CHAPTER 10

Monopoly

Is Microsoft a monopoly? Let's start by asking what the word means. Etymology suggests (and popular usage affirms) that a "monopoly" is a *single seller,* the only firm in its industry. Well then, is Microsoft a *single seller?* Obviously, Microsoft is the only firm that sells Windows. Equally obviously, Microsoft is *not* the only firm that sells operating systems. So whether Microsoft is a single seller depends on how narrowly you define the market.

Is Coca-Cola a single seller? It's the only firm that sells Coke but it's not the only firm that sells cola drinks. You might answer the "single seller" question one way if you think that Coke and Pepsi are basically identical, and quite another way if you're convinced you can always tell the difference.

We would prefer to avoid having to make such difficult judgments, so we'll use a different definition. We'll say that a firm has **monopoly power** (or **market power**) if it faces a downward-sloping demand curve for its product; in other words, a firm has monopoly power if it is not perfectly competitive. We will use the word *monopoly* informally to refer to any firm with market power. Single sellers are therefore a good example to keep in mind, but not the only examples.

Market power or monopoly power

The ability of a firm to affect market prices through its actions. A firm has monopoly power if and only if it faces a downward-sloping demand curve.

By that definition, Microsoft is surely a monopoly; the demand curve for Windows slopes downward. In other words, if Microsoft wants to increase the sales of Windows, it has to lower the price. Everyone who's willing to buy Windows at the current price has already bought it. Your neighborhood convenience store probably also has some degree of monopoly power: to draw more customers, it must lower its prices. This contrasts with the competitive wheat farmer who can triple his output and still sell it all at the going market price.

How do monopolies behave, and is monopoly power ever a good thing? Those are the questions we will address in this chapter. We'll learn how monopolists set prices and quantities, and we'll study the welfare consequences of those choices. In the second section, we'll study the sources of monopoly power, which will lead to a deeper welfare analysis. Finally, in the third section, we will learn about a variety of profitable pricing strategies that are available to a monopolist but not viable under perfect competition.

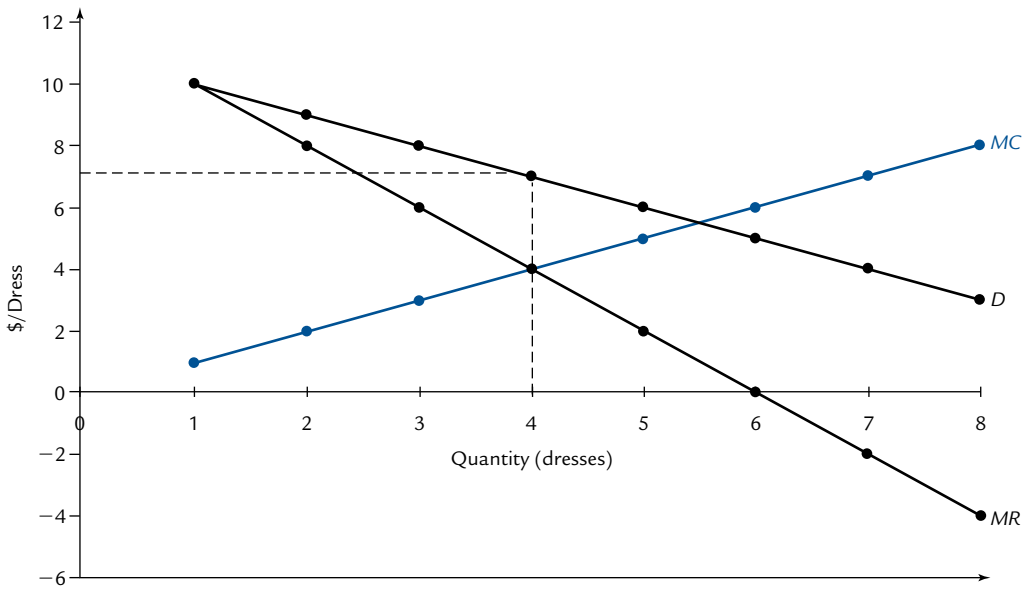
10.1 Price and Output under Monopoly

In this section, we will learn how a monopolist chooses price and quantity and will examine the welfare consequences of these choices.

Monopoly Pricing

The Tailor Dress Company, which we first met in Exhibit 5.3, is a monopolist. The demand curve for its product, displayed in Exhibit 10.1, is downward sloping. The exhibit also displays Tailor's marginal revenue curve (which can be computed from the demand curve) and its marginal cost curve.

EXHIBIT **10.1** **Monopoly Price and Output**



Demand Curve

Quantity of dresses	Price	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost
0					
1	$10/dress	$10	$10/dress	3	$1/dress
2	9	18	8	5	2
3	8	24	6	8	3
4	7	28	4	12	4
5	6	30	2	17	5
6	5	30	0	23	6
7	4	28	−2	30	7
8	3	24	−4	38	8

The Tailor Dress Company produces 4 dresses (the quantity at which marginal cost equals marginal revenue) and sells them at a price of $7 apiece. The price is read off the demand curve at a quantity of 4.

Like any firm, Tailor operates at the point where marginal cost equals marginal revenue; that is, it produces 4 dresses. Tailor charges the highest price at which demanders will purchase those dresses; reading from the demand curve at a quantity of 4, we find that price to be $7.

The Monopolist's Marginal Revenue Curve

In Exhibit 10.1 the marginal revenue curve lies everywhere below the demand curve. To understand why, let's compute the marginal revenue when the Tailor Dress Company produces 3 dresses. Suppose the company has already produced 2 dresses, which can be sold for $9 each, yielding a total revenue of $18. When it makes a third dress, two things happen. First, because the price of dresses is now $8, and because Tailor is making 1 more dress, total revenue goes up by $8. Second, the first 2 dresses, which could have been sold for $9 each, can now be sold for only $8 each, reducing total revenue by $2. The marginal revenue derived from the third dress is $\$8 - \$2 = \$6$. The marginal revenue is less than the demand price of $8.

In general, there are two components to a monopolist's marginal revenue: There is the *price* at which he can sell an additional item (an increment to revenue), and the *price reduction* on earlier items that will now have to be sold at a lower price in order to induce demanders to accept the new quantity (a decrement). Combined, these yield a marginal revenue that is less than the demand price.[1]

Exercise 10.1 Compute the two components of marginal revenue at a quantity of 4. Do they add up to the number in the table in Exhibit 10.1?

Notice that a competitive producer faces only the first component of marginal revenue. Because he can sell any quantity at the market price, he does not need to reduce this price when he increases his output. This is why marginal revenue is equal to (demand) price for a competitive producer, although it is always less than that for a monopolist.

Elasticity and Marginal Revenue

Suppose you're a monopolist and you want to sell one more item. How much do you have to lower your price?

The answer depends on the demand curve you're facing. In particular, it depends on the elasticity of that demand curve, which is a concept we met back in Chapter 4. Remember that the elasticity of the demand curve (also called the price elasticity of demand) is denoted by η and given by the formula:

$$\eta = \frac{P \cdot \Delta Q}{Q \cdot \Delta P}$$

where ΔQ and ΔP are the changes in quantity and price. Another way to write this is:

$$\Delta P = \frac{P \cdot \Delta Q}{Q \cdot \eta}$$

[1] If you have had calculus, you may recognize this as an application of the product rule for differentiation. Because Total revenue = Price × Quantity, we can write

$$MR = \frac{dTR}{dQ} = P + Q\,\frac{dP}{dQ}$$

The term dP/dQ, being calculated along the downward-sloping demand curve, is negative.

In this case, we've asked a question about what you have to do to sell just *one more item;* in other words, we're thinking about the case where $\Delta Q = 1$. So our formula simplifies to:

$$\Delta P = \frac{P}{Q \cdot \eta}$$

This is the formula that tells you how much your price must change to move that additional item off your shelf. Note that ΔP should be negative: To sell an extra item, you have to *lower* your price, not *raise* it! And the right-hand side of the formula confirms that ΔP is indeed negative, just as it should be, because P and Q are both positive but η is negative. We can also write the absolute value of ΔP as:

$$|\Delta P| = \frac{P}{Q \cdot |\eta|}$$

Let's think a little more about the consequences of selling an additional item. We've just seen how much your *price* must change; now let's figure out how much your *revenue* changes.

Your revenue changes for two reasons. First, you're selling another item at the price P. That adds P to your revenue. Second, your price falls by the amount $|\Delta P|$, and this affects all the items you're selling, so your revenue falls by $|\Delta P| \cdot Q$. The net effect is that your revenue changes by the amount:

$$P - |\Delta P| \cdot Q$$

Plugging in our formula for $|\Delta P|$, we can rewrite this as:

$$P - \frac{P}{Q \cdot |\eta|} \cdot Q = P - P \cdot \frac{1}{|\eta|} = P \cdot \left(1 - \frac{1}{|\eta|}\right)$$

That's how much your revenue changes when your quantity increases by 1. In other words, that's your marginal revenue. To summarize, for a monopolist we have:

$$MR = P \cdot \left(1 - \frac{1}{|\eta|}\right)$$

To gain some further insight into this formula, let's recall what we already know about marginal revenue. If you take another look at Exhibit 10.1, you'll see that *MR* is sometimes positive (in this case, for quantities less than 6) and sometimes negative (in this case, for quantities greater than 6). You'll also see that *at the monopoly quantity* (which in this case is 4), *MR* is positive. That's because at the monopoly quantity, $MR = MC$, and *MC* is always positive.

Now the formula tells us that in order for *MR* to be positive, we must have $|\eta| > 1$. And we've just agreed that at the monopoly quantity, *MR* is positive. So we can conclude that at the monopoly quantity, $|\eta| > 1$.

When $|\eta| > 1$ we say that *the demand curve is elastic,* and when $|\eta| < 1$ we say that *the demand curve is inelastic.* So our conclusion can be reworded:

A monopolist always operates on the elastic portion of the demand curve.

Measuring Monopoly Power

In competition, price equals marginal cost. Under monopoly, price can exceed marginal cost; the difference is sometimes called the firm's *markup.* In other words, the

markup is given by the formula $P - MC$. Sometimes we express the markup as a fraction of the price; the resulting measure

$$P - \frac{MC}{P}$$

is called the firm's **Lerner Index.** For a competitive firm, the Lerner Index is zero. For a monopolist, it should be positive.

Lerner Index

The excess of price over marginal cost, expressed as a fraction of the price.

We have already shown that $MR = P\left(1 - \left(\frac{1}{|\eta|}\right)\right)$, and theory tells us that firms operate where $MC = MR$. So in the formula for the Lerner Index, we can replace MC with $P\left(1\left(\frac{1}{|\eta|}\right)\right)$ to get

$$\text{Lerner Index} = \frac{P - MC}{P} = \frac{P - P\left(1 - \frac{1}{|\eta|}\right)}{P} = \frac{1}{|\eta|}$$

In other words, the markup (as a fraction of the price) is equal to one over the elasticity of demand; therefore, the less elastic the demand curve, the higher the markup.

Regulatory agencies use the Lerner Index as a measure of monopoly power. In the rubber industry, the index is a quite small .049; in the retail gasoline industry, it is .100; in the soft drink industry it is .600 (.640 for Coca-Cola and .560 for Pepsi-Cola). In other words, Coca-Cola sells for about 64% more than the marginal cost of production, while Pepsi-Cola sells for about 56% more than the cost of production. Perhaps surprisingly, the Lerner Index in the electric power industry fluctuates around .05, which means that electricity is pretty close to competitively priced.

The Price of Gasoline, The Price of Oranges, and Monopoly Power

Back in 1999, Middle Eastern oil producers nearly tripled the price of crude oil. You might think this was bad for American oil companies who buy crude oil and then convert it to gasoline. But by the summer of the year 2000, gas prices had risen so much that oil company profits were actually higher than in previous years.

Around the same time, a frost in Florida destroyed a substantial portion of the orange crop. You might think this was bad for growers who had spent an entire year raising those crops. But the price of oranges rose so much that growers ended up having an unusually profitable year.

Why were oil companies and orange growers able to prosper in the face of apparent disaster? Many news reporters and politicians have said that it's because they were exploiting monopoly power. But economic analysis reveals that exactly the opposite is true: Rising costs can lead to rising profits only in the *absence* of monopoly power. The fact that the gas companies and orange growers did so well in difficult times is proof that they are *not* acting as monopolists.

Here's why: A monopolized industry does not have to wait for a disaster before raising prices. A monopolized oil industry would *already* have raised its prices to the point where additional price increases were no longer profitable. Likewise for the orange growers.

Here's the same argument in more precise terms: A monopolist operates at the point where marginal revenue equals marginal cost. But marginal cost is never negative, so

marginal revenue is never negative. Thus a monopolist always operates at a point where *higher quantities mean more revenue.*

Saying exactly the same thing in reverse, *lower quantities mean less revenue.* So if a monopolist raises his price—thereby lowering his quantity—his revenue must fall. If you see the opposite—a rise in price accompanied by a rise in revenue—you must not be looking at a monopolist.

We can say exactly the same thing in the language of elasticities: We've seen that a monopolist always operates on the elastic part of the demand curve. But because the oil and orange industries were able to raise prices with little reduction in quantity, they must have been on the inelastic parts of their demand curves; they cannot have been controlled by monopolists.

Greedy Recording Studios or Greedy Artists?

The famous recording artist Ellenell has a contract that gives him 20% of all revenue from his recordings. The studio that issues those recordings charges $15 for an Ellenell CD. But Ellenell has denounced his own studio for excessive greed and says he'd like to see the price come down to $10, even though it would cost him money.

That story is fiction, but it's often repeated in fact: Musicians frequently criticize recording studios for overpricing their music out of "greed." Does that mean that musicians care more about their fans than producers do?

Not necessarily. Because the fact is that under standard recording contracts, *any* musician—even one motivated entirely by personal greed—would want to see the price of CDs reduced.

Here's why: Remember that profit is maximized when marginal revenue equals marginal cost. For the record company, the marginal cost of producing another CD is equal to the cost of burning, packaging, and shipping that CD—say about $1. Therefore, the record company chooses a quantity and a price where marginal revenue equals $1 per disk.

