for General Auto. General Auto responds by raising the price of automobiles even more than he would if steel were competitively produced. Similarly, General Steel raises the price of steel even more than he would if automobiles were competitively produced. Throw in a General Tire, a General Computer, and, let's say, a General Electric and we have a recipe for economic disaster. Each general tries to grab a larger share of the pie, but the combined result is that the pie gets much, much smaller.

Monopoly profit

PETER HARHOLDT/SUPERSTOCK

Compare a competitive market economy with a monopolized economy: Competitive producers of steel work to reduce prices so they can sell more. Reduced prices of steel result in reduced prices of automobiles. Cost savings in one sector are spread throughout the economy, resulting in economic growth. In a monopolized economy, in contrast, the entire process is thrown into reverse. Each firm wants to raise its prices, and the resulting cost increases are spread throughout the economy, resulting in poverty and stagnation.

One of the great lessons of economics is to show that good institutions channel self-interest toward social prosperity, whereas poor institutions channel self-interest toward social destruction. Business leaders in the United States are no less self-interested than generals in Algeria. So why are the former a mostly positive force, while the latter are a mostly negative force? It's because competitive markets channel the self-interest of business leaders toward social prosperity, whereas the political structure of Algeria channels self-interest toward social destruction.

The Benefits of Monopoly: Incentives for Research and Development

GlaxoSmithKline prices its AIDS drugs above marginal cost. If GSK didn't have a monopoly, competition would push prices down, more people could afford to buy Combivir, and total surplus would increase (i.e., deadweight loss would decline). So isn't the solution to the monopoly problem obvious? Open up the industry to competition by refusing to enforce the firm's patent or force Glaxo-SmithKline to lower its price.

In fact, many countries pursue one or the other of these policies. India, for example, has traditionally not offered strong patent protection, and Canada controls pharmaceutical prices. India's and Canada's policies have successfully kept pharmaceutical prices low in those countries. Many people argue that the United States should also control pharmaceutical prices. Unfortunately, the story is not so simple. We need to revisit our question, what's wrong with monopoly?

In the United States, researching, developing, and successfully testing the average new drug cost nearly $1 billion.[8] Firms must be compensated for these expenses if people expect them to invest in the discovery process. But if competition pushes the price of a pill down to the marginal cost, nothing will be left over for the cost of invention. And he who has no hope of reaping will not sow.

Patents are one way of rewarding research and development. Look again at Figure 13.3, which shows the green rectangle of monopoly profit. It's precisely the expectation (and hope) of enjoying that monopoly profit that encourages firms to research and develop new drugs.

RANDY M. URY/FLIRT/CORBIS

Thomas Edison spent years experimenting with thousands of materials before he discovered that carbonized bamboo filament would make a long-lasting lightbulb. If anyone could have capitalized on his idea, Edison would not have been able to profit from his laborious research and development and perhaps he would not have done the necessary research in the first place.

Profit fuels the fire of invention.

Eyes on the prize Prizes are another way of rewarding research and development without creating monopolies. SpaceShipOne, pictured here, won the $10 million Ansari X Prize for being the first privately developed manned rocket capable of reaching space and returning in a short time. Netflix, the DVD distribution firm, offered and paid a $1 million prize for improvements to its movie recommendation system. The Department of Defense has sponsored prizes for driverless vehicles and Congress established the L-Prize for advances in lightbulb technology.

If pharmaceutical patents are not enforced, the number of new drugs will decrease. India is poor and Canada is small, so neither contributes much to the global profit of pharmaceutical firms. But if the United States were to limit pharmaceutical patents significantly or to control pharmaceutical prices, the number of new drugs would decrease significantly.[9] But new drugs save lives. As noted in the introduction, antiretrovirals like Combivir were the major cause of the 50% decrease in AIDS deaths in the United States in the mid–1990s. We should be careful that in pushing prices closer to marginal cost, we do not lose the new drug entirely.

In evaluating pharmaceutical patents, you should keep in mind that patents don't last forever. A patent lasts for at most 20 years, and by the time a new drug is FDA-approved, its effective life is typically only 12–14 years. Once the drug goes off patent, generic equivalents appear quickly and the deadweight loss is eliminated as price falls.

