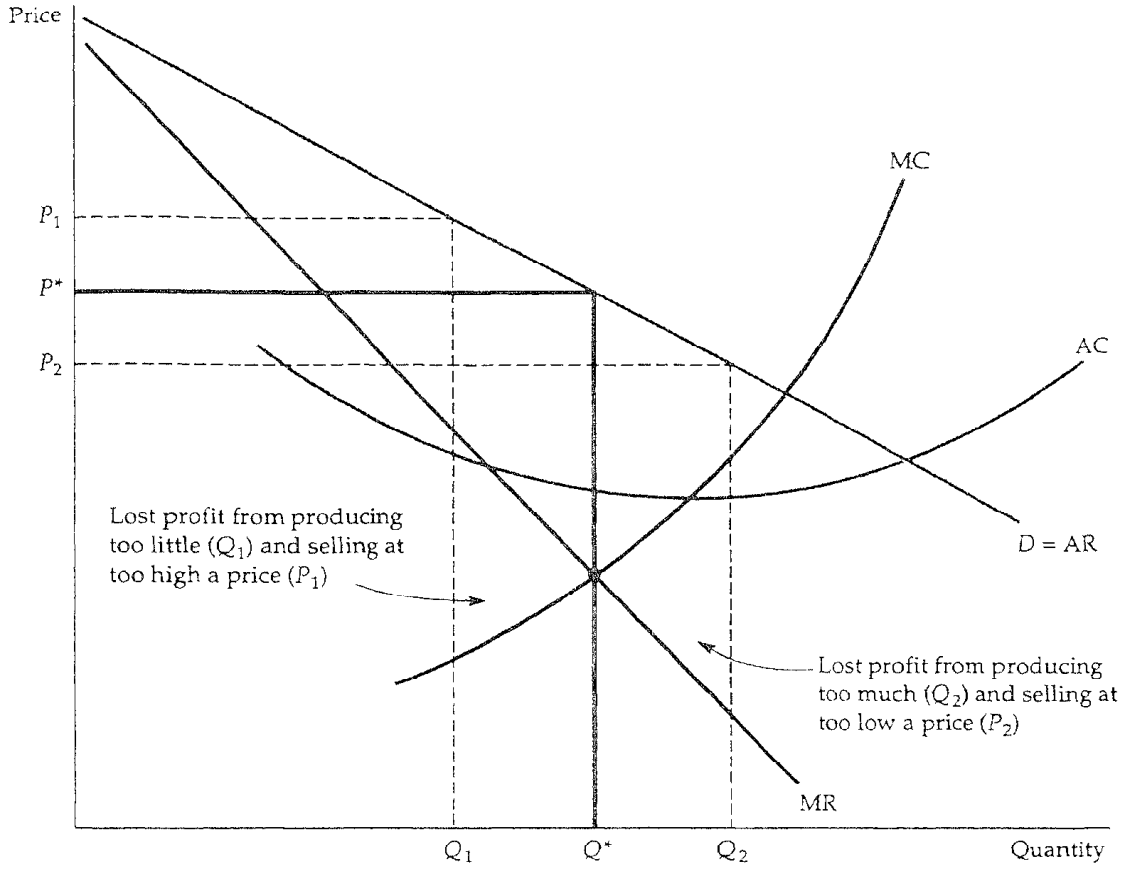

FIGURE 10.2 Profit Is Maximized When Marginal Revenue Equals Marginal Cost. Q^* is the output level at which MR = MC. If the firm produces a smaller output, say Q_1, it sacrifices some profit because the extra revenue that could be earned from producing and selling the units between Q_1 and Q^* exceeds the cost of producing them. Similarly, expanding output from Q^* to $Q2$ would reduce profit, because the additional cost would exceed the additional revenue.

higher price P_1. As Figure 10.2 shows, marginal revenue would then exceed marginal cost, so 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 unit is zero. So the smaller quantity Q_1 is not profit maximizing, even though it allows the monopolist to charge a higher price. By producing Q_1 instead of Q^*, the monopolist's 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, so if the monopolist pro-

duced a little less than Q_2 it would increase its total profit (by MC - MR). The monopolist 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 $\Delta R/\Delta QQ$ is marginal revenue, and $\Delta C/\Delta Q$ is marginal cost, so 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

$$C(Q) = 50 + Q_2$$

(i.e., there is a fixed cost of $50, and variable cost is Q_2). And 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 $Q = 10$, which corresponds to a price of $30.[3]

Cost, revenue, and profit are plotted in Figure 10.3a. When the firm produces little or no output, profit is negative because of the fixed cost. Profit increases as Q increases, until it reaches a maximum of $150 at $Q^* = 10$, and then decreases as Q is increased further. And 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. Profit is maximized when marginal revenue equals marginal cost, so the slopes are equal.

Figure 10.3b shows 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, so average profit is $30 - $15 = $15 per unit. Since 10 units are sold, profit is (10)($15) = $150, the area of the shaded rectangle.

[3] Note 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 $Q = 10$.

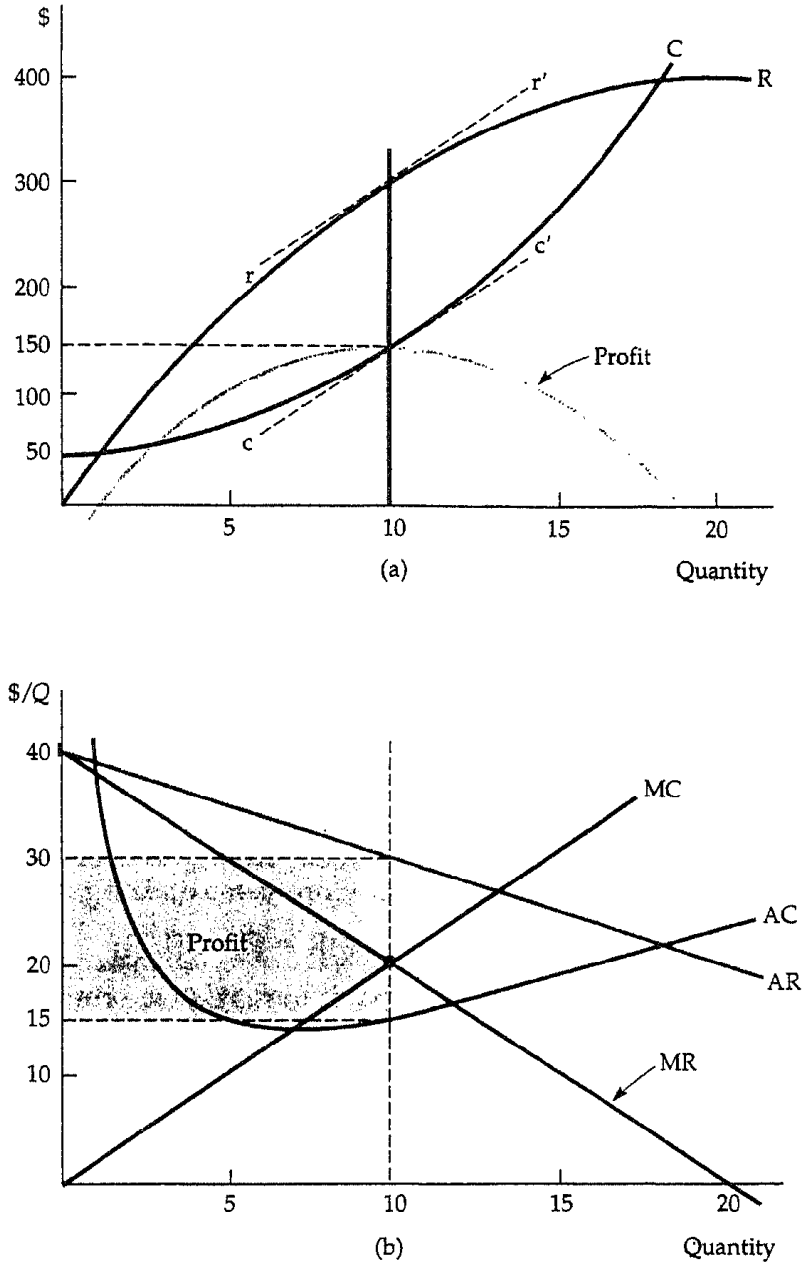

FIGURE 10.3 Example of Profit Maximization. (a) Total revenue R, total cost C, and profit, the difference between the two. (b) Average and marginal revenue and average and marginal cost. Marginal revenue is the slope of the total revenue curve, and marginal cost is the slope of the total cost curve. 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 only the firm's marginal cost 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 rewrite the expression for marginal revenue:

