

# 9 | Monopoly



**Figure 9.1 Political Power from a Cotton Monopoly** In the mid-nineteenth century, the United States, specifically the Southern states, had a near monopoly in the cotton supplied to Great Britain. These states attempted to leverage this economic power into political power—trying to sway Great Britain to formally recognize the Confederate States of America. (Credit: modification of work by “ashleylovespizza”/Flickr Creative Commons)

## Bring it Home

### The Rest is History

Many of the opening case studies have focused on current events. This one steps into the past to observe how monopoly, or near monopolies, have helped shape history. In the spring of 1773, the East India Company, a firm that, in its time, was designated ‘too big to fail,’ was continuing to experience financial difficulties. To help shore up the failing firm, the British Parliament authorized the Tea Act. The act continued the tax on teas and made the East India Company the sole legal supplier of tea to the American colonies. By November, the citizens of Boston had had enough. They refused to permit the tea to be unloaded, citing their main complaint: “No taxation without representation.” Arriving tea-bearing ships were warned via several newspapers, including *The Massachusetts Gazette*, “We are prepared, and shall not fail to pay them an unwelcome visit; by The Mohawks.”

Step forward in time to 1860—the eve of the American Civil War—to another near monopoly supplier of historical significance: the U.S. cotton industry. At that time, the Southern states provided the majority of the cotton Britain imported. The South, wanting to secede from the Union, hoped to leverage Britain’s high dependency on its cotton into formal diplomatic recognition of the Confederate States of America.

This leads us to the topic of this chapter: a firm that controls all (or nearly all) of the supply of a good or service—a monopoly. How do monopoly firms behave in the marketplace? Do they have “power?” Does this

power potentially have unintended consequences? We'll return to this case at the end of the chapter to see how the tea and cotton monopolies influenced U.S. history.

## Introduction to a Monopoly

In this chapter, you will learn about:

- How Monopolies form: Barriers to Entry
- How a Profit-Maximizing Monopoly Chooses Output and Price

There is a widespread belief that top executives at firms are the strongest supporters of market competition, but this belief is far from the truth. Think about it this way: If you very much wanted to win an Olympic gold medal, would you rather be far better than everyone else, or locked in competition with many athletes just as good as you are? Similarly, if you would like to attain a very high level of profits, would you rather manage a business with little or no competition, or struggle against many tough competitors who are trying to sell to your customers? By now, you might have read the chapter on **Perfect Competition**. In this chapter, we explore the opposite extreme: monopoly.

If perfect competition is a market where firms have no market power and they simply respond to the market price, monopoly is a market with no competition at all, and firms have complete market power. In the case of **monopoly**, one firm produces all of the output in a market. Since a monopoly faces no significant competition, it can charge any price it wishes. While a monopoly, by definition, refers to a single firm, in practice the term is often used to describe a market in which one firm merely has a very high market share. This tends to be the definition that the U.S. Department of Justice uses.

Even though there are very few true monopolies in existence, we do deal with some of those few every day, often without realizing it: The U.S. Postal Service, your electric and garbage collection companies are a few examples. Some new drugs are produced by only one pharmaceutical firm—and no close substitutes for that drug may exist.

From the mid-1990s until 2004, the U.S. Department of Justice prosecuted the Microsoft Corporation for including Internet Explorer as the default web browser with its operating system. The Justice Department's argument was that, since Microsoft possessed an extremely high market share in the industry for operating systems, the inclusion of a free web browser constituted unfair competition to other browsers, such as Netscape Navigator. Since nearly everyone was using Windows, including Internet Explorer eliminated the incentive for consumers to explore other browsers and made it impossible for competitors to gain a foothold in the market. In 2013, the Windows system ran on more than 90% of the most commonly sold personal computers. In 2015, a U.S. federal court tossed out antitrust charges that Google had an agreement with mobile device makers to set Google as the default search engine.

This chapter begins by describing how monopolies are protected from competition, including laws that prohibit competition, technological advantages, and certain configurations of demand and supply. It then discusses how a monopoly will choose its profit-maximizing quantity to produce and what price to charge. While a monopoly must be concerned about whether consumers will purchase its products or spend their money on something altogether different, the monopolist need not worry about the actions of other competing firms producing its products. As a result, a monopoly is not a price taker like a perfectly competitive firm, but instead exercises some power to choose its market price.

## 9.1 | How Monopolies Form: Barriers to Entry

By the end of this section, you will be able to:

- Distinguish between a natural monopoly and a legal monopoly.
- Explain how economies of scale and the control of natural resources led to the necessary formation of legal monopolies
- Analyze the importance of trademarks and patents in promoting innovation
- Identify examples of predatory pricing

Because of the lack of competition, monopolies tend to earn significant economic profits. These profits should attract vigorous competition as described in **Perfect Competition**, and yet, because of one particular characteristic of monopoly, they do not. **Barriers to entry** are the legal, technological, or market forces that discourage or prevent potential competitors from entering a market. Barriers to entry can range from the simple and easily surmountable, such as the cost of renting retail space, to the extremely restrictive. For example, there are a finite number of radio frequencies available for broadcasting. Once the rights to all of them have been purchased, no new competitors can enter the market.

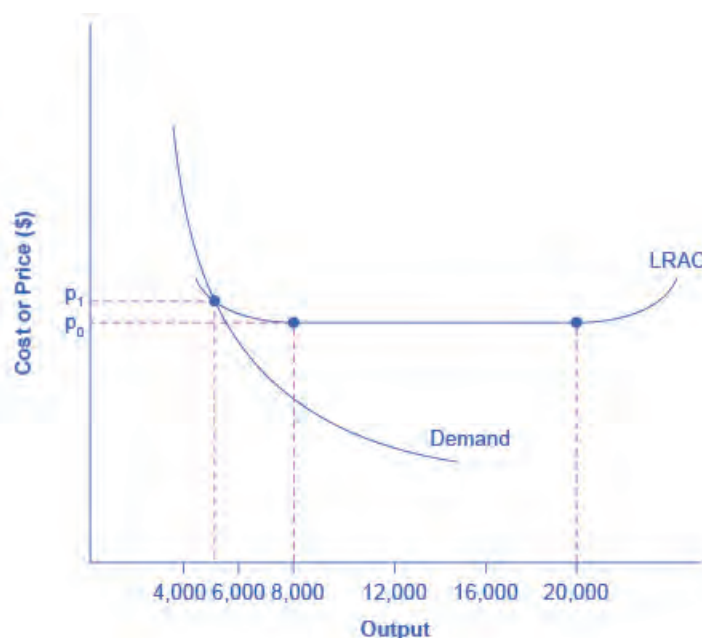
In some cases, barriers to entry may lead to monopoly. In other cases, they may limit competition to a few firms. Barriers may block entry even if the firm or firms currently in the market are earning profits. Thus, in markets with significant barriers to entry, it is *not* true that abnormally high profits will attract new firms, and that this entry of new firms will eventually cause the price to decline so that surviving firms earn only a normal level of profit in the long run.

