custom-made components often own the specialized dies needed to make them. Monteverde and Teece (1982) found that the more specialized the die, the more likely an automobile company is to own it.[4]

A firm may need workers, such as engineers, who are specially trained in how the firm operates (*specific human capital*) to produce a particular product. If it uses outside contractors as opposed to its own employees, opportunistic behavior is possible. For example, a contractor who knows that a firm is facing a deadline may demand more money. Vertical integration in the form of an employment relationship can avoid such problems.

If successive stages of a production process must be located adjacent to each other (that is, they involve *site-specific capital*), vertical integration is likely. The reason is that if a manufacturing firm stops demanding the input of a supplying firm, that supplying firm must relocate, which can be extremely costly. Opportunistic behavior can be avoided by integrating. The empirical section at the end of this chapter discusses three studies of the importance of specific physical assets and site-specific capital in the automobile and airplane manufacturing industries and in manufacturing as a whole.

When a firm relies heavily on one supplier for specialized products, not only is it at risk from opportunistic behavior by the supplier, but also a rival may try to interfere strategically with its supply. For example, in 1990, Conner Peripherals Inc., a disk-drive manufacturer, sued Seagate Technology Inc., a rival disk-drive manufacturer with half the market, charging that Seagate had blocked Conner's supplies of a critical component. Conner had bought thin film heads from Imprimis Technology Inc., the dominant supplier of the three thin film head vendors. After Seagate acquired Imprimis, it cut off Conner as a customer, according to Conner's complaint.[5]

Uncertainty. As an example of the second transaction-cost reason for vertical integration, *uncertainty,* suppose that a buyer cannot determine how long a durable machine will last. The best way to predict quality (life expectancy) may be to observe the method by which the machine is constructed. If an outside firm cannot monitor quality controls on construction, it may vertically integrate where quality is crucial.

Transactions Involving Information. The third transaction-cost reason for vertical integration concerns transactions involving information. It may be difficult to structure a contract that gives the supplying firm the appropriate incentives to develop the information. For example, if one firm pays another firm a fixed fee to obtain information on newly developing markets, the hired firm does not have an incentive to work hard at the margin to uncover all the information, and the buyer has

[4]See also Masten (1984), who shows that asset specificity influences asset ownership in the aircraft industry, Anderson and Schmittlein (1984), who examine asset specificity and the decision of a firm to have its own sales force, and Crocker and Reynolds (1993), who study how asset specificity influences procurement procedures of the Air Force.

[5]Ken Siegmann, "Conner Sues Seagate over Component Cut-Off," *San Francisco Chronicle,* April 19, 1990:C1. Roxanna Li Nakamura, "Conner Sues Seagate for Contract Reneging," *InfoWorld,* April 30, 1990.

no way of determining whether the supplier did a good job. Disputes on payments may well arise and be difficult to resolve. Such problems can be avoided by vertical integration.

Extensive Coordination. The fourth transaction-cost reason to vertically integrate is to facilitate extensive coordination, as in industries with networks such as airlines and railroads. A railroad depends heavily on developing feeder traffic for its through-routes. Although it might be possible to devise a price system for feeder traffic on each link in the network, such a system would be very complicated. As a result, there is an incentive for railroads to merge to deal with these coordination problems (Carlton and Klamer 1983).

Technological conditions alone do not explain the vertical integration of a firm. For example, a common case of vertical integration is a steel mill that produces its own pig iron. The molten pig iron is run directly into the steel furnace. Although it is inefficient to allow the pig iron to cool down and then ship it to a steel furnace where it must be heated again, it is not necessary that one firm produce both pig iron and steel: Two firms can locate side by side. However, because pig iron production and steel production are so interrelated, there is a potential for opportunistic behavior if two separate firms are involved. Therefore, vertical integration often arises when production processes at different stages are closely interrelated. (See **www.aw-bc.com/carlton_perloff** "Biotech Firms.")

Integration to Assure Supply

A common reason for vertical integration is to assure the supply of important inputs. Timely delivery of an item is of concern to businesspeople, yet standard models of market behavior ignore this topic. Assurance of supply is important in markets where price is not the sole device used to allocate goods (see Chapter 17). Nonprice allocation occurs in a wide range of common situations. For example, a bakery frequently runs out of bread by the end of the day and yet does not raise its price. Instead, late-arriving customers cannot buy the bread. Similarly, grocery stores frequently run out of produce without raising prices. In many producer-good industries, good customers often get the product during "tight" times, and other customers must wait. It is the marketing department, not customer responses to short-run price movements, that allocates goods. Such rationing has occurred in many industries, including paper, chemicals, and metals. Toyota and Dell Computers stress the use of *just-in-time* deliveries of inputs to minimize inventory costs while ensuring timely delivery.

When rationing is a possibility, there is an incentive to vertically integrate in order to raise the probability of obtaining the product. A firm has an incentive to produce its own supplies to meet its predictable level of demand and to rely on other firms for supplies to meet its less stable demand. Outside suppliers respond to this risky environment by raising prices. This arrangement, in which outside suppliers bear the risky demand, may not be the most efficient system for reliably providing the product, but may provide a strong incentive for a firm to vertically integrate (Carlton 1979b).

Integration to Eliminate Externalities

A firm may integrate to internalize externalities. If all Radio Shack stores carry the same products, maintain certain standards of service, and provide advice on the use of their products, a regular customer who moves from one city to another knows what to expect from a Radio Shack in the new city. That is, there is a positive reputation externality. A consumer who likes one of the outlets knows that the others are similar. Thus, it is in the chain's best interest to maintain high uniform standards. A bad store can harm the business of all distributors and lower the profit of the firm, Tandy, that supplies the products sold by these distributors. Thus, Tandy has an incentive to integrate forward into distribution (own Radio Shack stores) to control this externality.

Integration to Avoid Government Intervention

The only thing that saves us from the bureaucracy is its inefficiency.
—Eugene McCarthy (former U.S. senator and presidential candidate)

Firms may vertically integrate to evade or avoid government price controls, taxes, and regulations. A vertically integrated firm can avoid *price controls* by selling to itself. For example, the federal government has controlled prices on steel products on several occasions since World War II: It set a maximum price that could be charged for steel. Under binding price controls, a firm that buys steel is unable to purchase all the steel that it wants at the controlled price because producers choose to ration steel rather than supply as much as is demanded at the controlled price. A firm that badly needs more steel for its production process may find that it pays to purchase the company that supplies it with steel. Because transactions within a company are unaffected by price controls, a buyer who really wants steel can get it by purchasing a steel company and producing all the steel it needs. Purchasing a steel company is thus a simple way to avoid price controls (see Example 12.3). Indeed, if there are no

EXAMPLE 12.3 *Own Your Own Steel Mill*

A legal case, *Perlman v. Feldmann* (219 F.2d 173 [1955], cert. denied), illustrates the incentive for vertical integration in the presence of rationing. Feldmann controlled a majority of the stock of Newport Steel Corporation, which produced steel products. In 1950, steel supplies were becoming tight, apparently due to fear of Korean War price controls. Feldmann arranged for the sale of a controlling interest of Newport's stock to the Wilport Corporation, a user of steel. Wilport, by obtaining controlling interest, would be able to control the allocation of steel (to itself) in times of shortages.

The plaintiff in this case was a shareholder who complained that the high price Feldmann received for his shares ($20 versus $12 for noncontrolling shares) represented a value that other shareholders were entitled to because it represented the value of steel at uncontrolled market prices. The Court ruled that Feldmann was not entitled to receive the entire value of the right to control allocation, but only his pro-rata share of that value. Even though Feldmann was allowed only his pro-rata share, his activities reflect the incentive created by price controls to vertically integrate.

transaction costs to buying steel companies, and if owners of steel mills are entitled to steel in proportion to their ownership, then price controls on steel are completely ineffective because all users vertically integrate by acquiring ownership interests in steel mills.

Similarly, *taxes* encourage vertical integration. Depending on where firms are located, they may be subject to different taxes. For example, tax rates differ by state as well as by country. A vertically integrated firm may be able to shift profits from one location to another simply by changing the *transfer price* at which it sells its internally produced materials from one division to another. (See **www.aw-bc.com/carlton_perloff** "Oil Depletion Allowance," for an example.) By shifting profits from a high tax jurisdiction to a low tax jurisdiction, a firm can increase its profits. The Internal Revenue Service is, of course, aware of such shifting and insists that firms use internal transfer prices that reflect prices in the marketplace (see Chapter 18).

Government *regulations* create incentives for a firm to vertically (or horizontally) integrate when the profits of only one division of a firm are regulated. For example, the profits that local telephone companies earn on local services are regulated, but their profits on other services, such as selling telephones in competition with other suppliers, are not regulated. If a telephone company can shift profit from its regulated division to its unregulated division, it can effectively avoid the regulation of its local telephone service.

For example, suppose that such a firm is able, through accounting conventions, to transfer costs from its unregulated division to its regulated division, thus lowering its reported profits in the regulated line of business and raising them in the unregulated line. At the next rate hearing, the telephone company may argue that it is entitled to increase its rates to raise its profits in its regulated business. By shifting profits from the regulated to the unregulated division, the telephone company can thus increase its overall profits. The fear that profits would be transferred from a regulated business to an unregulated business, and the difficulty of detecting such transfers, motivated the U.S. government to control the entry of local telephone companies into unregulated businesses after it dismantled the phone monopoly.[6]

Integration to Increase Monopoly Profits

God helps them that help themselves. —*Benjamin Franklin*

A firm may be able to increase its monopoly profits in two ways by vertically integrating.[7] First, a firm that is a monopoly supplier of a key input in a production process used by a competitive industry may be able to vertically integrate forward, monopolize the production industry, and increase its profits. Or a firm that is a buyer may benefit from acquiring its sole supplier. Second, a vertically integrated monopoly supplier may be able to price discriminate.

[6]Even if some avoidance of regulation does occur, there may be offsetting efficiencies to society from allowing the telephone company to enter new businesses. See Chapter 20 on regulation and **www.aw-bc.com/carlton_perloff** "The Breakup of AT&T."

[7]As discussed in Chapter 11, another reason for vertical integration is strategic. A firm that controls scarce inputs could put its rival at a disadvantage.

Vertical Integration to Monopolize Another Industry. In some cases, a monopoly supplier of an input can increase its profits by vertically integrating to monopolize the producing industry. When does it pay to forward integrate to extend monopoly power? The answer depends on the production process, as the following model illustrates.

In the industry illustrated in Figure 12.1, consumers purchase Q units of a competitively produced good at price p. The competitive industry produces that good using a production function, f, that depends on inputs of energy, E, and labor, L:

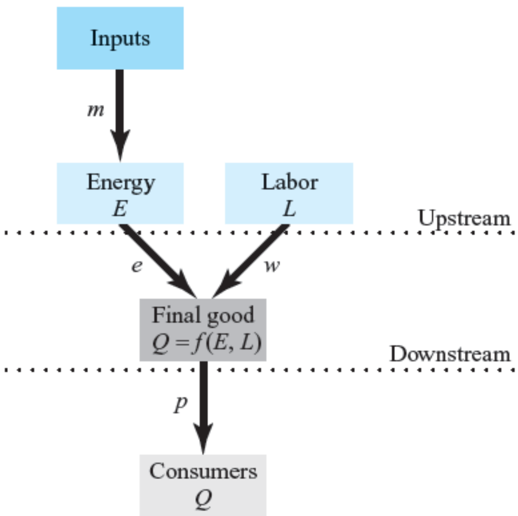
$$Q = f(E, L) \tag{12.1}$$

These inputs are sold to competitive firms at prices e and w (wage), respectively. The firms that supply the inputs in the production process are referred to as the **upstream firms**, and the firms that produce the good are called **downstream firms**. (In the past, firms often located along a river, and the upstream firms used the flow of the river to take their products downstream on boats or barges to the processors, who in turn sent it downstream to consumers.)

We make five assumptions about the market in Figure 12.1:

1. *Constant returns to scale:* The production function, $f(E, L)$, exhibits constant returns to scale. That is, if both inputs are doubled, output doubles.
2. *The inputs are produced at constant marginal cost:* The producing firms can buy as much labor, L, as they want at a wage of w (the supply curve of labor is horizontal at w). Energy, E, is produced at a constant marginal cost of m.
3. *Monopoly upstream:* This is the only upstream firm that supplies energy, and it does not fear that entry by other firms will eliminate its monopoly.

FIGURE 12.1 Vertical Organization of an Industry



4. *Competition downstream:* The downstream industry is competitive. We relax this assumption later.
5. *Costs of vertically integrating:* Certain costs are associated with vertically integrating, such as negotiation and legal fees. Thus, unless there are benefits from vertically integrating, the firm does not integrate.

Under what additional conditions does it pay for the monopoly supplier of E to vertically integrate forward and take over the downstream production? The answer depends on whether the industry has a fixed-proportions production or a variable-proportions production function. In a **fixed-proportions production function**, the inputs are always used in the same proportions, so the proportions used are independent of relative factor prices. In a **variable-proportions production function**, one factor can be substituted for another to some degree, so the ratio of factors used is sensitive to relative factor prices.

Given the four assumptions, there are two key results:

1. If the downstream production process uses fixed proportions, the upstream monopoly does not have an incentive to vertically integrate. It makes the same profit whether it integrates or not.
2. If, alternatively, the downstream production process uses variable proportions, the monopoly has an incentive to vertically integrate. It integrates if its increase in profits exceeds the cost of integration.

The following sections examine fixed proportions and variable proportions in turn and then present a numerical example to illustrate how the two cases differ.

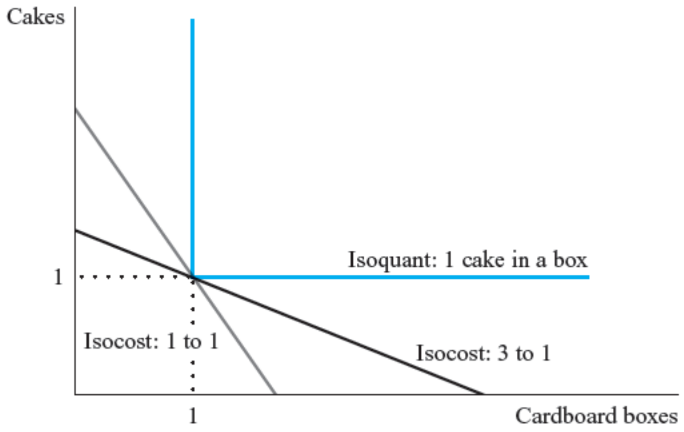
Fixed-Proportions Production Function. In a fixed-proportions production process it is impossible to substitute one input for another. Producing firms buy cardboard boxes from one input market and cakes from another input market. The production industry takes one box and one cake and produces a "cake in a box," which it sells. If the cost of a cake doubles while the cost of a box remains unchanged, the production firm still uses the same proportions of cakes and boxes (one of each), because it cannot substitute boxes for cakes.

Graphically, such a production process has an *isoquant* (a curve that shows the various combinations of the inputs that produce a given output level) in the shape of an L, as Figure 12.2 shows. The isoquant illustrates the various combinations of cakes and boxes that can be used to make one cake in a box. If the firm has two boxes and one cake or one box and two cakes, it can make only one cake in a box.

The figure also shows an isocost line (the various combinations of the inputs that cost a given amount) where the prices for cakes and boxes are equal (1 to 1), and another isocost line where a cake costs three times as much as a box (3 to 1). Regardless of the relative price of the two inputs, the cost-minimizing combination of inputs is to use one unit of each to make one cake in a box: Both isocost curves hit the isoquant at the point (1, 1) in Figure 12.2.

Now we can compare the profits that the energy monopoly makes if it vertically integrates and if it does not. For simplicity, suppose that it takes 1 unit of E and 1 unit of L to make 1 unit of Q.

FIGURE 12.2 Fixed-Proportions Isoquant and Isocost Curves



The integrated monopoly's cost of producing a unit of Q is $m + w$. That is, it takes 1 unit of E, which costs the firm m to make, and 1 unit of L, which can be hired at a cost of w. Figure 12.3a shows this per-unit, or marginal, cost, $MC_Q = m + w$. Also in the figure is the inverse demand curve for the final product, $p(Q)$, which shows the price that consumers are willing to pay to buy Q units of the product, and the corresponding marginal revenue curve, MR_Q.

The integrated monopoly maximizes its profits by producing Q^* units of output so that its marginal cost equals its marginal revenue: $MC_Q = m + w = MR_Q$. It uses $E^* = L^* (= Q^*)$ units of inputs. It charges p^* and makes a profit (box in Figure 12.3a) of

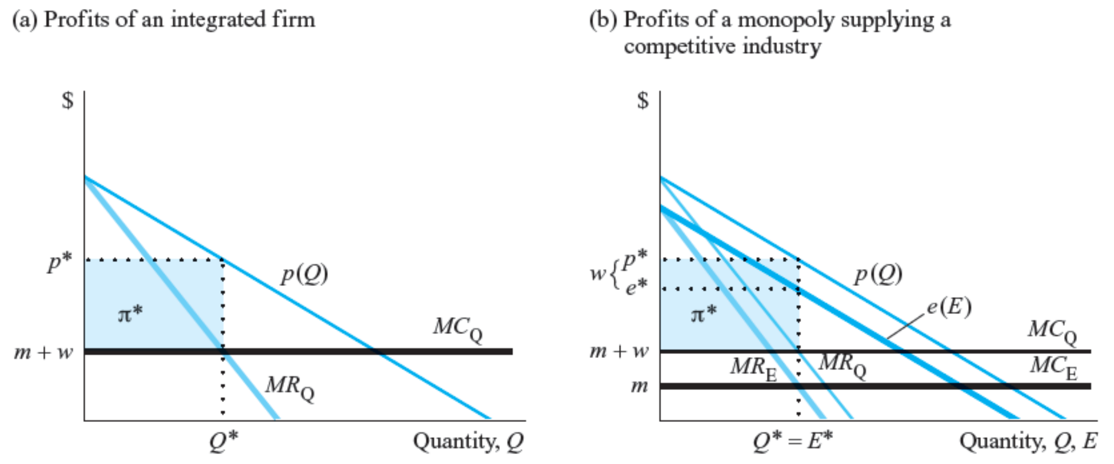
$$\pi^* = [p^* - (m + w)]Q^*. \tag{12.2}$$

We can contrast the vertically integrated industry to one in which the energy monopoly supplies a competitive industry. The nonintegrated energy monopoly's marginal cost of producing E, MC_E, is m and is shown as a thick black line in Figure 12.3b. It faces an inverse demand, $e(E)$, for its product from the competitive industry, shown in the figure as a thick blue line. This line shows the highest price, e, that the competitive industry pays for E units of energy. The corresponding marginal revenue curve is MR_E (the thick light blue line).

The output market demand curve of Figure 12.3a is shown in Figure 12.3b as a thin blue line for comparison. Both sets of curves can be shown in the same diagram because both sets of curves are scaled the same (it takes 1 unit of E to produce 1 unit of Q).

The demand curve facing the upstream monopoly can be derived from the demand curve facing the competitive downstream industry. The monopoly views its demand curve as the highest price it can charge the downstream firms for a given quantity of E.

FIGURE 12.3 Fixed-Proportions Production Function



The price a competitive downstream firm receives for a unit of its output is p. To produce that unit of output, it must spend w for a unit of labor. Thus, the most it will pay for a unit of E is $e = p - w$. As a result, the demand curve facing the input monopoly equals the demand curve facing the competitive industry minus w. As shown in the figure, the monopoly's demand curve, $e(E)$, is just the industry's demand curve, $p(Q)$, shifted down by w.[8]

The energy monopoly sets its output at E^* to equate its marginal revenue, MR_E, with its marginal cost, $MC_E = m$. Thus the energy monopoly maximizes its profit, $[e(E) - m]E = [(p(E) - w) - m]E$, which is identical to what the vertically integrated firm maximizes, Equation 12.2, because $E = Q$. It charges m. As the diagram shows, $E^* = Q^*$. That is, the industry output and the amount of energy used are the same whether the industry is vertically integrated or not. The energy monopoly's profit (box in Figure 12.3b),

$$\pi^* = (e^* - m)E^* = [(p^* - w) - m]E^*,$$

is the same as before. The monopoly now receives only e^* (which is $p^* - w$) instead of p^* per unit sold, but its costs are only m instead of $m + w$ per unit produced.

[8]The competitive downstream industry price, p, equals the marginal cost, $MC(Q) = e + w$. That is, $p = e + w$. The price (demand function) is decreasing in Q, and e (the price the monopoly charges) is decreasing in E. Because $Q = E$, this price equation can be rewritten as $p(E) = e(E) + w$, or, $e(E) = p(E) - w$. That is, the derived demand curve facing the upstream monopoly equals the demand curve facing the competitive industry minus the cost of a unit of labor.

Thus, because the upstream firm earns the same profit whether it integrates or not, if there is any cost to integration, it chooses not to integrate. What is the intuition behind this result? When the nonintegrated monopoly raises its price for a unit of E by \$1, the marginal cost of the downstream firm $(m + w)$ rises by \$1, so the price to consumers also goes up by \$1. That is, the energy monopoly can perfectly control the final price consumers pay without vertically integrating. Not only can it raise the price, but also it captures all the resulting profits. None go to the competitive industry, which merely passes on higher energy costs to consumers. The reason that the nonintegrated monopoly can control the downstream price perfectly is that the downstream firms cannot substitute away from the input produced by the monopoly.

Variable-Proportions Production Function. The preceding intuition suggests that the results are different if the competitive downstream industry faces a variable-proportions production function, with which the downstream industry substitutes away from the input monopoly's product if the price rises.

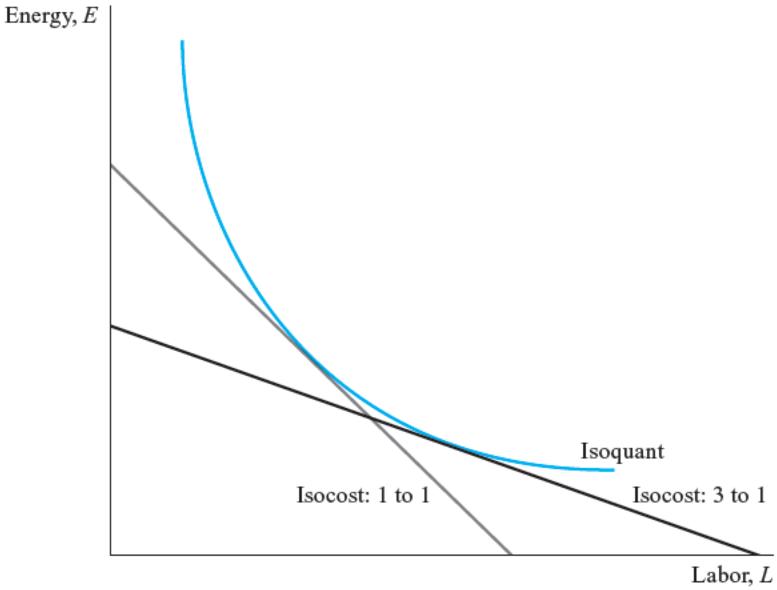
Figure 12.4 shows the isoquant of a variable-proportions production function. Unlike the fixed-proportions production function, it is a smooth curve, showing that the products are (imperfect) substitutes. As a result, as the relative costs of the inputs change, as shown by a shift in the slope of the isocost line, the firm substitutes more of the now less expensive input for the more expensive input. With a variable-proportions production function, if the upstream energy monopoly increases its price to the competitive downstream industry, firms in that industry substitute more labor for the monopoly's product. If the monopoly raises its price by a dollar, the price of the final good no longer necessarily increases by a dollar, and the amount of E used falls by relatively more than Q does.

Consider an extreme case where the two inputs are perfect substitutes in the production process. Here, the isoquant is a straight line. For example, downstream food processing firms (manufacturers of crackers and other similar products) view palm oil and coconut oil as perfect substitutes, so the isoquant is a straight line with a slope of -1. If a monopoly in palm oil increases its price above that of coconut oil, all the downstream firms switch to coconut oil. Thus, an upstream monopoly cannot raise the price of palm oil above that of coconut oil.

In short, if downstream firms have some ability to substitute between inputs (variable-proportions production process), the upstream monopoly does not have complete control over the downstream industry. Every time it raises its price, the downstream industry substitutes away from its input and this substitution, though it constrains the market power of the monopoly, leads to inefficient production, because efficiency requires the slope of the isoquant to equal the slope of the isocost line. That slope equals the ratios of the inputs' marginal costs. Downstream firms are using too much L and too little E. This inefficiency means that there are less profits for the monopoly to seize.

If the upstream firm integrates forward so that it monopolizes the downstream industry, it has complete control and can use the inputs in the most efficient combination. Thus, its profits increase. If profits increase by more than the cost of vertical integration, the firm vertically integrates. At **www.aw-bc.com/carlton_perloff** "Fixed

FIGURE 12.4 Variable-Proportions Isoquant and Isocost Curves



vs. Variable Proportions," we provide a detailed numerical example that illustrates that vertical integration can raise the profit of an upstream input monopoly if the production process of downstream firms uses variable proportions, but not if it uses fixed proportions. We also explain that with variable proportions, the price to consumers can go up or down depending on whether the efficiency effect overwhelms the increased market power (see Mallela and Nahata 1980).

Price Discrimination. A monopolistic supplier may vertically integrate so that it can successfully price discriminate. Chapter 9 explains that an essential element for successful price discrimination is the ability to prevent resale of the product by those who pay a low price to those who pay a high price. If resale cannot be prevented, it is impossible to price discriminate. Vertical integration can be used to prevent resale.[9]

For example, aluminum ingot is used in many products (see Example 9.4). For simplicity, suppose that aluminum ingot is used to produce only aluminum wire and aircraft. There are good alternatives for aluminum wire in electric cables, such as copper, but there are no good alternatives to aluminum in airplanes. As a result, the elasticity

[9]Carlton and Perloff (1981) show that preventing vertical integration eliminates the ability of firms with market power to price discriminate and hence affects the rate at which a nonrenewable resource such as oil is exhausted.

of demand for aluminum ingot by wire manufacturers is much higher than it is for airplane manufacturers. Thus, it is profitable to charge a higher price for aluminum ingot to airplane manufacturers than aluminum wire producers.

If the aluminum monopoly charges a higher price to airplane manufacturers without integrating, the aluminum wire producers can purchase aluminum ingot at a relatively low price and resell to the airplane manufacturers at a lower price than the monopoly charges. To prevent this resale, the aluminum monopoly can vertically integrate forward and become the only producer of aluminum wire. It can then charge a very high price for aluminum ingot to the aircraft manufacturers, without worrying about resales from wire manufacturers. By transforming the product from aluminum ingot to aluminum wire, the vertically integrated firm prevents resales.

Integration to Eliminate Market Power

Just as a firm can increase its monopoly profit by vertically integrating, another firm can reduce or eliminate monopoly power by vertically integrating. Suppose, for example, that only one firm sells an input that is essential for your production process. If that firm is charging you a high, monopoly price, you should determine whether it is cost effective for you to vertically integrate backward and produce that product yourself. You could, for example, build a new production plant to produce that input.

If, instead of building a new plant, your firm tries to buy its supplier, it faces the same issues analyzed in the previous section. The combined profit of the buying and supplying firm rises only if there are variable proportions in production. If there are fixed proportions, there is no gain from integration. In this case, the purchase of a monopoly supplier by a buyer affects neither total profit nor the profits of individual firms. Presumably, the monopoly supplier will sell its firm for the discounted present value of the future monopoly profits, so the buyer winds up paying the same total monopoly overcharge whether or not vertical integration occurs.

The Life Cycle of a Firm

If you want to make an apple pie from scratch, you must first create the universe.
—Carl Sagan

Firms vertically integrate if the benefits outweigh the costs. Stigler (1951) and Williamson (1975), building on Adam Smith's theorem that "the division of labor is limited by the extent of the market," used the ideas discussed in the preceding section to develop a theory of the life cycle of firms. They explain why firms rely on markets during certain periods, whereas during other periods, they vertically integrate.

If the demand for a product is small, so that the collective output of all the firms in the industry is small, each firm must undertake all the activities associated with producing the final output itself. Why don't some firms specialize in making one of several inputs that they then sell to another firm to assemble the final product? The answer is that when the industry is small, it does not pay for a firm to specialize in one activity even if there are increasing returns to scale. A specialized firm may have large setup (fixed) costs. If the specialized firm produces large quantities of output, the average setup or fixed cost per unit is small. In a small industry, however, the setup costs per unit are large, so that, if specialized firms are to earn a profit, the sum of the specialized firms' prices must be higher than the cost of a firm that produces everything for itself.

As the industry expands, it may become profitable for a firm to specialize, because the per-unit transaction costs fall.[10] That is, as the industry grows, firms *vertically disintegrate.* When the industry was small, each firm produced all successive steps of the production process, so that all firms were *vertically integrated.* In the larger industry, each firm does not handle every stage of production itself but rather buys services or products from specialized firms.

For example, in the 1860s, Birmingham, England, was the leading production center of the small-arms industry.[11] Virtually all of the 5,800 people working in this industry were located in a small district near St. Mary's Church. The firms were localized because large numbers of firms specialized in particular processes, so parts frequently had to be transported from one workshop to another. The typical master gun manufacturer owned a warehouse rather than a factory or workshop. These entrepreneurs purchased semifinished parts from "material-makers," such as barrel makers, lock makers, sight stampers, trigger makers, ramrod forgers, gun-furniture makers, and bayonet forgers. The gun maker then sent the parts to a succession of "setters-up," or specialized craftsmen, who assembled them into guns. For example, jiggers worked on the breech end; stockers dealt with the barrel and lock and shaped the stock; barrel strippers prepared the gun for rifling and proofing; and hardeners, polishers, borers and riflers, engravers, browners, and finally the lock freers adjusted the working parts.

As an industry matures further, new products often develop and reduce much of the demand for the original product, so that the industry shrinks in size. As a result, firms again vertically integrate.

In 1919, 13 percent of manufacturing companies studied had two or more establishments making successive products, where the product of one was the raw material of the next (Stigler 1951, 135). In 1937, successive functions were found in 10 percent. Similarly, in 1919, 34.4 percent of all complex central offices had successive establishments (companies with establishments in two or more vertically related industries); in 1937, only 27.5 percent did. Studies prior to 1970 found no overall trend in vertical integration after 1929 (Adelman 1955, Laffer 1969, Livesay and Porter 1969). Tucker and Wilder (1977) also find little variation in their vertical integration indices from the mid-1950s to the early 1970s. However, Maddigan (1981) concludes that "major" firms became more vertically integrated from 1947 to 1972. O'Huallacháin (1996) documents a small decline in vertical integration over the period 1977–1987, although there was significant variation across industries.

[10]A specialized firm cannot charge for its product a price that is higher than the minimum average cost of the product if one of the nonspecialized firms produces it itself.

[11]This discussion is based on G. C. Allen, *The Industrial Development of Birmingham and the Black Country, 1860—1927,* (London: 1929), 56–7 and 116–7, cited by Stigler (1951).

Vertical Restrictions

I don't trust him. We're friends. —*Bertolt Brecht*

A manufacturer that contracts with a distributor to sell its product may place vertical restrictions on the distributor's actions beyond requiring it to pay the wholesale price for the product. These vertical restrictions are determined through contractual negotiations between the manufacturer and the distributor. The manufacturer places these restrictions so as to approximate the outcome that would occur if the firms vertically integrated. Examples of restrictions include requirements that the distributor sell a minimum number of units, that distributors not locate near each other, that distributors not sell competing products, and that distributors charge no lower than a particular price.

Why are restrictions used instead of vertical integration? Manufacturers often rely on independent firms to distribute their products rather than doing their own distribution, because the costs of monitoring employees at distribution outlets exceed the costs of using independent firms. For example, the distribution outlets may be far apart, making it costly for managers to travel to them and spend time becoming familiar enough with local market conditions to be able to judge the efficiency of a particular distribution outlet.

Every manufacturer, regardless of whether it is a monopoly or a competitive firm, wants its product distributed at the lowest possible costs. The manufacturer also wants the distributors to price and sell in a manner that is best for the manufacturer.

Economists describe the relationship between a manufacturer and a distributor as a **principal-agent** relationship: The *principal* hires the *agent* to perform an action in a manner that the principal cannot fully control. Here, the manufacturer (principal) contracts with distributors (agents) to sell its product. The manufacturer cannot perfectly observe the sales effort of the distributors and realizes that they may try to take advantage.

For example, distributors may advertise less than they contracted to do, in order to save money and *free ride* on the manufacturer's reputation. **Free riding** occurs when one firm benefits from the actions of another without paying for it. Free riding is an externality. Where free riding is possible, each distributor has an inadequate incentive to advertise; it prefers to rely on the efforts of others and does not do its share. These principal-agent problems are often addressed through vertical restrictions that the manufacturer places on the distributor beyond requiring it to pay the wholesale price for the product.

Economists and the courts initially were uneasy about vertical restrictions because several such restrictions—for example, forbidding the distributor to lower its price or sell competing products—appear to restrain competition and should not occur in a perfectly competitive market. But this observation may only tell us that the economic models of perfect competition, in which distribution is taken to be a costless activity, are not applicable here. Simple models of competition ignore the cost of sales efforts. Where it takes resources to distribute a product, a manufacturer must pay somebody to do it and wants to control how the distribution takes place. Thus, models of perfect competition that ignore the cost of distribution do not provide good intuition for markets that rely on substantial sales effort.

In the following sections we identify a number of problems that arise when vertical integration is impossible, and describe the vertical restrictions that are used to deal with these problems. We then discuss the pro- and anticompetitive implications of these vertical restrictions.

Vertical Restrictions Used to Solve Problems in Distribution

Four problems commonly arise when distribution is costly and a manufacturer retains a distributor to retail its products:

1. There is a double monopoly markup (also called double marginalization) by successive monopolies in manufacturing and distribution.
2. Some distributors may free ride (not do their share in promoting the good) on other distributors.[12]
3. Some manufacturers may free ride on other manufacturers.
4. There may be a lack of coordination among distributors that leads to externalities.

We discuss each problem in order, along with the vertical restrictions designed to deal with each.

Double Monopoly Markup. If the manufacturer and the distributor are both monopolies, each adds a monopoly markup (the difference between its price and its marginal cost is positive), so consumers face two markups instead of one. This double markup provides an incentive for firms either to vertically integrate or to use vertical restrictions to promote efficiency and thereby increase joint profits. We first illustrate the losses due to the double monopoly markup and then show how vertical restrictions can be used to prevent these losses where vertical integration is not practical.

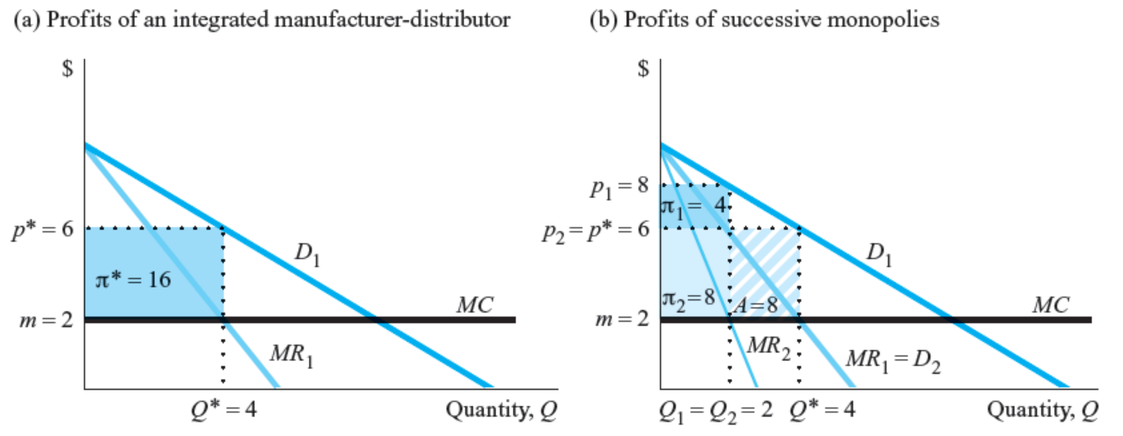
An Example of the Loss from a Double Monopoly Markup. To illustrate the effect of a double markup, we contrast a market in which a manufacturer is vertically integrated into distribution to one with two successive monopolies. Both consumers and firms lose from the double markup.[13]

Suppose that the vertically integrated, monopolistic manufacturer-distributor faces the downward-sloping demand curve, D_1, for its product in Figure 12.5a. The firm produces Q^* units so as to equate its marginal cost of production, m, and its marginal

[12]Most of the existing literature on vertical restraints emphasizes the role of free riding. However, Winter (1993) presents a more general way to explain why manufacturers want to use vertical restraints.

[13]Suppose that a retailer buys a good from the manufacturer and then resells it. The retailer has no additional costs other than the price it pays the wholesaler, and faces a constant elasticity of demand with elasticity ϵ_1. Because it has monopoly power, the retailer sets its price, p_1, equal to $\mu_1 p_2$, where p_2 is the manufacturer's price for the good and $\mu_1 = 1/[1 + 1/\epsilon_1] > 1$ is the usual monopoly markup (Chapter 4). The manufacturer sets its price, p_2, equal to $\mu_2 m$, where $\mu_2 = 1/[1 + 1/\epsilon_2] > 1$, ϵ_2 is the demand elasticity facing the manufacturer, and m is its constant marginal cost. Thus, $p_1 = \mu_1\mu_2 m$ and there is a double monopoly markup over the manufacturing cost of $\mu_1\mu_2$, which is greater than either μ_1 or μ_2 alone.

FIGURE 12.5 Monopolies in Both Manufacturing and Distributing



revenue, MR_1. For graphic simplicity, we assume that the costs of distribution are zero. The firm's profit, π^*, the blue shaded area in the figure, equals the monopoly markup per unit (the difference between the sales price, p^*, and the cost per unit) times the number of units, Q^*.

Now suppose that the monopolistic, upstream manufacturer uses a monopolistic, downstream firm to distribute its product. Because each firm adds a monopoly markup to its per-unit costs, there is a double monopoly markup. Here, the distributor faces the same downward-sloping demand curve, D_1, and marginal revenue curve, MR_1, as in Figure 12.5a. The manufacturer charges the distributor a wholesale price, p_2, per unit. The distributor treats this wholesale price as its marginal cost. It maximizes its profits by selling Q_1 units, such that its marginal cost, p_2, equals its marginal revenue, $MR_1(Q_1)$, which is a function of Q_1, as shown in Figure 12.5b. Because distribution costs are assumed to equal 0 and demands are linear, $p_2 = p^*$.

The number of units of the manufactured good the distributor demands depends on the manufacturer's wholesale price, p_2, and is determined by the intersection of the MR_1 curve with the horizontal line at p_2. This demand curve facing the manufacturer, D_2, equals the distributor's marginal revenue curve, MR_1. The manufacturer maximizes its profits by choosing its output level, Q_2, so that its marginal cost, m, equals its marginal revenue, MR_2 (the curve marginal to D_2).

Figure 12.5b shows the resulting double markup. The manufacturer charges p_2, which is above its marginal cost of m; the distributor charges p_1, which is above its marginal cost of p_2. Because the marginal revenue is less than price, $p^* = p_2 < p_1$. Consumers facing the double markup buy less output, Q_2, than when there is an integrated firm, Q^*. As a result, they are worse off. Using the demand curve, $p = 10 - Q$, and setting marginal cost, m, equal to 2, $p^* = p_2 = 6$ and $p_1 = 8$.[14] Thus, consumers pay a third more ($8 instead of $6) due to the successive monopoly markup than they would pay if the firms were integrated. They buy half as many units: $Q_1 = Q_2 = 2$ instead of $Q^* = 4$.

The firms' collective profits are also lower. The profits of the integrated firm are $\pi^* = 16$. With the successive monopolies, the retailer's profits, π_1, are 4 and the manufacturer's profits, π_2, are 8. As Figure 12.5b shows, π^* equals π_2, plus Area A, the profits lost due to reduced sales from the higher price. Total profits drop by Area $A - \pi_1 = 8 - 4 = 4$. That is, the total profits of the successive monopolies are 25 percent lower than those for the integrated firm.

Vertical Restrictions to Reduce Double Markups. Thus, both consumers and firms are worse off with successive monopolies than when there is a single, integrated monopoly. These losses provide a strong incentive to integrate.[15] It is not always practical to do so. For example, where the manufacturer is Japanese and the distributor is French, it may be too costly for the Japanese firm to vertically integrate into distribution. One alternative is to use vertical restrictions.

The problem with the successive monopolies is that the distributor has an incentive to restrict output and raise price. The manufacturer does not want its distributor to restrict output further—or, equivalently, to increase its price, p_1, above the wholesale price, p_2—because profits from the distributor's markup go to the distributor, not the manufacturer. The manufacturer wants as efficient a distribution system as possible (that is, with the smallest distributor's markup).

Ideally, the manufacturer wants to induce competition at the distribution level in order to drive p_1 to the wholesale price, p_2. There are many instances, however, when it is not possible to have competition in distribution, so the manufacturer is stuck with a monopolistic distributor. Before discussing why competition at the distribution level may be impossible, we examine three vertical restrictions that manufacturers can use to induce a monopoly distributor to behave more competitively.

Where it is legal, the manufacturer may be able to impose contractually a *maximum retail price*, $\bar{p}$, that the distributor can charge. By so doing, a manufacturer prevents a distributor from raising its price much above the wholesale price, p_2. As a result, the distributor sells more units. If $\bar{p}$, is set equal to p_2, the distributor behaves like a competitive firm, sells Q^* units, and the outcome is the same as with an integrated firm. If the distributor does not accept this restriction, and $\bar{p}$ is set between p_1 and p_2, then a

[14] In this example, $p_1 = D_1(Q_1) = 10 - Q_1$, $MR_1 = 10 - 2Q_1 = p_2 = D_2(Q_2) = 10 - 2Q_2$, and $MR_2 = 10 - 4Q_2$. Equating marginal cost and marginal revenue for the upstream firm, $m = 2 = 10 - 4Q_2 = MR_2$, implies that $Q_2 = 2$, so $p_2 = 10 - (2 \times 2) = 6$. As a result, $p_2 = 6 = 10 - 2Q_2 = MR_1 = 10 - 2Q_1$, $Q_1 = 2$, and $p_1 = 10 - 2 = 8$.

[15] If the integrated firm produces as efficiently as the separate firms, then integration makes consumers and the firm better off. Even if the integrated firm is less efficient, the desirable effect of eliminating one of the monopoly markups may outweigh this negative effect. It is possible, however, that some vertical mergers are privately profitable but not socially desirable, and that some socially desirable mergers are not privately profitable (Ross 1990).

quantity between Q_1 and Q^* is sold. Such restrictions were common in the United States before 1976, when a change in the law made it illegal for manufacturers to control the retail prices of independent distributors.

A manufacturer uses **quantity forcing** if it imposes a *sales quota* on a distributor; that is, the distributor must sell a minimum number of units. With this restriction, a manufacturer does not have to restrict a distributor's price. Sales quotas induce distributors to expand their output by lowering their prices. Many automobile dealerships and computer retailers have sales quotas.

Another tactic is for a manufacturer to adopt a more complicated pricing scheme than merely charging a distributor p_2 per unit of output. A manufacturer can use a two-part pricing scheme, as described in Chapter 10. It charges the distributor one price for the product and a second price for the right to sell the product. For example, the manufacturer sells the **franchise** rights, or rights to sell the product (often together with a brand name) to the distributor, for a *franchise fee.*

Why would a manufacturer want to set two prices? Suppose that instead of charging the distributor a price per unit of p_2, which is greater than its marginal cost, m, the manufacturer charges its marginal cost. Here, the distributor equates marginal revenue to its marginal cost, m, and sells Q^* units, which is the same outcome as with a vertically integrated firm. Thus, by setting $p_2 = m$, the manufacturer prevents the second monopoly distortion.

If the manufacturer charges m per unit, however, it earns zero profits, and the distributor earns all the monopoly returns. But the manufacturer may make positive profits from its franchise fee. Indeed, as long as there are many *potential* distributors, the use of a franchise fee allows the manufacturer to earn the same profits as it would earn if it were vertically integrated into distribution. The manufacturer can offer for sale the *right* to be the sole distributor of its product with a contractual guarantee that the wholesale price to the distributor is m per unit. The largest franchise fee a distributor is willing to pay is the value of the monopoly profits, π^*, as shown in Figure 12.5a. If a large number of firms want the monopoly franchise rights, competitive bidding ensures that the franchise fee equals the present value of the monopoly profits. Thus, the manufacturer can achieve the equivalence of vertical integration by charging a franchise fee and charging the marginal cost for its product.

In summary, if there is only one distributor, the problem of double monopoly markups may occur. If vertical integration is not feasible, vertical restraints such as maximum retail prices, quotas, or franchise fees may reduce or eliminate the problem. See Examples 12.4 and 12.5.

Free Riding Among Distributors. In a typical distribution arrangement, several independent firms distribute one manufacturer's product. Each distributor benefits from the promotional activities of other distributors without having to pay for them. The following sections identify several situations where free riding by distributors is likely to occur and then discuss some vertical restraints that may minimize free riding.

Where distributors must make substantial expenditures (for advertising, showrooms, training a sales staff, training purchasing agents, maintaining quality) to sell a

EXAMPLE 12.4 *Double Markup*

Do both food manufacturers and grocery retailers exercise market power in setting prices, so that consumers face a double markup? In the past, many industry observers believed that food manufacturers had substantial market power whereas supermarkets were relatively passive, competitive firms. Recently, though, industry experts report that supermarkets have acquired greater bargaining power relative to manufacturers. The explanations for this shift include the growing importance of private label brands (brands carrying the store's own label) and the increased concentration at the retail level (the average four-firm concentration ratio is 70 percent in the 100 largest metropolitan areas). The resulting increase in retailer market power and competition for limited shelf space has prompted manufacturers increasingly to pay slotting allowances to retailers to get their new products displayed.

Yogurt provides an interesting test of whether a double markup occurs. Dannon and General Mills together account for 62 percent of national yogurt sales, and private labels have 15 percent. Thus, the larger manufacturing firms may have market power as well as retailers.

Villas-Boas (2002) tested the double markup hypothesis for grocery store sales of yogurt. She used her yogurt demand curve estimates to compute price-cost margins for retailers and manufacturers under various models of vertical contracting between manufacturers and retailers in the supermarket industry. These models included double markup pricing, a vertically integrated model, and a variety of alternatives: strategic supply scenarios, allowing for collusion, nonlinear pricing, and strategic behavior with respect to private label products. On the basis of statistical tests, she rejected the double markup hypothesis. She concluded that manufacturers' wholesale prices are close to their marginal costs and that retailers have market power in the vertical chain. This result is consistent with two explanations: Manufacturers lack market power, or they exercise it by engaging in some form of second-degree price discrimination (nonlinear pricing) in which their marginal price equals their marginal cost.

Sources: Ellickson (2000), Sexton et al. (2002), Villas-Boas (2002), and Ward et al. (2002).

product, free riding is likely, because some of that sales effort helps other distributors. A distributor that cannot reap the full benefits of its sales efforts has an incentive to reduce those efforts and thereby sell less of the manufacturer's product. Free riding, therefore, is a problem that arises because distributors are not compensated *separately* for sales efforts; instead, they are compensated for sales efforts on behalf of a particular product only when they sell that product.

Suppose that one distributor heavily *advertises* a manufacturer's product that is also carried by another distributor. The first distributor creates a demand for the product, which benefits both distributors, but the second distributor incurs no cost at all. Unless something is done, the first distributor may have little incentive to advertise, because it does not capture the full benefits of its advertising.

EXAMPLE 12.5 *Blockbuster's Solution to the Double Marginalization Problem*

Before 1998, distributors of video movies exercised market power by selling tapes to video rental stores at a fixed price of about $65 to $70 regardless of the title. Retailers would decide how many tapes to stock and what price to charge. To the extent that retailers also exercised market power, customers rented fewer movies due to the double markup, and movie distributors' profits fell correspondingly.

As we have seen in this chapter, one solution to the double marginalization problem is to have distributors charge retailers a low per-unit fee (marginal cost) and then capture all subsequent profit in a separate fee. One mechanism to do this would be a revenue sharing contract combined with a unit fee per tape. Blockbuster introduced such a contract in 1998, and other video rental firms quickly followed suit. A typical contract sets the revenue sharing percentage at between 40 and 60 percent with a per-unit tape charge of $8 to the retailer.

Using detailed data on video rental stores, Mortimer (2002) estimates that the sum of retailers' plus distributors' profits increased from 3 to 6 percent as a result of this more efficient contracting and that consumers benefited substantially. She estimates that the rental price declined from $4.64 to $4.08 and that the average number of tapes in a store's inventory rose from 20.1 to 24.2 for the most popular films. For the next most popular category of movies, prices fell from $3.47 to $3.01 and the average inventory per title rose from 9.7 to 11.7. Mortimer concludes that revenue sharing would have an even more dramatic effect if all video rental firms adopted it. For the most popular category of movie, she estimates that the rental price would fall from $4.08 to $2.88.

There are many examples of free riding other than advertising. Selling many durable goods (for example, automobiles, stereo equipment, and appliances) requires a large showroom to display products, so that consumers can select the best model to satisfy their particular needs. Showrooms, of course, cost money, as does the inventory on display. If only one distributor has a well-stocked showroom, all customers go to that showroom to decide which product to buy, but they can buy from other distributors with less fancy showrooms and smaller inventories. These distributors can charge a lower price than the first distributor because their costs are lower. Thus, no dealer has an incentive to maintain a well-stocked showroom.

There was a clear example of this behavior near the Berkeley campus of the University of California. A discounter opened a store next door to a retailer that sold stereo equipment in a fancy, well-stocked showroom with carpets and attractive lighting. The discounter piled its merchandise in its original boxes on a linoleum floor under minimal lighting. The store had a crude, handwritten sign in the window that said, "Go next door, see which equipment you want, then come here for a lower price."

Another example of free riding occurs when a distributor's *sales staff* must be well trained in order to sell a product. Computer salespeople are a good example. If one distributor has highly trained salespeople, customers go to that store and learn a great deal about the product. Some of them subsequently may buy from a distributor (often a mail-order house or an Internet firm) without a trained staff, at a lower price. Discount distributors can sell at lower prices because they do not incur training costs. Again, the first distributor has a reduced incentive to maintain a well-qualified staff.

Still another example of free riding concerns *certification.* Here, there are no explicit services—only a distributor's reputation that its product line is of high quality. For example, certain department stores are known for carrying only high-quality, trendy clothes. Presumably, they have built this reputation by hiring qualified staff who are able to spot trends in fashion as well as to recognize high-quality clothes.

Other stores that carry the same merchandise as that stocked by the "certifying" fashion store reap a benefit: Their goods have been certified by the fashionable store as being of high quality and trendy. The other stores are free riding on the reputation of the certifying store and do not invest in building up their own reputations. This free riding creates a dilemma for the manufacturer (Marvel and McCafferty 1984). If the manufacturer sells to only the highest-quality stores, it may not get large enough distribution of its product. If it sells to every store, high-quality stores may be unable to capture an adequate return on their reputations.

A final example of free riding occurs when the *reputation of the product,* which the dealer can affect, influences the overall demand for the product. For example, imagine a chain of independently owned food shops all selling under the same brand name (say, McDonald's, Burger King, or Wendy's). The brand name carries a certain reputation that attracts buyers. If one shop decides to chisel on quality and to produce a lower quality than the other shops, the brand's reputation declines and all distributors suffer. The chiseling firm loses reputation, but if customers primarily rely on brand reputation and not an individual store's reputation, the decline in demand facing the chiseling store may be more than offset by the decline in that store's cost. For example, if the store is located on an interstate highway and has little repeat business, it may be profitable for the store to lower its quality and to free ride on the brand's reputation.

Manufacturers encourage sales efforts by distributors to increase the demand for the product, thereby increasing the manufacturer's profits. Because free riding reduces the incentive of distributors to promote a manufacturer's product, manufacturers use a variety of vertical restrictions to deal with the free-riding problem. Several of these restrictions create a *property right* in the sales efforts that distributors expend on behalf of a manufacturer. That is, these restraints are designed so that distributors reap much of the benefits from their sales effort.

One of the most common vertical restraints is an **exclusive territory**, in which only a single distributor may sell a product within a region: The distributor obtains monopoly rights to customers who buy within its territory. Exclusive territories usually involve a promise by the manufacturer that other distributors will not be allowed to locate within a certain distance of the existing distributor. For example, a distributor of Cadillacs may have a clause in its contract with General Motors (GM) that prevents

EXAMPLE 12.6

Free Riding on the Web

The rise of the Internet as an important sales channel creates several free-rider problems. For example, suppose that Harry's Camera Store has an exclusive territory for a given brand of camera. The exclusive territory provides an incentive for the retail outlet to have a trained sales staff who can explain the camera's features to a customer. However, if the customer, after visiting the store, finds that she can buy the camera at a lower price from a store on the Internet, then the Internet store's free riding reduces Harry's incentive to provide a strong sales effort. Ultimately, Harry's no longer has an exclusive territory.

With the rise of the Internet, auto dealers became concerned about the ability of auto manufacturers to bypass them and possibly to free ride off them through Internet sales. As a result of effective political actions, auto dealers have long benefited from state laws that protect their exclusive territorial rights. The dealers used these laws to convince GM and Ford to abandon plans to sell directly to customers on their own Internet sites. Liquor and insurance dealers have also used state laws to thwart manufacturers from directly selling over the Internet.

But what happens when dealers can't prevent a manufacturer or other retailers from setting up their own Web sites? For goods where free riding is likely to be a problem, the manufacturer has an incentive to try to prevent it. Therefore, one should not expect any bargains at a manufacturer's Web site or that of other authorized retailers for products where free riding could cause problems.

Carlton and Chevalier (2001) find this result in their study of perfume and DVD players. For perfume brands with exclusivity—a restriction on the number of retail outlets—manufacturers control free riding by using only retail Internet sites that do not discount or by avoiding using retail Internet sites and instead selling only at their own high-price Internet site.

Similarly, the two DVD manufacturers with the largest U.S. sales, Sony and RCA, charge prices at their own Web sites that are about 5 percent higher than prices on their authorized retailers' Web sites. Unlike the case of fragrances, there were several Web sites of unauthorized retailers where one could buy DVDs at discount prices. In an effort to control free riding, DVD manufacturers have been devoting increasing efforts to restricting the availability of their product through these unauthorized retailers.

GM from opening any other Cadillac dealership within a radius of several miles of it. By granting a geographic monopoly to the distributor, the manufacturer insulates it from competition. This insulation may be essential if the distributor is to reap the benefits of its sales efforts (see Example 12.6). Of course, creating market power for the distributor creates the problem of a double monopoly markup. Thus, the manufacturer may have to impose other vertical restrictions as well.

A second type of vertical restraint manufacturers use to stimulate sales efforts is to *limit the number of distributors.* The effect of this limitation is similar to that of exclusive territories. That is, price competition is limited, and more of the gain from sales efforts accrues to the distributor that makes the efforts. Again, the manufacturer must contend with the problem of a double monopoly markup due to the market power it confers on individual distributors.

Another method of controlling free riding is a **resale price maintenance** agreement where a manufacturer sets a *minimum* price that retailers may charge.[16] Such agreements create an incentive for retailers to compete for customers in other dimensions, such as sales effort. For example, if the wholesale price the distributor pays is $10, and the minimum resale price is $20, each dealer has an incentive to spend up to $10 to attract customers. Thus, up to $10 per unit is invested in advertising, training sales staff, or fancy showrooms. Minimum price restrictions channel competition among distributors toward sales effort and away from price cutting. They lead to more sales effort than occurs without them.

Many countries ban resale price maintenance. The practice was outlawed by Canada in 1951, Sweden in 1954, Denmark in 1955, the United Kingdom in 1965 (though exemptions may be requested), and the United States in 1976. Where legal, however, resale price maintenance is widely used.[17] One study estimates that, before resale price maintenance was banned in the United Kingdom in 1965, 44% of consumer expenditures on goods were on price-maintained items. Other studies indicate that the rate was 25% to 40% by 1960. A Canadian study estimates that 20% of goods sold in grocery stores and 50% of goods sold in drug stores were price maintained. In Sweden, 30% of consumer goods were covered by resale price maintenance. Another study indicates that, before the ban, coverage in the United States varied from 4–10% of retail sales.

A fourth approach to dealing with free riding is for the manufacturer to *advertise on behalf of its distributors.* If the manufacturer takes over the sales effort and handles the advertising, it does not have to worry about free riding among distributors, who can only free ride on the sales efforts of other distributors. A manufacturer that advertises and stimulates demand for its product can charge each distributor for that service through higher wholesale prices or a higher franchise fee. The problem with the manufacturer's assumption of the marketing and advertising function is that the appropriate advertising and marketing may differ by locale, and a local distributor may be better informed than the manufacturer about the best strategy for its area. If local distributors have no comparative advantage in marketing, the manufacturer should vertically integrate, all else equal.

One solution to this information problem is cooperative advertising, in which the manufacturer agrees to pay some of the distributors' advertising costs. The cooperative

[16]See Overstreet (1983) and Yamey (1966) for detailed discussions of several instances of resale price maintenance. See Telser (1960) for a discussion of why manufacturers want resale price maintenance agreements, which used to be allowed in the United States under what were called *fair trade laws.* See Mathewson and Winter (1984), Marvel and McCafferty (1984), Perry and Porter (1986), and Klein and Murphy (1988) for further discussions of vertical restraints to deal with free riding.

[17]See the survey of studies in Overstreet (1983, 113, 152–6). The following numbers on the percentage of goods covered by resale price maintenance agreements are based on his summary. There is an extensive discussion of various countries' laws in Yamey (1966).

arrangement can place the responsibility for choosing the advertising in the hands of the knowledgeable party, the local distributor, and the advertising subsidy from the manufacturer to the dealer helps prevent the free-riding problem from eroding the distributor's incentive to advertise.

A fifth approach to the free-rider problem is for the manufacturer to monitor each dealer's sales effort and compensate each accordingly, perhaps by rewarding dealers by sending them larger or more timely shipments when demand is unexpectedly high. This monitoring is costly.

Free Riding by Manufacturers. It is also possible that competing manufacturers can free ride off the efforts of each other. Suppose that two competing manufacturers both use the same distributor to sell their product and that one manufacturer conducts a massive advertising campaign to entice consumers to go to the distributor to buy its product. The second manufacturer benefits from the increased customer flow. In fact, because the free-riding manufacturer does not advertise, it has lower costs than the advertising manufacturer and can sell at a lower price. The distributor then can (correctly) tell a customer who is enticed into the store by the advertising of the first manufacturer, that the second manufacturer's product is a much better deal at a lower price. See **www.aw-bc.com/carlton_perloff** "Requiring Exclusivity."

Another example of free riding among manufacturers occurs when one manufacturer trains its distributors to repair or sell its product. To the extent that such training is costly and can be applied to other products, a second manufacturer can free ride on these training expenditures by using the same distribution outlets as the first manufacturer. Again, the free rider has lower costs and can outcompete the manufacturer that pays for the training.

A final example of free riding among manufacturers occurs when one manufacturer provides a list of potential customers to a distributor. If the distributor also sells the competing products of a second manufacturer, the second manufacturer benefits from the first manufacturer's customer list. These examples of free riding among manufacturers are similar in their effects to free riding among distributors. If the free riding is unchecked, manufacturers have reduced incentives to advertise, provide training for distributors, and develop customer lists. The solution to these free-rider problems is to create a system that allows manufacturers to obtain the full reward for their sales efforts. One common solution, **exclusive dealing**, is for manufacturers to forbid their distributors to sell the products of competing manufacturers (Marvel 1982).

Externalities Due to a Lack of Coordination Among Distributors. A manufacturer that relies on independent distributors that compete with each other usually wants to coordinate or restrict the ways in which they compete. For example, distributors often compete with each other on location (see Chapter 7 on monopolistic competition). The optimal location from a manufacturer's viewpoint may differ from the one that emerges under monopolistic competition by independent retailers.

A manufacturer wants to ensure that its goods are available wherever consumers are likely to buy. For example, by selling at unprofitable locations, the manufacturer may prevent buyers from trying other products, and thereby develop brand loyalty. This strategy can raise profits elsewhere, and hence total profits. Because an independent dealer sells only where its profits are nonzero, a conflict arises between the locational desires of the manufacturer and its independent distributors.

Competition among distributors depends on how each distributor thinks the others will react to its behavior. This competitive interaction among dealers can lead to a price and service quality that are different from what the manufacturer prefers. As shown in Chapters 6 and 7, price and quality vary depending on rivals' behavior toward each other, so it is unlikely that any particular oligopolistic outcome is consistent with the manufacturer's desires. Again, a conflict arises between the manufacturer's desires and the outcome of competition among distributors.

For example, suppose that a monopoly distributes its product using competing retailers whose sales efforts are important. Even in the absence of free riding, the incentive of the retailers to sell the product is inadequate from the monopoly's perspective because the competitive retailers make little on each additional sale (unlike the monopoly). Similarly, the retailers are less likely than the monopoly to want to stock inventories and bear the risk of unsold goods. That is why many book publishers allow stores a refund on unsold goods (Kandel 1996). In summary, by controlling competition among all dealers, a manufacturer can profitably coordinate their pricing, sales efforts, and locations and achieve higher profits than those that result from uncoordinated decision making among competing distributors. Table 12.1 summarizes the main problems arising in distribution, and the possible solutions for a manufacturer. Example 12.7 examines these issues in the alcoholic beverage industry.

The Effects of Vertical Restrictions

In general, manufacturers use various combinations of vertical restrictions to reduce the problems of double monopoly markup, free riding, and competitive interactions. These restrictions typically limit the amount of competition that can occur in a market and, at the same time, encourage additional efforts to sell the product.

A restriction on competition is something that an economist abhors, as it may increase market power. On the other hand, an increase in sales efforts is something that an economist applauds. So, should an economist conclude that vertical restraints are desirable or undesirable? There is no clear-cut answer to this question, but one can make several observations about the trade-off between restrictions and additional sales effort. In the following sections we describe markets where vertical restrictions benefit both firms and consumers, where the effects are ambiguous, and where vertical restrictions harm consumers. Finally, we note the implications of banning vertical restrictions.

Desirable Effects of Vertical Restrictions. Vertical restrictions that benefit both firms and consumers are unambiguously desirable. It is often in a manufacturer's selfish interest to use vertical restrictions that help consumers. Any manufacturer, even one with substantial market power, wants its product distributed at the lowest cost. Distribution is viewed by the manufacturer as an input necessary to make a sale, just as a raw material is an input in the manufacturing process. A monopolistic manufacturer

EXAMPLE 12.7

Brewing Trouble: Restricting Vertical Integration in Alcoholic Beverage Industries

Regulation has spawned strange vertical relationships within the U.S. alcoholic beverage industry, often creating monopolies and affecting vertical relationships. The Twenty-first Amendment to the U.S. Constitution, which ended Prohibition in 1934, states in section 2 that "the transportation or importation into any state, territory, or possession of the United States for delivery or use therein of intoxicating liquors, in violation of the laws thereof, is hereby prohibited." This passage has been interpreted as giving the states permission to continue restricting the marketing of alcoholic beverages. (See, however, Example 3.3.)