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

Note that the extra revenue from an incremental unit of quantity, $\Delta(PQ)/\Delta Q$, has two components. Producing one extra unit and selling it at price P brings in revenue $(1)(P) = P$. But the firm faces a downward-sloping demand curve, so 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,

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

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 $E_d = (P/Q)(\Delta Q/\Delta P)$. Hence, $(Q/P)(\Delta P/\Delta Q)$ is the reciprocal of the elasticity of demand, $1/E_d$, measured at the profit-maximizing output, and

$$\text{MR} = P + P(1/E_d)$$

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

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

which can be rearranged to give us

$$\boxed{\frac{P - \text{MC}}{P} = -\frac{1}{E_d}} \qquad (10.1)$$

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 will be a positive number because the elasticity of demand

[4] Remember 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, this equation can be used to check whether a particular output level and price are optimal.

is negative.) Equivalently, we can rearrange this equation to express price directly as a markup over marginal cost:

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

For example, if the elasticity of demand is -4 and marginal cost is $9 per unit, price should be $9/(1 - ¼) = $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, so that 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.

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 a series of prices and quantities as happens with 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.

This is illustrated in Figures 10.4a and 10.4b. 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 10.4a 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 MRi does. As a result, the quantity produced stays the same. Price, however, falls to P_2.

In Figure 10.4b 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,

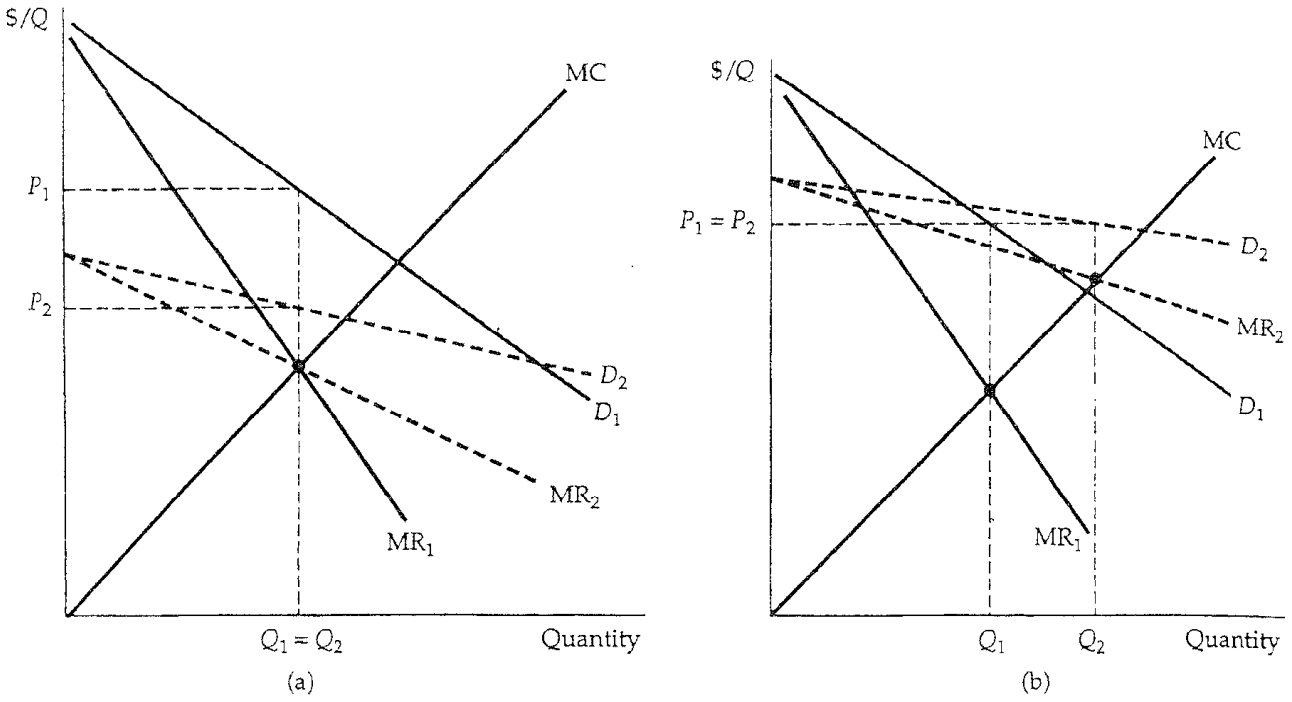

FIGURE 10.4a Shift in Demand Leads to Change in Price but Same Output. The demand curve D_1 shifts to new demand curve D_2. But the new marginal revenue curve MR_2 intersects marginal cost at the same point that the old marginal revenue curve MR_1 did. The profit-maximizing output therefore remains the same, although price falls from P_1 to P_2.

FIGURE 10.4b Shift in Demand Leads to Change in Output but Same Price. 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.

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.

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 upwards 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 upwards 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. 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.)

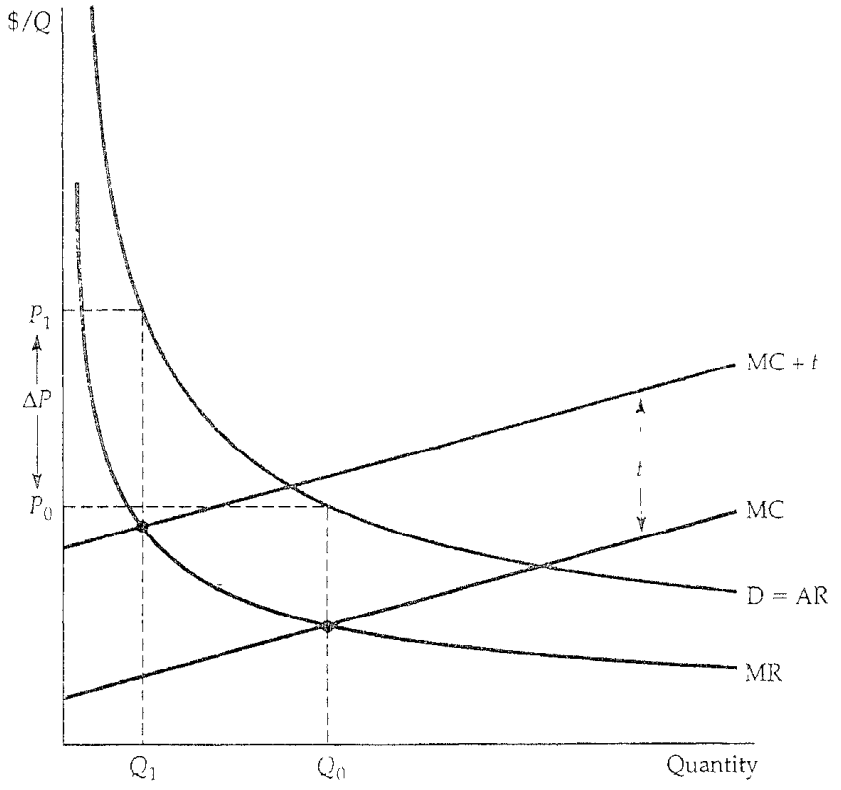

FIGURE 10.5 Effect of Excise Tax on Monopolist. With a tax t per unit, the firm's effective marginal cost is increased by the amount t to MC + t. In this example, the increase in price ΔP is larger than the tax t.

*The Multiplant Firm

We have seen that a firm maximizes profit by setting output 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.

First, 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.