There are two types of monopoly, based on the types of barriers to entry they exploit. One is **natural monopoly**, where the barriers to entry are something other than legal prohibition. The other is **legal monopoly**, where laws prohibit (or severely limit) competition.

## Natural Monopoly

Economies of scale can combine with the size of the market to limit competition. (This theme was introduced in **Cost and Industry Structure**). **Figure 9.2** presents a long-run average cost curve for the airplane manufacturing industry. It shows economies of scale up to an output of 8,000 planes per year and a price of  $P_0$ , then constant returns to scale from 8,000 to 20,000 planes per year, and diseconomies of scale at a quantity of production greater than 20,000 planes per year.

Now consider the market demand curve in the diagram, which intersects the long-run average cost (LRAC) curve at an output level of 6,000 planes per year and at a price  $P_1$ , which is higher than  $P_0$ . In this situation, the market has room for only one producer. If a second firm attempts to enter the market at a smaller size, say by producing a quantity of 4,000 planes, then its average costs will be higher than the existing firm, and it will be unable to compete. If the second firm attempts to enter the market at a larger size, like 8,000 planes per year, then it could produce at a lower average cost—but it could not sell all 8,000 planes that it produced because of insufficient demand in the market.



**Figure 9.2 Economies of Scale and Natural Monopoly** In this market, the demand curve intersects the long-run average cost (LRAC) curve at its downward-sloping part. A natural monopoly occurs when the quantity demanded is less than the minimum quantity it takes to be at the bottom of the long-run average cost curve.

This situation, when economies of scale are large relative to the quantity demanded in the market, is called a natural monopoly. Natural monopolies often arise in industries where the marginal cost of adding an additional customer

is very low, once the fixed costs of the overall system are in place. Once the main water pipes are laid through a neighborhood, the marginal cost of providing water service to another home is fairly low. Once electricity lines are installed through a neighborhood, the marginal cost of providing additional electrical service to one more home is very low. It would be costly and duplicative for a second water company to enter the market and invest in a whole second set of main water pipes, or for a second electricity company to enter the market and invest in a whole new set of electrical wires. These industries offer an example where, because of economies of scale, one producer can serve the entire market more efficiently than a number of smaller producers that would need to make duplicate physical capital investments.

A natural monopoly can also arise in smaller local markets for products that are difficult to transport. For example, cement production exhibits economies of scale, and the quantity of cement demanded in a local area may not be much larger than what a single plant can produce. Moreover, the costs of transporting cement over land are high, and so a cement plant in an area without access to water transportation may be a natural monopoly.

## Control of a Physical Resource

Another type of natural monopoly occurs when a company has control of a scarce physical resource. In the U.S. economy, one historical example of this pattern occurred when ALCOA—the Aluminum Company of America—controlled most of the supply of bauxite, a key mineral used in making aluminum. Back in the 1930s, when ALCOA controlled most of the bauxite, other firms were simply unable to produce enough aluminum to compete.

As another example, the majority of global diamond production is controlled by DeBeers, a multi-national company that has mining and production operations in South Africa, Botswana, Namibia, and Canada. It also has exploration activities on four continents, while directing a worldwide distribution network of rough cut diamonds. Though in recent years they have experienced growing competition, their impact on the rough diamond market is still considerable.

## Legal Monopoly

For some products, the government erects barriers to entry by prohibiting or limiting competition. Under U.S. law, no organization but the U.S. Postal Service is legally allowed to deliver first-class mail. Many states or cities have laws or regulations that allow households a choice of only one electric company, one water company, and one company to pick up the garbage. Most legal monopolies are considered utilities—products necessary for everyday life—that are socially beneficial to have. As a consequence, the government allows producers to become regulated monopolies, to insure that an appropriate amount of these products is provided to consumers. Additionally, legal monopolies are often subject to economies of scale, so it makes sense to allow only one provider.

## Promoting Innovation

Innovation takes time and resources to achieve. Suppose a company invests in research and development and finds the cure for the common cold. In this world of near ubiquitous information, other companies could take the formula, produce the drug, and because they did not incur the costs of research and development (R&D), undercut the price of the company that discovered the drug. Given this possibility, many firms would choose not to invest in research and development, and as a result, the world would have less innovation. To prevent this from happening, the Constitution of the United States specifies in Article I, Section 8: “The Congress shall have Power . . . To Promote the Progress of Science and Useful Arts, by securing for limited Times to Authors and Inventors the Exclusive Right to their Writings and Discoveries.” Congress used this power to create the U.S. Patent and Trademark Office, as well as the U.S. Copyright Office. A **patent** gives the inventor the exclusive legal right to make, use, or sell the invention for a limited time; in the United States, exclusive patent rights last for 20 years. The idea is to provide limited monopoly power so that innovative firms can recoup their investment in R&D, but then to allow other firms to produce the product more cheaply once the patent expires.

A **trademark** is an identifying symbol or name for a particular good, like Chiquita bananas, Chevrolet cars, or the Nike “swoosh” that appears on shoes and athletic gear. Roughly 1.9 million trademarks are registered with the U.S. government. A firm can renew a trademark over and over again, as long as it remains in active use.

A **copyright**, according to the U.S. Copyright Office, “is a form of protection provided by the laws of the United States for ‘original works of authorship’ including literary, dramatic, musical, architectural, cartographic, choreographic, pantomimic, pictorial, graphic, sculptural, and audiovisual creations.” No one can reproduce, display, or perform a copyrighted work without permission of the author. Copyright protection ordinarily lasts for the life of the author plus 70 years.

Roughly speaking, patent law covers inventions and copyright protects books, songs, and art. But in certain areas, like the invention of new software, it has been unclear whether patent or copyright protection should apply. There is also a body of law known as **trade secrets**. Even if a company does not have a patent on an invention, competing firms are not allowed to steal their secrets. One famous trade secret is the formula for Coca-Cola, which is not protected under copyright or patent law, but is simply kept secret by the company.

Taken together, this combination of patents, trademarks, copyrights, and trade secret law is called **intellectual property**, because it implies ownership over an idea, concept, or image, not a physical piece of property like a house or a car. Countries around the world have enacted laws to protect intellectual property, although the time periods and exact provisions of such laws vary across countries. There are ongoing negotiations, both through the World Intellectual Property Organization (WIPO) and through international treaties, to bring greater harmony to the intellectual property laws of different countries to determine the extent to which patents and copyrights in one country will be respected in other countries.

Government limitations on competition used to be even more common in the United States. For most of the twentieth century, only one phone company—AT&T—was legally allowed to provide local and long distance service. From the 1930s to the 1970s, one set of federal regulations limited which destinations airlines could choose to fly to and what fares they could charge; another set of regulations limited the interest rates that banks could pay to depositors; yet another specified what trucking firms could charge customers.