Pharmaceuticals are not the only goods with high development costs and low marginal costs. Information goods of all kinds often have the same cost structure. Video games like Halo, Madden NFL, and The Sims have typical development costs of $7 million to $10 million; Grand Theft Auto IV cost more than $100 million to develop. Once the code has been written, however, the marginal cost of distributing on the Internet is close to zero. Prices, typically $40–$60, are therefore well above marginal costs. Since prices exceed marginal costs, there is a deadweight loss, which in theory could be reduced by a price control. Reducing prices, however, would reduce the incentive to research and develop new games. What would you rather have: Pong at $2, or, for $50 a game, a constant stream of new and better games?

Video games may seem trivial, but the trade-off between lower prices today at the expense of fewer new ideas in the future is a central one in modern economies. In fact, modern theories of economic growth emphasize that monopoly—*when it increases innovation*—may increase economic growth.

Nobel prize–winning economic historian Douglass North argues that economic growth was slow and sporadic until laws, including patent laws, were created to protect innovation:

> [T]hroughout man's past he has continually developed new techniques, but the pace has been slow and intermittent. The primary reason has been that the incentives for developing new techniques have occurred only sporadically. Typically, innovations could be copied at no cost by others and without any reward to the inventor or innovator. The failure to develop systematic property rights in innovation up until fairly modern times was a major source of the slow pace of technological change.[10]

Patent Buyouts—A Potential Solution?

Is there a way to eliminate the deadweight loss without reducing the incentive to innovate? Economist Michael Kremer has offered one speculative idea.[11] Take a look again at Figure 13.3. The green profit rectangle is the

value of the patent to the patent owner, $800 million. Suppose that the government were to offer to buy the rights to the patent at, say, $850 million? The monopolist would be eager to sell at this price. What would the government do with the patent? Rip it up! If the government ripped up the patent, competitors would enter the field, drive the price down to the marginal cost of production, and eliminate the deadweight loss. In other words, Combivir would fall from $12.50 a pill to 50 cents a pill, and more of the world's poor could afford to be treated for AIDS.

The great virtue of Kremer's proposal is that it reduces the price of new drugs without reducing the incentive to develop more new drugs. Indeed, by offering more than the potential profit, the government could even increase the incentive to innovate! As usual, however, there is no such thing as a free lunch. To buy the patent, the government must raise taxes, and we know from Chapter 6 that taxes, just like monopolies, create deadweight losses. Also determining the right price to buy the patent is not easy and some people worry that corruption could be a problem.

Kremer's idea has never been tried on a widespread basis, but despite these problems, economists are becoming increasingly interested in patent buyouts and the closely related idea of prizes as a way to encourage innovation without creating too much deadweight loss.

Economies of Scale and the Regulation of Monopoly

Governments are not the only source of market power. Monopolies can arise naturally when **economies of scale** create circumstances where one large firm (or a handful of large firms) can produce at lower cost than many small firms. When a single firm can supply the entire market at lower cost than two or more firms, we say that the industry is a **natural monopoly.**

A subway is a natural monopoly because it would cost twice as much to build two parallel subway tunnels than to build one, but even though costs would be twice as high, output (the number of subway trips) would be the same. Utilities such as water, natural gas, and cable television are typically natural monopolies because in each case it's much cheaper to run one pipe or cable than to run multiple pipes or cables to the same set of homes.

In Figure 13.5, we compared competitive firms with an *equal cost* monopoly and showed that total surplus was higher under competition. The comparison between competitive firms and natural monopoly is more difficult. Even though natural monopolies produce less than the optimal quantity, competitive firms would also produce less than the optimal quantity because they could not take advantage of economies of scale.