Almost all states have laws that create a three-tier distribution channel: suppliers (brewers, vintners, and importers); wholesalers; and retailers (liquor stores and restaurants). Allegedly, the original purpose of the laws was to prevent vertical integration in the industry, which might lead retailers to push the house brand beyond acceptable social limits. The Federal Alcohol Administration (FAA) Act was designed to prevent such marketing abuses. The FAA Act forbids practices that induce retailers to carry only one supplier's brands, and prevents suppliers from having ownership interest in retailers, although it does permit them to own retailers outright.

Starting in the 1970s, wholesalers have successfully backed various laws that enrich them. Twenty-three states require suppliers to sell only to locally licensed wholesalers and prohibit suppliers from having any interest in a wholesale or retail establishment. In addition, 18 "control" states (and one Maryland county) monopolize the distribution of alcoholic beverages and sell them at the wholesale and often at the retail levels. Consequently, almost all alcoholic beverages must be handled by wholesalers, because suppliers cannot directly deal with retailers. Thus, these laws prevent vertical integration and make the middlemen a powerful (and profitable) force between suppliers and retailers.

tries to distribute the product as efficiently as possible, just as it tries to produce the good at the lowest cost.[18] Thus, although in some cases vertical restrictions can be used for anticompetitive purposes, a number of economists argue that many, if not most, vertical restrictions benefit consumers by lowering prices or increasing services.

Vertical restrictions may lower prices either because they increase the output of existing firms or because they encourage new firms to enter markets. Vertical restrictions that allow a firm to promote its product more effectively and that lead to more output sold at a lower price help both firms and consumers. For example, competition among

[18]For examples of instances when vertical restrictions are procompetitive, see several of the case studies in Lafferty, Lande, and Kirkwood (1984) and Ippolito (1991).

Many state laws protect wholesalers from being "fired" by suppliers. All states except Alaska and Hawaii (which has a more general law) have franchise termination laws specifically covering some or all of beer, wine, and spirit distribution. These laws increase the double markup problem by precluding suppliers from enforcing provisions designed to limit downstream markups by ending a franchise relationship with a wholesaler. The consequence has been an increase in wholesaler markups, which often account for 18 to 25 percent of the price of wine to retailers and 15 to 25 percent of the price of liquor—percentages that exceed those typical in comparable industries.

At least prior to 1977, federal antitrust law prohibited establishing exclusive territories unless they were mandated under state law. Now 24 states mandate exclusive dealing, which gives wholesalers regions in which they are monopolies. Even in states without a monopoly wholesaler, laws make entry difficult, so there are only a small number of wholesalers. California has only two distiller liquor wholesalers, Young's Market and Southern Wine & Spirits. These two firms also control 70 percent of wine distribution. In Massachusetts, two firms control 43.5 percent of alcohol distribution and the top four control 65.3 percent. Some suppliers, such as Joseph E. Seagram & Sons, wanted wholesalers who could distribute their products over entire states and regions. Apparently they reasoned that large distributors would have lower costs and that wholesalers could avoid spillover and free-riding effects in promoting brands and maintaining quality. However, restricting the number of wholesalers increases their market power. A study by the New York City Department of Consumer Affairs found that beer prices rose 30 percent in the year that Miller Brewing and Anheuser-Busch set up exclusive agreements.

Sources: Fortune, December 9, 1985:135; Jordan and Jaffee (1987); Whitman (2003); **www.nabca.org**.

different brands is heightened if competing firms can effectively promote their products. That is, although competition among dealers of the same brand is restricted, competition across brands is encouraged, because the vertical restrictions stimulate sales efforts for each brand. Vertical restrictions also may make entry easier, which leads to lower prices. Without vertical restrictions, new products that rely heavily on sales efforts have difficulty breaking into a market.

In many cases, consumers view the *relevant product* as both the good and the service provided with it. Consumers who cannot get full use from a good without instruction from the retailer suffer if the good is sold without service. For example, it may pay for a neophyte photographer to buy a camera from a local store that provides instructions on how to use it. Although the camera can be purchased at a lower price from a mail-order distributor, the extra service from the local store may be worth the difference in price.

TABLE 12.1 **Problems That Arise in Distribution and Manufacturers' Responses**

Problems in Distribution	Manufacturers' Responses
Double monopoly markup	Encourage competition among distributors Sell at marginal cost and charge a franchise fee Establish sales quotas or maximum prices
Free riding among dealers	Establish exclusive territories or restrict the number of dealers Establish minimum price (resale price maintenance) Take over the marketing effort Monitor and subsidize or pay for dealers' sales effort
Free riding among manufacturers	Impose exclusive dealing on dealers
Lack of coordination among dealers leading to externalities	Use a combination of the policies above

In such cases, the good-with-service is really an entirely different product than the good without service. Vertical restrictions allow the good to be sold with service (sales effort). Without the restrictions, the price is lower, but fewer services are provided.

Ambiguous Effects of Vertical Restrictions. Whether a vertical restriction is desirable depends on the same factors that influence the social desirability of product choice. Imagine two groups of buyers: those who know how to use a good (experienced users) and those who do not (beginners). With no training provided, experienced users buy the good at $10 and beginners do not purchase it. With vertical restrictions that allow beginners to receive instruction, both groups buy the good for $11. The experienced users are worse off with the vertical restrictions because they spend more per unit but do not benefit from the availability of training. The beginners, however, are better off because if they purchased the good, it must be worth at least $11 to all of them, and some may receive consumer surplus.

Training is not the only useful sales effort. Showrooms are also useful—for example, to automobile, camera, computer, and stereo buyers. Without showrooms, potential customers could not easily examine the various products before purchase. Many, if not most, consumers would prefer to pay a slightly higher price and have a chance to test-drive a car before purchasing it.

Vertical restrictions, just like vertical integration, can be used to price discriminate. Suppose that consumers in California have an inelastic demand for some product, and consumers in Illinois have an elastic demand. The manufacturer wants to charge a high wholesale price to the distributor in California and a low price to the distributor in Illinois. If the manufacturer tries to do so, however, the independent Illinois distributor may be able to profitably resell in California the product it buys from the manufacturer. By granting exclusive territories to the independent distributors in exchange for no resale agreements, the manufacturer can charge a low wholesale price in Illinois and a high price in California. As explained in Chapters 9 and 10, however, imperfect price discrimination has ambiguous welfare effects and can increase or decrease welfare compared to simple monopoly pricing.

A growing literature shows that a variety of vertical contracts (or vertical integration) possibly impairs competition. From our earlier discussion, we know that a monopoly producer of good *A* gains nothing if it vertically integrates into a competitive downstream market for good *B* that is produced in fixed proportion to *A*. Moreover, if the market for *B* is not competitive so that a further markup is added to the price of *B*, then vertical integration (or a vertical contract involving nonlinear pricing) into *B* eliminates the inefficiency of the double markup, and consumers benefit. Thus with fixed proportions, vertical contracts (or vertical integration) do not harm and may benefit consumers.

However, there are at least two possibly offsetting effects. First, as we have already shown, if the production process has variable proportions, an input monopoly gains market power by vertically integrating forward (which tends to raise the price), even though it produces more efficiently (which tends to lower the price), so that the price may rise or fall. Second, if firms in market *B* differentiate their products then the input monopoly may not be able to constrain the final price for *B*, and hence the price will remain excessively high even if the input monopoly integrates forward. Again, it is unclear whether price will rise or fall with vertical integration. However, the reader is reminded that in calculating social welfare, gains in efficiency frequently swamp increases in deadweight loss. The principles for why these two conditions alter the desirable effects of vertical integration are at the heart of several papers on the possible harmful effects of vertical contracts and vertical integration. The theoretical possibilities of harm in these models depend on very specific and hard-to-verify conditions and, with slight changes in assumptions, the theoretical possibility of harm disappears. There have been few, if any, attempts to empirically document the validity of these conditions in any industry.[19] It is a fruitful area for research.

Undesirable Vertical Restrictions. In some cases, vertical restrictions (and vertical integration) can be used for anticompetitive purposes. For example, they may be used to cartelize an industry or to prevent entry, or otherwise harm rivals by raising rivals' costs (Chapter 11).[20]

[19] Rey and Stiglitz (1995) illustrate how competing manufacturers can use exclusive contracting with distributors to lessen the intensity of competition among the manufacturers. Ordover et al. (1990) explain how vertical integration (or its equivalent achieved through vertical contracts) can harm competition for differentiated products. See also Bernheim and Whinston (1998), Chen (2001), Rey and Tirole (1986), Riordan and Salop (1995), and Segal and Whinston (2000a).

[20] Salinger (1988), Riordan (1998), Ordover, Salop, and Saloner (1990), Hart and Tirole (1990), and Riordan and Salop (1995) discuss whether vertical mergers can harm competition. However, see Carlton (1990) and Reiffen and Vita (1995) for a critique of this literature. In the absence of transaction costs (or legal impediments to contracting), if there is an incentive for a vertical merger that harms consumers, then there is an incentive for the same result to be achieved by a vertical contract in the absence of the merger. Hence, it is only when such contracting cannot occur that one should worry about the anticompetitive consequences of a vertical merger. Those anticompetitive effects are similar to the ones discussed here in relation to vertical contracting.

Vertical restrictions can lead to either distributors' or manufacturers' cartels. A group of dealers can impose vertical restraints that lead to monopolization. For example, suppose that a particular group of dealers alone can distribute a product. They may force the manufacturer to grant exclusive territories, leading to local monopolies and restricted competition among dealers. As discussed in Chapter 5, allocating territories is an effective way to cartelize and results in higher consumer prices. This outcome is likely only if entry into distribution is difficult, so that the manufacturer has no choice but to assist in the creation of the dealer cartel.

Vertical restrictions (or vertical integration) can also help to perpetuate a cartel of manufacturers. Suppose that a group of manufacturers wants to collude. It may be difficult for them to observe the price that each is charging its dealers if they are not vertically integrated into distribution. If they all agree to charge the same price at retail, however, and enforce this agreement with vertical restrictions (such as resale price maintenance) on dealers, it is easier for them to detect if any manufacturer cheats on the agreement by lowering price, because it is easier to observe retail prices than wholesale prices.

Vertical restrictions (or vertical integration) may be used to increase the difficulty of entering an industry. For example, Chapter 11 shows how an incumbent can make it difficult or impossible for a rival to enter by tying up scarce distribution channels. Exclusive dealing is one way for manufacturers to tie up distribution. Under such agreements, both parties to the contract agree to rely only on each other, not on other firms. Such strategic behavior can successfully raise the cost of entry only if the channels of distribution are limited.

Rasmussen et al. (1992) and Segal and Whinston (2000) explain how a manufacturer can become a monopoly by tying up distribution without having to pay for it. Imagine that there are 100 dealers (no more can enter) and that a manufacturer needs at least 30 dealers to enter profitably. By signing exclusives with 71 dealers, the incumbent firm can foreclose entry of a rival and can become a monopoly. How much will the monopoly have to pay the dealer for this privilege? Nothing! As long as each distributor thinks that at least 71 other dealers will sign with the monopoly, dealers will rush to sign an exclusive agreement for free.[21]

Banning Vertical Restrictions

Even where vertical restrictions are undesirable, in some cases little is accomplished by banning them. If vertical restrictions are outlawed, a manufacturer has an incentive to vertically integrate and handle its own distribution, so that it can impose the desirable restrictions. It would be counterproductive to enact a law preventing contracts between independent firms when a firm could easily avoid such prohibitions by vertically integrating and distributing the product itself.[22] Only where the cost of vertically inte-

[21] Carlton and Waldman (2002), Nalebuff (forthcoming), Whinston (1990), and Stephandis and Choi (2001) show that, in other situations where scale matters, vertical restrictions can foreclose the market to competition. See Carlton (2001) for a more detailed discussion.

[22] Sometimes vertical integration is banned. See Barron and Umbeck (1984) and Blass and Carlton (2001) for an analysis of the costly consequences of a ban on oil companies owning their own gas stations.

grating is much higher than the cost of imposing vertical restrictions does a ban on vertical restrictions effectively end such practices.

In summary, although manufacturers impose vertical restrictions to increase their profits by generating more sales efforts, consumers may either gain or lose. Courts have recognized the value of increasing competition by encouraging promotional efforts. The courts have tried to bar certain vertical restrictions such as those that enhance or create a dealer or manufacturer cartel or raise costs of entry. Unfortunately, even where vertical restrictions are undesirable, forbidding them does not prevent the associated harms unless vertical integration is more expensive than the vertical restrictions. See Chapter 19 and **www.aw-bc.com/carlton_perloff** "Vertical Relations Antitrust Laws" for details on the relevant U.S. laws concerning vertical integration and vertical restrictions.

Franchising

One special type of vertical relationship is that between a *franchisor* and a *franchisee* (Caves and Murphy 1976, Rubin 1978). The franchisor, a firm such as McDonald's, sells a proven method of doing business to the individual franchisee (the owner of a McDonald's outlet) or sometimes sells only the right to carry the franchisor's brand. Franchises include fast food outlets, car repair centers, service stations, auto dealers, and soft-drink bottlers. A franchisor that provides a total system of doing business is called a *business-format* franchisor. Most franchises—with the exception of gas stations, auto dealers, and soft-drink bottlers—are business-format franchises.

Franchising has been growing in importance. From 1975 to 2003, the number of U.S. franchise outlets has increased from about 220,000 to more than 580,000.[23] According to one estimate, 40 percent of U.S. retail sales take place at franchise outlets.[24] Table 12.2 shows the 10 fastest growing franchises in the United States in 2003. Number one on the list, Subway, now has 17,000 locations in 75 countries.

The business-format franchisor provides the franchisee with training and other assistance, which often includes advice on purchasing, pricing, choice of location, accounting procedures, and advertising.[25] The franchisee agrees to run the business in the manner stipulated by the franchisor, who continues to monitor the franchisee's performance to make sure that it abides by the franchisor's methods. The franchisor's vertical restrictions greatly limit the way a franchise is run, though federal antitrust and state laws often limit aspects of franchisor control (see Chapter 19). (See Brickley, Dark, Weisbach 1991 for an analysis of how franchisors have responded to various

[23] *The 1986 Franchise Annual* and *The 2003 Franchise Annual*, Lewiston, N.Y.: Info Press. The *Franchise Annual* excludes some types of franchises, such as auto dealerships and gasoline stations. The reported numbers would be much higher if such omitted franchises were included.
[24] "Franchising in the United States," *AP Newswire*, July 6, 2002.
[25] This assistance does not result in generally lower failure rates for franchises compared to nonfranchises. Instead, the evidence suggests similarities in failure rates with the failure rate for small franchises being somewhat higher in the initial years, but lower in later years than that of independent firms (Bates 1995, Stanworth et al., 1998).

TABLE 12.2 **Fastest-Growing Franchises in the United States in 2003**

Franchisor	U.S. Franchises	Company-Owned Outlets	Franchise Fee	Royalty Fee on Sales
Subway (sandwiches)	15,257	1	$12,500	8%
Curves (women's fitness & weight loss)	4,671	0	$24,900	$395/month
7-Eleven Inc. (convenience stores)	3,761	2,547	varies	varies
McDonald's (hamburgers)	11,465	8,094	$45,000	12.5% +
Jani-King (commercial cleaning)	7,843	33	$8,600–$16,300	10%
Taco Bell Corp. (Mexican quick-service food)	5,363	1,331	$45,000	5.5%
Quizno's Franchise Co. (sandwiches)	2,000	0	$25,000	7%
Super 8 Motels Inc. (economy lodging)	1,987	0	varies	5%
Jackson Hewitt Tax Service (income tax preparation)	3,709	516	$25,000	15%

Source: EntrepreneurMag.com.

laws restricting their actions.) Franchisee agreements can typically be terminated by the franchisor. As compensation to the franchisor, the franchisee usually pays a franchise fee plus a percentage, or royalty, on sales, which is usually in the range of 0–10 percent.

The franchisor-franchisee relationship requires each party to rely on the efforts of the other—efforts that may be difficult to observe. Because a franchisor has difficulty monitoring how well a franchise is run, it provides incentives to the franchisee by letting the franchisee keep the bulk of extra profits. Thus, the franchisee has an incentive to work harder than a salaried employee of the franchisor would.

In cases where it is not difficult to monitor the behavior of the franchisee, the franchisor may own the outlet itself. Many franchisors own and operate a substantial fraction of their outlets. In the United States, about 13% of franchisor sales come from company-owned outlets excluding such heavily franchised sectors as auto dealerships and gas stations (*2003 Franchise Annual*). Car dealerships are 100% franchised, and gasoline stations 85% franchised, while fast-food restaurants are 79% franchised, and convenience stores are 82% franchised (Hadfield 1990, *2003 Franchise Annual*). Company-owned outlets tend to be larger than independent franchises and typically are located closer to a regional headquarters of the franchisor than independent franchises. There appears to be a long-run tendency for the proportion of company-owned outlets to decline as the franchisor continues to expand (Martin 1988, Brickley and Dark 1987). Lafontaine (1992) finds that the incidence of franchising is greater when there is an incentive or monitoring problem at the franchise level. Consistent with LaFontaine's findings, Shephard (1993) and Blass and Carlton (2001) find that gas stations are more likely to be company operated the higher the volume of gasoline sold and if the station has no repair bays.

After entering into the agreement, the franchisee expects the franchisor to continue to offer services and to make sure that the other franchisees maintain the reputation of the brand. If the franchisor sells franchises to inept people, the brand name declines in value and so does the business of each franchisee—even those run efficiently. By linking the franchisor's fee to a percentage of sales, as is typical, the franchisor has an incentive to continue to assist and monitor franchisees and to ensure that they succeed. If total sales fall, the franchisor's fee falls.

A more difficult question is why the franchisor's fee depends on sales and not profits. After all, it is profits, not sales, that franchisees and franchisors want to maximize. One answer is that it is easier to measure sales rather than profits (which, for example, requires a determination of depreciation). Another answer, which is difficult to verify, is that a fee based on sales, and not profits, better induces the franchisor to monitor other franchisees and preserve the brand's reputation.

Because an independent franchise sets its own retail prices, it is possible to examine whether prices at company-owned franchises are lower than at independent franchises due to the elimination of double marginalization. LaFontaine (1995) compared prices between company-owned and independent franchises for identical products at Arby's, Dairy Queen, KFC, McDonald's, Wendy's and other fast food franchises in the Pittsburgh and Detroit areas. She found that prices at company-operated franchises were 2 percent lower on average. Her results that prices are lower at company-owned franchises are consistent with similar results on gas pricing by Barron and Umbeck (1984) and Shephard (1993).

Empirical Evidence

There are many theories as to why firms vertically integrate or impose vertical restrictions. Real-world evidence illustrates how significant the explanatory power of the various theories is in predicting where vertical integration and vertical restrictions occur. We examine first the evidence on vertical integration and then that on vertical restrictions.

Evidence on Vertical Integration

Most existing studies of the reasons for vertical integration focus on the transaction costs or market power theories discussed in this chapter. Williamson's (1975, 1985) transaction costs or specific assets theory holds that when either firm in a vertical relationship must invest in a specific asset (one with no alternative use), vertical integration may be used to avoid opportunistic behavior. Opportunistic behavior typically involves reneging on implicit or explicit contracts or promises, with the intent of extracting a larger share of the rents generated by the transaction. The firm does whatever is least expensive—vertically integrates or relies on markets—taking into account possible opportunistic behavior by other parties. The market power theory holds that firms vertically integrate to increase profits or eliminate market power. This section discusses empirical studies that examine why firms produce some products internally but obtain others through market procurement.

Monteverde and Teece (1982) examine quasi-integration by automobile manufacturers. They explain why, in some cases, a manufacturer owns a machine necessary to produce a part, rather than buying the part from another firm that owns the machine. For example, suppose the machine that makes a specialized part that can only be used by the manufacturer must be custom built. If another firm owns that machine, it is at the mercy of the manufacturer, which could suddenly announce it is no longer willing to buy the parts, making the machine virtually worthless. This opportunistic behavior can be avoided if the manufacturer vertically integrates backward and owns the other firm. A less extreme solution is quasi-vertical integration, in which the manufacturer owns only the machine, not the other firm. The other firm runs the machine for the manufacturer and charges an hourly rate.

Monteverde and Teece (1982) examine a sample of manufactured components from two divisions of a major U.S. automobile supplier, all of which require special machinery and cannot be purchased on the open market. Monteverde and Teece test whether the possibility of opportunistic behavior leads to quasi-integration. Opportunistic behavior is likely if the value of the specialized asset to the downstream firm is much higher than for its next most valuable use. To illustrate this point, suppose the machine that makes a specialized part can be converted easily to produce parts for other firms. In that case, the opportunities for exploitation of this firm by the manufacturer are much less than if there is no other use for the machine. Opportunistic behavior is more likely the higher the tooling cost (the cost of producing the special machines to produce the part) and the more specialized the part (the higher the cost of converting the machine to its next best use). Monteverde and Teece's empirical evidence confirms that quasi-integration is more likely in these circumstances.

Different firms make very different decisions, however. For example, GM buys 57 percent of its parts from its own divisions, whereas Chrysler buys only 30 percent from its own divisions.[26]

Masten (1984) studies vertical integration in the aerospace industry. Firms can either make various components used in the industry themselves or buy from others. As in the previous study, integration is more likely when specialized assets are used. Masten employs two measures of asset specificity. The first, *design specificity,* reflects whether the item is used exclusively by this company (highly specialized), is easily adaptable for use by other aerospace firms (somewhat specialized), or is used in other industries (relatively standard). For example, transistors and resistors are standard items, and hybrid circuits designed for specific firms are highly specialized. The second, *site specificity,* reflects whether having the product produced nearby reduces costs. Masten also measures the complexity of the product: The more *complex* the product, the more things that can go wrong, and the greater the possibility of opportunistic behavior.

Masten's statistical analysis shows that products that are highly complex and highly design specific are more likely to be produced internally, but that site specificity, at

[26]David Woodruff and Zachary Schiller. "Smart Step for a Wobbly Giant." *Business Week,* December 7, 1992:38.

least in this industry, is not an important factor. If the product is both design specific and complex, there is a 92 percent probability that it is produced internally. If it is design specialized but not complex, there is a 31 percent probability of internal production. The probability drops to 2 percent or less if it is not design specialized, regardless of whether or not it is complex. Thus, design specialization appears to be the most important factor. Other studies showing the importance of asset specificity include Spiller (1985), Weiss (1992), Crocker and Reynolds (1993), Minkler and Park (1994), Whyte (1994), and Wimmer and Garen (1997).

Lieberman (1991) examines the importance of asset specificity, market power, and assurance of supply as explanations for vertical integration in the chemical industry. His study is a rigorous test of Carlton's (1979a) theory on the importance of supply assurance. Lieberman finds strong support for the importance of both asset specificity and supply assurance, but not market power, as reasons for vertical integration.

Evidence on Vertical Restrictions

Most of the empirical studies of vertical restrictions concentrate on the effects of resale price maintenance. This section examines resale price maintenance as well as other types of vertical restrictions.

Most of the studies presented to Congress in 1975, when it was debating making resale price maintenance illegal, found that maintained prices were from 16 to 19 percent higher than those in states that did not enforce fair trade laws. A Library of Congress study estimated that consumers paid between $1.66 billion and $6.23 billion more on retail transactions covered by fair-trade laws than in free-trade states. Thus, families in fair-trade states may have paid $150 more per year for maintained prices (Shepard 1978).

Several studies of resale price maintenance have compared the periods before and after the federal law in 1976 that banned the practice.[27] By looking at prices and output in the two periods, these studies try to test whether resale price maintenance helps or harms consumers. The difficulty with such studies is that it is not clear whether the behavior of prices and output allow one to distinguish the case where resale price maintenance is harmful from the case where it is helpful. For example, if resale price maintenance is anticompetitive, prices should fall and output should rise after the ban. But the same may be true even when resale price maintenance is procompetitive. The reason is that if the resale price maintenance promotes sales effort and promotional activity, then some of the effect of that sales effort and promotional activity will remain in the short run. Once resale price maintenance is not allowed, prices should fall as firms compete, and output should rise. But eventually the benefit of past promotional efforts will subside and free riding will reduce additional sales promotions, with a re-

[27]Although federal law prohibits resale price maintenance, manufacturers can legally pressure distributors to control the retail price. For example, manufacturers can suggest a retail price, can choose to deal with retail stores that do not discount, and can structure promotional incentives so that retail stores do not charge less than the manufacturer-specified minimum advertised price.

sulting decline in output. The price will be lower, but so will promotional activity, so output may be higher or lower than before the repeal of the resale price maintenance. Thus whether a ban benefits consumers may depend on the value that consumers place on sales services.

A study by Shepard (1978) of the 18-month period following federal repeal of resale price maintenance (January 1976 to June 1977) suggests that consumers saved $6.5 billion more in fair-trade states. The prices of discount firms are estimated to have fallen 11.6% relative to the prices they were forced to charge in December 1975, and specialty store (nondiscounter) prices fell by only 1.8%. Price differentials between discounters and nondiscounters in furniture, apparel, and tools became very large, 20–30%. Nonprice competition probably fell as a result. A survey of retailers in California, a fair-trade state, found that nondiscount specialty stores discounted some product lines sold at nearby discount outlets. Moreover, 15% of surveyed retailers claimed that they or their rivals had reduced their advertising budgets following repeal. This claim is supported by average advertising linage purchased by retailers in major newspapers in the 108 largest U.S. cities. In 1975, prior to repeal, mean advertising in the 82 fair-trade cities was 13.2% higher than in free-trade cities. In 1976, after repeal, advertising in these cities was only 12.7% higher.

Ornstein and Hanssens (1987) consider whether resale price maintenance of liquor increased or decreased welfare. Presumably, if resale price maintenance increases efficiency in distribution, it increases output and thereby raises consumer surplus.[28] They compare states with resale price maintenance to others for the period 1974–1978. They find that the presence of resale price maintenance lowers per capita consumption by 8%, holding other factors constant. They also compare the effects in California counties for eight years prior to the repeal and in 1984. The repeal of the law had a significant negative impact on liquor store license values of between 23% and 25%. This large loss is consistent with the belief that resale price maintenance was used to establish prices above the competitive level. It is also consistent with the view that resale price maintenance was used to create some profits in the distribution sector in order to encourage sales effort.

Using a cross-state analysis, Ornstein and Hanssens estimated the welfare loss from resale price maintenance, ignoring the negative externalities from drinking. Based on estimates of the price elasticity of demand for liquor that range from -0.5 to -1.5, their estimates of the direct welfare loss range from $2.5 to $7.5 million. The wealth transfer from consumers to firms was more substantial: $226.6 million in 1978, or 4.5% of estimated retail sales in the affected states. Given the data difficulties associated with the estimates, Ornstein and Hanssens say that these figures should be viewed as suggestive only.

[28] More liquor sold at a lower price increases consumer surplus from direct consumption. More consumption, of course, could cause substantial harm, such as from drunk driving. These indirect harms are not included in the welfare calculations that follow.

Ippolito (1991) and Overstreet (1983) study several industries that used resale price maintenance. They conclude that the evidence favors the hypothesis that resale price maintenance is used to facilitate sales effort and not to facilitate a cartel among dealers or manufacturers.

In addition to studies of resale price maintenance, there have been studies of other types of vertical restrictions. For example, Ekelund et al. (1987) analyze the effect of exclusive territories on the price of beer. They conclude that, when account is taken of state advertising restrictions on price, there is no evidence that exclusive territories raise price.

Mueller and Geithman (1991) examine the effect of the distribution system used by Sealy, a manufacturer of mattresses. In 1968, Sealy instituted a new licensing agreement designating each licensee's former exclusive sales territory as an "area of primary responsibility" (APR). When a licensee sold outside its APR, it had to pay the owner of the invaded APR a "passover payment" and "warranty repair charge." Consequently, distributors made few sales outside of their APRs. As a result of a private antitrust action, this practice was found to be a restraint of trade. Starting in 1981, Sealy licensees began selling in others' APRs. Sales outside of retailers' own APR went from 0.9% in 1980 to 4.6% in 1985.

Mueller and Geithman conclude that the licensing system created market power for local dealers, to the detriment of Sealy. When this system ended, consumers enjoyed substantial discounting. Apparently, no free-rider problem leading to reduced advertising resulted. Local and national advertising rose above their 1980 levels. Eckard (1994) questions Mueller and Geithman's interpretation of the evidence and notes that, inconsistent with a diminution of local dealers' market power, Sealy's profit fell after 1980.

There is a need for more empirical studies to identify both desirable and undesirable vertical arrangements. Although many theoretical papers show how vertical restrictions can be either harmful or helpful, the evidence from U.S. antitrust case law provides at best weak support that the effects are harmful. Thus Easterbrook (2002) argues that it would be a mistake for courts to take a harsh attitude toward vertical arrangements.

SUMMARY

Vertical integration occurs for the same reasons that firms are created in the first place. Although firms may vertically integrate to increase monopoly profits, they also have many efficiency-related motives. When firms decide not to vertically integrate, they may impose vertical restrictions on the firms with which they deal. It is often in the best interest of a manufacturer to use vertical restrictions to give limited monopoly power to distributors. By doing so, the manufacturer induces the distributors to put forth more sales effort. These vertical restrictions can stimulate product sales and promote competition. In certain circumstances, vertical integration and vertical restrictions may be used for purely anticompetitive reasons. Although there are exceptions, in general, it is difficult to show that either vertical integration or vertical restrictions decrease welfare.

PROBLEMS

1. A manufacturing firm merges with another firm to vertically integrate forward into the production of selling of products so as to engage in price discrimination. Will such a vertical merger help some groups of consumers at the expense of others?
2. If a state passes a law protecting independent franchisees from having their franchises terminated, what is the likely effect of that legislation?
3. If a pure profits tax (a percentage of the economic profits) is collected at the retail level, does a downstream monopoly's incentive to vertically integrate change? Does the incentive change if the tax is collected at both upstream and downstream levels? Does a sales tax (at the retail level) affect the incentive to vertically integrate?
4. A monopolistic producer uses a dealer network, in which it limits the number of dealers and restricts them to exclusive territories, to sell its product in another country. Some importers buy the product in the other country and sell it in the United States. Such imported products are said to be sold on the *gray market.* Explain why the manufacturer might not act to prevent such gray market sales.
5. A woman wants to present a friend with a gift and, as an inside joke, wants to present it inside an empty red-and-white-striped barrel of Kentucky Fried Chicken. She tries to buy the empty carton from a fast food chain that sells Kentucky Fried Chicken and is told that it costs $10! The barrel full of chicken costs $10.99. The reason is that the corporate headquarters keeps its inventory on the amount of chicken sold by the number of cardboard containers sold.[29] To ensure an accurate count, the parent firm may have required the franchisees to purchase cartons only from it. Should society bar the franchisor from requiring such purchases by franchisees? Why does the franchisor want to use this method? How can the franchisee try to get around this restriction?
6. One possible measure of the degree of vertical integration is the ratio of value added (sales minus material and energy costs) to sales. Contrast this measure for a mining firm and for a car producer.

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

See Perry (1989) on vertical relations and Katz (1989) on vertical contractual relations for excellent, relatively nontechnical surveys of the entire literature. The classic articles on vertical integration are Coase (1937) and Stigler (1951). The two books by the leading proponent of the transaction costs approach, Williamson (1975, 1985), are relatively nontechnical and are fascinating reading. Blair and Kaserman (1983) is a clear but more technical analysis. Telser (1960) is the first article to present the modern rationale for vertical relations and is nontechnical. A clear discussion of that topic is White (1985). See Martin (1988), Hadfield (1990, 1991), Gallini and Lutz (1992), Lafontaine (1992, 1995), Katz and Owen (1992), and Brickley (1999, 2002, forthcoming) for recent work on franchising. Preston (1994), Noll and Owen (1994), Warren-Boulton (1994), and Guerin-Calvert (1994) use economics to analyze five important cases involving vertical arrangements.

[29]Clark DeLeon, "The Colonel: That Will Work, Won't It?" *Philadelphia Inquirer,* December 30, 1980:2-B.

PART FOUR

Information, Advertising, and Disclosure

CHAPTER 13

Information

There is no absolute knowledge. . . . All information is imperfect. We have to treat it with humility. —*J. Bronowski*

This chapter examines the problems that arise from limited consumer information. Consumers often do not know which store sells a good at the lowest price or how quality varies across brands. Providing consumers with information about product prices, attributes, or quality alters their purchasing behavior and thereby affects market structure. The results of recent research on markets in which consumers have limited information are startling and contradict the strongest conclusions from the standard economic models based on perfect consumer information. In markets in which consumers have limited information, high-quality products may not be supplied, some of the desirable effects of perfect competition vanish, and firms may have an incentive to reduce consumers' information.

The five major questions addressed in this chapter are

1. What is the effect if consumers have limited information about product quality?
2. What is the effect if consumers have limited information about prices charged by stores?
3. If some consumers have full information and others only limited information, is the full-information equilibrium obtained?
4. Do firms have an incentive to lower consumer information so as to price discriminate?
5. When does providing consumers with more information lower the equilibrium price?

The chapter begins by showing that if consumers have limited information about a product's quality, one of two serious problems occurs: Either the market does not exist, or, if it does exist, the quality produced is different (usually lower) than would occur in a world of perfect information.[1] For example, often only the lowest-quality products are produced. Providing information through experts, standards, and certification is socially desirable if the benefits to consumers outweigh the costs of collecting and disseminating the information. Warranties or guarantees may also eliminate problems due to limited information.

Next, we show that imperfect consumer information about prices may eliminate a market, enable even small firms to set their prices above marginal cost, or lead to the charging of a variety of prices for a homogeneous good. That is, with imperfect consumer information about price, perfect competition is impossible. In this sense, the *law of supply and demand* and the *law of a single price* do not hold in markets with limited information.

Then, we consider that firms may purposely raise consumers' costs of search in order to obtain market power. For example, a firm may charge different prices for the same good at various locations or under different brand names so as to make it difficult for consumers to find the low-priced brand. Finally, we show that improving consumer information can sometimes lower average price.

Why Information Is Limited

Research by psychologists, economists, marketing experts, and others reveals that consumers have imperfect knowledge of prices and qualities in the marketplaces where they shop. There are five chief reasons for this limited knowledge (Federal Trade Commission 1978).

First, information varies in reliability. Not all "information" is accurate, and hence a rational consumer should not rely equally on information from all sources. Information that was once correct may become dated and therefore inaccurate.

Second, there is a cost to collecting information. It does not pay for consumers to collect information beyond the point where the marginal benefit equals the marginal cost of collecting it. For example, going to several stores to determine which one has the lowest priced candy bar almost certainly does not make sense. See Example 13.1 and **www.aw-bc.com/carlton_perloff** "Sources of Consumer Information."

Third, consumers can remember and readily recall only a limited amount of information (see **www.aw-bc.com/carlton_perloff** "Do Consumers Know How Much

[1]Many economists call the limited information equilibrium *nonoptimal* or *inefficient* or say that it is a *market failure*. Because it is common terminology, we will refer to departures from perfect competition as inefficient. However, this terminology is inaccurate because it implies that a problem exists that can and should be fixed. It is costly to provide perfect information, and the costs of providing perfect information may exceed the benefits. Thus, even though such departures from a perfect world are commonly referred to as nonoptimal, it may not be optimal or even possible to correct this "inefficiency" or "market failure."

EXAMPLE 13.1

Genetically Modified Organisms: Do Consumers Not Care or Not Read?

All Western countries strictly regulate the labeling of food products.The labels must be informative in the sense that they are accurate and useful descriptions of the ingredients or characteristics of the product. Although the labels may not be explicitly misleading, producers have an incentive to stress only positive characteristics on the labels, putting the unfavorable qualities in small type. Consequently, regulators impose strict conditions on the size, color, and positioning of information on packages.

A key factor that is handled differently across countries is whether a food product contains genetically modified organisms (GMOs). European countries require a disclosure about GMOs in lettering that is at least as large as those in the list of ingredients. Surveys indicate that European consumers are hostile to products containing GMOs. However, Noussair, Robin, and Ruffieux (2001) conducted an experiment that suggests that this hostility may not translate into buying behavior.

Their experiment shows that consumers don't react to labeling, probably because they do not even notice it, and hence do not realize that the product contains GMOs. Using people from Grenoble, France, the experimenters conducted Vickery auctions to determine the consumers' willingness to pay. In these auctions, each participant simultaneously submits a bid independently. The good goes to the highest bidder at an amount equal to the second-highest bid. According to theory, each bidder has a dominant strategy to bid an amount equal to his or her actual willingness-to-pay.

In period 1 of the experiment, four chocolate bars without packaging were auctioned, including two identical bars, called *S* and *U*. Each subject received a taste of the four products. Then an auction was held. In the second period, the subject saw the original packaging (without the price but with the list of ingredients). The package for *S* listed corn, and that for *U* listed "genetically modified corn." A second auction was conducted. In the third period, the subjects were shown a magnified and projected list of ingredients from the packaging and were invited to read the list of ingredients.

In the first two periods, the average bid for products *S* and *U* were essentially equal. However, in the third period, the average bid for the GMO product, *U*, was only 75 percent as high as that for the non-GMO product, *S*. Moreover, 80 percent of the subjects were willing to pay a positive price for *U*. Thus, although the reported hostility to GMO products exists, apparently most people will still buy the products and will generally pay as much for them as non-GMO products, as they do not read the labels carefully.

They Pay?"). They are, of course, more likely to retain and recall relatively important information.

Fourth, it is often efficient for consumers to use simplified rules to process information. That is, they rationally use only some of the information they have collected because it is costly to process it. A customer may check a restaurant bill to see if any nonordered items were included, but may not check the addition. A sensible consumer processes information up to the point where the marginal benefit equals the marginal cost of processing more information (this behavior is called *bounded rationality*).[2]

Fifth, some consumers do not have sufficient education or intelligence to process available information on all products correctly. For example, some quite intelligent people do not know how to determine the quality of various computers or industrial organization textbooks, the healthfulness of foods, or the probability that a house plant will survive in their yard. Others lack the math skills to compare the cost of buying a car by paying for it outright to the cost of making a relatively small payment each month for years. See Example 13.2.

Limited Information About Quality

Lord Bowen's definition of hard work: *answering yes or no on imperfect information.*

Consumers frequently do not know how quality varies across brands in markets for the services of professionals (doctors, lawyers, plumbers, electricians, and economists), processed foods, used goods, and complex mechanical or electronic products. There is **asymmetric information**: One party (seller) to a transaction knows a material fact (the quality of the good) that the other party (buyer) does not. Asymmetric information about quality can have either of two undesirable results: An equilibrium may not exist, or, if the equilibrium exists, resources are used less efficiently than they would be if there were perfect, symmetric information.

The Market for "Lemons"

Probably the best-known study of the way limited information can disrupt a market is Akerlof's (1970) classic analysis of the market for "lemons." Akerlof shows that, where sellers have perfect information and consumers have extremely limited information, a market may not exist, or only the lowest-quality product may be sold.

For example, in the used car market, the seller (current owner) has learned over time if the car rarely needs repairs (a good car) or frequently needs them (a "lemon"), whereas, at best, a potential buyer knows the probability of getting a good car. If buyers cannot distinguish between good and bad used cars, the cars sell for the same price.

Bad Products Drive Out Good Products. Bad cars are overvalued and good cars are undervalued in this market. For example, suppose that consumers believe that half the used cars in the market are lemons that consumers value at $100 and the other half are good cars that they value at $200. Consumers are risk-neutral: They are indifferent

[2]Simon (1957, 1959), Cyert and March (1963), and Williamson (1964).

EXAMPLE 13.2

Understanding Consumer Information

The "fat-free" label isn't misleading! The fat is free. We only charge for the other ingredients.

Many consumers do not understand potentially valuable information:

Unit Pricing: A shopper can use unit pricing information in grocery stores to determine which brands or sizes are relatively inexpensive per unit. In 300 post-shopping interviews in 1975, 39% of shoppers claimed to use unit pricing frequently, and another 32% occasionally. Only about 19% said that they seldom or never used shelf tags for price comparisons, and 10% admitted that they had never noticed the tags. Thus, over 7 out of 10 customers said that they occasionally used unit pricing, whereas only 22% rated unit pricing as "not helpful."

The other consumers may not use unit pricing because they cannot process the information. One experiment found that understanding of the unit price information increased with education. The percent who understand the unit price information was 48 for those completing grade school, 71 for those with some high school, 75 for high school graduates, 81 for those with some college, and 83 for college graduates.

Insurance Cost: Surveys show that the model life insurance cost-disclosure format adopted by the National Association of Insurance Commissioners is incomprehensible to the average consumer. Only 38% of life insurance purchasers knew that a policy's index number could be used to compare the costs of life insurance policies. Only 21% knew that the lower the policy's index number, the lower its cost, and 61% said that they did not know how to use an index number.

Brightness of Light Bulbs: Since 1970, the Federal Trade Commission has required the disclosure of brightness information for light bulbs. Five years after the rule was promulgated, most consumers did not understand the concept of "lumens," which measure brightness. In a survey of 168 people, only one mentioned lumens as a pertinent factor in selecting light bulbs.

Nutrition: According to a 1991 Harris Poll, 22% of people say that they have trouble understanding food label information. Moreover, although the Food and Drug Administration requires that nonstandard food items be labeled, many consumers (including the authors of this text) find it hard to understand the meaning of certain terms. For example, if a product is not the real thing and is nutritionally inferior to the real thing, it must be called *imitation.* If the product is not real but is nutritionally equivalent, it may be called a *substitute.* The terms *salt free, no salt, no salt added, unsalted,* and *without salt* may be misleading to many consumers. These phrases mean that no salt has been added during processing, but the original product may be very high in salt or sodium.

Sources: The Progressive Grocer, October 1975:48; D. McCullogh and D.I. Padberg, "Unit Pricing in Supermarkets," *Search: Agriculture* 1971:1:18, Table 22; Federal Trade Commission (1979, 93–4); Sheldon Margen and Dale Ogar, "To Your Health: The Writing on Food Labels Often Confuses," *San Francisco Chronicle,* October 22, 1986:FF4; Sheldon Margen and Dale Ogar, "To Your Health: Labels on Our Food Don't Tell the Whole Story," *San Francisco Chronicle,* October 29, 1986:FF3; Associated Press, "20% Confused by Food Labels," *San Francisco Chronicle,* March 12, 1991:B4.

between having a dollar and having something that has a 50 percent probability of being worth nothing and a 50 percent probability of being worth \$2. Then the value to a typical consumer of a randomly selected car is \$150 $(= 1/2 \times 100 + 1/2 \times 200)$. That is, the buyer is willing to pay more than the value of a bad car (\$150 $>$ \$100) because the car might be good, but the buyer is not willing to pay the full value of a good car (\$150 $<$ \$200) because the car might be a lemon.

In such a market, bad cars drive out good cars. Although an owner of a bad car is delighted to sell it for more than it is worth, an owner of a good car is unwilling to sell it for less than its value and keeps it. Thus, in a market with only two types of cars, only the bad cars are sold. Because only bad cars are sold, buyers know they are getting lemons and will only pay the value of a lemon, \$100. *There is no market for good-quality used cars.*

This example can be extended to many qualities of cars, but the result is the same. The lowest-quality cars eventually drive all other cars out of the market by the same sort of reasoning.[3]

This type of problem also arises in markets for insurance and for home repair. The price of health insurance increases with age because older people are more likely to need health insurance. Healthy senior citizens, however, may not find medical insurance attractive because the premiums are too high. As in the used car example, there is **adverse selection**: As the price of an insurance policy rises, only the worst risks buy the policy. If individuals can determine their own health better than insurance companies, insurance companies sell a disproportionate number of policies to the least healthy members of society.

Similarly, suppose that some roofers use high-quality materials and others use low-quality materials. If homeowners cannot tell the honesty of a roofer for many years (for example, bad materials break down in 5 years and good materials last 10 years) and must pay bad and good roofers the same amount, then bad roofers may drive out the good ones, whose costs are higher. In each of the examples, high-quality goods that would be sold if buyers and sellers had symmetric information are not sold if there is asymmetric information. Consumers are therefore deprived of the ability to consume certain products.

Asymmetric Information Lowers Quality. Although not all markets with asymmetric information degenerate so that only the lowest-quality item is sold, there is always inefficiency in these markets relative to a world with perfect information: Quality levels are too low (Leland 1979a, 1979b). Unfortunately, these inefficiencies relative to a perfect world usually cannot be remedied by government intervention, because providing perfect information is often prohibitively expensive.

These low-quality inefficiencies are due to an *externality* in which a firm does not completely capture the benefits from selling a higher-quality product. When a seller

[3]The Akerlof model applies better to insurance and similar markets where people cannot easily switch between being buyers and sellers. Kim (1985) shows that when people can decide whether to be a buyer or a seller, the results may differ.

provides a relatively high-quality product, the average quality in the market rises, so buyers are willing to pay more for *all* products. That is, the high-quality seller shares the benefits of its high-quality product with sellers of lower-quality products by raising the average price to all. Because the price based on average quality is less than the cost of producing the higher-quality product, a firm is unwilling to produce and sell it.

Solving the Problem: Equal Information

I only ask for information. —*Charles Dickens*

The problem of bad products driving out good ones results from the asymmetry of information. Where information is symmetric, markets are more likely to exist. We consider two types of symmetric information: Either both sides costlessly know the quality of a product, or neither knows.

If both buyers and sellers know the quality of used cars, prices reflect the true values of cars. Good-quality cars sell for more than bad-quality cars. The market is perfectly competitive and there are no inefficiencies.

If sellers know no more than buyers (as with new cars), then good and bad cars are sold at a price that reflects an average of the two qualities. That is, the price does not reflect the true value of a given car, but it does equal the expected value. Where there is symmetric but imperfect information, markets do not vanish.

Whether it pays for consumers (or sellers) to obtain information, however, depends on the costs of obtaining it as well as its benefits. Where costs of obtaining information are relatively low, consumers obtain the information and markets function smoothly; if costs are high, the information is not gathered and inefficiency results.[4]

One possible solution to the asymmetric information problem is to require sellers to make disclosures (Chapter 14). Consumers also obtain information in at least five other ways.

Guarantees or Warranties. By providing credible *guarantees* or *warranties,* sellers of high-quality goods credibly convey the information to consumers that their products are of high quality. By providing consumers with information, such firms are able to charge higher prices that reflect the higher quality of their goods.

[4]In some markets, price may convey the information necessary for consumers to infer relative qualities of different products; in others, price is not a good indicator. See Grossman and Stiglitz (1980) and Cooper and Ross (1984). Ginter, Young, and Dickson (1987) survey studies of the relationship between price and quality in many different types of markets (clothing, cameras, shoes, food, small appliances, and others) and find that the correlation between price and quality is almost always low (in all studies, the average correlation was less than 0.29). On the other hand, price does correlate well with some major purchases of durable goods (Gerstner 1985; Tellis and Wernerfelt 1987; and Curry and Reisz 1988). Smallwood and Conlisk (1979) and Chan and Leland (1982) contend that high prices should be correlated with high quality when there are informed consumers. Bagwell and Riordan (1991) show that when quality is fixed, a high price can signal high quality if a higher-quality good costs more to produce. Klein and Leffler (1981) argue that high prices signal high quality as a payoff for the repeated choice of the high-quality good by consumers. These theoretical issues are discussed in more detail below and in the next chapter.

EXAMPLE 13.3

Counterfeit Halal Meat

Many Muslims—including a quarter of the 6–8 million Muslims in the United States—only eat food prepared according to strict Islamic guidelines called Halal. Unfortunately, many stores are selling counterfeit Halal. Halal meat is expensive, and retailers commonly mislabel other meats so as to pass them off as Halal.

One solution is legal intervention. Several states have passed laws making it a crime to sell food falsely labeled as Halal. And in England, Wales, Northern Ireland, and the Irish Republic, authorities have raided vendors peddling fake Halal.

Another approach is the use of a guarantee. Mohammed Patel, a Chicago grocer, put a sign in his store window: "If you prove our meat is not Halal, we will give you $50 thousand." The sign greatly increased his business.

Sources: Charles Osgood, "Laws to Stop Counterfeit Halal Foods," August 19, 2003; **wcbs880.com/siteSearch/osgood_story_231115949.html; www.ehn-online.com/cgi-bin/news/news1/EpVyykuAyFLWiuELJf.html; www.muslimconsumergroup.com/news.htm**.

However, guarantees only convey this information if they are credible. For example, an established dealer's guarantee on a used car is more credible than a guarantee from an individual. A guarantee is valuable only if the buyer believes that the seller can be found and made to honor it in the future.[5] See Example 13.3.

Typically, guarantees are provided only if the life of a product does not depend heavily on how consumers use it. Otherwise, buyers have an incentive to use the product relatively carelessly and rely on the seller to fix problems under the warranty. A *moral hazard* is an incentive for a consumer to behave carelessly when the product is covered by a guarantee that the seller will fix all problems (even those caused by the consumer).

Liability Laws. Liability laws may serve the same function as explicit warranties. If consumers know that liability laws or contract laws force the manufacturer to make good on defective products, then the manufacturer need not list its obligations in a warranty. The problem with relying on legal recourse rather than explicit warranties, however, is that the precise obligations of the manufacturer may be ambiguous, and as a result, the transaction costs (such as going to court) may be high. Thus, manufacturers may find that explicit warranties are still necessary.

Reputation. A store or manufacturer may rely on its reputation to signal that its goods are of high quality. A store that expects repeated purchases by a consumer if it

[5]A Federal Trade Commission study found that only 4.8 to 14.8 percent of consumers carefully study guarantees and warranties before purchasing; thus, in many markets, they may be provided for reasons other than to signal quality before purchase (Crocker 1986).

provides high-quality products has a strong incentive not to provide defective products. In general, in markets where the same consumers and firms deal regularly, a reputation is easy to establish. In markets where items are purchased infrequently, reputations are harder to establish.

Experts. A disinterested party, an expert, may be able to provide consumers with reliable information. For example, if a potential purchaser of a used car can take it to a mechanic and get it appraised, then any information asymmetry may be eliminated.

Consumer groups may publish expert comparisons of different brands, as in Consumers Union's *Consumer Reports.* Objective information supplied by outside organizations is rare because information is a *public good* (a good that, if it is supplied to anyone, can be supplied to others at no extra cost). Information is socially valuable if it is worth more (say, to consumers) than it costs to provide it. Although socially valuable information may exist, it is possible that no firm can profitably provide it because it cannot capture all the benefits. Consumers Union does not capture the full value of its information through subscriptions because subscribers to its magazine, *Consumer Reports,* lend their copies to friends, libraries stock the magazine, and newspapers report on its findings. As a result, Consumers Union does not engage in as much research as it otherwise would.

Standards and Certification. The government, consumer groups, industry groups, or others may provide information in the form of *standards* and *certification.* A **standard** is a metric or scale for evaluating the quality of a particular product. For example, the "R-value" of insulation tells how effectively it works. **Certification** is a report that a particular product has been found to meet or exceed a given level on a standard.

Standard Setters: Industry groups may set their own standards and get an outside group or firm, such as Underwriters' Laboratories (UL) or Factory Mutual Engineering Corporation (FMEC), to certify that their products meet specified standard levels. Often standards are set to guarantee conformity across brands. For example, a VHS video-recorder owner is assured that a VHS tape manufactured by another firm works in that machine.

Government agencies may require manufacturers to disclose information about their products, such as the energy consumption of an electric appliance or the potentially harmful side-effects of certain drugs. Governments may set and enforce minimum quality standards by requiring that professionals be licensed and that drugs be effective or by testing the products directly. For example, in 1988 the U.S. Food and Drug Administration (FDA) tested 115,000 condoms for defects, rejected 30 million imported condoms as defective, and ordered the recall of 3 million domestic condoms.[6] Governments also may set fines to guarantee that firms meet standards or liability rules requiring firms to recompense consumers if products malfunction.

[6]Robert M. Andrews, "His Job: Condom Tester," *San Francisco Chronicle,* February 9, 1990:B6. The FDA works with manufacturers to ensure that latex condoms are not damaged. An average of 996 out of 1,000 spot-checked condoms must pass a water test for leaks. Under pressure from the FDA, one manufacturer recalled 57 million condoms in 1997. All but one U.S. producer has had a recall as of 2003.

Effect of Standards: Unfortunately, standards and certification may either help or hurt. They are harmful if their information is degraded or misleading, or if they are used for anticompetitive purposes. Where consumers are inexpensively informed of the relative quality of all goods in a market, the information is unambiguously useful. Often, however, information is degraded.

For example, although quality may vary along a continuous scale, it may be the case that only a high- versus a low-quality rating is used. With such standards, products are likely to be made so that they have either the lowest-possible quality (and hence cost of manufacture) or just barely a high enough quality level to obtain the high-quality rating.

Such high–low rating schemes are often combined with the exclusion of low-quality goods or services. For example, many state and local governments license professionals, and only those meeting some minimum standards are granted licenses and allowed to practice. In most states dozens, if not hundreds, of professions and crafts are licensed, such as electricians, plumbers, dentists, psychologists, contractors, and beauticians. In California, as of 1991, nearly one in four workers holds a professional license, including approximately 400,000 cosmetologists, 300,000 contractors, and 200,000 private investigators.

Licensing has two offsetting effects (Leland 1979a, 1979b). First, the restrictions raise the average quality in the industry by eliminating low-quality goods or services. Second, these restrictions raise the prices consumers pay. The number of people providing services is reduced because the restrictions screen out some potential suppliers. Moreover, consumers are unable to obtain the lower-quality and less expensive goods or services. As a result, welfare may go up or down depending on whether the increased-quality or the higher-price effect dominates. Only by setting the standard properly and changing it as necessary can welfare be raised. It is debatable whether such restrictions can be set properly and cost-effectively by government agencies.

A better solution than trying to set the best possible standard is to provide consumers with objective information on the relative quality of each brand or professional, and let them judge whether the price savings justifies purchasing a low-quality good or service. Restrictions on supply may be superior to providing such information only if consumers are unable to understand more subtle grading systems or if it is too costly for consumers to train themselves to use this information.

A further problem with licensing and mandatory standards and certification is that they can be used for anticompetitive purposes, such as erecting entry barriers to new firms and products. For example, many model plumbing and building codes required that pipes be made of copper or a few other types of materials and have certain dimensions (Federal Trade Commission 1978, 162–63). As a result, manufacturers of plastic pipe faced problems in introducing their products.[7] These mandatory standards in building codes impeded the diffusion of innovations (Oster and Quigley 1977).

[7]One reason for the building-code restriction on plastic pipes is that they can be installed more quickly and by less skilled labor than copper pipes can. As a result, plumbing unions supported the restrictive codes in order to increase the demand for their skilled labor.

A similar problem arises because many professions license themselves, under government auspices. Thus, doctors, lawyers, electricians, and others may set their own licensing standards. These groups may define standards that prevent entry of professionals from other states or those who have just finished their education, so as to keep the wages of currently licensed professionals high. Here, licensing is very likely to be socially harmful, because it excludes qualified professionals and raises consumers' costs. Unfortunately for economists, their profession is not licensed, so they cannot act in this anticompetitive manner to limit supply and raise their wages.

Evidence on Lemons Markets

The lemons market theory has been tested with both empirical and experimental evidence. The evidence is used to examine whether a lemons market problem exists and whether various proposed solutions work.

Empirical Evidence. Empirical evidence is used to determine whether the lemons problem occurs in used car markets and whether laws requiring sellers to disclose all known defects to buyers eliminate the lemons problem. Lacko (1986) analyzed Federal Trade Commission telephone survey data on used cars purchased between October 1978 and January 1980 to answer these questions. One test of the lemons problem is to see if quality varies by type of seller. If warranties, reputation, or friendship can prevent the lemons problem, then dealers or friends and relatives should provide better-quality cars than those purchased from a stranger through an ad.

To test this hypothesis, a statistical analysis was used that controlled for the age, mileage, and repair record of the used cars. For used cars 1–7 years old, few differences in quality were found by type of seller (through an ad, friend or relative, new and used car dealer, used car only dealer, or someone of whom the buyer had heard). With older cars (8–15 years old), average quality differed significantly by seller. Cars purchased from friends and those purchased from a new and used car dealer were rated higher. Cars purchased from friends or relatives were statistically significantly less likely to need a repair than those purchased through an ad. Finally, compared to cars purchased through an ad, repair expenditures were \$418 lower for cars purchased from a friend or relative, \$533 lower if purchased from a new and used car dealer, and \$449 lower if purchased from someone the buyer had heard of from others.

The survey data were used to test the effectiveness of a Wisconsin law requiring the disclosure of defects in used cars sold by car dealers. The Wisconsin defect–disclosure law did not have a statistically significant effect on quality (compared to cars sold in other states). One possible reason is that it applied only to car dealers, for whom the lemons problem was not severe.

Thus, there is little evidence of a lemons market problem for used cars less than 8 years old, but there is evidence of the problem for cars 8 to 15 years old. Apparently, reputation or loyalty helps prevent the lemons problem. You can buy higher-quality cars from friends, relatives, or people you know slightly than you can through ads. New and used car dealers also provide higher-quality cars, presumably to maintain their reputations.

All 50 states and Washington, D.C., have lemon laws (**autopedia.com/html/Hotlines_lemon2.html**). However, consumers do not always take advantage of them. For example, in the first 13 months Connecticut's lemon law was in effect, only 40 autos were returned out of 113,000 registered cars (Smithson and Thomas 1988). See Example 13.4.

Experimental Evidence. The Federal Trade Commission sponsored an experimental study of markets where buyers have less information than sellers (Lynch et al.

EXAMPLE 13.4

Certifying Thoroughbreds

Unlike buyers, horse breeders know a thoroughbred's full medical history, temperament, and physical attributes as well as other valuable information. Such information is valuable because the difference between low-quality and high-quality horses is substantial. Less than 1 percent of thoroughbreds win the top-stakes races, and many earn nothing from racing.

An owner of a thoroughbred has three choices: keep the horse and race it or sell at either a certified or noncertified public auction. A breeder "nominates" a horse for a certified auction by paying a nonrefundable fee to the auction house and providing information such as the horse's pedigree. The auction house physically inspects the horse and permits only the high-quality horses to be auctioned. In contrast, at a noncertified sale, auction houses sell all nominated horses. About one in five horses sold at auction is certified.

Typically, buyers are allowed to inspect horses before all sales and may perform minimally intrusive tests such as x-rays and sonograms. By eliminating low-quality horses, certified auctions allow buyers to save resources by inspecting only relatively high-quality horses.

Certification, by providing a minimum quality standard, may reduce but not eliminate adverse selection. Wimmer and Chezum (2003) conducted several tests of whether certification, by providing consumers with more information, reduces the lemons problem.

For example, they find that noncertified horses' post-sale racetrack earnings per race is less than the earnings of certified or retained thoroughbreds, controlling for other observable characteristics. Similarly, they estimate the effect of adverse selection on prices in noncertified sales and find that the expected price on the basis of observable characteristics is $88,259 at certified sales, whereas the expected price is only $9,253 at noncertified sales. Controlling for observable characteristics, they estimate that 87 percent of the difference in the price of a randomly selected horse at a certified sale to one at a noncertified sale is attributable to the seller's selection process. Thus, they conclude that certification reduces the lemons problem by providing buyers with information.

1986). College students played the roles of buyers and sellers, and two types of quality were offered: low-quality items (lemons) and high-quality items. In some experiments, sellers were not identified; that is, they did not have a brand name. In other experiments, the sellers were identified by number or brand names. Sellers were allowed to advertise in some experiments by making a claim about the quality of the item offered. In some cases sellers were allowed to make false claims, whereas in other experiments, only true claims were allowed. The key results were

- Without brand names or advertising, virtually only lemons were sold. This result confirms Akerlof's prediction.
- Where only truthful claims were permitted, the market behaved almost perfectly efficiently. High-quality products were supplied whether or not brand names were allowed.
- Reputations alone were not enough to overcome the lemons problem. That is, when sellers had brand names but were not restricted to truthful claims, virtually only lemons were sold.

This last result is surprising because one would expect that reputation alone could solve the lemons problem. Perhaps the value of brand names in this experiment was not sufficient to establish a reputation for truthfulness because the long-term gain from a favorable reputation was not sufficiently high.

Limited Information About Price

The person who succeeds will be the person with the best information.

—Disraeli

Firms can obtain market power from consumers' lack of knowledge about prices and quality. Limited information can lead to a monopolistic price in what would otherwise be a competitive market. See Example 13.5.

For example, suppose that many stores in an area sell the same good. If one store raises its price above the level of others, and all consumers know it—that is, consumers have *full information*—that store loses all its business. As a result, the store faces a demand curve that is horizontal at the going market price, and has no market power. The market price is the full-information competitive price, p^c.

In contrast, suppose that some or all customers do not know that other stores charge lower prices: Consumers have *limited information* about price. Now, a store can raise its price without losing all its sales (Diamond 1971).[8] The store faces a downward-sloping demand curve and has some market power. As shown in the following model, if there is a single price in the market, it is higher than p^c. However, there may be either no market or a multiple-price equilibrium (stores sell at different prices).

[8]Probably the first paper to make this point clearly was Scitovsky (1950). Diamond (1971) was the first to present a formal mathematical analysis. Salop (1976) and Stiglitz (1979) provide excellent, relatively nontechnical surveys of the early literature.

EXAMPLE 13.5 *Price Dispersion and Search Costs in the Talmud*

The Talmud, written by Jewish scholars about 1,500–1,800 years ago, consists of laws together with interpretations and discussions. In one section, the rabbis analyzed the consequence of price dispersion. One group of rabbis proposed that if a buyer paid more than one-sixth above fair market value (a term that is never precisely defined), the buyer could demand a cancellation of the sale and a full refund. A buyer's right to demand the refund is limited to the time it takes the buyer to show the merchandise to another knowledgeable person, such as another seller.

Rabbi Tarfon of Lod disagreed with the proposal and instead suggested that the buyer could demand cancellation of the sale and a full refund only if the buyer paid more than one-third above fair market value. Lod was a center for trade, and initially the merchants of Lod supported Rabbi Tarfon's ruling.

They changed their minds, however, when Rabbi Tarfon announced that a buyer had a full day to exercise his rights. Apparently, the merchants believed that with the great number of merchants in Lod, search costs were so low that, in less than a day, an overcharged buyer easily could find a seller who would agree that the buyer had been overcharged.

Source: The Talmud, Steinsalz Edition, 1990, Random House, Volume III, Part III, Tractate Bava Metzia: 99–100.

The Tourist-Trap Model

A typical tourist, Lisa, arrives in a small town filled with souvenir stands. Each stand sells mugs with the town hall painted on it. Lisa wanders by one of these stands, sees some mugs, and decides to buy one. She has but a short time before her bus leaves, and she does not expect to return to this town again. Thus, she does not have time to check the prices at each souvenir stand, and she cannot use information obtained through even a limited search in the future.

If there are many such tourists, what prices do the stands charge for these mugs? To answer this question, we make four assumptions for specificity:

- All firms (souvenir stands) have the same costs and sell the identical product.
- All consumers have identical demand functions.
- A guidebook provides each consumer with the general distribution of prices (how many stands charge each price), but does not give the particular price each stand charges.
- The tourist's cost of going to a stand to check the price or to buy is c, which reflects the tourist's time and expenses (taxi rides).

Thus, if Lisa goes to two souvenir stands, her search costs are $2c$. If she buys a mug at the second stand at price p, her total cost is $p + 2c$. The least a mug will cost her is $p + c$, because she must visit at least one stand to buy a mug.

Fixed Number of Firms. Initially, assume that there are a fixed number of souvenir stands, n. How much does each one charge for the mug? We start by considering whether each stand charges the full-information, competitive price, p^c, which equals the constant marginal cost.