What products are considered utilities depends, in part, on the available technology. Fifty years ago, local and long distance telephone service was provided over wires. It did not make much sense to have multiple companies building multiple systems of wiring across towns and across the country. AT&T lost its monopoly on long distance service when the technology for providing phone service changed from wires to microwave and satellite transmission, so that multiple firms could use the same transmission mechanism. The same thing happened to local service, especially in recent years, with the growth in cellular phone systems.

The combination of improvements in production technologies and a general sense that the markets could provide services adequately led to a wave of **deregulation**, starting in the late 1970s and continuing into the 1990s. This wave eliminated or reduced government restrictions on the firms that could enter, the prices that could be charged, and the quantities that could be produced in many industries, including telecommunications, airlines, trucking, banking, and electricity.

Around the world, from Europe to Latin America to Africa and Asia, many governments continue to control and limit competition in what those governments perceive to be key industries, including airlines, banks, steel companies, oil companies, and telephone companies.

## Link It Up

Visit this [website \(http://openstaxcollege.org//patents\)](http://openstaxcollege.org//patents) for examples of some pretty bizarre patents.



## Intimidating Potential Competition

Businesses have developed a number of schemes for creating barriers to entry by deterring potential competitors from entering the market. One method is known as **predatory pricing**, in which a firm uses the threat of sharp price cuts to discourage competition. Predatory pricing is a violation of U.S. antitrust law, but it is difficult to prove.

Consider a large airline that provides most of the flights between two particular cities. A new, small start-up airline decides to offer service between these two cities. The large airline immediately slashes prices on this route to the



bone, so that the new entrant cannot make any money. After the new entrant has gone out of business, the incumbent firm can raise prices again.

After this pattern is repeated once or twice, potential new entrants may decide that it is not wise to try to compete. Small airlines often accuse larger airlines of predatory pricing: in the early 2000s, for example, ValuJet accused Delta of predatory pricing, Frontier accused United, and Reno Air accused Northwest. In 2015, the Justice Department ruled against American Express and Mastercard for imposing restrictions on retailers who encouraged customers to use lower swipe fees on credit transactions.

In some cases, large advertising budgets can also act as a way of discouraging the competition. If the only way to launch a successful new national cola drink is to spend more than the promotional budgets of Coca-Cola and Pepsi Cola, not too many companies will try. A firmly established brand name can be difficult to dislodge.

## Summing Up Barriers to Entry

**Table 9.1** lists the barriers to entry that have been discussed here. This list is not exhaustive, since firms have proved to be highly creative in inventing business practices that discourage competition. When barriers to entry exist, perfect competition is no longer a reasonable description of how an industry works. When barriers to entry are high enough, monopoly can result.

Barrier to Entry	Government Role?	Example
Natural monopoly	Government often responds with regulation (or ownership)	Water and electric companies
Control of a physical resource	No	DeBeers for diamonds
Legal monopoly	Yes	Post office, past regulation of airlines and trucking
Patent, trademark, and copyright	Yes, through protection of intellectual property	New drugs or software
Intimidating potential competitors	Somewhat	Predatory pricing; well-known brand names

**Table 9.1 Barriers to Entry**

## 9.2 | How a Profit-Maximizing Monopoly Chooses Output and Price

By the end of this section, you will be able to:

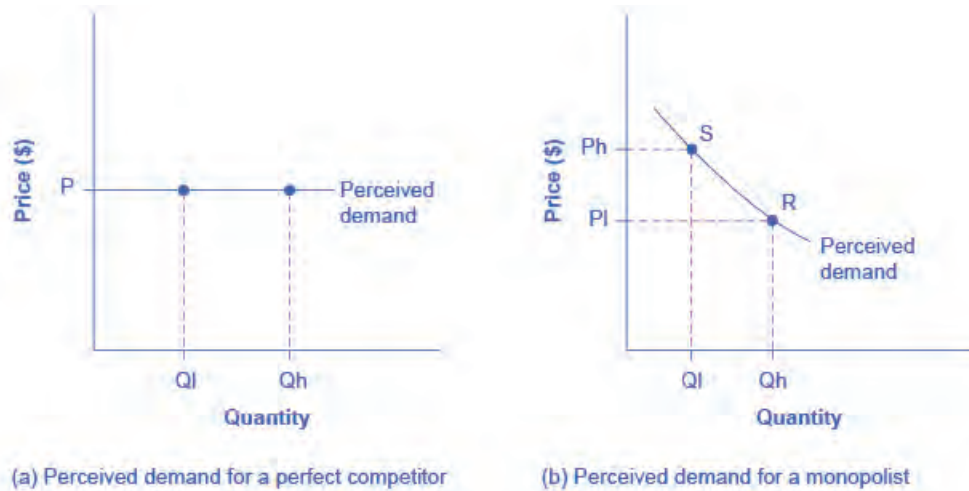
- Explain the perceived demand curve for a perfect competitor and a monopoly
- Analyze a demand curve for a monopoly and determine the output that maximizes profit and revenue
- Calculate marginal revenue and marginal cost
- Explain allocative efficiency as it pertains to the efficiency of a monopoly

Consider a monopoly firm, comfortably surrounded by barriers to entry so that it need not fear competition from other producers. How will this monopoly choose its profit-maximizing quantity of output, and what price will it charge? Profits for the monopolist, like any firm, will be equal to total revenues minus total costs. The pattern of costs for the monopoly can be analyzed within the same framework as the costs of a perfectly competitive firm—that is, by using total cost, fixed cost, variable cost, marginal cost, average cost, and average variable cost. However, because a

monopoly faces no competition, its situation and its decision process will differ from that of a perfectly competitive firm. (The Clear It Up feature discusses how hard it is sometimes to define “market” in a monopoly situation.)

## Demand Curves Perceived by a Perfectly Competitive Firm and by a Monopoly

A perfectly competitive firm acts as a price taker, so its calculation of total revenue is made by taking the given market price and multiplying it by the quantity of output that the firm chooses. The demand curve *as it is perceived by a perfectly competitive firm* appears in **Figure 9.3 (a)**. The flat perceived demand curve means that, from the viewpoint of the perfectly competitive firm, it could sell either a relatively low quantity like  $Q_l$  or a relatively high quantity like  $Q_h$  at the market price  $P$ .



**Figure 9.3 The Perceived Demand Curve for a Perfect Competitor and a Monopolist** (a) A perfectly competitive firm perceives the demand curve that it faces to be flat. The flat shape means that the firm can sell either a low quantity ( $Q_l$ ) or a high quantity ( $Q_h$ ) at exactly the same price ( $P$ ). (b) A monopolist perceives the demand curve that it faces to be the same as the market demand curve, which for most goods is downward-sloping. Thus, if the monopolist chooses a high level of output ( $Q_h$ ), it can charge only a relatively low price ( $P_l$ ); conversely, if the monopolist chooses a low level of output ( $Q_l$ ), it can then charge a higher price ( $P_h$ ). The challenge for the monopolist is to choose the combination of price and quantity that maximizes profits.