Second, 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. Then the firm would do better by producing more at both plants because the revenue earned from the additional units would exceed the cost. Since marginal costs must be the same at each plant, and 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. 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, setting 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

$$\boxed{MR = MC_1 = MC_2} \qquad (10.3)$$

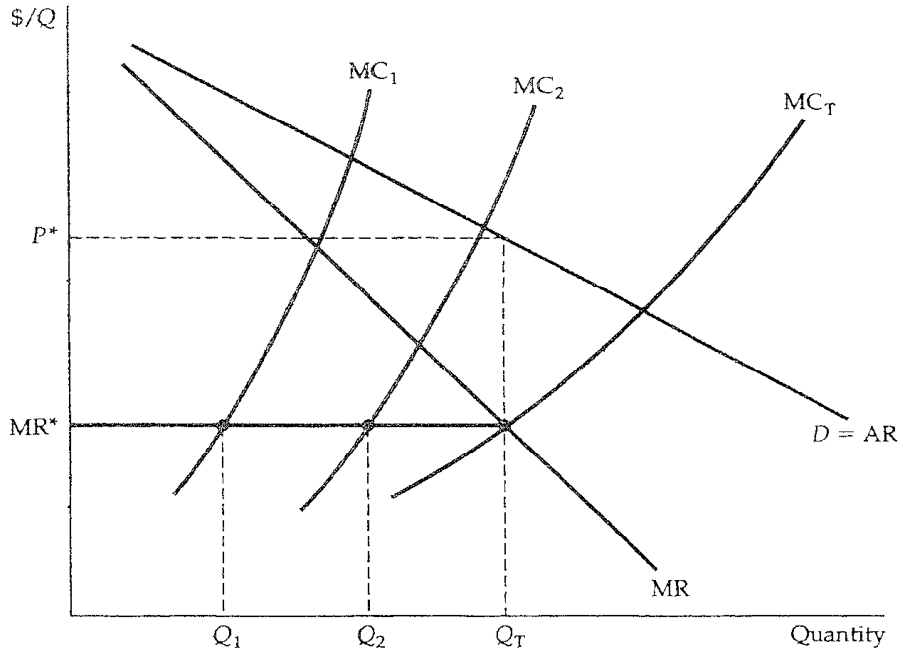

FIGURE 10.6 Production with Two Plants. A firm with two plants maximizes profits by choosing output levels Q_1 and Q_2 *so* that marginal revenue MR (which depends on *total* output) equals marginal costs for each plant, MC_1 and MC_2.

Figure 10.6 illustrates this 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 labelled MC_T. This is the firm's total marginal cost and is obtained by horizontally summing MC_1 and 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 determines total output Q-r. 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 shown in Equation (10.3).

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

[5] Note the similarity to the way we obtained a competitive industry's supply curve in Chapter 8 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 this competition can take in Chapters 12 and 13. But we should explain here why in a market with several firms, each firm is likely to face a downward-sloping demand curve, and therefore will produce so that price exceeds marginal cost.

Suppose, for example, that four firms produce toothbrushes, which have the market demand curve shown in Figure 10.7a. Let's assume that these four firms are producing an aggregate of 20,000 toothbrushes per day (5000 per day each), 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.

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

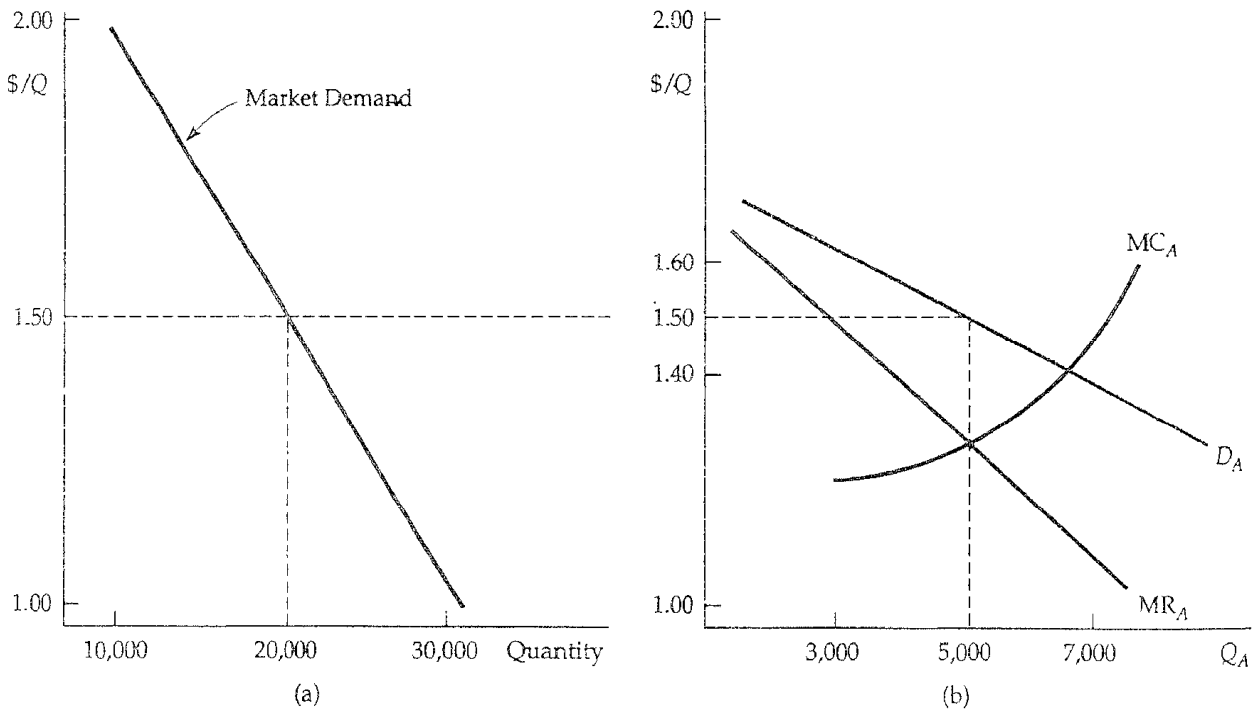

FIGURE 10.7a Market Demand for Toothbrushes.
FIGURE 10.7b Demand for Toothbrushes as Seen by Firm A. At a market price of $1.50, elasticity of .market demand is -1.5. Firm A, however, sees a much more elastic demand curve DA because of competition from other firms. At a price of $1.50, Firm A's demand elasticity is -6. Still, Firm A has some monopoly power. Its profit-maximizing price is $1.50, which exceeds marginal cost.

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 10.7b, 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 anticipate that by raising price from $1.50 to $1.60, its sales will drop, say, from 5000 units to 3000, as consumers buy more toothbrushes from the other firms. (If *all* firms raised their prices to $1.60, sales for Firm A would fall only to 4500.) But for several reasons, sales won't drop to zero, as they would in a perfectly competitive market. First, Firm *A*'s toothbrushes might be a little different from its competitors, so some consumers will pay a bit more for them. Second, the 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, perhaps 7000 toothbrushes instead of 5000. But it will not capture the entire market. Some consumers might still prefer the competitors' toothbrushes, and the competitors might also lower their prices.

So Firm *A*'s demand curve depends 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 that is more elastic than the market demand curve, but 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 10.7b that quantity is 5000 units, and the corresponding price is $1.50, which exceeds marginal cost. So 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. First, how can we *measure* monopoly power, so that we can compare one firm with another? (So far we have been talking about monopoly power only in *qualitative* terms.) Second, 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

was introduced by economist Abba Lerner in 1934 and is called *Lerner's Degree of Monopoly Power:*

$$L=(P\text{-MC})/P$$

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

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

Remember, however, that E_d is now the elasticity of *the firm's* demand curve, and not the market demand curve. In the toothbrush example discussed above, 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 might earn a lower profit because it has much higher average costs.

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, if we remember that E_d is the elasticity of demand for the *firm,* and 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 price the firm charges. 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

[6] There 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, shifts in demand, etc. See Robert S. Pindyck, "The Measurement of Monopoly Power in Dynamic Markets," *Journal of Law and Economics* 28 (April 1985): 1-93-222.