Breaking the Full-Information, Competitive Equilibrium: To determine whether the full-information, competitive equilibrium (price equals marginal cost) price holds when consumers have limited information, we need to determine if any firm has an incentive to deviate from that price. If firms benefit from deviating from this proposed equilibrium, they **break the equilibrium**; that is, the proposed equilibrium is not an equilibrium.

If all other stands charge the full-information, competitive price p^c, it pays for a deviant firm to set a higher price. The deviant firm can profitably charge $p^* = p^c + \epsilon$, where ϵ is a small, positive number, and not lose its customers.

For example, Lisa walks up to the stand and sees that the mug sells for p^*. Her guidebook tells her that all the other souvenir stands charge p^c. "What amazingly bad luck," she thinks to herself (or something to that effect), "I've hit the only expensive stand in town." She is annoyed and considers going elsewhere because she knows with certainty that any other stand will charge her less. Nonetheless, she does not go to another stand if the price in this stand, p^*, is less than the price at another stand *including* the additional cost of getting to that stand: $p^* < p^c + c$. That is, she does not go to another stand if the cost of search, c, is greater than ϵ, the price markup.

Thus, it pays for the deviant stand to raise its price by an amount just less than the cost of additional search. As a result, the proposed equilibrium where all stands charge the full-information, competitive price p^c can be broken: *The full-information, competitive price equilibrium is not an equilibrium when consumers have limited information about price and positive search costs.*

Is all stands charging p^* an equilibrium? No, that proposed equilibrium can also be broken, as we can show by using the same type of argument. If a deviant stand raises its price to $p^{**} = p^* + \epsilon = p^c + 2\epsilon$, it is not worthwhile for a tourist unlucky enough to enter that stand to search further. Thus, p^* is not the equilibrium price. Along similar lines, all stands charging p^{**} cannot be an equilibrium.

So what is the equilibrium price? We know that the equilibrium price cannot be less than p^c, because firms would lose money selling for less than the full-information, competitive price. Similarly, we have shown that it cannot be p^c or a price slightly above p^c because firms have an incentive to raise prices.

There is a remaining possibility that we have not rejected. If all stands charge the monopolistic price p^m, no stand would want to charge a higher price. *If there is a single price equilibrium, it can only be at p^m.* At prices below p^m, firms have an incentive to raise prices.

When Lisa learns the price at the souvenir stand, she decides whether to buy. If the price is set too high, the stand loses sales and hence profits (marginal revenues exceed marginal costs). Only when the price is set so that the stand's marginal revenue equals its marginal cost, the monopolistic price, is its profit maximized. Even if the stand could charge a higher price without losing all its sales, it has no incentive to do so.

The only remaining question is whether a stand would like to charge a lower price than p^{m} if all other stands are charging p^{m}. If not, then p^{m} is the single-price equilibrium. If it does want to charge a lower price, there is no single-price equilibrium.

It can pay a deviant stand to lower its price only if the decrease is substantial enough to induce consumers to search for this low-price stand.[9] If search costs are c, and if the stand lowers its price by less than c, then consumers have no incentive to search for this low-price stand. Thus, the stand makes less on each sale, and its profits must fall. It may pay, however, for a stand to deviate by dropping its price by more than c. If there are few stands, consumers may search for this low-price stand. Although the stand makes less per sale than the high-price stands, its profits may be higher due to greater volume. Here, there is no single-price equilibrium.

If there are many stands, consumers do not search for the low-price stand because their chances of finding it are slight. As a result, when a large number of stands makes searching for a low-price stand impractical, the proposed single-price equilibrium at p^{m} is an equilibrium.[10]

Reducing Search Costs: Can reducing search costs lower the equilibrium price? Strangely, the equilibrium price does not change as long as search costs are positive and there is a single-price equilibrium.

Suppose that the government or a private firm sells firm-specific price information. As a result, the cost of search (learning the price at a single store) falls from c to $c/2$. We can repeat the previous analysis because nothing depends on the size of c, as long as c is positive. A deviant firm can still raise its price by $\epsilon < c/2$ and break any proposed single-price equilibrium at a price less than p^{m}.

Thus, *lowering search costs has no effect on the single-price equilibrium until search costs fall to zero.*[11] If search costs fall to zero, consumers have full information, so the only possible equilibrium is at p^{c}, which equals marginal cost.

Nonexistence of the Single-Price Equilibrium: Where search costs are positive, can the proposed single-price equilibrium where all firms charge the monopolistic price p^{m} be broken? The answer depends on the shape of consumer demand curves, the number of firms in the industry, and the search costs.

As already noted, if the number of firms is small, the single-price equilibrium at p^{m} may be broken by firms cutting price. An even more striking result is that, for demand curves of certain shapes, consumers visit no stores and buy nothing if firms charge p^{m}. The market does not exist (Stiglitz 1979, 340). Suppose that each tourist wants at most one mug and will buy the mug only if the price is no more than p^{u}. That is, a

[9]We continue to use the assumption of the model that consumers know the distribution of prices but not which particular stand has the lowest price. This latter assumption is, of course, unrealistic if there are only a few stands.

[10]It may be possible for firms to advertise that they have low prices and thereby overcome the high search-cost problem, as discussed in the next chapter.

[11]See, however, Stahl (1989), who presents a model in which oligopolistic pricing varies smoothly between marginal cost pricing and monopoly pricing as the search cost changes.

tourist's demand curve is a vertical line at a quantity of 1 up to a price p^u. Given this demand curve, $p^m = p^u$.

To go to even one stand, a consumer must incur a search cost, c. As a result, the full cost of a mug, the price plus the search cost, is $p^m + c$. Thus, the full cost of shopping for the mug, $p^m + c = p^u + c$, exceeds the maximum value the consumer places on the mug, p^u, so the consumer does not shop at all!

In attempting to take advantage of the tourists, the souvenir stands set their prices so high that consumers do not find it worthwhile to shop. Thus, if consumers have this type of demand curve, p^m is not an equilibrium, and there is no single-price equilibrium.

If no single-price equilibrium exists, the only possible equilibrium is for firms to charge different prices. In this simple tourist-trap model, however, the lowest-price firm has an incentive to raise its price by the reasoning above. Thus, there is no possible multiple-price equilibrium; there may be no equilibrium. We discuss multiple-price equilibria in a more complicated model after the following examination of the effects of entry.

Free Entry. With a small number of stands, each of which charges the monopoly price, each one may earn large profits. If there are no barriers to entry, these profits attract new stands. As new stands enter the industry, the number of tourists going to any one souvenir stand falls, and profits fall. Entry continues until profits are driven to zero. A *monopolistically competitive* equilibrium results: Price is above marginal cost, but each firm's profits are zero.[12]

In contrast to a market where consumers have full information, the additional entry does not necessarily lower price if consumers have limited information. Additional entrants must sink some costs (buy a souvenir stand), so society can be worse off with free entry: Consumers do not gain from entry, all monopoly profits are dissipated in excess entry (firms earn zero profits), and social expenditures on sunk costs rise.

Indeed, under certain circumstances, reducing the number of firms may increase *effective* competition. For example, if there is a large number of firms, it does not pay for any one firm to cut its price from p^m. If several stands merge to form a chain of souvenir stands and collectively lower prices, however, they may be able to induce individuals to search for one of the stands in this low-price chain (Stiglitz 1979, 340). Thus, by reducing the number of independent stands (though not necessarily the number of souvenir stands), effective competition may be increased and price lowered.

This reasoning suggests a result that is the exact opposite of that for a market where consumers have full information. *With imperfect consumer information,* competition may be socially wasteful because of entry costs, so that *welfare may rise as the number of firms falls.*[13]

[12]If consumers' demand curves are downward sloping, the equilibrium resembles that of the standard monopolistically competitive industry. Price is above marginal cost (at the quantity where marginal revenue equals marginal cost), and the demand curve is tangent to the average cost curve (so that profits are zero).

[13]Some of the surprising results of the tourist-trap model change when there are repeated transactions. We discuss the roles of repeated transactions and reputations in more detail in the next chapter.

★The Tourists-and-Natives Model

If it's tourist season, why can't we shoot them? —*Steven Wright*

Our analysis of the tourist-trap model raises two questions about markets in which consumers have limited information about price. First, is there a model in which a multiple-price equilibrium is possible? That is, is there an equilibrium where stores charge different prices for the identical good so that there is a **price dispersion**? Second, if some consumers are fully informed, even though others have limited information, can there be a full-information equilibrium where price equals marginal cost?

Both questions can be examined by modifying the tourist-trap model so that there are two types of consumers. A persistent price dispersion requires that at least some consumers be unable or unwilling to learn which stands charge the low price.[14] The discussion below shows that where some consumers are fully informed and others have limited information, there is either a multiple-price equilibrium (Example 13.6) or a single-price equilibrium at marginal cost.

Consider a market in which all firms have identical costs, but there are two types of consumers with different search costs. Natives are *informed* consumers and have zero search costs. They know the entire distribution of prices in the market. Tourists are *uninformed* consumers who have search costs of c. For example, natives in a town might know the prices charged by each restaurant, but a tourist has to spend time (search costs) to learn the price at any given restaurant.

Natives buy only at low-price stores. Thus, even if tourists do not know the distribution of prices charged by different stores, the shopping behavior of the natives may drive the market price to the full-information, competitive price p^c. For price to be driven to marginal cost, there must be a substantial number of knowledgeable consumers.

In a rigorous version of this model, Salop and Stiglitz (1977) show that with many informed and many uninformed consumers, a single, competitive-price equilibrium may exist, but it is also possible that there is a single-price equilibrium at a higher price, or a multiple-price equilibrium. To illustrate their result, we add the following assumptions:

- Of the L consumers in this market, the natives, αL, are informed and the tourists, $(1 - \alpha)L$, are uninformed.
- Each consumer buys 1 unit of the good as long as the price is no higher than p^u.
- There are n firms.

[14]Stigler (1961) shows that if there is a price dispersion, consumers search for low prices, and that if the search is costly, they do not conduct sufficient searches to learn the entire price distribution. A number of papers present models where firms have different costs, and random changes affect the market so that the store with the lowest price keeps changing, and hence consumers cannot easily learn the identity of the low-cost store in a given period. The explanation that follows assumes that the firms have identical cost functions and there are no random changes. See Reinganum (1979) for an analysis where firms' costs differ.

EXAMPLE 13.6

Price Dispersion

Prices for many goods vary substantially across stores. Some of the variation reflects differences in the stores' characteristics, such as location. The rest of the price dispersion reflects an individual store's pricing strategies (including temporary sales).

Price variations vary by goods and across cities. We calculated the ratio of the highest to the lowest observed price during 1999 for a large (67.6 oz.) bottle of Coca-Cola and for a large (64 oz.) container of Tropicana Pure Premium orange juice. The table shows how this ratio varies across grocery stores and the number of stores for which we have data by city.

	Coke		Tropicana Orange Juice	
City	Ratio	Stores	Ratio	Stores
Atlanta	1.6	6	1.3	6
Boston	1.6	3	1.3	3
Cedar Rapids, IA	1.6	12	1.4	12
Chicago	1.9	8	2.0	8
Detroit	1.1	3	1.0	3
Denver	1.8	4	1.4	4
Eau Claire, WI	6.4	11	1.9	8
Grand Junction, CO	1.5	10	1.5	10
Houston	2.0	7	1.3	3
Kansas City	1.5	6	1.4	6
Los Angeles	1.6	8	1.6	8
Memphis	1.3	5	1.4	5
Midland, TX	2.9	9	1.4	7
Minneapolis/St. Paul	1.6	3	1.7	3
New York	2.2	8	1.5	8
Philadelphia	1.8	3	1.4	3
Pittsburgh	1.9	3	1.8	5
Pittsfield, MA	1.6	12	1.6	7
Rome, GA	1.4	3	1.2	3
St. Louis	1.3	7	1.7	7
San Francisco/Oakland	2.2	4	1.7	4
Seattle/Tacoma	2.8	5	1.6	3
Tampa/St. Petersburg	1.6	3	1.4	3
Visalia, CA	2.5	16	1.6	10

Maynes and Assum (1982) found that consumers' perception of the degree of price dispersion was most accurate for items with relatively small actual price dispersion, such as many food items and heating oil. Consumers tended to underestimate the spread of prices for high-dispersion items such as consumer durables.

Sources: Maynes and Assum (1982) and authors' calculations.

This model has several possible equilibria, such as the full-information, competitive price equilibrium and a two-price equilibrium. Under what circumstances can the full-information, competitive price equilibrium be broken? In this proposed equilibrium, all firms set the same price p^c, and each is assumed to obtain an equal share of the consumers, so it sells $q^c = L/n$ units of output. Suppose that a deviant firm raises its price to $p^* = p^c + \epsilon$. By the same reasoning as in the tourist-trap model, this firm obtains no informed customers but still gets its share of uninformed customers, as long as $\epsilon < c$. Thus, the firm's sales fall to $(1 - \alpha)q^c$.

Many Informed Consumers. If there are many informed consumers, it does not pay for a firm to deviate by raising its price above p^c. As shown in Figure 13.1, the demand curve facing the deviant firm consists of four parts. If the firm's price is above p^u, its sales are zero.[15] If its price is between p^u and p^c, it sells $q^u = (1 - \alpha)q^c$ units, because it loses all its informed customers. If its price equals p^c, its sales are q^c. If its price is slightly below p^c, all the informed consumers shop there as well as its share of the uninformed consumers, so its sales are $\alpha L + (1 - \alpha)q^c$. The deviant is uninterested in charging less than p^c, because that price is below its average cost, so that it makes negative profits.

With the demand curve as shown in Figure 13.1, it does not pay for the deviant to raise its price, because it loses money. Although it receives more per sale ($p^u > p^c$), it makes so few sales that its costs exceed its revenues: At q^u, its average cost is above p^u.

The proposed equilibrium at p^c cannot be broken. There are so many informed consumers that a store charging more than p^c loses so much business that it loses money. Thus, *if there are enough informed consumers, all consumers are charged the full-information, competitive equilibrium price.*

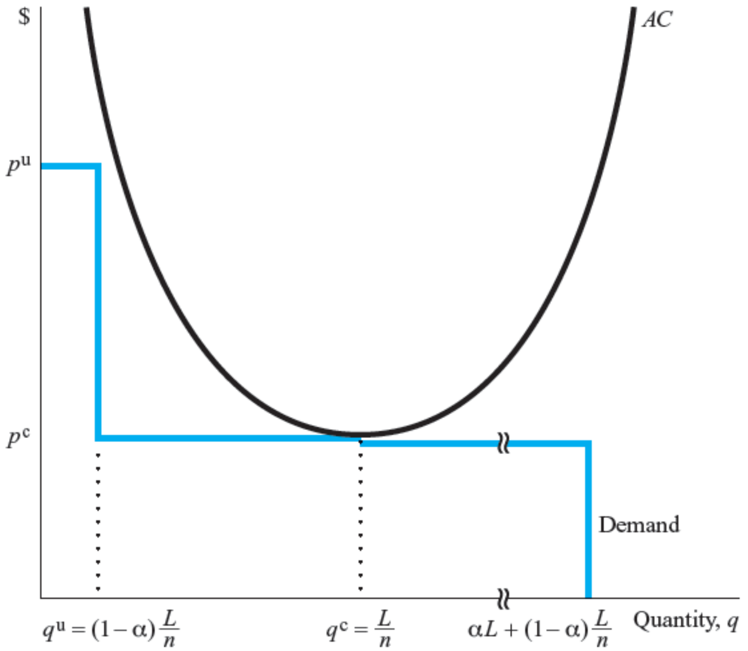
Few Informed Consumers. In contrast, if there are relatively few informed consumers, a deviant firm can raise its price without losing many customers. Let q^a be the quantity such that the average cost equals p^u, $AC(q^a) = p^u$, as Figure 13.2 shows. It pays for a firm to deviate if $q^u = (1 - \alpha)L/n = (1 - \alpha)q^c > q^a$ or

$$\alpha < 1 - \frac{q^a}{q^c}. \tag{13.1}$$

In Figure 13.2, at q^u the deviant firm's average cost is less than p^u, so it makes a profit if it charges p^u. Because the firm would earn zero profit at p^c, it has an incentive to raise its price. Thus, *if there are relatively few informed consumers* (α is relatively small),

[15] It is implicitly assumed in Figure 13.1 that the deviant raises its price to p^u. As explained in the discussion of the tourist-trap model, the deviant charges ϵ more than the price other firms are charging, or p^u (the maximum price a consumer is willing to pay), whichever is less. For it to be profitable for the deviant firm to charge p^u, search costs, c, must be large enough that $p^c + c \geq p^u$.

FIGURE 13.1 Single-Price Market



it pays to deviate, and *the proposed full-information, competitive price equilibrium is broken*. Equation 13.1 shows that the number of informed consumers needed to produce a single-price equilibrium depends on the shape of the average cost curve and the maximum price consumers are willing to pay, p^u.

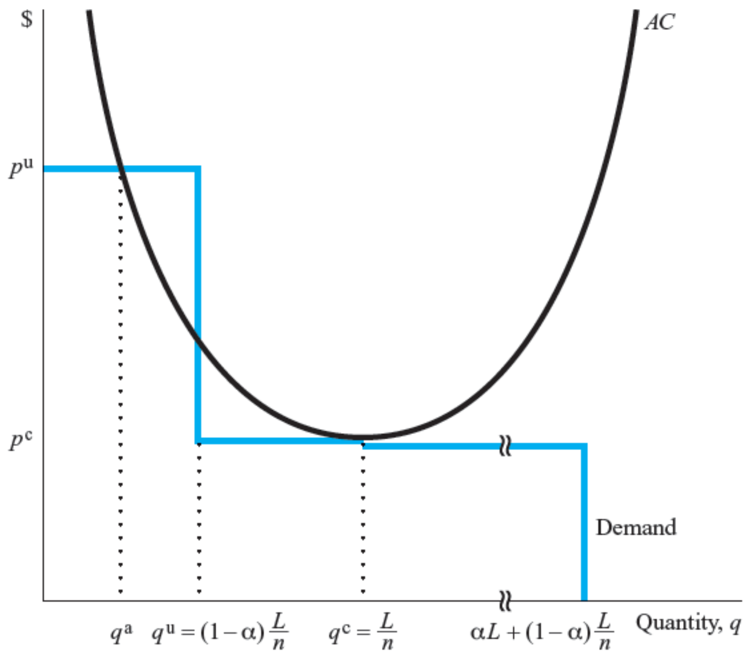
There cannot be an equilibrium where all firms charge p^u. A firm can lower its price to any amount less than p^u and obtain all the informed consumers. It profits because it has more sales at a price that is almost as high as p^u.

Can there be a multiple-price equilibrium? Given our assumptions, a *two-price equilibrium is possible, but there cannot be an equilibrium with more than two prices.*

Suppose that there is a three-price equilibrium with some stores charging $p^1 = p^u$; others charging p^2, $p^u > p^2 > p^c$; and the rest charging $p^3 = p^c$. The stores charging p^2 make no sales to informed customers. They have, on average, the same number of uninformed customers as stores charging p^u, but they make less money than those stores. As a result, if a store charging p^2 raises its price, it loses no customers and earns higher profits, so that this proposed three-price equilibrium can be broken.[16] Thus, it does not make sense for a store to charge less than p^u and more than p^c.

[16]This reasoning holds even if $p^1 < p^u$ and $p^3 > p^c$.

FIGURE 13.2 Breaking the Single-Price Equilibrium



By similar reasoning, we also can reject equilibria with even more prices. Thus, the only possible multiprice equilibrium is a two-price equilibrium.[17]

If there is a two-price equilibrium, the low-price firms charge p^c and the high-price firms charge p^u. All the informed customers shop at the low-price stores, and the uninformed consumers shop randomly. Thus, the low-price stores' share of the market is greater than the proportion of informed consumers.[18] Appendix 13A calculates the number of firms in the equilibrium and the fraction of each type of firm.

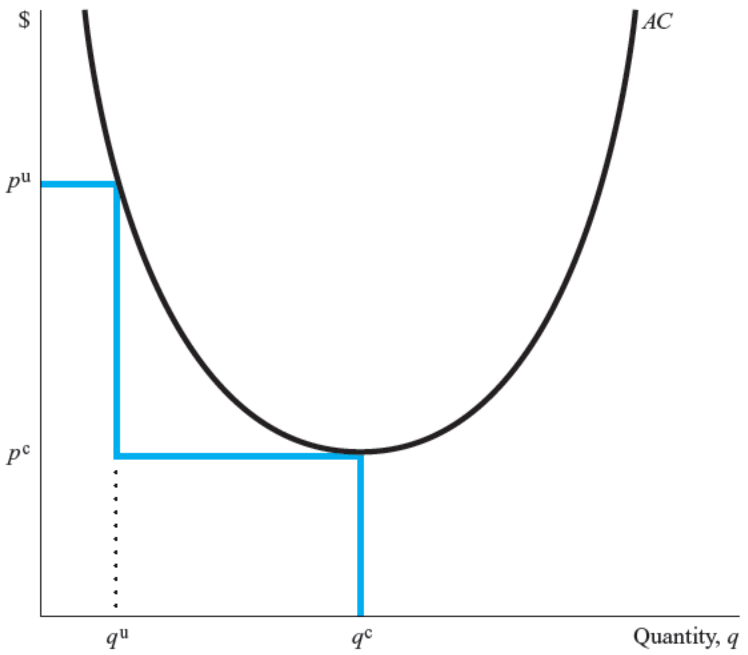
[17]With other, less restrictive assumptions, there may be many different prices in a market. For example, if consumers know about some but not all firms, firms may charge a full range of prices (Butters 1977). Rothschild (1974) provides a good survey of search theories, which explain price distributions. Where there are many prices charged, as the number of firms increases, the cost of obtaining information may rise. As a result, some firms may charge higher prices as new firms enter. A study of the prices of primary-care physicians' services in 92 metropolitan areas concludes that factors that increase search costs, such as the number of providers, increase average prices (Pauly and Satterthwaite 1981).

[18]Thus, consumers who go to large stores and buy brands with large shares of the market may be acting rationally (Smallwood and Conlisk 1979). If uninformed consumers observe market shares, they become informed. It is possible, however, that if consumers use share as a signal, then the first entrant in a market may maintain its high share solely as a result of its historical monopoly rather than its superior product.

All firms must make the same profits, or a firm has an incentive to change its pricing policy. The low-price stores make zero profits because $p^c = AC(q^c)$, as Figure 13.3 shows. Thus, in equilibrium, the high-price stores must also make zero profits. Suppose instead that they make positive profits (as Figure 13.2 shows). Then, either new firms enter the market as high-price stores, or low-price stores start charging high prices. As the number of high-price stores increases, each one sells less (as the uninformed consumers are spread over more stores). The number of high-price stores increases until profits are driven to zero when each firm is charging its profit-maximizing price, as Figure 13.3 shows.

To summarize, where only a relatively small number of customers are informed, there may be a two-price, monopolistically competitive equilibrium.[19] The low-price stores charge a price equal to marginal cost (the full-information, competitive price),

FIGURE 13.3 Two-Price Equilibrium



[19]Albrecht, Lang, and Vroman (2002) extend this result to examine the price and quality effects of increasing the fraction of fully informed consumers. In equilibrium there may be three firm types: high-price/high-quality, low-price/low-quality, and high-price/low-quality. The last of these takes advantage of the uninformed by mimicking the high-quality firm's price, but provides low quality. Increasing the share of informed customers harms the uninformed by altering the mix of firms.

and the high-price stores charge their profit-maximizing price. See Example 13.7. Both types of stores make zero profits in equilibrium because of entry. All the informed consumers and some of the uninformed consumers shop at the low-price stores, so these stores have a disproportionately large share of the market. In **www.aw-bc.com/carlton_perloff** "Monopoly Price Dispersion," we show that a monopoly may create *noise* in a market—charging different prices for nearly identical products or for the same product at different stores—as a means of sorting consumers so as to price discriminate.

Providing Consumer Information Lowers Price

> *It is a great nuisance that knowledge can only be acquired by hard work. It would be fine if we could swallow the powder of profitable information made palatable by the jam of fiction.* —*W. Somerset Maugham*

It seems intuitively obvious that providing consumers with comparative price information should lower the average price observed in the market. Yet, as the tourist-trap model shows, lowering the cost of search has no effect as long as the cost is positive. That result may not be as perplexing as it first appears because merely decreasing the cost of search does not provide consumers with extra information. Indeed, in the tourist-trap equilibrium, no further searches occur when the costs of search are lowered, so consumer information does not increase.

An information program that actually provides consumers with comparative price information may, then, have an effect where merely lowering the cost of search does not. The following discussion first summarizes theoretical arguments that supplying more consumer information results in a lowered equilibrium price and then presents some empirical evidence that supports this conclusion.

How Information Lowers Prices

At least two types of models show that improving information can lower prices. First, as the tourists-and-natives model with many firms shows, as more consumers become informed, the market share of low-price firms increases. Indeed, as most consumers become informed, all stores charge the low, competitive price. A second model described at **www.aw-bc.com/carlton_perloff** "Information and Price Dispersion" shows that, where information is provided that allows consumers to better estimate true prices, the average price may fall. This latter model explains the existence of a single-price equilibrium, where the price lies between the monopolistic and the full-information, competitive price (marginal cost).

In the second model, consumers, who want to shop at the lowest-price store but do not know which store has the lowest prices, gather information. They collect information by visiting various stores, reading advertisements, watching commercials, and asking friends (see Example 13.7). Consumers form estimates based on available information

EXAMPLE 13.7

Tourist Cameras

Many economists predicted that the Internet, by providing consumers with low-cost searches through the use of shop-bots (Web sites that compare prices across firms), would lead to competitive pricing for many manufactured goods. Unfortunately, this prediction has not panned out so far.

If electronic markets were highly competitive, we would expect either one price or perhaps a trade-off between price and services or fees. We would anticipate that firms that provide extra service, offer guarantees, or charge low shipping rates and other fees would set higher prices to cover their extra costs. But neither hypothesis is true for a popular Olympus digital camera or a Hewlett-Packard flatbed scanner (Baylis and Perloff 2002).

Indeed, it appears that there are "good" firms and "bad" firms out there in the ether. Good firms offer both low prices and superior services, while bad firms charge higher prices and provide fewer services and guarantees.

For example, for the Olympus digital camera, sites that provide a return guarantee—an unconditional offer to return the good for a refund—charged about $42 less than firms that did not. Moreover, many of the high-price sites charged lump-sum handling fees and membership fees—an average of $11.66 for the camera—that were not charged by the low-price firms.

This outcome is consistent with the Salop-Stiglitz (1977) model showing that firms may charge informed and uninformed consumers different prices. Some uninformed customers (tourists) in the 2002 study have a positive cost of searching for the lowest-price firm in that they do not know how to use shop-bots, while informed customers (natives) face virtually no cost to search. If there are enough uninformed customers, some firms will charge high prices and make relatively few sales to uninformed customers, while other firms will charge low prices and sell to informed customers and lucky uninformed customers.

Indeed, some Web sites appear to be designed to make searching costly. On one Web page, the potential customer chooses "cameras," on another page the brand, and on yet another page a specific model. Some sites require going through as many as nine pages to reach a particular camera. One possible explanation is unintentional bad design. An alternative explanation is that the site was purposely designed to select for those customers with low search costs or low time preference. Such a practice makes sense if the firm charges those customers a low price and charges a higher price at another site that is easier to search. Indeed, many firms have multiple sites under differing firm names. On sites where it takes more than three pages to get to the desired product from the home page, firms charged $48.25 less for the Olympus camera.

of the prices at each store and then choose the store they estimate has the lowest price (Perloff and Salop 1986).

Because consumers do not know the prices exactly, however, a store may raise its price without losing all its customers. That is, the demand curve facing each store changes from being perfectly elastic under full information to being less elastic under limited consumer information. As consumers become more knowledgeable, the demand curve facing a firm becomes more elastic. Thus, if consumers gain more information, prices may fall.

An Example: Grocery Store Information Programs

Does providing consumers with information increase the market shares of relatively low-price stores, lower the average market price, and reduce the variance in prices across stores? A 1974 experiment by the Food Price Review Board of Canada was designed to answer these questions for grocery stores.[20]

There were three phases in the experiment. During Phase 1 (a 17-week period), supermarket price information was collected in both the control city, Winnipeg, and the experimental city, Ottawa-Hull. Only during Phase 2 (a 5-week period) was the information on grocery store prices in Ottawa-Hull published in newspapers and mailed to some consumers, whose behavior was then monitored in detail. At no time was price information disseminated in the control city, Winnipeg. In the final phase (6 weeks), price information was again collected in both cities but not disseminated.

Average food prices declined in Ottawa-Hull by 1.5% during the first week of Phase 2, by 3.0% the following week, and then remained steady for the next three weeks. During the first week following the end of Phase 2, prices dropped an additional 2.5%. Thus, the total decline over this 6-week period was 7.1%. Prices in the control market declined by 0.6% during Phase 2. Thus, prices in the experimental city fell relative to prices in the control city by 6.5% during the 6-week period that included the first week of Phase 3 (see Figure 13.4).

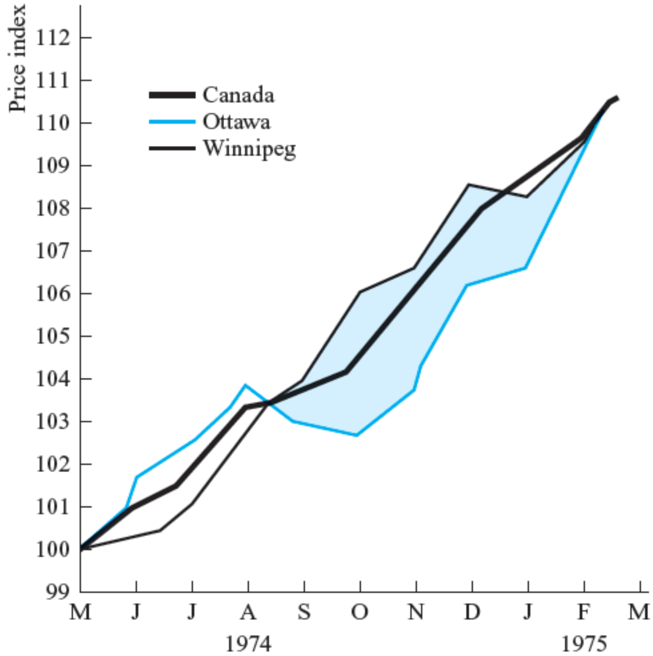
During the experimental period, prices at the higher-price stores (and chains) fell more than those at initially low-price stores. The difference in price index levels between high- and low-price stores dropped from a maximum of 15% during the preinformation period to a low of 5.4% at one point in Phase 2. The difference for chains fell from a maximum of 7.3% to a low of 3.1%. The average range of prices during the 12-week period prior to the information program was 9.71% compared to 7.83% during Phase 2.

A consumer survey found that 43% of the consumers in the test market indicated that they had changed stores as a direct result of the comparative price program. As a result of this shift, the top four corporate chains increased their share of the market from 74% to 81%. Lower-priced chains increased their share relative to others.

Average retail food prices in the test market began to rise within two weeks after the termination of the information program and increased 8.8% by the end of the research period. One interpretation of these results is that during the information period, a once-and-for-all drop in average prices occurred. With the end of the information program, prices increased to their preinformation levels. It appears that stores realized that the experiment would be short-lived and were particularly aggressive in trying to

[20]Devine and Marion (1979) and Devine (1978). Lesser and Bryant (1980) critique Devine and Marion (1979), who respond in Devine and Marion (1980).

FIGURE 13.4 Consumer Price Index for Food Consumed at Home, May 1974–March 1975 (May 1974 = 100)



Note: Observations are made once a month during the first two weeks of each month.

Source: Devine and Marion (1979) from Statistics Canada.

convince consumers that they had relatively low prices while the program was in effect. Apparently, to maintain low prices, information must be continuously supplied.

A back-of-the-envelope calculation of the welfare gain (the change in the sum of consumer surplus plus profits) indicates that it could significantly exceed the costs of collecting the information. The basic results of this experiment were largely duplicated in another experiment conducted in the province of Saskatchewan in October 1975 to determine the long-run effects of an information program (Devine 1978).

A similar experiment was conducted in the United States by Purdue University and the U.S. Department of Agriculture in four pairs of U.S. cities (Boynton et al. 1981, McCracken, Boynton, and Blake 1982). Relative prices declined by 0.2 to 3.7 percent in the experimental compared to the control markets. In three of the four experimental cities, a statistically significant decline in the prices of the 26 items, which were individually reported, was found. In all four experimental cities, a statistically significant decline in the total (100-item) index was found.[21]

Thus, a number of studies have shown that providing consumers with information can lower average price. When the information programs are ended, however, the average price tends to rise to its original level. Providing information to consumers may increase welfare (see **www.aw-bc.com/carlton-perloff,** “Warnings that Affect Markets” and “Cost-Benefit Analysis of Providing More Accurate Information”).

SUMMARY

There are five major results from models in which consumers have limited information about quality or prices. First, if consumers have limited information about the quality of a product, either there is no market or, where the market exists, quality levels are usually lower than the levels produced if consumers have full information. Expert information, reputation, standards, and certification may provide consumers with information about quality and hence rectify these problems; however, standard setters can behave anticompetitively.

Second, where consumers have limited information about prices, no equilibrium may exist or, if it exists, even small firms may set prices above marginal costs. In this sense, the law of supply and demand does not hold. Indeed, with this type of limited information, it is possible for welfare to be higher with fewer firms than with many.

Third, when some consumers know the prices at all stores and others must incur search costs to determine the price at any given store, two types of equilibria are possible. If there are enough informed consumers, the equilibrium price equals marginal cost. If there are relatively few informed consumers, a two-price equilibrium is likely, where some stores charge a high price and others charge marginal cost, even though the good is homogeneous. The law of a single price does not hold.

Fourth, with differently informed consumers, price discrimination is possible. A monopoly may charge different prices at its different stores in order to price discriminate between informed and uninformed consumers.

Fifth, lowering the cost of gathering information may not lower average prices. For example, in a single-price equilibrium, reducing search costs for all consumers may have no effect. In contrast, providing consumers with the location of the lowest-price store is likely to lower average price.

Thus, markets with limited information differ from those with perfect information. Providing information or lowering the cost of obtaining information may not always increase welfare when the costs of providing the information or lowering the search

[21]Perhaps the strongest evidence that this information program had an effect is that a number of stores covered in this study banned the price reporters (Don Yaeger, “U.S. Price Study Goes on Despite Two-City ‘Lockout,’ ” *Supermarket News*, February 11, 1980:1). In some cities, the indexes were challenged by the stores (Don Yaeger, “Purdue Price Study to Be Ended Early,” *Supermarket News*, February 25, 1980:1, 34).

costs are taken into account. The next chapter examines the incentives of individual firms to inform or misinform consumers by using advertising and the effects of such advertising.

PROBLEMS

1. Many online retail stores provide information on product pricing to consumers who visit their website. However, some provide shipping information only after a customer enters his order. The customer can choose to void the order if he thinks the shipping charges are excessive. Explain how this way of providing shipping information is likely to impact consumers.
2. Some cities grade restaurants on cleanliness, giving them a grade of A, B, or C. The grades are posted in the front window of the restaurant. How do you think this system would compare to a numerical grading system where the grades are on a scale of 1 to 100?
3. Suppose that two economists write a textbook. Their publisher offers them royalties on sales of the book equal to α percent of the sales revenue. The economists are concerned. They believe that such a royalty system causes the publisher to sell less than the joint profit-maximizing number of copies of the book. Demonstrate this reasoning. They believe that a royalty in the form of a lump-sum payment, L, or δ percent of profits does not cause the publisher to publish too few books. Why do they agree to the α percent royalty? *Hint:* One explanation concerns asymmetric information on the part of the publisher concerning costs of publication.
4. Determine the equilibrium prices, quantities, and number of high- and low-price stores in the tourists-and-natives model if consumers have downward-sloping, linear demand curves: $q = a - bp$, where a and b are positive constants.
5. A firm spends a large amount on advertising that informs consumers of the brand name of its bananas. Should consumers conclude that its bananas are likely to be of higher quality than unbranded bananas? Why or why not?

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

Two nontechnical papers that give a good overview of many of the issues covered in this chapter are Salop (1978) and Beales, Craswell, and Salop (1981). More technical articles on uncertainty, information, and welfare are Colantoni, Davis, and Swaminuthan (1965), Allen (1981), and Kahnemann, Slovic, and Tversky (1982). Important work on the value of information includes Lave (1963), Gould (1974), and Antonovitz and Roe (1986). Work on search and strategic behavior by firms includes Wilde and Schwartz (1979) and Varian (1980). The role of information in oligopolistic or monopolistic competition is discussed in Shapiro (1982), Wolinsky (1986), and Ross (1988). Stiglitz (1989) provides an excellent survey of the pre-1990 literature.

APPENDIX 13A

Market Shares in the Tourists-and-Natives Model

In the two-price equilibrium in the tourists-and-natives model, the low-price stores, β fraction of the n stores, charge p^c and sell q^c, whereas the high-price stores, $1-\beta$ fraction, charge p^u and sell q^u. The high-price stores only sell to their share of the $(1-\alpha)L$ uninformed consumers, $(1-\alpha)L(1-\beta)$, so each high-price firm sells

$$q^u = \frac{(1-\alpha)L(1-\beta)}{n(1-\beta)} = \frac{(1-\alpha)L}{n}. \tag{13A.1}$$

The share of total sales of a high-price store is

$$1-\beta = \frac{q^u}{L} = \frac{1-\alpha}{n}. \tag{13A.2}$$

Each low-price store sells to its share of the αL informed consumers and to its share of the $(1-\alpha)L\beta$ uninformed consumers who are lucky enough to find a low-price store:

$$q^c = \frac{\alpha L + (1-\alpha)L\beta}{n\beta}. \tag{13A.3}$$

The share of total sales of a low-price store is

$$\beta = \frac{q^c}{L} = \frac{\alpha + (1-\alpha)\beta}{n\beta}. \tag{13A.4}$$

In equilibrium, the low-price stores get all the informed consumers and some of the uninformed consumers (the lucky tourists), so their share of the market is greater than the proportion of informed consumers: $\beta > \alpha$.

In equilibrium, the low-price and high-price firms make zero profit due to entry. Let q^a be the quantity at which average cost equals p^u. In equilibrium, $q^a = q^u$, so that

$$q^a = \frac{(1-\alpha)L}{n}. \tag{13A.5}$$

Similarly, q^A is the quantity at which average cost equals p^c, so

$$q^{A} = q^{c} = \frac{\alpha L + (1 - \alpha)L\beta}{n\beta}. \tag{13A.6}$$

Thus, q^{a} and q^{A}, Equations 13A.5 and 13A.6, are two equations in two unknowns, β and n. Solving Equation 13A.5 for n yields

$$n = \frac{(1 - \alpha)L}{q^{a}}. \tag{13A.7}$$

Substituting from Equation 13A.7 into 13A.6 and rearranging terms,

$$\beta = \frac{\alpha q^{a}}{(1 - \alpha)(q^{A} - q^{a})}. \tag{13A.8}$$

The two-price equilibrium is characterized by n and β (Equations 13A.7 and 13A.8). The βn low-price stores sell $q^{A} = q^{c}$ (Equation 13A.6) units at p^{c}, and the $(1 - \beta)n$ high-price stores sell $q^{a} = q^{u}$ (Equation 13A.5) at p^{u}.

CHAPTER 14

Advertising and Disclosure

Advertisements contain the only truth to be relied on in a newspaper.
—Thomas Jefferson

Advertising is a racket . . . its constructive contribution to humanity is exactly minus zero.
—F. Scott Fitzgerald

Advertising has many purposes. An advertisement may inform consumers that a firm has a new product or the lowest price, or it may help to differentiate the firm's product from that of its rivals. A firm uses advertisements to inform consumers of its product's strengths but not its weaknesses. Firms grudgingly disclose some facts to consumers, enthusiastically advertise other claims, and hide yet other product attributes. This chapter examines the motives for advertising and for truthful or untruthful disclosure.

In 2003, Microsoft spent nearly one-fifth of a billion dollars on a single advertising campaign to induce users to upgrade to its latest version of Microsoft Office. As Table 14.1 shows, the firm with the highest advertising budget in the United States, General Motors, spent \$3.65 billion in 2002 to advertise automobiles and trucks. The second-largest advertiser, AOL Time Warner, spent \$2.92 billion to promote its media empire. Number 3, Procter & Gamble, dropped \$2.67 billion trying to induce customers to buy its soaps, cleaners, and other products. The U.S. government spent \$1.08 billion and was the 24th-largest advertiser.

Advertising as a percentage of sales varies widely, as Table 14.1 shows. For example, Verizon, the 14th-largest advertiser, allocated only 2.4 percent of its sales revenues to advertising, whereas L'Oreal, which is the 20th-largest advertiser, spent 26.3 percent.

U.S. advertisers account for more than half of the world's advertising expenditures (53.7 percent). Total expenditures on advertising in the United States are

TABLE 14.1 **Twenty-five Leading National Advertisers**

	Rank	U.S. Advertising in 2002 ($ millions)	Advertising as a Percentage of U.S. Revenue (%)
Automotive			
Daimler Chrysler	6	2,032	2.8
Ford Motor	5	2,252	2.1
General Motors	1	3,652	2.6
Honda	18	1,193	3.1
Toyota	13	1,553	3.0
Electronic and Office Equipment			
Sony	11	1,621	8.2
Entertainment and Media			
AOL Time Warner	2	2,923	9.0
Viacom	16	1,260	6.1
Walt Disney	7	1,803	8.7
Food, Restaurants, Soft Drinks			
Altria	17	1,206	2.7
McDonald's	15	1,336	24.6
Nestle	25	1,073	5.8
PepsiCo	21	1,114	6.7
Government			
U.S. government	24	1,083	n.a.
Personal Care			
L'Oreal	20	1,118	26.3
Procter & Gamble	3	2,673	12.6
Unilever	10	1,640	14.2
Pharmaceutical			
GlaxoSmithKline	12	1,554	9.7
Johnson & Johnson	8	1,799	8.0
Merck	19	1,158	2.4
Pfizer	4	2,566	12.4
Retail			
J. C. Penney	22	1,108	3.4
Sears, Roebuck	9	1,661	4.5
Telephone			
SBC Communications	23	1,092	2.5
Verizon	14	1,528	2.4

Source: Advertising Age Web site http://adage.com/dataplace/archives.

six times higher than in Japan (second place) and ten times more than in Germany (third place).[1]

Advertisers pay for television and radio broadcasts. It is hard to imagine life without Saturday morning cartoons supported by toy and cereal ads. Firms may also influence magazine and newspaper reporting by threatening to remove advertising.[2] Advertising may provide 50 percent of the revenues of magazines and 80 percent of newspapers. United States junk mail constitutes one out of every six pieces of mail worldwide.[3] Advertising on the Internet is increasing exponentially.

Another recent trend is to tie movie advertising campaigns with related products manufactured by other firms. Dr Pepper cans carried ads for the movie *X2: X-Men United*. Another film, *The Matrix Reloaded,* had promotional tie-ins with Coca-Cola (PowerAde), General Motors (Cadillac), Heineken, and Samsung. PowerAde sports drinks were sold in oddball bottles inspired by the movie. Movie makers also sell "product placements" to manufacturers—for a fee, a firm's product will be prominently displayed within the movie. According to Jeff Bell, vice president for the Jeep division, because scenes in the script for *Lara Croft Tomb Raider: The Cradle of Life* "show Lara using Jeeps as a tool for her to achieve her heroic, adventurous endeavors," Jeep signed a cross-marketing agreement with Paramount, the film's studio.[4]

Despite the pervasive role of advertising in our daily lives, standard models of competition ignore promotional efforts. This chapter incorporates those efforts into models of competitive and noncompetitive behavior.

We start our discussion by considering how product types affect the informational content of advertising, contrasting advertisements that inform with those that attempt to persuade without using many facts. Next we examine the profit-maximizing advertising level, and then we consider whether the profit-maximizing level of advertising is socially optimal. The effects of advertising on prices, entry barriers, and consumer welfare are described.

We then consider when firms advertise truthfully and when they lie, and discuss the optimal level of enforcement of truth-in-advertising laws. Finally, we analyze a firm's decision to disclose or hide information. Although a firm may have strong incentives to tell consumers about the high quality or low prices of its products, it may hesitate to disclose facts about weaknesses in those products, such as side effects and bad repair records. Indeed, as Chapter 13 shows, a firm may gain market power by reducing consumers' information. In many cases, however, it is in the firm's best interest to disclose information. Although truth-in-advertising laws encourage truthful disclosures, we show that mandatory disclosure laws may have a perverse effect.

[1]http://adv.asahi.com/english/market/advertising.html.
[2]A health magazine allegedly offered to report favorably on two diet products for $25,000 (Robert J. Samuelson, "The End of Advertising?" *Newsweek,* August 19, 1991:40).
[3]L. M. Boyd, "Grab Bag," *San Francisco Chronicle,* January 23, 1993:C20.
[4]Stuart Elliott, "Summer Movie Tie-Ins Coming Early and Often," *New York Times*, April 30, 2003:C1 and C5.

The four key points made in this chapter are

1. The purpose of promotion is to increase sales by shifting consumers' tastes or informing them of opportunities.
2. Although some types of advertising are harmful, many other types are welfare improving. Even where moderate advertising is helpful, however, there may be excessive advertising.
3. Skepticism by consumers discourages false advertising. Partial enforcement of antifraud laws may increase the amount of both truthful and false advertising.
4. When antifraud laws are fully enforced, firms generally have an incentive to disclose relevant information to consumers. Under some circumstances, however, mandatory disclosure laws reduce the extent of such disclosures.

Information and Advertising

Advertising may convey hard facts, make vague claims, or try to create a favorable impression of a product. Some advertisements list a store's prices. If consumers learn that a firm has the lowest prices in town, the demand for its products increases. In contrast, other advertisements merely show a product being used in a pleasant setting. An attractive person consuming a soft drink near a waterfall may convey to consumers the impression that this product is refreshing. By convincing consumers that its product has certain desirable traits, a firm can differentiate its product from others. As its product becomes differentiated, a firm may face a higher and less elastic demand curve, so that it can charge a higher price and earn greater profits (see Chapter 7). For example, one heavily promoted brand of bleach sells at a much higher price than many other physically identical bleaches.

Promotions

Advertising can be subtle and indirect or it can hit you over the head with its bluntness. Advertising is only one of many ways to promote a product; firms also use price discounts and sales staffs. When it is hard to describe a product, a firm may include a discount coupon in its advertisement to encourage consumers to try the product. In addition to advertising in newspapers, on radio, and on television, firms may advertise indirectly by establishing a brand name or otherwise establishing a positive reputation.

For example, some agricultural firms now sell their fruits and vegetables under brand names (Example 14.1). Unlike sellers of unbranded produce, these farmers are trying to develop a reputation for producing a particular (presumably high) quality of produce. Such branding can help overcome the "lemons" problem discussed in Chapter 13. Although this chapter concentrates on advertising, most of the discussion applies equally well to other types of promotions.

EXAMPLE 14.1 *Branding and Labeling*

Most fruits and vegetables are sold without a brand name. Consumers assume that a tomato is a tomato and that there is little variability in quality across firms. That is, these markets competitively provide perfectly homogeneous products. Recently, however, several firms (Natural Pak Produce Inc., Campbell Soup Co., and Dart & Kraft Inc.) have started selling branded tomatoes.

Consumers are willing to pay more for products that they believe are superior. Sunkist oranges, Dole pineapples, and Chiquita bananas have gross profit margins 10 percent to 60 percent higher than generic produce. When introduced, one brand of tomato sold at about $1 per pound, or 30¢ more than unbranded tomatoes.

There are risks associated with building a brand. Unless firms can provide better produce consistently, consumers may eventually hold a brand's name against it. After all, why pay more for a product that's no better than the unbranded produce? Further, even if consumers view the product as superior and pay a premium for it, the premium may not be high enough to cover the extra costs of producing higher quality and establishing a brand name. Castle & Cooke, Budd Co., and other smaller firms did not recoup their investment on branded cauliflower, grapes, and broccoli.

Similarly, labeling can be used to promote products. Consequently, producers will fight for the right to restrict the use of these names.

In 2003, the European Union (EU) listed 41 wines, cheeses, and other products that it wants protected by a global trade pact. The EU agricultural commissioner claimed that geographical indicators are a quality guarantee and prevent confusion among consumers. The EU accuses producers in other countries of abusing (using) the names of its delicacies. It wants to create a global register of geographically defined products that would prevent producers from other areas from using the names.

The United States and Canada are among other countries resisting this proposal, which would restrict products labeled as beaujolais, champagne, chianti, and medeira wines; feta, gorgonzola, and roquefort cheese; Parma ham and mortadella sausages; and others. Similarly, India wants to protect darjeeling tea, Sri Lanka defends its ceylon tea, and Guatemala claims its Antiguan coffee.

In some countries, local producers have registered these names as their trademarks. Italian Parma ham cannot be sold in Canada because the trademark "Parma ham" is reserved for a ham produced in Canada.

Sources: Christopher S. Eklund, "Will a Tomato by Any Other Name Taste Better?" *Business Week*, September 30, 1985:105; Naomi Koppel, Associated Press Worldstream, June 11, 2003.

"Search" Versus "Experience" Goods

The informational content of advertising depends on whether consumers can determine the quality of a product prior to purchase (Nelson 1970, 1974). If a consumer can establish a product's quality by inspection before purchase, the product has

search qualities. Examples are furniture, clothing (determining style), and other products whose chief attributes can be determined by visual or tactile inspection. If a customer must consume the product to determine its quality, it is said to have **experience qualities**. Examples are processed foods, software programs, and psychotherapy.[5]

Advertising provides direct information about the characteristics of products with search qualities; advertisements for search products often include photographs. In some cases a consumer cannot directly observe a physical attribute, but it can be concisely described. For example, food and drink advertisements may claim that their products are low in calories. In contrast, for experience goods, the most important information may be conveyed simply by the presence of the advertising; some advertisers do little more than mention the name of the firm to enhance the firm's reputation. Such advertisers hope that consumers infer the quality or reputability of a firm by the frequency of its advertising and the expense involved: Fly-by-night firms may be less likely to advertise in expensive publications or on national television.

Some firms claim that all their products are excellent. Their advertisements contend that if you have experienced and liked one of their products, you will like all of them (Duncan Hines, Green Giant). Such advertisements may do little more than show the company's name; they do not describe the properties of each of its products. Alternatively, a firm may try to convince consumers that its product is different from and superior to other, similar brands—that is, it may attempt to differentiate its product from competing brands (for example, Bayer vs. generic aspirin, Clorox vs. generic bleach, Coke vs. Pepsi, Tide vs. all other laundry detergents).

Informational Versus Persuasive Advertising

Some economists distinguish between **informational advertising**, which describes a product's objective characteristics, and **persuasive advertising**, which is designed to shift consumers' tastes. For example, informational advertising may cite the price of a product, compare the advertising store's price to its rivals' prices, describe the features of the product, or list its uses. Persuasive advertising may explicitly or implicitly make claims aimed to stimulate a purchase, such as "Smoke these cigarettes to look more mature and sexier."

Some companies may use persuasive advertising to try to change consumers' perceptions of their product (reposition their brand in product space) when they cannot truthfully change their informative advertising. For example, Dr Pepper's share of soft drinks grew by about a tenth in 1992 over 1991 when the firm altered the product's image. In the 1970s and 1980s, the brand's ads said that Dr Pepper was a misunder-

[5]Some economists identify a third category, in which the quality of some goods cannot be determined even after consumption. Darby and Karni (1973) call these *credence* goods. Examples include many repair services and medical care, where the consumer must rely on the provider's assurances that the work was done properly. See also Becker and Murphy (1993), who treat advertising as a complementary good to the consumed good, and Becker (1996), for an analysis of the formation of tastes.

stood beverage, and appealed to those consumers who wanted to stand out in a crowd and who craved "much more" than a cola. Not surprisingly, this policy relegated Dr Pepper to a narrow segment of the market. Then Dr Pepper discovered that many of its consumers were cola drinkers, and realized that by insulting colas they were attacking their own customers. They went from saying drink Dr Pepper because you don't like cola to saying drink it as an alternative to cola because you drink so much cola.

It seems reasonable that producers of search goods are more likely to use informational advertising and that experience-goods producers are more likely to use persuasive advertising, but this division is not perfect. The advertising/sales ratio for products classified as experience goods is three times greater than that for products classified as search goods, and the difference is statistically significant (Nelson 1974, 738–40). A possible inference is that images (used in persuasive advertising) are forgotten more quickly than facts (used in informative advertising). Thus, consumers may learn and remember that a particular good has fewer calories (is "less filling") in one or a few exposures to an advertisement, but may need to be bombarded with repeated exposures to be convinced that a product "tastes great."

Such empirical evidence must be viewed with caution, however, because it is difficult to classify products as either experience or search goods or as using either informational or persuasive advertising. If your younger brother's self-image depends on the need to be "cool" and he sees an ad showing a cool person such as a well-known actor or singer using a particular brand of sunglasses, he may interpret the advertisement as being informative (see Example 14.2).[6] It tells him and his friends that this particular brand of sunglasses is cool. You, on the other hand, may view such testimonial advertising as persuasive, having little informational content.

Profit-Maximizing Advertising

All advertising is designed to increase the demand for a firm's product whether facts are used or merely smoke and mirrors. An increase in informative or persuasive advertising expenditures from α to α' causes an outward shift of the demand curve facing a firm from $D(Q, \alpha)$ to $D(Q, \alpha')$, as shown in Figure 14.1.[7] The firm chooses its output, given its advertising expenditures, by setting its marginal revenue with respect to quantity, $MR(Q, \alpha)$, equal to its marginal cost, MC, which we assume equals average cost (for simplicity).[8]

The outward shift in the demand curve increases profits (not adjusted for advertising expenditures) for two reasons. First, profits increase by area B and area C because

[6]Celebrity endorsements have a long, proud history. Buffalo Bill Cody hawked Kickapoo Indian Oil in the mid-nineteenth century, and Honus Wagner allowed his autograph to be imprinted on a Louisville Slugger bat in 1905.

[7]The following analysis ignores the effects of the firm's advertising and quantity decisions on other firms. Empirical evidence suggests, however, that the amount of advertising is influenced by market structure (Weiss, Pascoe, and Martin 1983). Lambin (1976) finds that advertising by rivals lowers a firm's market share roughly by as much as its own advertising increases it. Dorfman and Steiner (1954) was one of the first articles to model advertising's effects on demand.

[8]That is, $MR(Q, \alpha) \equiv \partial R(Q, \alpha)/\partial Q$, where R, revenues, equals $D(Q, \alpha)Q$.

EXAMPLE 14.2 *Celebrity Endorsements*

The celebrity is a person who is known for his well-knownness.
—Daniel J. Boorstin

Do celebrity endorsements work? Certainly some advertisers believe they do, given how much they spend hiring well-known shills. Former high school basketball star LeBron James inked a four-year promotional deal with Nike for $100 million even before he started playing basketball for the Cleveland Cavaliers. A 1999 study at Illinois State University concluded that approximately one-fifth of all television advertising features a well-known individual from the worlds of sports, television, movies, or music.

However, academic and industry studies indicate that the effectiveness of celebrity ads is mixed. Industry lore suggests that celebrity ads are particularly effective in Japan, Korea, and Taiwan. Probably the biggest advertising battle in 2004 will be between two male-potency drugs, Levitra and Viagra, as former NFL coach Mike Ditka goes up against baseball slugger Rafael Palmeiro. In contrast, a third male-potency drug, Cialis, will not use a celebrity—instead, Lilly, the maker of Cialis, will stress that its drug lasts longer.

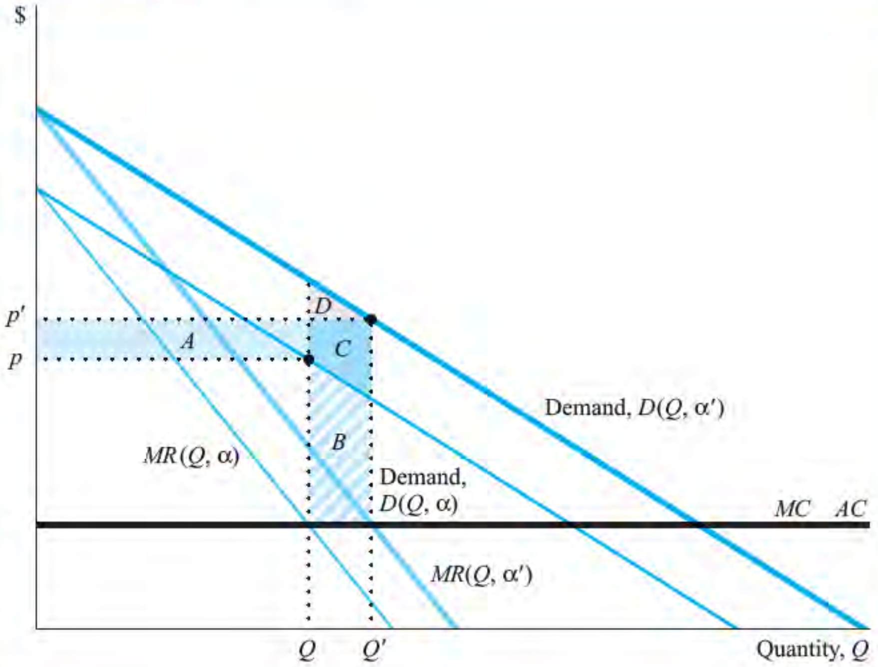
Firms can select from a range of celebrities with vastly different fees for ads and personal appearances. As of 2003, daytime stars (such as Kamar De Los Reyes and Kassie DePaiva) are often available for two- to three-hour personal appearances for between $5,000 and $10,000. Sports figures (such as Jim Palmer, Mike Ditka, and Mary Lou Retton) cost between $10,000 and $35,000, compared to some sports stars (Mark McGwire, Joe Montana, and Magic Johnson) whose time runs in the $50,000 to $100,000 range. Some television, film, and recording stars (Jennifer Aniston, Faith Hill, and Jim Carrey) may cost more than one-quarter of a million dollars.

Of course, when a firm builds an advertising campaign around a star and that star stumbles in public, the firm can be left with egg on its face, as Avis found when O. J. Simpson was accused of murder. More subtly, Nike received bad press when its top representative, Tiger Woods, admitted that he was switching from his Nike golf club to a Titleist to improve his game. One way to reduce such risks of embarrassment is to use a group of celebrities. In Great Britain, Nike gathered some of the world's greatest soccer players for its campaign.

Sources: "Celebrity Scares," *Marketing Week*, August 7, 2003:23; "Asking the Right Questions Before You Hire a Celebrity Spokesperson," *PR News*, May 19, 2003; "Companies Need to Forge Brands," *Korea Herald*, September 3, 2003; Matt Schiering, "Celebrity Endorsements," *Brandweek*, September 15, 2003; Luke Timmerman, "Ads for Viagra Competitor Cialis to Focus on Results, Not Celebrities," *Seattle Times*, October 10, 2003.

the firm increases its sales from Q to Q'. This extra profit is $(p' - AC)(Q' - Q)$, where AC is the average (and marginal) production cost, so $(p' - AC)$ is the profit per unit. Second, the firm makes more profits on the Q units it used to sell, area A. Because price rises from p to p', its profits on the first Q units increase by $(p' - p)Q$.

FIGURE 14.1 Advertising



Thus, profits (ignoring advertising costs) increase by the sum of areas A, B, and C due to the extra advertising.

If the extra expenditure on advertising, $E = \alpha' - \alpha$, is less than or equal to the increase in profits, $A + B + C$, the extra advertising pays. If profits rise by more than the advertising expenditures, then advertising expenditures should be increased even more. A profit-maximizing firm sets its advertising expenditures so that the last dollar spent on advertising increases its profits, excluding advertising costs, by exactly one dollar (Appendix 14A). That is, the firm maximizes its profits by setting the marginal cost of advertising equal to the marginal benefit. (Example 14.3 illustrates that groups of producers may fail to do so.)

The lower the cost, the more advertising in a society. In ancient Egypt, some entrepreneurs used criers to announce ship and cargo arrivals. By 1630, printing lowered the cost of advertising sufficiently that wide-scale public advertising became common. More recently, the development of radio and television again lowered advertising costs. Today, the largest advertisers spend over a billion dollars a year on advertising, thus ensuring that we are constantly exposed to it.

The perfect competition model ignores selling costs and assumes that firms can sell all they want at the market price. In fact, most firms do incur selling costs. Usually, firms with market power incur promotional expense to cause their demand curves to shift outward or become more inelastic, so that they can sell more at higher prices.

EXAMPLE 14.3 *Milk Advertising*

State and federal milk-marketing programs fund over $200 million annually for generic milk advertising and promotion. There is a mandatory assessment of 15¢ per hundredweight on all milk marketed for commercial use in the contiguous 48 states. Of that 15¢, at least one-third goes to national advertising and promotion programs, and the rest goes to qualified local promotion programs.

Liu and Forker (1988) assume that consumers forget at a constant rate, so that there is an incentive to continue advertising. They estimate, for New York City, that a 1 percent permanent increase in advertising causes the demand for milk to rise and reach a new higher level in about six months. The long-run demand elasticity with respect to advertising is 0.0028. With current levels of advertising, 18.27 pounds of milk are consumed per month per capita. If advertising were only 10 percent of historical levels, all else the same, consumption would fall 1.5 percent to 17.99 pounds per month per capita. They calculate that the profit-maximizing level of advertising (where marginal benefit equals marginal cost; see Appendix 14A) is about 55 percent of the historical level. Depken, Kamerschen, and Snow (2003) find that U.S. milk advertising is less than the profit-maximizing level.

Similarly, Suzuki et al. (1994) examine the effect of comparable Japanese generic milk promotion on sales. They estimate that the marginal rate of return to promotion is 6.04 in 1981 and 4.33 in 1989, so the Japanese milk marketing boards need to advertise more to maximize profits. Hill, Piggott, and Griffith (2001) report that the Australian dairy industry underinvests in generic milk promotion.

However, it is possible for a firm to advertise and still face a very elastic demand curve. For example, such a firm may act as a price-taker, but needs to advertise to inform customers where its store is located. That is, advertising need not be inconsistent with price-taking behavior. Moreover, competing firms may jointly advertise to increase demand for a homogeneous product. For example, California farmers spend more than $100 million annually on advertisements (Carman, Green, and Mandour 1992). Advertising for dancing raisins represents 5.8 percent of California raisin crop value.

Effects of Advertising on Welfare

Advertising may be described as the science of arresting human intelligence long enough to get money from it. —*Stephen Leacock*

Many social commentators attack advertising. Yet the Federal Trade Commission (FTC), which is supposed to protect consumers, opposes groups that want to forbid advertising, arguing that some advertising benefits consumers. This section examines research on the effects of advertising on welfare. Substantial empirical evidence indicates that advertising about prices can increase competition and raise welfare. In some cases, nonprice advertising can overcome the lemons problem discussed in Chapter 13. Theoretical models differ, however, as to whether advertising always promotes welfare.

Price Advertising Increases Welfare

Advertising that provides price information tends to lower the market price. Truthful advertising lets consumers know where to buy at the lowest price. Because it is costly, firms do not advertise unless the costs are at least covered by the additional revenues from an increase in demand.