## Clear It Up



### What defines the market?

A monopoly is a firm that sells all or nearly all of the goods and services in a given market. But what defines the “market”?

In a famous 1947 case, the federal government accused the DuPont company of having a monopoly in the cellophane market, pointing out that DuPont produced 75% of the cellophane in the United States. DuPont countered that even though it had a 75% market share in cellophane, it had less than a 20% share of the “flexible packaging materials,” which includes all other moisture-proof papers, films, and foils. In 1956, after years of legal appeals, the U.S. Supreme Court held that the broader market definition was more appropriate, and the case against DuPont was dismissed.

Questions over how to define the market continue today. True, Microsoft in the 1990s had a dominant share of the software for computer operating systems, but in the total market for all computer software and services, including everything from games to scientific programs, the Microsoft share was only about 14% in 2014. The Greyhound bus company may have a near-monopoly on the market for intercity bus transportation, but it is only a small share of the market for intercity transportation if that market includes private cars, airplanes, and railroad service. DeBeers has a monopoly in diamonds, but it is a much smaller share of the total market for

precious gemstones and an even smaller share of the total market for jewelry. A small town in the country may have only one gas station: is this gas station a “monopoly,” or does it compete with gas stations that might be five, 10, or 50 miles away?

In general, if a firm produces a product without close substitutes, then the firm can be considered a monopoly producer in a single market. But if buyers have a range of similar—even if not identical—options available from other firms, then the firm is not a monopoly. Still, arguments over whether substitutes are close or not close can be controversial.

While a monopolist can charge *any* price for its product, that price is nonetheless constrained by demand for the firm’s product. No monopolist, even one that is thoroughly protected by high barriers to entry, can require consumers to purchase its product. Because the monopolist is the only firm in the market, its demand curve is the same as the market demand curve, which is, unlike that for a perfectly competitive firm, downward-sloping.

**Figure 9.3** illustrates this situation. The monopolist can either choose a point like R with a low price ( $P_L$ ) and high quantity ( $Q_H$ ), or a point like S with a high price ( $P_H$ ) and a low quantity ( $Q_L$ ), or some intermediate point. Setting the price too high will result in a low quantity sold, and will not bring in much revenue. Conversely, setting the price too low may result in a high quantity sold, but because of the low price, it will not bring in much revenue either. The challenge for the monopolist is to strike a profit-maximizing balance between the price it charges and the quantity that it sells. But why isn’t the perfectly competitive firm’s demand curve also the market demand curve? See the following Clear It Up feature for the answer to this question.

## Clear It Up



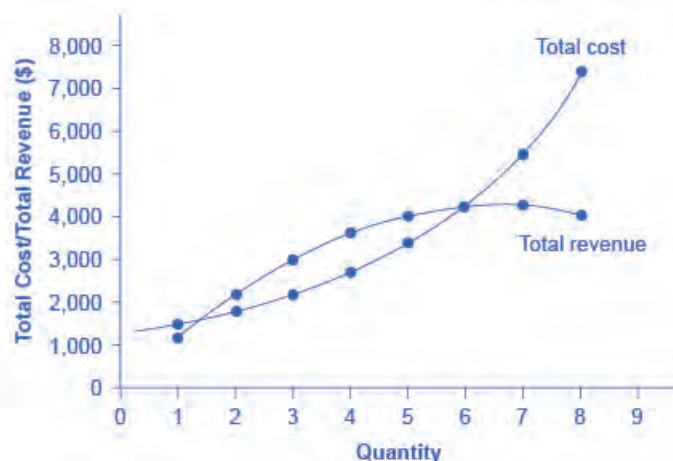
### What is the difference between perceived demand and market demand?

The demand curve as perceived by a perfectly competitive firm is not the overall market demand curve for that product. However, the firm’s demand curve as perceived by a monopoly is the same as the market demand curve. The reason for the difference is that each perfectly competitive firm perceives the demand for its products in a market that includes many other firms; in effect, the demand curve perceived by a perfectly competitive firm is a tiny slice of the entire market demand curve. In contrast, a monopoly perceives demand for its product in a market where the monopoly is the only producer.

## Total Cost and Total Revenue for a Monopolist

Profits for a monopolist can be illustrated with a graph of total revenues and total costs, as shown with the example of the hypothetical HealthPill firm in **Figure 9.4**. The total cost curve has its typical shape; that is, total costs rise and the curve grows steeper as output increases.





**Figure 9.4 Total Revenue and Total Cost for the HealthPill Monopoly** Total revenue for the monopoly firm called HealthPill first rises, then falls. Low levels of output bring in relatively little total revenue, because the quantity is low. High levels of output bring in relatively less revenue, because the high quantity pushes down the market price. The total cost curve is upward-sloping. Profits will be highest at the quantity of output where total revenue is most above total cost. Of the choices in [Table 9.2](#), the highest profits happen at an output of 4. The profit-maximizing level of output is not the same as the revenue-maximizing level of output, which should make sense, because profits take costs into account and revenues do not.

Quantity	Total Cost	Quantity	Price	Total Revenue	Profit = Total Revenue – Total Cost
1	1,500	1	1,200	1,200	–300
2	1,800	2	1,100	2,200	400
3	2,200	3	1,000	3,000	800
4	2,800	4	900	3,600	800
5	3,500	5	800	4,000	500
6	4,200	6	700	4,200	0
7	5,600	7	600	4,200	–1,400
8	7,400	8	500	4,000	–3,400

**Table 9.2 Total Costs and Total Revenues of HealthPill**

To calculate total revenue for a monopolist, start with the demand curve perceived by the monopolist. [Table 9.2](#) shows quantities along the demand curve and the price at each quantity demanded, and then calculates total revenue by multiplying price times quantity at each level of output. (In this example, the output is given as 1, 2, 3, 4, and so on, for the sake of simplicity. If you prefer a dash of greater realism, you can imagine that these output levels and the corresponding prices are measured per 1,000 or 10,000 pills.) As the figure illustrates, total revenue for a monopolist rises, flattens out, and then falls. In this example, total revenue is highest at a quantity of 6 or 7.

Clearly, the total revenue for a monopolist is not a straight upward-sloping line, in the way that total revenue was for a perfectly competitive firm. The different total revenue pattern for a monopolist occurs because the quantity that a monopolist chooses to produce affects the market price, which was not true for a perfectly competitive firm. If the monopolist charges a very high price, then quantity demanded drops, and so total revenue is very low. If the

monopolist charges a very low price, then, even if quantity demanded is very high, total revenue will not add up to much. At some intermediate level, total revenue will be highest.