If the economies of scale are large enough, it's even possible for price to be lower under natural monopoly than it would be under competition. Figure 13.6 on the next page shows just such a situation. Notice that the average cost curve for the monopoly is so far below the average cost curves of the competitive firms, that the monopoly price is below the competitive price. It's possible, for example, for every home to produce its own electric power with a small generator or solar panel, but the costs of producing electricity in this way would be higher than buying electricity produced from a dam even if the dam was a natural monopoly.
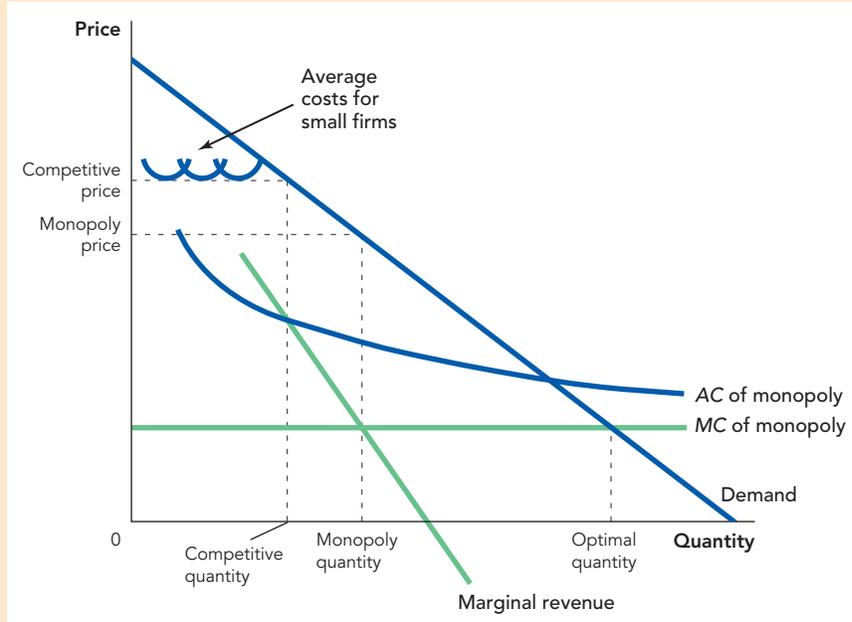
Economies of scale are the advantages of large-scale production that reduce average cost as quantity increases.

A **natural monopoly** is said to exist when a single firm can supply the entire market at a lower cost than two or more firms.

FIGURE 13.6

A Monopoly with Large Economies of Scale Can Have a Lower Price than Competitive Firms Economies of scale mean that a monopoly producer can have lower costs of production than competitive firms. It's cheaper to produce electricity for 100,000 homes with one large dam, for example, than with a solar panel for each home. If economies of scale are large enough, the monopoly price can be lower than the competitive price and the monopoly output can be higher than the competitive output.

Is there any way to have our cake and eat it too? That is, is there a way to have prices equal to marginal cost and to take advantage of economies of scale?

In theory the answer is yes, but it's not easy. In Chapter 8, we showed that a price control set below the market price would create a shortage. But surprisingly, when the market price is set by a monopolist, a price control can increase output. Let's see how.
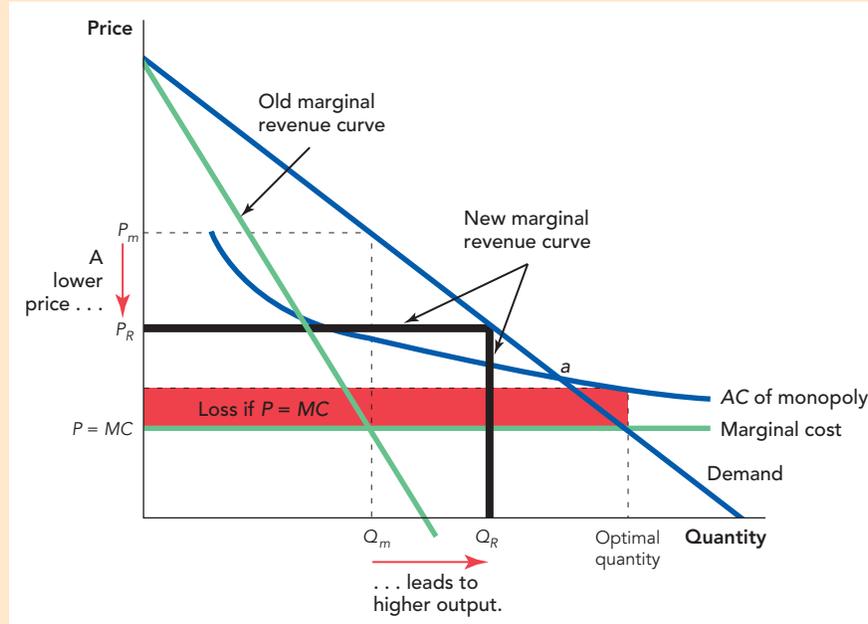
Suppose that the government imposes a price control on the monopolist at level P_R, as in Figure 13.7. Imagine that the monopolist sells two units and suppose it wants to sell a third. What is the marginal revenue on the third unit? It's just P_R. In fact, when the price is set at P_R, the monopolist can sell up to Q_R units without having to lower the price. Since the monopolist doesn't have to lower the price to sell more units, the marginal revenue for each unit up to Q_R is P_R. Notice that we have drawn the new marginal revenue curve in Figure 13.7 equal to P_R in between 0 and Q_R (after that point, to sell an additional unit, the monopolist has to lower the price on all previous units so the MR curve jumps down to the level of the old MR curve and becomes negative). Now the problem is simple because, as always, the monopolist wants to produce until $MR = MC$, so Q_R is the profit-maximizing quantity.