For the artist, who receives a percentage royalty (let's say 20%) from each disk sold, that means that marginal revenue is 20¢ per disk. But for the artist, who is not involved with production and shipping, the marginal *cost* per disk is zero. That means that from the artist's point of view, marginal revenue exceeds marginal cost, so profits are not being maximized. To maximize profits, quantity must be increased (and hence price must be decreased) until marginal revenue equals zero.

Thus a purely profit-maximizing entertainer will always lobby the producer to lower the price of CDs. Of course, if the entertainer can mask his self-interested motivation as a concern for the welfare of his fans, he might very well be tempted to do that.

The Monopolist Has No Supply Curve

Where is the monopolist's supply curve? Points on the supply curve answer questions such as: "How much would you produce at a going market price of $1?" and "How much would you produce at a going market price of $2?" and so on. These are questions that a monopolist is never asked, because he never faces a going market price. The price is a consequence of the monopolist's actions, rather than a datum to which he must react. Therefore, a monopolist has no supply curve; a supply curve presumes the existence of a going market price.

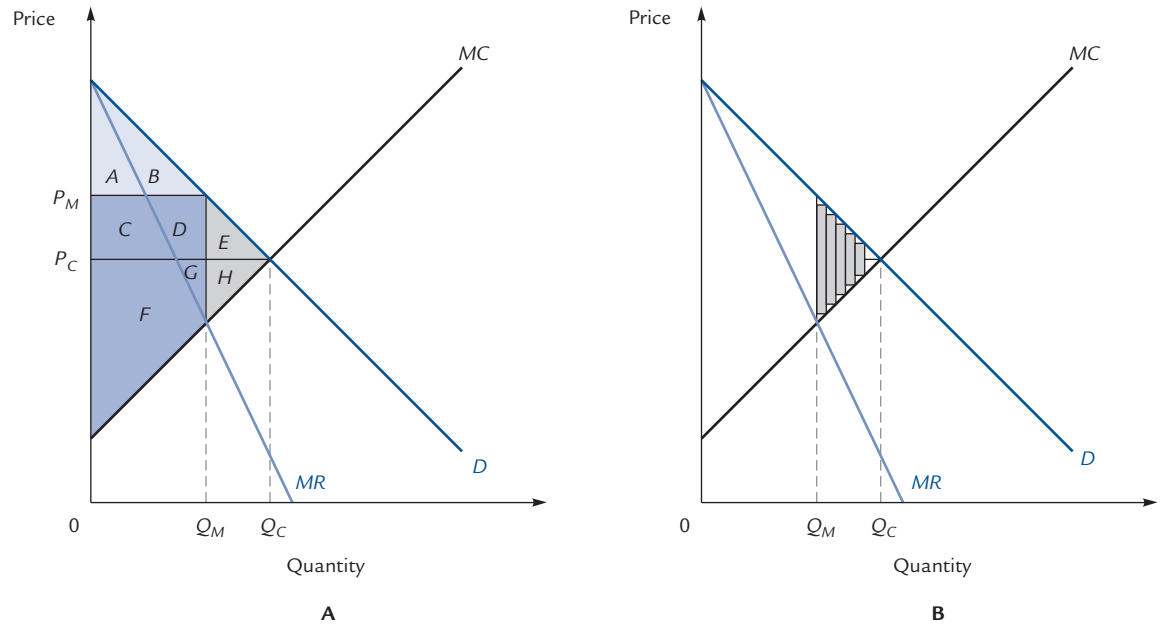
Welfare

Suppose the shoe industry is dominated by a monopoly supplier of the "single seller" breed. Suppose also that a competitive shoe industry would produce with the same (industrywide) marginal cost curve as the monopolist's. Exhibit 10.2 shows the quantities produced by the monopolist (Q_M) and the competitive industry (Q_C) and the prices that they charge. The table shows consumers' and producers' surpluses in each case.

Exercise 10.2 Verify the entries in the table in Exhibit 10.2.

From Exhibit 10.2 it is clear that consumers' surplus is reduced by the existence of the monopoly. It is less obvious, but nonetheless true, that producers' surplus is increased. The monopoly producer's surplus exceeds the competitive producers' sur-

EXHIBIT **10.2** **Monopoly versus Competition**



	Competition	Monopoly
Consumers' Surplus	$A + B + C + D + E$	$A + B$
Producers' Surplus	$F + G + H$	$C + D + F + G$
Social Gain	$A + B + C + D + E + F + G + H$	$A + B + C + D + F + G$
Deadweight Loss	—	$E + H$

The table assumes that a monopoly and a competitive industry would have the same marginal cost curve. The competitive industry produces the equilibrium quantity Q_C, and the monopolist produces its profit-maximizing quantity Q_M. Because marginal value still exceeds marginal cost at Q_M, it would be efficient for additional units to be produced. The social gains from additional units after Q_M are represented by the rectangles in panel B. Because the monopolist does not produce those units, those social gains are sacrificed, giving a deadweight loss of $E + H$.

plus by the amount $C + D - H$, and your first thought might be that it would be necessary to measure areas in order to determine whether this is positive or negative. Recall, however, that the monopolist is choosing the strategy that will benefit him the most. Because the monopolist could choose the competitive output Q_C but prefers the smaller output Q_M instead, we infer that the producer's surplus is higher at Q_M than at Q_C. In other words, $C + D + F + G > F + G + H$.

Exhibit 10.2 also shows a social welfare loss of $E + H$ due to the existence of the monopoly. This is the amount by which the consumers' losses exceed the producer's gains. It is easy to see the reason for this welfare loss: When output is at Q_M, marginal value still exceeds marginal cost. It is socially beneficial to produce another pair of shoes, creating the first rectangle of social gain shown in panel B of the exhibit. From the viewpoint of efficiency, additional pairs of shoes should be produced, as they would be under competition.

When an item's marginal value exceeds its marginal cost, the competitive producer will always choose to provide it, because he can sell the item for more than it will cost him to produce it. However, the monopolist will not always make the same choice. The monopolist must reason as follows: "It is true that I can sell the next item for more than it will cost me to produce it. But it is also true that producing this item will reduce the price at which I can sell all of the items I've already decided to produce. I have to weigh both of these considerations before deciding to proceed." The second consideration is, of course, irrelevant to the competitor, whose actions do not affect the market price.

Monopoly and Public Policy

What can be done to reduce the efficiency loss due to monopoly? Because the inefficiency results from a reduction in output caused by the monopolist's pursuit of high profits, some might argue that the government should tax away the monopolist's ill-gotten gains, say, by imposing an excise tax. However, this "solution" only reduces efficiency still further. The original problem is that production is less than it should be from a social viewpoint, and the effect of an excise tax is to lower production still further. The tax increases the deadweight loss.

Exercise 10.3 Draw the monopolist's demand, marginal revenue, and marginal cost curves both before and after the imposition of an excise tax on his output. Label the areas of deadweight loss both before and after the tax.

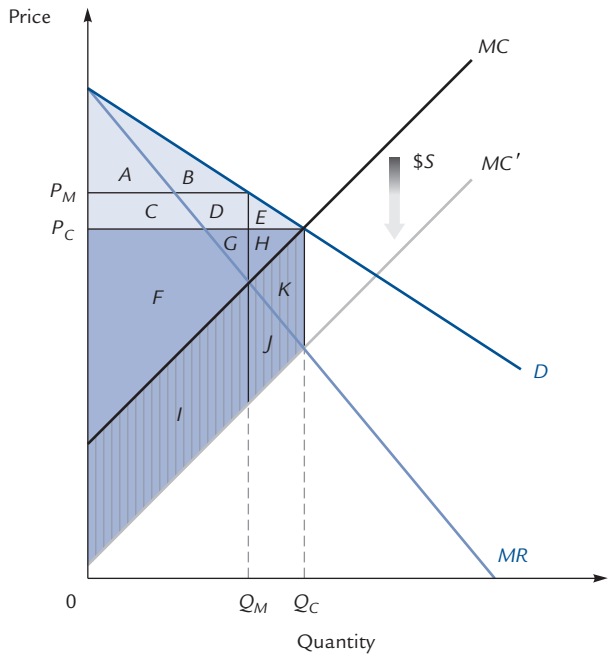
Subsidies

The preceding observation suggests that the real solution might be to give the monopolist a *subsidy* per unit of output.

Exhibit 10.3 shows the effect of an "ideal" subsidy, that is, one of exactly the right size to induce the monopolist to supply the competitive quantity Q_C. We know that this quantity maximizes social gain, so the deadweight loss is reduced to zero.

To see how the gains and losses are distributed over society, notice that the ideally subsidized monopolist produces the same quantity at the same price as does a competitive market. Therefore, the consumers' surplus is the same in either case. The monopolist earns both the competitive producers' surplus and the revenue from the subsidy; the latter, of course, comes from the taxpayers.

EXHIBIT **10.3** **A Subsidized Monopolist**



	Competition	Unsubsidized Monopoly	Subsidized Monopoly
Consumers' Surplus	$A + B + C + D + E$	$A + B$	$A + B + C + D + E$
Producers' Surplus	$F + G + H$	$C + D + F + G$	$F + G + H + I + J + K$
Cost to Taxpayers	—	—	$I + J + K$
Social Gain	$A + B + C + D + E + F + G + H$	$A + B + C + D + F + G$	$A + B + C + D + E + F + G + H$

An unsubsidized monopolist produces the quantity Q_M. The subsidy of $\$S$ per unit of output, which lowers the marginal cost curve to MC', is chosen to be of just the right size so that the monopolist will now produce the competitive quantity Q_C. Because the competitive quantity maximizes social gain, the deadweight loss is eliminated. The table confirms that social gain is the same as it would be under competition.

We can see this distribution in Exhibit 10.3. In the presence of the $\$S$-per-unit subsidy, the monopolist chooses the quantity Q_C and the price P_C. Therefore, the consumers' surplus is $A + B + C + D + E$, just as in competition. To compute the producers' surplus by our usual methods, we would have to draw a horizontal line at the "price received by suppliers," a distance $\$S$ above the price charged in the marketplace. This would clutter the diagram beyond all redemption, so we resort to an alternative method, which was introduced in Exhibit 8.13. According to this method, we calculate using the price charged in the marketplace and the new, lower marginal cost curve. This gives a producers' surplus of $F + G + H + I + J + K$. By elementary geometry, the cost to taxpayers, $\$S \times Q_C$, is represented by the area of the trapezoid $I + J + K$. These calculations are shown in the third column of the table in Exhibit 10.3. The social gain is just what it would be under competition, so the deadweight loss is zero, as we have already argued that it must be.

Of course, this analysis assumes an "ideal" subsidy, which in turn assumes that policymakers are able to discern both the competitive equilibrium quantity and the size of the subsidy needed to call forth that quantity from the monopolist. A more reasonable expectation is that the subsidy will either be too small or too large. If it is too small, it is still certain to be welfare-improving, but perhaps by less than we might hope. If it is too large, it will encourage overproduction. Depending on the size of the subsidy, this could be either less or more detrimental than the underproduction it was designed to replace.

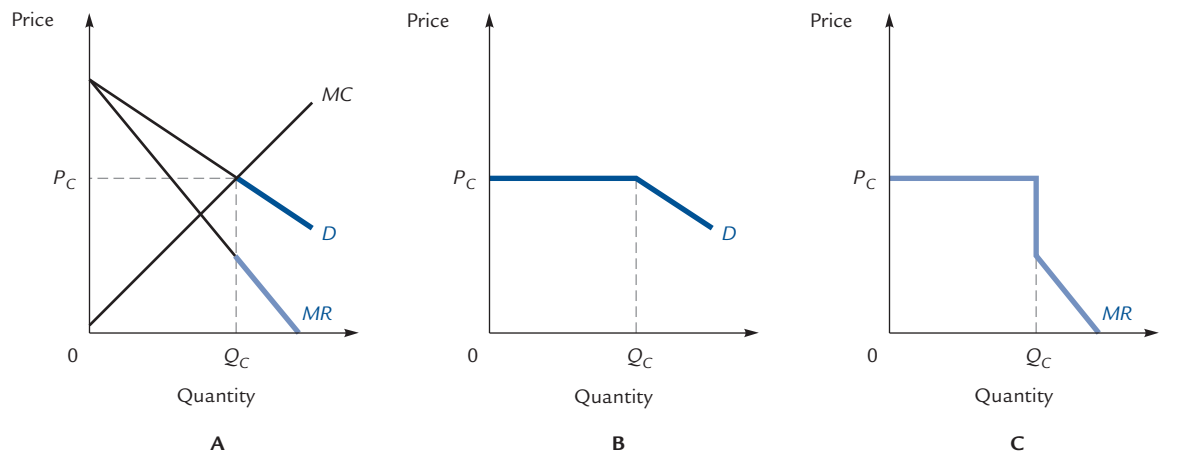
Exercise 10.4 Draw diagrams depicting the effects of subsidies that are smaller or larger than the optimal one. Indicate the areas of deadweight loss in each. Compare these areas with the areas of deadweight loss from an unsubsidized monopoly.

Price Ceilings

From an efficiency standpoint, it is desirable to subsidize a monopolist, although the size of the optimal subsidy may be difficult to determine. From a political viewpoint, it can be difficult to generate support for subsidies to a monopolist who is already perceived as wealthier than he "deserves" to be. There is, however, another approach to the "problem" of monopoly.

Consider a price ceiling imposed on a monopolist at the level of the competitive price. This is shown in panel A of Exhibit 10.4. If the price ceiling is perfectly enforced, the monopolist effectively faces a flat demand curve at the price P_C out to the quantity Q_C. This is because no demander can ever offer a price higher than P_C, so that portion of the demand curve that lies above P_C becomes irrelevant to the monopolist's calculations. The new demand curve is as shown in panel B of Exhibit 10.4; it is flat out to

EXHIBIT **10.4** **A Price Ceiling**



If a monopolist is required by law to charge no more than the competitive price P_C, then it effectively faces the demand and marginal revenue curves shown in panels B and C. It produces at the point Q_C, where marginal cost and marginal revenue are equal.