If relatively low-price stores advertise their prices and attract more customers, these stores gain in size and the average price in the market falls (Smallwood and Conlisk 1979). In the tourists-and-natives model (Chapter 13), if tourists can gather information only by visiting local stores, the cost of information gathering may be sufficiently high to create a two-price equilibrium in which some stores charge natives the low price and others charge tourists the high price. If, however, relatively low-price stores can advertise in the local paper, the tourists' cost of gathering information falls, more consumers become informed, and the market share of low-price stores increases. If enough consumers become informed, all stores may charge the low price. Thus, without advertising, no store may find it profitable to charge the low price; but with advertising, all stores may charge the low price.[9]

Many empirical studies show that advertising about price lowers the average price consumers pay for products such as drugs (Cady 1976), eyeglasses (Benham 1972; Example 14.4), liquor (Luksetich and Lofgren 1976), toys (Steiner 1973), and retail gasoline (Maurizi 1972). Other studies show that although advertising can lower the price of legal and optometric services, it may also cause quality to fall in such markets (Arnould 1972, Muris and McChesney 1979, Kwoka 1984, Schroeter, Smith, and Cox 1987).

Because advertising can lower price in a market, it is in the interest of professional groups to ban advertising. Until Supreme Court decisions stopped them, doctors, dentists, and lawyers prevented advertising on the grounds that it was unprofessional.

Advertising to Solve the Lemons Problem

In some markets, firms cannot profitably sell high-quality products because consumers are unable to distinguish between high-quality and low-quality products, as in the lemons model (Chapter 13). If firms can use guarantees or warranties to signal high

[9]Butters (1977) shows that the less expensive is advertising or consumer search, the lower is the average price in a market. He also demonstrates that a free market generates the optimal amount of advertising and the maximum possible welfare. Stigler and Becker (1977) and Nichols (1985) also conclude that competing firms buy the socially optimal quantity of advertising. Stegeman (1991) argues that where consumers receive price information only through advertising, under certain conditions, competitive firms advertise less than is socially optimal.

EXAMPLE 14.4

Social Gain from Price Advertising

In the past, some states forbade price advertising for eyeglasses. Benham (1972) shows that eyeglass prices in 1963 were substantially higher in states that banned advertising than in those that had no restrictions. Adjusting for differences across states in income, age, sex, and family structure, the cost of eyeglasses was $7.37 higher in states with complete advertising restrictions. Because the average price was $26.34 in states with no restrictions, the restrictions increased the average cost by 28 percent.

There was only a $1.32 difference (which was not statistically significant) among states that had restrictions on price advertising but not other forms of advertising and those that had no restrictions. Thus, complete bans on advertising have a more significant effect on price.

A Federal Trade Commission study (Bond et al. 1980) also reports that prices were lower in cities that allowed advertising than in those that did not. Moreover, they found that the quality of the glasses was the same in both sets of cities. In cities without advertising bans, even optometrists who did not advertise charged an average of $20 less for an exam and glasses than did their counterparts in cities that banned advertising.

In the late 1970s, the Federal Trade Commission (FTC) enacted a trade regulation prohibiting states and trade organizations from restricting price advertising for eyeglasses and related services. The basis for this rule was the economics literature showing that such restrictions increase average price (see Ippolito 1986).

More recently, a court decision eliminated Rhode Island's ban on liquor price advertising in 1996. The Rhode Island Liquor Stores Association opposed ending the ban. By comparing Rhode Island prices to those in Massachusetts, Milyo and Waldfogel (1999) find that stores that advertise reduce price by more than 20 percent on those items that they advertised, and cut prices on products advertised by rivals. Nonadvertising firms did not lower prices in response to advertising by rivals. Milyo and Waldfogel conclude that ending the advertising ban had little effect on overall liquor price levels.

quality, the lemons problem can be avoided. Similarly, advertising may solve the lemons problem if it signals quality.[10]

Suppose, for example, that a firm wants to start selling a high-quality experience good. The firm believes that if consumers try its product, they will like and purchase it repeatedly. That is, the firm's incentive to provide high-quality goods is to induce repeat

[10]Nelson (1974), Schmalensee (1978a), Klein and Leffler (1981), Shapiro (1983), Wolinsky (1983), Kihlstrom and Riordan (1984), Milgrom and Roberts (1986), and Rogerson (1986). For a different view see Allen (1984). Bagwell and Riordan (1991) point out that high and relatively slowly declining prices also signal a high-quality product. High prices result in a loss of sales volume that is more damaging for lower-cost, lower-quality products.

sales (Klein and Leffler 1981, Shapiro 1983, Rogerson 1986). The firm hopes to make large profits by signaling its high quality and getting consumers to try its product.

To keep this example simple, let us make two additional assumptions. First, assume that consumers can find out about a product's quality only by trying the good; otherwise, the firm could produce a few items, give them away to some consumers, and rely on word of mouth to sell its product (Dodson and Muller 1978). Second, assume that the firm's marginal and average variable costs of production are the same as those of firms that produce low-quality goods (we drop this assumption later in this chapter). As a result, if the high-quality firm sells more units than low-quality firms sell at the same price, it makes higher profits on these sales.

The high-quality firm has a greater incentive to advertise than does the low-quality firm. The high-quality firm's advertising leads to repeated sales, whereas the low-quality firm's advertising leads to sales only in the current period. Because both types of firms have the same costs of production and advertising and because the rewards to advertising are greater for the high-quality firm, it engages in more advertising.[11]

When Advertising Is Excessive

It is against the law to advertise on tombstones in Roanoke, Virginia.

Newspaper columnists and social philosophers often argue that there is too much advertising because it induces consumers to buy goods they do not "need." This argument has been formalized to show that where products are differentiated, firms engage in more than the socially optimal amount of both persuasive and informative advertising. We explain why this conclusion may not always hold.

★Advertising for a Single Product. Until recently, most economists concluded that very little could be said about the welfare effects of persuasive advertising.[12] They reasoned that if advertising changes consumers' tastes (as reflected by consumers' utility functions), then there is no fixed basis for comparing welfare before and after advertising.

Suppose that an advertisement convinces many consumers that using a cologne makes them more attractive, and thus results in more sales at a higher price. Are consumers better off? The price is higher than before, but some consumers are receiving more pleasure from using the cologne than before. Most social commentators who are not economists say that the consumers just "think they are better off," and hence argue that their greater pleasure after advertising is spurious and should be discounted. Economists, however, typically argue that consumers are the best judges of their own tastes. Unfortunately, it is difficult to compare consumers' pleasure before and after advertising if the scale on which the pleasure is measured has changed.

[11]Rogerson (1986) discusses some complications in this type of model. Fluet and Garella (2002) and Linnemer (2002) show that whether firms use price or advertising to signal quality depends on the type of competition between the firms and the knowledge of consumers.

[12]For an earlier debate on the welfare effects of advertising, see Kaldor (1949–50) and Telser (1966).

In a clever but controversial article, Dixit and Norman (1978) argue that strong welfare conclusions can be drawn. They use the two natural extremes of consumers' preadvertising and postadvertising tastes (utilities) as the basis for their conclusions. For example, if you believe that advertising is pure deception, you could use preadvertising tastes in evaluating welfare. If instead, you believe that postadvertising tastes represent the consumers' true interest, you should use those tastes. If on the basis of both sets of tastes one gets the same welfare results, then Dixit and Norman argue that the results hold regardless of one's underlying assumptions about the appropriate set of tastes.

We start by examining the welfare effects of advertising on a monopoly and its customers. The monopoly has a constant marginal cost of production. Advertising is supplied at constant cost, so that advertising agencies do not receive unusual profits, and hence the advertising cost is the same for both the firm and society. As a result, the welfare analysis can ignore the advertising agencies; they receive zero profits regardless of the amount of advertising.

Let α be the initial level of advertising that is increased to a new level α'. We refer to α as the *preadvertising* level and α' as the postadvertising level. In Figure 14.1, the additional advertising expenditure, $E = \alpha' - \alpha$, causes the demand curve to shift outward to $D(Q, \alpha')$. That is, at any given price, consumers demand more output postadvertising. If output falls, welfare definitely falls, and no further analysis is necessary. We assume, then, that the equilibrium price, p', and quantity, Q', are higher in the postadvertising monopolistic equilibrium than in the original equilibrium (with price p and output Q), as shown in Figure 14.1.

As an initial standard, we use the preadvertising preferences of consumers, as reflected by the preadvertising demand curve with α advertising, $D(Q, \alpha)$. In the postadvertising equilibrium, consumers appreciate this product more than before, so consumers buy $Q' - Q$ more units. The additional consumer surplus from these extra units is the area under the preadvertising demand curve between Q and Q', because we are evaluating welfare at the preadvertising level. The cost of producing these extra units is the area under the marginal (and average) cost curve between Q and Q'. Thus, the net social gain from these extra units, area $B - E$, is the difference between the extra consumer surplus and the cost of producing them less the cost of the additional advertising, E.

Using the postadvertising preferences as our standard, consumer surplus increases by the area under the postadvertising demand curve between Q and Q'. Thus, the change in welfare is the increase in consumer surplus above the marginal cost curve, $B + C + D$, minus the additional cost of advertising, E. That is, using the postadvertising preferences, welfare changes by $B + C + D - E$, instead of just $B - E$, using the preadvertising preferences. For small amounts of advertising, C and D are generally very small relative to B, so that there is little difference in the change in welfare between the two standards.

In either case, the gain to advertising is the area under the *relevant* demand curve (either the pre- or postadvertising demand curve) between Q and Q' and above the marginal cost curve, less the additional advertising expenditures, E. That is, we are measuring the social value of a change in output from Q to Q' using the relevant standard.

The outward shift of the consumers' demand curve due to additional advertising increases the monopoly's profits for two reasons, as discussed above. First, the monopoly sells $Q' - Q$ more units of output. Second, the monopoly sells each unit of output at a price that is $p' - p$ dollars more per unit than before. Thus, the monopoly's profits increase by the sum of areas A, B, and C, less the cost of advertising, E. The increase in price due to the advertising makes firms better off by raising profits, $A + B + C - E$, but makes consumers worse off by raising the cost of the original output, $A = (p' - p)Q$. The change in welfare, using either standard, approximately equals the increase in profits to the monopoly less the extra expenditures, A, by consumers.

Using the preadvertising preferences, welfare cannot rise unless the monopoly finds advertising profitable. The change in welfare, $B - E$, is less than the increase in profits, $A + B + C - E$.[13] Thus, unless an increase in advertising increases profits, welfare cannot rise. Alternatively stated, profitability is a *necessary* condition for additional advertising to increase welfare; it is not a *sufficient* condition, because profits could go up $(A + B + C - E > 0)$, and yet welfare could fall $(B - E < 0)$.

Using postadvertising preferences, the change in welfare is $B + C + D - E$. For a small increase in advertising, C and D are small relative to A and B. Again, welfare cannot increase unless profits, $A + B + C - E$, are positive. Thus, using either set of preferences, profitability is a necessary condition for welfare to rise.

In equilibrium, the monopoly increases advertising until the extra expenditure on advertising, E, exactly equals the marginal increase in profits net of advertising, $A + B + C$. That is, in equilibrium, the change in the monopoly's marginal profits, net of the additional advertising expenditures from one more dollar of advertising, is zero. Because the change in welfare is marginal profits (which are zero in equilibrium) minus the extra consumer expenditures due to advertising (which are positive), the marginal change in welfare is negative for the last advertising dollar. Regardless of the welfare standard—preadvertising or postadvertising preferences—a marginal increase in advertising causes welfare to fall by approximately area B, the extra consumer expenditures. That is, advertising is excessive: *At the equilibrium, a small decrease in advertising increases welfare.*

Dixit and Norman (1978) show that these results hold in oligopolistic and monopolistically competitive markets as well. They conclude that in all these markets:

- A small increase in advertising raises welfare only if the firm finds it profitable. There cannot be too little advertising, because if society benefits from the advertising, the firm finds it profitable to provide it.
- Reducing advertising from the profit-maximizing level raises welfare. This result holds even using the postadvertising preferences of consumers.

[13]The change in welfare is approximately the difference between the extra profits of the monopoly, $A + B + C - E$, and the higher cost to consumers for the original output, A, or $B + C - E$. For small changes in advertising expenditures, C is small relative to B, so that $B + C - E$ approximately equals $B - E$, the change in welfare. Area A represents a transfer of wealth from consumers to the monopoly and hence does not affect total welfare: The monopoly's gain offsets the consumers' loss.

That is, it is possible that a low level of profitable advertising maximizes welfare, but that firms advertise at a higher level. Even at that excessive level, however, welfare may be higher than with no advertising.

Two serious criticisms of Dixit and Norman's (1978) conclusions have emerged.[14] First, as Fisher and McGowan (1979) explain, in general, one should not examine welfare on the basis of just preadvertising or just postadvertising preferences. Suppose that an improvement in the product's quality, instead of advertising, shifted demand. Dixit and Norman's analysis would imply that there is an overinvestment in product quality. The reason for this counterintuitive result is that Dixit and Norman compare welfare before and after advertising using either the preadvertising or postadvertising preferences for both equilibrium outcomes. If the preadvertising equilibrium based on the preadvertising preferences is compared to the postadvertising equilibrium based on the postadvertising preferences, the welfare effects of advertising are ambiguous. If advertisements (or quality improvements) change preferences (consumers' willingness to pay), the utility levels of consumers pre- and postadvertising cannot be directly compared. Here it is inappropriate to use just one or the other set of preferences to evaluate the welfare effects.

Second, Shapiro (1980) explains that if advertising serves to inform consumers that a product exists rather than to shift tastes, there is too little advertising. In Shapiro's example, some consumers are unaware of the product before it is advertised. After exposure to advertising, they become aware of the product and purchase it, but no consumer tastes have changed. Unless the monopoly can price discriminate, it advertises too little, because it bears the full cost of advertising but does not receive the full benefits (it does not capture all the additional consumer surplus).[15] The welfare effects of advertising are also ambiguous when the advertising concerns differentiated goods (see **www.aw-bc.com/carlton_perloff** "Advertising and Differentiated Products"). Example 14.5 discusses the welfare effects of advertising for sin goods.

Advertising as a Barrier to Entry. Dixit and Norman (1978) and Grossman and Shapiro (1984) do not argue that all advertising is harmful; they contend only that there is too much of some types in certain circumstances. Many people, however, argue that persuasive advertising is anticompetitive and should be banned.

Persuasive advertising is said to be anticompetitive for two reasons (Bain 1956, Comanor and Wilson 1974). First, advertising may cause some consumers to conclude mistakenly that physically identical brands differ, an effect called **spurious product differentiation**. For example, some people pay a premium for branded bleaches that are chemically identical to many generic brands. Because buying behavior depends on consumers' perceptions of products rather than on the products' physical characteristics, advertising can lead to higher prices for some brands than for others. It is not clear

[14] Dixit and Norman (1979, 1980) respond to these criticisms.

[15] See Shapiro (1980) for a graphic analysis. A similar point is made by Diamond and Rothschild (1978). Shapiro (1980) and Dixit and Norman (1980) also debate the welfare effects when advertising affects consumers differently. See also Becker and Murphy (1993).

EXAMPLE 14.5 *Welfare Effects of Restricting Alcohol Ads*

Governments often try to discourage "sinful" activities, such as drinking, smoking, and gambling. Rather than ban these activities outright or tax them, governments may limit advertising.

To prevent more government interference in their industries, firms may voluntarily restrict ads. For example, U.S. distilled spirits producers voluntarily banned the use of radio ads starting in 1936 and television ads starting in 1948. However, as distilled spirits producers have recently lost market share to beer and wine firms, this compact has collapsed. Crown Royal whiskey broke the voluntary ban by broadcasting a television commercial in June 1996. After other distillers did likewise, the Distilled Spirits Council of the United States voted unanimously to rescind its voluntary ban on November 7, 1996. With the end of the voluntary ban, a lively public debate has raged as to whether state or federal governments should ban such ads.

Alcohol advertising bans are widely supported because of the belief that ads promote alcohol consumption and abuse. In Europe, 6 percent of all deaths among people under 75 and 20 percent of all acute hospital admissions are related to alcohol use. Nonetheless, advertising of alcoholic beverages is widespread. According to *Advertising Age,* in 2003, U.S. beer, wine, and liquor firms spent $1.7 billion on advertising, which represents nearly 15 percent of their sales.

Studies in the United States, Canada, and various European countries in the late 1980s and early 1990s found that advertising had little effect on the total market demand for alcoholic beverages (although advertising might strongly affect the sales of the advertised product). Consequently, some people concluded that, because bans of television or billboard ads would not affect total demand, they would have little effect. However, such bans may affect competition within the beverage industry, the demand for other products, and the use of advertising in other, nonbanned media.

Based on their study of the relationship between alcohol advertising bans and alcohol consumption in 20 countries, Saffer and Dave (2002) report that alcohol advertising bans decrease alcohol consumption. They conclude that such bans reduce alcohol consumption by 5–8 percent. Tremblay and Okuyama (2001) note that eliminating alcohol advertising bans tends to increase price competition, which can lead to greater alcohol sales.

Nelson (2003) finds, not surprisingly, that a restrictive law that applies to only one beverage (or one form of advertising) results in substitution toward other beverages (or nonbanned media). In particular, he finds that laws banning price advertising of distilled spirits lead to lower consumption of spirits and wine but higher consumption of beer. He also finds that, if a government wants to restrict alcohol consumption, advertising bans may be less effective than requiring that alcohol be sold by a monopoly or by raising the legal drinking laws.

Sources: Tremblay and Okuyama (2001), Saffer and Dave (2002), and Nelson (2003).

whether consumers are fooled in these cases by claims that a particular brand is superior in some unspecified way. For example, advertising may cause consumers incorrectly to become concerned that some generic brands are weak or contaminated and thus find it worth paying the premium for a branded good to avoid this (false) worry.

Second, some economists argue that advertising by firms already in an industry may make entry by new firms more difficult. A potential entrant must advertise extensively to overcome the goodwill created by an incumbent firm's advertising, whereas the incumbent incurred no such introductory advertising expense when it entered the market. Such a barrier to entry increases the market power of incumbent firms, and they charge higher prices as a result. The importance of this entry barrier depends on how long-lasting the effects of advertising are. The empirical evidence is not completely clear. Some researchers, among them Ayanian (1983), find that the effects of advertising for some goods last for several years, whereas other researchers, such as Boyd and Seldon (1990), find that advertising effects are gone within a year.

If the incumbent has no advantage over a potential entrant in advertising, the advertising does not restrict entry even if the incumbent has built up goodwill through its past efforts (Schmalensee 1974). If a potential entrant can advertise as effectively as an incumbent, eventually it will be on an equal footing with the incumbent. The potential entrant, foreseeing that day, is not deterred from entering, and there is no long-run barrier to entry as defined in Chapter 3 (see also von Weizsäcker 1980). Moreover, in many cases the entrant incurs lower advertising costs than the incumbent, especially if the incumbent has already persuaded consumers that the product is desirable. On the other hand, if (as in Chapter 11) the second entrant faces higher marketing costs than the first, there is a barrier to entry. Because there are theoretical arguments on both sides of this issue, the debate can be resolved only with empirical evidence. There are almost as many empirical studies claiming that advertising is not anticompetitive as there are studies showing that it is, however.

Many studies examine whether concentration ratios are related to advertising.[16] Studies finding that advertising increases concentration (Mann, Henning, and Meehan 1967, Ornstein et al. 1973, Strickland and Weiss 1976) are no more common than those finding that it either has no effect or lowers concentration (Telser 1964, 1969, Ekelund and Maurice 1969, Ekelund and Gramm 1970, Vernon 1971, Edwards 1973). Whether these studies actually test that advertising causes barriers to entry is open to question (Schmalensee 1976). For example, Weiss, Pascoe, and Martin (1983) infer that market structure, as measured in part by concentration ratios, determines advertising/sales ratios. The connection between concentration ratios and market power is tenuous at best, and the direction of causality between concentration ratios and advertising is not clear. Indeed, it is likely that both are determined simultaneously rather than that one determines the other.[17]

[16]Telser (1964) was probably the first to do so. Many of these studies are reviewed in Ornstein (1977) and Comanor and Wilson (1979).

[17]Lambin (1976) and Schmalensee (1973) attempt to measure separately the effects of advertising by firms on their own demand curves and on the industry's demand curve. Unfortunately, their data do not allow them to measure these effects precisely.

Another approach (Comanor and Wilson 1974, Miller 1969, Weiss 1969) examines the relationship between various accounting measures of profit and advertising. Again, the causality of any such relationship is open to question. Moreover, if advertising is long-lived in the sense that advertising today affects purchasing decisions in the future, then short-run profitability differences associated with advertising may be misleading.[18] Firms may incur costs today, lowering current profits, that raise profits in the future. Ayanian (1983) estimates that the average stock of advertising (the cumulative effect of many advertisements) typically lasts seven years. After adjusting profits for the stock of advertising, he concludes that advertising does not cause entry barriers that result in unusual profits.

As we previously discussed, a number of studies show that informative advertising about prices can lower the average price in a market. Persuasive advertising, by enabling new firms to differentiate their products, can sometimes facilitate entry. Thus, even if it could be shown that persuasive advertising can create barriers to entry, restricting advertising would also reduce its desirable effects of facilitating entry.

False Advertising

Advertising is legalized lying. —*H. G. Wells*

False advertising is illegal. If enforcement is lax, however, firms can advertise for years in a false, deceptive, or misleading manner with few, if any, penalties. This section considers the circumstances under which firms are most likely to engage in false advertising and whether truth-in-advertising or antifraud laws are desirable. The results are surprising: Under some circumstances, antifraud laws can lead to more false advertising.

Limits to Lying

The truth is the safest lie.

Why don't all firms lie in their advertising? One answer is that most consumers are hard to fool (Nelson 1974, Schmalensee 1978a).[19] Nelson (1974, 749) proposes a consumer decision rule that usually prevents a consumer from being deceived: "[B]elieve an advertisement . . . when it tells about the functions of a brand; do not

[18]Lambin (1976, 97) reports that the elasticity of sales with respect to advertising expenditures usually is greater in the long run. The short-run elasticity for electric shavers is 0.229 (a 1 percent increase in advertising expenditures leads to a 0.229 percent increase in sales), but the long-run elasticity is over twice that, 0.597. Similarly, the short-run and long-run elasticities for cigarettes are 0.154 and 0.752; for detergents, 0.055 and 0.659; and for soft drinks, 0.057 and 0.415.
[19]But not always: A 1945 *Fortune* magazine article reported that at least 10 men had written letters proposing marriage to Betty Crocker, the fictional spokesperson for a food company.

believe the advertisement when it tells how well a brand performs that function." The functions of a brand are easily tested before purchase (search qualities), whereas the performance can be confirmed only after purchase (experience qualities). A firm's claim that it sells king-size beds is much easier to confirm than the claim that the bed will last for 50 years. Thus, the first claim is more plausible than the second.

False advertising is more likely for experience goods than for search goods. For example, in a six-month period, all 58 Federal Trade Commission cases of deceptive advertising about product attributes concerned experience qualities rather than search qualities (Nelson 1974, 750). A false claim about a search good leads to no additional purchases if the claim can be inexpensively checked prior to purchase. Making such a false claim only damages a firm's reputation. As a result, firms have no incentive to make such a claim. In contrast, they may have an incentive to lie about experience goods, because the lie may prompt consumers to make a trial purchase.

Nonetheless, the amount of false advertising about experience goods may be minimized by high-quality firms' incentives to advertise the truth.[20] A consumer who tries and enjoys a high-quality item is likely to make repeated purchases, whereas a consumer disappointed by a low-quality product does not buy it again. Thus, the benefit to having a consumer try its product is greater for a high-quality firm than for a low-quality firm if both have the same costs. As a result, high-quality firms should advertise more than low-quality firms do, so that even the *amount* of persuasive advertising may be a signal of quality.

This argument appears sound as far as it goes: High-quality firms have a greater incentive to advertise extensively than low-quality firms do, assuming that both have the same costs. In many, if not most, markets, however, low-quality or fraudulent firms have relatively low costs. A fly-by-night firm can sell a worthless product that is almost costless to produce, so that its costs are substantially below those of a high-quality firm. The fly-by-night firm makes larger profits on its initial sales because it makes higher profits per unit; however, it expects no repeat business and has no expectation of surviving for very long. In such markets, therefore, it is unclear whether a high-quality firm with a relatively high cost of production advertises more or less (Schmalensee 1978a, Kihlstrom and Riordan 1984, Milgrom and Roberts 1986) than a low-quality firm.

We would expect high-quality products to be advertised more if the variable costs of the high-quality firm are no higher than those of low-quality firms and if consumers cannot learn about a product's quality except through consumption (Shapiro 1983, Rogerson 1986).[21] However, if the high-quality firm has relatively high costs, a large

[20]The conditions under which advertising can serve as a signal of quality are discussed in Nelson (1974), Schmalensee (1978a), Klein and Leffler (1981), Shapiro (1983), Wolinsky (1983), Allen (1984), Kihlstrom and Riordan (1984), Milgrom and Roberts (1986), and Rogerson (1986, 1988).

[21]If potential consumers can learn about quality through word of mouth from others who have tried the product, a high-quality firm need only sell a small amount of output at low introductory rates to convince consumers that it has an outstanding product, and hence it has no incentive to advertise extensively.

amount of advertising may not signal high quality.[22] Thus, either high-quality or low-quality firms may advertise more, so extensive advertising is not necessarily associated with high quality. For example, Kotowitz and Mathewson (1986) do not find evidence in either automobiles or whole-life insurance that greater advertising indicates better buys or signals higher quality.

The advertising industry claims to police itself to some degree. The American Association of Advertising Agencies, representing agencies that produce 80 percent of television and print advertising, established a children's advertising review unit in 1974. Since then, it has persuaded companies to modify or discontinue 270 commercials that had the potential to mislead or confuse children.[23]

Antifraud Laws

> *An advertisement for a carburetor to save gasoline ended with: ". . . If not satisfactory, money will be returned." When some customers complained, they were told, "So far, all money we have received has been satisfactory."*[24]

A company that sells an unsafe or otherwise substandard product typically can produce at lower cost than can firms producing a safe or standard product. Such a firm may engage in deceptive advertising that implies that its products are safe and useful in order to induce consumers to buy. Although there may be no repeat sales from satisfied customers, the company may still make money if its costs are low enough. One approach to dealing with deceptive ads is to prosecute unscrupulous firms under antifraud laws.

Paradoxically, more deception may occur when an antifraud law is moderately enforced than when it is not enforced at all (Nelson 1974, 749–51). Suppose, for example, that the law prohibits the mislabeling of the fabric content of clothing. If the law is almost always enforced, consumers believe that a clothing label is usually correct, thereby giving a manufacturer an incentive to mislabel. That is, if consumers believe that labels are generally accurate, false labels may fool them (see **www.aw-bc.com/carlton_perloff,** "Taking Candy from Babies"). In contrast, in the absence of any enforcement, consumers generally do not trust clothing labels.[25] Here, deceptive labels do little harm because no one believes them. As a result, firms have little incentive to make deceptive claims.

Does it follow that we should not have antifraud laws? Such a conclusion is too strong. These laws induce firms to make more information available to consumers. If a firm knows that consumers do not believe its claims in the absence of an antifraud law,

[22]Even here, however, extensive advertising signals quality under some circumstances (Milgrom and Roberts 1986).

[23]Anthony Ramirez, "Advertising: Campaigns for Children Criticized," *New York Times*, July 18, 1990:C9.

[24]L. M. Boyd, "Grab Bag," *San Francisco Chronicle*, April 2, 1988: C12.

[25]Eaton and Grossman (1986b) show that a firm may have an incentive to disclose information accurately if its product is very different from the products of its rivals.

it does not bother making any. Thus, there is a trade-off between having more claims (and perhaps more information) and having more deception.

The government must determine the optimal level of enforcement, taking into account the cost of enforcement. The optimal level of enforcement lies in the middle range between no enforcement and testing all claims.

Disclosure Laws

Do you promise to tell the truth, the whole truth, and nothing but the truth?

Disclosure laws require firms to reveal truthfully to consumers certain information about their products. Antifraud laws require only that any information voluntarily disclosed by firms be truthful. A firm advertises primarily to inform consumers about the desirable properties of its products, but it may also disclose their undesirable properties, such as side effects of drugs, for various reasons. For example, the firm may provide appropriate warnings as protection against liability suits, or it may decide that full disclosure is profit-maximizing. In some markets, the government requires firms to make disclosures about all *material* facts: all the good and bad factors that should influence the decision to buy the product.

As discussed in Chapter 13, a market for lemons may develop if high-quality sellers cannot practically differentiate their products from those of low-quality sellers, with the result that consumers remain uninformed. Here, however, we consider markets in which high-quality sellers have both an incentive and the ability to distinguish their products.[26]

Recall from the previous chapter that when statements about a product's quality can be established at low cost after the sale, firms not only tell the truth but provide warranties or guarantees to establish that they are telling the truth. For example, if a firm states that its box of oranges contains six oranges, a consumer can verify this claim upon opening the box, at virtually no cost.

When statements about a product's quality are costly to convey to consumers or costly to verify after the sale, firms do not offer standard guarantees. For example, it is difficult for a car maker to describe the quality of an automobile's construction and difficult for a consumer to verify this quality even after purchase. We do not expect to see a guarantee that all the parts of an automobile are of high quality and were properly assembled. It is relatively easy, however, to determine whether or not the car breaks down. If high-quality cars have a lower probability of failure than low-quality cars, a car maker can use guarantees covering breakdowns instead of direct guarantees of construction. We now consider the need for and effects of disclosure laws under various assumptions about the buyers and sellers.

[26] The following discussion is based on Grossman and Hart (1980), Milgrom (1981), and especially Grossman (1981b).

EXAMPLE 14.6 *Restaurants Make the Grade*

Los Angeles County health inspectors have graded restaurants on their hygiene for many years. Prior to 1998, restaurants did not generally choose to reveal their hygiene ratings. Beginning in 1998, it became mandatory for restaurants to post their hygiene ratings as either an A (the restaurant received a score of 90–100), B (80–89), C (70–79), or lower. Jin and Leslie (2003) find that this campaign to better inform consumers has had substantial effects. Mandatory disclosure raised hygiene scores by an average of 5.3%. Restaurants receiving an A saw their revenues increase by 5.7%, those receiving a B saw their revenues rise by 0.7%, while those receiving a C saw their revenues decrease by 1%. An analysis of hospital admission records revealed that admissions for food-related disorders dropped by 13.3%, even though non-food-related admissions increased by 2.9%. In short, the mandatory information disclosures increased welfare.

Firms may have an incentive to reveal product information when buyers are knowledgeable about the sellers' ability to obtain information about the product through testing or other means. It is also possible that firms may fail to test for fear of being forced to disclose unfavorable results. (See **www.aw-bc.com/carlton_perloff** "Product Disclosure.")

Empirical Evidence. Disclosure laws are common in financial markets, housing markets, and other markets where the quality of products is complex and sellers have substantially more information than buyers. We now examine two markets—securities and used cars—where disclosure laws are used. See Example 14.6 for an important example in another market.

Federal securities legislation was designed to prevent the overpricing of new stock issues resulting from buyers' ignorance about the undesirable attributes of these new stocks (Benston 1973, Hilke 1984). Stigler (1964b) and Jarrell (1981) compare the rates of return and the associated risks of investing in new issues before and after the 1933 Securities Act that imposed stringent disclosure requirements. They find, at most, small differences in relative performance across periods, although one researcher determines that fewer risky new stocks were available after the disclosure requirements.[27]

Another type of study examines the purchase of consumer durables. Consumers may differ in their ability to determine quality before purchasing, in their bargaining power, and in the gains they provide to firms when they are satisfied. McNeil et al. (1978) find that the poor pay more for used cars, are less likely to receive redress for defects they discover after purchase, and are less satisfied and more likely to believe

[27]Hilke (1984), commenting on these studies, questions whether the mandatory disclosure requirements of the 1933 Securities Act significantly increased disclosure requirements.

that something was misrepresented. This study also finds that the adoption of disclosure regulations in Wisconsin did not help. In short, there is little evidence to show that disclosure laws have been useful in either financial or used car markets.

SUMMARY

Firms have an incentive to inform consumers about the strengths of their products and to try to shift their tastes. In addition to advertising in newspapers and on radio and television, firms may advertise indirectly by creating brand names or otherwise establishing positive reputations.

A firm determines the profit-maximizing amount of advertising by setting the marginal cost of advertising equal to the marginal benefit stemming from increased sales. Existing empirical studies find that firms generally spend more on advertising for experience goods (goods that the consumer must try in order to determine if they are desirable) than on search goods (goods that consumers can instantly appraise).

The welfare effects of advertising are complex and depend on the type of product and type of advertising. Advertising about prices of homogeneous products typically lowers the average price that consumers pay, as demonstrated in studies of eyeglasses and other products. However, these studies show only that some advertising is desirable; they do not show that firms engage in the socially optimal amount of advertising. When persuasive advertising changes consumers' utility, one cannot determine if there is too much or too little advertising.

Advertising that leads to the spurious differentiation of goods and results in higher prices for consumers is harmful. Advertising may also create a barrier to entry, but the evidence supporting this view is mixed. Thus, the effects of advertising on consumer welfare are generally ambiguous. In some markets, advertising can make entry easier for a firm without a reputation, but it can also lead to the creation of market power.

Skepticism by consumers discourages false advertising. Paradoxically, antifraud laws can increase the amount of both truthful and false advertising. Society must therefore trade off the cost of enforcing antifraud laws and the harm of false advertising against the benefit from an increase in truthful advertising in order to determine how strictly to enforce these laws.

When antifraud laws are fully enforced, firms generally have an incentive to disclose relevant information to consumers. Surprisingly, under some circumstances, mandatory disclosure laws can reduce the extent of such disclosures by reducing the incentives for firms to acquire information. Existing empirical studies of mandatory disclosure laws fail to reveal a beneficial effect in securities and used car markets.

PROBLEMS

1. Using a graph similar to Figure 14.1, explain why a firm might not want to spend α on advertising, even though doing so shifts the firm's demand curve to the right. (*Hint:* Discuss what happens to the elasticity of demand or the price at the monopoly optimum.)

2. What is the profit-maximizing rule for advertising if advertising depreciates (that is, consumers forget about it over time if not reminded)?
3. What happens if a firm advertises, but only some people see the ads? *Hint:* Consider the tourists-and-natives model in Chapter 13.
4. A manufacturer uses vertical restraints in its contract with its dealer network (see Chapter 12) to encourage dealers to advertise locally. Under what conditions are such vertical restraints socially desirable?
5. Using the model in Appendix 14A, suppose the inverse demand curve facing a monopoly is $p = a + \alpha - bQ$, where α is the amount of advertising, and the cost function is mQ. Determine the optimal level of advertising and output.

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

The following are relatively nontechnical (or have nontechnical sections). To get a good overview of the older literature on advertising, see Schmalensee (1973) and Comanor and Wilson (1974, 1979). More recent work includes Bagwell (2001), Ekelund and Saurman (1988), and Leahy (1997).

APPENDIX 14A

Profit-Maximizing Advertising

Suppose that the price a firm may charge, p, is a function of its output, Q, and advertising, α. That is, its inverse demand curve is

$$p = p(Q, \alpha). \tag{14A.1}$$

Its revenues, then, are

$$R = p(Q, \alpha)Q \equiv R(Q, \alpha). \tag{14A.2}$$

The firm's costs are the sum of its production costs, $C(Q)$, and its advertising costs, α, where \$1 of advertising costs \$1.

In a one-period model that ignores the effect of advertising on future purchasing behavior, the firm maximizes its profits through its choice of quantity and advertising levels:

$$\max_{Q, \alpha} \pi = R(Q, \alpha) - C(Q) - \alpha. \tag{14A.3}$$

The two first-order conditions are

$$\pi_Q = R_Q - C_Q = 0, \tag{14A.4}$$

$$\pi_\alpha = R_\alpha - 1 = 0, \tag{14A.5}$$

where $R_Q \equiv \partial R/\partial Q$, $R_\alpha \equiv \partial R/\partial \alpha$, and $C_Q \equiv \partial C/\partial Q$. The optimal Q and α must simultaneously satisfy Equations 14A.4 and 14A.5. According to Equation 14A.4, output should be chosen so that marginal revenue from an extra unit of output, R_Q, equals the marginal cost of producing an extra unit, C_Q. According to Equation 14A.5, the firm should advertise until the marginal revenue resulting from an increase in advertising, R_α, equals the marginal advertising cost, 1.

PART FIVE

Dynamic Models and Market Clearing

CHAPTER 15

Decision Making Over Time: Durability

Time is nature's way of keeping everything from happening at once.

This chapter is the first of two that analyze firms' decision making over time. Here, we examine markets for goods that last for several time periods—**durable goods**. Examples of durable goods include light bulbs, automobiles, washing machines, and X-ray machines. In the United States, expenditures on durable goods are about 10 percent of all personal consumption expenditures and half of all sales of goods.[1]

Manufacturers of durable goods must decide how long their products should last. By spending more money initially, a manufacturer can make the product last longer. Manufacturers' decisions about durability depend on several factors. In particular, manufacturers consider whether consumers only care about the flow of services from the durable good (such as light from a light bulb or transportation from a car) or whether they also care about the durability of the good that provides the service (consumers prefer to drive a new rather than an old car). This chapter answers two questions about durability:

1. Does market structure affect the durability of products? For example, does a monopoly produce as durable a product as a competitive firm?
2. Does it matter whether a monopoly rents or sells its goods?

How Long Should a Durable Good Last?

In the long run, we are all dead. —*John Maynard Keynes*

When buying a durable good, consumers consider how long it should last and its resale value in future years. For example, manufacturers of high-quality, expensive cars often argue that consumers are better off buying their cars than less

[1] 2003 *Economic Report of the President* (Tables B-2 and B-9).

expensive, lower-quality ones because the better cars last longer and can be resold for a higher percentage of their initial purchase price in any future year.

A firm must trade off higher initial manufacturing costs against a product with a longer life that it can sell at a higher price. The firm's optimal policy is to increase initial expenditures up to the point where the marginal cost of greater durability equals the marginal benefit from a higher sales price. The firm's decision may be influenced by a number of factors, including its market power and the presence or absence of a resale market. We start by examining a competitive firm's decision and then a monopolistic firm's decision where consumers care about only the flow of services from the durable good.

Competitive Firm's Choice of Durability

I'm not afraid to die. I just don't want to be there when it happens.

—Woody Allen

Consider a competitive light bulb manufacturer's trade-off. The firm manufactures a light bulb that lasts N periods under normal use. A light bulb that is N periods old is just as useful—provides as much light—as a new one. At the end of N periods, the light bulb dies and must be replaced; it does not pay to fix it.[2]

When one says that a light bulb is useful, one refers to the *service*—the light of a specified intensity—that the light bulb provides. The light bulb is a machine or **capital asset**: something that lasts for many periods and that provides a service in each period.[3]

The manufacturer must decide how durable to make the light bulb; that is, the manufacturer must choose N. Suppose that the constant marginal cost of manufacturing a light bulb that lasts N years is $C(N)$. The more durable (long-lived) is the light bulb, the higher the cost of manufacture but the less frequently the bulb wears out. Thus, the firm faces a trade-off between durability and manufacturing cost. The competitive firm must pick the optimal trade-off because if it cannot produce efficiently, other firms will drive it out of business.

What is the cost of providing the light service from one light bulb forever? In the first period, the bulb costs $C(N)$. No replacement is needed until N periods later, at which time $C(N)$ dollars must again be spent to replace the bulb. Thereafter, every N periods, the bulb must be replaced at a cost of $C(N)$ dollars.

Costs in the future, however, are less important than costs today because future dollars are worth less. For example, if the interest rate is 10 percent, a dollar today is worth \$1.10 next period. Alternatively stated, a dollar next period is worth only

[2]A light bulb differs from many other products in that light from an older light bulb is the same as light from a new one until it suddenly dies. The main results of this section, however, do not depend on this special property of light bulbs. They do depend on the assumption that consumers do not care about the life of the light bulb in the sense that light from a bulb that lasts one year is equivalent to consumers as light from two bulbs each of which lasts six months.

[3]The light bulb, a machine, is a *stock*, which has no time dimension. The service is a *flow*, which has a time dimension: the amount of light *per period.*

\$0.91 (1/1.1) today. To calculate the present value of a stream of future expenditures, then, we *discount* expenditures in the future. Thus, if one is committed to pay \$1 this year and \$1 next year, the *present value* of this commitment, assuming a 10 percent interest rate, is \$1 + \$0.91 or \$1.91. Therefore, the present value of the cost of providing one light bulb's worth of service forever is the cost of producing it today, plus the discounted cost of producing another after N periods, plus the discounted cost of producing another in $2N$ periods, and so on.[4]

Figure 15.1 illustrates the effect of interest rates on the cost of providing one light bulb's worth of service forever. The present value of costs is plotted as a function of N, the durability of the bulb, for a particular cost function.[5] One line is the present value of costs for an interest rate of 10 percent, and the other for a rate of 20 percent. A competitive firm picks the durability, N, that minimizes the present value of the costs of providing 1 unit of light bulb service forever. If the interest rate is 10 percent, the present value of cost is minimized at $N = 13$ years. If the interest rate is 20 percent, it is minimized at $N = 7$ years. Thus, the higher the interest rate, the less durable the bulb should be because the future savings from delaying replacement of the bulb diminish, whereas the cost of making the good more durable is borne currently and not discounted.

The Monopoly's Choice of Durability

The meaning of life is that it stops. —*Franz Kafka*

Does a monopoly make a different decision regarding durability than a competitive firm? Suppose only one company can produce light bulbs. Its choice of durability may depend on whether it rents or sells the product. We start by analyzing this problem if the monopoly rents; that is, it sells light services rather than light bulbs. The sales problem is analyzed later.

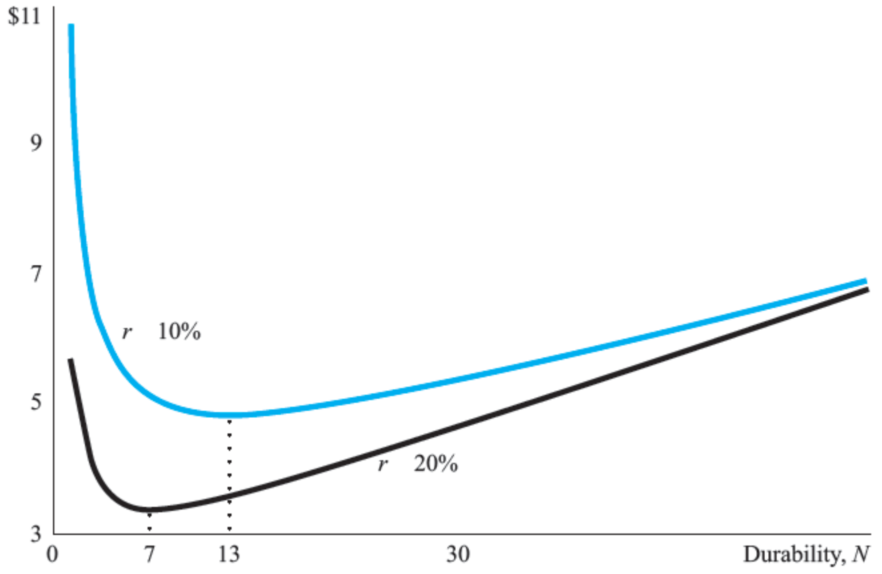
Renting. Let $Q(R)$ be the number of units of light services that consumers demand in each period if the rental price is R. This demand curve, $Q(R)$, does not change over time. If the monopoly rents the bulbs in each period at price R, it receives a continuous flow of revenue equal to $RQ(R)$ in each period. In contrast, the monopoly's costs of producing $Q(R)$ units per period are not incurred continuously. To provide $Q(R)$ units per period, the monopoly must initially produce $Q(R)$ bulbs, then produce another $Q(R)$ bulbs N periods later, and so on.

The monopoly chooses a rental price, R, and a durability, N, that maximize profits, where profits equal the discounted present value of rentals minus production costs. The choice of durability, however, does not concern consumers. Consumers only care about the rental cost of the light service. How long the bulb lasts is irrelevant to con-

[4]Interest may be compounded continuously rather than just once a year. With continuous compounding and an annual interest rate of 10 percent, the present value of \$1 next year is \$1$e^{-.1} \cong$ 90¢. In the following, except where otherwise noted, continuous compounding is used.

[5]The cost function is $C(N) = N^{\alpha}$, where $\alpha = .487$ in Figure 15.1. See **www.aw-bc.com/carlton_perloff** "Optimal Durability Under Competition and Monopoly" for a mathematical treatment.

FIGURE 15.1 Present Value of Costs of Providing One Unit of Service Forever



sumers if the monopoly instantly replaces burned-out bulbs with new ones. As a result, the monopoly should choose the N that minimizes the discounted present value of the cost of producing $Q(R)$ units of service forever. Given constant returns to scale, the N that minimizes total cost also minimizes the cost of producing one unit.

Thus, both a competitive firm and a monopoly choose the same N, which is the one that minimizes the cost of producing a unit of light service forever. This result is not surprising because both a monopoly and a competitive firm always produce so as to minimize costs. If the choice of durability affects only costs, both competitive and monopolistic firms choose the same durability. If there are no scale economies and durability does not affect demand for the service, *the optimal durability is identical for a monopoly and a competitor.*[6]

[6]See **www.aw-bc.com/carlton_perloff** "Optimal Durability Under Competition and Monopoly." Schmalensee (1979a) and Liebowitz (1982a) surveyed the durability literature. Swan (1970) was the first to show that a monopoly chooses the same durability as competitive firms under constant returns to scale (cost is increasing in durability but constant per unit with respect to the level of output). Sieper and Swan (1973) relaxed the constant-returns-to-scale assumption by introducing a fixed-capacity cost. They show that durability is independent of market structure in the long-run equilibrium (though not necessarily in the short run). Kamien and Schwartz (1974) showed that with rising average-cost curves, a monopoly chooses a lower durability than competitive firms. However, Swan (1977) noted that if the monopoly has access to the same technology as the competitive industry (many plants), then the independence result continues to hold. More recently, Abel (1983) found that the independence result holds under weaker conditions than constant returns to scale, but that without constant returns to scale, the independence result need not hold. We show later that when the product is sold instead of rented, the monopoly may opt for a shorter-lived product.

TABLE 15.1 Time Pattern of Revenues and Costs

Period	1	2	3	4	...	N	$N+1$	$N+2$	$N+3$	...
Rental revenue per unit	R	R	R	R	...	R	R	R	R	...
Sales revenue per unit	$R\lambda$	0	0	0	...	0	$R\lambda$	0	0	...
Costs per unit	$C(N)$	0	0	0	...	0	$C(N)$	0	0	...

Once the optimal N is chosen, the monopoly must choose how many bulbs, Q, to rent. The monopoly sets marginal revenue equal to marginal cost so as to maximize profits. A competitive firm chooses its output level so that its marginal cost equals price. Thus, although both the competitive industry and the monopoly choose the same durability, the monopoly produces fewer units at a higher price.

Selling. Whether the monopoly rents or sells does not affect this analysis *if the monopoly can convince consumers that it will stick to a particular pricing policy in the future.* We assume that aggregate demand is constant over time. Table 15.1 shows the pattern of revenues and costs for the monopoly over time. The top line shows the rental revenues. The firm receives rents of R in each period for each bulb. The bottom line shows the monopoly's expenditures over time to produce the bulb; the firm has chosen R and N to maximize profits.

Now suppose the monopoly, instead of collecting rent R in each period, allows the rents to accumulate and only collects the rent every N periods. The monopoly collects rents of $R\lambda$, where $R\lambda$ is the present value of the rental for N periods collected all at once rather than every period for N periods.[7] For example, if the rent, R, is \$1 per period, the duration, N, is 3 periods, and the interest rate is 10 percent, then the present value of the rent for 3 periods is $R\lambda = \$1 + \$0.9048 + \$0.8187 \cong \$2.72$. Only \$2.72 is collected rather than \$3 because rent in the future is worth less than rent today.

Both the monopoly and consumers are indifferent between a rent of \$1 per period and a payment collected every three periods of \$2.72 if transaction costs are negligible and *consumers believe that prices will not change in the future.* The monopoly is indifferent between receiving the payment of \$2.72 every three periods or a rent of \$1 each period. The monopoly has no incentive to charge a sale price different from \$2.72 if that is derived from the profit-maximizing rental. A lower or higher price would reduce profits.

As a result, if the bulb is sold rather than rented, the monopoly sells it for $R\lambda$, which is equal to the present value of the rental stream. The present value of the profits from both selling and renting is the same. Because the costs are the same in both

[7] The discount factor with continuous compounding is $\lambda = (1 - e^{-rN})/(1 - e^{-r})$, where r is the annual interest rate.

cases, and (by construction) the present value of revenues collected over N periods is the same, the results of the rental analysis also hold for the sales case and the monopoly chooses the durability that minimizes costs, just as in the competitive case.

Costly Installation and Maintenance

We have just shown that under certain conditions, durability is the same under competition as it is for both a monopoly that rents and a monopoly that sells. When installation is costly or better maintenance can extend a product's life, however, durability can differ across these market structures.

Costly Installation. Suppose that it is costly to install a light bulb. For example, suppose that a maintenance person must change the bulb. If the costs are the same for each consumer, both the monopoly and the competitive firm choose the same durability that minimizes the full cost of changing the bulb, including the installation.

In contrast, suppose that the costs of installing light bulbs vary across consumers, so that the total costs of buying and installing a light bulb differ across consumers. Those consumers with relatively high replacement costs prefer relatively expensive, long-lived bulbs. In contrast, those with relatively low costs prefer relatively inexpensive, short-lived bulbs. Here, durability affects the demand for the service and, since consumers are heterogeneous, the results of the previous section no longer apply. Durability is an attribute of the product that the monopoly can use to segregate consumer groups. In this case, the problem becomes choice of quality. The analysis in Chapter 10 shows that the monopoly typically produces a different range of durabilities than does a competitive industry.

Maintenance. Let us now make the problem more realistic. Suppose that the durability of the product is determined by consumer behavior as well as by the manufacturer. ("If I had known that I was going to live this long, I would have taken better care of myself.") For example, a consumer may be able to use labor to maintain a machine, such as a car, so that it lasts longer. The consumer purchases labor in a competitive market and combines the labor with the machine to produce machine service.

Many different combinations of machines of a particular durability and labor services can be used to produce a steady flow of machine services. If the price of a machine is relatively high, consumers maintain it longer to economize on the number of times the expensive machine must be purchased. For example, when the price of new cars increases, consumers keep their old cars longer.

This problem is analogous to the case of vertical integration with variable proportions discussed in Chapter 12. A monopoly provider of a machine does not want its consumers substituting away from the machine and toward labor. Firms may try to prevent this substitution by contracts that place vertical restraints on consumers. For example, a firm may *tie* maintenance to the purchase of the machine.[8] Maintenance is also tied to the machine if a firm refuses to sell the machine and instead only rents it with maintenance included.

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[8] Epple and Raviv (1979) show these results also hold when durability is stochastic (varies randomly around an average).

EXAMPLE 15.1

United Shoe

United Shoe, which had over 80 percent of the shoe-making equipment market, originally only leased certain machines. As a result of losing an antitrust case [*U.S. v. United Shoe Machinery Corporation,* 110 F. Supp. 295 (1953)], United Shoe was forced to offer its equipment for sale. The United Shoe case is often cited as an example of how a monopoly of a durable good such as shoe-manufacturing equipment only wants to lease and not sell its product.

Based on their examination of the facts of this case, Masten and Snyder (1993) contend that the court's conclusions and subsequent economic analyses are wrong about United Shoe's motivation for its leasing policy. They believe that the lease-only policy was a response to the need to obtain prompt repair. Complicated shoe-making machinery was subject to breakdowns and required continuous service and development. If a firm bought such a machine, it might worry that United Shoe would not provide reliable service.

United Shoe's lease contracts created an automatic incentive for repair. If the machine failed, United Shoe received no lease payment until it repaired the machine. This penalty created incentives for United Shoe to repair the machine quickly—which is what the customer wants when a crucial machine fails.

Masten and Snyder point to two pieces of evidence that support their view. First, they find that it is not true that United Shoe only leased machinery. Indeed, of the 343 machine types it manufactured, United Shoe offered 42 for sale only, 122 for either sale or lease, and 179 for lease only. Thus, a theory based on the desire of a durable good monopoly only to lease does not explain the company's behavior.

Second, they found that United Shoe's lease-only policy was primarily used for expensive, complicated machines that were critical to the buyer's production. This pattern is consistent with using lease-only contracts where providing quick service is essential.

In a famous antitrust case, United Shoe was charged with attempting to monopolize the market for machines that manufacture shoes. One of United Shoe's tactics that was attacked was its refusal to sell certain machines outright. Prior to losing an antitrust case, United Shoe only leased some of its machines with maintenance included. One possible explanation for this *lease-only* policy is that it prevents consumers from maintaining their machines longer than is desirable from the firm's point of view. See Example 15.1.

This maintenance example suggests those conditions where market structure will influence the durability choice. When the consumer can alter the lifetime of his machine in response to the price of a new machine, there will be a consumer optimization decision that will constrain a monopoly that sells but not one that rents. The reason is that there is no consumer optimization decision in the rental case. For example, as goods age, their operating costs often increase. Consumers will choose to stick with their low-quality old goods longer as the price of new goods rises. This ability of consumers to substitute can constrain a monopoly that sells and cause it to behave differently than a monopoly that rents (Rust 1986).

Renting Versus Selling by a Monopoly

It is better to buy a quart of milk by the penny than keep a cow.

—James Howell

Even if machines do not require maintenance, a monopoly may prefer to rent rather than to sell. In the preceding example, in which the monopoly and consumers were indifferent between renting and selling, we assumed that the consumers believed that the monopoly would stick to a particular pricing policy in the future. If, however, the monopoly cannot convince consumers that it will do so, it can make more money by renting than by selling. Indeed, where the monopoly must sell the durable good, it may lose much (or even all) of its market power. To illustrate this result, the following sections first examine the effect of consumers' ability to resell the product, then consumers' behavior, and finally the monopoly's behavior.

Resale Market

Until now, we have assumed that consumers keep a machine until it dies. This section examines the effect on a durable goods monopoly if consumers can resell the machine.

Consider a monopoly that produces a nondurable good (a good that is completely consumed in one period) and sells Q^* units at $10 to those who value the product the most. Even if those Q^* consumers may resell the product, there are no further transactions because, by assumption, those Q^* consumers who valued the product most already own it, and no one else is interested in bidding the product away. The market price remains at $10. The ability to resell leaves the optimal pricing unchanged.

As long as the consumers who value the machine the most do not change over time, the same result holds for durable goods. Suppose a monopoly sells durable machines with a lifetime of N and that it is profit maximizing to sell Q^* units every N periods. That is, customers consume Q^* units of machine service (for example, light) each period. The initial consumers of the machines are those who value it the most, and by assumption they continue to be the ones who value it the most, so there are no resales. The opportunity for resales leaves the optimal (sales) solution unaffected.

Suppose now that the overall demand curve for the machine services each period does not vary over time, but the consumers who value the machine the most change. In this case, there are resales from owners who now place less value on the machines to consumers who now value the machines highly but do not own them. Because Q^* machines (the monopoly's optimal number) are available each period, the value consumers place on consuming the product per period (the implicit rental price) is unchanged over time because, by assumption, aggregate demand is unchanged. The initial sales of the machine reflect the discounted present value of these consumer values. As in Table 15.1, resale does not affect R (the implicit rental price), so the solution is the same as in the case where the identity of those who value the good the most is unchanged.

We illustrate these results with a light bulb example. Consumers are willing to pay \$1 per period per light bulb, the interest rate is 10 percent, and the monopoly's optimal solution is to produce 50 light bulbs that last 3 periods. The present value of a bulb given a rental of \$1 for 3 periods is \$2.72 (= \$1 + \$.90 + \$.82).

Now suppose that consumers' desires change over time so that resales occur each period but that overall demand for services each period is unchanged. If an initial owner in the first period sells the bulb a year later to another consumer, then the discounted value in the initial period from the resale in the beginning of the second period is \$1.72.[9] That is, after reselling the bulb, the initial owner has spent \$2.72 − \$1.72 = \$1 for the use of the bulb for one year, which equals the rental rate for one year. It is, of course, of no interest to the monopoly if this resale occurs because the total demand it faces has not changed: The same number of bulbs are demanded in each period as when consumers' desires were unchanging. With a resale market of used goods, the optimal solution to the monopoly's problem is the same whether consumers' preferences change or do not change because the full monopoly profits are obtained in the initial sales of the light bulb.[10] The presence of a resale market does constrain the price that can be charged by the monopoly in the periods subsequent to the initial sale. See Example 15.2.

Without a resale market, when the consumers who value the good the most change over time, the monopoly cannot obtain as high profits as it would if the same consumers always valued the good the most. For example, suppose you want the use of a refrigerator during this school year only. If you cannot resell it, you are not willing to pay as much for it as you would if you planned to keep it for its entire product life. Resales help both consumers and the monopoly by effectively lowering the cost of providing each unit of service to consumers and by allowing the monopoly to capture the value of subsequent resales in the initial purchase price.

A resale market is different than a recycling market. To show the distinction, we examine an aluminum monopoly. The aluminum is sold to fabricators who sell aluminum pots to consumers. Suppose consumers discard aluminum pots when they get old. A recycling firm finds the pots. The pots are melted to create aluminum. This recovered aluminum is sold in a *secondary market* that competes with the original monopoly. Consumers are not willing to pay as much for the aluminum as they would if they could resell it. The secondary market constrains the monopoly, but consumers' willingness to pay is lower than when *they* receive the value of the recycled pot.

[9]The original owner receives \$1.9048 in the second period, so the discounted value of this resale in the initial period is \$1.72.

[10]One qualification to this result is that the optimal rental solution (that prevents resale) does not require the monopoly to reduce output over time. A sales policy cannot always duplicate a rental policy when cutbacks in output are required over time. Moreover, if consumers differ, preventing resale can sometimes allow price discrimination.

The importance of a secondary market was debated in a famous antitrust case involving Alcoa. Alcoa was the sole supplier of aluminum ingot; however, aluminum products can be recycled to obtain aluminum ingot. The legal question became whether Alcoa had market power even though it did not control the secondary scrap market directly. The recycling market constrained the price Alcoa could charge in subsequent periods for its aluminum. When demand is growing over time, the constraint of the secondary market on the monopoly's pricing is an empirical issue (see Example 15.3 and Martin 1982). If demand is growing extremely rapidly so that the supply of the resold material does not account for a large fraction of demand, then there is little constraint on the monopoly. Academic analyses of the Alcoa case (Example 15.3) find that Alcoa was little constrained by the secondary market due to growing demand.

We can now understand how a monopoly that sells may have an incentive to intervene in the used good market, buy up and discard used goods, and thereby reduce the supply of used goods. Alternatively, the monopoly may produce a durable good with a shorter life. Suppose consumers do not regard new and used goods as perfect substitutes. Then control of (or intervention into) the used good market can better allow a monopolist who sells to price discriminate. (Fudenberg and Tirole 1998, 1999, Waldman 1997, and Hendel and Lizzeri 1999a). A renting monopoly automatically can control the ratio of new and used goods, but this is not true for a monopoly that sells. Accordingly, intervention in the used good market can enable the monopoly that sells to reduce the availability of used goods and charge a higher price for new goods by eliminating the substitutable used goods. Therefore, laws or actions by the monopoly may raise the transaction costs of using the resale market, thereby limiting the competition the monopoly faces from secondhand sales. (In contrast, the Internet may lower these transaction costs, in so doing exacerbating the monopoly's problem.) Many developed countries have laws requiring that artists receive a share of the proceeds of any resale. To the degree that they are enforced—typically only for major artists at auction sales in a few European countries—these laws discourage resales (Perloff 1998, Solow 1998).

Recent literature considers the effect of leasing when there is also an adverse selection problem, where the resellers of a durable good know its quality but potential buyers do not (see the lemons model in Chapter 13). See Example 15.4.

★Consumers' Expectations Constrain the Monopoly

We should all be concerned about the future because we will have to spend the rest of our lives there. —*Charles Francis Kettering*

When resales are possible, the price that consumers are willing to pay for a durable good depends on both the value of the services of the durable good during the period the consumer owns it and the resale value at the end of that period. That is, consumers' expectations about the future resale price affect the initial price. For example, if you buy a house, the amount you are willing to pay depends in part on how much

EXAMPLE 15.2 *The Importance of Used Goods*

In 1985, Deere & Co. proposed acquiring the farm machinery division of Versatile Co., a Canadian company. Deere & Co. is one of the world's largest manufacturers of a variety of tractors. Versatile was one of the largest producers of four-wheel-drive (4WD) tractors, which have power in all four wheels.

Versatile and Deere were the top two North American producers of 4WD tractors in 1985 and were of roughly equal size; between them, they had a substantial share of the sales of new tractors. There were only two other major producers of 4WD tractors. Just a few years earlier there had been double the number of firms, but the precipitous collapse of the farm economy reduced the 1985 demand for 4WD tractors to about 30 percent of that in 1981, from about 14,000 units to about 5,000 units.

Tractors are a durable good, and 4WD tractors are especially durable, lasting anywhere from 15 to 30 years. There is a well-organized market for used tractors, and many farmers can substitute between new and used equipment. As a result, there is a close relationship in the price movements of new and used goods.

If new and used goods are substitutes, then market shares based on new sales have limited meaning. Even if a firm suddenly becomes a monopoly of new sales, but new sales account for only a small fraction of total tractors in use, the monopoly could not raise the price of new tractors significantly.

The rental rate of tractors is determined by the intersection of the supply curve of tractor services with the demand curve. The price equals the discounted present value of future rentals. In any year, the supply of tractor services equals the services available from the new stock plus those available from the old stock. The supply of services from the old stock equals the (depreciated) service left in tractors sold in previous years. The supply curve in year *t* can be written as a function of the year and the rental rate, *R*:

$$S(R, t) = S_o(R, t) + S_n(R, t),$$

where $S_o(R, t)$ is the old supply at rental rate R in year t and $S_n(R, t)$ is the new supply at rental rate R in year t.

If we ignore maintenance, the rental rate, *R*, does not affect the supply from previous years, so we need not write the supply from previous years as a function of the rental rate. An econometric analysis indicates that the annual depreciation rate was

you think you will receive when you sell it years later. This section analyzes the effects of consumers' price expectations on a monopoly.

Products that are likely to be fads, and hence worthless in the future, tend to sell for less today than products that will remain valuable. In general, consumers' price expectations depend on what they believe about the demand curve and the output of a moabout 8 percent per year. Because 92 percent of the previous year's supply is available in a given year, the supply in 1985 was

$$S_o(1985) = .92\ S_n(1984) + .92 \times .92\ S_n(1983) + \cdots.$$

Based on this formula and the data on sales, the ratio of new tractors to existing stock in 1985 was less than 10 percent. Because older tractors dominate the stock of tractors in use and are likely to do so for years to come, even a monopoly of new tractors could not profitably and significantly reduce total industry supply (and hence significantly raise prices) for several years.

The U.S. Department of Justice, in deciding whether to permit mergers, is concerned primarily about the effect of a merger on prices. Thus, the Department of Justice is likely to permit a merger that creates a firm with a large market share but no ability to raise prices.