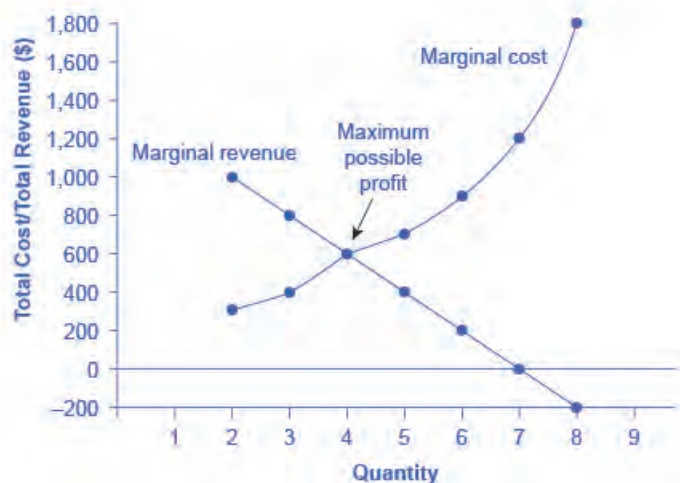
However, the monopolist is not seeking to maximize revenue, but instead to earn the highest possible profit. Profits are calculated in the final row of the table. In the HealthPill example in [Figure 9.4](#), the highest profit will occur at the quantity where total revenue is the farthest above total cost. Of the choices given in the table, the highest profits occur at an output of 4, where profit is 800.

## Marginal Revenue and Marginal Cost for a Monopolist

In the real world, a monopolist often does not have enough information to analyze its entire total revenues or total costs curves; after all, the firm does not know exactly what would happen if it were to alter production dramatically. But a monopolist often has fairly reliable information about how changing output by small or moderate amounts will affect its marginal revenues and marginal costs, because it has had experience with such changes over time and because modest changes are easier to extrapolate from current experience. A monopolist can use information on marginal revenue and marginal cost to seek out the profit-maximizing combination of quantity and price.

The first four columns of [Table 9.3](#) use the numbers on total cost from the HealthPill example in the previous exhibit and calculate marginal cost and average cost. This monopoly faces a typical upward-sloping marginal cost curve, as shown in [Figure 9.5](#). The second four columns of [Table 9.3](#) use the total revenue information from the previous exhibit and calculate marginal revenue.

Notice that marginal revenue is zero at a quantity of 7, and turns negative at quantities higher than 7. It may seem counterintuitive that marginal revenue could ever be zero or negative: after all, does an increase in quantity sold not always mean more revenue? For a perfect competitor, each additional unit sold brought a positive marginal revenue, because marginal revenue was equal to the given market price. But a monopolist can sell a larger quantity and see a decline in total revenue. When a monopolist increases sales by one unit, it gains some marginal revenue from selling that extra unit, but also loses some marginal revenue because every other unit must now be sold at a lower price. As the quantity sold becomes higher, the drop in price affects a greater quantity of sales, eventually causing a situation where more sales cause marginal revenue to be negative.



**Figure 9.5 Marginal Revenue and Marginal Cost for the HealthPill Monopoly** For a monopoly like HealthPill, marginal revenue decreases as additional units are sold. The marginal cost curve is upward-sloping. The profit-maximizing choice for the monopoly will be to produce at the quantity where marginal revenue is equal to marginal cost: that is,  $MR = MC$ . If the monopoly produces a lower quantity, then  $MR > MC$  at those levels of output, and the firm can make higher profits by expanding output. If the firm produces at a greater quantity, then  $MC > MR$ , and the firm can make higher profits by reducing its quantity of output.

Cost Information				Revenue Information			
Quantity	Total Cost	Marginal Cost	Average Cost	Quantity	Price	Total Revenue	Marginal Revenue
1	1,500	1,500	1,500	1	1,200	1,200	1,200
2	1,800	300	900	2	1,100	2,200	1,000
3	2,200	400	733	3	1,000	3,000	800
4	2,800	600	700	4	900	3,600	600
5	3,500	700	700	5	800	4,000	400
6	4,200	700	700	6	700	4,200	200
7	5,600	1,400	800	7	600	4,200	0
8	7,400	1,800	925	8	500	4,000	−200

**Table 9.3 Costs and Revenues of HealthPill**

A monopolist can determine its profit-maximizing price and quantity by analyzing the marginal revenue and marginal costs of producing an extra unit. If the marginal revenue exceeds the marginal cost, then the firm should produce the extra unit.

For example, at an output of 3 in **Figure 9.5**, marginal revenue is 800 and marginal cost is 400, so producing this unit will clearly add to overall profits. At an output of 4, marginal revenue is 600 and marginal cost is 600, so producing this unit still means overall profits are unchanged. However, expanding output from 4 to 5 would involve a marginal revenue of 400 and a marginal cost of 700, so that fifth unit would actually reduce profits. Thus, the monopoly can tell from the marginal revenue and marginal cost that of the choices given in the table, the profit-maximizing level of output is 4.

Indeed, the monopoly could seek out the profit-maximizing level of output by increasing quantity by a small amount, calculating marginal revenue and marginal cost, and then either increasing output as long as marginal revenue exceeds marginal cost or reducing output if marginal cost exceeds marginal revenue. This process works without any need to calculate total revenue and total cost. Thus, a profit-maximizing monopoly should follow the rule of producing up to the quantity where marginal revenue is equal to marginal cost—that is,  $MR = MC$ .

## Work It Out

### Maximizing Profits

If you find it counterintuitive that producing where marginal revenue equals marginal cost will maximize profits, working through the numbers will help.

Step 1. Remember that marginal cost is defined as the change in total cost from producing a small amount of additional output.

$$MC = \frac{\text{change in total cost}}{\text{change in quantity produced}}$$

Step 2. Note that in **Table 9.3**, as output increases from 1 to 2 units, total cost increases from \$1500 to \$1800. As a result, the marginal cost of the second unit will be:

$$\begin{aligned} MC &= \frac{\$1800 - \$1500}{1} \\ &= \$300 \end{aligned}$$

Step 3. Remember that, similarly, marginal revenue is the change in total revenue from selling a small amount of additional output.

$$MR = \frac{\text{change in total revenue}}{\text{change in quantity sold}}$$

Step 4. Note that in [Table 9.3](#), as output increases from 1 to 2 units, total revenue increases from \$1200 to \$2200. As a result, the marginal revenue of the second unit will be:

$$\begin{aligned} MR &= \frac{\$2200 - \$1200}{1} \\ &= \$1000 \end{aligned}$$

Quantity	Marginal Revenue	Marginal Cost	Marginal Profit	Total Profit
1	1,200	1,500	−300	−300
2	1,000	300	700	400
3	800	400	400	800
4	600	600	0	800
5	400	700	−300	500
6	200	700	−500	0
7	0	1,400	−1,400	−1,400