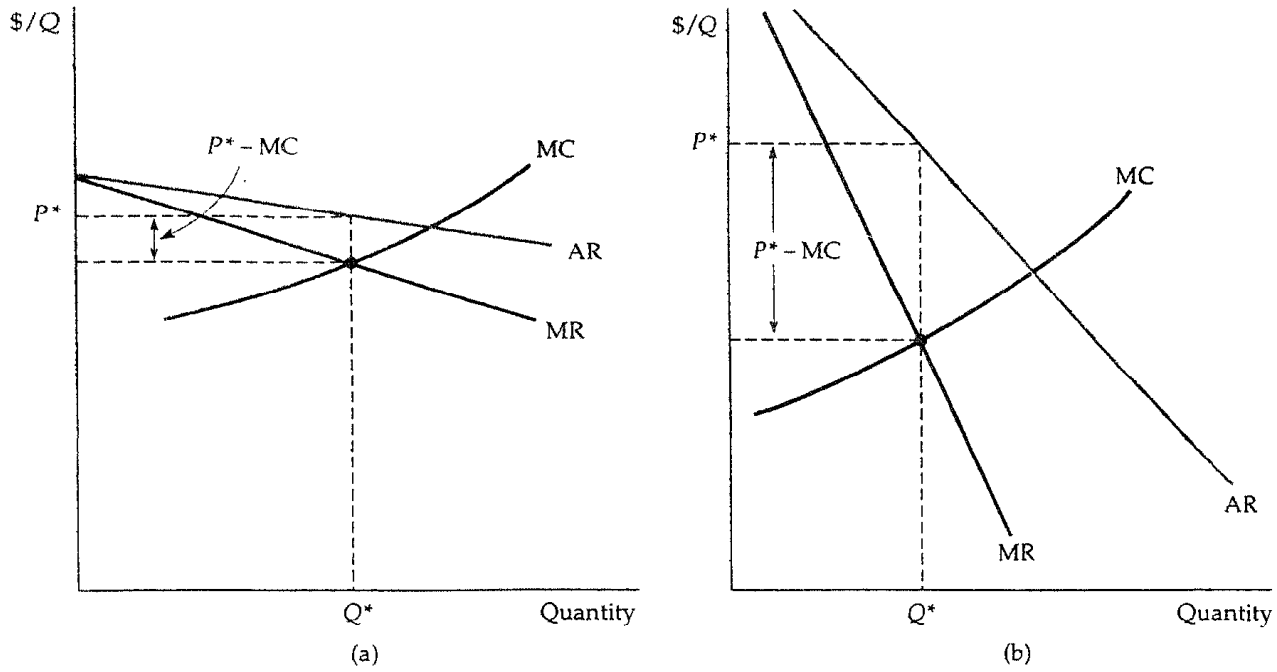

FIGURE 10.8 Elasticity of Demand and Price Markup. The markup $(P - MC)/P$ is equal to minus the inverse of the elasticity of demand. If demand is elastic as in (a), the markup is small, and the firm has little monopoly power. The opposite is true if demand is inelastic, as in (b),

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 10.8a and 10.8b illustrate these two extremes.

EXAMPLE 10.1 MARKUP PRICING: SUPERMARKETS TO DESIGNER JEANS

Three examples should help clarify the use of markup pricing. Consider a retail supermarket chain. Although the elasticity of market demand for food is small (about -1), several supermarkets usually serve most areas, so no single supermarket can raise its prices very much without losing many 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 *Ed* 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, together with 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 on Sundays or 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 find it inconvenient to drive to the supermarket. The elasticity of demand for a convenience store is about-5, so 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 for sale to their customers). With designer jeans, demand elasticities in the range of -3 to -4 are typical for the major labels. This means that price should be 33 to 50 percent higher than marginal cost. Marginal cost is typically $12 to $18 per pair, and the wholesale price is in the $18 to $27 range.

EXAMPLE 10.2 THE PRICING OF PRERECORDED VIDEOCASSETTES

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 many more videocassettes are rented through small retail outlets than are sold outright, the market for sales is large and growing. Producers, however, found it difficult to decide what price to charge for their cassettes. As a result, in 1985 popular movies were selling for vastly different prices as the data for that year show in Table 10.2.

Note that *The Empire Strikes Back* was selling for nearly $80, while *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 views on pricing by producers. The issue was whether lower prices would induce consumers to buy the 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 con-

TABLE 10.2 The Prices of Videos in 1985 and 1993

1985		1993	
Title	Retail Price ($)	Title	Retail Price ($)
Purple Rain	$29.98	*Batman Returns*	$19.95
Raiders of the Lost Ark	24.95	*Lethal Weapon 3*	17.95
Jane Fonda Workout	59.95	*Terminator 2*	17.95
The Empire Strikes Back	79.98	*Beauty and the Beast*	19.95
An Officer and A Gentleman	24.95	*Teenage Mutant Ninja Turtle Movie*	14.95
Star Trek: The Motion Picture	24.95	*Home Alone 2*	17.95
Star Wars	39.98	*Aladdin*	17.95

sumers 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. They strongly indicated that demand was elastic and that the profit-maximizing price was in the range of $15 to $30. As one industry analyst said, "People are becoming collectors. ... As you lower the price you attract households that would not have considered buying at a higher price point," [8] And, indeed, as Table 10.2 shows, by 1993 most producers had lowered prices across the board. As a result, sales and profits increased.

10.3 *Sources of Monopoly Power*

Why do some firms have considerable monopoly power, and other firms have little or none? Remember that monopoly power is the ability to set price above marginal cost, and the amount by which price exceeds marginal cost depends inversely on the firm's elasticity of demand. As equation (10.3) 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. The question is, why do some firms (e.g., a supermarket chain) face a demand

[7] "Video Producers Debate the Value of Price Cuts," *New York Times,* Feb. 19, 1985.

[8] "Studios Now Stressing Video Sales Over Rentals," *New York Times,* Oct. 17, 1989. For a detailed study of videocassette pricing, see Carl E. Enomoto and Soumendra N. Ghosh, "Pricing in the home-Video Market," New Mexico State University working paper, 1992.

curve that is more elastic, while others (e.g., a producer of designer clothing) face one that is less elastic?

Three factors determine a firm's elasticity of demand. First is the *elasticity of market demand.* The firm's own demand will be at least as elastic as market demand, so the elasticity of market demand limits the potential for monopoly power Second is 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. Third is 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. Lets 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. Then 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 that was illustrated in Figure 10.7. The market demand for toothbrushes might not be very elastic, but each firm's demand will be more elastic. How much more depends on how the firms compete with one another. (In Figure 10.7, the elasticity of market-demand is -1.5, and the elasticity of demand for each firm is -6.) But no matter how the firms compete, the elasticity of demand for each firm could never become smaller in magmtude than -1.5.

The demand for oil is fairly inelastic (at least in the short run), which is why OPEC could raise oil prices far above marginal production cost during the 1970s and early 1980s. The demands for such commodities as coffee, cocoa, tin, and copper are much more elastic, which is why attempts by producers to cartelize those 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 hence its monopoly power, is the number of firms in the 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" (i.e., firms that have a significant share of the market). For example, if only two large firms account for 90 percent of sales in a mar-

ket, 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 the market is highly *concentrated*[9]

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 would prefer that no new firms enter the market. 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.[10] 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 market 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 the 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

How competing firms interact is also an important-and sometimes the most important-determinant or 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 would probably drive prices down to nearly competitive levels. Each firm, will be afraid to raise its price for fear of being undercut and losing its market share, and thus it will have little or no 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. Raising prices in concert rather than individually is more likely to be profitable, so 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 equal, monopoly power is smaller when firms compete aggressively and is larger when they cooperate.

[9] A statistic called the *concentration ratio,* which measures the fraction 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.

[10] In the United Stares, patents last for 17 years.

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. (This is the case with oil, which is why OPEC had considerable short-run but 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, while monopoly power 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. Does monopoly power make consumers and producers in the aggregate 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.[11] (We assume that the competitive market and the monopolist have the same cost curves.) Figure 10.9 shows the average and marginal revenue curves arid 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 will buy at price P_c also lose surplus, of 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 B + C. This is *the deadweight loss from monopoly power.* Even if the monopolist's

[11] If 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.