The Department of Justice felt that the Versatile acquisition posed anticompetitive problems. The Department of Justice understood the constraining effect of used equipment but felt that it was not significant enough to prevent price from rising over the foreseeable future. In deference to the Canadian government's plea that otherwise Versatile would exit the industry, the Department of Justice said it would allow the acquisition if there were no other potential buyer. The transaction was never completed.

The analysis suggests that any durable good with a low depreciation rate and a large outstanding stock might be hard to monopolize, at least initially (Carlton and Gertner 1989). For example, in the automobile industry, the depreciation rate (23 percent) is about three times higher than that for tractors. Thus, all else the same, a monopoly in automobiles could raise prices sooner than one in tractors because used goods constrain the market for a shorter time in the automobile industry.

Moreover, it can be shown that in a durable good industry, competition among oligopolists is likely to be more intense than in a nondurable good industry (Carlton and Gertner 1989). The intuition behind this result is that a firm that makes an extra sale today is taking current and future rentals from rivals, increasing the incentive to make sales today relative to that for a nondurable good.

Note: Carlton worked as a consultant to Deere & Co.

Sources: Farm and Industrial Equipment Institute. *State of the Industry 1985 Update* and *The State of the Industry 1978–1980;* Canadian Firm and Industrial Equipment Institute. *Industry Outlook* 1986; U.S. Department of Agriculture, Economic Research Service. *Outlook and Situation Report,* August 1985.

nopoly in subsequent periods, because demand and output levels determine the resale price.

The constraining effect of consumers' expectations leads to a surprising result, sometimes called the **Coase Conjecture** (Coase 1972): A durable goods monopoly that sells its product has less market power—indeed, in the extreme case, no market

EXAMPLE 15.3 *The Alcoa Case: Secondhand Economics*

In 1945, Judge Learned Hand, writing for a panel of three judges, found the Aluminum Company of America (Alcoa) guilty of monopolizing the domestic aluminum market. The case turned, in large part, on the court's finding that the relevant market consisted only of domestic aluminum production and net imports of primary ingot. The court held that secondary aluminum, which is obtained by remelting aluminum scrap, was *not* part of the market even though secondary aluminum is a close substitute for primary aluminum. Judge Hand's reasoning was that Alcoa controlled the secondary production through its domination of primary production. Essentially, he contended that the existence of secondary aluminum producers did not substantially curtail Alcoa's monopoly profits from the sale of primary aluminum.

Several economists have examined whether Judge Hand was correct. Gaskins (1974) estimated the demand for aluminum and the supply of secondary aluminum and used other data to simulate the long-run effects of having a secondary market. He compared simulations with and without a secondary market, and he obtained two key results. First, the presence of a secondary (recycling) market causes a durable goods monopoly to set a higher price initially. Second, because the demand for aluminum was growing over time, the constraining effect of the secondary market was small.

For one set of parameters, he found that the initial price was 6 percent above the monopoly price without a secondary market and nearly 3.5 times larger than the competitive price (long-run marginal cost). The long-run monopoly equilibrium price with a secondary market was 14 percent less than the monopoly price without a secondary market, but 2.8 times higher than the competitive price. According to the simulations, the monopoly price with a secondary market falls slowly over time, so that it takes 100 years for the price to fall within 5 percent of its long-run equilibrium value.

Swan (1980), using different models, conducted other simulations that reached the same conclusion: Alcoa's predicted price was only slightly below the monopoly price without a secondary market and well above the competitive price (based on Alcoa's own cost figures).

power—when compared to a monopoly that rents the durable good.[11] The intuition behind this result is that a monopoly that sells has an incentive to cut price in the future, whereas such behavior does not occur if the monopoly only rents. We now illustrate this result through a series of examples.

[11]See Stokey (1981), Bulow (1982), and Gul, Sonnenschein, and Wilson (1986) for proofs of the Coase Conjecture under various conditions. Bagnoli, Salant, and Swierzbinski (1989) show that the Coase Conjecture proof of Gul, Sonnenschein, and Wilson (1986) depends on a continuum of consumers (two neighboring consumers are virtually identical) and that, with discrete demand types, the Coase Conjecture can fail.

Gaskins explained why the first-period price is higher than the short-run monopoly price. His argument has three steps. (1) Initially, there is no stock of aluminum, so there is no secondary market. Later, for a given stock of aluminum in the world, the higher the price for aluminum, the more it pays to convert scrap aluminum to pure aluminum, so the supply of secondary aluminum is increasing in price. (2) When maximizing the present discounted profits, a firm must trade off short-run versus long-run profits. Thus, the firm must be concerned that higher production in the short run will lead to a larger stock of aluminum later and hence more competition from the secondary market. (3) Therefore, in the initial period, the primary-producer monopoly sells even less than the short-run profit-maximizing level of output and charges a price that is higher than the monopoly price.

Gaskins concluded that Judge Hand's contention that monopoly control of primary production is nearly equivalent to a pure monopoly in its welfare implications was approximately correct in this case. That is, leaving out the secondary market did not substantially bias the results. Including the secondary market still would have left Alcoa with a large market share and would have led to the same conclusion. Because in other cases the secondary market can constrain pricing in the primary market, it is, in general, a mistake to ignore it (Fisher 1974).

Suslow (1986b) argued that, because new and used aluminum are not perfect substitutes, Alcoa's market power was not as constrained by the fringe as it would have been were they perfect substitutes. Similarly, she noted that there are lengthy recycling lags, so Alcoa faced limited recycling in its early years. She estimated that before 1940, Alcoa's markup of price over its short-run marginal cost was 59 percent. That is, she concluded that the "Alcoa problem" was not very important to Alcoa.

Technical Note: In the simulations of Gaskins and Swan, Alcoa is assumed to be able to set its pricing in the initial period and to stick to that pricing. Thus, these results differ from the more appropriate model that assumes Alcoa changes its policy over time. See the discussion in this chapter on consumer expectations and Suslow (1986a).

Examples Where Consumers Do Not Expect Price Cuts. First, suppose that a monopoly produces a nondurable good that lasts for only one period. There are no costs of production. The demand curve for the services of the good is

$$Q(R) = 20 - R \tag{15.1}$$

where R is the rental price and $Q(R)$ is the amount demanded at rental rate R. In this one-period market, the optimal policy for the monopoly is to charge \$10 and sell 10 units.[12] The monopoly's profits (revenues) are \$100. It makes no difference whether

[12] The monopoly's profits are equal to its revenues, which are $20R - R^2$. The first-order condition for profit-maximization is $20 - 2R = 0$, or $R = 10$.

EXAMPLE 15.4

Leasing Under Adverse Selection

Car manufacturers must consider the effect of the used car market on their future sales. People who highly value quality buy new cars, which they eventually resell to lower-valuation consumers. As our discussion of the lemons model (Chapter 13) illustrates, adverse selection occurs in used car markets because the seller, who has driven and maintained the car, is likely to know more about the quality of the car than potential buyers do. Indeed, Emons and Sheldon (2002) find that the predictions of the lemons model are true: Used car buyers in Switzerland are less informed than sellers, and sub-average cars are traded by private sellers (although not necessarily by dealers).

If all leased cars were returned to dealers, sellers (dealers) of used leased cars would not have better information than potential buyers because no self-selection would have occurred in which only the worst-quality used cars were sold. Because leasing, but not selling, new cars avoids adverse selection in the used car market, we would expect that the price for used cars that were leased would exceed that of used cars that originally were purchased new (Hendel and Lizzeri 2002, Waldman 2003). That expectation is confirmed by the data on prices. Consequently, a monopoly seller of new cars could lease to avoid the inefficiency in used car markets that results from asymmetric information. Such a monopoly earns more money from leasing a new car and then reselling than it would from selling the new car and leaving the initial buyer with the problem of reselling a used car subject to the lemons problem.

Consumers can choose between buying and leasing a car. Those who lease make an additional choice: to buy the car at the end of the lease period or to return it. Auto-leasing contracts typically specify a rental rate and an option price at which the used good can be bought at the end of the lease period. This price need not have any connection to the expected price of a used car.

By making these choices, consumers segment the market. Whether consumers buy, lease without buying, or lease with buying provides information that influences the degree of adverse selection in the used car market. Strikingly, higher-income consumers are more likely than lower-income consumers to lease (contrary to what the

the monopoly rents or sells because there are no future periods: Renting is identical to selling.

Suppose this durable good lasts for two periods and that the demand curve for services (rather than for the good itself) is Equation 15.1 in each of the two periods and zero thereafter. If the monopoly only rents the good and the demand curve for services remains constant, the optimal policy is for the monopoly to rent 10 units of the good in Period 1 for \$10 and 10 units in Period 2 for \$10, producing all 10 units in Period 1 and no units in Period 2. With this policy, the monopoly earns \$200 total (assuming the interest rate is zero for simplicity).

popular press frequently claims, arguing that lower-income people prefer the lower cash flows from leasing).

Hendel and Lizzeri (2002) predict that leased cars will have a higher turnover rate than purchased new cars because owners of leased cars value having the latest model car, and because the resale market for leased cars avoids the serious adverse selection problem of the typical used good market. In fact, people who lease cars are more likely to return the car at the end of the lease period than are owners likely to sell on the used car market after two or three years. Only one-quarter of leased cars are bought at the end of the contract. Because most lease contracts mature in two or three years, a large percentage of leased cars are sold in the used market by the time they are three years old. In 1996, formerly leased cars were 42% of all "premium" used cars: those two to four years old. Nearly 20% more leased cars were resold in this period than owned cars. As a result, used cars that were leased were of better quality than used cars of the same vintage that were not leased.

In a lemons market where owners resell their cars, we may expect that used cars offered for sale are worth less than the average used car price. In contrast, by setting a post-lease purchase price higher than the market-clearing price in the used market, the manufacturer can make sure that its resold leased cars are worth more than the average used car price.

The share of consumers leasing new cars has risen substantially over time: About 3.5% leased new cars in 1985, 7.3% in 1990, 24.2% in 1995, and 31.5% in 1998 and 2002, according to CNW Marketing/Research. Hendel and Lizzeri note that the increased popularity of leasing is partially explained by recent improvements in durability. The incentive of a manufacturer to lease rises as its good becomes more durable, because by improving the resale market value (by mitigating the adverse selection problem), the manufacturer can considerably increase the full value of a new good (which includes its initial lease price plus its resale value).

Sources: **http://www.eere.energy.gov/vehiclesandfuels/facts/2003/fcvt_fotw269.shtml**, Hendel and Lizzeri (2002), and Waldman (2003).

Now consider the optimal sales policy *if consumers do not expect a price cut in the second period and the monopoly can commit to selling nothing in the second period.* The monopoly sells 10 units at the beginning of Period 1 for $20. Consumers are willing to pay $20 per unit to buy because, according to Equation 15.1, consumers are willing to pay $10 per period per unit in Periods 1 and 2. The monopoly earns $200 in Period 1 and no revenue in Period 2. This argument is the same as the one made previously with respect to Table 15.1. Thus, the optimal sales policy is equivalent to the optimal rental policy and gives the monopoly $200 in profits.

Consumers Expect Future Price Cuts. For the optimal rental policy and the optimal sales policy to be equivalent, the monopoly must sell 10 units in Period 1 and nothing in Period 2. Is such a policy believable? We now show that the monopoly has an incentive to produce in the second period, so that the price in Period 2 is less than in Period 1, and rational consumers anticipate this fall in price.

Consider the demand curve the monopoly faces in Period 2. Because only one period remains at the beginning of Period 2, a consumer willing to rent the good for R in Period 2 is willing to pay R to purchase the good. That is, in the last period there is no difference between the sales price and the rental price for a durable product. Therefore, the demand curve the monopoly seller faces in Period 2 equals the demand given in Equation 15.1 minus the 10 units that are already in the marketplace. This residual demand curve in Period 2 is shown in Equation 15.2, where R_2 is the rental rate that is equivalent to the selling price of the good in Period 2, and $Q_2(R_2)$ is the number of additional units beyond those already sold in Period 1 that the monopoly sells in Period 2 for R_2:

$$Q_2(R_2) = (20 - R_2) - 10 = 10 - R_2. \tag{15.2}$$

Given this residual demand curve in Period 2, will the monopoly decide to produce zero units in Period 2? The answer is clearly no. The monopoly faced with the demand curve of Equation 15.2 sets $R_2 = \$5$, sells $Q_2 = 5$, and receives revenues of \$25 in Period 2.[13] Thus, the monopoly has an incentive to produce a positive amount in Period 2. The sales policy in which the monopoly produces 10 units in Period 1 and 0 units in Period 2 is not credible to consumers, who recognize that the monopoly has an incentive to produce a positive amount in Period 2.

Won't these sales in Period 2 be good for the monopoly? Surprisingly, the answer is no if consumers anticipate this behavior. But why? If the monopoly can sell 10 units in Period 1 for \$200 and then sell 5 more units in Period 2 for an additional \$25, the monopoly earns a total of \$225, which is more than the previous \$200. Unfortunately for the monopoly, this calculation is wrong.

A monopoly that only rents is unconstrained in setting profit-maximizing rental fees. In the calculation above, the highest total profit it can earn is \$200; hence, earning more is impossible, because \$200 *is* the profit-maximizing solution. The problem with the reasoning in the sales calculation is that no one is willing to pay \$20 per unit in Period 1 if the monopoly is going to sell the same unit in Period 2 for only \$5.[14] In other words, consumers in Period 1 are only willing to pay $R_1 + R_2$ for a machine,

[13] The monopoly's profit is $\pi_2 = (10 - R_2)R_2$. From the first-order condition with respect to R_2, $R_2 = 5$. Substituting 5 for R_2 into Equation 15.2, $Q_2 = 5$.

[14] We assume that consumers are rational and have perfect foresight about the monopoly's behavior in Period 2. If consumers are myopic and do not expect the monopoly to produce in the second period, then consumers' expectations not only do not constrain the monopoly, but benefit the monopoly, which can earn profits of \$225. That is, the monopoly's maximized profit is \$200 if consumers cannot be fooled but more if they can. For example, if consumers are gullible, the monopoly can tell them that the price will rise next period to induce them to pay more initially. Indeed, profit is unbounded if consumers believe everything they are told.

where R_1 is the implicit rental value they place on the machine in Period 1 (\$10) and R_2 is the rental value in Period 2 (\$5). No consumer values the good at \$10 in Period 2 if it can be purchased for only \$5. If the monopoly produces additional units in Period 2, so that R_2 equals \$5 instead of \$10, consumers are only willing to pay \$15 (rather than \$20) to purchase the good in Period 1. Thus, the total amount the monopoly earns from sales is actually $\$15 \times 10 + \$5 \times 5 = \$175$, which is less than the \$200 it would earn if it only rented.

This example illustrates an important point: When the monopoly sells the good rather than rents it, it has an incentive to produce and sell a positive number of additional units in Period 2. These additional sales drive the price down in Period 2 below what it would have been had no additional units been produced. This lower price, in turn, causes consumers to lower the amount they are willing to pay for the good in Period 1. Moreover, consumers recognize the monopoly's incentive to produce in Period 2 and *expect* such additional production to occur. Their expectations influence their behavior in Period 1.

If the monopoly rents, it faces no constraints from consumers' price expectations. It can produce more in later periods without affecting the rental rate in the first period, because consumers do not care about future production. It is not optimal for the monopoly to produce and rent additional units in Period 2: If it tries to rent more units in Period 2, the rental rate is driven down below the profit-maximizing level.

Thus, a monopoly that must sell the good is actually constrained in a way that does not occur in the rental case. When selling, the monopoly cannot credibly commit to producing zero units in Period 2, in contrast to the rental case. It cannot credibly commit in the sales case because consumers know that it is *not* optimal for the monopoly to produce nothing in the second period, whereas that policy is optimal if the monopoly only rents.

Because the rental solution was an unconstrained profit maximization, a monopoly earns as high or higher profits from renting as it does from selling. The monopoly is harmed in the selling case by being unable to credibly restrain itself from producing in the future. In other words, the monopoly suffers from being able to produce additional units in Period 2 profitably because this extra production lowers price in the initial period. United Shoe Company, IBM, and Xerox all initially only rented some of their durable products; however, they are now legally required to sell them (Bulow 1982, 318). (But see Example 15.1.)

There are several methods whereby a monopoly can overcome the problem caused by consumers' expectations. Before discussing them, however, let us return to the problem of the monopoly that must sell a durable good in a two-period world and determine its *second-best* policy (its "optimal" policy given that it must sell rather than rent).

The Monopoly's Optimal Sales Policy. To determine the monopoly's second-best sales policy, we work backwards starting in Period 2 (see Appendix 15A for more detail). Suppose the monopoly sells Q_1 in Period 1. Then, the residual demand curve facing the monopoly in Period 2 is

$$Q_2(R_2) = 20 - R_2 - Q_1, \tag{15.3}$$

which is a generalization of Equation 15.2, where we replace the number 10 with Q_1. The monopoly solves for the optimal rental rate, R_2, that maximizes profits, where demand depends on the quantity sold in Period 1.

The residual demand curve in Figure 15.2 hits both the R_2 and Q_2 axes at $20 - Q_1$. The marginal revenue curve, *MR*, corresponding to this residual demand curve hits the Q_2 axis at half the distance from the origin, $10 - 1/2Q_1$, as does the demand curve, because the demand curve is linear. Because costs (and hence marginal costs) are zero, profits are maximized where $MR = 0$. As the figure shows, that occurs where $R_2 = Q_2 = 10 - 1/2Q_1$. Total profits in Period 2, π_2, are shown as the shaded box in the figure. Thus, output, rents, and profits in the second period all depend on output in the first period, Q_1. The monopoly wants to maximize the present value of profits in the two periods combined, which are equal to profits in Period 1 plus profits in Period 2 (assuming the interest rate is 0, so that profits in Period 2 are not discounted). That is, the present value of profits (*PVP*) is

$$PVP = \pi_1 + \pi_2 = (R_1 + R_2)Q_1 + R_2Q_2. \tag{15.4}$$

The sales price in Period 1 equals the rental rate in that period plus the rental rate in Period 2. The sales price in Period 2 equals the rental rate in that period. The rental rate in Period 2 depends on the total amount consumed in Period 2, $Q_1 + Q_2$.

Having shown that the monopoly's choice of R_2 and Q_2 depends on Q_1, we now examine how profits depend on Q_1. Because R_1 depends on Q_1 (Equation 15.1), *PVP*

FIGURE 15.2 Profits in the Second Period

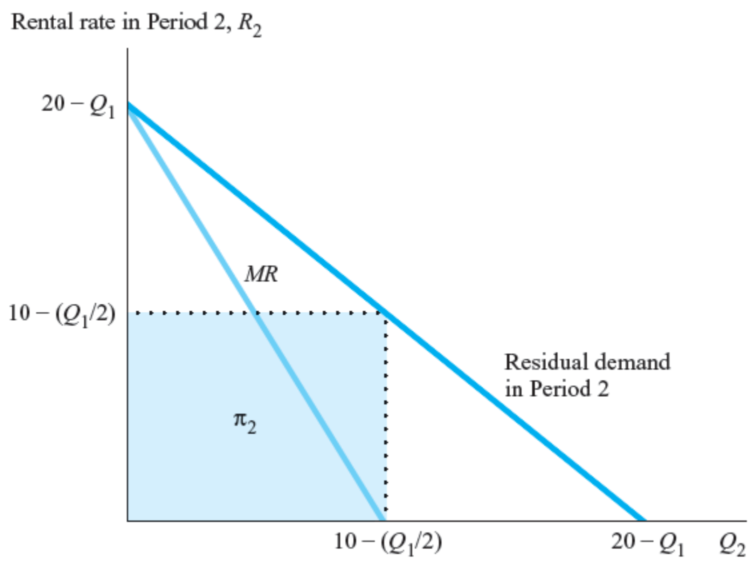


TABLE 15.2 Profits in a Two-Period Model

Sales Period 1, Q_1	Rental Rate Period 1, R_1	Sales Period 2, Q_2	Rental Rate Period 2, R_2	Profits Period 1, π_1	Profits Period 2, π_2	Present Value of Profits, $PVP = \pi_1 + \pi_2$
1	19	9.5	9.5	28.5	90.25	118.75
2	18	9	9	54	81	135
3	17	8.5	8.5	76.5	72.25	148.75
4	16	8	8	96	64	160
5	15	7.5	7.5	112.5	56.25	168.75
6	14	7	7	126	49	175
7	13	6.5	6.5	136.5	42.25	178.75
8	**12**	**6**	**6**	**144**	**36**	**180**
9	11	5.5	5.5	148.5	30.25	178.75
10	10	5	5	150	25	175
11	9	4.5	4.5	148.5	20.25	168.75

$\pi_1 = (R_1 + R_2)Q_1$
$\pi_2 = R_2Q_2$
$Q_2 = 10 - 1/2Q_1$

(Equation 15.4) can be expressed in terms of only Q_1. Table 15.2 shows how profits vary with Q_1. Where $Q_1 = 8$, the present value of profits is maximized at $180.

This *PVP* of $180 is higher than the $175 that is obtained when $Q_1 = 10$. Setting $Q_1 = 10$ leads to higher profits in the first period than when $Q_1 = 8$, but profits in the second period are enough lower that *PVP* is lower when $Q_1 = 10$. However, this *PVP* of $180 is lower than the rent-only *PVP* of $200.

The Paradox. The preceding analysis demonstrates that a monopoly's profits are lower when it sells rather than rents. The reason selling is less profitable is that the monopoly produces too much in the later periods. In our example, the monopoly is better off committing to produce nothing at all in the second period. Unfortunately for a monopoly that sells the machine, that policy is not credible. Consumers realize that the monopoly will produce in Period 2 and hence the price in Period 2 will be below that in Period 1, so they will pay less in Period 1 than if they expected no production in Period 2. This problem with consumer expectations does not arise in our example when the monopoly only rents because the expectation is credible that the monopoly that rents will not expand output in the future.

In our two-period sales example, the price in Period 2 is below that in Period 1. When the two-period sales example is extended to cover many periods (Appendix 15A), the monopoly's price falls in each subsequent period. It can be shown that the price falls to zero as the number of periods increases. A monopoly's behavior, where it sells continuously over any given time span, can be approximated by a model with a finite number of many short time periods. As the length of the periods shortens, the number of periods increases. The model suggests that the price will be driven to zero quickly by this increase in periods (Appendix 15A). It therefore follows that a monopoly that sells a durable good can never receive a price above the competitive price (zero in our example) even for a short period of time. One way to think about this puzzling result is that if the monopoly cannot credibly commit to a policy of no further production, it is as if the monopoly is a different firm in each future period. With an infinite number of future periods, it is as if there were an infinite number of competitors. Thus, the monopoly of the future is competing with the monopoly of today, and this competition immediately drives the price down to the competitive level.[15]

This result is indeed bizarre and arises, in part, from the extreme assumption that has been made about the cost conditions. It is not the assumption that costs are zero that turns out to be critical. The results hold for any (constant) positive level of marginal costs. The critical assumption is that the output level can be increased costlessly as fast as the monopoly desires. If consumers know that the monopoly cannot expand output costlessly, then consumers can credibly believe that output in the future is constrained and therefore the price can remain above the competitive price for some time. This insight leads to a variety of policies that a monopoly can undertake to get around the expectations problem.

How the Monopoly May Solve Its Expectations Problem. We have just shown that a durable goods monopoly that sells its product loses monopoly power when consumers form their own expectations as to the monopoly's future behavior.[16] A monopoly can only overcome this problem by credibly committing itself not to take advantage of certain profitable opportunities in the future. There are at least five ways the monopoly may avoid the expectation problem (Bulow 1982, 329–31).

First, the monopoly can refuse to sell the product and only *rent* or lease it. Renting or leasing may reduce or avoid the expectation problem (Bulow 1982) (see Example 15.5). Durable goods are frequently leased. A third of the capital equipment used by U.S. corporations is leased.

Second, the monopoly may try to convince consumers that it will limit the number of units it produces, which will prevent the future price from falling. If consumers are aware that a monopoly faces an upward-sloping marginal cost curve, they know that the monopoly will produce fewer units than it would if it faced a horizontal marginal cost curve.[17] Consequently, if a monopoly has a choice of two technologies, it may

[15]We ignored depreciation of the durable good in our discussion. Bond and Samuelson (1984), Suslow (1986a), and Karp (1996) examine the durable goods monopoly problem with depreciation.

[16]For a discussion of durable goods and oligopoly, see Ausubel and Deneckere (1987), Gul (1987), and Carlton and Gertner (1989).

[17]Kahn (1986) shows that if the monopoly sells an infinitely durable product with an increasing marginal cost of production, the sales policy results in a lower level of stock (that is, cumulative sales) than the socially optimal level, but that the monopolistic stock asymptotically approaches the socially optimal long-run solution. If the good is not infinitely durable, the asymptotic stock under the monopoly sales policy is less than the socially optimal long-run solution.

EXAMPLE 15.5 *Sales Versus Rentals*

A monopoly has an incentive to rent to avoid problems due to consumer expectations about future prices (the Coase Conjecture problem). In contrast, a firm with rivals may want to sell. Increased sales, like greater durability, allow the firm to lock up consumers today (prevents them from buying from rivals in the future). Thus, we would expect that the more competition a firm faces, the greater its sales/rental ratio.

Both IBM and Xerox substantially increased their sales/rental ratios (where rental includes returns from both renting and services) from 1968 to 1983 as their competition apparently increased. This ratio for IBM rose from 0.46 in 1966 to 1.38 in 1983. The ratio for Xerox rose from 0.28 in 1968 to 0.85 in 1983. Various factors in addition to increased competition may have contributed to the increased use of sales.

Source: Bulow (1986), Carlton and Gertner (1989).

choose a less efficient technology with a steeper marginal cost curve (Karp and Perloff 1996). In the extreme case where the monopoly's marginal cost curve is vertical, it can produce at most a fixed number of units. For example, an artist may commit to producing only a limited number of a particular lithograph (each explicitly numbered) by destroying the plate used to produce it.

Third, if the firm cannot explicitly contract to control its future production, it may attempt to acquire a *reputation* for never lowering price. For example, De Beers, the South African diamond monopoly, claimed it had a policy of never reducing the nominal price of its diamonds (although it apparently has on occasion). See **www.aw-bc.com/carlton_perloff** "A Diamond Price Is Forever?"

Fourth, because the problem of expectations arises only for durable goods, the monopoly can produce *less durable* goods. The monopoly can use **planned obsolescence**—purposely making a durable good short-lived—as a way of limiting its ability to lower its price in the future (Bulow 1986, Waldman 1993, Fishman and Rob 2000, and Kumar 2002). Having new models each year, as with automobiles or high-fashion dresses, may be examples of planned obsolescence; however, the costs of redesigning products frequently limit the monopoly's ability to use this technique. Microsoft and other software firms can relatively easily upgrade their products. See Example 15.6.

Fifth, the monopoly can *guarantee* to buy back products from any consumers at the price they paid for it. This *buy-back* provision protects the consumer in case the monopoly expands output and thereby lowers price in the future. This policy is not feasible where consumer abuse may lower the value of a product, as with automobiles, or if the products cannot be easily transferred, as with railroad tracks. Similarly, a monopoly may use other contractual clauses, such as best-price or most-favored-nation provisions to reassure customers about future prices (Butz 1990).

Thus, there are a number of ways in which a durable goods manufacturer may precommit itself to assure consumers that goods purchased today will not drop in value tomorrow. A durable good monopoly can maintain its market value by renting or by

EXAMPLE 15.6 *Lowering the Resale Value of Used Textbooks*

A monopoly or oligopoly producer of a durable good can reduce competition from used goods by producing new, superior products over time. Successful textbooks are revised (and, we hope, improved) relatively frequently, typically at three- or four-year intervals. As we were working on this textbook's revision, the fourth edition, we used an Internet book-price search site to check the prices of the third edition. The (then current) third edition had a U.S. list price of $98. Used copies of the third edition in good-to-excellent shape sold for between $50 and $90. In contrast, used (or even unused) copies of the second edition sold for between $7.50 and $65. Thus, the issuance of a new edition reduced the resale value of an older edition.

The publisher gains from issuing a revised textbook because it contains new material that makes it more valuable than the older edition, a feature that allows the publisher to charge more for the newer edition than it could charge for the older one. However, because frequent revisions lower students' expectations about the resale value of a text, the publisher knows that frequent revisions lower the price that students are willing to pay for a new edition, ignoring the improvements. A publisher must consider the trade-off between these two offsetting effects when deciding how frequently to revise a text. Finally, some books are classics that students never want to part with. Our advice to you is to save this invaluable book for use as a reference (or paperweight) and not even consider reselling it!

selling "with strings attached." What is striking in this case is that the strings bind the monopoly, not the consumers, and that the monopoly likes it that way.

SUMMARY

The future isn't what it used to be.

Market structure usually does not affect the durability of a good when durability, by itself, is not important to consumers and when firms are not constrained by consumer expectations. Firms choose the durability that minimizes the cost of providing the services. This result does not hold if consumers have preferences for a specific durability (such as new model cars).

Generally, a monopoly is better off if it can rent its product than if it must sell it. When the monopoly must sell the product with no strings attached, consumers can invest more in maintenance, so they purchase fewer durable goods in the future. Moreover, rational consumers expect that a monopoly will produce more units in the future, thereby lowering both future prices and resale values, and as a result, the initial purchase price. A monopoly that sells recognizes that a resale market can increase the willingness of buyers to pay for a new good, but that it can also limit the monopoly's ability to price discriminate between consumers who want the new good and those who want the used good. Under certain conditions, a monopoly that sells a durable good may make no monopoly profits at all. It is therefore in the monopoly's best interest to *credibly* commit itself not to expand future output and not to lower prices in the future. If it can do so, it can make monopoly profits from selling as well as from renting.

PROBLEMS

1. A textbook author does nothing to change a book's content, but reorders the problems at the back of each chapter. What effect, if any, will this have on book sales?
2. Suppose that firms improve products over time. If there is a switching cost to changing products, explain how that can affect pricing.
3. Explain how the analysis in Problem 1 is affected if farmers never sell or buy used tractors (that is, transaction costs are too high for a used tractor market to develop).
4. Explain how the analysis in Problem 1 is affected if an investment tax credit (which lowers a firm's taxes in proportion to the amount spent on new capital) encourages overconsumption of tractors.
5. Explain how the analysis in Problem 1 is affected if four-wheel-drive tractors are close substitutes for other types of tractors.
6. Suppose the cost of producing a machine that lasts N periods is $C(N) = N^{1/2}$. If the interest rate is 5 percent, what duration should the firm plan for its machine? Describe the conditions determining whether it should modify its behavior if consumers can maintain the machine for one extra period for \$1. Does your answer depend on whether the manufacturer rents or sells the machine?
7. Why does an artist destroy a lithograph plate after making a fixed number of copies?

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

See Schmalensee (1979a) and Liebowitz (1982a) for surveys of the early durability literature. Waldman (2003) provides a nontechnical discussion of modern durable good theory.

APPENDIX 15A

Multiperiod Durable Goods Monopoly

A monopoly that sells, rather than rents, a durable good in many periods earns less than one that only rents, as discussed in the chapter. Here, we determine the output and price in each period. We start by considering a two-period world.

Two Periods

A monopoly sells a durable good. For simplicity, we assume that

- There is no cost of production (so marginal cost equals 0).
- The interest rate equals 0.
- The duration of the good is given and equals two periods.
- Resales are allowed.
- Total demand for services is unchanged over the two periods and equals

$$Q_i = 20 - R_i, \tag{15A.1}$$

where Q_i is the output sold in Period i and R_i is the rental rate in that period.

In order to determine the monopoly's optimal policy, we must work backwards starting in Period 2. Suppose that the monopoly sells Q_1 in Period 1. Then the residual demand curve facing the monopoly in Period 2 is

$$Q_2(R_2) = 20 - R_2 - Q_1. \tag{15A.2}$$

The monopoly solves for the rental rate in Period 2, R_2, that maximizes profits, where demand depends on the quantity sold in Period 1.

Because there is, by assumption, no cost of production, the monopoly's profits in Period 2 are equal to its revenues,

$$\pi_2(R_2, Q_1) = R_2Q_2(R_2) = R_2(20 - R_2 - Q_1). \tag{15A.3}$$

Notice that profits in the second period are a function of the rental rate in Period 2 and output in Period 1: $\pi_2(R_2, Q_1)$.

Differentiating Equation 15A.3 with respect to R_2, setting the resulting partial derivative equal to zero, and rearranging terms gives the profit-maximizing rental rate in the second period:

$$R_2 = \frac{20 - Q_1}{2}. \tag{15A.4}$$

This same result is shown in Figure 15.2. By substituting Equation 15A.4 into Equation 15A.2, we find that the profit-maximizing output in the second period is

$$Q_2 = \frac{20 - Q_1}{2}. \tag{15A.5}$$

By substituting for R_2 and Q_2 in Equation 15A.3 (using Equations 15A.4 and 15A.5), we find that profits in Period 2 are

$$\pi_2 = \frac{(20 - Q_1)^2}{4}. \tag{15A.6}$$

Thus, output, rents, and profits in the second period all depend on output in the first period, Q_1.

The monopoly wants to maximize the present value of profits in the two periods. The present value of profits, *PVP*, equals profits in Period 1 plus discounted profits in Period 2 (we assume that the interest rate equals 0, so profits in Period 2 are not discounted), or

$$PVP = \pi_1 + \pi_2 = (R_1 + R_2)Q_1 + R_2Q_2, \tag{15A.7}$$

because the sales price in Period 1 equals the rental rate in Period 1 plus the rental rate in Period 2. By substituting for π_2 from Equation 15A.6 into Equation 15A.7 and noting that demand in the first period is $Q_1 = 20 - R_1$ or $R_1 = 20 - Q_1$, we obtain

$$PVP = \left[(20 - Q_1) + \frac{20 - Q_1}{2}\right]Q_1 + \frac{(20 - Q_1)^2}{4}. \tag{15A.8}$$

Equation 15A.8 expresses the present value of profits as a function of just Q_1. Once Q_1 is determined, Q_2 is determined from Equation 15A.5, and in turn, the rental and sales rates for both periods are determined.

To maximize the present value of profits, we must differentiate Equation 15A.8 with respect to Q_1 and set that derivative equal to zero. Simplifying that expression shows that the Q_1 that maximizes the *PVP* is 8. Substituting $Q_1 = 8$ into the other equations shows that $R_2 = 6$, $Q_2 = 6$, $R_1 = 12$, $\pi_2 = 36$, $\pi_1 = 144$, and $PVP = 180$ (which is less than the present value of the optimal rental profits of 200).

Infinite Number of Periods

Suppose, now, that the monopoly sells in each of T periods, where T is arbitrarily large. It is possible to show that the rental rate in period i is

$$R_i = \beta_i R_{i-1}, \tag{15A.9}$$

where $\beta_i < 1$ is a constant for Period *i*. From Equation 15A.9, it follows that the rental rate in Period *i* can also be expressed as a function of the rental rate in the initial period, R_0:

$$R_i = (\beta_i \beta_{i-1} \beta_{i-2} \cdots \beta_1) R_0. \tag{15A.10}$$

The product of the β's must approach zero as *i* grows large (Stokey 1981). Because the length of a time period is arbitrary, if the time periods are very short, so that there are many periods within any given time interval, the rental rate immediately falls to zero by this reasoning.[1] A striking implication of this result is that a monopoly of a durable good with zero cost of production receives a price of zero—the competitive price. See, however, Kahn (1986) for a model where marginal cost is upward sloping and Bagnoli et al. (1989), where consumers are heterogeneous.

[1]A situation where a monopoly sells continuously over a given time interval can be approximated by a model with many short time periods. The approximation improves as the length of the time periods falls so that the number of periods grows large.

CHAPTER 16

Patents and Technological Change

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 respective writings and discoveries.
—U.S. Constitution, Article 1, Section 8

Patents, which give the inventor or creator of a new product an exclusive right to sell it, have both desirable and undesirable effects. The chief benefit is that the possibility of obtaining monopoly profits encourages more inventive activity. Without patents or other similar incentives, there may not be enough inventive activity. The chief disadvantage is that new products may be sold at excessively high (monopoly) prices if no close substitutes are available.

Were it not for these exclusive rights, it might not pay for a drug company to invest large sums to discover a drug that cures cancer or prevents heart attacks. But once the drug is discovered, setting the price many times higher than the manufacturing cost puts the drug beyond the reach of many consumers who would gladly pay a competitive price—or even all their wealth—for it.

This chapter begins by discussing the various methods of granting inventors and other creators exclusive rights to encourage their work. The remainder of the chapter concentrates on answering five questions relating to patents and imperfect competition:

1. If there were no patents or other government incentives, would there be too little research and development (R&D)?
2. If there is too little research, should the patent system be used to encourage research rather than other incentives, such as prizes, research contracts, and joint ventures (research projects conducted collectively by several firms)?
3. Given that we keep the patent system, how long should patent protection last to obtain the best possible trade-off between incentives to invest and the harms from monopoly?

4. Are monopoly profits higher if a patent holder produces the invention or licenses it to others for production?
5. How does the structure of a product market affect the incentives to conduct research and the timing of innovations?

Patents, Copyrights, and Trademarks

The protection of intellectual property is needed to create incentives for creative efforts. These efforts are, in large part, responsible for the inventions and other technological advancements that are important for economic growth. Indeed, there is a strong correlation between a country's income and the strength of its laws protecting intellectual property (Ginarte and Park 1997). Patents, copyrights, and trademarks are three important types of protection for intellectual property. The three types of protection differ in what they cover and how long they last. A fourth type of intellectual property right is a trade secret, such as the formula for Coca-Cola, where the invention is protected simply by keeping it a secret.

Patents

A patent provides an inventor with exclusive rights to a new and useful *product, process, substance,* or *design.* New products include machines (mechanisms with moving parts) or manufactured articles (without moving parts) such as tools. New processes or methods include chemical processes for treating metal or for manufacturing drugs, mechanical processes for manufacturing goods, or electrical processes. New substances include chemical compounds and mixtures; this concept covers the composition of matter. New forms of animals and plants can also be covered. New designs include the shapes of products where the shapes serve a functional purpose

The first U.S. patent act, written by Thomas Jefferson, was designed to give "liberal encouragement" to human ingenuity and was passed by Congress in 1790. The first patent was awarded in that year to Samuel Hopkins for making potash used to produce fertilizer, soap, and other products. Another early patent was Eli Whitney's cotton gin in 1794. Other U.S. patent holders include Abraham Lincoln for inflatable chambers that could lift boats over shallow water (1849); Mark Twain for a self-pasting scrapbook (1873) and for a history game (1885); Hedy Lamarr (as Hedwig Keisler Markey) and George Antheil (a film score composer) for an anti-jamming device to foil Nazi radar; Danny Kaye for a party noisemaker (1952); John Dos Passos for soap-bubble gum (1959); and Edwin E. (Buzz) Aldrin, Jr., (who walked on the moon) for a space station (1993). The record number of U.S. patents by the big three—Thomas Edison, 1,093, Edwin Land, (founder of Polaroid), 533, and Jerome Lemelson, roughly 500 and growing (**www.lemelson.org/about/patents.php**)—are not threatened by these celebrities, however.

Approximately 100,000 applications are submitted to the U.S. Patent and Trademark Office each year, and more than 5 million patents have been granted since 1790. Table 16.1 shows how the number of applications to, and patents issued by, the U.S.

Patent and Trademark Office grew from three patents granted in 1790 to 166,039 in 2001. Biotechnology and computer software patents doubled between 1990 and 2000 (Gallini 2002). The share of U.S. patents by foreign residents has increased substantially. Foreigners received only about 2% of all issued U.S. patents in 1850. That share increased to 4.2% in 1875, rose to 14.1% in 1900, dipped to 10.2% in 1950, and has been roughly 50% since 1975, reaching 51.3% in 2001. Japanese residents received 19% of all U.S. patents in 2001, followed by Germans with 6.5% and Taiwanese with 3.6%.

Corporations are responsible for most patents. For the ninth consecutive year, International Business Machines Corporation (IBM) led all organizations in patents in 2001, followed by NEC and Canon. The top 10 patenting organizations include two U.S. corporations, seven Japanese corporations, and one corporation from the Republic of Korea. The U.S. government was sixteenth among top patenting organizations. Independent inventors' share of all patents issued to U.S.-resident inventors was 19.1%.

In the United States since 1994, patents generally provide 20 years of protection from the filing date for these inventions. Exceptions include patents for new designs, which last 14 years from the date the patent issues. The 2004 fee for a patent is $385 for small entities (independent inventors, small businesses, and nonprofit organizations) and $770 for large ones. Small entity patent holders must pay maintenance fees after 3.5 ($455), 7.5 ($1,045), and 11.5 years ($1,610). The corresponding fees for large entities are $910, $2,090 and $3,220, respectively.

To obtain a patent, the inventor must prove that the invention is *useful* (especially for new chemicals), *novel,* and *nonobvious* (you cannot patent a slight modification of something known to everyone in the business); must publicly describe the innovation;

TABLE 16.1 U.S. Patent Applications and Grants

	Applications	Total Grants	Grants to Foreigners
1790	n.a	3	n.a
1800	n.a.	41	n.a.
1825	n.a.	304	n.a.
1850	2,193	884	20
1875	21,638	13,291	563
1900	39,673	24,656	3,483
1925	80,208	46,432	5,347
1950	67,264	43,039	4,408
1975	101,014	72,000	36,271
2000	295,926	157,495	78,869
2001	326,508	166,039	85,170

n.a. / not applicable

Source: **http://patents.uspto.gov/web/offices/ac/ido/oeip/taf/h_counts.htm** and, if appropriate, must provide a working model. Two percent of patent applications are granted in Israel, 5% in Ireland, 11% in China, 12% in Canada, 14% in the United Kingdom, 16% in Germany, 25% in France, and 44% in the United States.[1]

The U.S. Patent and Trademark Office issues three categories of patents: utility or mechanical patents, design patents, and plant patents. The most common patents are utility patents (and are normally what people mean when they say "patent"). They cover many types of inventions, such as mechanical devices, chemical compositions and processes, manufacturing methods, computer software, biotechnology, and business methods. Design patents cover only the ornamental appearance of a useful product. Plant patents protect types of plants such as flowers, fruits, shrubs, and vines.

Not all these inventions could be patented in the past. The courts extended patentability to genetically engineered bacteria in 1980, software in 1981, and business methods and financial service products in 1998.[2] These extensions have led to some very strange patents on business methods that seem obvious, such as Amazon.com's one-click Internet ordering process and Priceline.com's reverse auction method for booking products such as airline tickets on the Internet.

The 1999 Inventors Protection Act requires that all patent applications filed in the United States and abroad be made available for public inspection 18 months from the earliest domestic or foreign filing date. This rule should create a more certain environment for conducting research and development by reducing the concerns of potential inventors that someone has already patented the ideas on which they are working (Gallini 2002).

Copyrights

> *Only one thing is impossible for God: To find any sense in any copyright law on the planet!*
> *—Mark Twain*

Copyrights give their creators the exclusive production, publication, or sales rights to artistic, dramatic, literary, or musical works. Examples include articles, books, drawings, maps, musical compositions, distinctively designed items, or photographs. Copyright law covers original "works of authorship" as long as they are "fixed" in a "tangible medium," such as a book or a computer hard drive as may occur when a paper is posted on the Web. Computer software on floppy disks and music on records are other examples of works preserved on tangible media. Filing for copyright registration costs $30.

Whereas patents protect function and purpose (ideas, devices, mechanisms, methods, and means), copyrights cover artistic expression. Indeed, copyright law (§102(b)) states that

> In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery,

[1] World Intellectual Property Organization: **www.wipo.int/ipstats/en/publications/a/pdf/patents.pdf**.
[2] *Diamond v. Chakrabarty*, 447 U.S. 303, 206 U.S.P.Q. (BNA) 193 (1980); *Diamond v. Diehr,* 450 U.S. 175 (1981); *State Street Bank and Trust v. Signature Financial Group,* 149 F. 3d 1368 (Fed Cir. 1998).

regardless of the form in which it is described, explained, illustrated, or embodied in such work.

In the United States, since 1998, copyrights to businesses last 95 years (or 120 years from when the work was created if that period is shorter), whereas copyrights to individuals last for life plus 70 years. Many countries provide protection for different lengths of time. For example, in Japan copyright protection lasts 50 years after the death of the artist and recordings are also protected for 50 years. Copyrights have exceptions, such as the *Fair Use Doctrine,* which allows individuals to make copies for their own use of a short passage from a book.[3] *International copyrights* are reciprocal arrangements extending copyright protection to citizens of other participating countries. The United States has reciprocal relations with more than 100 countries, whereby a foreign author receives *national treatment*: The author's works are protected under the same rules as are a native author's.

Trademarks

Trademarks are words, symbols, or other marks used to distinguish a good or service provided by one firm from those provided by other firms. A trademark may be registered with the Patent Office in the United States.[4] Examples include Kodak film, Exxon gasoline, Apple computers, Clorox bleach, Bib the Michelin Man who symbolizes tires for the Michelin Company, and a stylized penguin that symbolizes paperback books published by Penguin Books. The one millionth trademark registered with the U.S. Patent Office is for Sweet 'N Low. Unlike copyrights and patents, trademarks do not expire after a fixed term, although a firm may lose its trademark protection. For example, if a word comes to signify all products in an industry, it no longer distinguishes a particular brand and the trademark protection ends.

To keep from losing its trademark, General Foods stresses "Sanka-*brand* decaffeinated coffee," so that Sanka will not come to describe all decaffeinated coffee. Xerox placed ads that say in part: "Once a trademark not always a trademark. . . . We need your help. . . . Whenever you use our name, please use it as a proper adjective in conjunction with our products and services: e.g., Xerox copiers or Xerox financial services.

[3]There may be another strange copyright exemption. In a recent case, *BV Engineering v. University of California, Los Angeles,* 858 F.2d 1394 (9th Cir.), a federal appeals court concluded that state institutions can "violate the federal copyright laws with virtual impunity" due to the immunity clause in the 11th Amendment to the Constitution, which prohibits suits against states for damages, and parts of the Copyright Act, which has sections that exempt states. Apparently a copyright holder can get an injunction against officials of state institutions to stop violating copyrights, but no damages can be collected. Congress tried to eliminate this loophole, but apparently was overruled by the courts.

[4]A *trademark* is literally a mark such as a word or logo that represents a product. A *service mark* is a mark for a service rather than a product. A *common law trademark* is a mark that is not formally registered but has accrued minimal rights through use. *State registration* of a trademark or service mark provides better protection than the common law, but is only useful within that state. A *trade name* is the name a firm uses to do business.

And never as a verb: 'to Xerox' in place of 'to copy,' or as a noun: 'Xeroxes' in place of 'copies.' With your help and a precaution or two on our part, it's 'Once the Xerox trademark, always the Xerox trademark.'" Examples of trademarks that have become generic names are aspirin, cellophane, cornflakes, dry ice, escalator, high-octane, kerosene, linoleum, mimeograph, nylon, raisin bran, shredded wheat, thermos, trampoline, and yo-yo (Landes and Posner 1987).

Distinctions Between Patents, Copyrights, and Trademarks

The remainder of this chapter concentrates on patents. Copyrights can be analyzed similarly to patents, as protection designed to encourage creation. Trademarks, too, can be analyzed as providing protection by encouraging firms to develop reputations that convey information to consumers, allowing them to identify which products they like and dislike (Landes and Posner 1987).

One important distinction between patents and copyrights is that copyrights protect the particular expression of an idea, whereas patents protect any tangible embodiment of the idea itself. Two versions of the same story told in two different ways (*Romeo and Juliet* and *West Side Story*) can be copyrighted. A patent, however, prevents others from using an application of an idea in their products.

Therefore, patents allow greater exclusivity and, presumably, more monopoly power. Patents, though, are more difficult to obtain than copyrights. As the following discussion shows, a society's patent policy reflects a trade-off between more stimulus to invention and more monopoly power. Because the greater the monopoly power, the sooner one can accumulate large profits, it is not surprising that society sets patent terms shorter than those for copyrights.

Incentives for Inventions Are Needed

> *If you took away everything in the world that had to be invented, there'd be nothing left except a lot of people getting rained on.* —*Tom Stoppard*

Many economists and policy makers believe that without patents or other government incentives, there would be too little research. According to Jones and Williams (1998) and Mansfield (1998), the estimated private rate of return to R&D is far less than the social rate of return. The chief reason is that inventions are fundamentally new information, and information is a public good.[5] If I eat a hot dog, you can't eat that same hot dog. However, if I possess some information, you can possess and benefit from that same piece of information. Thus, my knowledge of the information doesn't prevent you from using it. If some consumers of the information can obtain it costlessly (for example, you can read a book in a library), the producer of the information has

[5]See also, for example, Arrow (1962). When secrecy about a discovery can be maintained, this problem may be eliminated (Taylor and Silberston 1973, ch. 9; Kitch 1975; and Cheung 1982).

less incentive to produce it than if everyone had to pay for it. Why would anyone be willing to incur the entire expense of developing new information, processes, or products if people could benefit from them for free? Although some people like inventing for its own sake or as a service to humanity, many current inventors and firms undertake research for the pecuniary rewards.[6] Thus, if they could not benefit from their new developments, this latter group would not engage in research.

Eliminating most such research would harm society because it has social value. New manufacturing methods lower the costs of producing existing products and allow society to produce more output with the same amount of input. New products increase productivity (for example, improved seeds with higher output or better quality) or give pleasure (videocassette recorders). Indeed, society becomes dependent on many new inventions. For example, 46% of Americans say they do not know how they could get along without Scotch tape.[7] Although 11% of Americans say the wheel is the greatest invention of all time, 10% say the automobile is.[8] How would our world survive without perforated toilet paper, invented in the 1880s by English manufacturer Walter James Alcock; the zipper, designed for boots and shoes by Chicago engineer Whitcomb L. Judson, who filed for a patent in 1893; or the Barbie doll, developed by Ruth Handler in 1959?[9] Of course, not everyone believes all new products are desirable: 67% of Iowans think music videos are among the "least useful changes" in modern life.[10] Further, 0% of American car owners keep gloves in their glove compartments.[11]

To create new products, many firms invest large amounts of money. For example, IBM Corp. spent $4.75 billion in 2002, or 5.9 percent of revenues. However, R&D expenditures as a percent of revenues vary substantially across firms: In 2002, Chevron Texaco (oil) invested 0.2% of its revenues in R&D; Hewlett-Packard (equipment, computers) invested 5.8%; Microsoft (software), 15.2%; Advanced Micro Devices (microprocessor chips), 30.3%; Biogen (biotechnology), 32%; and Genentech (biotechnology), 22.9%.[12] Of the 71,000 U.S. corporate-owned patents issued to Americans in 2000, universities held only 4.4%.[13]

[6]John Walker (the inventor of matches) and Pierre and Marie Curie (the discoverers of a process for isolating radium) never took out patents because they believed that their inventions should belong to all of humanity. Recently, much computer software, such as Linux, is *open source*, in which innovators make software code publicly available (Lerner and Tirole 2002a).
[7]Roper Organization, as cited in Lapham, Pollan, and Etheridge (1987).
[8]R. H. Bruskin, as cited in Lapham, Pollan, and Etheridge (1987).
[9]Irving Wallace, David Wallechinsky, and Amy Wallace, "The Column of Lists: Anonymous Inventions," *San Francisco Chronicle,* August 10, 1988:B3.
[10]Des Moines Register and Tribune Company, as cited in Lapham, Pollan, and Etheridge (1987).
[11]Runzheimer International, as cited in Lapham, Pollan, and Etheridge (1987).
[12]Data from individual firms' 10-K forms. These comparisons may be somewhat misleading. For example, oil companies appear to do little R&D because their value added as a fraction of sales is low. Oil companies appear more R&D-intensive if we compare R&D to value added or scientists to total employment.
[13]U.S. Patent and Trademark Office, **www.uspto.gov/web/offices/ac/ido/oeip/taf/univ/asgn/table_1.htm**.

U.S. investment in knowledge—defined as the sum of investment in R&D, software, and higher education—was almost 7% of gross domestic product (GDP) in 2000, well above the share for the European Union or Japan.[14] The average for Organization for Economic Cooperation and Development (OECD) countries (large developed nations) was 4.8% of GDP, of which almost half was for R&D. OECD countries spent $645 billion on R&D in 2001, with the United States accounting for 44% of the OECD total, the European Union 28%, and Japan 17%. More than 30% of total business R&D is in the service sector in Norway, Denmark, Australia, and the United States, but less than 10% falls in this sector in Germany and Japan. High-technology industries invested more than 52% of total manufacturing R&D in 2000: over 60% in the United States, 47% in the European Union, and 44% in Japan. As of 2000, gross domestic expenditure on R&D is over 4% of GDP in Israel; between 3% and 4% in Sweden and Finland; between 2% and 3% in the United States, Korea, and most OECD countries; and between 1% and 2% for Canada and the United Kingdom. While 37% of U.S. and 34% of Japanese citizens have post–high school education, only 21% do so in the European Union, according to the OECD.

The United States apparently puts more resources into pure research, rather than commercial applications, than other countries, receiving more Nobel prizes in the sciences since 1950 than all the other countries in the world combined. However, the percentage of defense R&D was 14% in the United States in 2001, compared to virtually nothing in other OECD countries.

Imitation Discourages Research

Men often applaud an imitation and hiss the real thing. —*Aesop*

Without a patent, anyone could use new information, and *imitations* of new inventions could be sold legally. Suppose you discovered a cure for AIDS. You could sell your new drug for large sums of money if a patent gave you exclusive rights. Without a patent, other companies could duplicate your drug, and competition would drive the price to the competitive level. You would incur all the research costs, but not all the private benefit (profits). For example, Ford's innovation of an assembly line was quickly duplicated by others. Every firm wants to copy others' inventions, and no firm wants to go to the expense of inventing anything itself. Thus, without patents, consumers could buy new inventions at competitive prices, but there would be few new inventions. Indeed, society tries to reduce the number of certain types of new inventions by not offering patent protection. For example, in the United States, you cannot patent a gambling device such as a slot machine.

Even with patents, the return to the inventor of a new invention may be less than its value to society. For example, although Xerox earns substantial returns from its plain paper copier, other companies, upon seeing Xerox's success, were able to invent similar but not identical products. They were able to capture some of Xerox's plain pa-

[14] OECD, STI Scoreboard 2003. **www.oecd.org/dataoecd/41/0/17130709.pdf**.

per copier business in spite of existing patents. During a 10-month period in 1974, 16 companies, including IBM, Kodak, 3M, Addressograph-Multigraph, Bell & Howell, GAF, Litton, and Pitney-Bowes, obtained 390 patents in the field of xerography (Scherer 1981, 292). In many cases, then, competitors can “invent around” a patent, lowering the patent’s value to its inventor.[15]

In 1992, an appeals court judge ruled that reverse engineering (disassembly) is “fair use” of software. The court ruled that[16]

> Disassembly of copyrighted object code is, as a matter of law, a fair use of the copyrighted work if such disassembly provides the only means of access to those elements of the code that are not protected copyright and the copier has a legitimate reason for seeking access.

Reverse engineering is used by software manufacturers to create applications that are compatible with certain hardware or that imitate functions of other software programs.

Moreover, many patents and copyrights are not enforced (Example 16.1). Mansfield et al. (1982) estimate that imitators’ costs average only 65% of innovators’ development costs. A survey of high-level R&D managers in 129 lines of business finds that even for major new or improved products, many firms are capable of duplicating an innovation (Levin, Klevorick, Nelson, and Winter 1987). In 2% of the cases, no firm is capable of duplication; however, in 19% of the cases, 1 or 2 firms are capable of duplicating; in 57% of the cases 3 to 5 firms are capable; in 20%, 6 to 10 firms; and in 3%, more than 10 firms. For a typical new product, the corresponding numbers are 1%, 4%, 26%, 49% and 20%. That is, for a typical new product, in 70% of the cases, 6 or more firms can produce an imitation.

Work on copying innovations can start quickly. Information about R&D programs in manufacturing industries is in the hands of at least some rivals within 12 to 18 months after the development decision is made (Mansfield 1985). Information spreads due to movements of employees between firms, formal and informal communications among engineers and scientists at various firms (especially at professional meetings), reports of input suppliers and customers, and reverse engineering of new products.

Even if the patent restrictions can be circumvented, patents increase the cost of imitation, as Table 16.2 shows. At the very least, they typically delay the time when imitators enter the market. Mansfield (1968) reports that in the United States, the time between the first use of a major innovation and the time when 60% of all related products have imitated the innovation can be as short as a month (see Example 11.4) or a year (packaging beer in tin cans), or as long as several decades (by-product coke oven for steel mills and continuous annealing of tin-plated steel). Of 48 firms interviewed, the median estimate of the increase in the cost of imitation due to patents is

[15] To prevent entry by rivals, defensive *sleeping patents* may be obtained by the original inventor. These similar patents are not used but prevent others from patenting these similar products. See Gilbert and Newbery (1982), Chapter 11, and the following discussion.

[16] Shawn Willett, “Appeals Court Judge Rules Reverse Engineering Is Fair Use of Software,” *InfoWorld,* November 2, 1992, 14:24.

EXAMPLE 16.1 *Piracy*

A patent, copyright, or trademark is of little value if the right is not enforceable. Protecting intellectual property, such as music and computer software, from unauthorized copying has proved difficult. Music and software publishers have responded in many ways to the threat of piracy. For example, they have sued companies such as Napster that facilitate copying and have instituted copy protection schemes. So far, these attempts to prevent copying have had at best limited success anywhere in the world. By some estimates, 90% of movies, music, and software in China comprises illegal copies that are sold for a fraction of the original price—one-fifth for many new DVDs. Worldwide use of music-sharing services such as Napster and Kazaa flourished, at least before a series of lawsuits by publishers in 2003. These lawsuits apparently had some success in the United States. According to one survey, the share of computer users who employed file-sharing programs to download music fell from 29% in the spring of 2003 to 14% by late 2003.

Music and software publishers claim that they suffered piracy losses in excess of $17.6 billion in 2002. However, it is possible that consumers who use pirated copies eventually decide to purchase legitimate copies of that work or other related works. Thus, the effect of piracy on legitimate demand is an empirical question. Hui and Png (2003) examine this question using data from 28 countries for music CDs from 1994 through 1998. They conclude that publishers' losses from theft outweigh the positive effects of piracy. Adjusting for the positive effects, they conclude that the industry's 1998 loss was 42% of the industry estimate, or 6.6% of sales.

However, Hui and Png note that, were it not for the piracy, publishers would have increased prices, so that the industry suffered additional forgone revenue losses. For example, in response to unrelenting online piracy, Universal Music Group, the world's largest record company, announced in 2002 that it would sell 43,000 downloadable songs without monthly fees or copying restrictions and in 2003 that it would cut prices on its CDs by as much as 30% to lure consumers back to stores. Thus, although piracy hurts producers, the implications of piracy for overall welfare are ambiguous.

Sources: Joseph Kahn, "The Pinch of Piracy Wakes China Up on Copyright Issue," *New York Times*, November 1, 2002:C1, C5; Benny Evangelista, "Universal to Sell Songs Online for 99 Cents," *San Francisco Chronicle*, November 20, 2002:B2; Hui and Png (2003); Amy Harmon, "Universal to Cut Prices of Its CD's," *New York Times*, September 4, 2003:C1, C2; Nick Wingfield, "Online Swapping of Music Declines in Wake of Suits," *Wall Street Journal*, January 5, 2004:B4.

11% overall, 30% in ethical drugs (pharmaceuticals without advertising directed at consumers), 10% in chemicals, and 7% in electronics and machinery (Mansfield et al. 1982).

Similarly, the Levin, Klevorick, Nelson, and Winter (1987) survey finds (Table 16.3) that the cost of duplicating an innovation as a percentage of the innovator's cost

TABLE 16.2 **Estimated Percentage Increase in Imitation Cost Due to Patents for 33 New Products in the Chemical, Drug, Electronics, and Machinery Industries**

Percent Increase in Imitation Cost	Number of Products	Percent of Cases Studied
Under 10%	13	39%
10–19%	10	30%
20–49%	4	12%
50–99%	0	0%
100–199%	3	9%
200% and more	3	9%
Total	33	100%

Source: Mansfield (1984).

TABLE 16.3 **Cost of Duplicating an Innovation as a Percentage of the Innovator's R&D Cost: Frequency Distribution of Median Responses**

Type of Innovation	Less Than 25%	26%–50%	51%–75%	76%–100%	More Than 100%	Timely Duplication Not Possible
Major new process						
Patented	1	5	19	66	26	10
Unpatented	5	10	55	49	6	2
Typical new process						
Patented	2	15	61	41	6	2
Unpatented	8	43	58	14	4	0
Major new product						
Patented	1	4	17	63	30	12
Unpatented	5	13	58	40	7	4
Typical new product						
Patented	2	18	64	32	9	2
Unpatented	9	58	40	15	5	0

Note: Each row adds to 127, reflecting the 127 lines of business surveyed.

Source: Levin, Klevorick, Nelson, and Winter (1987, Table 8, 809).

was higher for patented than unpatented major or typical processes or products. They also show that on average it takes longer to duplicate a major new product if it is patented than if it is not. As a result, even though obtaining a patent requires revealing information to potential imitators, many firms obtain patents.

Patents Encourage Research

By imposing costs on potential imitators, patents can give market power to patent holders. The resulting profits can be a strong inducement to be the first to invent a new product.

A rational inventor engages in costly research up to the point where the expected marginal return from more research equals its marginal cost. If the inventor's return is less than society's, the inventor tends to underinvest in research. Patents may permit inventors to capture a large share of the benefits (internalize the externality) associated with the production of knowledge by insulating them from competition. By granting these exclusive rights through patents, society encourages more inventions in some industries (see Example 16.2 and **www.aw-bc.com/carlton_perloff** "The Importance of Patents Varies by Industry"). However, even when patents protect the inventor from imitation, the patent holder's monopoly profit is less than the full social benefit (unless the patent holder can price discriminate). Thus, although patents encourage additional research, they may induce less than the optimal level.

Alternatively, patents may also encourage too much innovation (Hirshleifer 1971, Mansfield et al. 1977). For example, suppose an improved method of weather prediction is developed that allows accurate prediction of crop yields after all planting decisions have been made. The inventor can make a fortune speculating on future farm prices. Despite the profits from speculation, there may be little efficiency gain to society from the new forecasting technique.

Patents Encourage Disclosure

Disseminating new ideas is valuable to society (see Example 16.3). The sooner a good new idea is adopted, the quicker society benefits. Moreover, one idea can lead to others. Thus, policies that increase the diffusion of inventions are desirable.

Some countries' patent laws encourage disclosure of new discoveries sooner than other countries' laws. To obtain a patent, an inventor must demonstrate that the invention is novel and nonobvious. By providing patent protection to inventors, society obtains two valuable results: greater incentives for additional research and development and an acceleration of innovation through disclosure of inventions.[17] Section 112 of the patent law states that

> the specification shall contain a written description . . . in such full, clear, concise and exact terms as to enable any person skilled in the art . . . to make and use the same.

Such disclosure can increase the pace of invention as one inventor builds on the work of another. For example, the government maintains a "microbe zoo" in Rockville, Maryland, where, for $70 (or $40 for nonprofit organizations), virtually anyone with a college degree in science can buy a vial of the same genetically altered cells that Genentech developed at a cost of $200 million to produce TPA, a clot-dissolving drug designed to

[17]This section is based on Scotchmer and Green (1990).