Q_C and becomes identical with the old demand curve thereafter. The new marginal revenue curve is shown in panel C of the exhibit: In the region where demand is flat at P_C, we always have marginal revenue equal to P_C (just as in the competitive case). In the region of downward-sloping demand, the original marginal revenue curve is still in effect; thus, the new marginal revenue curve jumps downward at the quantity Q_C.

The monopolist produces the quantity where its new marginal revenue curve meets its marginal cost curve, that is, the competitive quantity Q_C (refer to panel A to see this). Consumers' surplus and producers' surplus are what they would be under competition, and there is no deadweight loss.

Exercise 10.5 Give the reasons for the assertions made in the preceding paragraph. In a competitive market, price controls cause social loss due to time spent waiting in line and so on, yet no such social loss takes place in the market pictured in Exhibit 10.4. Why not?

Unfortunately, finding the optimal price ceiling may be no easier for the policymaker than finding the right level of subsidy. In the absence of a competitive market, it is difficult to determine what the competitive price would be. It is therefore possible to set the price ceiling either too high or too low. If it is set too high, its effect will be diminished. Deadweight loss will be reduced but not eliminated altogether. If it is set too low, there will be deadweight loss due to underproduction. If it is set very low, the deadweight loss can be greater than with an unregulated monopoly.

Exercise 10.6 Draw diagrams depicting price ceilings that are higher or lower than the optimal one. Show the areas of deadweight loss and compare them with the deadweight losses in the absence of a price control.

Rate-of-Return Regulation

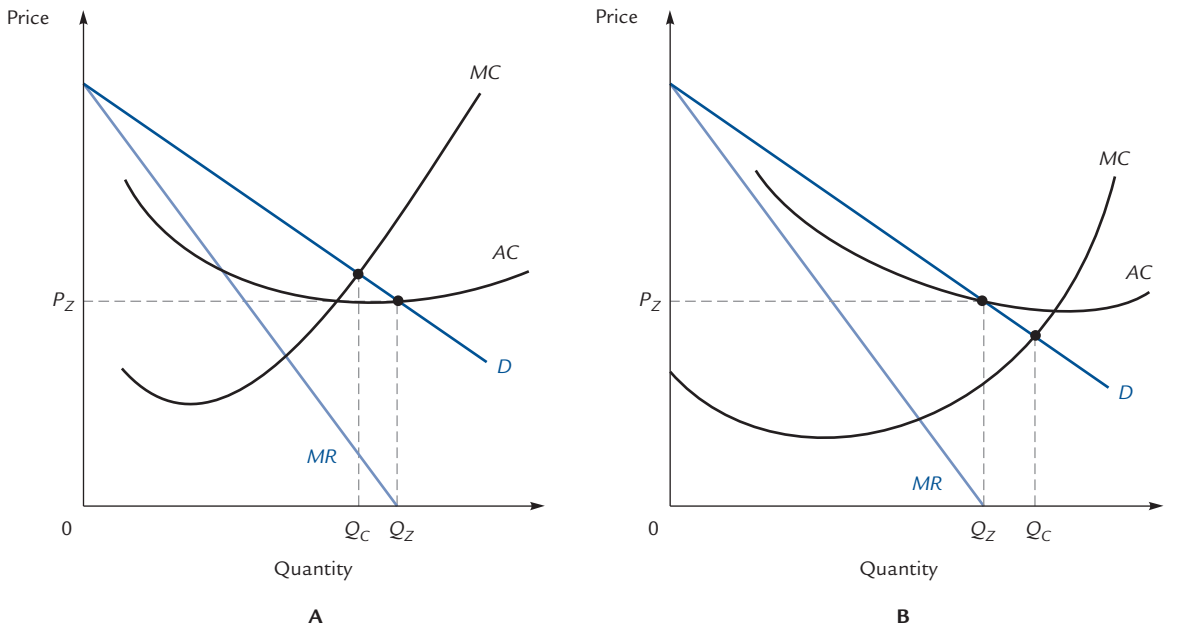
In practice, many monopolists (such as public utility companies) are required to set prices in such a way that they will earn no more than a "normal" rate of return on their capital investment. That is, they must earn no more than they could by investing the same amount of capital in some other industry; they are required to earn zero economic profits.

It is sometimes argued that this policy is desirable because the goal is to make monopolists behave more like competitors, and competitors earn zero profits in long-run equilibrium. The problem with this argument is that it is not the zero-profits aspect of competition that one wishes to reproduce; it is the efficiency aspect. Although efficiency and zero profits are compatible under competition, they are very unlikely to be compatible under monopoly.

Exhibit 10.5 shows two possible configurations of demand, marginal revenue, marginal cost, and average cost curves. In each case the monopolist earns zero profits when it produces the quantity Q_Z and sells at the price P_Z. At this point, price exactly covers average cost. However, in each case the efficient level of output is Q_C, where a competitive industry would produce. In panel A, a monopolist that is required to earn zero profits will produce too much from the viewpoint of efficiency. In panel B, the monopolist will produce too little.

There are additional problems with regulation requiring the monopolist to earn zero profits. One is that such regulation provides the monopolist with no incentive to

EXHIBIT **10.5** **Zero-Profit Regulation of Monopoly**



The two panels show two possible configurations of demand, marginal revenue, marginal cost, and average cost curves for a monopolist. If the monopolist is required by law to earn zero profits, it will produce that quantity Q_Z at which the demand price is equal to average cost. The efficient level of output is Q_C, where marginal cost equals demand. As the two panels show, Q_Z could be either greater or less than Q_C.

seek more efficient methods of production. If a new technology would lower the average cost and if the result of this is that the monopolist must lower its price accordingly, then there is no reason for it to adopt the new technology.

10.2 Sources of Monopoly Power

We turn now to the question of why monopolies arise in the first place. The answers will make it necessary to modify some of our welfare analysis.

Natural Monopoly

Suppose you want to produce a new word processing program. Your fixed costs (the costs of developing the software) are likely to be quite high, but your marginal costs (the costs of copying the software onto disks) will be extremely low. In fact, if the software is distributed over the Internet, your marginal cost might be essentially zero.

In a competitive market, word processing software would sell at marginal cost—that is, it would be almost free. But at that price, all firms earn negative profits, so nobody is willing to enter the industry. Therefore, a competitive market for word processors cannot survive.

By contrast, a monopolist can sell software for substantially more than its marginal cost. Microsoft Word sells for many times the cost of producing an additional copy. Therefore, Microsoft can earn enough to cover its fixed costs and is willing to remain in business.

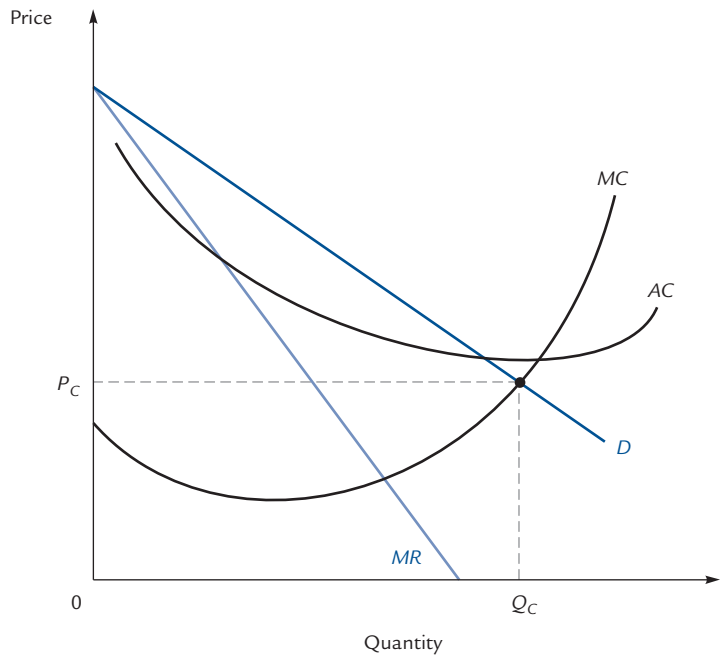
Notice that Microsoft's average cost curve is decreasing. To see why, consider an extreme example: Suppose it costs $1,000 to write the software, and suppose it costs exactly zero to run off a copy. Then if Microsoft sells 1 copy, its average cost is $1,000 per copy; if it sells 2 copies, its average cost is $500 per copy; if it sells 3 copies, its average cost is $333.33 per copy, and so on.

Whenever a firm's average cost curve is decreasing at the point where it crosses market demand, we say that there is a condition of **natural monopoly.** This condition is illustrated in Exhibit 10.6. We have just seen that Microsoft is an example of a natural monopoly. We shall now see that, more generally, under conditions of natural monopoly, a competitive industry cannot survive.

Natural monopoly
An industry in which each firm's average cost curve is decreasing at the point where it crosses market demand.

If the firm in Exhibit 10.6 were forced to set prices and quantities as if the industry were competitive, it would produce the quantity Q_C at the price P_C. However, at this point average cost is greater than the price P_C, so the firm earns negative profits. If firms are forced to price competitively, none will remain in the industry.

EXHIBIT **10.6** **Natural Monopoly**



A natural monopoly occurs when each firm's average cost curve is downward sloping at the point where it crosses industry demand. Because marginal cost crosses average cost at the bottom of the U, marginal cost must cross demand at a point where price is below average cost. Thus, if the firm priced competitively, it would earn negative profits.

In fact, if the industry were competitive, the situation would be even worse than we have just described, because the industry supply curve, being the sum of all of the firms' supply curves, would lie to the right of the marginal cost curve shown in the exhibit. Therefore, the equilibrium price would be even lower than P_C.

It follows that at the competitive price, no firm can cover its costs. A monopoly producer, however, may be able to enter the industry and prosper. The industry can survive only if it is monopolized.

The Welfare Economics of Natural Monopoly

In Exhibit 10.2, we compared the social gain under monopoly with the social gain that would be available if the industry were perfectly competitive. Now we've seen that in the case of a natural monopolist, the comparison is misleading, because if the industry were perfectly competitive, it could never survive. So the first observation is that, realistically, the monopoly outcome might be the best we can hope for.

But not always. There can still be competition, even when the competition is not perfect. You might have noticed that Microsoft, despite having achieved considerable monopoly power, was never the world's only producer of computer software, or even the world's only producer of word processors. What social purpose is served by such competition?

If other firms produce exact clones of Microsoft Word, there's a lot of social waste: Each firm duplicates Microsoft's development costs without doing anything to reduce the (already very low) marginal cost of producing copies. Still, this activity might have some offsetting social benefits, by putting downward pressure on the prices of word processors. As long as the price remains high enough for firms to survive, any price reduction leads to more sales and a higher social gain.

But that's not the only effect of competition in the market for word processors. The fact is that other firms *don't* produce exact clones of Microsoft Word; instead, they're always trying to produce something better—and Microsoft is always trying to stay ahead of them. There might always be monopoly power in the software industry, but firms still compete to capture that monopoly power for themselves—and they do so by upgrading the quality of their products; in other words, they *innovate*.

What is the social value of all the innovation? It's a mixed bag. On the one hand, consumers benefit from better products. On the other hand, a lot of resources get devoted to adding small bells and whistles, and those resources might have been better employed elsewhere.

Take an extreme example: Suppose that by investing $50 million, you could create a word processor just slightly better than those that are currently available. The reward to that effort is enormous, because you'll capture a very large fraction of the market. But the benefit to consumers might be very much less than $50 million, because your product is only slightly better than its competitors. In that case, you will surely invest the $50 million, even though the gains to consumers are minimal—say, $10 million. Thus your innovation creates a net social loss of $40 million.

Patents

Patents are another source of monopoly power with ambiguous welfare consequences. A patent confers a legally protected monopoly for 17 years after the development of a new invention. In the absence of this monopoly, the invention could be copied by others and produced competitively. On the other hand, if there were no patents, the

incentive to invent would be much reduced and many inventions might not come into being in the first place. In deciding on the optimal length of a patent, it is necessary to weigh the losses from monopoly production against the gains from promoting inventive activity.

Keep in mind, though, that there is an optimal quantity of inventive activity, and that it is socially undesirable to grant incentives for people to be inventive past the point where the marginal benefits of inventions exceed the marginal gains from inventors' alternative employment. Another factor often ignored is that patents divert creative individuals *away* from making socially valuable innovations that are not patentable. The inventors of the Macintosh computer received many valuable patents; the inventor of the supermarket received none. If the length of patent protection is increased, society will have more inventions like the Macintosh and fewer like the supermarket; it is very hard to judge the optimal mix.

With all of these uncertainties in mind, you should be somewhat skeptical of attempts to estimate the optimal life of a patent, but such attempts have been made.[2] Although the results necessarily depend on a number of ad hoc assumptions, they tend to suggest that the existing 17-year limit is a reasonable one.

The History of Photography: Patents in the Public Domain

Patents are good because they encourage innovation; patents are bad because they confer monopoly power. Is there a way to get the good without the bad?

Perhaps. When Louis Daguerre invented photography in the eighteenth century, the French government granted him a patent—and then purchased the patent from him and placed it in the public domain. That way Daguerre was rewarded for his invention, but photography still became widely available at a competitive price.

Harvard Professor Michael Kremer has proposed that the same idea could be implemented on a much wider scale. Inventors could be granted patents just as they are today, but the government could make a practice of purchasing each new patent and placing it in the public domain.

The problem is to determine how much the government should pay for a patent. The glib answer is: They should pay what it's worth. But how can they discover what it's worth?

Kremer's idea is to auction off the patent and then have the government step in at the last minute and purchase the patent for an amount equal to the winning bid. This works as long as auction bidders bid sensibly. But what is their incentive to bid sensibly if they never actually get to buy the patent?

Here, then, is Kremer's modified suggestion: Auction off each patent. At the end of the auction, flip a coin. If the coin comes up heads, the government steps in to buy the patent; if not, then the winning bidder gets it. The fact that the coin might come up tails keeps bidders honest; at the same time, half of all patents end up in the public domain, which is better than none.