Notice that the monopolist produces *more* as the government-regulated price of its output *falls*.

So what price should the government set? Since the optimal quantity is found where $P = MC$, the natural answer is that the government should set $P_R = MC$. Unfortunately, that won't work when economies of scale are large because if the price is set equal to marginal cost, the monopolist will be taking a loss. Remember that Profit = $(P - AC) \times Q$ so setting P_R equal to marginal cost creates a loss illustrated by the red area in Figure 13.7.

The government could subsidize the monopolist to make up for the loss when $P_R = MC$ but, once again, taxation has its own deadweight losses. If the

FIGURE 13.7

A Price Control on a Monopoly Can Increase Output Without regulation, the monopoly maximizes profit by choosing P_m, Q_m. If the government imposes a price control at P_R, the monopolist chooses Q_R, a larger quantity. The optimal price is at $P = MC$, but at this price the monopolist is making a loss and will exit the industry. The lowest price that will keep the monopolist in the industry is $P = AC$ at point a. At that price, the monopolist makes a zero (normal) profit.

government set $P_R = AC$ at point a, where the AC curve intersects the demand curve, the monopolist would just break even; output would then be larger than the monopoly quantity but less than the optimal quantity. This seems like a fairly good solution, but there are other problems with regulating a monopolist. When the monopolist's profits are regulated, it doesn't have much incentive to increase quality with innovative new products or to lower costs. The strange history of cable TV regulation and California's ill-fated efforts at electricity deregulation illustrate some of the real problems with regulating and deregulating monopolies.

I Want My MTV

Regulation of retail subscription rates for cable TV seemed to keep prices low in the early years of television, when there were basically only three channels, ABC, CBS, and NBC. In the 1970s, however, new technology made it possible for cable operators to offer 10, 20, or even 30 channels. But if subscription rates were fixed at the low levels, thereby limiting profit rates, the cable operators would have little incentive to add channels. Recognizing this, Congress lifted caps on pay TV rates in 1979 and on all cable television in 1984.

Deregulation of cable TV rates led to higher prices, just as the theory of natural monopoly predicts, but something else happened—the number of television channels and the quality of programming increased dramatically. And, contrary to natural monopoly theory, consumers seemed to appreciate the new channels more than they disliked the higher prices. This is evident because even as prices rose, more people signed up for cable television.[12]

Congress re-regulated "basic cable" rates in 1992 but left "premium channels" unregulated. *Wayne's World* was the result. Let's explain: Cable operators were typically required to carry a certain number of channels in the basic package, but they had some choice over which channels were included in the package.

Quality comes at a price.

So when basic cable was re-regulated, the cable operators moved some of the best channels to their unregulated premium package. To fill the gaps in the basic package, they added whatever programs were cheap, including television shows created by amateurs on a shoestring budget. *Wayne's World,* a *Saturday Night Live* comedy sketch, mocked the proliferation of these amateur cable shows.

Rates were mostly deregulated again in 1996. Not entirely coincidentally, this was the first year that HBO won an Emmy. Today, "basic tier cable" is regulated by local governments, but anything beyond the most basic service is predominantly free of regulation and cable companies can charge a market rate. As before, prices have risen since deregulation, but so have the number of television channels and the quality of programming.

If you like *Game of Thrones, Pretty Little Liars,* and *The Walking Dead*, then cable deregulation has worked well. Deregulation of electricity, however, has proven shocking.

Electric Shock

Government ownership is another potential solution to the natural monopoly problem. In the United States, there are some 3,000 electric utilities, and two-thirds of them are government-owned (the remainder are heavily regulated). Government ownership of utilities began early in the twentieth century with municipalities owning local distribution companies. In the 1930s, the federal government became a major generator of electricity with the construction of the then largest manmade structures ever built, the Hoover Dam in 1936 and the even larger Grand Coulee Dam in 1941.

Government ownership and regulation worked reasonably well for several decades in providing the United States with cheap power. Without the discipline of competition or a profit motive, however, there is a tendency for a government-run or regulated monopoly to become inefficient. Why reduce costs when costs can be passed on to customers? In the 1960s and 1970s, multibillion-dollar cost overruns for the construction of nuclear power plants drew attention to industry inefficiencies as the price of power increased.