EXAMPLE 16.2 *Patents Versus Trade Secrets*

In exchange for a patent and its protection, an inventor's ideas are exhibited for the entire world to see. Consequently, rather than patent and reveal their new ideas, many firms keep the details of their innovations secret. Moreover, some countries do not have patent systems covering all ideas.

Are patents crucial for inventive activity? Are trade secrets a good substitute? To answer these questions, Moser (2003) collected data from exhibition catalogues for two nineteenth-century world fairs on technology: the Crystal Palace Exhibition in London in 1851, with 13,876 exhibits in 30 industries, and the Centennial Exhibition in Philadelphia in 1876, with 19,076 exhibits in 344 industries. National committees picked the most innovative products for exhibition. Products displayed at the exhibitions were economically useful (that is, commercial) innovations. Only a fraction of innovations are patented, and not all patents lead to economically useful innovations. Indeed, many of these products were not patented in either the home country or the country where they were exhibited.

Many economists (such as Nordhaus 1969 and Gilbert and Shapiro 1990) contend that strong patent laws raise the number of innovations that are made within a country. One might infer from these arguments that countries without patent laws should display few important new technologies. However, countries without patent laws brought many important innovations to the fairs and received a disproportionate share of medals for outstanding innovations.

Switzerland had the second-highest number of exhibits per capita among all countries that visited the Crystal Palace Exhibition. Swiss inventors, who concentrated on watch making and specialized steel making for scientific and optical instruments, kept their innovations secret rather than patent them. This strategy was successful because their potential English competitors found these innovations to be difficult to reverse engineer. Had the Swiss inventors obtained patents, their rivals would have learned their most important secrets.

Moser does not find evidence that patent laws increased levels of innovative activity but does report strong evidence that patent systems influenced in which industries innovative activity occurred. In countries without patent laws, inventors concentrated on industries where secrecy was effective relative to patents. Because the manufacture of scientific instruments became mechanized during this period, progress in this industry required innovations in manufacturing machinery, which critically depended on patent protection. Inventors in countries without patent laws began to specialize in food processing, another industry where secrecy was effective. The share of Dutch innovations in food processing rose from 11 percent to 33 percent after the abolition of the Netherlands' patent laws in 1869 under pressure from the Free Trade party. Moser concludes that introducing forceful and effective patent laws in countries without patents may have a stronger influence on changing the direction of innovative activity than on raising the number of inventions.

Source: Moser (2003).

EXAMPLE 16.3

Monkey See, Monkey Do

Some of humans' closest relatives also invent. In 1953, a young female macaque monkey in the south of Japan invented an improved method of food preparation when she washed a muddy sweet potato in a stream before eating it. Some monkeys quickly imitated her behavior, and it became the norm in her immediate group in fewer than 10 years. By 1983, all Japanese macaques used this method.

This Einstein of monkeys innovated again in 1956. She invented a new technique of throwing handfuls of mixed sand and wheat grains upon the sea and then skimming the floating cereal from the surface. By 1983, virtually all Japanese macaques were using her method.

Thus, monkeys can invent, can learn from others by observing, and are willing to replace old methods with superior processes. However, the diffusion of inventions—adoption by others—takes time. In these cases, full diffusion took three decades.

Sources: Kawai, Watanabe, and Mori (1992); Hall (forthcoming).

prevent heart attacks.[18] The purchaser can use the vial for research purposes, but may not violate Genentech's patent and sell the product in competition with Genentech. The TPA-producing cells are just one of more than 8,000 patented life forms at the American Type Culture Collection. For $560, a firm may make a deposit consisting of six vials of living materials. The fee covers 30 years of storage. By depositing here, a company partially meets the patent requirement to supply enough information to allow a skilled specialist to reproduce its invention. It has been estimated, however, that only 1 percent of recombinant DNA patents need a deposit today; the general scientific community has a good understanding of the technology so that a written description is sufficient. For a $100 fee, a depositor obtains a list of all the people requesting a sample of its patented organism, which may be useful to check for patent infringement.

Some firms do not patent discoveries so that their competitors will not learn about them. These firms must protect their secret knowledge (*trade secrets*) from leaking out to others, as can occur when employees take a job with a competitor. It is illegal for employees to reveal trade secrets of their former firms. To the degree that firms use the patent system, there is greater disclosure than would occur with trade secrets.

The United States, under the 1951 Invention Secrecy Act, blocks patents from being issued and, in some cases, prohibits the inventors from selling or licensing their technology to anyone except the government if it believes doing so could threaten national security. Nearly 6,000 inventions are still covered today, even with the end of the Cold War. Most are nonnuclear technologies that the government does not want to see exported, including computer hardware, advanced ceramic materials, laser systems, and others.

[18] Sabin Russell, "'Microbe Zoo' Stores Life Forms," *San Francisco Chronicle,* May 23, 1988:C1, C5.

Competing firms may make similar discoveries at virtually the same time, although two or more applications for nearly identical inventions represent only about 1 percent of all U.S. patent applications.

The novelty requirement greatly affects possible profits and the incentive to disclose. The more extreme the requirement that an innovation differ from previous ones, the harder it is to obtain a new patent, and the longer the owner of a current patent can earn monopolistic profits. As a result, the more stringent the novelty requirement, the greater the reward to a patent and hence the greater the incentive to engage in research. On the other hand, the less frequently patents are issued, the less likely one can obtain a patent, so the lower the incentive to engage in research. Moreover, the less frequently patents are issued, the less disclosure there is, which tends to slow research by others. Thus, the stringency of a novelty rule affects the trade-off between rewards and incentives and has an ambiguous effect on the incentive to engage in R&D.[19]

★Patents, Prizes, Research Contracts, and Joint Ventures

Most of the economic research on how to encourage inventive activity has centered on choosing the optimal patent system. But why should society only use patents? Why not use other incentives such as *prizes* and *government research contracts*?[20] For example, the government could offer a cash prize to the first person who discovers a cure for AIDS, or it could give research contracts to firms or individual researchers to work on an AIDS cure. Alternatively, the government could relax antitrust prohibitions (as the U.S. government has done) to allow firms to coordinate research activities through research **joint ventures.**

The following example illustrates how patents, prizes, research contracts, and joint ventures affect research effort. (See **www.aw-bc.com/carlton_perloff** "Patents, Prizes, and Research Contracts" for the corresponding mathematical analysis.) Suppose there is an industry for research with the following properties (as illustrated in Table 16.4):

- There are an unlimited number of identical firms that can each undertake one research project. The number of firms currently in the industry, and hence the number of projects undertaken, n, is shown in the first column of Table 16.4.
- Each research firm can conduct one research study at a constant marginal (and average) cost: $m = 1$. Thus, the total cost of research for n firms is $C(n) = nm = n$ (Column 6).
- The more firms actively searching for a particular invention, the higher the probability that at least one of them will discover it. Thus, $\rho(n)$, the probability

[19] Scotchmer and Green (1990) show that a weaker novelty rule is better than a stronger rule in some markets, but they do not claim that their result holds in all markets. They argue, however, that first-to-file is better than first-to-invent in virtually all cases.

[20] The following comparison of prizes, research contracts, and patents is based in large part on Wright (1983).

TABLE 16.4 Costs and Benefits of Research Programs

Number of Projects, n	Expected Marginal Social Benefit	Expected Payoff with a Prize = B	Probability of Success, $\rho(n)$	Expected Social Benefit, $B\rho(n)$	Social Cost, $C(n)$	Net Social Benefit, $B\rho(n) - C(n)$
1	4.14	4.60	0.18	4.60	1.00	3.60
2	3.38	4.17	0.33	8.35	2.00	6.35
3	2.76	3.80	0.46	11.41	3.00	8.41
4	2.25	3.48	0.56	13.91	4.00	9.91
5	1.84	3.19	0.64	15.94	5.00	10.94
6	1.50	2.93	0.70	17.61	6.00	11.61
7	1.23	2.71	0.76	18.97	7.00	11.97
8	**1.00**	**2.51**	**0.80**	**20.08**	**8.00**	**12.08**
9	0.82	2.33	0.84	20.98	9.00	11.98
10	0.67	2.17	0.87	21.72	10.00	11.72
11	0.54	2.03	0.89	22.32	11.00	11.32
12	0.44	1.90	0.91	22.81	12.00	10.81
13	0.36	1.79	0.93	23.22	13.00	10.22
14	0.30	1.68	0.94	23.54	14.00	9.54
15	0.24	1.59	0.95	23.81	15.00	8.81
16	0.20	1.50	0.96	24.03	16.00	8.03
17	0.16	1.42	0.97	24.21	17.00	7.21
18	0.13	1.35	0.97	24.35	18.00	6.35
19	0.11	1.29	0.98	24.47	19.00	5.47
20	0.09	1.23	0.98	24.57	20.00	4.57
21	0.07	1.17	0.99	24.65	21.00	3.65
22	0.06	1.12	0.99	24.71	22.00	2.71
23	0.05	1.08	0.99	24.77	23.00	1.77
24	0.04	1.03	0.99	24.81	24.00	0.81
24.84	0.03	1.00	0.99	24.84	24.84	0.00
25	0.03	0.99	0.99	24.84	25.00	−0.16

$m = 1$, per-firm cost of a research project

$B = \$25$

$\alpha = 0.031$

$\rho(n) = (1 - e^{-\alpha n})$, probability of success with n projects

of (at least one) success (Column 4), is an increasing function of the number of firms, n.

- Research takes place in period $t = 0$. If the discovery is made in that period, society benefits in subsequent periods ($t = 1, 2, \ldots$). For simplicity, we assume that research does not take place in subsequent periods if the discovery is not made in the initial period.
- If successful, the research will allow production of a new product at a constant marginal cost. If the present value of the potential benefit to society (the

present value of the consumer surplus at the competitive price) from a successful invention is $B = \$25$, then the expected social benefit of having n firms race to make the discovery is $B\rho(n)$: the benefit times the probability of success (Column 5).

The analysis begins by determining the optimal number of firms racing to be the first to make the discovery. Next, we suppose that the government has as much information as firms about all possible research projects and ask how many firms would race under five possible government incentive programs: no government incentives, government research programs, government prizes, legal joint ventures (research projects funded by two or more firms), and patents. Finally, we examine how the analysis changes if the government has less information than research firms have.

Determining the Optimal Number of Firms

Society should choose the number of firms racing to make discoveries that maximizes expected *net social benefit* (Column 7 of Table 16.4), which is the expected social benefit, $B\rho(n)$, minus the social cost, $C(n) = nm = n$. In our example, net social benefit is maximized at 8 firms, as shown in Table 16.4 (bold row) and Figure 16.1a.

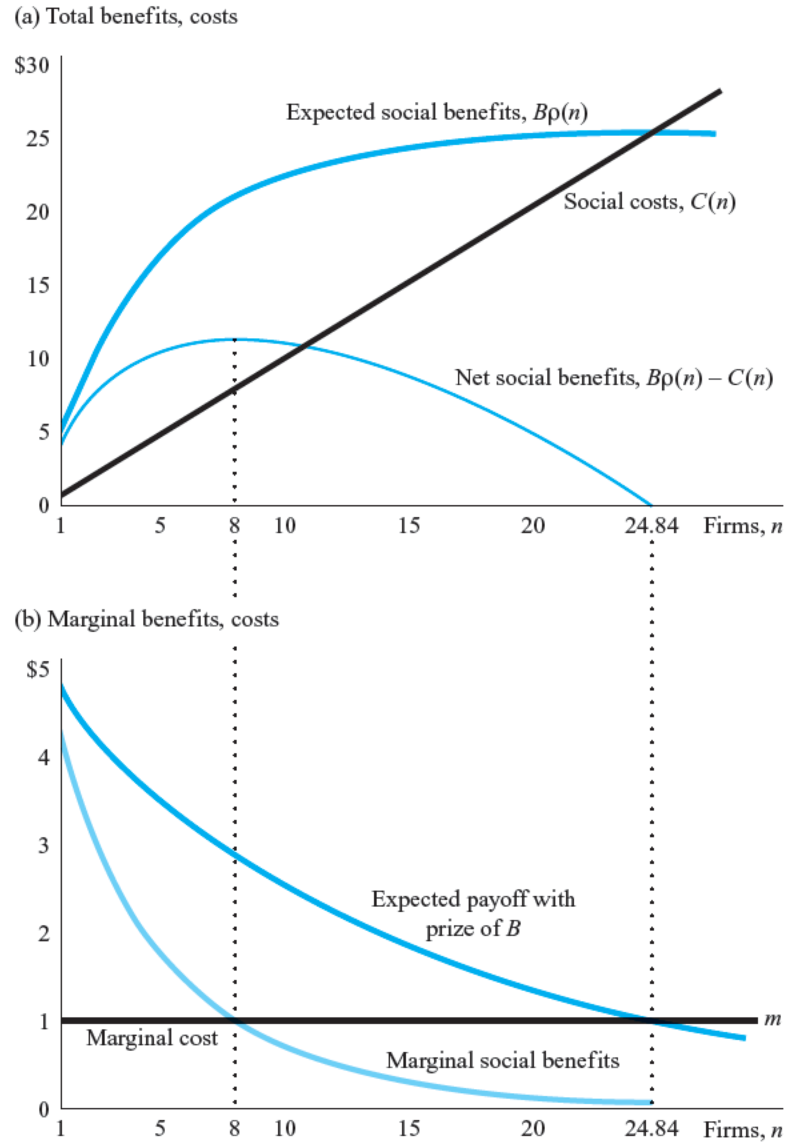
Figure 16.1a shows that both the social costs of a research program, $C(n) = n$, and the expected social benefits, $B\rho(n)$, increase with the number of research programs. When there are few firms, adding one more firm substantially increases the probability of success. However, in this example, as more firms join the race, the probability of success approaches 1 (certainty), so that adding more firms to the race has little effect on expected benefits. Thus, expected social benefits first rise rapidly and then level off. The thin blue line in Figure 16.1a is the expected net social benefit, $B\rho(n) - C(n)$, which equals the gap between the expected social benefits and social costs. The gap between social benefits and costs and the height of the net social benefits curve is maximized at 8 firms.

Another way to describe that result is to say that the marginal (social) cost equals the marginal social benefit at 8 firms (see Figure 16.1). The marginal social cost of one more research program is $m = 1$, which is the height of the marginal cost curve in Figure 16.1b and the slope of the cost curve in Figure 16.1a. The marginal benefit curve in Figure 16.1b equals the slope of the expected benefit curve in Figure 16.1a. The gap between expected benefits and costs is greatest in Figure 16.1a at $n = 8$—where the slope of the benefit and cost curves are equal (in Figure 16.1b).

Suppose that one more firm undertakes a research project. The expected benefit increases by 0.9 from 20.08 to 20.98 (Table 16.4), but the marginal cost of that extra research project is 1, so net benefits fall by $0.1 (= 1 - 0.9)$, from 12.08 to 11.98.[21]

[21]The marginal benefit, the derivative of $B\rho(n)$ with respect to n, at $n = 8$ only approximately equals the benefits at $n = 9$ minus the benefits at $n = 8$.

FIGURE 16.1 Costs, Expected Benefits, and Net Social Benefits from R&D



No Government Incentives

Is it progress if a cannibal uses knife and fork? —*Stanislaw Lem*

In the absence of patents and other incentives to invent, few, if any, inventions may be produced. If once a discovery is made everyone can copy it, then the new product is sold at a competitive price, and the inventor makes no economic profits. If inventors bear the full private and social cost of research ($m = 1$) but receive no private financial benefits from their inventions, the profit-maximizing solution for inventors is to engage in no research.

Government-Financed Research

A government can encourage more research by subsidizing research costs. The U.S. government, for example, has given 20 percent tax credits for R&D expenditures. These credits have increased over time. For example, a 1992 U.S. Tax Court decision permits companies to use stock options for engineers (incentives for workers) in calculating R&D tax deductions. India provides both tax breaks and special duty-free export zones for its software makers.

More directly, the government can pay firms to conduct research. In the preceding example (Table 16.4), the government can ensure that the optimal number of research projects is undertaken by offering eight research contracts to the lowest bidders and retaining the rights to successful products. Competitive bidding drives the price to $m = 1$. Assuming that the firms engage in energetic research even though payments are independent of success, this approach leads to the optimal solution. Of course, the government can only pick the optimal number of firms if it knows the true research costs and expected benefits. With adequate information, this approach is efficient if the research is funded efficiently (for example, the government raises the money through nondistorting taxes, such as lump-sum taxes).[22]

In 2002, the federal government paid for 28 percent of the estimated $264 billion spent on R&D in the United States. Defense was 15 percent of the total R&D. Private industry paid 65 percent.[23]

Japan's Ministry of Economy, Trade, and Industry (METI—formerly MITI) finances laboratories that produce commercial products. Often a discovery is licensed to as many Japanese firms as possible. Other times, it is licensed to one firm for three to five years to develop the technology and then licensed broadly. METI spent 0.57 trillion yen in 2001, between one-eighth and one-half of Japan's R&D expenditures.[24] Other Japanese agencies, such as the Japan Research Development Corp., provide additional support.

Mansfield (1984), based on a study of 25 major firms in chemical, oil, electrical equipment, and primary metals industries in the United States, concludes that without government support, these firms would have funded only between 3 percent and

[22]In recent years, however, there have been complaints that, although the U.S. government funded the medical research, monopoly rights were given to a single company. For example, the National Institutes of Health spent $30 million developing Taxol, an anticancer drug, and then gave Bristol-Myers Squibb Co. exclusive commercial rights in 1991. Tim Smart, "How Many Times Must a Patient Pay?" *Business Week*, February 1, 1993:30–1.
[23]U.S. National Science Foundation: **www.nsf.gov**.
[24]**www.nsftokyo.org/rm97-06.html#mitibgt; www.meti.go.jp/policy/tech_research/indicator/english(h13.10).pdf**.

EXAMPLE 16.4

Joint Public-Private R&D

Many research projects at land-grant universities in the United States and other public institutions are jointly funded by the public and private sectors. One fear is that the private funding distorts research away from maximizing the public good to maximizing private returns.

A case study of Canadian malting barley, which is used in the production of beer, illustrates how sources of funding affect research. Research is funded by the Canadian government, universities and associated research institutions, and by the Brewing and Malting Barley Research Institute (which is funded by private firms). The contribution from private firms was 28.3 percent of the total in 1951, but fell to 6.7 percent by 1981.

Research can improve the yield or quality of barley. Ulrich, Furtan, and Schmitz (1986) calculate the public (social) return and the private (industry) return. They conclude that the social rate of return would be at least 40 percent higher if only yield research were funded. The (relatively small) grants and liaison work from the private sector, however, are likely to keep public research institutes concentrating on a research path that produces both yield and quality improvements. The private sector's best strategy is to provide just enough funding to encourage the "right kind" of publicly funded research. They calculate that every $1 spent by the private sector costs the public sector $25.74 from distorted research that reduces social welfare.

Thus, the interaction between the public and private sectors can cause two problems. The problem that economists have traditionally worried about is that public investment in research displaces private investment. The private sector's share of R&D expenditures on barley has fallen substantially over time. A second problem is that relatively small private contributions may distort public research programs. At least with barley, the social loss from this distortion is large.

20 percent of the energy R&D that they performed with government support. Lichtenberg (1987) finds that, for the entire private sector, federal R&D expenditures do not statistically significantly raise or lower private-sector expenditures. Thus, the government can increase the total amount of research by offering government contracts because its funding does not reduce private research efforts by an equal amount (however, see Example 16.4). A reduction in private research is even less likely if the government funds research that private industry would otherwise ignore.

Prizes

I can forgive Alfred Nobel for having invented dynamite, but only a fiend in human form could have invented the Nobel Prize.

—*George Bernard Shaw*

The government, with little risk, can induce firms to engage in research by offering prizes for successful research because if no one makes the discovery, the government has no cost. Even if anyone can copy the discovery once the prize is awarded, a large

EXAMPLE 16.5 *Prizes*

Prizes are used to spur research. Three important historical examples are the development of the chronometer, the introduction of canning, and the invention of celluloid. A more recent example concerns refrigerators.

In 1713, prizes were offered in England to encourage the discovery of the measurement of longitude at sea. One of the important discoveries was that of Mayer, who was able to accurately predict the moon's position, which allowed a calculation of a ship's longitude. For this discovery, Mayer's widow received £3,000. Awards of £10,000, £15,000, and £20,000 were offered for a chronometer that measured longitude to within 60, 40, and 30 minutes respectively. In 1762, 49 years later, John Harrison claimed the £20,000 award. Payment was completed in 1773. By 1815, £101,000 in prizes had been awarded.

In 1795, Napoleon's Society for the Encouragement of Industry offered a prize of 12,000 francs for a method of food preservation that could be employed by the military. Fifteen years later, in 1810, Nicolas Appert received the prize for his method of food canning that used heat treatment of food in sealed champagne bottles.

In the 1860s, John Wesley Hyatt invented celluloid, the first synthetic plastic. By doing so, he won a $10,000 prize in a contest to develop a substitute for ivory billiard balls.

Electrical utilities, due to government regulation (see Chapter 20), often want to discourage electrical consumption at the margin. Refrigerators account for about a fifth of household electricity demand. In 1992, 25 electrical companies offered a prize of $27.5 million for the best design for a new refrigerator that runs on 25 percent less electricity than the government standard and uses no chlorofluorocarbons (a refrigerant blamed for damaging the ozone layer). They received 500 responses. In 1993, Whirlpool won.

Sources: Wright (1983, 704); Stigler (1986); Morris (1991).

enough prize can induce firms and inventors to undertake research (see Example 16.5). If the government sets the prize properly, the optimal number of firms race to win it; setting a higher prize, however, stimulates excessive research.

Optimal Prize. A firm undertakes a research project in an attempt to win a prize if its expected winnings are at least as great as its costs.[25] The number of firms racing to win the prize is determined by the size of the prize. To induce the optimal number of firms, n^*, to compete for a prize, the government must set the prize so that if n^* firms race to be first, each firm's expected earning equals its research costs.

[25]For simplicity, this example assumes that firms are risk-neutral and are willing to take a fair bet. That is, they participate in a gamble if their expected winnings equal their expected costs. Moreover, if there is a tie, the prize is either split equally or awarded randomly to one of the successful firms.

The probability that at least one firm makes the discovery is $\rho(n)$. If each of the n firms believes it has an equal chance of winning, then its expected gain is $\rho(n)/n$ times the prize. From the preceding analysis, we know that at the optimal number of firms, $n^* = 8$, the cost of a research project, $m = 1$, exactly equals the expected marginal social benefit of having n^* firms race to make the discovery. The optimal prize, then, is determined by dividing the expected marginal social benefit at $n^* = 8$, which is 1, by a firm's probability of winning, $\rho(8)/8$. Using the numbers in Table 16.4, the optimal prize is \$9.96 = \$1/(.80304/8).[26]

With this prize, each firm's expected winnings are the same as the expected marginal social benefits for $n = 8$ shown in Table 16.4. With $n = 8$, each firm's expected winnings are \$1.00, which equals its costs. A ninth firm considering joining the race calculates that its expected winnings are \$0.93 (\$9.96 $\times$ $\rho(9)/9$), or less than its cost of \$1.00, and decides that it is not worth joining the race. As a result, only the optimal number of firms, 8, compete for the prize. Net social benefit is maximized at \$12.08. As long as the government has the necessary information to set the prize optimally, and as long as the prize is financed without distortions, prizes can efficiently induce innovation.

Too High a Prize and the Common-Pool Problem

It might appear reasonable to set the prize equal to the social value of the discovery, $B = \$25$, rather than \$9.96. That prize is so high, however, that too much research is undertaken.

The *Expected Payoff with a Prize* $= B$ column in Table 16.4 shows a firm's expected benefit from engaging in research if the prize is \$25. If 24 firms engage in research, the probability, $\rho(24)$, that at least one will be successful is 99.24 percent, so the probability that a particular firm wins the prize is 0.9924/24 = 4.13 percent. As a result, each firm's expected prize is \$25 times 4.13 percent, or \$1.03, as shown in Table 16.4. With 25 firms competing, each firm's expected earnings are \$0.99 (less than the cost of a research project). Thus, if there can only be a whole number of firms racing for the prize, 24 firms compete.

That much research is excessive because the competition dissipates almost all of the rents from research. Table 16.4 shows that the net social benefit when $n = 24$ is \$0.81: The social cost of the research nearly equals the expected benefits. This problem is analogous to the overfishing or *common pool* problem (see **www.aw-bc.com/carlton_perloff** "Commons"). Each firm considers its private return rather than the social return when deciding whether to undertake research. If there can be a fractional number of research projects, 24.84 projects are undertaken, and net social benefits are completely dissipated. Figure 16.1b shows the expected returns from each research project, which are equal to the marginal cost, \$1.00, when there are 24.84 projects. In

[26]The prize equals $B\rho'(n^*)/[\rho(n^*)/n^*]$, where $B\rho'(n^*)$ is the expected marginal social benefit from having n^* compete, and $\rho(n^*)/n^*$ is the probability that one of the n^* firms will be the first to make the discovery. See **www.aw-bc.com/carlton_perloff** "Patents, Prizes, and Research Contracts."

contrast, the expected marginal benefit to society from having the last project is only about 3¢, as shown in Table 16.4.

To summarize, when the prize is set at $9.96, only 8 firms compete, and the probability that at least one will make the discovery is only 80 percent. When the prize is set at $25, 24 firms compete and the probability rises to 99 percent. Increasing the probability by these extra 19 percentage points, however, requires that the social cost of the research rise from $8 to $24, or 300 percent. Thus, raising the probability by 19 percentage points does not pay. With a prize of $9.96, net social benefit is maximized at $12.08, whereas with a prize of $25, net social benefits are essentially eliminated.

Relaxing Antitrust Laws: Joint Ventures

The reason there is too little research without additional incentives, such as prizes and government research contracts, is that there is an externality if an inventor cannot capture the full value of a new discovery. In the absence of patent laws, each firm interested in producing a new product prefers to copy the discovery of another firm that paid to develop the product. As a result, each firm may wait for others to bear the cost, and little research is undertaken.

If all the firms in an industry, however, agree to share the cost of development in a research joint venture, this externality problem can be avoided. Firms may fear, however, that such joint research activity may lead to antitrust prosecutions. When the firms meet to agree on funding the research and sharing existing knowledge, the government may suspect that they also conspire to set the price for the new product at the monopoly level. Many policy makers and economists argue that antitrust laws and policies should be changed to encourage joint research activities (but not joint price setting).[27] The National Cooperative Research Act of 1984 tried to reduce firms' fears of antitrust penalties by lowering the damages a joint venture must pay if it is convicted of an antitrust violation. One provision of this act is that registered joint ventures cannot be sued for punitive damages and treble damages under the antitrust laws.

When several patents covering a single process are owned by multiple firms, a firm may be inhibited from engaging in R&D for fear that its invention may be worthless unless it can license the other relevant patents on reasonable terms. In such situations, firms may form a patent pool, in which they agree to cross-license patents to each other at reasonable rates (Lerner and Tirole 2002b). However, firms with competing patents can use patent pools to collude and can either exclude or charge a monopoly price to firms outside the pool (Gilbert 2002).

The U.S. Department of Justice (DOJ) has approved patent pooling in a number of antitrust cases (Gallini 2002). For example, in 1997, the DOJ allowed the pooling of patents for the MPEG-2 video compression technology, which involved nine patent holders and 27 patents. Similarly, the DOJ permitted pooling of Digital Versatile Disk (DVD) technologies in 1998 and 1999.

[27]See, for example, Ordover and Willig (1985), Grossman and Shapiro (1986), Brodley (1990), Jorde and Teece (1990), and Shapiro and Willig (1990).

It is unclear, in the preceding example, whether a joint venture finances the optimal number of research projects. On the one hand, a joint venture may be able to avoid needless duplication of research projects, and hence its costs of research may be lower than when there is competition. On the other hand, if the joint venture cannot capture the full expected social value, $B\rho(n)$, the joint venture undertakes too little research, because it bears the full social cost.[28] Except when it can act as a discriminating monopoly, a joint venture typically captures less than the full social value of a new product, which includes consumer surplus. Moreover, in an industry where research can be easily copied by firms outside the joint venture, the joint venture may capture little of the social value of a discovery. Joint ventures are unlikely to generate substantial research in such markets.

Joint ventures in technological fields, where R&D costs are high, are becoming increasingly common in the United States. Under the National Cooperative Research Act, 111 cooperative endeavors were registered between January 1985 and June 1988 (Jorde and Teece 1988). Joint ventures are more common in Japan and Europe.

International joint ventures are increasingly common. For example, in 1992, Toshiba, IBM, and Siemens announced they would collaborate in developing advanced memory chips and, on the same day, Fujitsu and Advanced Micro Devices said they would jointly manufacture flash memories (which are used for data storage instead of disk drives). From April 1991 to July 1992, at least seven technology alliances to produce memory chips were formed between U.S. and Japanese firms.

Patents

Patents, which grant exclusive rights to successful inventors, also induce research. Unlike prizes or government research contracts, however, patents lead to distortions due to monopoly pricing. Thus, they are less efficient than optimal prizes or research contracts if the government has sufficient information to induce the optimal amount of research. There are reasons to use patents, however, because the government typically has limited information. In any case, patents are an extremely common method of inducing research throughout the world. For example, the former Soviet Union, which one might expect to rely on government-directed research, issued one and one-half times as many patents as the United States.[29]

Value of a Patent. Suppose that the first successful firm receives a patent granting exclusive rights to sell the product. Does this reward of monopoly profits induce the optimal number of firms to conduct research? To determine how many firms engage in

[28]If the firms currently in the industry can obtain patent protection for a discovery they jointly finance, they can make it more difficult for other firms to enter the industry. This barrier to entry stems from the patent and not from the joint venture. Without such patent protection, firms are less likely to undertake a joint venture, because new entrants can profit from their discoveries.

[29]L. M. Boyd, "The Grab Bag," *San Francisco Examiner,* July 24, 1988: "This World" section, 7. An important U.S. example of an industry affected by patents is discussed at **www.aw-bc.com/carlton_perloff** "A Bell Patent Monopoly."

a **patent race**, in which several firms compete to be the first to make the discovery and be granted the patent, one needs to find out how much the patent is worth.

Continuing to use the same example, we add four assumptions to calculate the value of the patent:

1. The demand in each period for the new product is linear:

$$p = 6 - 5Q,$$

   where p is the price and Q is the number of units sold.
2. The marginal (and average) cost of production is 1.
3. If two firms make a discovery simultaneously, they split the patent rights.
4. The interest rate, r, is 10 percent.

A firm that obtains exclusive rights under a patent acts like a monopoly and maximizes its profits by setting marginal revenue equal to marginal cost. In the example, the monopoly charges price $p_m = \$3.50$, sells $q_m = 0.5$ units and makes annual profits of $\pi_m = \$1.25$. With monopoly pricing, the annual consumer surplus is \$0.65, which is one-fourth the consumer surplus of a competitive industry. These calculations show how much monopoly rights to sell the new good are worth per year. How much the patent is worth over time depends on how long it lasts. We consider two cases: a patent that lasts forever and one that lasts for only a few years.

Permanent Patent. If a patent lasts forever, the patent holder earns monopoly profits forever. These large potential rewards may induce many firms to race to win the patent, resulting in excessive research effort.[30]

If the patent lasts forever, and the interest rate $r = 10$ percent, the present value of the patent is $\pi_m/r = \$12.50$. That is, the present value of a stream of monopoly profits at the rate of \$1.25 every year forever is \$12.50. The present value of a permanent patent, in our example, is 50 percent (= \$12.50/\$25) of the net social value of the invention if the product were sold at competitive prices.

Each firm has an equal chance of obtaining the patent, so the expected return to a firm undertaking research is \$12.50 times the probability that it makes the discovery first, $\rho(n)/n$. A firm joins the patent race so long as its research costs, $m = 1$, are less than its expected benefits from winning the race.

In the example, 11.22 research projects are undertaken given permanent patent rights (see **www.aw-bc.com/carlton_perloff** "Patents, Prizes, and Research Contracts") if fractional projects are possible, or 11 if fractional projects are impossible.

[30]There is a large literature on patent races. Early articles include Usher (1964) and Barzel (1968). A later literature—Loury (1979), Dasgupta and Stiglitz (1980), Lee and Wilde (1980), Reinganum (1982)—which is surveyed in Reinganum (1984), investigates *poisson* patent races, in which the probability that a firm makes a discovery first depends only on its current R&D expenditures and not on its experience to date. An even more recent literature, where experience matters, is discussed later in this chapter.

Thus, in the example, a permanent patent leads to excessive research: 40 percent more research projects than the optimal number 8.[31]

Finite Patent Length. By having patents last shorter periods of time, *t*, the government can reduce the incentive for excessive research. Having exclusive rights for only *t* years reduces the present value of the flow of monopoly profits; thus, the expected private benefit to each firm is lower, so fewer firms engage in research.

Unlike a prize or a research contract, a patent causes a pricing distortion—a monopoly price—after a discovery. The government is faced with a trade-off: the longer the patent, the greater the inducement for research but the larger the cost due to more research projects and the monopoly loss. Given that the government uses patents, then, it should choose the length, *t*, to maximize expected net social benefit, taking into account monopoly pricing. Table 16.5 and Figure 16.2 show the net social benefits corresponding to various patent lengths, *t*.[32] Both show the number of projects and associated net social benefits if fractional numbers of projects are possible and if only whole numbers of projects are possible.

As shown in Table 16.5, if fractional numbers of projects are possible, net social benefit is maximized when $t = 11.4475$, there are $n = 6.004$ projects, and net social benefit = \$8.608908. If there can only be whole numbers of projects, the best solution is $t = 11.4408$, $n = 6$, and net social benefit = \$8.608906. If t is set at 15.94, there are 8 projects, and net social benefit is \$8.08.

Because of the distortions associated with patents, society only wants approximately 6 projects rather than the 8 desired with prizes or research contracts. To get 8 projects rather than 6 using patents, the length of time for the grant of exclusive rights must be increased 39 percent from 11.44 to 15.94. An increase in the number of projects from 6 to 8 only increases the probability of success from 70 percent to 80 percent (Table 16.4), which does not fully offset the additional costs. The net social benefit falls 6.2 percent, from \$8.61 to \$8.08 (Table 16.5).

Prior to the patent law change of 1995, patents lasted 17 years in the United States. (Since then, they last 20 years.) Why 17 years? The length of patent protection, in the first piece of legislation passed after the Constitution was signed into law by George Washington in 1790, was related to the length of an apprenticeship, which lasted for 7 years.[33] Some in Congress wanted to offer patent protection for the length of two apprenticeships. Other representatives, however, wanted to allow the patent to be renewed after 14 years for another 7 years. Congress decided to split the difference and offer a single term of 17 years.

Setting a fixed length for a patent for all types of products probably means that monopoly power is granted for too long a period for some types of products and too short

[31] This result stems, in part, from the particular probability function used in the example: $\rho(n) = 1 - e^{-\alpha n}$, where $\alpha = .2031$. If we choose $\alpha = 0.1342$, the optimal number of projects is 9, but a permanent patent leads to 8.51 projects, which is fewer than the optimal number.

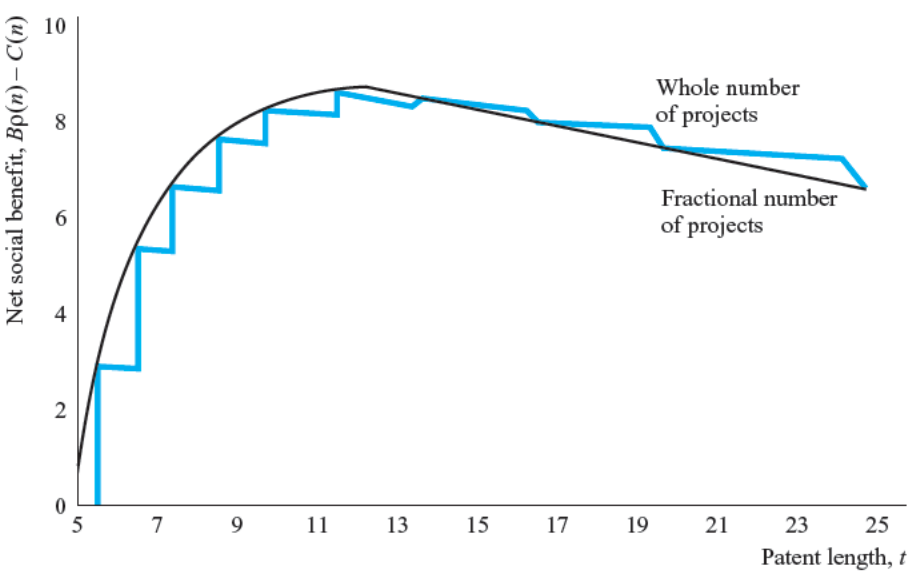
[32] We assume that the patent holder does not price discriminate. See, however, Hausman and MacKie-Mason (1988), who discuss the social desirability of price discrimination by patent holders and the effect of such discrimination on the optimal length of a patent.

[33] Michael Schrage, "Patent System Outmoded," *San Francisco Examiner,* November 3, 1991:E-14.

TABLE 16.5 **Optimal Patent Length**

	Fractional Firms Possible		Fractional Firms Impossible	
Length of Patent, *t*	Number of Projects, *n*	Net Social Benefit	Number of Projects, *n*	Net Social Benefit
5.35	0.50	$1.66	0.00	$0.00
5.71	1.00	3.10	1.00	3.20
6.53	2.00	5.35	2.00	5.35
7.47	3.00	6.91	3.00	6.91
8.56	4.00	7.91	4.00	7.91
9.00	4.35	8.14	4.00	7.84
9.87	5.00	8.44	5.00	8.44
10.00	5.09	8.47	5.00	8.42
11.00	5.74	8.60	5.00	8.29
11.4408	**6.00**	**8.608906**	**6.00**	**8.60891**
11.4475	**6.004**	**8.608908**	**6.00**	**8.60793**
12.00	6.31	8.59	6.00	8.53
13.00	6.82	8.51	6.00	8.41
13.40	7.00	8.47	7.00	8.47
14.00	7.26	8.39	7.00	8.39
15.94	**8.00**	**8.08**	**8.00**	**8.08**
19.51	9.00	7.48	9.00	7.48
25.36	10.00	6.72	10.00	6.72

FIGURE 16.2 Net Social Benefit Varies with Patent Length



EXAMPLE 16.6 *Mickey Mouse Legislation*

Mickey Mouse was going to enter the public domain in 2003, when the Walt Disney Company's 1928 copyright on the original Mickey Mouse character was set to expire. In response to intense lobbying by Disney and other corporations, congressional lawmakers passed a Mickey Mouse bailout law, the Sonny Bono Copyright Term Extension Act of 1998. This law increased copyright protection by at least 20 years for all "original works of authorship" such as books, songs, and graphical art copyrighted since 1923. Thus, this Mickey Mouse legislation extended Disney's rights to Mickey to 2023.

What is the logic behind this legislation? We grant monopoly power (a bad) to creators to encourage the production of new art or other inventions (a good) and hope that the net effect is positive. However, once the work has been created, granting additional monopoly power by extending the copyright period is unambiguously harmful. This act provided a huge windfall to holders of existing copyrights, including publishing conglomerates (such as AOL Time Warner) and movie studios (such as Disney) at the expense of the public.

The act also provides that any work copyrighted from 1978 on has copyright protection for the author or artist's life and the next 70 years (an increase from 50 years). Works copyrighted prior to 1978 are protected for 95 years. In contrast, the original 1790 legislation set the length of a copyright at 14 years with an option to renew for another 14 years.

The well-known images of Uncle Sam and Santa Claus were created by the nineteenth-century cartoonist Thomas Nast. Had Nast created under the Sonny Bono rules, everyone from the U.S. Department of Defense to retailers would be paying his estate royalties for these images, or, more likely, these images would not currently be an important part of our culture. Keeping works out of the public domain prevents others from using and extending original concepts, as Disney did when it drew on the work of the brothers Grimm to produce *Cinderella* and *Snow White*.

In 2002, a legal challenge to the Copyright Term Extension Act, *Eldred v. Ashcroft*, 57 U.S. 1160 (2003), reached the U.S. Supreme Court. Eric Eldred wanted to allow

a time for others.[34] Moreover, because, for some products, firms must obtain regulatory approval before the products can be sold, the effective patent life is shortened. To partially compensate for this problem, the Drug Price Competition and Patent Term

[34]Nordhaus (1969), however, argues that 17 years is close to optimal for many industries. Compare DeBrock (1985) and Dasgupta and Stiglitz (1980). See Gilbert and Shapiro (1990), who discuss the optimal coverage of a patent. Caves, Whinston, and Hurwitz (1991) examine what happens to prices of drugs when patents expire. They show that prices often remain high for some drugs, perhaps indicating that the monopoly power extends beyond the patent life.

people free access on his Web site to literary works such as Robert Frost poems and F. Scott Fitzgerald's novel *The Great Gatsby*, whose copyrights would have expired were it not for the great giveaway. His lawyer, Stanford Law School professor Lawrence Lessig, argued that the retroactive extension of copyright protection (but not the extension of protection to new works) violated the sense, if not the literal words, of the Constitution's grant to Congress of authority to "promote the progress of science" by issuing copyrights for "limited times." Fifteen economists from across the political spectrum, including the Nobel laureates Milton Friedman and Kenneth Arrow, wrote a brief supporting the challenge. At the hearing, Justice Sandra Day O'Connor said, "It is hard to understand how, if the overall purpose of the Copyright Clause is to encourage creative work, . . . some retroactive extension could possibly do that." As many people have, she concluded "One wonders what was in the minds of the Congress." Unfortunately, the Supreme Court rejected this challenge in 2003 in a 7–2 vote (O'Connor voted with the majority), apparently on the grounds of precedence: Congress has made this mistake of retroactively extending copyright protection many times in the past, including 11 times in the last 40 years.

Luckily, EU copyright protection lasts only 50 years. Consequently, copyright protection of a treasure trove of 1950s jazz (Ella Fitzgerald), opera (Maria Callas), and early rock 'n' roll (Elvis Presley) albums has expired or will expire soon. As these recordings enter the public domain in Europe, any European recording company can release albums that previously have been sold exclusively by a particular label. U.S. record companies are calling for EU countries to extend copyright terms, or failing that, for the United States to block imports of records still covered under U.S. copyrights that last 95 years.

Source: Amy Harmon, "Debate to Intensify on Copyright Extension Law," *New York Times*, October 7, 2002:C1; Amy Harmon, "Challenge in Copyright Case May Be Just a Beginning," *New York Times*, October 14, 2002:C4; Seth Shulman, "Freeing Mickey Mouse," *Technology Review*, November 2002:81; Anthony Tommasini, "Labels Ready for Battle on Copyright," *San Francisco Chronicle*, January 3, 2003:B2; Linda Greenhouse, "20-Year Extension of Existing Copyrights Is Upheld," *New York Times*, January 16, 2003:A22; **http://eldred.cc/eldredvashcroft.html; http://cyber.law.harvard.edu/openlaw/eldredvashcroft**.

Restoration Act of 1984 extends patent lives of pharmaceuticals to offset the delays in introducing new drugs as a result of regulatory requirements (Grabowski and Vernon 1986). In 1991–1992, Procter & Gamble asked Congress to extend its patent for the fat substitute olestra, which was due to expire in 1994, because the Food and Drug Administration was slow to approve it (some argue that Procter & Gamble delayed in submitting safety studies). Upjohn and U.S. Bioscience Inc. have also tried to extend patent claims through private bills before Congress. See Example 16.6 with respect to copyrights.

The time it takes to obtain a patent from the U.S. Patent Office differs across industries. According to the U.S. General Accounting Office, companies must wait an average of four years to obtain a patent in genetic engineering, compared to three years for other aspects of biotechnology, and an average of 18 months for all other types of patents.[35]

Where the pace of invention is rapid, the length of a patent may be irrelevant because new products eliminate the demand for older ones, even though the latter still have patent protection. In many European countries, patent lengths vary because patent holders must pay annual fees to maintain their monopoly rights under patents and may choose to let their patents lapse after a few years (Example 16.7).

Government Uncertainty

The example in Tables 16.4 and 16.5 demonstrates that if the government has as much information as research firms, it can set prizes or research contracts so as to induce the optimal level of research, maximizing net social benefit. When the government has full information, patents and joint ventures are less desirable than prizes or research contracts because they distort pricing. With prizes or research grants, after the discovery is made, the new product is sold at competitive prices, and consumer surplus is maximized.[36] For the life of a patent, a new product is sold at a monopolistic price, which leads to too few sales. However, if inventors have more information before they start inventing than do government officials, as seems likely, then patents and joint ventures may be superior.

Suppose the government sets a prize, research contract, or patent length before the value of an invention is known. If the researcher believes correctly that the invention is worth more than the value the government has set, then the patent may induce more research than the prize or government contract. Of course, if the length of the patent is very short, then prizes or research contracts, even if set too low, may be superior.[37]

In general, it is difficult for anyone, even the potential inventor, to predict the value of an invention beforehand. Indeed, even after it is invented, its value may be quite uncertain because demand is hard to predict or because of legal uncertainties about the ownership of the patent. For example, the inventor of the shoelace made $2.5 million on his patent, whereas the inventor of the safety pin earned only $400.[38] It is estimated that fewer than 1 of every 50 patent holders makes money from his or her patent.[39]

Patent Holders May Manufacture or License

A patent gives the inventor the monopoly on an idea for a fixed period of time. The patent holder may produce the product (or use its new process) or **license** (permit) others to produce it in exchange for a payment called a **royalty**. We will now show that

[35] *San Francisco Chronicle,* "How Slow Patent Process Hurts Biotechnology Firms," July 19, 1990:C2.
[36] If the inventor can obtain a patent on the government-financed research, however, this advantage is lost. Such patenting occurs in Australia (Tisdell 1974).
[37] Wright (1983) identifies the conditions under which patents, prizes, or research contracts are likely to be best in a world of uncertainty. Patents are likely to be best when the probability of success is low and the elasticity of supply of research is relatively high.
[38] L. M. Boyd, "The Grab Bag," *San Francisco Examiner,* March 27, 1988: "This World" section, 7.
[39] L. M. Boyd, "The Grab Bag," *San Francisco Examiner,* September 6, 1987: "Sunday Punch" section, 7.

EXAMPLE 16.7 *European Patents*

In many countries, unless patent holders pay an annual renewal fee, they lose their monopoly rights under the patent. A firm only renews a patent if the expected returns to one more year of exclusive rights exceed the cost of renewing. Pakes (1986) estimates the distribution of the value of holding patents in France and Germany and shows how this distribution changes over the lifetime of a patent. This information tells us the value to patent holders of the proprietary rights created by the patent in each year after the patent has been issued.

There is no renewal fee in France until a patent is 2 years old, 3 years old in Germany, or 5 years old in the United Kingdom. A patent can only be renewed until it is 16 years old in the United Kingdom, 18 in Germany, and 20 in France. Renewal fees are relatively low in all three countries in the early years, but increase significantly faster in Germany in later years.

The estimated average annual net profits from a patent, based on renewal data for the 1950s, 1960s, and 1970s, for France and Germany for the first five years, are (in 1980 $US):

Year	France	Germany
1	$380	$1,609
2	1,415	3,401
3	1,432	3,225
4	1,339	2,899
5	1,193	2,641

In France, the average annual initial net profit from a patent is $380. In that year, one-fifth of the French patent holders discover a use for the patent, allowing them to increase subsequent returns. Over 6 percent find that their patented ideas cannot be profitably exploited, so they do not pay the renewal fee in the second year. The rest renew, maintaining the option of patent protection while continuing to look for profitable uses. The average annual net profit on remaining patents rises to $1,415. The next year, another 9 percent fail to renew, and the average annual net profit increases to $1,432. Learning about profitable uses of the patent decreases over time, so that by the fifth year, virtually no more learning takes place, and obsolescence starts dominating learning. The average annual net profit on remaining patents falls to $1,193.

In contrast, the average initial net profit of German patents, $1,609, is much higher than French patents. One reason may be that 93 percent of French applicants are granted patents, whereas only 35 percent of German applicants are granted patents. As a result, fewer Germans bother to apply for patents of questionable value. A second factor is that French data contain all applicants, but the German data include only successful ones. The average annual net profit of German patents is $3,401 in the second year, $3,225 in the third, $2,899 in the fourth, and $2,641 in the fifth.

These results show that most patents have very low initial annual net profits. Indeed, most patent holders do not find a use for their patents within the first few years, and hence do not renew the patent after the first few years. Of those who do find a use for a patent, typically, they find it within the first few years. (See Schankerman, 1998, and Lanjouw, 1998, for more recent evidence on European patent renewals.)

a profit-maximizing inventor is indifferent between being the only seller of the product and licensing others to produce and sell it, so long as the product market was competitive prior to the invention.[40]

A Model of Licensing. Suppose a market was originally competitive and all firms produced at constant (marginal and average) cost m. The competitive price of the good was m, and Q units were sold. Now suppose someone develops a new process that allows the same good to be produced at a lower cost, $\underline{m}$, as shown in Figure 16.3a.

If the firm that owns the new patent decides to sell the product itself, it is essentially a low-cost dominant firm that faces a competitive fringe (Chapter 4).[41] The lowest price it considers charging is $\underline{m}$: Any lower price leads to losses. The highest price it can charge is m: Any higher price allows the fringe to undercut its price. Suppose that it is optimal for the dominant firm to charge just slightly less than m to prevent the fringe from making any sales. The profits from the invention are the difference between the old cost and new cost times the number of units sold. This amount is labeled *Royalties* in Figure 16.3a.

Now suppose the firm considers licensing other firms to use the new technology. The firm charges a royalty per unit of output sold by the other firms (*royalty rate*).

What royalty rate maximizes the firm's profits? To answer this question, we must determine the derived demand for a patent license: the maximum price a producer is willing to pay for a license. Figure 16.3a shows an example for a run-of-the-mill or minor invention that only slightly reduces the cost of production. The derived demand for licenses is the difference between the residual demand curve facing the patent holder and the cost of producing under the new process, $\underline{m}$. That is, the maximum royalty a competitive firm will pay for a license is the difference between the competitive price and the cost under the patented process. Thus, for the first Q units (the amount sold by a competitive industry), the competitive price is m, so the maximum royalty is $m - \underline{m}$, which is labeled the *Derived demand for license* in Figure 16.3a. If more units are sold, the value of the license drops, illustrating that the derived demand curve slopes down beyond Q units. Indeed, at Q^*, the value of a license is zero, because the competitive price equals the cost of production under the new process.

The profit-maximizing royalty occurs where the marginal revenue (MR) from selling one more license equals the marginal cost of a license. The marginal cost of a license is zero. Thus, the profit-maximizing royalty is determined by the intersection of the marginal revenue curve for a license with the quantity axis. In the case shown, that occurs at quantity Q and a royalty rate $r = m - \underline{m} = p - \underline{m}$. That is, the profit-maximizing royalty is the *total* per-unit savings from using the new process. This amount equals the earnings if the firm did not license the product, but sold it itself.

[40]This section focuses on only a small aspect of licensing. Gallini (1984), Gallini and Winter (1985), and Katz and Shapiro (1985a, 1986) discuss these and other important issues. For example, Gallini (1984) and Gallini and Winter (1985) note that, under certain circumstances, licensing may reduce inefficient R&D expenditures.
[41]This graphic presentation follows Arrow (1962), McGee (1966), Nordhaus (1969), and Dasgupta and Stiglitz (1980).

FIGURE 16.3 License Royalties

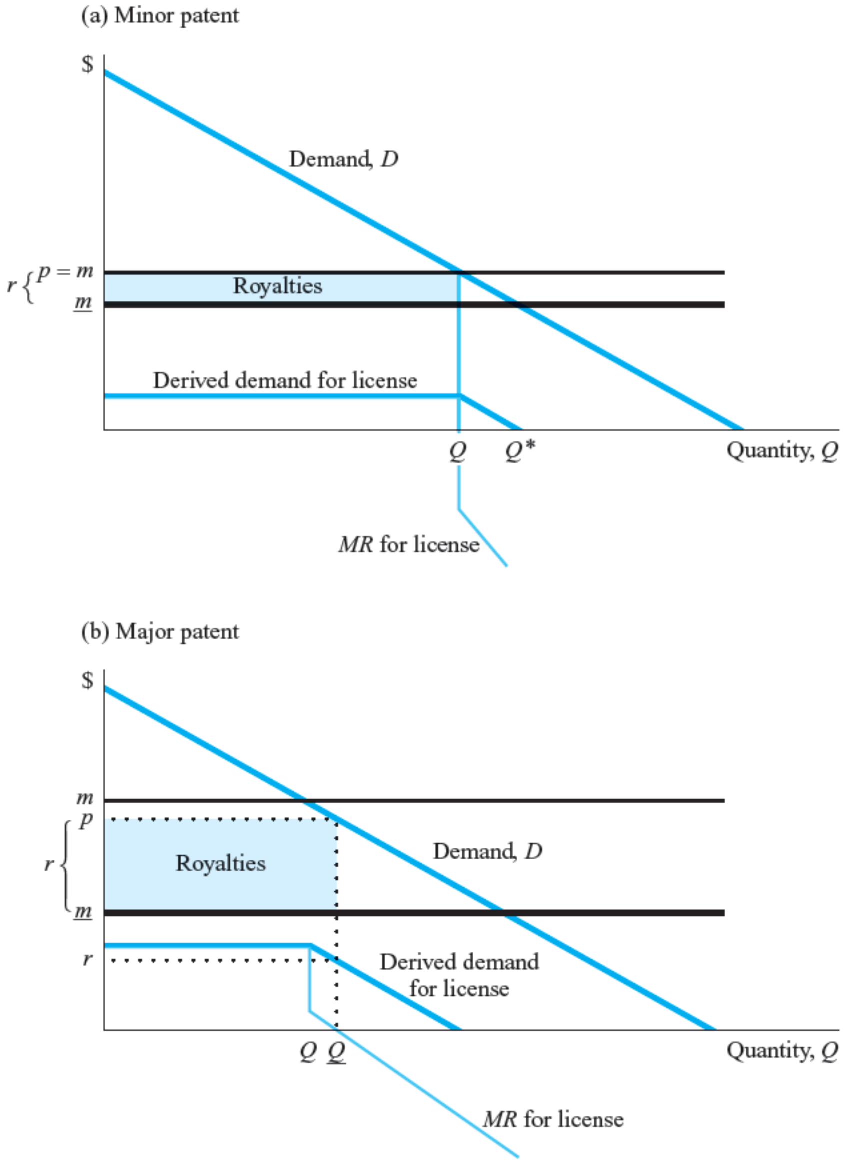


Figure 16.3b uses the same types of curves to examine the case of a major new process that produces a dramatic fall in costs. Here, the marginal revenue for the derived demand for licenses equals zero at $\underline{Q}$. The profit-maximizing price, p, lies between m and $\underline{m}$. As a result, the royalty rate $(r = p - \underline{m})$ is less than the cost reduction $(m - \underline{m})$, but $\underline{Q} > Q$ licenses are sold.

There are two conclusions from this analysis. First, if the inventor can produce as efficiently as others, the inventor is indifferent between selling the product and licensing it because the competitive fringe restricts the monopoly equally in both cases. Licensing is likely (and more profitable than not licensing) when licensees have lower manufacturing costs than the inventor. Licensing provides an important mechanism through which new discoveries can be implemented throughout the world (see **www.aw-bc.com/carlton_perloff** "International Licenses").

Second, the inventor captures all the gains to society of minor discoveries, but not of major discoveries. With minor discoveries, consumers continue to buy the same quantity at the same prices, so they are unaffected by the discovery. With major discoveries, price falls and quantity rises so that consumer surplus rises. So, with major discoveries, the inventor's gain is less than the total social gain.

Examples of Royalties. Licensing and the collection of royalties is very common. We discuss the licensing by two well-known companies and royalties collected by the record industry.

IBM has extensive and fundamental patents on all phases of computing. For example, it has a patent covering computer screen behavior such as when a cursor is on the last position on the last line of the computer display and you hit the carriage return/line feed button, the screen scrolls upward by one line. IBM has licensed its patents for over thirty years. By 1990, IBM claimed to have licensing agreements with 90 percent of PC manufacturers worldwide, collecting 1 percent to 3 percent of the selling price of all PCs. Other firms avoid paying royalties by signing cross-license agreements giving each firm access to the other's patents.

Record companies tried for years to obtain a royalty on analog tape recorders and blank audio cassettes that could be used to duplicate their records. With the arrival of the new digital audio tape and compact cassettes in 1991, they tried again. Under an agreement between digital audio technology companies and the recording and the consumer electronics industries, all digital audio tape recorders sold in the United States would be equipped with a special "serial copy management system" chip that would let owners make personal copies of songs but prevent them from making copies of copies that could be distributed commercially. In addition, the industry group agreed to a 3 percent royalty on blank digital audio tape and cassettes and 2 percent royalty on digital audio tape recorders. Congress ratified this agreement in the Audio Home Recording Act of 1992.[42]

Eliminating Patents

Support for patents is not universal. An energetic global debate is raging about patents in general and pharmaceutical patents in particular. At the end of the 1980s, at least 40 developing countries did not grant patents for pharmaceutical product innovations

[42] Michael Schrage, "Innovation: Cough It Up, Music Lovers (You Thieves)," *San Francisco Examiner,* September 1, 1991:E7; "Audio Recording Bill for Digital Machines Is Cleared by Senate," *Wall Street Journal,* October 8, 1992:B3.

(Lanjouw and Cockburn 2001). However, under the 1995 Agreement on Trade-Related Intellectual Property Rights (TRIPS), members of the World Trade Organization (WTO) must recognize and enforce product patents in all fields of technology, including pharmaceuticals, by 2005. One argument for doing so was that it would induce pharmaceutical companies to develop new drugs for poor countries (for example, to deal with tropical diseases). Many low-income countries opposed the agreement, predicting that establishing patent systems similar to those in the United States and Europe would raise the price of life-saving drugs and threaten the health of their people. The developing nations apparently accepted this agreement in exchange for future trade concessions on their export goods, such as textiles and apparel.[43]

What is the likely effect of adding drug patent protection in India? India led the opposition to the TRIPS agreement. Prior to 2003, India did not recognize pharmaceutical patents. Domestic Indian firms produced versions of many pharmaceuticals that were under patent in other countries.

Chaudhuri, Goldberg, and Jia (2003) estimate what would happen in the short run if the Indian pharmaceutical market for systemic antibacterials (antibiotics) had been under patent protection in India as they were in the United States. They calculate that the total annual welfare losses to the Indian economy from the withdrawal of the four domestic product groups would be approximately \$713 million (U.S. dollars), or about 118 percent of the sales of this segment of the market in 2000. Forgone consumer surplus represents almost all of this welfare loss. Lost domestic producer profit is roughly \$50 million (7 percent), and the profit gain to foreign producers is only about \$57 million per year. However, these calculations ignore the effects on future inventive activity. Presumably, the effect of patents in India on inventive activity is much less than the effect of U.S. or European patents.

Hughes, Moore, and Snyder (2002) ask what would happen in the long run if the U.S. government abruptly ended patent protection for current and future pharmaceuticals. Although increased access to current drugs would yield large benefits to current consumers, these benefits would come at a loss of future consumer benefits due to a reduction in the flow of new drugs as pharmaceutical firms reduced their R&D. To determine which effect is likely to dominate, Hughes et al. simulate the effects of this change in policy, which they call "Napsterizing" pharmaceuticals (Napster helped individuals obtain copyrighted music for free over the Internet).

While people of goodwill can debate the reliability of such simulations, the authors use as much available evidence as they can to produce reasonable estimates. To determine the price effects, they include evidence on the effects of the entry of generic drugs on the price of branded and generic products. They also note that the prices of branded drugs do not fall to the price of generics after generics enter; hence drug firms would still have some incentive to innovate. They conclude that, for each extra dollar in consumer benefit due to greater access to the current stock of drugs, future consumers would lose three dollars in present-value terms from reduced future innovation.

[43]The Unitesd States did not respect British copyrights when the United States was a net importer of intellectual property in the nineteenth century. The United States signed a bilateral copyright agreement only after the literary balance of trade changed in its favor (Ethier 2003).

Market Structure

The incentives to conduct research, the timing of innovations, and the nature of patent races are all determined by the market structures in the product and research industries. Joseph Schumpeter (1950) initiated modern research about the effects of market structure on innovation by stressing the role of economic agents in technological progress. In the Schumpeterian view, there is a positive relationship between innovation and market power, and large firms are more innovative than small firms.[44]

The Schumpeterian argument is that innovation is more important than price competition because it is a more effective means of gaining an advantage over competitors. Two connections exist between market structure and innovation. First, patents allow one to gain market power by innovating. Second, a firm with market power may be able to prevent entry and imitation through defensive patents, or maintain its power through the introduction of new products.

The two key questions considered in the remainder of this section are:

1. Does a competitive industry or a monopoly have a greater incentive to invent?[45]
2. Which type of industry innovates faster?

We first demonstrate that if firms do not have to worry about others inventing the product first, a competitive firm has a greater incentive to invent than a monopoly. Then we illustrate that a competitive firm sometimes innovates too quickly, and certainly more quickly than a monopoly. Finally, we show that a monopoly that must worry about a potential rival entering its market by inventing has an incentive to innovate to prevent entry. This threat of competition gives the monopoly a greater incentive to invent than a competitive firm. Thus, which type of market structure provides a greater incentive to invent depends on whether a patent race is possible.

Market Structure Without a Patent Race

Suppose that a firm, which is uniquely suited to innovate, believes that, if it does not invent a new process, no other firm will. If the firm is initially in a competitive market, it is likely to have a greater incentive to invent a cost-saving process than if it is a monopoly. The basic intuition is that the competitive firm earns profits from its new process over more units than does a monopoly (Arrow 1962).

Let us stick to the minor cost-reducing invention from the preceding section. We assume that a royalty fee is collected from each firm that produces the product in the final goods market and consider two contrasting market structures. In one, the inventing

[44] See Schumpeter (1950), Galbraith (1952), Nelson and Winter (1982), Kamien and Schwartz (1982), and Geroski (1991). See also **www.aw-bc.com/carlton_perloff** "Size and Innovation."

[45] We restrict attention to a monopoly and to a competitive industry consisting of identical firms. In any industry, of course, the firms may be heterogeneous and may pursue divergent R&D policies (Scott 1984, 1991b).

firm is initially part of a competitive market; in the other, the inventing firm is already a monopoly in the product market, and barriers to entry prevent future competition.

If the product market is competitive and the competitive price before invention is m, after invention the price is $\underline{m} + r$, where r is the per-unit royalty rate, as shown in Figure 16.4. For a minor innovation, the new price, $\underline{m} + r$, equals m, as discussed above. Thus, the competitive price and quantity, Q, are the same before and after the invention. In contrast, a monopoly sets marginal revenue equal to marginal cost. Figure 16.4 shows the original price, p_m, corresponding to the original cost m, and the new price $\underline{p}_m$ corresponding to the new cost $\underline{m}$. The corresponding quantities are Q_m, and $\underline{Q}_m$.

As a result of the innovation, the monopoly earns more on the original Q_m units and makes a profit on the extra $\underline{Q}_m - Q_m$ units, so its profits must rise. Its original costs were mQ_m = areas $A + B$. After the discovery, its costs are $\underline{m}Q_m$ = areas $B + E$. Thus, the change in its cost is $(A + B) - (B + E) = A - E$. Its revenues increase by the area under the marginal revenue curve between Q_m and $\underline{Q}_m$, or areas $D + E$. Thus, its profits rise by $(D + E) + (A - E) = D + A$.