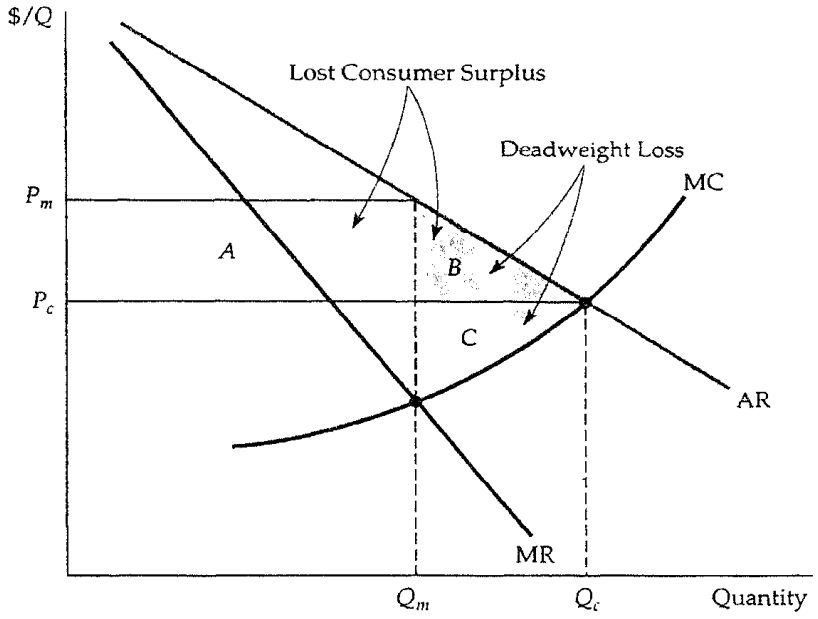

FIGURE 10.9 Deadweight Loss from Monopoly Power. The shaded rectangle and triangles show changes in consumer and producer surplus when moving from competitive price and quantity, P_c and Q_c, to a monopolists price and quantity, P_m and Q_m. Because of the higher price, consumers lose $A + B$ and producer gains A - C. The deadweight loss is $-B - C$.

profits were taxed away and redistributed to the consumers of its products, there would be an inefficiency because output would be lower than under competition. The deadweight loss is the social cost of this inefficiency.

There may be an additional social cost of monopoly power that goes beyond the deadweight loss in triangles B and C. The firm may spend large amounts of money in a socially unproductive way to acquire, maintain, or exercise its monopoly power. This might involve advertising, lobbying, and legal efforts to avoid government regulation or antitrust scrutiny. Or it might mean installing but not utilizing extra productive capacity to convince potential competitors that they will be unable to sell enough to make entry worthwhile. Roughly speaking, the economic incentive to incur these costs should bear a direct relation to the gains to the firm from having 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.

Price Regulation

Because of its social cost, antitrust laws prevent firms from accumulating excessive amounts of monopoly power. We will say more about the antitrust laws

at the end of [he chapter. Here, we examine another means by which society can limit monopoly power-price regulation.

We saw in Chapter 9 thai 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 10.10 illustrates price regulation. P_m and Q_m are the price and quantity that result without regulation. Now suppose the price is regulated to be no higher than P_1. Since 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 curve because at these output levels the firm will charge less than P_1, and so it would be unaffected by the regulation.

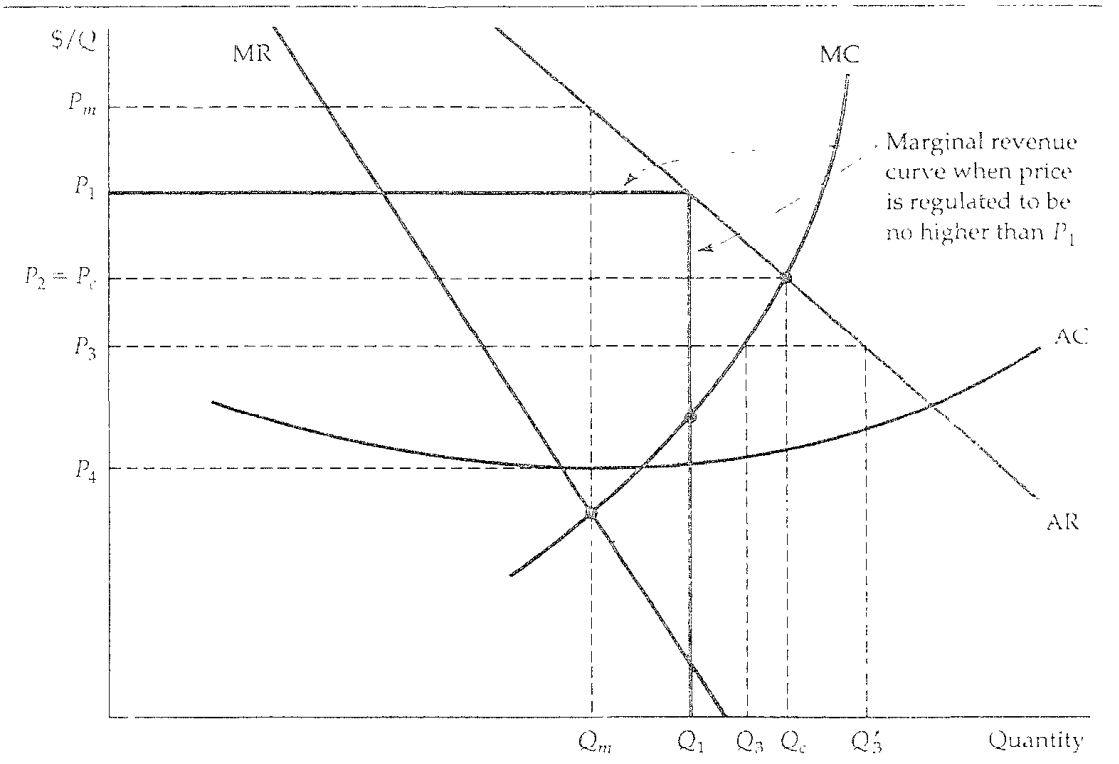

FIGURE 10.10 Price Regulation. If left alone, a monopolist produces Q_m and charges P_m. When the government imposes a price ceiling of P_1 the firm's average and marginal revenue are constant and equal to P_1 for output levels up to Q_1. For larger output levels, the original average and marginal revenue curves apply. The new marginal revenue curve is therefore the gray-shaded 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.

The firm's new marginal revenue curve corresponds to its new average revenue curve, and is shown by the gray-shaded line in the figure. For output levels up to Q_1, marginal revenue equals average revenue. For output levels greater than Q_1, the new marginal revenue curve is identical to the original curve. The firm will produce quantity Q_1 because that is where its marginal revenue curve intersects its marginal cost curve. You can verify that at price PI 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, and 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 is equivalent to imposing a price ceiling on a competitive industry. A shortage develops, (Q'_3 - Q_3), as well as a 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.

Price regulation is most often practiced for *natural monopolies,* such as local utility companies. Figure 10.11 illustrates natural monopoly. Note that average

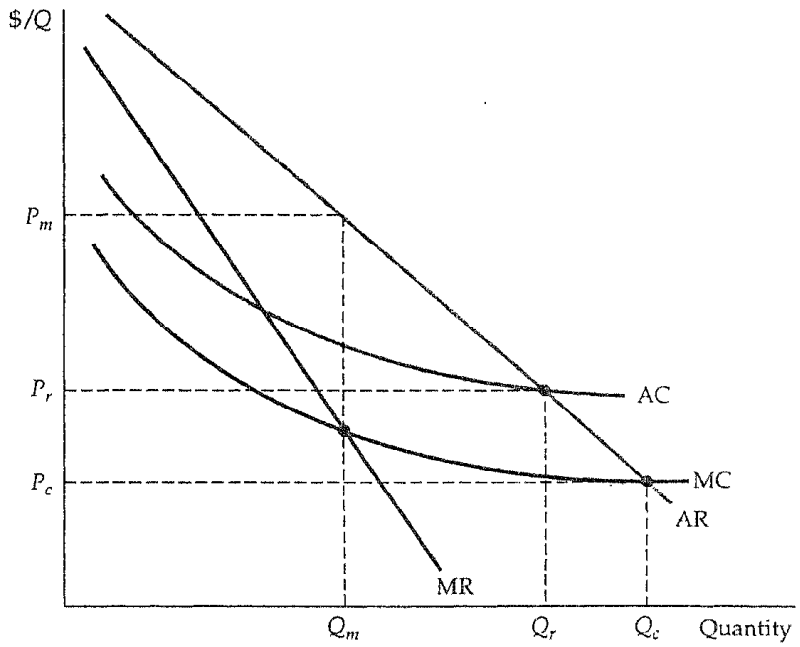

FIGURE 10.11. Regulating the Price of a.Natural Monopoly. A firm is a natural monopoly because it has economies of scale (declining average and marginal costs) over its entire output range. If price were regulated to be P_c, the firm would lose money and go out of business. Setting the price at P_r yields the largest possible output consistent with the firm's remaining in business; excess profit is zero.

cost is declining everywhere, so marginal cost is always below average cost. Unregulated, the firm would produce Q_m at P_m. Ideally, the regulatory agency would like to push the firm's price down to the competitive level P_c, but then the firm could not meet its average cost and would go out of business. The best alternative is therefore to set the price at P_r, where average cost and average revenue intersect. Then the firm earns no monopoly profit, and output is as large as it can be without driving the firm out of business.