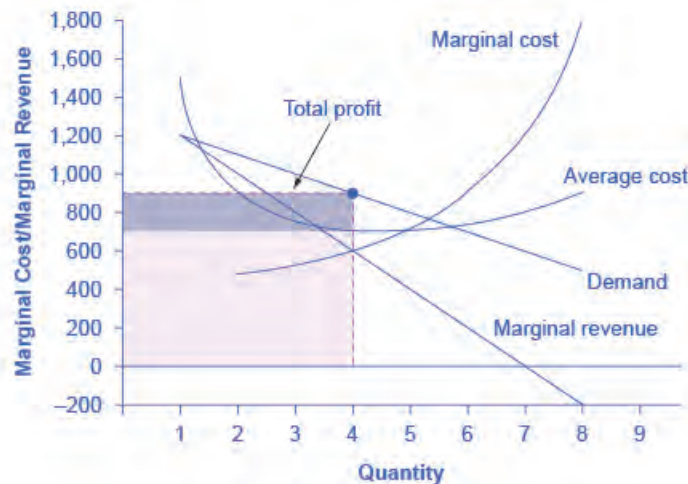
**Table 9.4 Marginal Revenue, Marginal Cost, Marginal and Total Profit**

**Table 9.4** repeats the marginal cost and marginal revenue data from [Table 9.3](#), and adds two more columns: **Marginal profit** is the profitability of each additional unit sold. It is defined as marginal revenue minus marginal cost. Finally, total profit is the sum of marginal profits. As long as marginal profit is positive, producing more output will increase total profits. When marginal profit turns negative, producing more output will decrease total profits. Total profit is maximized where marginal revenue equals marginal cost. In this example, maximum profit occurs at 4 units of output.

A perfectly competitive firm will also find its profit-maximizing level of output where  $MR = MC$ . The key difference with a perfectly competitive firm is that in the case of perfect competition, marginal revenue is equal to price ( $MR = P$ ), while for a monopolist, marginal revenue is not equal to the price, because changes in quantity of output affect the price.

## Illustrating Monopoly Profits

It is straightforward to calculate profits of given numbers for total revenue and total cost. However, the size of monopoly profits can also be illustrated graphically with [Figure 9.6](#), which takes the marginal cost and marginal revenue curves from the previous exhibit and adds an average cost curve and the monopolist's perceived demand curve.



**Figure 9.6 Illustrating Profits at the HealthPill Monopoly** This figure begins with the same marginal revenue and marginal cost curves from the HealthPill monopoly presented in [Figure 9.5](#). It then adds an average cost curve and the demand curve faced by the monopolist. The HealthPill firm first chooses the quantity where  $MR = MC$ ; in this example, the quantity is 4. The monopolist then decides what price to charge by looking at the demand curve it faces. The large box, with quantity on the horizontal axis and marginal revenue on the vertical axis, shows total revenue for the firm. Total costs for the firm are shown by the lighter-shaded box, which is quantity on the horizontal axis and marginal cost of production on the vertical axis. The large total revenue box minus the smaller total cost box leaves the darkly shaded box that shows total profits. Since the price charged is above average cost, the firm is earning positive profits.

**Figure 9.7** illustrates the three-step process where a monopolist: selects the profit-maximizing quantity to produce; decides what price to charge; determines total revenue, total cost, and profit.

### Step 1: The Monopolist Determines Its Profit-Maximizing Level of Output

The firm can use the points on the demand curve  $D$  to calculate total revenue, and then, based on total revenue, calculate its marginal revenue curve. The profit-maximizing quantity will occur where  $MR = MC$ —or at the last possible point before marginal costs start exceeding marginal revenue. On [Figure 9.6](#),  $MR = MC$  occurs at an output of 4.

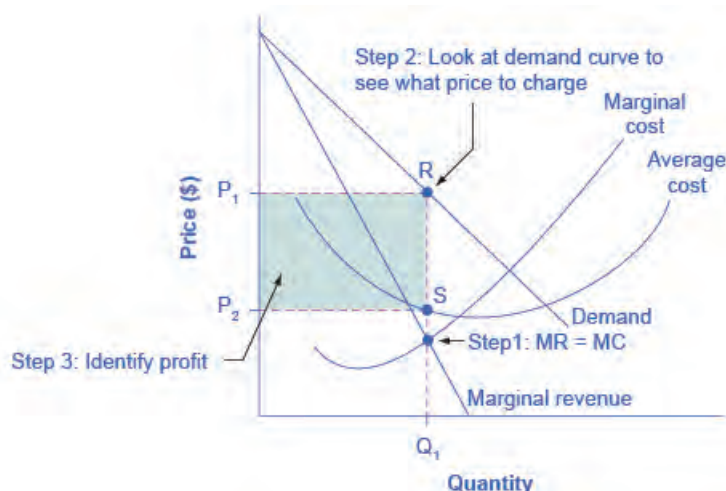
### Step 2: The Monopolist Decides What Price to Charge

The monopolist will charge what the market is willing to pay. A dotted line drawn straight up from the profit-maximizing quantity to the demand curve shows the profit-maximizing price. This price is above the average cost curve, which shows that the firm is earning profits.

### Step 3: Calculate Total Revenue, Total Cost, and Profit

Total revenue is the overall shaded box, where the width of the box is the quantity being sold and the height is the price. In [Figure 9.6](#), the bottom part of the shaded box, which is shaded more lightly, shows total costs; that is, quantity on the horizontal axis multiplied by average cost on the vertical axis. The larger box of total revenues minus the smaller box of total costs will equal profits, which is shown by the darkly shaded box. In a perfectly competitive market, the forces of entry would erode this profit in the long run. But a monopolist is protected by barriers to entry. In fact, one telltale sign of a possible monopoly is when a firm earns profits year after year, while doing more or less the same thing, without ever seeing those profits eroded by increased competition.





**Figure 9.7 How a Profit-Maximizing Monopoly Decides Price** In Step 1, the monopoly chooses the profit-maximizing level of output  $Q_1$ , by choosing the quantity where  $MR = MC$ . In Step 2, the monopoly decides how much to charge for output level  $Q_1$  by drawing a line straight up from  $Q_1$  to point R on its perceived demand curve. Thus, the monopoly will charge a price ( $P_1$ ). In Step 3, the monopoly identifies its profit. Total revenue will be  $Q_1$  multiplied by  $P_1$ . Total cost will be  $Q_1$  multiplied by the average cost of producing  $Q_1$ , which is shown by point S on the average cost curve to be  $P_2$ . Profits will be the total revenue rectangle minus the total cost rectangle, shown by the shaded zone in the figure.