This diagram shows that a monopoly gains less from the invention than an inventor in a competitive industry. The optimal royalty level for the inventor in the competitive market is $r = m - \underline{m}$. Thus, in a competitive market, the inventor earns $rQ = (m - \underline{m})Q$ = areas $A + D + F + G$ in Figure 16.4. In other words, the gain to the inventor in the competitive industry is $F + G$ more than the gain to the monopoly. Indeed, on just the first $\underline{Q}_m$ units, the competitive inventor earns $A + D + F$, whereas the monopoly only earns $A + D$. The royalties on the $Q - Q_m$ extra units sold in a competitive industry are "gravy." Thus, in this example, an industry with a product-market monopoly provides less of an incentive to conduct research than a competitive industry.

Even the gain to the competitive industry, however, is less than the full social benefit, $A + D + F + G + H$, the area bounded by the lines at m, $\underline{m}$, and the demand curve that could be achieved if output is $\underline{Q}$. Thus, the competitive market provides less of an incentive for research than is socially optimal, but more of an incentive than does a product-market monopoly.

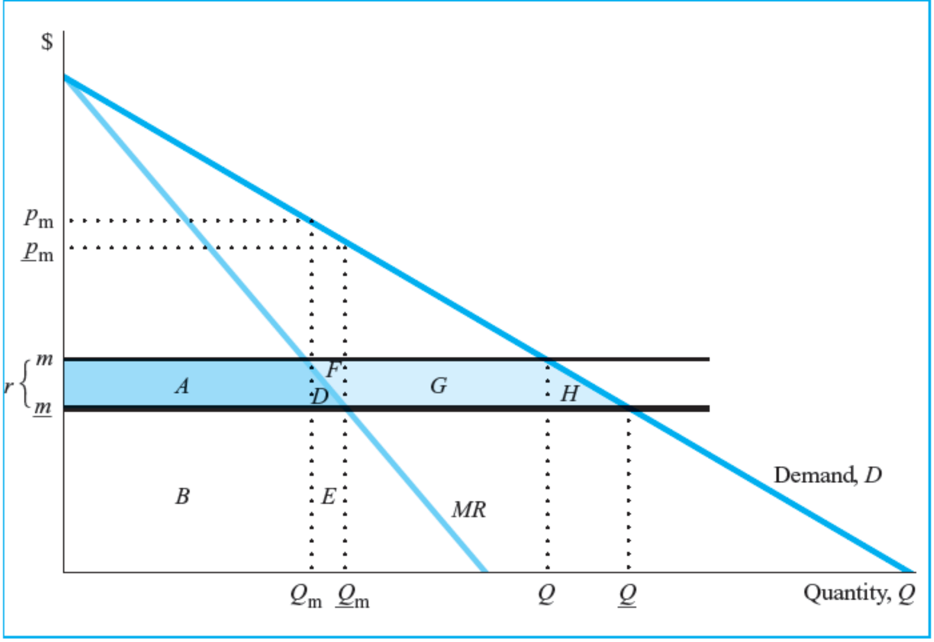
It is important to stress that, in this example, the innovator does not fear a patent race. Later in this chapter, we examine how the incentives to innovate depend on market structure when there is a patent race.

Optimal Timing of Innovations

Things have never been more like the way they are today in history.
—Dwight David Eisenhower

If only the first firm to produce and patent an innovation can collect royalties on it, competing firms have a strong incentive to be the first to invent. This incentive may be so strong that competitive firms innovate before a monopoly would. A monopoly does not have to worry about being in a patent race, so it innovates at whatever rate it considers optimal.

FIGURE 16.4 Gains to Discoveries Vary with Market Structure



Decades ago, several firms had the knowledge and ability to construct a supersonic transport (SST). Nonetheless, actual production took an enormous investment. In the race between Americans, the British-French *Concorde* team, and the Russians, the SST may have been produced too soon. Indeed, the SST was never profitable.

To illustrate that competing firms may innovate before monopolies, consider a new example (Table 16.6):[46]

- The knowledge to make a minor innovation is costlessly available, but it takes an investment of $2,000 to put it into operation. Once developed, the innovation can be used forever at no additional cost.
- This minor innovation saves $1 per unit of output in a particular production process. As previously discussed, the inventor sets the royalty rate for use of the innovation at $1. For simplicity, we assume the inventor can earn the royalty forever.
- In year 1, 60 units are demanded at the market price. With price held constant, demand grows, and output increases by 10 units each year. This growth in

[46]The following example is based on Barzel (1968). See Kamien and Schwartz (1982, ch. 4) for a rigorous version of a similar model.

TABLE 16.6 Earning Streams from Four Alternative Investment Policies of Investing $2,000

Year	Innovate Immediately	Invest Elsewhere	Innovate in Year 5	Innovate in Year 15
1	$60	$200	$200	$200
2	70	200	200	200
3	80	200	200	200
4	90	200	200	200
5	100	200	100	200
6	110	200	110	200
7	120	200	120	200
8	130	200	130	200
9	140	200	140	200
10	150	200	150	200
11	160	200	160	200
12	170	200	170	200
13	180	200	180	200
14	190	200	190	200
15	200	200	200	200
16	210	200	210	210
17	220	200	220	220
18	230	200	230	230
19	240	200	240	240
20	250	200	250	250
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
Present value	$1,600	$2,000	$2,000	$2,263.33

demand makes the innovation progressively more profitable. By year 15, demand has grown to 200 units.

- The interest rate is 10 percent.

There are four alternative earning streams. First, the inventing firm could put the innovation into effect immediately (the second column of Table 16.6). Because 60 units are sold in that year and the royalty rate is $1 per unit, the firm earns $60 that year, and in each successive year it earns $10 more. The present discounted value of these earnings, at 10 percent interest, is $1,600, which is less than the initial investment of $2,000.

The second strategy (column 3) is to invest the $2,000 elsewhere and earn 10 percent interest, or $200, forever. The present discounted value of this strategy is $2,000.

The third strategy (column 4) is to put the $2,000 in the bank earning 10 percent interest until the fifth year, when the innovation is activated. The firm earns $200 in years 1–4, $100 in year 5, $110 in year 6, and so forth. The present discounted value of these earnings is $2,000.

The final strategy has the largest present value: The firm leaves the $2,000 in the bank until year 15, when it puts the innovation into service. The present discounted value of this stream of earnings is $2,263.33. Making the switch from the bank to innovating at either an earlier or later year produces a lower present discounted value of earnings. The present value of earnings from the fourth option is the highest. As Table 16.6 shows, that strategy has as high or higher earnings than any of the other strategies in each year.

The optimal time to innovate is when the present value of the savings due to the innovation equals the present value of the alternative earnings of the original investment. That is, innovation should occur when the marginal revenues (from royalties) become large enough to cover the marginal cost of the forgone interest ($200). A monopoly facing this schedule uses that strategy.

Competitive firms may not behave like the monopoly, however, because they race to be first. Suppose you own a firm that can produce the innovation. You know that if you are the first to produce and patent it, you will collect royalties forever. Moreover, you know that if you are the first to innovate and your innovation occurs in year 15, your profits from the royalties will be maximized. You may not be able to wait until year 15, however. You know that it is profitable to innovate from any year after the fifth. You also know that if you wait, someone else may innovate first. If, in an attempt to be first, you innovate in year 5, you are indifferent between making the investment and leaving your money in the bank.

Thus, given the schedules in Table 16.6, a competitive industry is likely to innovate before a monopoly. A firm with a monopoly on information introduces the innovation at the time that is optimal for it. In this example, with a permanent patent, a competitive industry overinvests in research, as previously shown, and the research occurs *too soon*.

In general, the year a firm chooses to innovate depends on a variety of factors, such as the cost and demand functions and the number of rival firms. The innovation time of a competing firm is immediately after the zero profit introduction time (Kamien and Schwartz 1982). It is possible to construct examples in which competitive firms innovate before or after monopolies. One reason for this ambiguity is that monopolies charge more for the new product than competitive firms, so they face different benefit schedules in general from the innovation.

So far, we have shown that competitive firms may conduct research more quickly than a monopoly that is not involved in a patent race. The analysis of rates of adoption of new technologies is similar (see **www.aw-bc.com/carlton_perloff** "Adoption of a New Technology: Optical Scanners"). We now turn our attention to the case where a monopoly faces a patent race.

Monopolies in Patent Races

Suppose a monopoly fears that a potential rival will invent a new, similar product and enter the monopoly's market. Both firms have an incentive to invent the new product. If the monopoly gets there first, it maintains its monopoly power. If the potential rival is first to invent, it competes with the incumbent and duopoly results. Thus, the rewards are asymmetric: The monopoly stands to lose more from failing to be first than the rival. The rival loses only its R&D expenditures, whereas the monopoly loses its R&D expenditures and some of its monopoly profits.

Not losing is the monopoly's primary aim; it does not care particularly if it makes or implements the new discovery—it only cares that its rival does not. Indeed, if the monopoly makes the discovery first, it may let its patent "sleep." That is, a monopoly may patent related products so as to prevent anyone else from doing so and then not use the new patents (see **www.aw-bc.com/carlton_perloff** "Compulsory Licenses and Sleeping Patents" and Example 16.8).

Suppose someone invents a product that is slightly superior to the one the monopoly is currently selling. The monopoly is willing to bid more for the patent than a potential rival. The monopoly can use the new invention to maintain its monopoly power, whereas the rival only can use it to become a duopolist. Thus, the monopoly is willing to bid more than the potential rival, up to the difference between monopoly and duopoly profits. An incumbent firm also may have an advantage making new discoveries because of experience (see **www.aw-bc.com/carlton_perloff** "Learning by Doing, Innovation and Market Structure").

Unfortunately for the monopoly, it is not always able to bid for new inventions. The monopoly gets the patent if it invents first; otherwise a potential rival obtains it. If the potential rival could sell the patent to the monopoly, the potential rival would earn more than if it competes as a duopolist, but antitrust laws are intended to prohibit such practices.

How then can a monopoly maintain its monopoly power? Or, restated, how can the monopoly guarantee it is the first to invent (Gilbert and Newbery 1982, Kamien and

EXAMPLE 16.8 *Patent Thicket*

During the 1970s, the federal courts viewed computer programs as mathematical algorithms, which cannot be patented under U.S. law. One could patent systems that used software, but only if the novel aspects of the invention did not reside entirely in the software. Congress decided to protect computer programs under copyright law. Starting with a Supreme Court decision in *Diamond v. Diehr*, 450 U.S. 175 (1981), a series of court and administrative decisions by the U.S. Patent and Trademark Office made it dramatically easier to patent software-related inventions. Now, software patents are 15 percent of all patents.

Most software patents were acquired by manufacturing firms and large firms, with only 6 percent held by software publishers. Bessen and Hunt (2003) test whether software patents and R&D are substitutes or complements. They find that software patents substitute for firm R&D and are associated with lower R&D intensity. They conclude that firms primarily use software patents to create a strategic "patent thicket" to limit the ability of competitors to enter the market or to protect themselves from potential hold-ups.

TABLE 16.7 **Effectiveness of Alternative Means of Protecting the Competitive Advantages of New or Improved Processes and Products**

Method of Appropriation	Averages*	
	Processes	Products
Patents to prevent duplication	3.52	4.33
Patents to secure royalty income	3.31	3.75
Secrecy	4.31	3.57
Lead time	5.11	5.41
Moving quickly down the learning curve	5.02	5.09
Sales of service efforts	4.55	5.59

*Based on a survey of 650 high-level R&D managers of a cross-section of U.S. firms. Each manager answered on a 1–7 scale, where 1 = not at all effective and 7 = very effective.

Source: Levin, Klevorick, Nelson, and Winter (1987, Table 1, 794).

Schwartz 1982, Fudenberg et al. 1983, and Harris and Vickers 1985)? One way is to obtain such a big head start in a patent race that all potential rivals drop out of the race. A firm with a relatively short head start can discourage its rivals from entering a patent race. A trailing firm with no chance of catching up should drop out of the race immediately. In this case, the monopoly can maintain its market power, but it may be forced to innovate faster than it prefers. Alternatively, if the trailing firm has a good chance to gain the lead ("leapfrog" ahead), then it should stay in the race.

A survey of high-level R&D managers in U.S. firms, however, suggests that, in many cases, patents are not an important means of protecting a competitive advantage, as shown in Table 16.7 (Levin, Klevorick, Nelson, and Winter 1987). Patents were rated the least effective mechanisms of appropriating the returns from a competitive advantage for new processes. Secrecy, lead time, moving quickly down the learning curve (gaining experience that leads to lower production costs), and sales or service efforts were all rated higher. Patents ranked above secrecy, but below lead time, moving quickly down the learning curve, and sales or service efforts for new products. These averages across all industries, however, do not give the full picture. Patents were considered to be effective for protecting new products in inorganic chemicals, organic chemicals, drugs, and plastic materials. Thus, patent races are relatively less likely for new processes and relatively more likely for new products in certain industries with high levels of R&D.

SUMMARY

This chapter examines five questions concerning patents and technological progress and reaches the following conclusions. First, without patents or other government incentives to conduct research, there is typically too little R&D and hence too little technological progress. Too little effort is put into R&D because information externalities prevent inventors from capturing the values of their discoveries in the absence of property rights. Patents, prizes, government research contracts, and joint ventures can help overcome this problem.

Second, although patents encourage inventive activity, they cause monopoly pricing distortions. By adjusting the length of a patent, governments can trade off more inventive activity versus more efficient pricing. Shortening the length of a patent reduces the harms from monopoly pricing but also reduces the incentive to invent. Many, if not most, governments rely primarily on grants of monopoly power for a fixed maximum number of years in the form of patents to encourage research. In some cases, welfare may increase with changes in the lengths of patents, greater use of prizes or research contracts, and possibly from compulsory licensing of unused patents.

Third, government prizes and research contracts stimulate R&D and do not have the same drawback as patents and joint ventures—monopoly pricing. Patents, however, may come closer in stimulating the optimal amount of R&D if the government lacks the information or ability to set prizes or research contracts properly. The government may be unable to set them properly if it has less information than researchers about the value of potential new discoveries or the likelihood of making a discovery.

Fourth, a patent holder achieves the same profits by being the sole producer of the product as it does by licensing it and receiving royalties if production costs are the same across manufacturers. The patent holder can capture all the social benefits from many minor cost-saving inventions, but not from major ones.

Fifth, market structures affect rates of research. If there is only one innovator, then a monopoly may innovate more slowly than would a competitive firm. When either a competitive firm or a monopoly faces a patent race, it innovates more rapidly than it otherwise would. A firm can prevent a patent race, however, if it can obtain a sufficient lead in research. A monopoly wants to preempt other firms from engaging in a patent race, because patents are worth more to it than to competitive firms. If the monopoly makes the discovery first, it receives its monopoly profits, whereas if the competitive firm makes the discovery first, it must compete with the former monopoly and earn duopoly profits. It is unclear on theoretical grounds whether greater monopoly power would stimulate innovation in a particular industry and, instead, is an empirical question.

PROBLEMS

1. Suppose a firm has a patent but it is worried that the patent might not be upheld in a court as being valid because it is not sufficiently novel to deserve patent protection. After an entrant infringes the patent, it sues to have the patent declared invalid. The original firm offers to 'settle' this case by paying the entrant to stay out of the industry and admit that the patent is valid. What is the effect of such a settlement?
2. If a court determines that one firm has violated another firm's patent, the court can order the infringer to stop doing so immediately. Do you think the court should alternatively tell the infringer that it has to stop after some time period?
3. Graphically illustrate (using the benefit and cost curves in Figure 16.1) the effect of a longer patent life on the incentive to invent.

4. If the government could only observe prices, quantities, and royalty rates (but did not know the demand curves or the marginal cost curves), could it determine if a royalty was for a minor or major patent?
5. Using an argument similar to that for monopolistic competition, show that firms operate on the downward-sloping section of their average cost curves for inventive activities.

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

Arrow (1962) and Barzel (1968) are important early papers that are relatively nonmathematical. For good surveys of innovation theory, see Kamien and Schwartz (1982) and Reinganum (1989). An interesting collection of empirical research on patents is contained in Griliches (1984). Griliches (1990) surveyed recent work on the significance of patent statistics and Mairesse (1991) surveyed econometric studies on the relationship between R&D and productivity. Novos and Waldman (1984) examined copyrights, and Landes and Posner (1987) and Economides (1988b) analyzed trademarks. Wright (1983) discussed patents and alternatives. Katz and Shapiro (1987) analyzed the problems patents raise where licensing or imitation is possible. The *Rand Journal of Economics,* Vol. 21, 1990, had a special issue on patents and technology. Riordan (1992) discussed how regulation affects technology adoption with an application to cable television.

A new literature discusses the role of piracy of computer software, music, and other intellectual property. See, for example, Shy and Thisse (1999) and Banerjee (2003).

In recent years, the U.S. patent system has undergone a number of major changes. For an interesting viewpoint on the effects of these changes, see **www.bustpatents.com**, which argues that many U.S. patents are invalid—particularly software and biotech patents. Jaffe (2000) and Gallini (2002) provide superb surveys of the changes in the patent system and their effects. Gallini and Scotchmer (2001) survey recent theoretical literature, while Landes and Posner (2003) provide a comprehensive treatment of the economic foundations of intellectual property law.

CHAPTER 17

How Markets Clear: Theory and Facts

Fortune is like the market, where many times, if you can stay a little, the price will fall.
—*Francis Bacon*

Earlier chapters assumed that **market clearing**—the equilibration of the quantities supplied and demanded—occurs exclusively through the price mechanism.[1] Price alone determines how much consumers buy and firms sell. In many, if not most, markets, however, more than just price adjustments are used to allocate goods. This chapter examines the evidence on how goods are allocated to customers and presents some recent theories that explain some of the evidence.[2]

The chapter begins with a brief review of three simple, traditional theories about how markets clear. These theories focus on price as the mechanism for achieving resource allocation and investigate how the price-clearing function is altered depending on whether the market is a competitive one, an oligopoly, or a monopoly. We then provide evidence on what is known about price behavior. The evidence varies sufficiently from the predictions of the simple theories that it raises serious questions about their usefulness for explaining price behavior in many markets.

Next, we examine a variety of alternative theories that help explain some of the observed puzzles in the data on price. In particular, we present a general theory of market behavior without relying on price as the exclusive market-clearing mechanism. Finally, features of market structure other than the degree of market concentration are used to show how market structure matters in explaining the response of various industries to shocks in either supply or demand. Because the failure of markets to clear through price changes is a key assumption in several macroeconomic theories, the issues discussed in this chapter have received widespread attention from macroeconomics (such as Mankiw and Roemer 1991).

[1]One exception was the discussion of search in Chapter 13.

[2]This chapter is a revised version of Carlton (1989).

The five key points in this chapter are

1. Simple theories, which hold that price alone clears markets, are inconsistent with the evidence in many markets.
2. Other mechanisms that clear markets include adjusting consumption and inventories over time, altering quality and rationing.
3. Firms are slow to change prices because of transaction costs and other factors.
4. Long-term relationships between firms affect which mechanisms are used to clear markets.
5. How markets react to demand and cost shocks depends on more than just the degree of market concentration.

How Markets Clear: Three Simple Theories

This section briefly reviews the three most important simple models of the ways in which markets operate. These models form the background against which the next section analyzes the evidence on prices. Only by understanding where the models fail can economists develop better models.

Competition

The standard competitive model assumes that price adjusts so as to equate supply to demand.[3] The amount by which price must adjust depends not only on the size of the shifts in either supply or demand but also on the shape of the supply and demand curves. There are no unsatisfied demanders nor any sellers who wish to sell but cannot. All sellers receive and all buyers pay the same price, price changes are perfectly correlated across different buyers, and the transaction cost is zero.

Oligopoly Models

No single model of oligopoly behavior is universally accepted today. However, most models of oligopoly assume that there are no unsatisfied demanders or sellers who want to sell but cannot at whatever price is set, that price changes are passed along to all buyers simultaneously, and that it is not costly to transact in the market. In most models of oligopoly, prices behave differently than in a competitive market.

Many oligopoly theories predict that price is unresponsive to some cost fluctuations. Any time an oligopolistic firm changes its price, it faces a risk that it will trigger a price war. Hence, firms are reluctant to change price.

Monopoly

A monopoly equates marginal revenue to marginal cost. Thus, the monopoly price exceeds marginal cost. As in the models of competition and oligopoly, there are no un-

[3]How prices adjust to a new equilibrium is normally not explained. For example, which firm first changes its price and why? See Arrow (1959).

satisfied demanders at the market price, and the cost of allocating goods (the cost of using a market price to allocate goods) is assumed to be zero. The theory assumes that price changes across different buyers are perfectly correlated.

The theory explains how a monopoly reacts to shifts in either supply or demand. For example, if marginal cost changes, the new price is determined by the intersection of the new marginal cost curve with the marginal revenue curve.

It is commonly stated that a monopoly's price varies less than the competitive price in response to changes in costs. This conclusion is based on the assumption that demand curves are linear, so that any change in marginal costs translates into a change in the monopoly price that is *less* than the change in marginal costs. In the competitive case, because price equals marginal cost, the changes in price and marginal cost are equal. For example, if the demand curve is

$$Q = 9 - p,$$

and (constant) marginal cost equals \$1, the monopoly price is \$5. If marginal cost rises from \$1 to \$3, the monopoly price goes up from \$5 to \$6. That is, price rises by one-half of the increase in marginal cost. In contrast, if this industry were competitive, price would increase by the same amount as marginal cost.

It is also possible to construct examples in which the monopoly's price varies more than the competitive price in response to cost changes. For example, if the monopoly faces a constant elasticity of demand curve and has a constant marginal cost, its price equals a constant markup above marginal cost. Because the markup exceeds 1, it follows that the price increases by more than the increase in marginal cost. For example, if the elasticity is -2, the monopoly's price is \$2 if its marginal cost is \$1. If marginal cost rises to \$3, the optimal price rises to \$6, so the increase in price, \$4, exceeds the increase in marginal cost, \$2. If the industry were competitive, the price would increase by the same amount as marginal cost.

These examples regarding price variability show that the relation of price changes to cost changes varies with the shape of the demand curve. Therefore, it is not possible to make any general statements about the variability of price in relation to the variability of cost based on whether a market is competitive or monopolized. Moreover, because oligopolies range from almost competitive industries to almost monopolized industries, no general statements can be made for oligopoly. (For small cost changes, however, some theories of oligopoly suggest that prices may remain unchanged.)

Empirical Evidence on the Role of Price in Allocating Goods

Both casual observation and formal surveys on prices provide evidence on the role that price plays in clearing markets. This evidence is used to examine both the rigidity of prices and the movement of prices over the business cycle.

The Rigidity of Prices

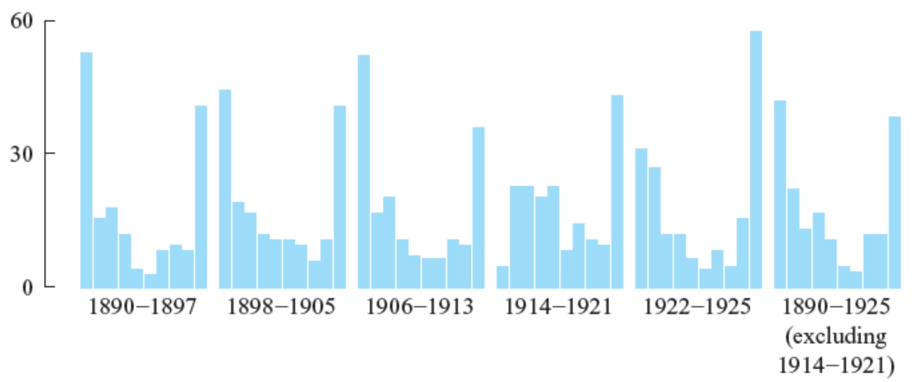
Casual evidence shows that prices are more rigid than most simple theories suggest and that consumers are sometimes unable to find the good. Consumers know that if there are three cars ahead of them at the gas station, the price of gasoline at the pump will not rise; rather, they will have to wait to get their car filled up. In fact, for many items commonly purchased, prices stay fixed for some time once they are set. Consumers know that it is not unusual to go to the supermarket to buy a product and find that the product is not in stock.

Newspaper articles often describe how some companies have difficulty assuring themselves of supply during periods of high demand. Histories of business (Chandler 1977) explain in detail that many firms vertically integrate, not necessarily to get a lower price for a product, but simply to get the product on a reliable basis. Waiting for delivery of a good and being unable to purchase a good when one wants it are typical rather than atypical experiences in many markets. In periods of tight supply, preferred customers get delivery, whereas new customers are often unable to assure themselves of a supply at the same price as steady customers. Indeed, short-term customers may be unable to get the product at all.

Such observations suggest that, in many markets, price is not the sole mechanism used to clear the market. None of the simple theories of the previous section are able to explain the existence of unsatisfied demanders, yet they appear to be an observed feature of many markets.

Early Price Surveys. Frederick Mills (1927) conducted one of the earliest studies regarding the flexibility and behavior of prices. Mills examined numerous price statistics

FIGURE 17.1 Frequency of Price Change



The horizontal axis measures frequency of price change. Frequency increases as one moves to the right within any one time period. The vertical axis measures the number of commodities of any given frequency.

Source: Mills (1927, 371)

gathered by the U.S. Bureau of Labor Statistics (BLS) for frequency of change and amplitude of change. His work represents an outstanding contribution to our knowledge of price behavior.

Figure 17.1 presents some of Mills's findings regarding the frequency of price change over various time periods. The diagrams show that the distribution across markets of the frequency of price changes is U-shaped; that is, there are many products whose prices change frequently, and many whose prices change infrequently.

It is possible that supply and demand are in equilibrium in all industries and that what Mills is showing reflects simply the distribution of shocks to various supply and demand curves. So, for example, there are many markets in which shocks and the resulting price changes are frequent and also many markets in which shocks and the resulting price changes are few. Another possibility is that in some markets prices change frequently and are the exclusive device used for market clearing, whereas in other markets prices do not vary frequently, and something else is working to clear those markets. **Price rigidity** is said to occur when prices do not vary in response to fluctuations in costs and demand.[4]

The next noteworthy study of prices was by Gardiner Means in 1935. Unlike Mills, Means had an enormous effect not only on economists but also on policy makers. His influence persists to this day. Means claimed that the traditional economists' models could not explain price behavior in many markets. He suggested that the Great Depression occurred because in many markets the laws of supply and demand had been "repealed," and prices no longer fluctuated to clear the markets. Means's arguments attracted widespread attention. His explanation for the Great Depression, which was inexplicable to most economists, was based on a breakdown in market clearing, which formed the basis for all economists' beliefs.[5] Means's hypotheses challenged the profession, and although (as explained later) his inferences were misguided, they were motivated by the inability of the simple theories to explain price behavior in many markets.

[4]Rigid prices are of interest, not because of the rigidity itself, but because the rigidity suggests that prices may not be clearing markets. Even if prices were perfectly indexed to inflation and hence were always changing, it would be troubling if there were unsatisfied buyers, a fact that would indicate that price was not clearing markets.

Inefficient resource allocation occurs in the simple models when the *marginal* price (the price of an additional unit) fails to clear markets. A contract that specifies a fixed quantity at a fixed price is *not* a rigid price that can induce inefficiency because the price of an additional unit is the price of buying that unit in the marketplace. When the quantity term is left open, the contract price is the marginal price; and, therefore, the rigid price has efficiency effects.

[5]Keynes and other macroeconomists developed theories to explain the Great Depression based on an assumption that wages (not final goods prices) failed to fluctuate to clear markets. Wage rigidity, however, is probably less important than price rigidity, so that the reliance by macroeconomists on wage rigidity is misplaced (Garman and Richards 1992). Evidence of how real wages (wages adjusted for inflation) behave over the business cycle can help one determine whether wages are stickier than prices. If prices are stickier than wages, real wages should be procyclical (rise during booms and fall during bad times); whereas, if wages are stickier than prices, real wages should be countercyclical (fall during booms and rise during busts). Real wages are procyclical (Zarnowitz 1985).

Means's theory was that many markets have **administered prices**: Prices are under the control of firms and not subject to the laws of supply and demand. Under this view, firms, for unexplained reasons, chose not to vary prices to clear markets. Means claimed that price changes in administered markets are much less frequent than in competitive markets and that when price changes occur, they are much larger. According to Means, because administered markets have long stretches of unchanging or rigid prices, prices fail to clear markets, resulting in a disequilibrium such as the Great Depression.

Means did not contend that administered prices were restricted to markets with high concentration, and there was confusion as to what he meant by an administered price. A voluminous and contentious literature developed that attempted to give structure to Means's arguments and test them.[6] This literature confirms that something unusual is going on in the behavior of some prices.[7]

The earlier work of Mills (1927), which attracted much less attention than that of Gardiner Means, does not indicate a significant increase in price rigidity from the 1890s to the mid-1920s (Figure 17.1). We are unaware of any study that shows greater rigidity of prices right after 1929. Means was correct in asserting that economists had inadequate theories for predicting the flexibility of prices, but the phenomenon he was talking about was not confined to the period of the Great Depression. Indeed, as shown below, the phenomenon of rigid prices characterizes the U.S. economy today.

Later Studies. The major criticism of Means's work is that it relies on price statistics gathered by the U.S. Bureau of Labor Statistics (BLS). A study done by McAllister (1961) for a Congressional Committee on Price Statistics shows that the BLS data typically do not reflect price discounts. Moreover, an examination of the way in which the BLS gathered price statistics shows that the number of firms reporting prices to the BLS varies from market to market. The more firms reporting price, the more likely is the observation of some flexibility in an average price. This is especially true when products are heterogeneous.

Recognizing the inadequacies of BLS price statistics, Stigler and Kindahl (1970) collected data on individual transaction prices based on actual transactions between buyers and sellers. Although the Stigler-Kindahl data undoubtedly contain reporting errors, they are probably the best source of information on pricing behavior available to economists today. Stigler and Kindahl construct indices of prices (averages of individual prices) for individual commodities and find that their price indices move much more smoothly than those of the BLS: Price indices based on actual transaction prices are much more flexible than those based on BLS data. Stigler and Kindahl conclude that the BLS data are misleading. Although Stigler and Kindahl do not explicitly claim

[6]See Beals (1975), Lustgarten (1975), Qualls (1979), Scherer (1980, Ch. 13), Weiss (1977), and Weston and Lustgarten (1974), and the references they cite.
[7]See, for example, Weiss (1977), but see Stigler and Kindahl (1973) for a different point of view.

that their findings are completely in accord with any of the simple theories of market clearing, they do suggest that their work goes a long way toward explaining the unusual findings of investigations based on BLS data.

Stigler and Kindahl recognize that there are some puzzling features even in their own data set. For example, they note that the typical pattern is for buyers and sellers to remain in contact with each other for long periods of time, even for transactions involving apparently homogeneous goods. That is, buyers and sellers view their relationship with each other as a valuable way of doing business and believe that the relationship is worth preserving. As shown later, this insight can be used to explain a great deal of what appears to be unusual pricing behavior.

Not only do the Stigler-Kindahl prices move more smoothly than the BLS data, the prices have different general trends from the BLS indices during some time periods. The BLS data are primarily based on price quotations for immediate delivery. The Stigler-Kindahl data are based on prices from long-term relationships between buyers and sellers. Therefore, it is likely that the BLS indices reflect fewer long-term contracts than the Stigler-Kindahl indices do (Stigler and Kindahl 1970, 6). A comparison of the Stigler-Kindahl and BLS price indices shows that during booms, spot prices (prices for immediate delivery) rise relative to long-term contract prices.[8]

Another interesting feature noted by Stigler and Kindahl is that although most of the transactions last a long time and may be pursuant to a contract, they seem to specify neither a price nor in many cases a quantity. Thus, it is not true that most contracts rigidly set both the price and the quantity terms in a marketplace (Williamson 1975).

Weiss (1977) weighs the evidence of Stigler and Kindahl against the evidence put forward by Means (1935, 1972). Although recognizing the difficulty of giving theoretical content to Means's hypothesis, Weiss concludes that the evidence on pricing does appear unusual in the sense that the simple theories do not do a good job of explaining pricing behavior.

Carlton (1986) reanalyzes the Stigler-Kindahl price data. Unlike Stigler and Kindahl, Carlton does not construct indices of prices to examine how a price index behaves over time, because indices can mask interesting behavior. For example, if new buyers pay different prices than old buyers, an index of prices may seem to be perfectly flexible even though most contracts are characterized by rigid prices. Yet, it is surely important to know whether price is being used to allocate goods to some buyers and not to others, and whether some other mechanism, such as a seller's knowledge of each buyer's requirements, is being used to allocate goods.

Carlton examines how often a price changes once it has been set to an individual buyer. The degree of price rigidity—the average length of time during which prices are unchanged—differs greatly across industries: from roughly 6 months in household appliances to over 18 months in chemicals (Table 17.1). There are several instances of

[8]There have been only a few attempts to explain this difference in behavior of the two types of prices: Stigler and Kindahl (1970), Carlton (1979a), and Hubbard and Weiner (1989).

TABLE 17.1 Price Rigidity by Industry

Industry	Average Duration of Price Rigidity (Months)
Steel	17.9
Nonferrous metals	7.5
Petroleum	8.3
Rubber tires	11.5
Paper	11.8
Chemicals	19.2
Cement	17.2
Glass	13.3
Truck motors	8.3
Plywood	7.5
Household appliances	5.9

Source: Carlton (1986, Table 1).

transactions in the Stigler-Kindahl data in which the price paid by a buyer does not change for periods of well over five years.[9]

The evidence in Table 17.1 could be consistent with the simple theories under some extreme assumptions. For example, one could argue that in industries with very rigid prices, the supply and demand conditions are virtually stable over time, whereas in the other industries with flexible prices, the supply and demand conditions change frequently. The duration of the rigidity in some prices to individual buyers is so long that this explanation is not credible.

One can also examine the correlation (co-movement) of price changes across different buyers of an identical commodity using the Stigler-Kindahl data. In all of the simple theoretical models of market clearing, price changes across different buyers of the same commodity should be highly correlated. Although price changes are highly correlated in some markets, there are several markets in which price changes appear to be poorly correlated across buyers.

One of Carlton's findings is a strong positive relationship between industry concentration and price rigidity. The more highly concentrated an industry, the greater the likelihood that its prices remain unchanged for long periods of time. Recall that the simple models make no predictions relating price rigidity to the amount of concentration in a market.[10]

[9]Cecchetti (1985) analyzes newsstand prices of magazines and finds that they changed infrequently, every seven years, on average, in the 1950s and every three years, on average, in the 1970s. See also Kashyap (1995).

[10]Although the theory of oligopoly can justify price rigidity in the face of small cost changes, as the industry becomes more concentrated and the oligopoly becomes more powerful, the oligopoly should behave more like a monopoly, and monopoly prices should not be rigid, according to the simple theory.

EXAMPLE 17.1 *Price Rigidity—It's the Real Thing*

In 1886, John Pemberton, a pharmacist, mixed together a dark, sugary syrup and produced Coca-Cola, one of the most successful products of all time. He and his partner, Frank Robinson, planned to sell this "medicine" (it originally contained as medicinal ingredients coca leaf and kola nut) by the glass. Instead of charging a high price typically associated with patent medicines, they charged 5 cents per glass. By the 1950s—when Coke was sold primarily in 6.5 ounce bottles instead of as a fountain drink—the price was still 5 cents! Thus, Coke prices were rigid for over 70 years.

Why did they remain rigid, and how did Coca-Cola control the retail price? Levy and Young (2002) believe that the prime reason for this rigidity was an implicit understanding that Coca-Cola had with its loyal consumers. Coke heavily advertised the nickel price, and consumers believed that neither Coke's price nor its quality would change. In addition, given the widespread use of vending machines, it would have been costly to reconfigure machines to accept something other than nickels (and a price increase to 10 cents was considered too high). Even though Coke often had no legal means to enforce a 5-cent retail price, it accomplished its goal by its massive advertising campaigns promoting nickel Coke.

In summary, detailed examinations of the Stigler-Kindahl data reveal price behaviors that are inconsistent with the simple models of market clearing. These findings do not necessarily prove that markets are operating inefficiently. Rather, they prove that the simple models of price clearing are inapplicable to certain markets. See Example 17.1.

Bils and Klenow (2002) examine BLS prices for consumer products using unpublished BLS data on products in 350 detailed categories of consumer goods and services. They find that about half of the prices remain in effect for more than five months. The prices of one-quarter of the consumer goods change on average each month, with the frequency highest for durable goods (32%), moderate for nondurable goods (29%), and lowest for services (20%). They also find that during inflationary periods, there is a large drop in the relative price of sticky-price goods relative to that of flexible-priced goods, and that this change in relative prices causes a significant shift in consumption away from sticky-price goods. There appears to be a strong negative relationship between price rigidity and whether the product is closely related to a primary input (Means found that the agricultural sector had much greater price flexibility than manufacturing in the 1930s), and a strong positive correlation between price rigidity and industry concentration. This latter result disappears when one controls for whether the product is a primary input.

International Studies. Gordon (1983), Encaoua and Geroski (1986), and others analyze the different degrees of price flexibility in various countries. Encaoua and Geroski (1986) use a detailed database to estimate the relationship between price, cost, and concentration across several countries (Canada, Japan, Sweden, United Kingdom, United States) and commodities. They find, in general, that the higher the degree of concentration in a market, the slower is the adjustment of price to cost changes.[11] They show that the more an industry is characterized by new entry and competition (measured by imports), the more likely it is that prices rapidly adjust to cost changes. They also find that price flexibility varies across countries; Japan, for example, has more flexible prices than the United States. Understanding the reasons for the different flexibility of prices across countries remains an important task.

Movements in Prices and Price-Cost Margins over the Business Cycle

There have been many empirical investigations of the relationships among price, price-cost margins, business cycles, and concentration.[12] Here we describe several recent studies, which reach different conclusions, so this area remains one of active research.

Domowitz, Hubbard, and Petersen (1986a, 1986b, 1987) examine the behavior of manufacturing prices in the United States over the period 1958–1981, using data on over 400 industries. They draw three interesting conclusions. First, price-cost margins (which theoretically equal the ratio of price minus marginal cost to price) in concentrated industries are *procyclical:* They rise in booms and fall in recessions (see also Qualls 1979). Second, price-cost margins in relatively unconcentrated industries tend to be *countercyclical:* They fall in booms and rise in recessions. Third, extensive unionization, which is more common in concentrated industries, keeps wages in those industries relatively stable over the business cycle.

They explain their finding of procyclical margins in concentrated industries by showing that costs, in particular real wages, are more rigid in those industries. That is, during a boom, a firm in a concentrated industry experiences a price increase that is accompanied by only a modest cost increase, so that the gap between price and (marginal) cost rises. Unions provide one explanation for the greater rigidity of wages in concentrated industries because unionization and concentration are positively correlated.

This finding of procyclical margins in concentrated industries has important implications about how concentrated markets work. A firm raises its price-cost margin only if its demand curve becomes less elastic. There is no apparent reason why industry demand elasticities should decrease in booms. Therefore, some other explanation is needed to explain procyclical margins in concentrated industries. Possible explanations could rely on either oligopolistic interdependence (for example, incentives to cheat on the oligopoly price in booms versus recessions) or on the long-term relationship of the buyer and seller.

Some researchers draw conclusions opposite to those of Domowitz et al. For example, Bils (1987) finds that marginal cost is procyclical and that, in general, margins are countercyclical. He finds no effect of concentration on this relationship; however, his investigation of the concentration effect relies on fewer observations than does the work of Domowitz et al. Bils takes special care to measure marginal as opposed to av-

[11] Domberger (1979) finds the opposite for the United Kingdom.
[12] See Chapter 8 and Schmalensee (1989) for a survey of some of these studies.

EXAMPLE 17.2 *How Much Is That Turkey in the Window?*

Chevalier, Kashyap, and Rossi (2000) examine fluctuations in price-cost margins for grocery store items that are subject to seasonal surges in demand. For example, what happens to margins on turkeys at Thanksgiving or on beer on the Fourth of July? They find that margins generally fall on seasonal items during their peak demand period because stores compete to attract customers by advertising low prices on popular seasonal items. MacDonald (2000) finds the same result and concludes that price declines are greater in markets with several rivals than where a single firm dominates.

erage variable cost. In contrast, Domowitz et al. use average variable cost in their measure of margins. If marginal cost is rising, then the true price-cost margin (the one based on marginal cost) could be unchanging or even falling over the business cycle, even though Domowitz et al. measure an increasing margin. Although the different definitions of costs may not completely explain the discrepancy between Bils and Domowitz et al., it reconciles at least part of the discrepancy.

Additional evidence against procyclical mark-ups in concentrated industries comes from Chevalier (1995) and Chevalier and Scharfstein (1995). Chevalier (1995) documents that when supermarket firms acquire a lot of debt and therefore see their likelihood of bankruptcy rise, they tend to raise prices especially in a concentrated industry where there presumably is more ability to set price. The empirical results of Chevalier and Scharfstein (1995) support the view that margins are countercyclical and that margins in concentrated industries and in markets where many firms face a significantly elevated likelihood of bankruptcy in recessions tend to be more countercyclical than the typical margin. See Example 17.2.

A final piece of contradictory evidence to procyclical margins comes from Mills (1936). Mills studies the behavior of margins during the period before and during the Great Depression and finds them to be strongly countercyclical. Although Mills does not investigate the relationship of margins to concentration, his strong finding across all industries does contrast with the finding of Domowitz et al. of only a tendency for countercyclical behavior of margins, and that tendency occurs only in unconcentrated industries.

Explaining the Evidence

The evidence on price behavior reveals that some markets are well described by the simple models of market clearing, but others are not. Markets differ greatly in price flexibility, with the degree of concentration being an important determinant of flexibility. In some markets, price changes to one buyer are uncorrelated with those to another buyer, suggesting that other factors, such as a seller's knowledge of a buyer, are involved. In many markets, long-term relationships between buyers and sellers are important.

There are several approaches (starting with Tucker 1938) to reconciling economic theory and the observed evidence. One approach is to extend and improve the simple theories. That approach can be quite fruitful, and we describe some of the most useful extensions. However, extensions to the simple theories help resolve only some of the inconsistencies between the theory and the evidence. The remainder of this section explores alternative theories that are useful in explaining the evidence.[13]

Extensions to the Simple Theory: The Introduction of Time

The expositions of the simple theories stress price as the market-clearing mechanism and ignore the possibility of delaying consumption or production to a later time, which is known as **intertemporal substitution**. It is a straightforward extension of the simple competitive model to date goods and treat a good at one date as different from the same good at a different date (Debreu 1959, ch. 7). In a dynamic model, a customer faces many substitutes to consuming a product today—not only other products, but also the same product consumed in the future. Similarly, a supplying firm can substitute production today for production tomorrow by holding inventories.

The introduction of time into any of the simple models of competition, oligopoly, or monopoly makes them more realistic by emphasizing the importance of intertemporal substitution on both the demand side and the supply side. The following sections describe how each of the three simple theories is altered by the introduction of time.

Competition. The demand curve for a product at a particular time depends not only on current price but also on consumers' perceptions about what the price of the product will be in the future. If consumers are willing to wait at least a short time to consume the product, then the price today cannot deviate very far above the price expected to prevail in the future without inducing consumers to cease purchasing today and wait to do so in the future. That is, the price elasticity of demand for purchases today (all else equal) is very high.

Similarly, the supply curve at a particular time depends not only on the current price but also on future expected prices. Intertemporal substitution affects the willingness of firms to supply the product today at a given price. Firms recognize that an alternative to producing and selling today is to produce today, hold goods in inventory, and sell them tomorrow. The ability of a firm to decide on the optimal time path of production and the optimal employment of factors of production, one of which is inventory, affects the shape of the short-run marginal cost curve.

[13]We do not explore the importance of risk aversion in explaining price rigidity. Empirical work indicates that it is not important (Carlton 1986). See Polinsky (1987) for a detailed study of risk aversion and pricing. Blinder et al. (1998) provide a good summary of several theories of price rigidity and explores their applicability based on surveys of businessmen.

In the competitive equilibrium, a separate price is determined for each commodity at each date at which it may be consumed. Anything that changes production cost, today or in the future, or demand, today or in the future, affects all prices over time. Thus, a shock to demand today affects the price of a good not only today but also in the future. As a result, shocks to supply or demand today may be absorbed primarily by something other than prices today. For example, an increase in demand today may have a small effect on prices today and in the future, but may shift a significant amount of consumption from today to the future.

The important insight from this view of competition is that even though prices are equating supply and demand, only small price changes may be necessary to equilibrate the market. Quantity shifts among different goods (in particular, the same good consumed at different periods of time) may bear the brunt of the adjustment, and not price.[14]

If there are large shifts in the timing of consumption as demand or supply conditions change, the data should reveal large swings in delivery lags (the lag between the placement and shipment of an order). Zarnowitz (1962, 1973), Maccini (1973), and Carlton (1983b) stress the importance of delivery lags as market-clearing phenomena. Many markets are characterized by large fluctuations in delivery dates and small fluctuations in price. For example, Table 17.2 presents measures of the variability (the standard deviation of the logarithm of a variable is a measure of the variability of the percent change in that variable) of price and delivery lags for several major manufacturing industries. As the table shows, the measure of variability of delivery lags is 1.6 to 8.3 times larger than the measure of variability in price for many industries. Thus, the insight of the dynamic competition theory—that the price fluctuations that clear markets may be lower than those predicted by a simple model that ignores the importance of intertemporal substitution—is consistent with the evidence.

Carlton (1985) estimates the importance of price and delivery lags in determining demand. As Table 17.2 shows, for many markets, the fluctuations in delivery lags also can be important in equilibrating demand and supply. For example, according to Table 17.2, an increase of one standard deviation in the logarithm of the price of steel causes demand to fall by about $.43 (= .03 \times 14.36)$ percent while an increase of one standard deviation in the logarithm of delivery lags causes demand to fall by about $.20 (= .25 \times .78)$ percent.

Nadiri and Rosen (1973), Haltiwanger and Maccini (1988), and Topel (1982) estimate the time paths by which firms adjust factors of production in an attempt to meet fluctuations in demand. These studies explicitly recognize that firms can vary price, inventories, labor, and other factors of production to achieve their desired sales. Such studies of intertemporal substitution in production provide a better understanding of the behavior of price over time. For example, if it is costless to store inventories, price cannot

[14]If goods are described by a vector of characteristics, then in response to a perturbation in either supply or demand, not only does the quantity consumed and the price of the good change but also its characteristics can change (Rosen 1974). For example, in response to an increase in the demand for bus transportation during rush hour, each bus may be much more crowded than during nonrush hours. That is, a less desirable product has been substituted, and prices have remained unchanged.

TABLE 17.2 Price and Delivery Lag Fluctuations

Industry	Standard Deviation of Log of Price	Standard Deviation of Log of Delivery Lag	Median Delivery Lag (months)	Demand Elasticity of Price	Demand Elasticity of Delivery Lag
Paper and allied products	.05	.08	.46	−1.37*	−.40*
Steel	.03	.25	1.95	−14.36*	−.78*
Fabricated metals	.03	.18	3.06	−1.75	−.30*
Nonelectrical machinery	.04	.25	3.63	−3.50*	−.35*
Electrical machinery	.05	.10	3.86	−1.60*	−.64*

*Indicates that the estimated coefficient is statistically different from zero using a commonly applied statistical criterion.

Source: Carlton (1983b, Table 1), and Carlton (1985).

be expected to increase. If price were expected to increase, there would be an incentive to sell less today and hold more inventory for the future, driving current price up. If price were expected to fall, then firms would sell their current inventory today, tending to drive price down. Therefore, the possibility of inventory holding tends to stabilize price.

A firm's choice of production technology influences its ability to engage in intertemporal substitution, affects the firm's supply curve, and thereby affects the speed with which supply can respond to changes in demand (Stigler 1939). Mills and Schumann (1985) investigate which firms adopt a production technology that is flexible in the sense that the firm can, at low cost, vary its production over a wide range of outputs. Mills and Schumann find that small firms typically have more flexible production technologies than large firms. It would follow, then, that small firms expand relative to large firms during booms.

In summary, a dynamic competition theory explains how markets respond to shocks without large changes in current prices. Instead of large price changes, large shifts over time in the quantities consumed or produced may occur as firms or consumers take advantage of intertemporal substitution.

Oligopoly. The introduction of time affects oligopoly models for many of the same reasons just discussed for the competitive model. That is, the ability of consumers to substitute across time periods and the ability of firms to produce across different time periods affect how the market responds to changes in supply or demand. In Chapters 5 and 6, we discussed the pricing implications of several different models of oligopoly over time. In Rotemberg and Saloner (1986) and Rotemberg and Woodford (1991), price wars break out in booms, whereas in Stigler (1964a) and Porter (1983b) and Green and Porter (1984), price wars break out in downturns in business activity or when economic uncertainty increases, as in inflationary times (Vining and Elwertowski 1976).[15] The empirical evidence discussed in Chapter 5 does not support the Rotemberg and Saloner model's prediction of when cartels break apart.[16]

Monopoly. The introduction of dynamic elements into the study of monopoly raises the same issues about intertemporal substitution in demand and supply discussed for competition. For example, a monopoly that can hold inventory takes into account the relation among the marginal revenue curves at different points in time in setting its price. As a result, the monopoly chooses a more stable price policy than the simple models of monopoly would suggest (Amihud and Mendelson 1983, Blinder 1982, Phlips 1983, and Reagan 1982).

The introduction of time raises an additional element in the case of monopoly (or perhaps among firms in an oligopoly) that does not arise in the case of competition. A monopoly is concerned not only with the influence of today's price on current demand, but also with its influence on future demand (Chapter 15 analyzes this effect for a durable goods monopoly). For example, an increase in the price of steel scrap may lead some steel producers to alter their plans for building new steel furnaces, and this in turn affects the future demand for steel scrap. To the extent that consumers adjust their future behavior in response to price changes today, a monopoly takes that adjustment into account in setting price. In contrast, a competitive firm has no control over its price today or in the future and, therefore, cannot respond to incentives to influence future demand.

For example, if costs rise unexpectedly in the short run but the monopoly knows that the increase is only temporary, the monopoly may not raise its price and pass these costs on to consumers for fear that they will misinterpret the current price increases as permanent and react to them in such a way that their long-run demand declines. Therefore, a monopoly may have an incentive to absorb temporary cost increases so that the current price is a good indicator to consumers of the future price.

Fixed Costs of Changing Price

If a fixed cost must be incurred every time a price is changed, a firm will not vary prices continuously as predicted by a simple market-clearing model under either competition or monopoly. Instead, an established price will remain fixed until a new price can exceed the old one by an amount sufficient to justify incurring the fixed costs (Barro 1972).[17]

[15] Carlton (1983a) discusses the effects of inflation on price behavior. Inflation raises information costs and can lead to greater use of standardized commodities with more flexible prices.

[16] In addition to studying the effect of successful collusion on pricing, intertemporal models in the presence of market power have been used to study inventory behavior (Rotemberg and Saloner 1989) and the pricing trade-offs that arise when a firm with an established client base seeks to attract new customers (Chevalier and Scharfstein 1995).

[17] Rotemberg and Saloner (1987) show that a duopoly with a fixed cost of price adjustment has more flexible prices than a monopoly under certain conditions.

This theory clearly accounts for price rigidities, but to be believable, it must explain the source of the fixed costs of changing a price. For example, it may cost money to publish a new catalog, print a new menu, or change the price of items already on the shelf.

Aside from the costs of having to relabel items, send out new catalogs, or print new menus, there is another reason that firms might be reluctant to change prices and might act as if they faced fixed costs for doing so. Some customers decide which firm to buy from only after comparing the price of that firm to the prices of other firms. As long as they believe nothing has changed, customers remain with the initially chosen firm. If they interpret a change in price by the firm as a signal that market conditions have changed, they may decide to search again to see if the chosen firm still has attractive prices. (See Ball and Cecchetti 1988.)

If the fixed costs of changing prices are high, then small price changes do not occur. Carlton (1986) tabulates the smallest observed price changes across a wide variety of products sold at the intermediate level of manufacturing and finds that, for the large majority of commodities examined, the smallest price changes are quite small. These small price changes in many goods suggest that, at least for these goods, the fixed costs of changing prices is small.[18] In contrast, Levy et al. (1997) find that the cost of price changes in supermarkets equals 35 percent of net margins. (See Example 17.3. See also Lach and Tsiddon 1996.)

Implications of an Unchanging Price for Inventories

Because prices for many products, once set, do not change for some time (Cecchetti 1985, Carlton 1986), there is a risk that consumers will be unable to buy products temporarily. The standard theories never consider the possibility that a product may be unavailable. Yet unavailability of a product is a fact of life in many markets.

Mills (1962) examines the behavior of a monopoly that must set price and production before observing demand. The optimal policy for a risk-neutral monopoly is to have enough output available so that the expected price received equals marginal cost. The expected price equals the price charged times the probability that a customer arrives and purchases the output.[19] The optimal inventory-holding policy of the firm depends on the markup of price above marginal cost. The closer price is to marginal cost, the smaller the optimal inventory; conversely, the higher the markup, the larger the optimal inventory. The incentive to hold inventory declines as the markup falls because the profit from making a sale falls, while the cost of holding unsold goods remains unchanged. What is interesting about this relationship is that the probability of *stock-outs* (shortages) increases as the market price falls relative to marginal cost.

[18]We use the word *suggest* because it is possible that we observe small price changes only when the new supply and demand conditions are expected to persist for a long time. The evidence could then be consistent with significant fixed costs of changing prices that cause prices to remain rigid for temporary shifts in supply and demand, but not for permanent ones. Although this explanation is possible, we have seen no evidence to support it.

[19]Imagine a newspaper vendor whose retail price is p, wholesale price is c, and that faces a random number of customers each day. If $F(S)$ is the probability that fewer than S customers will arrive in any day, then to maximize its profit, the risk-neutral vendor chooses S so that $p[1 - F(S)] = c$.

EXAMPLE 17.3 *The Cost of Changing Prices*

Economists who study price formation frequently comment that rigid prices reflect a relatively high cost of changing price. But what exactly are those costs? To answer this question, Zbaracki et al. (2003) followed one large industrial firm's price making process for its 8,000 products.

They divided costs into three kinds: physical, managerial, and customer. *Physical costs* include the cost of having to print and send out new prices, commonly called *menu costs. Managerial costs* include gathering the information needed to change prices and analyzing it. *Customer costs* reflect the effort of disseminating the new prices to customers and subsequent negotiations about price. This particular company began its price analysis in the summer and produced new list prices in November.

The study revealed that nearly a quarter of the cost (23%) of any price change is the time spent by managers in analyzing pricing and in communicating the price policy to the sales force. For example, company personnel involved in sales, marketing, finance, and pricing all spent considerable time on the pricing analysis before customers were informed about the new prices. By far, the most costly part of any price change (73%) is the time spent by managers and sales representatives meeting with customers and then renegotiating prices. The least costly part of the price change (4%) is the physical cost of the change.

Overall, the total cost of changing price accounted for 1.2% of the company's revenue, 6% of its operating cost, and 20% of its net margin. Although the firm changed more than 8,000 list prices, there were many more price changes because of individual price negotiations. The cost of per-price change ranged between $22 and $122. This estimate is considerably larger than estimates by some of the same authors for retail supermarkets and drugstores, primarily because of the large component involving customer interaction for this industrial company.

In Carlton (1977, 1978, 1984b, 1991), Deneckere and Peck (1995), DeVany and Saving (1977), and Gould (1978), consumers judge a firm not only by its pricing policy but also by its inventory policy. Consumers care not only about the price but also about the probability that a good is available. Inventory policy affects the probability that a firm has the good available. Some consumers prefer to shop at high-price stores that run out of goods infrequently, whereas others prefer to shop at stores that charge low prices but may run out of goods frequently.

Because a firm must maintain a relatively large inventory to satisfy customers whose demands fluctuate a great deal, the variability of consumers' demand for a product affects a firm's costs. Thus, the cost function of the firm depends on the demand characteristics of consumers. The simple separation between supply curves and demand curves is lost in these models.

If variability of demand influences a firm's costs, the firm wants to charge different consumers different prices based on their respective variability of demand. These price differences do not represent price discrimination; they reflect cost differences. Prices to consumers differ according to each consumer's variability of demand, even if each purchases the same quantity of a physically identical product in the long run. Moreover, if the variability of one customer's demand changes, then the price to that consumer would change while the prices to other consumers remain unchanged. The result would be a low correlation of price changes across consumers—a finding that characterizes many markets.

Prescott (1975), Eden (1990), and Dana (1999, 2001) use alternative models in which firms set prices before demand is revealed and customers can visit all stores before consuming, instead of visiting just the one store that the customers think is most likely to satisfy their demands. Imagine a road frequented by tourists driving into town looking for a hotel. The number of tourists varies from day to day. Prices are set each morning before any tourists arrive and cannot be changed during the day. The lowest-price hotels fill up first, so that the equilibrium involves a price distribution with the higher-price hotels renting all rooms less often than do the lower-priced ones, but every hotel earns zero expected profit. When demand is high, the prices paid rise on average because more high-priced rooms are rented. Thus, average price varies, even though the prices of all hotels are unchanged over time.

Now suppose that some travelers can book with a hotel in advance. Hotels prefer advanced bookings because reservations assure the hotel that its rooms are booked. Consequently, hotels use a pricing system similar to that of airlines, in which those customers who book early face different prices than those who are unable to book in advance. Dana (1998) shows that such pricing can lead to inefficiency.

Asymmetric Information and Moral Hazard

In many economic transactions, buyers and sellers have different information. Does the introduction of this kind of asymmetric information affect the equilibrium in a market? As discussed in Chapter 13, Akerlof (1970) showed that the answer is yes.

Akerlof's model can be extended to show how equilibrium may be characterized by either excess demand or supply (Stiglitz 1976, 1984). For example, suppose a firm wishes to hire one worker of a particular skill level. The firm obviously wants to pay as little as possible for such a worker. However, if the firm advertises a low wage, the people who apply for the job are likely to be low-quality workers. The higher the wage rate offered, the higher the average quality of the applicant. The average quality rises with the wage because higher-quality workers (in addition to the lower-quality workers who applied at the lower wage) apply for a job as the wage rises. Therefore, when a firm has difficulty measuring worker quality in advance, it sets a wage high enough to attract more than one applicant.[20] Equilibrium, therefore, involves setting a high wage and having an excess supply of labor apply to the firm.

[20]See also Keeton (1980) and Stiglitz and Weiss (1981) for examples in which interest rates remain rigid in models with asymmetric information.

Toward a General Theory of Allocation

This section sketches a theory that explains some of the puzzling evidence on price behavior that has already been reviewed. The theory relies on the simple insight that if it is costly to use a price system, then alternative allocation mechanisms may develop.[21]

The Cost of Creating a Market That Clears by Price Alone

Simple theories of market clearing ignore the cost of creating a market in which price allocates goods to buyers. Presentations of the standard theory often pretend that a fictional auctioneer adjusts prices to clear markets. Few markets, however, have auctioneers.

The markets that probably come closest to the textbook model of competitive markets are financial markets, such as futures markets. In a futures market, transactions for the right to buy or sell in the future occur. For example, Daniel agrees to buy and Lisa agrees to sell 1 bushel of wheat on April 1 of next year at an agreed-upon price and location. It is costly to run a futures market. Aside from the actual physical space required, there is the time cost for all those who participate in the market. For example, at the Chicago Board of Trade, there are floor traders and employees of the brokerage firms, as well as the members of the associated clearinghouses. The users of futures markets must somehow pay all the people who work either directly or indirectly in making the transactions for customers.[22] These payments can take several forms, such as direct commissions to those who transact, or bid-ask spreads to traders. If the trader buys at one price (called the bid price) but sells at a higher price (called the ask price), the trader can make a profit (the bid-ask spread) even in a steady market.

An important cost of making markets is the time cost of the actual customers (Becker 1965). A market in which customers had to spend large amounts of their own time in order to transact could be inefficient. The purpose of a market is not merely to create transactions, but to create transactions at the lowest cost.

Because the creation of markets is itself a productive activity that consumes resources, it makes sense to regard the making of markets as an industry. Just as there is competition to produce a better mousetrap, so too there is competition to produce better and more efficient markets (Carlton 1984a). The New York Stock Exchange competes with the NASDAQ market and the Chicago Mercantile Exchange competes with the Chicago Board of Trade. Creating successful markets is difficult (see Example 17.4).

Heterogeneity of the Product

The heterogeneity of the product is perhaps the most critical characteristic in determining whether an organized market (for example, one with an auctioneer) can be created that clears by price alone. If buyers prefer to buy at different firms, or at different

[21]The theories in this section are developed in detail by Carlton (1991). See also Okun (1981) and Williamson (1975).

[22]Markets also benefit nonusers by providing price information, thereby creating a free-rider problem.

EXAMPLE 17.4

Creating Futures Markets

It is difficult to create a successful futures market. Futures markets are markets that clear by price alone, and such markets exist for only a handful of commodities. Because there are definitely social benefits to the creation of such markets, and because at least some of these benefits can probably be privately appropriated, the paucity of such markets emphasizes that it must be costly to create them.

The table shows the average failure rates of new, successfully introduced futures markets (those listed in the *Wall Street Journal*) in the United States. The table indicates that about 40 percent of all futures markets fail by their fifth year. The making of successful markets is a risky activity, and, as the operators of exchanges well know, it is hard to predict which markets will succeed and which will fail.

Death Rates of Futures Markets

Age (Years)	Probability of Dying at the Given Age or Less
1	.16
2	.25
3	.31
4	.37
5	.40
10	.50

Source: Carlton (1984a).

times, or have different preferences for quality, it becomes more difficult to create an organized market that clears by price alone. Attempts to do so in the face of widespread product heterogeneity lead to markets with only a few traders in any given product, and the traders will not be able to pay for the cost of running the market (Telser and Higgenbotham 1977).

Suppose that each buyer can purchase either a standardized product or one specifically designed for the buyer. The advantage of a specially designed product is that it can satisfy the idiosyncratic needs of the buyer. The disadvantage is that the buyer is forced to transact in a less liquid (higher transaction cost) market. If there are few firms that can supply the buyer, the transaction costs rise. The greater the benefits from custom designing a product to one's own specifications, the less likely it is that a market can be created that clears by price alone. Indeed, in the extreme case, in which every buyer demands a slightly different product, it is impossible for traders to trade with each other without engaging in the time-consuming task of enumerating each product's characteristics, and the incentive to create an organized market is small.

Market Clearing in the Absence of Organized Markets. When an organized market does not exist, firms cannot costlessly discover the market clearing price, and they must rely on other methods to determine how to allocate their products to buyers. One alternative is for firms to post prices and for consumers to search over firms (see Chapter 13).

Another alternative is for firms to hire salespeople whose task is to become knowledgeable about the demands of individual customers. Even if it is difficult for the firm to set the market-clearing price, it may be possible to identify those customers who should obtain the goods so that goods can be efficiently allocated.[23] The firm could first use price to screen out those buyers who value the goods the least and then could use its knowledge of each buyer's needs to decide which of the remaining buyers should receive the goods. So, for example, it would not be uncommon during times of tight supply for steady customers to receive delivery while new customers wait. It would also not be unusual for buyers and sellers to enter into long-term relationships so that they could better understand each other's needs. See Example 17.5. Japanese firms frequently use this approach.