Regulation in Practice

Recall that the competitive price (P_c in Figure 10.10) is found where the firm's marginal cost and average revenue (demand) curves intersect. Likewise, for a natural monopoly, the minimum feasible price (P_r in Figure 10.11) is found where 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 usually 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 is called *rate-of-return regulation:* The maximum price allowed is based on the (expected) rate of return that the firm will earn.[12]

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, the firm's undepreciated capital stock is difficult to value. Second, a "fair" rate of return must be based on the firm's actual cost of capital, but that cost in turn depends on the behavior of the regulatory agency (and on investors' perceptions of what future allowed rates of return will be).

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, as well as 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 that are usually required to change the regulated price.

In the 1950s and 1960s, regulatory lag worked to the advantage of regulated firms. During those decades costs were typically falling (usually as a result of scale economies achieved as firms grew), so regulatory lag allowed these firms, at least for a while, to enjoy actual rates of return greater than those ultimately deemed "fair" at the end of regulatory proceedings. Beginning in the 1970s, however, the situation changed, and regulatory lag worked to the detriment of regulated firms. For example, when oil prices rose sharply, electric utilities

[12]Regulatory agencies typically use a formula like the following to determine price:

$$P = \text{AVC} + (D + T + sK)/Q,$$

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.

needed to raise their prices. Regulatory lag caused many of them to earn rates of return well below the "fair" rates they had been earning earlier.

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.

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 the 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.

Recall from Chapter 4 that a person's demand curve measures marginal value, or marginal utility, as a function of the quantity purchased. Therefore, your *marginal value* schedule is your *demand* curve for the good. But your marginal cost of buying additional units of the good depends on whether you are a competitive buyer or a buyer with monopsony power.

Suppose you are a competitive buyer, which means that you have no influence over the price of the good. Then 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 10.12a illustrates this. In that figure 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 10.12a 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. So 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 10.12b shows how a perfectly competitive seller decides how much to

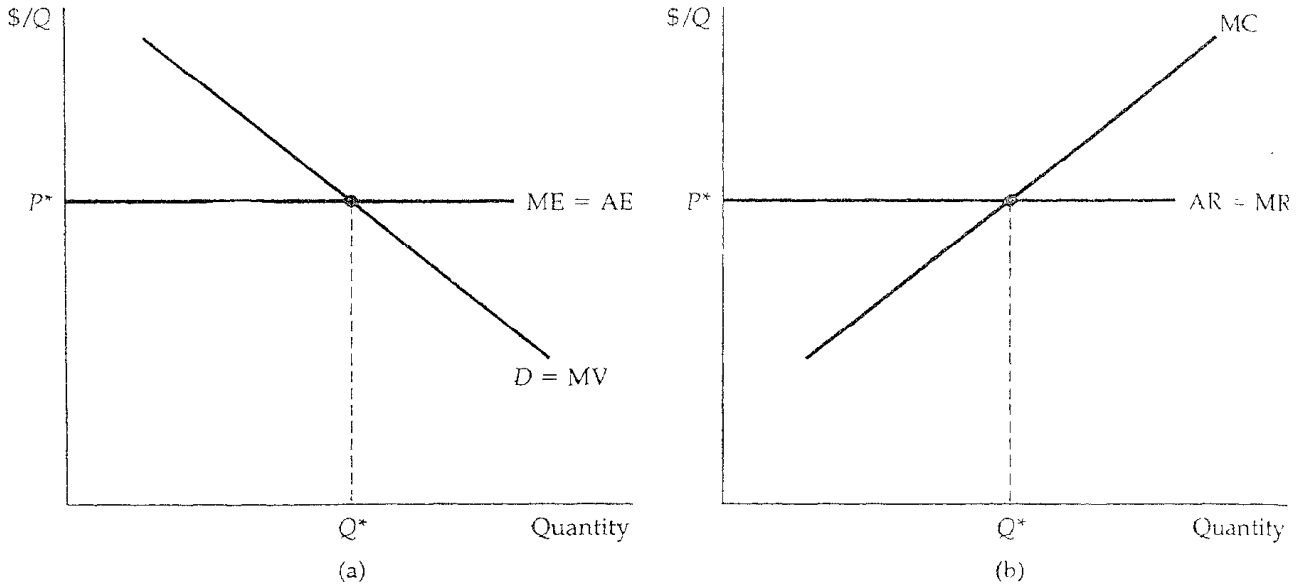

FIGURE 10.12 Competitive Buyer Compared to Competitive Seller. The competitive buyer in (a) takes market price P^* as given. Therefore, marginal expenditure and average expenditure are constant and equal, and the quantity purchased is found by equating price to marginal value (demand). The competitive seller in (b) also takes price as given. Marginal revenue and average revenue are constant and equal, and quantity sold is found by equating price to marginal cost.

produce and sell. Since 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. You again 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.

To determine how much to buy, set the marginal value from the last unit purchased equal to the marginal expenditure on that unit.[13] But note 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 num-

[13] Mathematically, 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.

ber of units you buy. In other words, the supply curve is the *average expenditure* curve. And since this average expenditure curve is upward sloping, the marginal expenditure curve must lie above it because the decision to buy an extra unit raises the price that must be paid for *all* units, not just the extra one.[14]

Figure 10.13 illustrates this. The optimal quantity for the monopsonist to buy, Q_m* is found at the intersection of the demand and marginal expenditure curves. And 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 Pc.

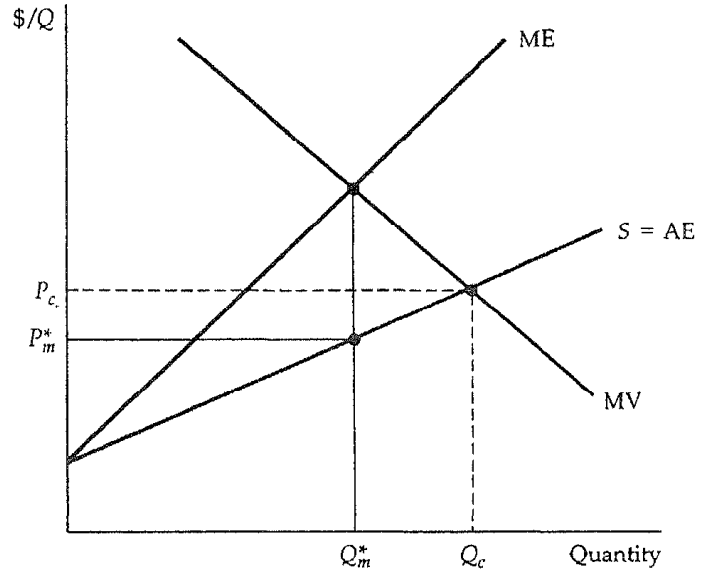

FIGURE 10.13 Monopsonist Buyer. The market supply curve is the monopsonist's average expenditure curve AE. Average expenditure is rising, so marginal expenditure lies above it. The monopsonist purchases quantity Q_m* where marginal expenditure and marginal value (demand) intersect. The price paid per 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.

[14] To 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

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

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

Monopsony and Monopoly Compared

Monopsony is easier to understand if you compare it with monopoly Figures 10.14a and 10.14b 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 a price P^* that is higher than the competitive price P_C..

The monopsony situation is exactly analogous. As Figure 10.14b illustrates, the monopsonist can purchase a good *at a price below its marginal value* because the supply, or average expenditure curve, it faces is upward sloping, so that 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 a price P^* that is lower than the competitive price P_C.