Historically, a single firm handled the generation, long-distance transmission, and local distribution of electricity. In the 1970s, however, new technologies reduced the average cost of generating electricity at small scales (in Figure 13.6 you can think of the curves labeled "Average costs for small firms" as moving down). Although the transmission and distribution of electricity remained natural monopolies, the new technologies meant that the generation of electricity was no longer a natural monopoly. Economists began to argue that unbundling generation from transmission and distribution could open up electricity generation to competitive forces, thereby reducing costs.

ANDREW ZARIVNY/SHUTTERSTOCK

The Hoover Dam The natural monopoly that lights Las Vegas.

California's Perfect Storm

Hoping to benefit from lower costs and greater innovation, California deregulated wholesale electricity prices in 1998. In the first two years after deregulation, all appeared well. In fact, as the new century was born, California was booming. In Silicon Valley, college students in computer

science were being turned into overnight millionaires and billionaires. In 2000, personal income in California rose by a whopping 9.5%. Higher incomes and an unusually hot summer increased the demand for electricity. But California's generating capacity, which was old and in need of repair, began to strain. To meet the demand, California had to import power from other states, but other states had little to spare. Hot weather was pushing up demand throughout the West and the supply of hydroelectric power had fallen by approximately 20% because of low snowfall the previous winter.

All of these forces and more smashed together in the summer of 2000 to double, triple, quadruple, and finally quintuple the wholesale price of electricity from an average in April of $26 per megawatt hour (MWh) to an August high of $141 per MWh. Prices declined modestly in the fall but jumped again in the winter, reaching for one short period a price of $3,900 per MWh and peaking in December at an average monthly price of $317 per MWh—about 10 times higher than the previous December's rate.[13] Worse yet, when not enough power was available to meet the demand, blackouts threw more than 1 million Californians off the grid and into the dark. The new century wasn't looking so bright after all.

Mother Nature was not the only one to blame for California's troubles. The combination of increased demand, reduced supply, and a poorly designed deregulation plan had created the perfect opportunity for generators of electricity to exploit market power.

When the demand for electricity is well below capacity, each generator has very little market power. If a few generators had shut down in 1999, for example, the effect on the price would have been minimal because the power from those generators could easily have been replaced with imports or power from other generators. Thus, in 1999, each generator faced an elastic demand for its product. In 2000, however, every generator was critical because nearly every generator needed to be up and running just to keep up with demand. Electricity is an unusual commodity because it is expensive to store, and if demand and supply are ever out of equilibrium, the result can be catastrophic blackouts. Thus, when demand is near capacity, a small decline in supply leads to much higher prices as utilities desperately try to buy enough power to keep the electric grid up and running. Thus, in 2000, the demand curve facing each generator was becoming very inelastic. And what happens to the incentive to increase price when demand becomes inelastic? Do you remember the lesson of Figure 13.4, also pictured on the right in Figure 13.8?

FIGURE 13.8

In the summer and winter of 2000, demand was near capacity and *every* generator was facing an inelastic demand curve. A firm that owned only one generating plant couldn't do much to exploit its market power: If it shut down its plant, the price of electricity would rise but the firm wouldn't have any power to sell! Many firms, however, owned more than one generator, and in 2000, this created a terrible incentive. A firm with four generators could shut down one, say, for "maintenance and repair," and the price of electricity would rise by so much that the firm could make more money selling the power produced by its
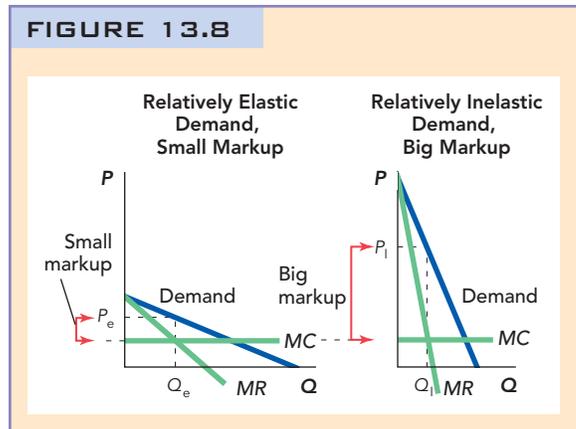
Barriers to entry are factors that increase the cost to new firms of entering an industry.

three operating generators than it could if it ran all four! Suspiciously, far more generators were taken off-line for "maintenance and repair" in 2000 and early 2001 than in 1999.[14]

California was not the only state to restructure its electricity market in the late 1990s. Other states such as Texas and Pennsylvania had opened up generation to competition and have seen modestly lower electricity prices. Restructuring has also occurred in Britain, New Zealand, Canada, and elsewhere, but California's experience has demonstrated that unbundling generation from transmission and distribution, which remain natural monopolies, is tricky.