Of course, there's no need to use a fair coin. A coin that comes up heads 90% of the time might do just as well. All that's necessary is for bidders to feel that there's enough chance of winning that they'll do their research and their bidding with appropriate care.

[2] One of the most famous attempts is by William Nordhaus, ***Invention,*** *Growth and Welfare* (Cambridge, MA: MIT Press, 1969).

Resource Monopolies

Monopolies occasionally result when a single firm gains control of a productive input that is necessary to the industry. The most commonly cited example is Alcoa (Aluminum Company of America), which completely dominated the market for aluminum in the first 40 years of the twentieth century. Alcoa initially established its monopoly position by acquiring critical patents, but it was able to maintain its position long after the patents expired largely by virtue of owning essentially all of the sources of bauxite (the ore from which aluminum is derived) in the United States.

Economies of Scope

The Sony Corporation produces televisions, DVD players, videocassette recorders, digital cameras, MP3 players, computers, video game consoles, and more. These products use overlapping technologies and, in many cases, some of the same components. Often multiple products can be produced in the same factory using the same equipment. These **economies of scope** allow Sony to produce more efficiently than smaller and more specialized firms, and helps to explain Sony's substantial market shares. More generally, whenever it's cheaper to produce several products in a single factory, we expect to see large multiproduct firms, which might, because of their size, enjoy substantial monopoly power.

Economies of scope
Efficiencies resulting from producing multiple products at a single firm.

Legal Barriers to Entry

In many industries, legal barriers to entry constitute a source of monopoly power. We will have more to say on this topic in Section 11.3. Here we will give one brief example. In many states travelers on limited-access highways can visit restaurants and gas stations at "oasis stops" without having to leave the highway. The number of oases is determined by an agency of the state government, which also decides which restaurants will be granted the rights to do business there. Because entry is restricted, these rights confer considerable monopoly power. (In many states the restaurants are subject to price controls, but they still appear to price higher than competitively.) There is a great deal of competition among restaurants to acquire these rights, much of which takes the form of lobbying appropriate government officials and applying other forms of political pressure. This lobbying process itself can consume valuable resources (lobbyists' time, for example) without producing offsetting social gains. The concomitant losses should be *added* to the welfare cost of monopoly, which is therefore underestimated by the methods of Section 10.1.

Exercise 10.7 Explain why it would be socially more efficient to legalize bribery of state officials who decide on the placement of roadside restaurants.

Some economists have used the observation of Exercise 10.7 to explain the preponderance of lawyers as members of state and federal legislative bodies. The reason is that it is easier to bribe a lawyer than (for example) a medical doctor. This is not because of any moral superiority on the part of physicians; it is a purely technological phenomenon. Many of the firms that seek favors from legislators have considerable need for legal services, and they can contrive to hire those services from favored lawyer–legislators at inflated fees. A number of U.S. congressmen from widely scattered parts of the country are associated with previously undistinguished law firms whose business has thrived

since one of the partners went to Washington. A small-town medical practice would find it far more difficult to plausibly collect million-dollar fees for services rendered to large corporations thousands of miles away.

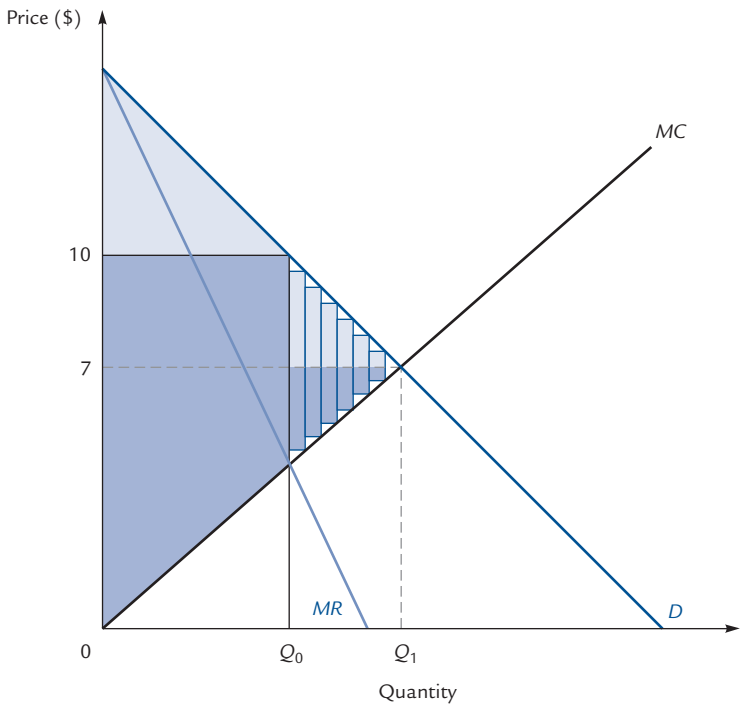
10.3 Price Discrimination

The analysis of monopoly pricing in Section 10.1 assumes that the monopolist will sell all of his output at a single price. In this section, we will see that, unlike a competitor, a monopolist can benefit by charging different prices for identical items.

Example: Monopoly in the Pie Market

Exhibit 10.7 shows the market for Mrs. Lovett's pies. Mrs. Lovett faces a downward-sloping demand curve, so she acts as a monopolist. That is, she produces the quantity Q_0 where marginal cost equals marginal revenue and charges \$10 per pie, read off the demand curve.

EXHIBIT **10.7** **Mrs. Lovett's Pies**



Mrs. Lovett, as a monopolist, produces Q_0 pies and sells them at a price of \$10. Once she has done so, she can still sell additional pies at prices that exceed her marginal cost. For example, at the competitive price of \$7, she could sell an additional $Q_1 - Q_0$ pies, creating additional social gains represented by the rectangles. The upper portions of the rectangles represent additions to consumers' surplus, and the lower portions represent additions to Mrs. Lovett's producer's surplus.

Mrs. Lovett could sell additional pies if she charged any price less than $10. For example, some customers may approach Mrs. Lovett and offer to buy additional pies at the competitive price of $7. Because this price exceeds Mrs. Lovett's marginal cost, both she and her customers would benefit from such a transaction. That is to say, both the producer's and consumers' surpluses will be increased. Each additional pie beyond Q_0 creates a rectangle of social gain, as in the exhibit. Mrs. Lovett earns the lower portions of these rectangles as additional producer's surplus. Her customers gain the upper portions.

Although the transaction would benefit everyone, it still might not take place. Why not? Because Mrs. Lovett will be willing to market additional pies at the lower price of $7 only on the condition that her customers continue to buy Q_0 high-priced pies. Ideally, Mrs. Lovett would like to market some pies at $10 and other identical pies at $7, and then post a sign in her shop reading: "Please buy as many $10 pies as you are willing to before purchasing any $7 pies." Realistically, she fears that her customers will not cooperate. This fear leads her to produce only Q_0 pies at a single monopoly price of $10.

Conceivably, Mrs. Lovett could attempt some approximation to the scheme she has just rejected. If she believes that the typical customer is willing to buy two pies at $10 each, she can sell pies at "$10 each, 3 for $27." This effectively enables her to sell each customer a third pie for $7 without cutting into the sales of $10 pies.

But this plan, too, has its flaws. First, some of her customers might in fact have been willing to pay $10 for a third pie. A more important (and perhaps fatal) flaw is this: Some customers may buy a third pie for $7, then resell the pie for $9 to somebody else who would have been willing to buy it from Mrs. Lovett for $10. In effect, she makes it possible for her own customers to go into competition with her! We will return to these problems later in this section.

Price discrimination
Charging different prices for identical items.

The act of charging different prices for identical items is known as **price discrimination.** Any monopolist faces the temptation to price discriminate, because he produces where marginal value exceeds marginal cost. Consequently, he can always sell additional items at a price higher than the marginal cost of producing them.

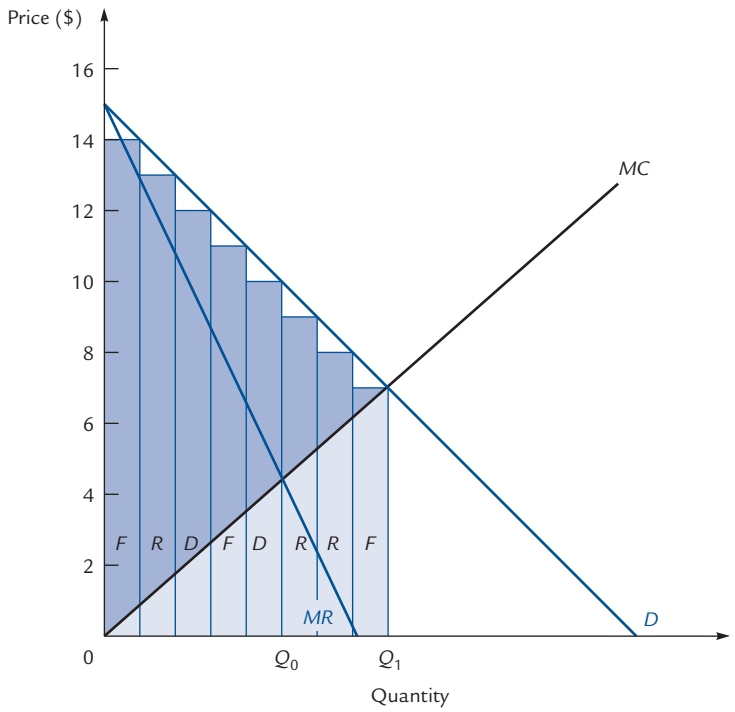
A competitive producer, by contrast, faces no temptation to price discriminate. This is because he can sell any quantity he wants to at the going market price, so there is never any reason for him to sell for less.

In order to price discriminate successfully, a monopolist must be able to prevent the low-priced units from being resold, undercutting his own higher-priced sales. This is easier in some industries than in others. Utility companies offer quantity discounts, for example, because technological barriers prevent a customer from buying lots of cheap electricity and reselling it to his friends at a profit.

First-Degree Price Discrimination

Returning to Mrs. Lovett, we find that there is yet another pricing policy with even greater potential to increase her revenue. Exhibit 10.8 shows again the market for Mrs. Lovett's pies; the curves are exactly as in Exhibit 10.7. The rectangles represent the marginal values that her customers place on pies. Each rectangle is labeled with the initial of the corresponding customer. Flicka has the highest marginal value, valuing her first pie at $14. Ricka values her first pie at $13, Dicka values her first pie at $12, Flicka values her second pie at $11, and so on. If Mrs. Lovett knows all this, she

EXHIBIT **10.8** **First-Degree Price Discrimination**



The rectangles show the marginal values of pies to Mrs. Lovett's customers, with each labeled by the initial of the corresponding customer. If she charges each customer the maximum amount that she is willing to pay for a pie, Flicka will have to pay $14 for her first pie, Ricka will pay $13 for her first pie, and so on. Because each customer pays her marginal value for each pie, there is no customers' surplus. All of the surplus is earned by Mrs. Lovett, who gains the entire shaded area.

can price her pies as follows: To Flicka the first pie is $14 and the second is $11. To Ricka the first pie is $13. To Dicka … and so on.

This scheme allows Mrs. Lovett to capture all of the social gains for herself. Each customer pays the maximum amount she would be willing to pay for each pie, so that she earns no surplus, while Mrs. Lovett gains the shaded areas shown in the exhibit. Mrs. Lovett will sell pies as long as she can collect prices higher than her marginal cost, so she will produce the competitive quantity Q_1. Therefore, there is no deadweight loss.

This scheme is called **first-degree price discrimination,** to distinguish it from the **second-degree price discrimination** that Mrs. Lovett practiced when she offered quantity discounts. In second-degree price discrimination each customer is offered the same set of prices, although the price may depend on the quantity purchased. In first-degree price discrimination each individual customer is charged the highest price he is willing to pay for each item.

Either form of price discrimination leads to an increase in output and an increase in welfare. Second-degree price discrimination benefits both the producer and the consumers. First-degree price discrimination benefits the producer in two ways. First, it allows him to appropriate the consumers' surplus. Second, it allows him to produce out to the competitive quantity, creating additional welfare gains, all of which go to the producer.

First-degree price discrimination
Charging each customer the most that he would be willing to pay for each item that he buys.

Second-degree price discrimination
Charging the same customer different prices for identical items.

Third-Degree Price Discrimination

Third-degree price discrimination
Charging different prices in different markets.

The third and most common form of price discrimination is called **third-degree price discrimination.** This occurs when a seller faces two (or more) identifiably different groups of buyers having different (downward-sloping) demand curves. Such a seller can increase profits by setting different prices for the two groups, provided resales can be prevented.

Example: Two Markets for Pies

Consider again Mrs. Lovett, who has discovered a second market for her pies. A grocery store in a large city 200 miles away is willing to buy as many pies as Mrs. Lovett wants to sell at a price of $7 each.[3]

What quantity of pies will Mrs. Lovett provide to her local customers? The ordinary monopoly quantity is Q_0 in Exhibit 10.9. At this quantity, her marginal revenue is $5 per pie. But Mrs. Lovett can always sell pies to the big-city grocery store at a marginal revenue of $7 per pie. Given this, it pays to sell fewer pies locally and more in the big city. Mrs. Lovett will keep transferring pies from the local market to the big-city market as long as the local marginal revenue is less than $7. This will reduce the local quantity to Q_2 in Exhibit 10.9.

In general:

Any producer selling in two different markets will choose quantities so that his marginal revenue is the same in each market.

The reason for this is that if marginal revenue in Market 1 were higher than marginal revenue in Market 2, the producer could increase his profits by selling one more item in Market 1 and one less in Market 2.

Because Mrs. Lovett sells only Q_2 pies at home, she is able to command a price of $11 for them. Then she will turn to the big-city market and will sell pies there as long as her marginal revenue ($7 per pie) exceeds her marginal cost. That is, she will produce Q_1 pies altogether, selling Q_2 of them at home for $11 each and $Q_1 - Q_2$ of them in the big city for $7 each.