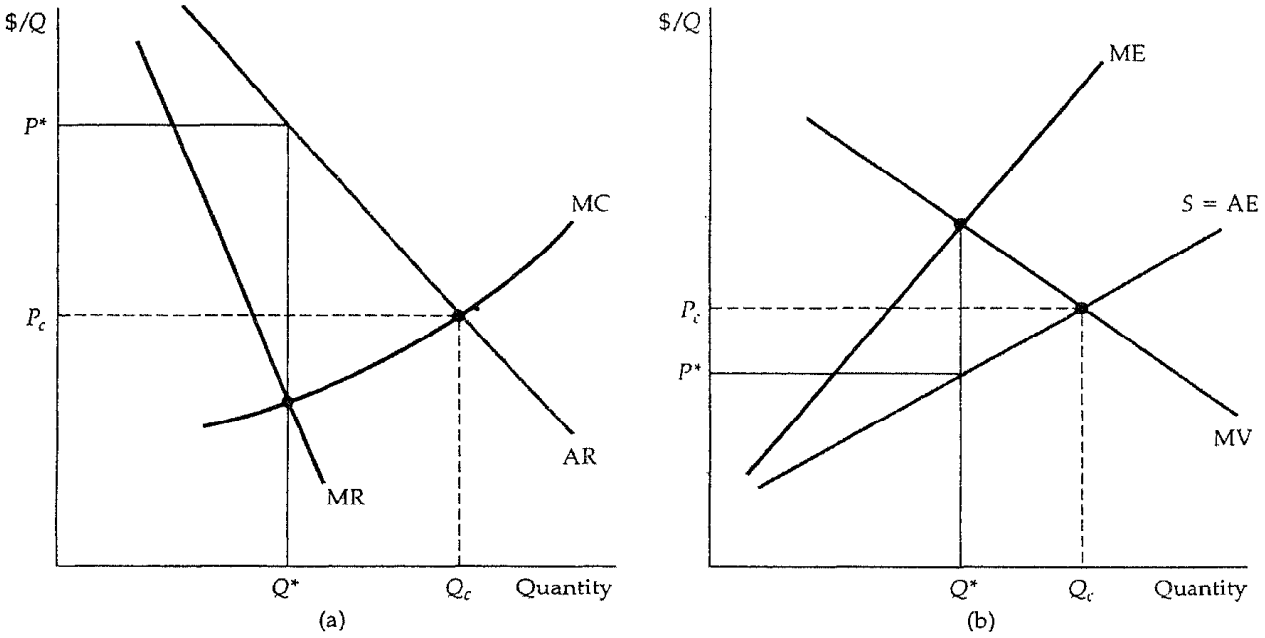

FIGURE 10.14 Monopoly and Monopsony. These diagrams show the dose analogy between monopoly and monopsony (a) The monopolist produces where marginal revenue intersects marginal cost. Average revenue .exceeds marginal revenue, so that price exceeds marginal cost. (b) The monopsonist purchases up to the point where marginal expenditure intersects marginal value. Marginal expenditure exceeds average expenditure,so that marginal value exceeds price.

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 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, but a buyer with monopsony power can purchase the 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.[15] If supply is very elastic (E5 is

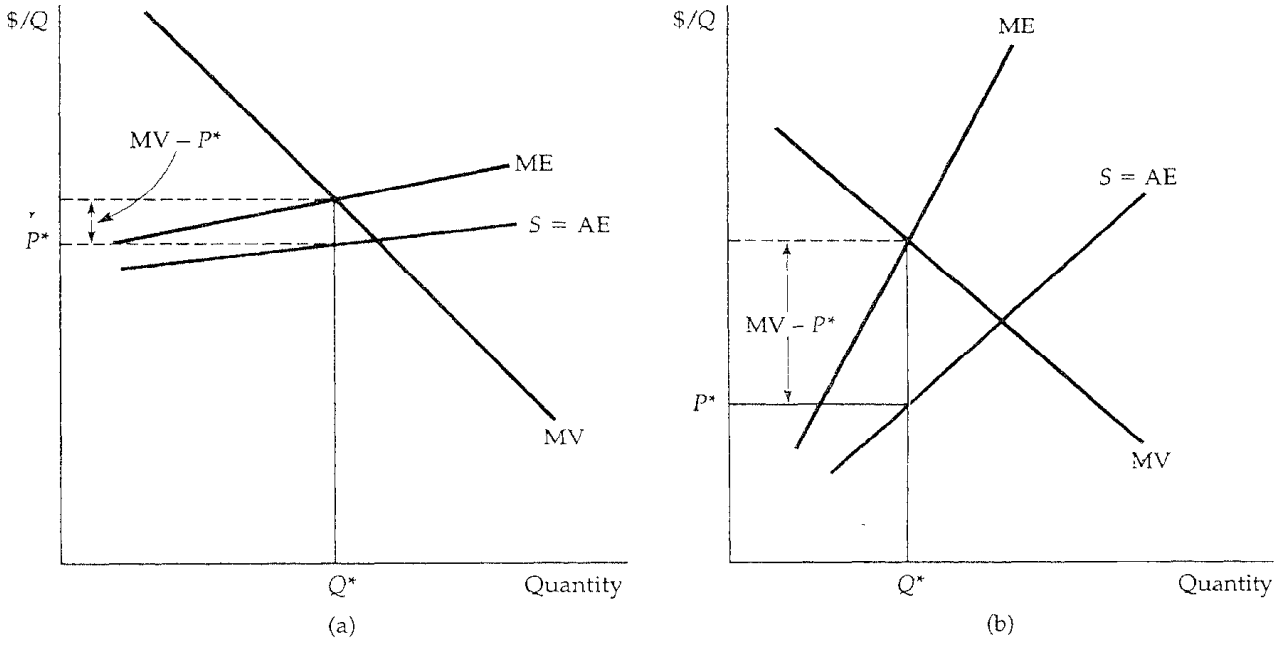

FIGURE 10.15 Elastic Versus Inelastic Supply, and Monopsony Power. Monopsony power depends on the elasticity of supply. When supply is elastic, as in (a), marginal expenditure and average expenditure do not differ by much, so price is close to what it would be in a competitive market The opposite is true when supply is inelastic, as in (b).

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

large), the markdown will be small, and the buyer has little monopsony power. If supply is very inelastic, the markdown will be large/ and the buyer has considerable monopsony power. Figures 10.15a and 10.15b illustrate this.

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 how those sellers interact. Monopsony power depends on three similar things: the elasticity of market supply, the number of buyers in the market, and how those buyers interact.

First consider the *elasticity of market supply.* A monppsonist benefits because it faces an upward-sloping supply curve, so that marginal expenditure exceeds average expenditure. The less elastic the supply curve, the greater is the difference between marginal expenditure and average expenditure, and the more monopsony power the buyer has. If only one buyer is in the market-a pure monopsonis-its monopsony power is completely detemiined 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.

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, and the market is almost completely competitive. The potential for monopsony power arises when the number of buyers is limited.

Finally, monopsony power is determined by the *interaction among buyers.* 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 thus they will 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 consumer and producer surplus that results from a competitive market to the surplus that results when a monopsonist is the sole buyer. Figure 10.16 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, so 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*. The buyer gains the surplus given by rectangle *A* by buying at a lower price. 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

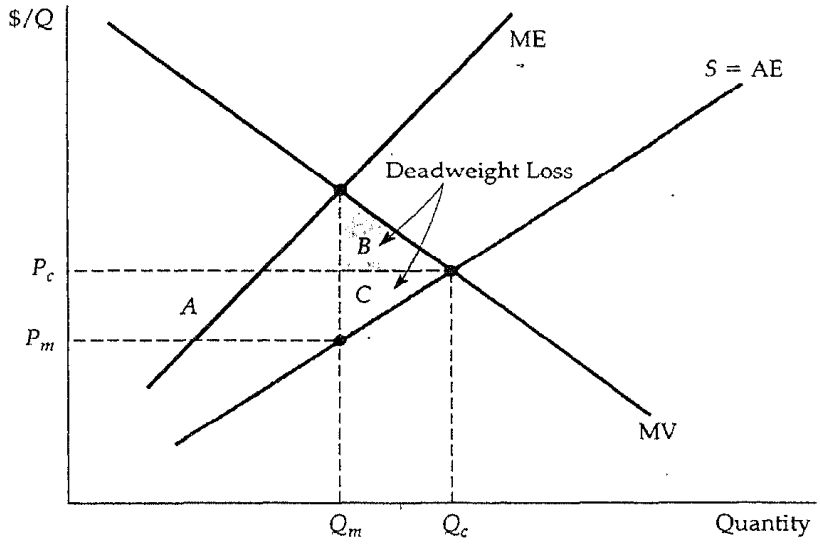

FIGURE 10.16 Deadweight Loss from Monopsony Power. The shaded rectangle and triangles show changes in consumer and producer surplus when moving from competitive price and quantity, P_c and Q_c, to monopsonist's price and quantity, P_m and Q_m. Because both price and quantity are lower, there is an increase 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.

lower than under competition. The deadweight loss is the social cost of this inefficiency.