Other Sources of Market Power

Table 13.1 summarizes some of the sources of market power. In addition to patents, government regulation and economies of scale, monopolies may be created whenever there is a significant **barrier to entry**, something that raises the cost to new firms of entering the industry. One firm, for example, might own an input that is difficult to duplicate. Saudi Arabia, for example, has some market power in the market for oil because the demand for oil is inelastic and Saudi Arabia controls a significant fraction of the world's oil supply. What makes oil special is that oil is found in large quantities in only a few places in the world so a single firm in the right place can monopolize a significant share of the total supply. The market power of Saudi Arabia is enhanced when instead of competing with other suppliers, it joins with them to form a cartel, a group of firms that acts in concert to maximize total profits. We analyze cartels at greater length in Chapter 15.

Brands and trademarks can also give a firm market power because the prestige of owning the real thing cannot be easily duplicated. Timex watches tell the time as well as a Rolex, but only the Rolex signals wealth and status.

Monopolies may also arise when a firm innovates and produces a product that no other firm can immediately duplicate. In 2006, Apple had a 70% share in the market for MP3 players even though Apple's iPod had many competitors—the iPod was simply better than its rivals.[15] As with

TABLE 13.1 Some Sources of Market Power

Sources of Market Power	Example
Patents	GSK's patent in Combivir
Laws preventing entry of competitors	Indonesian clove monopoly, Algerian wheat monopoly, U.S. Postal Service
Economies of scale	Subways, cable TV, electricity transmission, major highways
Hard to duplicate inputs	Oil, diamonds, Rolex watches
Innovation	Apple's iPod, Wolfram's Mathematica software, eBay

patent monopolies, monopolies produced by innovation involve a trade-off: iPods are priced higher than they would be if Apple had better competitors, but Apple would have less incentive to innovate if it didn't expect to earn monopoly profits.

□ Takeaway

After reading this chapter, you should be able to find marginal revenue given either a demand curve or a table of prices and quantities (as in Figure 13.1). Given a demand and marginal cost curve, you should be able to find and label the monopoly price, the monopoly quantity, and deadweight loss. With the addition of an average cost curve, you should be able to find and label monopoly profit. You should also be able to demonstrate why the markup of price over marginal cost is larger the more inelastic the demand—this relationship will also be useful in the next chapter.

What makes monopoly theory interesting and a subject of debate among economists is that it's not always obvious whether monopolies are good or bad. Instead, we are faced with a series of trade-offs. Patent monopolies, such as the one on Combivir, create a trade-off between deadweight loss and innovation. The monopolist prices its product above marginal cost, but without the prospect of monopoly profits, there might be no product at all.

Natural monopolies also involve trade-offs, this time between deadweight loss and economies of scale. Deadweight loss means that monopoly is not optimal, but when economies of scale are large, competitive outcomes aren't optimal either. Regulating monopoly seems to offer an escape from this trade-off, but as we saw in our analysis of cable TV and electricity regulation, the practice of regulation is much more complicated than the theory. Cable TV regulation kept prices low but it kept quality low as well. Overall, deregulation of cable television rates worked surprisingly well, at least according to the consumers who flocked to cable even as rates rose. In contrast, electricity deregulation left California at the mercy of firms wielding market power.

Economists don't always agree on the best way to navigate the trade-offs between deadweight loss, innovation, and economies of scale. Many monopolies, however, perhaps most on a world scale, are "unnatural"—they neither support innovation nor take advantage of economies of scale—instead they are created to transfer wealth to politically powerful elites. For these monopolies, economics does offer guidance—open the field to competition! Alas, economics offers less clear guidance about how to convince the elites to follow the advice of economists.

CHECK YOURSELF

> Consider ticket prices at major league baseball and professional football parks. How does the term "barrier to entry" help explain their pricing?

> How permanent are barriers to entry in the following cases: NBA basketball franchises, U.S. Postal Service delivery of first-class mail, U.S. Postal Service delivery of parcels?

□ CHAPTER REVIEW

KEY CONCEPTS

market power, p. 236

monopoly, p. 236

marginal revenue, *MR,* p. 236

marginal cost, *MC,* p. 236

economies of scale, p. 245

natural monopoly, p. 245

barriers to entry, p. 250