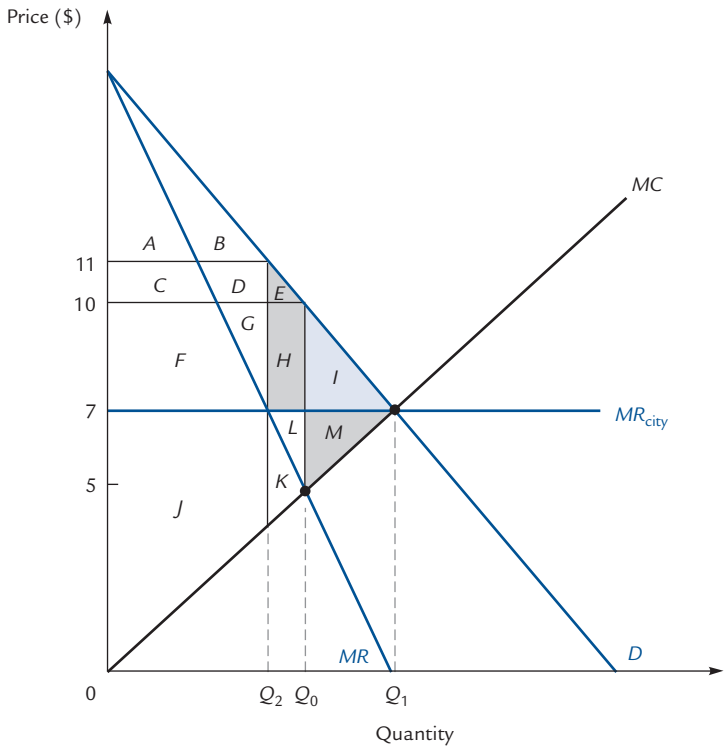
The table in Exhibit 10.9 shows social gains in three situations: Mrs. Lovett as a competitor, Mrs. Lovett as an ordinary monopolist, and Mrs. Lovett as a price-discriminating monopolist.

If Mrs. Lovett sold only in the local market, the deadweight loss would be $I + M$. When she can sell in both markets and price discriminate, the deadweight loss is $E + H + I$. $E + H$ can be either greater or less than M; therefore, Mrs. Lovett's price discrimination can be either beneficial or detrimental to welfare. On the other hand, it certainly hurts the local consumers.

Of course, like all price discriminators, Mrs. Lovett has to worry about resale. One of her neighbors may get the idea to drive to the city, buy a truckload of pies at $7 apiece, bring them back, and sell them locally for $10.50. Before long, Mrs. Lovett may find that she is no longer a monopolist in her hometown.

[3] By coincidence, $7 is also the competitive price in Mrs. Lovett's own hometown. Such remarkable coincidences are not to be expected. We make the assumption for purposes of this example, and only because it helps to keep the graph readable. None of the ideas that we will stress depend on this assumption.

EXHIBIT 10.9 Third-Degree Price Discrimination with Monopoly in One Market and Competition in Another



	Competition	Ordinary Monopoly	Price-Discriminating Monopoly
Consumers' Surplus	$A + B + C + D + E + F + G + H + I$	$A + B + C + D + E$	$A + B$
Producers' Surplus (Local)	$J + K + L + M$	$F + G + H + J + K + L$	$C + D + F + G + J$
Producer's Surplus (City)	—	—	$K + L + M$
Social Gain	$A + B + C + D + E + F + G + H + I + J + K + L + M$	$A + B + C + D + E + F + G + H + J + K + L$	$A + B + C + D + F + G + J + K + L + M$
Deadweight Loss	—	$I + M$	$E + H + I$

The demand and marginal revenue curves are from Mrs. Lovett's hometown market. In the distant city she can sell all of the pies she wants to at the competitive price of $7. In that case, she will sell only Q_2 pies at home, as opposed to the ordinary monopoly quantity Q_0. The reason is that she can always earn $7 marginal revenue by selling pies in the city, so that she will not sell pies at home when her marginal revenue there falls below $7. When she sells Q_2 pies at home, she sets a price of $11, higher than the ordinary monopoly price of $10. The table shows what social gains would be if the pie industry were competitive, if Mrs. Lovett were an ordinary monopolist, and if Mrs. Lovett were able to sell pies in both markets at different prices. In each case, the consumers' surplus comes entirely from the local market. There is no consumers' surplus in the city market, because the demand curve there for Mrs. Lovett's pies is flat.

A Monopolist in Two Markets

If Mrs. Lovett sells pies both in her hometown and in the big city, then she is a monopolist in one market and a competitor in another. Sometimes a producer is a monopolist in two markets. His behavior will be essentially the same as Mrs. Lovett's. Benjamin Barker is a barber who cuts the hair of both adults and children. Adults have one demand curve and children have another.

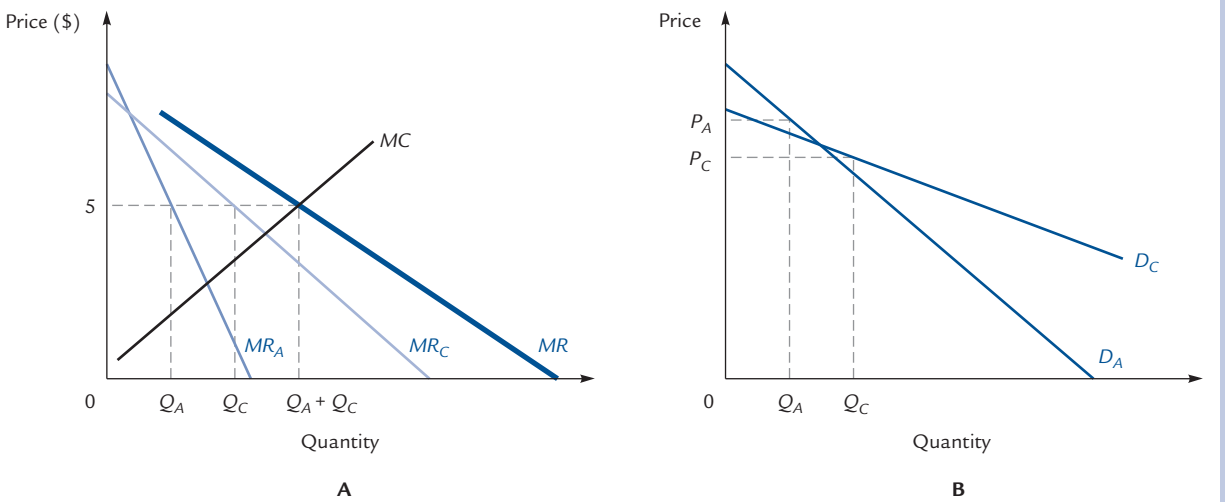
Benjamin wants to decide how many haircuts to sell to adults and how many to sell to children. We will call these quantities Q_A and Q_C. Then Benjamin wants to choose Q_A and Q_C so that his marginal revenue in the adults' market, his marginal revenue in the children's market, and the marginal cost to him of producing $Q_A + Q_C$ haircuts are all equal.

Exercise 10.8 Explain why Benjamin wants all three of these numbers to be equal. If any two were not equal, how could he alter his behavior to make himself better off? How would this change in his behavior tend to equalize the three quantities?

Exhibit 10.10 shows a graphic method for determining how many haircuts Benjamin will sell to each group. The MR_A and MR_C curves are the marginal revenue curves that he faces in the adults' and children's markets. The MR curve is obtained by summing MR_A and MR_C horizontally. That is, for any price, read the corresponding quantities off MR_A and MR_C; then add these to get the corresponding quantity on MR.

Benjamin can equalize his marginal cost and both marginal revenues by choosing the quantity where his marginal cost curve MC crosses the MR curve. In the exhibit this means that he produces a total of $Q_A + Q_C$ haircuts, so that his marginal cost is \$5 per haircut. He sells Q_A of these haircuts to adults and Q_C to children, so that his marginal revenue is \$5 per haircut in each market.

EXHIBIT **10.10** **Third-Degree Price Discrimination by a Monopolist in Two Markets**



Benjamin Barker sells haircuts to adults and children. The two groups have different marginal revenue curves, labeled MR_A and MR_C in panel A. The heavier curve, MR, is obtained by horizontally summing the curves MR_A and MR_C. Benjamin produces the quantity $Q_A + Q_C$ where MC crosses MR, selling Q_A haircuts to adults and Q_C to children. He chooses the corresponding prices off the adults' and children's demand curves, which are shown in panel B.

Once Benjamin has chosen the quantities Q_A and Q_C, he reads prices off the adults' and children's demand curves, just like any good monopolist. These prices, P_A and P_C, are shown in panel B of Exhibit 10.10.

Elasticities and Price Discrimination

There is an interesting relationship between the prices P_A and P_C in Exhibit 10.10. Write η_A for the elasticity of the adults' demand curve at P_A and η_C for the elasticity of the children's demand curve at P_C. Because the marginal revenue is \$5 in each market, the equation that relates price to marginal revenue says that:

$$P_A\left[1-\left(\frac{1}{|\eta_A|}\right)\right]=\$5 \text{ and } P_C\left[1-\left(\frac{1}{|\eta_C|}\right)\right]=\$5$$

It follows that:

$$P_A\left[1-\left(\frac{1}{|\eta_A|}\right)\right]=P_C\left[1-\left(\frac{1}{|\eta_C|}\right)\right]$$

From this equation we can see that:

$$\text{if } |\eta_C| > |\eta_A|, \text{ then } P_C < P_A$$

whereas:

$$\text{if } |\eta_C| < |\eta_A|, \text{ then } P_C > P_A$$

In other words:

The group with the more elastic demand is charged the lower price.

In more everyday language, elasticity of demand is described as "price sensitivity." So what we've really learned is that:

A price-discriminating monopolist offers the lowest prices to the most price-sensitive customers.

Movie theaters that offer discounts to students and senior citizens are engaging in third-degree price discrimination. So are railroads that sell special "youth passes." In each case, a lower price is offered to these customers, who are more sensitive to price. A possible reason for this price sensitivity is that students and senior citizens have either below-average incomes or low values of time. In either case, they will be more likely than others to shop around for alternatives when prices go up. This makes it desirable to price discriminate in their favor.

Price Discrimination and Welfare

When a monopolist moves from setting a single price to practicing third-degree price discrimination, his total output might go either up or down. Social welfare can also go either up or down. It is often quite difficult to predict the direction of the change in social welfare. However, under a variety of conditions, it is possible to prove that *if* total output falls, *then* social welfare must fall also. The proof is not easy.[4]

[4] See R. Schmalensee, "Output and Welfare Implications of Monopolistic Third-Degree Price Discrimination," *American Economic Review* 71 (1981):242–247; H. Varian, "Price Discrimination and Social Welfare," *American Economic Review* 75 (1985):870–875; and M. Schwartz, "Third-Degree Price Discrimination and Output: Generalizing a Welfare Result," *American Economic Review* 80 (1990): 1259–1263.

Conditions for Price Discrimination

We can now summarize the conditions necessary to make price discrimination profitable. First, the seller must have some degree of monopoly power. (Thus, wheat farmers never offer senior citizen discounts.) Second, resales must be controllable. Therefore, price discrimination is most often observed in markets for goods that have to be consumed immediately upon purchase, such as education. (Does your college charge different tuitions to different students by offering scholarship aid to some and not to others?) Each of these two conditions applies to any form of price discrimination. Finally, in the case of third-degree price discrimination, some mechanism must be found for offering lower prices to precisely those demanders who are more sensitive to price. (Are those students who get scholarships by and large the ones who would be most likely to go elsewhere—or to not attend college at all—if they had to pay full tuition?)[5]

Examples of Price Discrimination

One day recently, Dell Computer listed an ultralight laptop for $2,307 on its Web page for sales to small businesses. On the Web page for sales to health care companies, the same machine was listed at $2,228 and on the page for sales to state and local governments the price was $2,072.[6]

If your college library wants to subscribe to the *Proceedings of the National Academy of Sciences* (a prestigious scholarly journal), it will have to pay anywhere from $650 per year to $6,600 per year, depending on the size of your college.

Discount coupons for supermarket shopping constitute a mechanism for offering a lower price to appropriate consumers. The shoppers who find it worth their while to clip these coupons are those with a relatively low value of time (e.g., because their wages are low); by and large, these are the customers with a greater propensity for comparison shopping. The supermarket's ideal pricing policy is, "lower prices to those who would otherwise shop elsewhere." A practical approximation to this ideal is, "lower prices to those with enough free time to clip coupons."

It is important to notice that there would be no point to coupons if everyone redeemed them; in this case the store could just lower its prices and have the same effect. Similarly, there would be no point to coupons if only a random set of customers redeemed them. The point of coupons is that they offer lower prices to precisely those customers who are most sensitive to price.

Manufacturers' rebates (e.g., buy a coffeemaker and get a coupon that can be redeemed for $5) work much the same way. They are redeemed by precisely the shoppers who are willing to devote some extra time and energy to recovering a few dollars. These are the same shoppers who are most likely to compare prices at many stores or to decide to do without a coffeemaker altogether.

Promotions that require customers to save game cards, scratch off designated areas to reveal numbers, and the like serve the same purpose. These promotions may appeal primarily to families with children, who can be enlisted to paste, scratch, tear, and cut. It is reasonable to think that those with children are those most likely to be watching pennies in their food budgets.

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[5] A few years back, MIT sent a letter to parents announcing that it was raising both tuition and the amount of scholarship aid that it would provide. How would the parents have reacted if MIT had announced that it was going to exercise monopoly power more fully through an increase in price discrimination?

[6] These numbers appeared in a *Wall Street Journal* article by G. McWilliams.

Students sometimes reason that if grocery stores engage in price discrimination, for which monopoly power is a prerequisite, then grocery stores must be monopolies, so we should never use the competitive model when we study them. But, in fact, we use different models to describe different phenomena. Consider a simple analogy from physics: If we want to describe the interactions of several moving balls on a billiard table, it is often safe to assume there is no friction, because friction does not play an important role in the phenomenon under study. But if we want to explain why the balls roll instead of slide, friction suddenly becomes important and we switch to a description that takes account of it. Similarly, when we want to study the determination of prices and quantities in the grocery industry, the assumption of competition may be close enough to truth to yield deep and important insights. When we switch to studying a phenomenon like price discrimination, monopoly power acquires central importance and must be explicitly included in the description.