Bilateral Monopoly

What happens when a monopolist meets a monopsonist? Ifs 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 what the price and quantity will be. 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 verse. This does not mean that the market will end up looking perfectly competitive; monopoly power might be large, for example, and monopsony power small, so that 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 10.3 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 other industries the price-cost 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.[16] 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

[16] The study was by Steven H. Lustgarten, "The Impact of Buyer Concentration in Manufacturing Industries," *Review of Economics and Statistics* 57 (May 1975): 125-132.

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 orders by buyers.

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 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 where hundreds of buyers account for the sales.

A good example of monopsony power in manufacturing is the market for automobile parts and components, such as brakes and radiators. There are only three major car producers in the United States. Each 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 GM, Ford, and Chrysler in an excellent bargaining position with respect to their suppliers. Each supplier must compete for sales against five or ten other suppliers, but each can sell to at most three 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 the quality of its products and its ability to meet tight delivery schedules. Suppliers are also often required to respond to changes in volume, as auto sales and hence 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.[17]

10.7 *Limiting Market Power: The Antitrust Laws*

We have seen that market power-whether of sellers or buyers-harms potential purchasers who could have bought at competitive prices, and this 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, the firm's excess profits could be taxed away

[17] For a detailed discussion of the market for automobile components, see Michael E. Porter, "Note on Supplying the Automobile Industry," Harvard Business School Case No. 9-378-219, July 1981.

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. So in addition to the deadweight loss, excessive market power can lead to a socially objectionable transfer of money.

How, then, can society prevent market power from becoming excessive? 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. In the United States, this is done via the antitrust laws.

The primary objective of the antitrust laws is to promote a competitive economy by prohibiting actions that restrain, or are likely to restrain, competition, and by restricting the forms of market structure that are allowable.

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 to restrict their outputs and "fix" price above the competitive level. But *implicit* collusion in the form of *parallel pricing* can also be construed as violating the law. Firm *A* and Firm *B* need not meet or talk on the telephone to violate the Sherman Act; the publication of pricing information that leads to an implicit understanding can suffice.[18]

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 Clayton Act makes it unlawful to require the buyer or lessor of a good not to buy from a competitor. And it 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."

The antitrust laws also limit the activities of firms that have legally obtained monopoly power. For example, the Clayton Act, as amended by the Robinson-

[18] The 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.

Patman Act (1936), makes it illegal to discriminate by charging buyers of essentially the same product different prices. (As we will see in the next chapter, price discrimination is a common practice. It becomes the target of antitrust action when monopoly power is substantial.)

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 Clay ton 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 powers that are very broad and reach further than other antitrust laws.

The antitrust laws are actually phrased vaguely in terms of what is and what is not allowed. The laws 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 is important because it is difficult to know in advance what might be an impediment to competition, and this ambiguity creates a need for common law (i.e., courts interpreting statutes) and supplemental provisions and rulings (e.g., by the FTC and the Justice Department).

Enforcement of the Antitrust Laws

The antitrust laws are enforced in three ways. The first is through the Antitrust Division of the Department of Justice. As an arm of the executive branch, its enforcement policies closely reflect the view of whatever administration is in power. As the result of an external complaint or an internal study, the department can decide to 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.

The second means of enforcement is 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 it can decide to seek a formal commission order, requiring compliance.

The last and the most common means of enforcement is via *private proceedings.* Individuals or companies can sue for *treble (threefold) damages* inflicted on their business or property. The possibility of having to pay treble damages can be a strong deterrent to would-be violators of the laws. Individuals or companies can also ask the courts for an injunction to force a wrongdoer to cease anticompetitive actions.

The U.S. antitrust laws are more stringent and far-reaching than those of most other countries. Some people have argued that the laws have prevented American industry from competing effectively in international markets. The laws certainly constrain American business, and they may at times have put American firms at a disadvantage in world markets. But this must be weighed against their benefits. The laws have been crucial for maintaining competition, and competition is essential for economic efficiency, innovation, and growth.

EXAMPLE 10.4 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 chief executive officer of American Airlines, made a phone call to Howard Putnam, president and chief executive of Braniff Airways. To Mr. Crandall's later surprise, the call had been taped. It went like this:[19]

Mr. 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.

Mr. Putnam: Well . . .

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

Mr. *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.

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

Mr. *Putnam:* Do you have a suggestion for me?

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

Mr. *Putnam:* Robert, we . . .

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

Mr. *Putnam:* We can't talk about pricing!

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

Mr. Crandall was wrong. Corporate executives cannot talk about anything they want. Talking about prices and agreeing to fix them is a clear violation of Sectiori 1 of the Sherman Act. Mr. Putnam must have known this because he

[19] According to the *New York Times,* Feb. 24, 1983.

promptly rejected Mr. Crandall's suggestion. After learning about the call, the Justice Department filed a suit accusing Mr. Crandall of violating the antitrust laws by proposing to fix prices.

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

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, and we measure the amount of monopoly power by the extent to which price exceeds marginal cost. When buyers can obtain a price that is below their marginal value of the good, we say they have monopsony power, and we measure the amount of monopsony power by the extent to which marginal value exceeds price.
3. Monopoly power is determined in part by the number of firms competing in the market. If there is only one firm-a pure monopoly-monopoly power depends entirely on the elasticity of market demand. The less elastic demand is, 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 the market. If there is only one buyer-a pure monopsony-monopsony power depends on the elasticity of market supply The less elastic supply is, the more monopsony power the buyer will have. When there are several buyers, monopsony power also depends on how aggressively the buyers compete for supplies.
5. Market power can impose costs on society. Monopoly and monopsony power both cause production to be below the competitive level, so that there is a deadweight loss of consumer and producer surplus.
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. Suppose a monopolist was producing at a point where its marginal cost exceeded its marginal revenue. How should it adjust its output level to increase its profit?

2. We write the percentage markup of prices 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 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 sources of monopoly power? Give an example of each.

6. What factors determine how much 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 how much 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 the major provisions of the 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 is one of the largest producers of farm tractors in the world. They hire you to advise them on their 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 their problem? Explain why these facts are important.

3. A firm faces the following average revenue (demand) curve:

$$P = 100 - 0.01Q$$

where Q is weekly production and P is price, measured in cents per unit. The firm's cost function is given by $C = 50Q + 30{,}000$. Assuming the firm maximizes profits,

a. What is the level of production, price, and total profit per week?

b. The government decides to levy a tax of 10 cents per unit on this product. What will the new level of production, price, and profit be as a result?

4. The table below shows the demand curve facing a monopolist who produces at a constant marginal cost of $10:

Price	Quantity
27	0
24	2
21	4
18	6
15	8
12	10
9	12
6	14
3	16
0	18

a. Calculate the firm's marginal revenue curve.
b. What are the firm's profit-maximizing output and price? What is the firm's 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?

5. 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 labor costs increase in Factory #1 but not in Factory #2. How should the firm adjust (i.e., raise, lower, or leave unchanged): Output in Factory #1? Output in Factory #2? Total output? Price?

6. 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 the demand for the product is $P = 20 - 3(Q_1 + Q_2)$. How much should the firm plan to produce in each plant, and at what price should it plan to sell the product?

7. One of the more important antitrust cases of this 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 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?

8. 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 arid marginal cost curves. What are the monopolist's profit-maximizing price and quantity, and 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?

9. 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.

10. 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 $W = 1000 + 75n$.

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

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

***11.** Dayna's Doorstops, Inc. (DD), is a monopolist in the doorstop industry. Its cost is $C = 100 - 5Q + Q_2$, and demand is $P = 55 - 2Q$.

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

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

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

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

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

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

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

a. 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 the regulators want to make sure that LWE doesn't lose money, what is the lowest price they can impose? Calculate output, consumer surplus, and profit in that case. 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 you calculated in part (a). What fixed amount would each household have to pay for Kristina's plan to work? Why are you sure that no household will choose instead to refuse the payment and go without electricity?

***13.** 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.

a. What are its profit-maximizing price and quantity? What is the resulting profit?

b. Suppose the government regulates the price to be no greater than $4 per unit. How much will the monopolist produce, and what will its profit be?

c. Suppose the government wants to. set a ceiling price that induces the monopolist to produce the largest possible output. What price will do this?