## Clear It Up



### Why is a monopolist's marginal revenue always less than the price?

The marginal revenue curve for a monopolist always lies beneath the market demand curve. To understand why, think about increasing the quantity along the demand curve by one unit, so that you take one step down the demand curve to a slightly higher quantity but a slightly lower price. A demand curve is not sequential: It is not that first we sell  $Q_1$  at a higher price, and then we sell  $Q_2$  at a lower price. Rather, a demand curve is conditional: If we charge the higher price, we would sell  $Q_1$ . If, instead, we charge a lower price (on all the units that we sell), we would sell  $Q_2$ .

So when we think about increasing the quantity sold by one unit, marginal revenue is affected in two ways. First, we sell one additional unit at the new market price. Second, all the previous units, which could have been sold at the higher price, now sell for less. Because of the lower price on all units sold, the marginal revenue of selling a unit is less than the price of that unit—and the marginal revenue curve is below the demand curve.

*Tip:* For a straight-line demand curve, MR and demand have the same vertical intercept. As output increases, marginal revenue decreases twice as fast as demand, so that the horizontal intercept of MR is halfway to the horizontal intercept of demand. You can see this in the [Figure 9.8](#).



**Figure 9.8 The Monopolist's Marginal Revenue Curve versus Demand Curve** Because the market demand curve is conditional, the marginal revenue curve for a monopolist lies beneath the demand curve.

## The Inefficiency of Monopoly

Most people criticize monopolies because they charge too high a price, but what economists object to is that monopolies do not supply enough output to be allocatively efficient. To understand why a monopoly is inefficient, it is useful to compare it with the benchmark model of perfect competition.

**Allocative efficiency** is a social concept. It refers to producing the optimal quantity of some output, the quantity where the marginal benefit to society of one more unit just equals the marginal cost. The rule of profit maximization in a world of perfect competition was for each firm to produce the quantity of output where  $P = MC$ , where the price ( $P$ ) is a measure of how much buyers value the good and the marginal cost ( $MC$ ) is a measure of what marginal units cost society to produce. Following this rule assures allocative efficiency. If  $P > MC$ , then the marginal benefit to society (as measured by  $P$ ) is greater than the marginal cost to society of producing additional units, and a greater quantity should be produced. But in the case of monopoly, price is always greater than marginal cost at the profit-maximizing level of output, as can be seen by looking back at [Figure 9.6](#). Thus, consumers will suffer from a monopoly because a lower quantity will be sold in the market, at a higher price, than would have been the case in a perfectly competitive market.

The problem of inefficiency for monopolies often runs even deeper than these issues, and also involves incentives for efficiency over longer periods of time. There are counterbalancing incentives here. On one side, firms may strive for new inventions and new intellectual property because they want to become monopolies and earn high profits—at least for a few years until the competition catches up. In this way, monopolies may come to exist because of competitive pressures on firms. However, once a barrier to entry is in place, a monopoly that does not need to fear competition can just produce the same old products in the same old way—while still ringing up a healthy rate of profit. John Hicks, who won the Nobel Prize for economics in 1972, wrote in 1935: “The best of all monopoly profits is a quiet life.” He did not mean the comment in a complimentary way. He meant that monopolies may bank their profits and slack off on trying to please their customers.

When AT&T provided all of the local and long-distance phone service in the United States, along with manufacturing most of the phone equipment, the payment plans and types of phones did not change much. The old joke was that you could have any color phone you wanted, as long as it was black. But in 1982, AT&T was split up by government litigation into a number of local phone companies, a long-distance phone company, and a phone equipment manufacturer. An explosion of innovation followed. Services like call waiting, caller ID, three-way calling, voice mail through the phone company, mobile phones, and wireless connections to the Internet all became available. A wide range of payment plans was offered, as well. It was no longer true that all phones were black; instead, phones came in a wide variety of shapes and colors. The end of the telephone monopoly brought lower prices, a greater quantity of services, and also a wave of innovation aimed at attracting and pleasing customers.

# Bring it Home

## The Rest is History

In the opening case, the East India Company and the Confederate States were presented as a monopoly or near monopoly provider of a good. Nearly every American schoolchild knows the result of the ‘unwelcome visit’ the ‘Mohawks’ bestowed upon Boston Harbor’s tea-bearing ships—the Boston Tea Party. Regarding the cotton industry, we also know Great Britain remained neutral during the Civil War, taking neither side during the conflict.

Did the monopoly nature of these business have unintended and historical consequences? Might the American Revolution have been deterred, if the East India Company had sailed the tea-bearing ships back to England? Might the southern states have made different decisions had they not been so confident “King Cotton” would force diplomatic recognition of the Confederate States of America? Of course, it is not possible to definitively answer these questions; after all we cannot roll back the clock and try a different scenario. We can, however, consider the monopoly nature of these businesses and the roles they played and hypothesize about what might have occurred under different circumstances.

Perhaps if there had been legal free tea trade, the colonists would have seen things differently; there was smuggled Dutch tea in the colonial market. If the colonists had been able to freely purchase Dutch tea, they would have paid lower prices and avoided the tax.

What about the cotton monopoly? With one in five jobs in Great Britain depending on Southern cotton and the Confederate States nearly the sole provider of that cotton, why did Great Britain remain neutral during the Civil War? At the beginning of the war, Britain simply drew down massive stores of cotton. These stockpiles lasted until near the end of 1862. Why did Britain not recognize the Confederacy at that point? Two reasons: The Emancipation Proclamation and new sources of cotton. Having outlawed slavery throughout the United Kingdom in 1833, it was politically impossible for Great Britain, empty cotton warehouses or not, to recognize, diplomatically, the Confederate States. In addition, during the two years it took to draw down the stockpiles, Britain expanded cotton imports from India, Egypt, and Brazil.

Monopoly sellers often see no threats to their superior marketplace position. In these examples did the power of the monopoly blind the decision makers to other possibilities? Perhaps. But, as they say, the rest is history.

## KEY TERMS

**allocative efficiency** producing the optimal quantity of some output; the quantity where the marginal benefit to society of one more unit just equals the marginal cost

**barriers to entry** the legal, technological, or market forces that may discourage or prevent potential competitors from entering a market

**copyright** a form of legal protection to prevent copying, for commercial purposes, original works of authorship, including books and music

**deregulation** removing government controls over setting prices and quantities in certain industries

**intellectual property** the body of law including patents, trademarks, copyrights, and trade secret law that protect the right of inventors to produce and sell their inventions

**legal monopoly** legal prohibitions against competition, such as regulated monopolies and intellectual property protection

**marginal profit** profit of one more unit of output, computed as marginal revenue minus marginal cost

**monopoly** a situation in which one firm produces all of the output in a market

**natural monopoly** economic conditions in the industry, for example, economies of scale or control of a critical resource, that limit effective competition

**patent** a government rule that gives the inventor the exclusive legal right to make, use, or sell the invention for a limited time

**predatory pricing** when an existing firm uses sharp but temporary price cuts to discourage new competition

**trade secrets** methods of production kept secret by the producing firm

**trademark** an identifying symbol or name for a particular good and can only be used by the firm that registered that trademark

## KEY CONCEPTS AND SUMMARY

### 9.1 How Monopolies Form: Barriers to Entry

Barriers to entry prevent or discourage competitors from entering the market. These barriers include: economies of scale that lead to natural monopoly; control of a physical resource; legal restrictions on competition; patent, trademark and copyright protection; and practices to intimidate the competition like predatory pricing. Intellectual property refers to legally guaranteed ownership of an idea, rather than a physical item. The laws that protect intellectual property include patents, copyrights, trademarks, and trade secrets. A natural monopoly arises when economies of scale persist over a large enough range of output that if one firm supplies the entire market, no other firm can enter without facing a cost disadvantage.