Dangerous Curve

When you order a pizza and get "free delivery," you are being charged less for a pizza than somebody who picks one up at the take-out counter. (When you take out, you pay for both the pizza and for gasoline, making the effective price of the pizza higher.) People ordering pizzas by telephone have more elastic demand because they can easily hang up the phone and order a pizza elsewhere. Whenever a producer offers "free extras" that only some customers take, you should ask how the extras have been designed to appeal to the more elastic demanders.

Why, for example, do coffee shops in downtown office buildings typically offer free cup lids? Such a coffee shop has two classes of customers: those who work in the building and those who pass by the building on their way to work elsewhere. With regard to the first group, the shop has some monopoly power (people would rather not go outside for coffee). With regard to the second, it is nearly in perfect competition (people walking by can always stop somewhere else for coffee). Therefore, they would like to offer a "free extra"—such as a cup lid—that is taken primarily by those who are walking by.[7]

Many hotels offer rooms at two different prices. Often the only difference between a $50 room and a $60 room is $10. If you call ahead for a reservation, you will get a $50 room. If you walk in at 11 P.M. looking tired, the $50 rooms will all be filled.

Airlines charge less for travelers who are staying over a Saturday night. These are the nonbusiness travelers who are likely to find another mode of transportation, or choose not to travel, when prices are high.

Many jewelry stores will give you a discount on a new watch if you trade in your old watch. The watches they receive as trade-ins are immediately discarded. People who already have watches are effectively charged less than those who don't. Can you see why the first group has the more elastic demand?

Many furniture stores offer "free delivery." If a delivery ordinarily costs $25 and all customers take advantage of the free delivery, then the price of furniture increases by $25 and the "free delivery" has no real effect. What, then, is the point of free delivery? A more sophisticated analysis must recognize that if only some customers accept the free delivery, then it can be a form of price discrimination. Professor Robert Michaels of the California State University at Fullerton points out that "free delivery is not free for many buyers." You have to wait at home for the delivery truck and are often not told when to expect it; if you and the driver miss each other, you have to wait a long time for

[7] This example, invented by Robert Topel of the University of Chicago, is intended to be frivolous. An alternative (and perhaps more plausible) explanation is that cup lids are priced at marginal cost, and the best practical approximation to a marginal cost of .001¢ is zero.

your delivery to be rescheduled. Customers with a low enough opportunity cost to wait at home for a weekday delivery also have a low opportunity cost of shopping and hence more elastic demand for furniture from a particular store. Free delivery (and hence an effectively lower price) is offered to the more elastic demanders.

In each of these examples you should give thought to the question of how resales are controlled. Firms have been known to get very creative about this. Many years ago the Rohm and Haas chemical company produced a compound called methyl methacrylate that was used both in dentistry and industrial production. There were few good substitutes for this compound in dentistry, but there were many in industry. As a result, dentists were charged a much higher price than industrial users; as a further result, industrial users bought cheap and sold to dentists. The marketing directors at Rohm and Haas considered many strategies to combat this activity, one of which was to add arsenic to the compound before selling it in the industrial market. This plan was never implemented, but a closely related one was: They started a *rumor* that they had added the arsenic. This had the desired effect.

Versioning

Versioning
Offering an inferior product to facilitate price discrimination.

Versioning occurs when a company offers an inferior version of its product, not because it's less costly to produce but because it facilitates price discrimination.

In the 1990s, IBM offered two products—the Laser Printer and the Laser Printer E. The two products were identical except that the Laser Printer E contained an extra chip that caused it to print more slowly. This enabled IBM to price discriminate by charging a high price for the Laser Printer and a lower price for the Laser Printer E.

In the nineteenth century, railroads offered third-class seats in carriages without roofs. The writer Jules Dupuit explained why:

> *It is not because of the few thousand francs which would have to be spent to put a roof over the third-class carriage. What the company is trying to do is to prevent the passengers who can pay the second-class fare from traveling third class. It hits the poor not because it wants to hurt them, but to frighten the rich.*

Book publishers offer both hardcover and softcover editions of their books. Contrary to what you might expect, the paperbacks are cheaper *not* because they're cheaper to produce (in fact the costs of production for a hardback and a paperback are surprisingly similar) but because publishers want to charge more to those readers who are willing to pay for a hardcover.

It's worth stressing that for the hardcover/paperback scheme to work, hardbacks must have special appeal to the least price-sensitive customers. Why might that be the case? Arguably, the least price-sensitive customers are precisely those who are most likely to fall in love with their books and hence to want books that will last for several decades.

Example: Priceline.Com

Airlines price discriminate through services like Priceline.Com, which allows you to "name your own price" for airline tickets. Priceline's customers can specify their dates of travels, but not the times. To use Priceline's service, you must agree that if your bid is accepted, you will be willing to fly at any time of morning, noon, or night.

That's a form of price discrimination—travelers who go through Priceline pay lower prices than those who book through the airlines or through traditional travel agents. Why do the airlines want to target discounts to Priceline users? By and large, travelers

who can be flexible about their departure times can also be flexible about whether to fly at all. If you don't care when you fly, it's pretty clear you're not trying to get to an urgent business meeting—so you might be willing to kill a day taking the train, or to cancel your trip altogether.

That's why Priceline works—it targets discounts to the most price-sensitive customers. You might imagine that Priceline would be even more successful if it allowed you to specify preferred travel times, and promised to book you at those times if possible. Unfortunately, that scheme would draw travelers to Priceline who might otherwise be willing to pay full fare—and the airlines would prefer not to offer discounts unnecessarily. Successful price discrimination requires—as much as possible—confining the discounts to the customers who are unwilling to pay full price.

In the year 2000, Priceline tried to set up a subsidiary that would allow you to "name your own price for gasoline." Anyone who has taken an economics course could have told them not to bother. Gasoline is sold in competitive markets, and price discrimination is a viable strategy only where there is some monopoly power. Predictably, Priceline's gasoline project failed almost immediately.

Counterexamples

Price discrimination is evidence of monopoly power, and students confronted with so many examples sometimes infer that monopoly power is ubiquitous. It is important, then, to realize that many practices having the appearance of price discrimination are, in fact, something quite different. Price discrimination occurs when the same product is sold at two different prices. Often, a careful examination will reveal that two apparently identical products are actually quite different.

Many restaurants offer a lower price at the salad bar to those who order an entrée. This has the appearance of price discrimination, but an alternative explanation is that people who order entrées tend to take less food at the salad bar. This would explain a lower price on the basis of a lower cost to the restaurant. Ice cream shops usually charge less for a second scoop than for a first. Is this second-degree price discrimination? Neither the preparation of the cone, nor the opening of the freezer, nor the ringing of the cash register has to be repeated for the second scoop of ice cream. Such factors make serving the second scoop genuinely cheaper for the ice cream shop and provide an alternative explanation.

In fact, almost everything that appears to be price discrimination admits at least one alternative explanation. Alternative theories are available even for the most widely accepted examples, some of which we have used in this book. Earlier we offered grocery store coupons as an example of price discrimination. A different hypothesis is that coupon-clippers have low values of time and hence can arrange to do their shopping when the store is not crowded. Nonclippers arrive at 5 P.M. on their way home from work, when the store is crowded, adding to general congestion and the lengths of the checkout lines. The nonclippers are therefore genuinely more expensive to serve, and so pay higher prices.

An objection to this new theory is that if grocery stores really want to charge less at certain times of the day, they can just announce discount prices for those who shop at those times. There is no need to introduce the artifice of coupons. A counter to the objection is that time-of-day discounts can be a logistical nightmare: What do you do with the customer who complains that he would have checked out at 2:59 rather than 3:01 if only he had gotten competent service at the meat counter?

In general, economists who are disinclined to believe in substantial monopoly power will welcome this kind of analysis. Those who believe that monopoly power is a significant economic force will be more comfortable with a diagnosis of price discrimination. But in analyzing any particular market, it pays to put prejudice aside and weigh the inherent plausibility of competing theories.

Price Discrimination at the Dry Cleaners?

Many dry cleaners charge more to clean and press a woman's shirt than a man's, even when the shirts are made of the same material. Is this price discrimination?

To believe it's price discrimination, you have to believe that dry cleaners have some monopoly power; otherwise price discrimination could not survive. Suppose, for example, that because of price discrimination, the going price for a man's shirt is $3 and the going price for a woman's shirt is $5. Then under competition, no dry cleaner accepts any men's business at all; they all declare themselves to be specialists in women's clothing. That bids down the price of women's shirts and bids up the price of men's—and this continues until the two prices are equal.

Only under monopoly can price discrimination survive: A monopolist might exhaust the market of women who are willing to pay $5 and then move on to men who are willing to pay $3. To believe that dry cleaners price discriminate, you must believe that dry cleaners are monopolists.

But are they? There are six virtually identical dry cleaners within walking distance of your textbook author's house. How can they have monopoly power?

One answer is that there might be a lot of brand loyalty. If customers are very reluctant to switch from one dry cleaner to another, then each cleaner has some monopoly power and price discrimination is possible.

But another possibility is that dry cleaners really are competitive, in which case the price differential for men's and women's clothes cannot be an instance of price discrimination; instead it must reflect a real difference in costs. And in fact there's a good candidate for what that difference is. It's more expensive to press a woman's shirt than a man's for two reasons. First, men's shirts come in standard shapes and can be pressed by machine; women's shirts are more varied and often have to be pressed by hand. Second, men's shirts, unlike women's, are usually worn under jackets, so the pressing doesn't have to be as perfect.

Price Discrimination and the Internet

Andrew Odlyzko, of the Digital Technology Center at the University of Minnesota, has argued that the Internet presents unprecedented opportunities for price discrimination. A traditional bookseller doesn't know very much about your reading habits, but Amazon.Com, if you are a repeat customer, knows quite a bit. In principle, Amazon could use that information to set different prices for different consumers.

There is widespread public discomfort about the "privacy violations" that occur when companies like Amazon keep track of individual buying habits. In a provocative article,[8] Odlyzko argues that much of this discomfort can be traced to consumer resistance to price discrimination. Whether or not you find his article convincing, you'll almost surely find it an entertaining source of anecdotes about price discrimination, several of which have found their way into this chapter.

[8] "Privacy, Economics and Price Discrimination on the Internet," A. M. Odlyzko. ICEC2003: Fifth International Conference on Electronic Commerce, N. Sadeh, ed., ACM, 2003, pp. 355–366.

Two-Part Tariffs

Disneyland amusement park has substantial monopoly power. How should Disneyland wield that power? Should it charge a low admission price, to draw lots of visitors who will pay monopoly prices for the rides and other attractions? Or should it charge low prices for the rides, to draw lots of visitors who will pay a monopoly price to get in?

Polaroid is the only maker of Polaroid cameras and Polaroid film. Should the company charge a low price for the cameras to increase the demand for high-priced film? Or should it charge a low price for film to increase the demand for high-priced cameras?

Some monopolists—like Disneyland and Polaroid—get to charge their customers twice. There's an initial fee (for admission to the park or the Polaroid camera) and then ongoing charges for the purchase of goods or services (like ride tickets or Polaroid film).

In both examples, the initial fee itself buys you nothing except the right to make future purchases. For the most part, the only reason to enter Disneyland is so you can spend more money after you get inside. And surely the only reason to buy a Polaroid camera is so you can start buying and using film.

There are more examples. Some private dining clubs charge yearly membership fees that entitle the member to buy meals. Banks charge annual fees for credit cards that allow you to borrow money at interest. Neither the membership nor the credit card is of any value until you start using it.[9]

When a firm charges a fee for the right to buy its products, we say that it has set a **two-part tariff.** Most of the time, the word *tariff* refers to a tax on imported goods, but the phrase *two-part tariff* is an exception to the rule. Here the word *tariff* simply means "price."

Two-part tariff
An entry fee that allows you to purchase goods or services.

Setting the Entry Fee

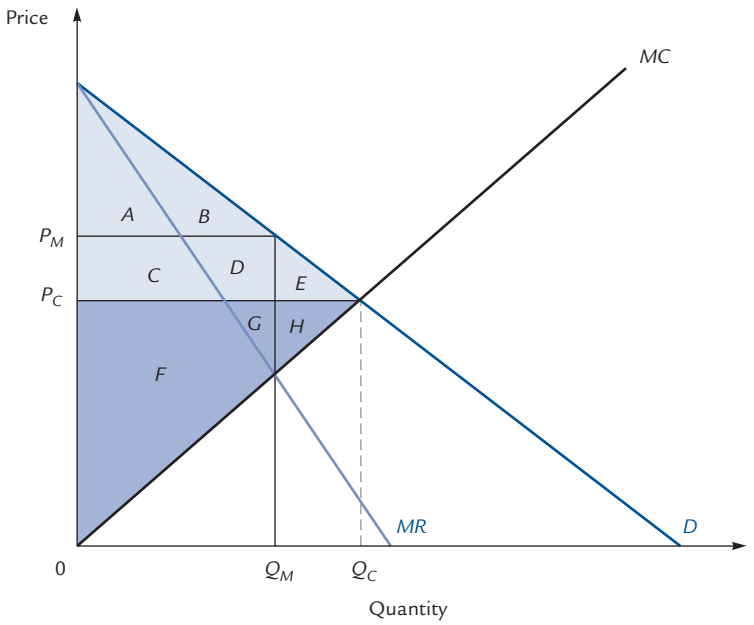
Let's figure out the optimal strategy for a two-part tariff monopolist. Exhibit 10.11 shows the demand, marginal revenue, and marginal cost curves for a firm such as Disneyland or Polaroid. The quantity on the horizontal axis is the quantity of the good that customers purchase *after* they've paid the entry fee; in the case of Disneyland it is the quantity of rides, while in the case of Polaroid it is the quantity of film.

First let's see what happens if the firm charges the monopoly price P_M in Exhibit 10.11. The first observation is that the firm earns $C + D + F + G$ in producer's surplus on the sale of the ride tickets, film, or whatever else it is selling. Now how much will the firm charge consumers for the right to buy those products? The answer, of course, is that it will charge the maximum amount consumers are willing to pay—and that amount is measured by the consumer's surplus, in this case $A + B$. So if the firm charges the price P_M for its products, it will earn $C + D + F + G$ in producer's surplus on the sales and an additional $A + B$ in admission fees. The total is $A + B + C + D + F + G$. Notice that consumers are left with no surplus at all.

Now let's see what happens if the firm charges the competitive price P_C. Producer's surplus on product sales is reduced to $F + G + H$. But admission fees can be raised $A + B + C + D + E$, giving the firm a total of $A + B + C + D + E + F + G + H$. This

[9] With the credit card, as with Disneyland, our assumptions are only approximations to the truth: In reality, some people want to enter Disneyland just to enjoy the atmosphere, and some people want credit cards just for convenience, paying off their full balances each month to avoid all interest charges. But if there are few enough of those unusual people, our analysis will be close to correct.

EXHIBIT **10.11** **Pricing Strategy with a Two-Part Tariff**



If the firm sells the monopoly quantity Q_M at the monopoly price P_M, it will earn a producer's surplus of $C + D + F + G$ and will be able to charge the consumer $A + B$ as an entry fee. But if it sells the competitive quantity Q_C at the lower price P_C, it will earn the smaller producer's surplus $F + G + H$ while collecting the larger entry fee $A + B + C + D + E$. Under the second strategy, the firm's net earnings are increased by $E + H$.

is more than it earns at the monopoly price P_M. Once again, consumers are left with no surplus at all. All of the social gain goes to the firm.

So the firm does best by charging a competitive price for its goods. That way, it is therefore not surprising that the firm does best by charging a competitive price—as long as it is collecting all the social gain, it will want that social gain to be as large as possible, and that's accomplished by competitive pricing.

Differences among Customers

Let's be clear on what it means to charge the full consumer's surplus as an admission fee. Here's an example. Suppose in Exhibit 10.11, that area $A + B + C + D + E$ is equal to $1,000, and the firm has 100 identical customers. Then each of the 100 customers earns a consumer's surplus of $10, so the right admission fee is $10 per customer.

But what if the customers are not identical? Suppose, for example, that one of them earns a consumer's surplus of $901, while the others earn $1 each. Then area $A + B + C + D + E$ will still equal $1,000, but if the monopolist tries to capture this area by charging an admission fee of $10, it will drive away 99% of its customers!

The problem here is that while the *average* customer earns a consumer's surplus of $10, it's not true that every customer is average, except in the case where every customer is identical. As long as all (or most) of the customers are *nearly* identical, they will all (or almost all) earn consumer's surpluses of *about* $10, so an admission fee of just a bit under $10 will retain all (or most) of the customers and allow the monopolist to earn nearly $1,000 in admission fees. But when the differences among customers

are dramatic, the monopolist cannot capture the bulk of the consumers' surplus in this way. In this case, our conclusion—that the monopolist should price his product competitively—no longer holds.

Two-Part Tariffs and Price Discrimination

When there are significant differences among customers, a monopolist will look for opportunities to price discriminate. For a two-part tariff monopolist, there's a clear strategy for price discrimination: By charging a low entry fee and a high price for the product, the monopolist effectively charges lower prices to the lightest users, and there is a good chance that the lightest users are precisely the ones who will walk away in the absence of a discount.

At Disneyland, for example, those patrons who come only to ride the roller coaster are very different from those who feel a compulsion to go on every ride. Disneyland might reasonably expect that those in the former group will go and find a *different* roller coaster unless they get a discount, while those in the latter group are unlikely to find many good substitutes for Disneyland. Thus, the goal is to target discounts to the roller-coaster-only crowd. This goal is accomplished through a low admission price coupled with a high price for ride tickets; roller-coaster riders buy only one ticket while their more compulsive neighbors buy dozens.

Similarly, if Polaroid charges a low price for cameras and a high price for film, it is effectively charging more to those who take a lot of pictures. The *real* goal is to charge more to those who are willing to pay the most; but by and large, those who are willing to pay the most might be precisely the ones who take the most pictures.

The Bottom Line

A two-part tariff monopolist with identical customers will want to capture as much surplus as possible by setting a low (competitive) price for the product and a high admission fee. A two-part tariff monopolist with very different customers will want to price discriminate by setting a low admission fee and a high price for the product.

The typical firm faces a base of customers who are neither identical nor dramatically different, and therefore will want to compromise between the two strategies; firms with more diverse groups of customers will shade more toward the high admission fee.

Sometimes a firm has to experiment for a while in order to learn how different its customers are. Disneyland has gone through a series of different pricing policies, ranging from free admission and high-priced rides to free rides and high-priced admission.

Popcorn at the Movie Theater

Suppose you own a movie theater, where you have some monopoly power and you make money both at the box office and the popcorn stand. Should you charge a high price for admission and a low price for popcorn, or vice versa?

If your customers are all identical, Exhibit 10.11 provides the answer, interpreting the "price" and "quantity" in that exhibit as the price and quantity of popcorn. By pricing popcorn competitively, you earn a total of $A + B + C + D + E + F + G + H$ in producer's surplus at the popcorn stand plus admission fees at the box office. If you priced the popcorn at the higher price P_M, you would earn only $A + B + C + D + F + G$. Thus, you should price the popcorn competitively.

People who have not studied economics usually get this wrong. They reason that once customers have entered the theater, the theater owner might as well take advantage of his monopoly power at the popcorn stand. That argument overlooks the fact that higher prices at the popcorn stand must mean either lower prices at the box office or fewer people going to the movies.

What if the customers are very different? Then you might think that you can apply the same reasoning we used for Disneyland and Polaroid cameras to conclude that popcorn should be priced high and the admission fee should be low in order to price discriminate. But that's not quite right. The case of the movie theater is not exactly like the case of the Polaroid camera, and here's why: A Polaroid camera is valuable *only* because it allows you to buy film, but it's not true that admission to the movie theater is valuable only because it allows you to buy popcorn. Consumers earn surplus just by entering the premises and being allowed to see the movie. A theater owner will want to try to capture some of that surplus. The best way to do so is not apparent from Exhibit 10.11, which shows only the surplus earned at the popcorn stand and not the surplus earned from seeing the movie.

The problem is to charge a high overall price to those who are willing to pay that price and a low overall price to those who would otherwise go to a ball game or stay home and watch TV. *If* the people who especially love going to the movies are the same people who buy a lot of popcorn, then the right strategy is to price discriminate with a high price at the popcorn stand. But if the people who especially love going to the movies are the same people who buy relatively *little* popcorn, then the right strategy can be to price discriminate in their favor with a *low* price at the popcorn stand—even with a price below marginal cost. You will be invited to work out the details of the analysis in Problem 27 at the end of this chapter.

Summary

A firm has monopoly power when it faces a downward-sloping demand curve for its product. Such a firm also faces a downward-sloping marginal revenue curve that lies everywhere below the demand curve. Like any producer, the monopoly firm chooses the quantity where marginal cost equals marginal revenue, and then charges the price that corresponds to that quantity on the demand curve.

Because marginal revenue lies below demand, the monopolist chooses a quantity at which marginal cost is less than the consumer's marginal value. Thus, it underproduces from the point of view of social welfare. Various public policies can address this problem. If the monopolist is given a subsidy per unit of output, it will increase production. If a price ceiling is set at the competitive price, the monopolist will essentially face a flat marginal revenue curve and behave like a competitor.

Monopolies arise for various reasons. An industry where each firm's average cost curve is decreasing at the point where it crosses market demand is known as a natural monopoly. If price were set equal to marginal cost in such an industry, profits would be negative and no firms would enter. A monopoly producer, however, may be able to survive because he can charge a price that is higher than marginal cost.

One common source of natural monopoly is the combination of high fixed costs and low marginal costs. However, this is not the only source. Other sources of monopoly power include patents, the control of resources, and barriers to entry erected by the government.

Sometimes a monopolist can increase its profits by charging different prices for identical items. This practice is known as price discrimination. In first-degree price discrimination, each consumer is charged the maximum he would be willing to pay for each item. If successful, this allows the monopolist to collect all of the social gain for himself, and it provides an incentive to produce the competitive quantity. In practice, perfect first-degree price discrimination is almost never possible, but it can sometimes be approximated.

In second-degree price discrimination, each customer is offered the same set of prices, but prices vary with the items purchased. Quantity discounts can be an example of second-degree price discrimination. However, quantity discounts are not always price discrimination. They can result instead from genuine cost savings to the seller when larger quantities are exchanged.

The most common type of price discrimination is third-degree price discrimination, in which two identifiably different groups of customers are charged different prices. In this case, the lower price will go to the group with the more elastic demand curve. Senior citizen discounts at movie theaters are an example.

For price discrimination to be profitable, the firm must have monopoly power, must be able to find a device that discriminates in favor of the appropriate group, and must be able to prevent resales.

Another pricing policy available to some monopolists is a two-part tariff, where the customer is charged a one-time fee for the right to buy goods from the monopolist. If the monopolist prices at marginal cost and sets an entry fee equal to the consumer surplus, he can maximize social gain and capture all of this gain for himself. However, if different consumers have different demand curves, this strategy requires knowing each consumer's demand curve and setting his entry fee accordingly. In practice, this is usually not possible. Therefore, the monopolist's pricing problem is a difficult one. Pricing at marginal cost creates more gain for him to capture through entry fees. On the other hand, in some cases (like Polaroid film), pricing above marginal cost offers the opportunity to price discriminate. Choosing the right strategy is a complicated matter, involving both the characteristics of the product and the characteristics of the demanders.

Author Commentary

www.cengage.com/economics/landsburg

AC1. Read this article for another view of the patent system.

AC2. For more examples of price discrimination, read this article.

Review Questions

R1. Explain why a monopolist's marginal revenue curve lies below the demand curve. Explain why this leads the monopolist to produce an inefficient quantity.

R2. If a monopolist were operating on the inelastic part of the demand curve, what could the monopolist do to increase profits?

R3. A frost in Florida kills half the orange crop, and the price of oranges rises by so much that orange growers' revenue is actually higher than in a normal year. **True or False:** This indicates that Florida orange growers have some monopoly power.

R4. Draw a graph to show what happens when a monopolist is offered an optimal subsidy.

R5. Draw a graph to show what happens when a monopolist is subjected to an optimal price ceiling.

R6. List a few sources of monopoly power.

R7. What is a natural monopoly? In the presence of natural monopoly, how must the welfare analysis of monopoly pricing be modified?

R8. Describe the three types of price discrimination. Give examples of each.

R9. **True or False:** Only a competitor would offer discounts to selected customers, because a monopolist can always require his customers to pay full price.

R10. Why might a monopolist who can charge an entry fee choose to price his product at marginal cost? Under what conditions is this a wise strategy?

Numerical Exercises

N1. Suppose that a monopolist faces the demand curve:

$$Q = a - bP$$

where a and b are constants. Show that his marginal revenue curve is given approximately by the equation:

$$MR = a - \frac{2Q}{b}$$

(This approximation becomes exact when very small units are chosen.)

N2. Suppose that a monopolist sells in two markets with demand curves:

$$Q_A = 100 - 10P_A$$
$$Q_B = 8 - 2P_B$$

a. Show that for any given quantity, demand is more elastic in market A than in market B.

b. Suppose that the monopolist produces at zero marginal cost. How much does he supply in each market, and what prices does he charge? (*Hint:* Use the formula for marginal revenue from the preceding problem.)

c. Suppose that the monopolist's marginal cost curve is given by:

$$MC = Q/21$$

How much does he supply in each market, and what prices does he charge?

d. Reconcile your answers to parts (a), (b), and (c) with the statement in the text that the group with more elastic demand is always charged the lower price.

e. Suppose that the monopolist's marginal cost curve is given by

$$MC = Q/3$$

What will the monopolist do?

N3. A monopoly barber sells haircuts to adults for \$30 and to children for \$10. Let η_A represent adults' elasticity of demand for haircuts and let η_C represent children's elasticity of demand.

a. Explain why $|\eta_A|$ and $|\eta_C|$ must both be greater than 1.

b. Find a formula for η_A in terms of η_C.

c. What is the largest possible value for $|\eta_A|$?

Problem Set

1. Rework problem 1 from Chapter 7, on the assumption that Gus is the only cab driver in town.

2. **True or False:** Unlike competitors monopolists have the option of earning higher profits by raising their prices.

3. A monopolistic firm produces widgets at a constant marginal cost of $10 apiece. One day it discovers a new production process that would lower its marginal cost by $1 per widget. Use a graph to show how much its producer's surplus will increase if it adopts the new production process.

4. For a good supplied by a monopolist, how does a sales tax of $1 per item affect the marginal revenue curve?

5. **True or False:** If they could, the customers of an ordinary (non-price-discriminating, non-admission-charging) monopolist would get together and bribe the monopolist to charge lower prices. Justify your answer by discussing how much the customers would be willing to offer and how much the monopolist would be willing to accept.

6. We know that for a competitively supplied good the economic incidence of a tax is independent of the legal incidence; that is, a sales tax and an excise tax of equal magnitudes have exactly the same effects. Is the same thing true for a good supplied by a monopolist?

7. **True or False:** An excise tax on a monopolist that causes quantity to fall by one unit is just as detrimental to social welfare as an excise tax on a competitive industry that causes quantity to fall by one unit.

8. **True or False:** If the supply of land is fixed, then it can be equally efficient for land to be supplied by a monopolist or by competitors.

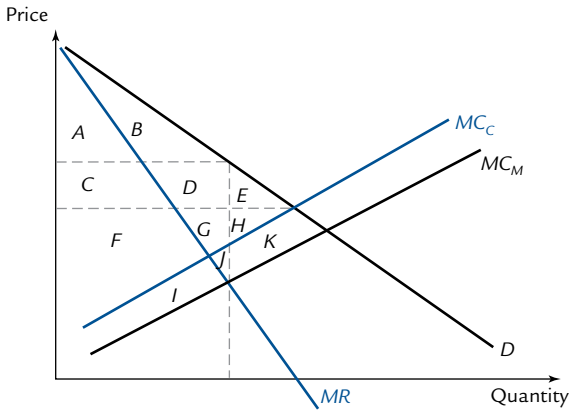
9. Fuzzy dice are produced only by Americans and consumed only by non-Americans. Can an excise tax on fuzzy dice improve the welfare of Americans? If so, use a graph to illustrate the optimal size of the excise tax. If not, use a graph to show why any excise tax must create a deadweight loss for Americans.