### 9.2 How a Profit-Maximizing Monopoly Chooses Output and Price

A monopolist is not a price taker, because when it decides what quantity to produce, it also determines the market price. For a monopolist, total revenue is relatively low at low quantities of output, because not much is being sold. Total revenue is also relatively low at very high quantities of output, because a very high quantity will sell only at a low price. Thus, total revenue for a monopolist will start low, rise, and then decline. The marginal revenue for a monopolist from selling additional units will decline. Each additional unit sold by a monopolist will push down the overall market price, and as more units are sold, this lower price applies to more and more units.

The monopolist will select the profit-maximizing level of output where  $MR = MC$ , and then charge the price for that quantity of output as determined by the market demand curve. If that price is above average cost, the monopolist earns positive profits.

Monopolists are not productively efficient, because they do not produce at the minimum of the average cost curve. Monopolists are not allocatively efficient, because they do not produce at the quantity where  $P = MC$ . As a result, monopolists produce less, at a higher average cost, and charge a higher price than would a combination of firms in a perfectly competitive industry. Monopolists also may lack incentives for innovation, because they need not fear entry.

## SELF-CHECK QUESTIONS

1. Classify the following as a government-enforced barrier to entry, a barrier to entry that is not government-enforced, or a situation that does not involve a barrier to entry.
  - a. A patented invention
  - b. A popular but easily copied restaurant recipe
  - c. An industry where economies of scale are very small compared to the size of demand in the market
  - d. A well-established reputation for slashing prices in response to new entry
  - e. A well-respected brand name that has been carefully built up over many years
2. Classify the following as a government-enforced barrier to entry, a barrier to entry that is not government-enforced, or a situation that does not involve a barrier to entry.
  - a. A city passes a law on how many licenses it will issue for taxicabs
  - b. A city passes a law that all taxicab drivers must pass a driving safety test and have insurance
  - c. A well-known trademark
  - d. Owning a spring that offers very pure water
  - e. An industry where economies of scale are very large compared to the size of demand in the market
3. Suppose the local electrical utility, a legal monopoly based on economies of scale, was split into four firms of equal size, with the idea that eliminating the monopoly would promote competitive pricing of electricity. What do you anticipate would happen to prices?
4. If Congress reduced the period of patent protection from 20 years to 10 years, what would likely happen to the amount of private research and development?
5. Suppose demand for a monopoly's product falls so that its profit-maximizing price is below average variable cost. How much output should the firm supply? *Hint:* Draw the graph.
6. Imagine a monopolist could charge a different price to every customer based on how much he or she were willing to pay. How would this affect monopoly profits?

## REVIEW QUESTIONS

7. How is monopoly different from perfect competition?
8. What is a barrier to entry? Give some examples.
9. What is a natural monopoly?
10. What is a legal monopoly?
11. What is predatory pricing?
12. How is intellectual property different from other property?
13. By what legal mechanisms is intellectual property protected?
14. In what sense is a natural monopoly "natural"?
15. How is the demand curve perceived by a perfectly competitive firm different from the demand curve perceived by a monopolist?
16. How does the demand curve perceived by a monopolist compare with the market demand curve?
17. Is a monopolist a price taker? Explain briefly.



18. What is the usual shape of a total revenue curve for a monopolist? Why?
19. What is the usual shape of a marginal revenue curve for a monopolist? Why?
20. How can a monopolist identify the profit-maximizing level of output if it knows its total revenue and total cost curves?
21. How can a monopolist identify the profit-maximizing level of output if it knows its marginal revenue and marginal costs?
22. When a monopolist identifies its profit-maximizing quantity of output, how does it decide what price to charge?
23. Is a monopolist allocatively efficient? Why or why not?
24. How does the quantity produced and price charged by a monopolist compare to that of a perfectly competitive firm?

## CRITICAL THINKING QUESTIONS

25. ALCOA does not have the monopoly power it once had. How do you suppose their barriers to entry were weakened?
26. Why are generic pharmaceuticals significantly cheaper than name brand ones?
27. For many years, the Justice Department has tried to break up large firms like IBM, Microsoft, and most recently Google, on the grounds that their large market share made them essentially monopolies. In a global market, where U.S. firms compete with firms from other countries, would this policy make the same sense as it might in a purely domestic context?
28. Intellectual property laws are intended to promote innovation, but some economists, such as Milton Friedman, have argued that such laws are not desirable. In the United States, there is no intellectual property protection for food recipes or for fashion designs. Considering the state of these two industries, and bearing in mind the discussion of the inefficiency of monopolies, can you think of any reasons why intellectual property laws might hinder innovation in some cases?
29. Imagine that you are managing a small firm and thinking about entering the market of a monopolist. The monopolist is currently charging a high price, and you have calculated that you can make a nice profit charging 10% less than the monopolist. Before you go ahead and challenge the monopolist, what possibility should you consider for how the monopolist might react?
30. If a monopoly firm is earning profits, how much would you expect these profits to be diminished by entry in the long run?

## PROBLEMS

31. Return to **Figure 9.2**. Suppose  $P_0$  is \$10 and  $P_1$  is \$11. Suppose a new firm with the same LRAC curve as the incumbent tries to break into the market by selling 4,000 units of output. Estimate from the graph what the new firm's average cost of producing output would be. If the incumbent continues to produce 6,000 units, how much output would be supplied to the market by the two firms? Estimate what would happen to the market price as a result of the supply of both the incumbent firm and the new entrant. Approximately how much profit would each firm earn?
32. Draw the demand curve, marginal revenue, and marginal cost curves from **Figure 9.6**, and identify the quantity of output the monopoly wishes to supply and the price it will charge. Suppose demand for the monopoly's product increases dramatically. Draw the new demand curve. What happens to the marginal revenue as a result of the increase in demand? What happens to the marginal cost curve? Identify the new profit-maximizing quantity and price. Does the answer make sense to you?
33. Draw a monopolist's demand curve, marginal revenue, and marginal cost curves. Identify the monopolist's profit-maximizing output level. Now, think about a slightly higher level of output (say  $Q_0 + 1$ ). According to the graph, is there any consumer willing to pay more than the marginal cost of that new level of output? If so, what does this mean?