10. The following table shows the total cost of producing various quantities of shoehorns and the total value of those shoehorns to consumers. What are the price and quantity produced if the shoehorn industry is competitive? What are they if it is monopolized? What is the extent of the social loss due to the existence of the monopoly? (The answers to all of these questions should be numbers. Assume that only a whole number of shoehorns can be produced.)

Q	*TC*	*TV*	*Q*	*TC*	*TV*
1	$2	$10	5	$15	$37
2	4	19	6	19	41
3	7	26	7	24	43
4	11	32	8	29	44

11. The following diagram shows the (industrywide) demand for widgets and the associated marginal revenue curve. When the industry is monopolized, the marginal cost curve is MC_M. When the industry is competitive, the industry's marginal cost curve is MC_C. Suppose the industry is currently monopolized and you are a judge

with the power to break up the monopoly into several competing firms. In order to exercise that power in accordance with the efficiency criterion, which four of the labeled areas would you want to measure? (You are allowed to measure any four areas but no more.) How would you use that information to guide your decision?



12. **True or False:** To make a natural monopolist behave more efficiently, subsidies will work better than price controls.

13. **True or False:** If a natural monopolist is required to earn zero profits, it will produce less than is optimal, but if any other kind of monopolist is required to earn zero profits, it will produce more than is optimal.

14. **True or False:** A regulated monopoly is more likely to engage in discriminatory hiring practices than is an unregulated monopoly.

15. Bad Ideas Inc. is the world's only manufacturer of disposable sweaters. After a sweater is made, Bad Ideas can attach buttons on the right, making it suitable for men, or on the left, making it suitable for women. No man will wear a woman's sweater and no woman will wear a man's sweater. Bad Ideas faces the following demand and marginal cost schedules for its sweaters:

Quantity	Men's Demand Price	Women's Demand Price	Marginal Cost
1	$10	$24	$1
2	9	16	1.5
3	8	12	2
4	7	9.50	2.5
5	6	4	3
6	5	0	3.5
7	4	0	4
8	3	0	4.5

How many sweaters does it produce? How many does it sell to men, and at what price? How many does it sell to women, and at what price?

16. **True or False:** Heavy competition among firms for a limited number of customers leads to such devices as discounts for students and senior citizens.

17. Many hotels allow children to stay in their parents' rooms for free. Why?

18. Some Canadian restaurants (especially in tourist areas) will accept U.S. currency at a more favorable exchange rate than the banks will give. Why?

19. In many cities, when three people share a taxicab to exactly the same address, the fare depends on whether the three were traveling together at the time they hailed the cab. Riders who know each other are charged less than those who don't. Why?

20. The Taos Pueblo is an ancient American Indian community in New Mexico that admits tourists. The admission fee is $5 per car plus $5 per camera.

- **a.** Give an explanation of this pricing strategy that is based on price discrimination.
- **b.** Give an explanation of this pricing strategy that is not based on price discrimination.
- **c.** Which of your explanations do you believe? Why? What further evidence would help you to decide between your two theories?

21. Many cable television services will allow you to purchase viewing rights to several channels but will not allow you to purchase viewing rights to just one. Why might this be a profit-maximizing strategy for them? What determines the fee for the full cable service?

22. The Fredonia Gas and Electric Company is required by law to distribute all its profits to the citizens of Fredonia. **True or False:** The average Fredonian won't mind paying a monopoly price for electricity, because the monopoly profits are all returned to the citizens anyway.

23. Suppose Wegman's is the only grocery store in Rochester, and there is an admission fee to enter Wegman's. **True or False:** If the admission fee were outlawed, consumers would be better off and social gain would increase.

24. Snidely Whiplash owns all the houses in the Yukon Territory, where he charges the highest rent the citizens (who are all identical) are willing to pay. Snidely has just bought all the grocery stores in town. Should he charge a monopoly price for groceries? (*Hint:* Start by using a graph to illustrate the market for groceries. If Snidely charges monopoly prices at the grocery store, how much will he have to lower the rent on houses to prevent everyone from leaving town?)

25. All Oxbridge University students are identical, and they are all indifferent between attending Oxbridge and the next best alternative. Students eat at the student union.

- **a.** If Oxbridge rents space in the student union to several food providers (such as Subway and McDonald's) who then compete with each other, how much rent can Oxbridge collect? (Illustrate your answer with a graph, showing the quantity of food bought on the horizontal axis and the price of food on the vertical.)
- **b.** If Oxbridge rents all the space in the student union to a single food provider who charges monopoly prices, how much rent can Oxbridge collect?
- **c.** If prospective students are aware of the dining situation on campus, how would the decision to go with a monopoly food provider affect the amount of tuition the university can collect?
- **d.** In order to maximize its profits, should Oxbridge rent to a monopolist or to several competitors?

26. All Oxbridge University students are identical, and they are all indifferent between attending the Oxbridge and their next best alternative. The only place students can buy textbooks is at the Barnes and Noble bookstore on campus. The bookstore wants to start charging admission, but needs the university's permission to do so. Use a graph to illustrate the answers to the following questions:

- **a.** How much is the bookstore willing to pay the University for permission to charge admission?

b. If the bookstore starts charging admission, how much must the university cut tuition to prevent all the students from leaving?

c. Will the bookstore get the permission it's seeking? Why or why not?

27. In downtown Whoville, there are several department stores and several parking lots. The department stores face upward sloping marginal cost curves. Parking spaces are provided at zero marginal cost. To shop at the stores, you have to park your car. (There is no other way to get downtown.)

a. Suppose the department stores are competitive, and all the parking lots are owned by a single monopolist. Use a graph to illustrate the price of department store merchandise. In terms of your graph, what determines the price of a parking space?

b. Suppose the department stores are owned by a single monopolist and the parking lots are competitive. Now what determines the price of a parking space?

c. Which is better for consumers: competitive department stores and monopolized parking lots, or monopolized stores and competitive parking lots? Which yields a higher social gain?

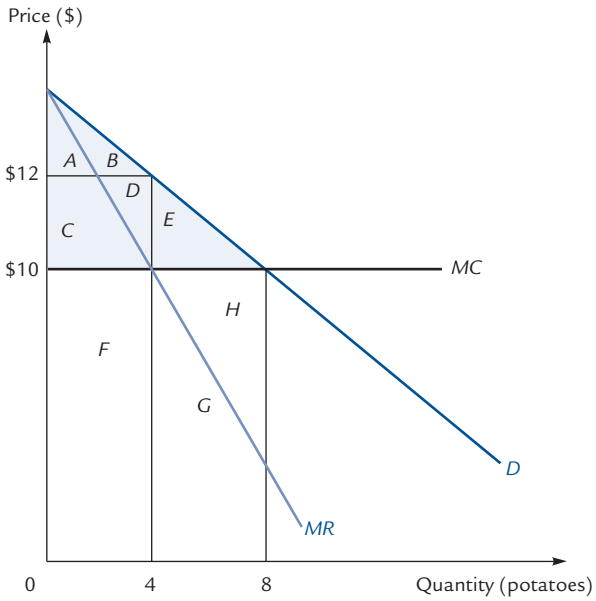
28. Hughes Tool produces a patented drill bit (thus, it has a monopoly on the bit). Only Hughes Tool can resharpen the bit. Suppose it costs Hughes Tool exactly $100 to resharpen a drill bit.

a. **True or False:** If all of Hughes Tool's customers value the drill bit equally, then Hughes Tool should charge exactly $100 for a resharpening.

b. **True or False:** If Hughes Tool's customers differ significantly in how much they value the drill bit, then Hughes Tool should charge exactly $100 for a resharpening.

c. If you see Hughes Tool taking steps to prevent competitors from offering resharpening services, what can you conclude about the diversity of Hughes Tool's customers?

29. Suppose you are a monopoly seller of potatoes, facing a constant marginal cost of $10 per potato. Your customers are all identical, and they all have the following demand curve:



a. Suppose you announce a price per potato and allow consumers to buy as many potatoes as they like. What price do you charge? How much surplus do you earn per customer?

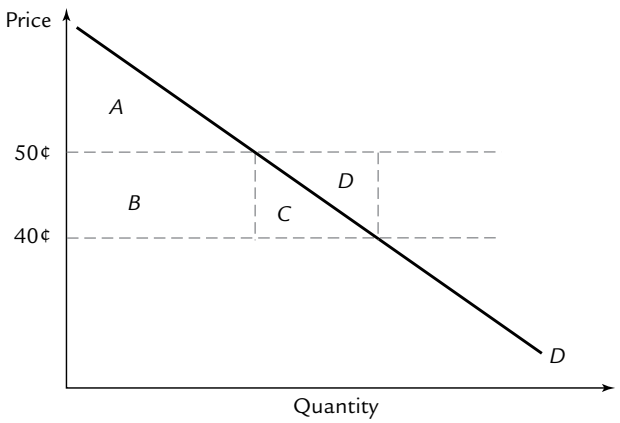
b. Suppose you package potatoes in bags of four and set the price per bag so that each consumer buys one bag. What price do you charge per bag and how much do you earn per customer?

c. Suppose you package potatoes in bags of four and set the price per bag so that each consumer buys two bags. What price do you charge per bag and how much do you earn per customer?

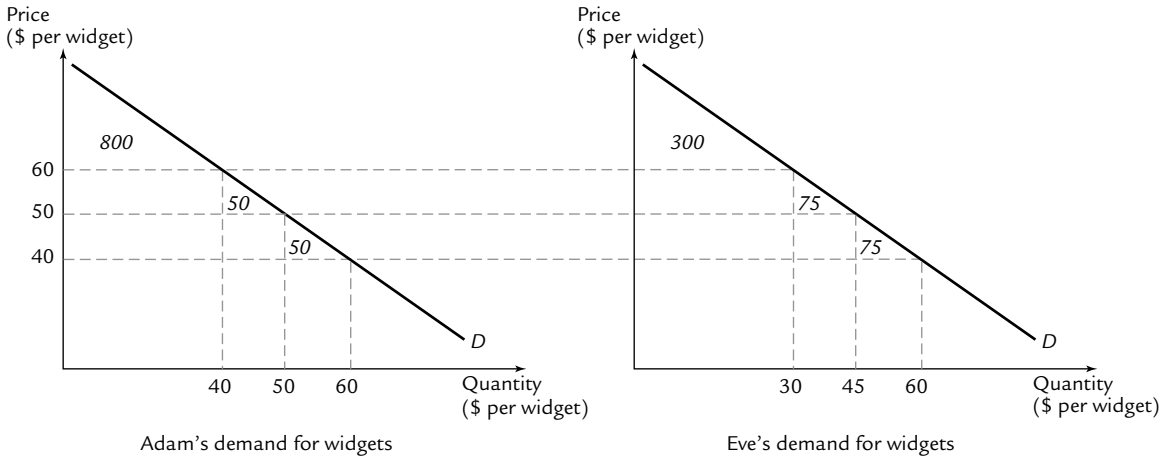
d. Suppose you package potatoes in bags of eight and set the price per bag so that each consumer buys one bag. What price do you charge per bag and how much do you earn per customer?

e. Which of the four strategies in parts (a) through (d) maximizes your profit?

30. You're the monopoly owner of a movie theater with two customers, Thelma and Louise. Thelma doesn't care at all about the movie; she just comes to buy popcorn. Louise doesn't like popcorn; she just comes to watch the movie. Thelma's demand curve for popcorn is as shown in the graph below. Louise is willing to pay up to $A + B + C$ to see the movie. It costs you 50¢ a bag to provide the popcorn. You're deciding whether to sell it for 50¢ a bag or for 40¢ a bag. Which of the illustrated areas in the graph would you want to measure to help you make your decision, and exactly how would you use that information?



31. Suppose you are the owner of the only widget store in town. You purchase your widgets from the manufacturer at $50 apiece. Inside your store, you charge a single price for widgets; you can also charge an admission fee to enter the store. Your two customers, Adam and Eve, have the following demand curves:

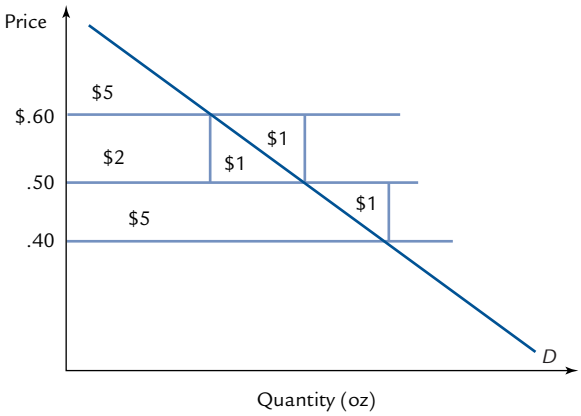


Adam's demand for widgets

Eve's demand for widgets

(The labels in the triangles stand for areas, measured in dollars.) Assume you are committed to keeping both of your customers. Is it best to price your widgets at $40, $50, or $60? Why?

32. Suppose you are the monopoly owner of a movie theater. You can provide popcorn at a marginal cost of 50¢ per bag. It costs you nothing to allow people to enter the theater. You have two customers, Gene and Roger. Gene is willing to pay up to $20 to see the movie, and Roger is willing to pay up to $10. Gene never buys popcorn under any circumstances. Roger's demand for popcorn is the curve in the following graph:



a. Suppose you charge 60¢ for popcorn. What's the highest admission price you can charge if you're determined to keep both customers?

b. How does your answer to (a) change if you charge 50¢ or 40¢ for popcorn? If you want to maximize profits while keeping both customers, what price should you charge for popcorn?

c. Could you do better if you were willing to charge an admission price that drives one of your customers away?

d. How would your answers change if Gene is willing to pay not $20 to see the movie, but $4? What if he's willing to pay $9? $25?