If price is not the sole mechanism to allocate goods, prices may remain rigid even though goods are being efficiently allocated. Although rigidity of prices implies inefficiency in any of the simple models in which price is the exclusive mechanism for efficient resource allocation, rigidity does not necessarily imply inefficiency in a world in which price is but one of many methods firms use to allocate goods. A theory that combines price with nonprice methods of allocation has five major implications:[24]

Knowledge of Needs: The longer the buyer and seller deal with each other (the better they know each other), the less need there is to rely on price to allocate goods efficiently. A seller's knowledge of a buyer's need can be a substitute for an impersonal (auction) market that clears by price alone. For example, a seller may know that a particular buyer's demand is greatest during the summer season and will ensure a large enough supply during that period to satisfy the buyer.

Different Treatment of Long-term Customers and Short-term Customers: The length of time over which a buyer and seller do business becomes a characteristic of the transaction and can make one buyer different from another in the eyes of the seller. A customer who regularly buys one unit every week is purchasing a different *product* than does the customer who purchases a unit only once. Therefore, observing differences in price movements to different buyers who buy identical physical commodities at one instant may reveal nothing about allocative efficiency; prices for different "products" should be expected to move differently from one another. The evidence that indices of spot prices and long-term contract prices do not always move together (Stigler and Kindahl 1970) is consistent with this implication, as is the evidence that the correlation of price movements across buyers of the same product is often low.

[23]For example, imagine that a firm with a capacity of 100 units has only two buyers, who are known to be identical but whose level of demand is not precisely known. If the firm is operating at capacity (that is, each buyer's demands are high at the stated price), then the efficient allocation is obvious (50–50), even if the exact market-clearing price is not known (Carlton 1991).

[24]Additional implications regarding behavior during periods of price controls, speed of price adjustment, behavior of price indices, and the role of marketing departments are discussed and tested in Carlton (1986, 1991).

EXAMPLE 17.5

Oh Say, Does That Star-Spangled Banner Yet Fly?

In the aftermath of the terrorist attacks of September 11, 2001, patriotic spirit flourished in the United States as Americans united to cope with the tragedy. One outcome of this patriotic fervor was a huge and unexpected increase in the demand for the American flag. How did flag manufacturers and retailers respond?

The answer is that the major flag retailers and flag makers did not raise prices, and the flag makers had to ration their scarce supply of flags. All of the flag makers faced excess demand from flag retailers for their flags. The flag makers delivered flags to flag retailers who were their previous customers. They did not supply new retailers who wanted to capitalize on the sudden jump in the demand for flags. Because the supply of flags was limited, manufacturers limited the number of flags that their traditional retail flag store customers could buy, typically in proportion to their historical purchases. Naturally, potential buyers were dissatisfied. "What we tried to do was make the dissatisfaction uniform throughout our customer base," reported Valley Forge, a flag supplier. Neither established flag retailers nor flag suppliers raised prices for fear that doing so would generate ill will among customers. According to Flag Zone, a retailer, "Nobody raised prices." If any flag supplier had jacked up the prices that it charged Yankee Doodle Flag Co., that retailer announced that it would cease doing business with that manufacturer in the future.

In addition, flag makers used various means to increase their output in the face of unprecedented demand. For example, Valley Forge reduced the number of flag styles it supplied from more than 100 to 12. Another company used printed rather than embroidered stars in order to raise production.

Source: Jeff Bailey, "Lessons for Small Firms from a Spike in Sales," *New York Times*, December 31, 2002:A11.

Different Prices for Customers: The pattern of a buyer's demand over the business cycle or, alternatively, the co-movement of one buyer's demands with those of other buyers is crucial information for the seller because it permits the seller to plan capacity to match customer needs. Even though two buyers purchase the same cumulative amount of the identical commodity, they may be charged different prices and have their prices change differently simply because they have different buying patterns over time. Moreover, the evidence on different price movements for different buyers of the same product is consistent with this observation.

Turnover and Price Rigidity: Rapid turnover of customers prevents the use of long-term relationships in which a seller's knowledge of customers is used to allocate goods. Industries with significant new entry or with customers that have little firm or brand loyalty should rely on price as the primary mechanism to allocate goods.

Firms Object to New Futures Markets: The establishment of a new futures market disrupts the traditional pricing policies of existing firms in an industry. These firms often complain about the introduction of the new futures market. For example, the aluminum futures market was established in the late 1970s. Aluminum producers opposed its establishment (*American Metal Market*, January 6, 1978, 9). If the allocation of goods is a productive activity that requires resources, then a futures market acts as a competitor to the marketing departments of firms in the industry. Futures markets create marketing information. Without futures markets, other agents, such as salespeople, must create this marketing information and be compensated for doing so. If a futures market is established, there is increased competition in marketing, and the value of marketing skills declines. Therefore, it is natural for firms that were successfully performing the marketing function before the introduction of the futures market to complain about the increased competition.

Market Structure Is More Than Concentration

Industrial organization economists often examine how market behavior differs as concentration in a market changes.[25] However, there are many other features of market structure that matter a great deal in explaining how markets behave and, in particular, how they respond to shocks in either supply or demand. For example, the previous sections show that market operation is significantly influenced by the ability of consumers and suppliers to substitute over time, and by the market's reliance on price to allocate goods.

This section presents two illustrations of market characteristics that influence an industry's responses to shifts in either supply or demand.[26] The two illustrations involve whether an industry holds inventories and whether an industry has a fixed price in the face of random demand. For simplicity, we treat these characteristics as given and proceed to analyze the subsequent industry behavior; however, these characteristics may depend on underlying economic conditions.

Produce-to-Order Versus Produce-to-Stock

Industries are organized in two basic ways: **produce-to-order**, where firms wait for orders and then produce, or **produce-to-stock**, where firms produce first, hold inventories, and then sell the inventoried products (Zarnowitz 1973, Belesley 1975). Our economy has probably increased its reliance on industries that produce to order versus

[25]This experiment only makes sense if concentration in a market is an exogenous variable. Concentration, however, is an endogenous variable and is influenced by the relative efficiency of firms (Demsetz 1973, Peltzman 1977, Sutton 1991, 1998, and Chapter 8). See Schmalensee (1985) for a different viewpoint.

[26]Other characteristics that influence the industry's response to shifts in either supply or demand include the ability of the industry to plan (Carlton 1982), the degree of vertical integration, (Carlton 1983a, Wachter and Williamson 1978), the importance of new products (Shleifer 1986), and the possibility of search (Lucas 1981, Diamond 1982).

those that produce to stock, especially with the relative growth of the service sector in recent times. In recent years, Japanese firms have emphasized the use of *just-in-time* deliveries of factors to minimize the maintenance of inventories.

An industry that produces to stock can satisfy customers more quickly and can take greater advantage of economies of scale than an industry that produces to order. On the other hand, an industry that produces to order eliminates the cost of inventory holdings of the final good (though not necessarily of inputs), can custom design products to closely match buyers' specifications, and can, perhaps, use flexible technologies to compensate for its lack of inventory holdings of the final output. The need to cut or raise prices significantly in order to clear markets often is greater in produce-to-stock industries than in produce-to-order ones. Moreover, the transmission of shocks to other sectors of the economy or into the future depends on whether an industry produces to stock (that is, holds inventories). For example, if either firms or final consumers hold inventories, a temporary increase in demand is at least partially accommodated by a decrease in inventory that, next period, will lead to an increase in production to replenish these stocks. If inventory is not being held, the increase in demand may only drive up current prices, with little, if any, increase in production in the current or subsequent periods.

Transmission of Shocks in Industries with Fixed Prices

In many industries, once prices are set, they do not change for some period of time. The production of the goods must occur before demand is observed, and therefore there is some risk that firms will run out of the good. The ratio of inventory to average demand depends on the ratio of price to cost (Carlton 1977). The reason is that the opportunity cost of a lost sale rises with price, so that the incentive to hold inventories increases with price. If price exceeds cost by a large amount, the amount of goods produced exceeds the amount demanded, on average. If, in contrast, price is close to cost, inventory on hand is small relative to the average level of demand, and the firm frequently runs out of stock.

Carlton (1977) also shows that in response to an increase in the riskiness of demand, firms increase their inventory holdings when price significantly exceeds marginal cost and decrease them when price is close to marginal cost. Firms that operate with little extra inventory are not able to cushion demand shocks. Therefore, when prices are temporarily unchanging and demand becomes riskier, an economy is more vulnerable to disruption (stock-outs) from shocks the closer prices are to marginal costs.

Economists have investigated the aggregate macroeconomic implications of models involving fixed costs of price changes (Akerlof and Yellen 1985, Mankiw 1985, Blanchard and Kiyotaki 1987).[27] This work shows that the need to adjust prices may be less important for a firm with market power (price above marginal cost) than for the economy as a whole. The firm's decision to change price in response to a demand change depends on whether the resulting increased profit, which depends on the gap between the new marginal revenue and marginal cost, offsets the fixed cost of the price change. Society's increased welfare from the price change depends on the gap between

[27] See also Dreze (1975), Fischer (1977), Hall (1978), Malinvaud (1979), Rotemberg (1982), and Phelps and Taylor (1977).

price (not marginal revenue, which is lower) and marginal cost and the fixed cost of the price change. If the firm was initially maximizing profits, so that marginal revenue equals marginal cost, then for small changes in demand the firm has no incentive to lower price even if society would benefit. Therefore, a firm's incentive to incur a cost to change price and society's incentive to do so may diverge.[28]

SUMMARY

The empirical evidence about price behavior is sufficiently inconsistent with the simple theories of market clearing that economists are now exploring more sophisticated theories. Prices for some products are much more rigid than any of the standard theories predict.

In markets in which prices do not adjust rapidly, temporary shortages occur. Other mechanisms besides price adjustments clear these markets. For example, consumers may postpone consumption or firms may adjust their inventories over time. Firms are slow to change prices because of transaction costs and for other reasons.

New theories account for some of the more puzzling features of market clearing. These theories recognize that intertemporal substitution matters, that marketing is a costly activity, and that price adjustments in conjunction with nonprice methods are often used for allocation.

The nature of the relationships between buyers and sellers helps determine the best method to clear the market. The creation of new futures markets may alter which methods are used. The way markets react to demand and cost shocks depends on many factors in addition to the degree of concentration in the market.

PROBLEMS

1. Rigid prices can create inefficiency. Do minimum wage laws impose such inefficiency?
2. Due to the recent financial crisis, banks sold certain financial derivatives that caused liquidity problems as they were difficult to sell. One proposal to increase liquidity is to standardize such products and trade them on organized exchanges. What reaction might banks have to this proposal?
3. Suppose that a firm has an upward-sloping marginal cost curve. Illustrate how the price-marginal cost margin behaves as price increases. How does the price-average cost margin change as price increases?
4. Is the establishment of an organized auction market more likely to benefit small firms or large firms?
5. Suppose two customers pay different prices for the identical physical product. Give a sufficient condition such that it is reasonable for an analyst to conclude that there is no price discrimination.

Answers to the odd-numbered problems are given at the back of the book.

[28] A closely related point is that in the presence of distortions between price and marginal cost, the value of an output expansion can be greater to society than to a firm (see Harberger 1971). Hart (1982) and Hall (1988a) apply this principle in a macroeconomic setting.

PART SIX

Government Policies and Their Effects

CHAPTER 18

International Trade

Free trade, one of the greatest blessings which a government can confer on a people, is in almost every country unpopular.
—Thomas Babington, Lord Macaulay 1824

Increasingly, industrial organization theory has been applied to international trade problems.[1] There are at least two reasons. First, international trade topics such as trade in branded products, dumping, the use of tariffs, subsidies, and quotas, and transfer pricing within a multinational firm are closely related to analogous problems in industrial organization. Second, interest groups that want either protection from foreign competition or subsidies from taxpayers use industrial organization theories to provide a patina of intellectual rigor to their pleas. Unfortunately, many of the policies governing international trade are contrary to the economic interest of consumers, and many laws cannot be justified on efficiency grounds by economic theories.

This chapter addresses four major issues:

1. Trade between countries may result in product differentiation, predatory pricing, price discrimination, or free riding.
2. Tariffs, quotas, and subsidies are used to create or battle monopolies.
3. Strategic trade policies are used to help domestic oligopolists compete with foreign rivals.
4. Trade policies help some groups and hurt others.

Reasons for Trade Between Countries

There are many reasons for trade between countries. The most important reason, the theory of *comparative advantage,* is that it is cost-effective for the countries to trade. After briefly discussing the theory of comparative advantage, we

[1] See, e.g., Krugman (1989).

turn to explanations for trade that are based on industrial organization theories: trade in differentiated products, free riding, and dumping (selling abroad at prices below costs or domestic prices).[2] Although the theory of comparative advantage explains much of the volume of trade between countries, the studies in Feenstra (1988) and others find that the theory does not explain other patterns of trade, especially those involving trade in similar products.

Comparative Advantage

Traditionally, the existence of trade between countries has been explained using the theory of comparative advantage. According to this theory, a country exports those products it can produce relatively inexpensively and imports those goods that it can produce only at relatively great expense.[3]

To illustrate this theory, suppose that the United States and Japan initially do not trade, and each country is in competitive equilibrium, in which price equals marginal cost. The United States produces and sells rice at \$1 per bag and televisions at \$10 per set. Japan produces rice at 200¥ (yen) and televisions at 1,000¥. If the United States were to produce one fewer television set, it could produce 10 extra bags of rice. Japan could produce one more television set at the cost of only 5 bags of rice. Thus, the two countries combined could produce the same number of television sets and have 5 extra bags of rice if they reallocated their resources in this manner. Both could gain if the United States shipped rice to Japan and Japan shipped television sets to the United States (assuming no transportation costs).

This argument that there is a *gain to trade* does not depend on absolute productivity levels. The argument would still hold if one Japanese worker could produce more of both goods than an American worker, or vice versa. The argument turns on only the *relative* costs of the goods in the two countries.

An **exchange rate** is the price of one currency in terms of another currency. In the previous example, if the exchange rate is 200¥ per dollar, a bag of rice sells for the same price in both countries, but a Japanese television set sells for half the price of an American set, so that Japanese sets would be shipped to the United States. If the exchange rate is 100¥ to the dollar, a television set costs the same in both countries, but a bag of U.S. rice sells for half as much as Japanese rice, so that U.S. rice would be shipped to Japan.[4]

The relative advantage of countries in producing, for example, food or clothing depends on the technology of each country and on each country's endowment of land, labor, and other resources. A country with a lot of labor and little capital finds it to its

[2]In addition, firms may have an incentive to ship products to other countries to avoid taxes. See **www.aw-bc.com/carlton_perloff** "International Transfer Pricing."
[3]We discuss this traditional explanation for trade only briefly. See any basic trade textbook, such as Krugman and Obstfeld (1997), Caves, Frankel, and Jones (1999, ch. 3), or Houck (1986) for more details.
[4]Trade models must have a constraint that links the value of imports and exports. In such models, there is an equivalence between taxes on exported and imported products (Lerner 1936). This chapter abstracts from several general equilibrium issues that link together expenditures on exports and imports.

advantage to export labor-intensive products and import capital-intensive products from countries with lots of capital and little labor. Given the United States' highly trained labor force, we would expect it to export goods and services requiring knowledgeable workers to countries that do not have a highly trained workforce.

Intra-Industry Trade in Differentiated Products

Trade of similar goods between similarly developed countries has grown rapidly.[5] For example, the United States both imports and exports automobiles, processed foods, clothing, and many other goods. That is, not only do countries with different endowments of factors of production trade one type of good for a very different good, but also countries with similar endowments of factors trade similar goods.

Models of differentiated products can explain this latter type of trade between countries. It does not make sense, of course, to have two-way trade in an undifferentiated product such as short-grain rice: One country should only export and the other country should only import. In contrast, countries may both import and export differentiated goods. Some Americans want to buy British cars and some British consumers want to buy American cars.

By applying the representative consumer model of differentiated products (Chapter 7) to international trade, we can show that consumers may benefit from such trade. Suppose consumers in each of two countries demand a variety of differentiated products (each produced by a different firm) and value variety. Because of scale economies (Chapter 7), only a finite number of different products get produced in each country.

Without international trade, the equilibrium number of products is, say, n in each country. If the two countries trade, the size of the combined market expands and each country can still produce n different products, but together, consumers in each country can choose between $2n$ different products. Thus, consumers are better off because they face a wider choice.

Free Riding, International Price Differences, and Gray Markets

The value of a dollar in terms of the German mark, the Japanese yen, or other currencies—that is, the exchange rate for the dollar—changed substantially over the last two decades. For example, $1 was worth 203 yen at the end of 1980, 251 yen at the end of 1984, 136 yen at the end of 1990, and 107 yen at the end of 2003. The change in exchange rates greatly affects the incentives to trade between the United States and other countries.

Suppose that $1 is worth 1 Japanese yen initially. Two identical products might sell for $1 in the United States and 1 yen in Japan. Now suppose that the exchange rate changes so that a dollar becomes more valuable: $1 is worth 2 yen or, equivalently, 1 yen is worth $.50. A Japanese retailer could ship the product to the United States and receive $1 or 2 yen, instead of receiving 1 yen from selling the product at home. Firms that ship products between the two countries to make a profit cause the price in the

[5] Helpman and Krugman (1985, 1989), and Helpman (1988).

United States to fall (because the supply there rises) and the price in Japan to rise (because the supply there falls). This process, called *arbitrage,* drives the prices in the two countries into equality at the new exchange rates. For example, if the product is produced only in the United States and the competitive supply curve is horizontal, the U.S. price remains at $1, but the Japanese price rises to 2 yen ($1 at the new exchange rate).

In the mid-1980s, the prices of many products did not behave as expected in several countries as exchange rates fluctuated and the dollar became more valuable. Many prices remained at their initial levels rather than changing in response to exchange rate fluctuations. Even if the foreign and U.S. prices were roughly equivalent initially, after the exchange rates changed they were no longer equivalent. For example, Mercedes cars, Nikon cameras, and French perfume sold for much higher prices in the United States than in foreign countries when prices are expressed in a common currency using prevailing exchange rates.

Apparently these manufacturers prevented arbitrage from equilibrating the prices in different countries. Some manufacturers only permit authorized dealers to handle their products. Any authorized dealer that imports the product from Europe instead of buying it from the manufacturer could lose its authorization. The foreign goods shipped to the United States outside of normal channels (those authorized by the manufacturer) of distribution are called *gray market* goods. Efforts to prevent gray markets by camera manufacturers are discussed in Example 18.1.[6]

Two possible explanations can be given for the rise of gray markets: one based on international price discrimination and the other on costs of promotion and free riding. Suppose that the price elasticity of demand for a product is initially the same in the United States and in a foreign country, but the demand becomes relatively less elastic in the United States as the dollar appreciates in value. A manufacturer with market power would price discriminate, charging more in the United States and attempting to prevent resale of its goods from foreign distributors to U.S. distributors. If the manufacturer cannot prevent resales, a gray market forms.

Although the price discrimination explanation is logically possible, it is doubtful that it can explain much of the behavior during this period. Why should the U.S. price elasticity of demand increase as the exchange rate rises? Surely the demand for all goods did not simultaneously become less elastic in the United States. Moreover, in several of the affected industries, there are many competitors, so that significant market power seems unlikely.

An alternative explanation based on international free riding may be more plausible. A distinguishing characteristic of most, if not all, of the products with gray markets was that they were heavily promoted using advertising or other sales efforts.

Suppose that some product, say cameras, is manufactured in Japan. Cameras are a promoted product in which the reputation of the camera is created and established in a consumer's mind. Promotion typically involves advertising as well as in-store

[6]Fargeix and Perloff (1989) show that under certain circumstances, manufacturers may oppose tariffs designed for their protection and instead may prefer gray markets.

EXAMPLE 18.1

Gray Markets

During the early to mid-1980s, the dollar rose substantially in value relative to other major trading currencies. This increase led to some dramatic differences across countries in the prices of branded goods in terms of dollars. For example, a Mercedes-Benz that sold for about $24,000 in Los Angeles cost only $12,000 in Munich, Germany. Rolex watches cost $600 in Zurich, Switzerland, but $1,800 in New York. Similar price differentials were observed in the markets for cameras and perfume. These large international price differences led to gray markets.

As a result of gray market imports, authorized U.S. distributors faced competition from goods purchased abroad and sent to the United States without the consent of the manufacturer. For example, an authorized dealer sold an Olympus camera in the United States for about $240, whereas the U.S. gray market price was $190 for the same camera. Distributors and manufacturers spent considerable effort to track down and limit the unauthorized shipments from abroad, but frequently were not successful.

Due to the gray market, some customers paid a lower price but were not always able to benefit from promotion and sales efforts of authorized U.S. distributors. Some customers became dissatisfied. For example, several manufacturers provide warranties on cameras sold by authorized U.S. distributors, but not for physically identical cameras sold through the gray market. When customers with gray market cameras needed warranty service, they often were rudely surprised to learn that, based on the serial number of their camera, they were not entitled to the U.S. warranty. Occasionally, to preserve goodwill, the manufacturer would foot these repair bills. Numerous articles in newspapers warned consumers of the potential problems with buying gray market goods.

By the late 1980s, however, the value of the dollar had fallen relative to the currency of most of our trading partners. Because of the lowered value of the dollar, the concern with the gray market in the United States disappeared.

The increased value of the yen relative to the dollar, however, created incentives for goods in the United States to be shipped to a Japanese gray market. For example, in 1988, a Canon camera sold for $340 in New York and for a dollar-equivalent price of $462 in Japan. Cameras sold in the gray market in Japan were selling for 30 to 40 percent less than similar cameras sold through authorized distribution channels.

Source: Larry Armstrong, "Now, Japan Is Feeling the Heat from the Gray Market." *Business Week,* March 14, 1988:50–51; Sylvia Porter, "Gray Market Goods Cause Consumer Problems." *The Dispatch,* July 15, 1985:11; Grace Weinstein, "Gray Market Discounts: Be Careful." *Good Housekeeping,* September 1, 1985:251; Maks Westerman, "The $7 Billion Gray Market: Where It Stops, Nobody Knows." *Business Week,* April 15, 1986:86–87.

demonstrations.[7] The amount and effectiveness of promotion varies by country. Indeed, if the reputation of the product, which is created by promotion, differs in the two countries, the camera in the United States is not the same product as the camera in Japan. As a result, differences in price may not reflect price discrimination. Indeed, the price differences might only reflect the different costs of promotion in the two countries.

To illustrate this theory, suppose a Japanese manufacturer faces the same elasticity of final demand, ϵ, in the United States and Japan, so that there is no possibility of traditional price discrimination. The manufacturer incurs a constant marginal and average cost m to produce the product and uses one distributor in each country to sell the product to customers and to promote the product or train consumers to use it. The manufacturer provides each distributor with an incentive to provide sales effort by giving the distributor an exclusive territory, in this case a country (Chapter 12). The manufacturer charges the distributor its marginal cost, m, for the product and extracts all distributor profits using a franchise fee (which gives the distributor the exclusive right to sell the product).

To keep the example simple, assume, initially, that both U.S. and Japanese distributors must incur a promotional or training expenditure of E dollars per unit and E yen per unit respectively and that initially \$1 equals 1 yen. The distributor maximizes its profit by setting its marginal revenue equal to its marginal cost. Equivalently, its monopoly price markup (Lerner's Index) equals the negative of the reciprocal of its elasticity of demand,[8]

$$\frac{p - (m + E)}{p} = -\frac{1}{\epsilon}, \tag{18.1}$$

where all relevant prices and costs are in yen. In the United States, the optimal retail price is determined by

$$\frac{p - (fm + E)}{p} = -\frac{1}{\epsilon}, \tag{18.2}$$

where p and E are in dollars, m is in yen, and f is the exchange rate (initially $f = 1$) converting yen to dollars. If $m = 1$, $E = 1$, and the elasticity of demand, ϵ, equals -2, then $p = 4$ in each country.

[7] For example, to many consumers, a sophisticated camera becomes useful and valuable only if camera store personnel are sufficiently trained (at great expense) so that they can inform the consumer about the product. A camera sold by trained personnel is a different product than one sold by personnel without training. We expect the price of a camera to be higher in countries where consumers have access to an expensive distribution system with trained sales people than in countries with no distribution system.

[8] The distributor's profit is $\pi = [p(q) - (m + E)]q$ minus a (fixed) franchise fee. Thus, its first-order condition is $p'q + p = (m + E)$, or marginal revenue equals marginal cost. This expression can be rewritten as

$$\frac{p - (m + E)}{p} = -\frac{p'q}{p}.$$

Noting that $p'q/p = (dp/dq)(q/p) = 1/\epsilon$ we obtain Equation 18.1, which is equivalent to Equation 4.3.

Suppose an unauthorized American distributor can import the product and sell it in a gray U.S. market. The unauthorized firm would free ride on the efforts of the authorized firm and would provide no promotional or training efforts. For example, the authorized dealer could provide a showroom where consumers could try out the product or provide training in using it. The unauthorized dealer could send its customers to the showroom to see the product.

The authorized Japanese distributor has an incentive to sell to the unauthorized U.S. distributor. By doing so, the Japanese distributor can avoid incurring the (Japanese) promotion charge of 1 yen and the unauthorized American distributor can free ride off the promotion efforts of the authorized American distributor. The authorized Japanese distributor could profitably sell to an unauthorized American distributor for, say, 3 yen, and the unauthorized American distributor could profitably sell to customers for $3.50, which is less than the authorized U.S. distributor's monopoly price of $4.

Similarly, the authorized American distributor has an incentive to sell to an unauthorized Japanese distributor, who can free ride on the promotional efforts of the Japanese distributor. Thus, bilateral international trade occurs because of international free riding. Indeed, there is an incentive for this bilateral trade to occur even if there is no difference in the retail price between the two countries in the absence of gray markets. This free riding harms the manufacturer because it erodes the incentive of its authorized distributors to promote the product, and it can ultimately harm consumers by reducing or eliminating promotional and service activities by distributors (Chapter 12).

There are two additional implications of free riding in an international context that do not arise in the domestic story. First, the optimal U.S. price varies as the exchange rate, f, changes. By solving Equation 18.2 for p, we find that the optimal U.S. price is $(fm + E)\epsilon/(1 + \epsilon)$. The production cost, m, is fixed in yen because the product is produced in Japan; however, p varies as the exchange rate, f, changes. The percentage change in the U.S. price in response to a change in f becomes smaller when the fraction of manufacturing cost to total cost becomes smaller.[9] For many heavily promoted products, the actual manufacturing cost is such a small fraction of total cost that one may see little price variation in the optimal U.S. price in response to changes in the exchange rate. Thus, if manufacturing costs are a small share of total costs, free riding provides an explanation for why the price of highly promoted internationally traded products did not vary much in response to large exchange rate fluctuations.

Second, the incentive to free ride increases as the promotional expense increases (Chapter 12). Even if initially E dollars equals E yen, after a large exchange rate movement in which the dollar becomes more valuable (f falls), the E dollars of U.S. promotion is much more valuable than the E yen of Japanese promotion and the profitable

[9]The percentage change in price with respect to a change in the exchange rate is $(dp/df)/p = m/(fm + E)$. If $f = 1$ initially, the percentage change equals the share of manufacturing costs in total costs.

incentive for the authorized Japanese distributor to ship to a free-riding, unauthorized U.S. distributor increases. Therefore, we expected to see more authorized Japanese distributors shipping goods to the United States in the 1980s than in the 1990s. Moreover, it is not just the Japanese distributor who has the incentive to ship to the United States. As f falls from its initial value of 1, the Japanese retail price $(m + E)\epsilon/(1 + \epsilon)$ is lower (when converted to dollars) than the U.S. retail price. This differential creates an incentive for any entrepreneur to buy at retail in Japan and ship to the United States.[10]

Indeed, in the mid-1980s, many people bought products in Japan at retail and resold them in the United States. Similarly, Japanese retail stores shipped the products to unauthorized U.S. distributors. Typically, these imported gray market goods were sold by U.S. discount retail stores at lower prices than were charged by authorized U.S. distributors.

Manufacturers feared that the free riding by these discount stores, together with the reduced price, would erode the incentives for their authorized U.S. distributors to promote the product. The manufacturer wants to control the free riding and will spend money to monitor the efforts of its authorized distributors and make sure that its authorized distributors are not participating in the gray market. However, it is much more difficult for a manufacturer to prevent Japanese customers (or retail stores) from selling to the United States.

In the mid-1980s, many manufacturers asked the U.S. government to protect their trademark on the branded products that they promoted by refusing to allow any unauthorized foreign trade in their branded goods unless the brand name was removed. In most cases, the manufacturers were unsuccessful.

Dumping

Certain types of price differentials across countries are prohibited. Under international law, a firm is **dumping** if it sells its product abroad at a price below its domestic price or below its actual costs. For example, if a Japanese firm sells steel in the United States for $250 a ton, but sells it at $300 a ton in Japan, that firm is said to be dumping steel in the United States.

In justifying laws against dumping, many argue that dumping is typically a strategic act designed to harm rival firms. There are many explanations for dumping.[11] We focus on three: predatory pricing, price discrimination, and reciprocal trade for spatial reasons. We then discuss the legal aspects of dumping.

[10] If retail stores in addition to distributors engage in sales promotion, the example becomes more complicated (see *An Analysis of Gray Markets,* Lexecon Report, 1985, in which Carlton participated), but the basic conclusion is unchanged. Free riding creates incentives for Japanese retail customers, Japanese retail stores, and Japanese distributors to ship to the United States in the example in the text.

[11] We have seen how free riding can give rise to foreign sales at prices below domestic prices. Ethier (1982) contends that dumping may result as a response to cyclical conditions. When domestic demand is low, firms may choose to sell abroad at a low price rather than lay off their employees. See also Davies and McGuinness (1982), Bernhardt (1984), Brander and Krugman (1984), Hillman and Katz (1986), Gruenspecht (1988a), Berck and Perloff (1990), and Dick (1991).

Predatory Dumping. If a firm sets an extremely low price in a foreign country so as to engage in predatory pricing (Chapter 11) against that country's firms, it is said to be engaged in **predatory dumping**. Firms in the United States frequently claim that a dominant firm (or entire industry acting collectively) in a foreign country sells its product in the United States at a price below the minimum average cost of the U.S. domestic firms, which drives them out of business. Once the domestic industry is destroyed, the foreign firm is free to raise its price in the United States to a monopoly price.[12]

This story of predatory dumping has the same logical problems that we discussed in Chapter 11. Why should the foreign firm be willing to incur losses for as long as necessary to destroy the U.S. industry? Why don't the U.S. firms retaliate or, better yet, encourage U.S. customers to consume massive amounts of goods so as to bankrupt the foreign firm? What prevents the U.S. firms from reentering the market once the foreign firm raises its price? The U.S. Supreme Court has recognized explicitly these logical problems in a case involving a charge of predatory dumping where it ruled that predation was not plausible (see Example 11.1).

If a foreign firm that is identical to U.S. firms tries to predate, it probably will fail and go bankrupt. However, a foreign country could tax its citizens to provide a subsidy to its firm to enable it to charge predatory prices in the United States. Charging low prices for extended periods of time might then be feasible for the foreign firm. A government, unlike a private firm, need not be constrained by economic rationality (Lott 1999). Nonetheless, when the price eventually rises, U.S. firms may be able to reenter the market. If there is little chance of success in subsequently raising price, the foreign country that is subsidizing the predation is providing a gift to U.S. consumers.

If a foreign firm has lower costs than U.S. firms, it can successfully drive them out of business but still set price above its costs. Once the U.S. firms are driven out of business, the foreign firm can raise its price to the point where U.S. firms are indifferent between reentering the market and not. That is, the foreign firm can limit price (Chapter 11).[13] Were a low-cost U.S. firm to engage in this action, it probably would not be violating any antitrust law. Indeed, we want to encourage efficient firms to take over markets because consumers can only benefit. Putting foreign policy concerns aside, it is difficult to see why efficient foreign firms should be treated differently than efficient domestic firms.

Discriminatory Dumping. If a firm charges a lower price in a foreign market than in the domestic market so as to price discriminate, it is engaging in **discriminatory dumping** (Viner 1923) and thereby violating antidumping laws. Suppose a Korean monopoly sells at home and in the United States. If demand is less elastic in Korea than in the United States, it is profit-maximizing for the monopoly to price discriminate and charge a lower price in the United States. In the absence of the price discrimination, the price will typically rise to Americans and fall to Koreans as long as both

[12]For example, the *Economist* (April 5, 1986: 82) reports: "To a man the American ragtrade believes that Crompton was driven out of business by Japanese dumping. They say that the day after Crompton filed for Chapter 11 bankruptcy the Japanese raised their prices on rival goods by 50 percent."
[13]Berck and Perloff (1990) show that it is not optimal for a low-cost foreign firm to predate in the sense of pricing below its marginal cost while driving competitive fringe domestic firms out of business.

American and Korean customers continue to be served. American consumers benefit, Korean consumers are hurt, and the monopoly benefits from the price discrimination.

Were it not for international trade barriers and transport costs, such price discrimination could never exist. Without trade barriers and transportation costs, entrepreneurs would ship goods from low-price countries to high-price countries (arbitrage) until prices are equated in both countries. That is, price discrimination is impossible unless resale can be prevented (Chapter 9).

In our example, U.S. consumers clearly benefit from price discrimination. Why then would the United States want to complain about discriminatory dumping? U.S. consumers benefit from such price discrimination; however, U.S. producers are harmed. Even though the gain to U.S. consumers exceeds the loss to U.S. producers, producers may bring actions against foreign firms under U.S. laws to prevent U.S. consumers from receiving such a benefit (Dixit 1988a).

Reciprocal Dumping. In a variant of the price discrimination story, firms in different countries engage in **reciprocal dumping** (Brander and Krugman 1983) where each firm dumps in the other's country. This story is based on a model of spatial competition (Chapter 7).

Suppose there is a single firm in each country. Without international trade, each firm charges the (same) monopoly price, p_m, in its own country. If trade is allowed, each firm sells in the other country if the cost, T, to ship a good to the other country is low enough so that $p_m - T$, exceeds marginal cost, m. If the firms invade each other's country, then, in each country, the domestic firm has a cost advantage over its foreign rival.

In equilibrium, the domestic firm sells more than the foreign firm at a price, p, that is lower than p_m because competition between the two firms drives prices down from the monopoly level. Moreover, the price a firm receives at home, p, is more than the net price, $p - T$, it receives from sales in the foreign country. That is, both firms are price discriminating in the sense that they receive different net prices from sales to different consumers. This reciprocal price discrimination or dumping benefits consumers in *both* countries by lowering prices below the monopoly level, although consumers are still paying more than the competitive price.

This shipping of identical goods in both directions (cross hauling) is clearly inefficient. It makes no sense for society to incur the transport costs of importing a foreign-produced product if that product can be supplied locally. Inefficient cross hauling arises only because of the noncompetitive market structure, but does result in lower prices to consumers.

Legal Standards for Dumping. Dumping is defined under the General Agreements on Tariffs and Trade (GATT) as selling a product "at less than its normal value."[14] Dumping is said to occur if a product is exported from Country 1 to 2 and

[14]GATT is a set of rules agreed to by many nations that controls the terms of trade between these nations. One purpose is to limit "trade" wars in which countries wind up adopting protectionist measures that dampen trade and harm all countries involved. In 1995, the World Trade Organization (WTO) was formed to promote international trade and incorporated GATT into its rules. It has about 150 member countries.

1. the price of the exported product in Country 2 is below the price of the comparable product in Country 1, or
2. if no such comparison can be made, the price of the exported product in Country 2 is below either (a) the price of a comparable product exported from Country 1 and sold in any other country, or (b) the cost of producing and selling the product.

Individual countries pass antidumping laws that are consistent with the GATT. In the United States, the International Trade Administration (ITA) within the U.S. Department of Commerce is responsible for administering the law in the United States. The U.S. International Trade Commission (ITC), an independent federal agency, conducts independent investigations into injury from dumping. The Court of International Trade and, if requested, the Court of Appeals for the Federal Circuit determine whether the ITC and ITA act in conformity with the antidumping statutes.

The antidumping laws are the most frequently used tool to limit competition from imports into the United States (Horlick 1989, 102). Between 1995 and 2002, 292 antidumping petitions were initiated with the ITA and ITC against firms in 48 countries around the world.[15] The per year rate of filing of cases was 36.5 compared to 22.9 cases per year in the 1970s (Sun 1993). Domestic firms bring actions under these laws frequently because the penalties in dumping cases are often very high and thereby offer sizable protection from foreign competition. For example, in March 2002, the U.S. imposed tariffs of between 8 and 30 percent on a wide range of steel products (Francois and Baughman 2003).

For the cases filed in the United States from 1995 to 2002, 14 percent were filed against Chinese firms, 9 percent against Japanese firms, 7 percent against South Korean firms, 5 percent against Taiwanese firms, and 4 percent each against German and Indonesian firms. Table 18.1 shows the pattern of dumping investigations in several countries.

Of the U.S. cases initiated during the period 1995–2002, 65.8 percent had antidumping duties assessed. Presumably, many cases filed have little merit. Whereas 76 and 75 percent of the suits against Chinese and Taiwanese firms, respectively, resulted in the imposition of an antidumping measure, only 38 percent of the cases against German firms had such a result.

Over time, governments have increasingly used antidumping cases to protect local industries (Finger and Flate 2003). Before 1994, the number of antidumping proceedings initiated by industrial (developed) countries far exceeded the number initiated by developing countries. Since 1994, that pattern has reversed as developing countries have increasingly protected their local industries. For example, between 1995 and 2002, industrial countries (Australia, Canada, the European Union, Iceland, Japan, New Zealand, Norway, Switzerland, and the United States) conducted 819 antidumping investigations, and developing countries (all other countries, excluding those 27 countries defined by the United Nations to be transition economies) brought 1,144.

[15]The World Trade Organization Web site has statistics on antidumping initiations and measures for the period 1995–2002 disaggregated by both reporting and affected country.

TABLE 18.1 Number of Dumping Case Investigations Initiated

	Year								
Country	1995	1996	1997	1998	1999	2000	2001	2002	Total
Argentina	27	22	14	8	24	45	26	14	180
EC	33	25	41	22	65	32	29	20	267
India	6	21	13	27	65	41	79	79	331
South Africa	16	33	23	41	16	21	6	4	160
United States	14	22	15	36	47	47	76	35	292
Other	61	101	137	121	138	102	146	124	930
Total	157	224	243	255	355	288	362	276	2160

Source: WTO website: **www.wto.org/english/tratop_e/adp_e/adp_stattab2_e.pdf**.

In contrast in the earlier 1987–1994 period, the corresponding numbers were 1,150 and 445. Moreover, if one adjusts for the amount of imports on the theory that more imports will lead to more antidumping actions, the intensity with which some developing countries (such as Argentina, India, and South Africa) use antidumping proceedings is far above the norm. Interestingly, the developing economies not only initiated more dumping proceedings than industrial economies over the period 1995–2002, but they also were the target of dumping proceedings more frequently than the industrial countries.

The United States defines dumping as "sales at less than fair value." The definition of fair value is extremely complex.[16] The U.S. antidumping laws mandate that a foreign firm's home price not be used as a basis of comparison if the home price is below fully allocated cost plus a reasonable profit. This provision has allowed U.S. antidumping actions to focus not on a comparison of the U.S. price with the home country price, but rather on a comparison of the U.S. price with the "full" cost plus reasonable profit (an 8 percent margin). About 60 percent of all U.S. dumping actions have used this standard since 1980 (Horlick 1989, 136). Curiously, while the below-cost justification is increasingly used in antidumping cases, the U.S. Supreme Court has sharply reduced the applicability of the doctrine in predatory pricing cases (Chapter 19 and Example 11.1).

[16]For example, Section 722(d)(1)(C) of the Tariff Act of 1920, as amended, 19 U.S.C. Section 1677a(d)(1)(C), and Section 353.10 of the antidumping regulations provide that, in determining whether the price in the United States is less than the price in the home country, the International Trade Administration of the U.S. Department of Commerce shall increase the U.S. price by: "the amount of any taxes imposed in the country of exportation directly upon the exported merchandise . . . which have been rebated, or which have not been collected, by reason of the exportation of the merchandise to the United States, but only to the extent that such taxes are added to or included in the price of such or similar merchandise when sold in the country of exportation. . . ." Such rules, of course, make these comparisons difficult (Karp and Perloff 1989b).

In cases where the below-cost standard is not used, the price of a particular transaction in the United States is usually compared to the average price in the home country to determine whether dumping occurred. Such a comparison is bound to find at least some offending individual U.S. sales as long as there is some price dispersion, as is typical for most products. For example, suppose that the average price in both the foreign country and the United States is \$5. However, in each country half the sales occur at \$6 and half at \$4. There could still be a finding of U.S. sales below fair value, because half of all U.S. sales are below the average home price of \$5. No offsetting credit is given for U.S. prices above \$5. These offending sales are subject to a duty equal to the dumping margin based on the average price.

A second element of any U.S. antidumping proceeding is the showing that material injury to the U.S. industry (*not* to U.S. consumers) results from the dumping. From an economic viewpoint, the sale of a foreign product in the United States must reduce U.S. domestic sales from what they otherwise would be. Despite the apparent simplicity of this concept, whether an "injury" occurred is often vigorously debated. The injury is usually interpreted as lower prices, output, investment, employment, and profits than would exist in the absence of dumping. The "materiality" requirement presumably requires that the effects are significant, not trifling.

A typical element of any dumping proceeding is to show that the imports were the "cause" of injury to U.S. industry. As a logical matter, events other than dumped imports influence an industry, and those other events should be considered when evaluating whether the injury caused by the dumped imports to the domestic industry was material.

The lack of economic logic underlying the desirability of antidumping laws combined with the lack of economic logic associated with parts of the administration of the antidumping laws probably results in a significant harm to U.S. consumers that is only partially offset by a small gain to U.S. producers.[17] The antidumping laws are often used to protect U.S. industries from competition and can be viewed as a successful use of government to protect powerful U.S. industries. If current practices continue, the cost to the United States will climb as the potential for international trade increases.

Tariffs, Subsidies, and Quotas

Tariffs, subsidies, and quotas serve to insulate a domestic market from international trade and may help domestic firms compete with foreign rivals.[18] We examine their use first in competitive markets, then in noncompetitive markets, and finally in markets in which there are positive externalities. We conclude the section with an evaluation of the evidence on the success of strategic international trade policies.

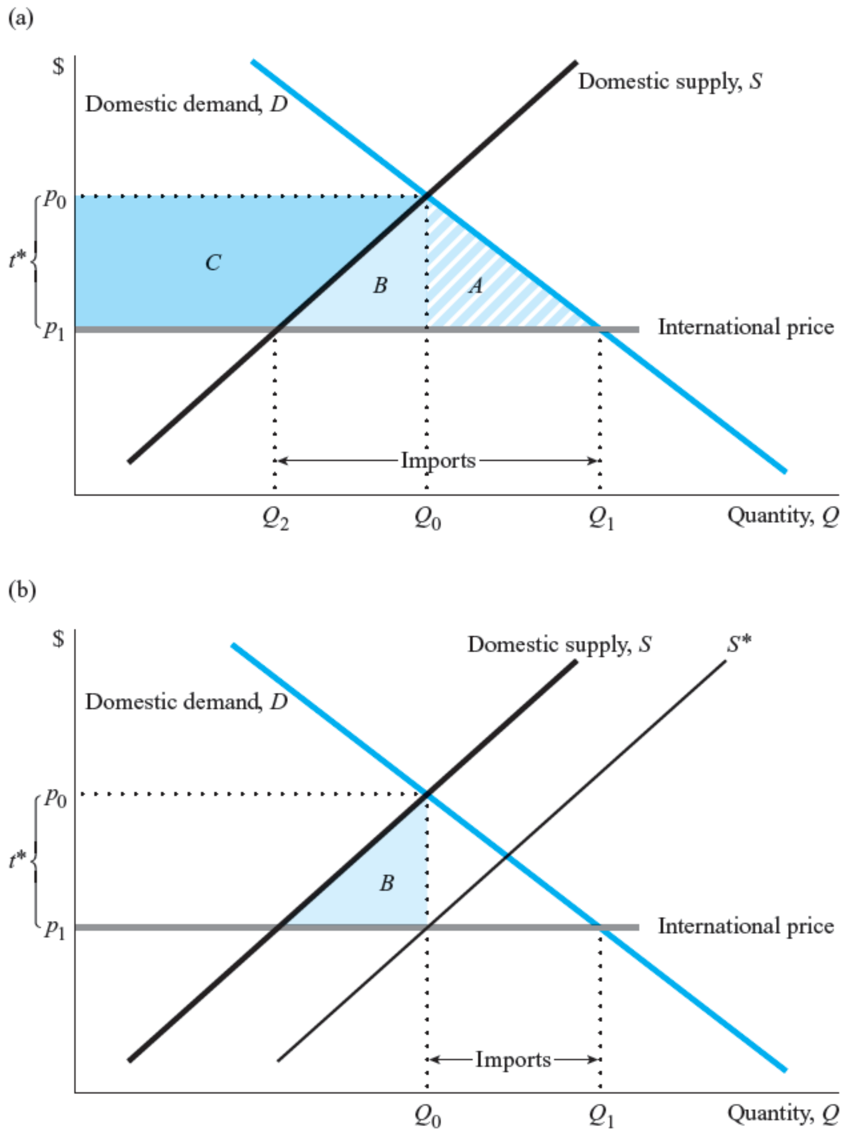
[17] A number of studies examine the effects of antidumping laws on exporting firms and conclude they are trade distorting (Webb 1987, Gruenspecht 1988a, Leidy and Hoekman 1990, and Staiger and Wolak 1991a, 1991b).

[18] See any of the standard texts on trade, such as Krugman and Obstfeld (1997) and Caves, Frankel, and Jones (1999), or Bhagwati and Ramaswami (1963).

Competition

The domestic industry is competitive. The domestic demand curve is $D(p)$ and domestic supply curve is $S(p)$. If there is no international trade, the equilibrium price is p_0 and the quantity consumed is Q_0 in Figure 18.1a.

FIGURE 18.1 (a) Effect of Tariff, t^*, That Eliminates Imports
(b) Effect of a Subsidy of t^*



Suppose that the rest of the world's competitive supply of the product is perfectly horizontal at the world price, p_1, which is below p_0. If trade occurs, the equilibrium domestic price is p_1 and the amount consumed is Q_1, which is larger than Q_0. Domestic production falls from Q_0 to Q_2. Imports make up the difference between the amount consumed, Q_1, and the amount produced domestically, Q_2.

Domestic consumers are better off with international trade because they consume more at lower prices. Domestic society saves resource costs because it spends only p_1 for the output it now imports instead of the higher price it used to pay. Those extra resources can be used to produce other valuable products. The net gain to the domestic country from international trade is the triangle formed by the sum of the areas labeled A and B.

Suppose that the domestic industry convinces its government to impose a *tariff* (a tax on imports) of t^* equal to or greater than $p_0 - p_1$. Foreign producers faced with such a tariff do not sell in this country, and the no-trade equilibrium is reestablished at a price p_0 and quantity Q_0. Domestic producers gain extra producer surplus, C in Figure 18.1a. Consumers lose consumer surplus equal to $A + B + C$. The net loss to society is the triangle $A + B$. A straight ban on imports would have exactly the same effect.

Suppose that instead of instituting a tariff to drive out foreign competition, the domestic government subsidizes the domestic industry by an amount, t^*, that equals $p_0 - p_1$. The effect of the subsidy is to shift the domestic supply down by t^* to S^* in Figure 18.1b. The equilibrium results in a price of p_1, domestic consumption of Q_1, domestic supply of Q_0, and imports of $Q_1 - Q_0$. Consumers prefer this equilibrium to the one in Figure 18.1a in which the tariff eliminates all trade because p_1 is less than p_0. Domestic producers are in exactly the same position as before in the no-trade equilibrium.

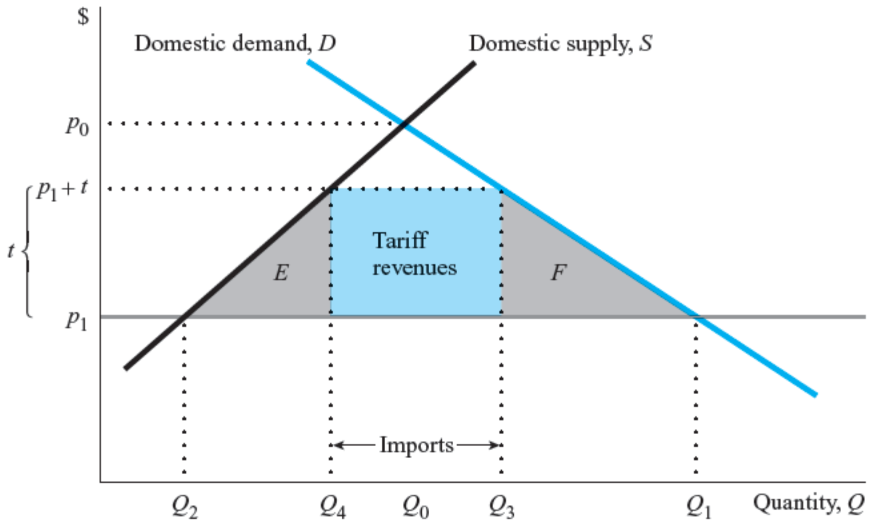
The deadweight loss in Figure 18.1b, B, is less than the deadweight loss from preventing trade in Figure 18.1a, $A + B$. Thus, a country can help its producers as much by using a subsidy as by preventing imports, yet create less deadweight loss.

Suppose that the domestic industry is not politically powerful enough to obtain the tariff $t^* = p_0 - p_1$, but instead receives a lower tariff t. The tariff t does not eliminate all imports, as Figure 18.2 shows. The domestic price equals $p_1 + t$, the quantity consumed is Q_3, the quantity domestically produced is Q_4, and imports equal $Q_3 - Q_4$. The deadweight loss to domestic society from the imposition of the tariff equals the sum of areas E and F. The tariff revenues collected are equal to the tariff times the imports, $t(Q_3 - Q_4)$.

What happens if the domestic industry persuades its government to impose a quota of $Q_3 - Q_4$ instead of the tariff? The same outcome as in Figure 18.2 results with one important exception. Instead of the domestic government collecting tariff revenues from foreign producers as in Figure 18.2, foreign suppliers earn extra revenues equal to the amount of the former tariff revenues.

By using quotas instead of tariffs, the domestic country enriches foreign suppliers. Because foreign suppliers reap a reward, the foreign governments could auction off the right to export to the domestic country. Thus, foreign governments could earn the tariff revenues formerly received by the domestic government.

FIGURE 18.2 A Tariff, t, That Reduces Imports



Quotas are one way for a country to provide benefits to either foreign suppliers or foreign governments and at the same time benefit domestic producers. Example 18.2 shows another way to benefit foreigners.

Creating and Battling Monopolies

Governments may attempt to increase domestic welfare or the profits of domestic producers by creating domestic monopolies or battling foreign monopolies.[19] We consider four cases. First, a government can help a domestic industry become a monopoly to the detriment of domestic consumers by preventing foreign competition. Second, a government can help domestic firms act like a monopoly to the rest of the world. Third, a government can help foreign producers restrict output, creating market power that hurts domestic consumers, through the use of an import quota. Fourth, a government can help its consumers by undermining a foreign monopoly.

Creation of Domestic Monopoly. Suppose a firm is the only domestic producer of a product for which there is a competitive world market. The domestic firm wants to be insulated from foreign competition so that it may exercise market power in the domestic market. In Figure 18.3, in the absence of world trade, the domestic producer sets a monopoly price p_m and sells Q_m, which is determined by the intersection of its

[19] Results for monopsony are similar. See Example 18.2.

EXAMPLE 18.2 *Timber Wars and Retaliation*

In the mid-1980s, U.S. lumber and timber producers complained to the U.S. International Trade Commission (ITC) and the U.S. Department of Commerce that Canada was subsidizing its lumber sales and causing material harm to U.S. producers. In late 1986, the Department of Commerce issued a preliminary finding that Canada was providing a 15% subsidy to its lumber producers and the ITC made an initial determination of harm to U.S. producers. Prior to the final ITC decision, a 15% countervailing duty was levied by the United States on Canadian imports, which would be refunded if the final ITC decision was favorable to Canada.

Canadian lumber is an important industry in Canada, accounting for about 4% of its gross national product. Canada exports about 60% of its lumber to the United States and accounts for about 30% of total U.S. supply. The Canadians weren't happy about the U.S. action. Canada's Minister of International Trade termed the duty "total harassment" and threatened retaliation. Canada imposed a 67% duty on U.S. corn shipments to Canada. The duty on Canadian lumber was scheduled to start on December 30, 1986. Negotiations with Canada continued in late 1986 to try to soothe the Canadians. The agreement that was reached was that the 15% duty (to be collected by the United States) would be replaced by a 15% Canadian export tax (to be collected and kept by Canada). The Canadian tax on corn remained.

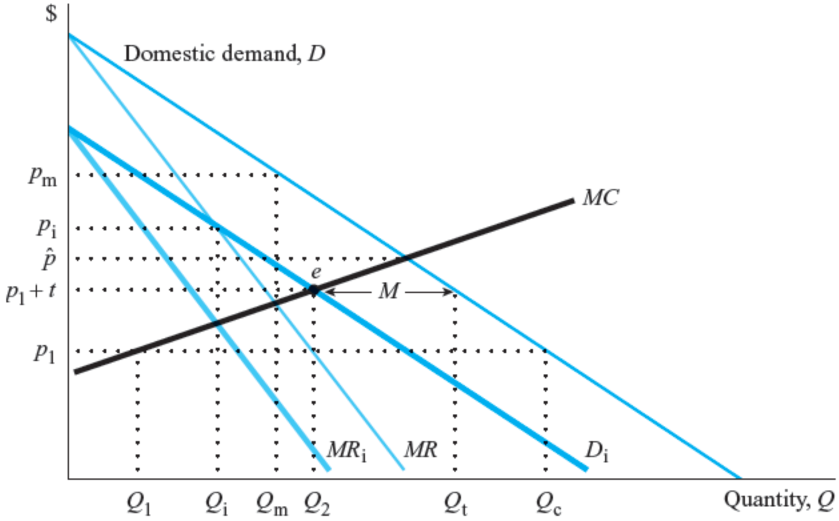
Had the United States established a tariff without inducing a response from Canada, that duty could have been regarded as the United States trying to exercise its monopsony power. By taxing Canadian output, the United States could capture some monopsony rents. U.S. consumers would be harmed, but U.S. producers would benefit and the U.S. government would earn tariff revenues. The resolution of the lumber controversy resulted in Canada's imposing an export tax on lumber sales to the United States.

Who won as a result of the trade war? The U.S. lumber producers and the Canadian government were the big winners, and the U.S. consumers and the U.S. government were the big losers. Kalt (1988) estimates (in U.S. dollars) that under either a 15% U.S. tariff or a 15% Canadian export tax, U.S. lumber producers gained \$416.8 million and U.S. lumber users lost \$556.9 million. If it set a tariff, the U.S. government's tariff revenues would have been \$340.5 million; however, it received no revenues from the Canadian export tax. The combined loss to the United States and Canada combined from either the tariff or the tax was \$22.5 million. With the tariff, the United States would have gained \$200.4 million and Canada would have lost \$223.0 million. Instead, with the export tax, Canada gained \$117.6 million and the United States lost \$140.1 million.

marginal cost, *MC,* curve and its marginal revenue, *MR,* curve (which corresponds to the domestic demand curve, *D*).

For simplicity, assume that foreign producers have a perfectly elastic (flat) supply curve at p_1. If trade is allowed, the domestic price is p_1 and the total quantity consumed is Q_c, in Figure 18.3. The domestic firm, which has no market power in the

FIGURE 18.3 A Comparison of a Tariff to a Quota for a Domestic Monopoly



presence of world trade, sells Q_1, where its *MC* curve hits the foreign supply curve at p_1.

If the government imposes a tariff *t*, the equilibrium is *e*, where the domestic producer sells Q_2 units at $p_1 + t$. If, as shown, *t* is small enough that $p_1 + t$ is less than $\hat{p}$ (which is determined by the intersection of *D* and *MC*), *M* units of the good are imported because the quantity demanded, Q_t, exceeds the amount the domestic producer is willing to supply, Q_2. However, if *t* is so large that $\hat{p} < p_1 + t < p_m$, no goods are imported even though the price at which the domestic firm sells is constrained by the threat of imports. If *t* is so large that $p_1 + t$ exceeds p_m, the threat of imports imposes no constraint at all on the monopoly.

Now suppose that instead of a tariff, a quota is set so that only *M* units of the good can be imported (the quantity imported if the tariff is set at *t*, as in Figure 18.3). Is a tariff of *t* a superior policy? Or, is an import quota set equal to *M* better? Or are the two policies equivalent?

The domestic supplier prefers the import quota. An import quota of *M* shifts the demand curve facing the domestic producer to the left to $D_i = D - M$. By construction, the new demand curve D_i includes the tariff equilibrium point *e*.

However, the monopoly does not want to operate at *e* and sell Q_2 units with an import quota. The monopoly wants to sell Q_i units, which is determined by the intersection of its *MC* and its new marginal revenue curve, MR_i (which corresponds to the demand curve D_i). The monopoly charges p_i, which is greater than the price under the tariff system, $p_1 + t$. Therefore, this import quota provides less of a constraint on the monopoly than the tariff policy.

The type of foreign trade restriction influences the effectiveness of foreign competition in restraining a monopoly. Indeed, certain types of import quotas may *not* restrain the domestic price at all. For example, suppose that the quota rule limits foreign sales, Q_f, to be no more than a fixed percentage, α, of domestic sales, Q_d. That is, $Q_f = \alpha Q_d$.

The domestic monopoly sets Q_d to maximize its profit,

$$\pi = [p(Q_f + Q_d) - m]Q_d,$$

where $p(Q_f + Q_d)$ is the inverse demand curve expressing price as a function of total output, $Q_f + Q_d$, and m is its constant marginal cost. Given the import restriction, the monopoly's profit may be written as

$$\pi = [p(Q_d(1 + \alpha)) - m]Q_d.$$

To maximize its profit, the monopoly chooses Q_d so that

$$\frac{p - m}{p} = -\frac{1}{\epsilon}, \tag{18.3}$$

where ϵ is the price elasticity of demand.[20] The monopoly sets its output such that its Lerner Index equals the negative of the reciprocal of the demand elasticity, which is the standard monopoly markup rule (Equation 4.3).

Thus, the monopoly's price is identical to what it would be if international trade were banned! The monopoly sells less as a result of the foreign sales, but, surprisingly, these additional foreign sales exert no downward pressure on the price. The reason is that the monopoly effectively controls the output of foreign suppliers because Q_f is tied to Q_d. Recognizing this link, the monopoly is able to restrict industry output so as to achieve the monopoly price.[21]

Thus, the nature of tariff or quota restrictions has a significant effect on the competitive constraints that foreign firms place on domestic firms.[22] Whether foreign sales

[20]The monopoly's first-order condition is $p'[1 + \alpha]Q_d + [p - m] = 0$. Rearranging terms, and noting that $1/\epsilon = p'Q_d(1 + \alpha)/p$, we obtain the expression in the text.

[21]Maximizing $[p(Q_d) - m]Q_d$ yields the same optimal p as maximizing $[p([1 + \alpha]Q_d) - m](1 + \alpha)Q_d$. Letting $(1 + \alpha)Q_d = Z$, this second objective is of the same form as the first one, $[p(Z) - m]Z$. Thus, the Q_d that maximizes the first objective is the same as the Z that maximizes the second objective, and the optimal price is the same for the two objective functions. The domestic monopoly maximizes the first objective function when $\alpha = 0$ (no trade). When $\alpha > 0$, the domestic monopoly maximizes the second objective function times a constant, $1/(1 + \alpha)$, hence the optimal price is independent of α.

[22]One implication of this result is that a government agency should take tariffs and quotas into account when evaluating a potential merger between two U.S. firms because these trade restrictions affect the amount of competitive pressures imposed by foreign firms on the merging firms. The April 1997 *Department of Justice and FTC Horizontal Merger Guidelines* have a separate section (Section 1.43—Special Factors Affecting Foreign Firms) that explicitly recognizes the need for evaluating the particular trade restrictions surrounding foreign trade in order to evaluate the constraint that foreign competition places on U.S. firms.

have a significant effect on price depends on the form of the quota or tariff. Example 18.3 illustrates an attempt to restrict foreign competition and raise domestic price through the use of quotas.

Creation of a Monopoly That Sells Abroad. In the examples we have examined so far, the tariff or quota policies reduce the domestic country's welfare because the losses to domestic consumers exceed the gains by the domestic producer. We now consider a policy that increases domestic welfare.

One country contains all the producers of a product that is sold only to consumers in other countries. These producers compete with each other so that the world price p_0 is competitive. The government recognizes that it could behave as a monopoly and efficiently cartelize the domestic industry by levying an export tariff of t so that the price the firm receives, p_1, plus t equals the monopoly price, p_m, in Figure 18.4. Effectively, the government is taxing the rest of the world. The domestic government, which is concerned only with its own citizens' welfare, does not mind that its tariff harms foreign consumers.

The domestic (exporting) country's gain from tariff revenues ($t \times Q_m$) is a rectangle, $A + B$ in Figure 18.4. The tariff reduces domestic producers' exports from Q_0 to Q_m. As a result, domestic producers lose producers' surplus equal to $B + C$.

The exporting country as a whole benefits from the tariff because the tariff revenues exceed the producers' losses. The rectangle A must exceed the triangle C, or p_m is not the monopoly price. If there were no tariff and the producers formed a cartel, the equilibrium price and exports would be the same as with the tariff, but the producers, rather than the government, would benefit from restricting exports.

Another method to effectively cartelize the domestic industry is to impose export controls. If industry output is restricted to the monopoly quantity Q_m, in Figure 18.4, the industry receives the monopoly price, p_m. Unlike with an export tariff, those domestic producers who are lucky enough to get a production quota keep the monopoly profits. As with an export tariff, the domestic country as a whole gains at the expense of foreign consumers.

Creation of a Foreign Monopoly. Just as export controls may create a domestic monopoly, import controls may create a monopoly of foreign suppliers. If the United States restricts imports of a particular good using a quota, it drives up the domestic price. If the United States slightly restricts imports, foreign profits rise. As the government restricts imports further, foreign profits rise until the imports are at the monopoly level (which is equivalent to creating a foreign cartel). Further restrictions reduce profits from the cartel level. A complete ban on imports eliminates foreign profits. Quotas help foreign and domestic producers but harm U.S. consumers by driving up the domestic price (see Example 18.4).

Combating a Foreign Monopoly. If the government of Country 1 uses an export tariff or quota so that its firms sell to consumers in Country 2 at a monopoly price, Country 1 benefits if Country 2 does not retaliate. Country 2 may be able to retaliate

EXAMPLE 18.3 *Foreign Doctors*

Controlling foreign supply benefits domestic suppliers of medical services. The American Medical Association (AMA) has exerted control over the number of doctors in the United States for many decades. During the 1960s, the American Medical Association's control of the number of domestic graduates weakened. At the same time, the immigration laws were changed; as a result, many more foreign doctors were able to practice in the United States and the percentage of new doctors who were foreign rose from roughly 15 percent in the 1960s to about 40 percent in the early 1970s. With these two sources of increased supply, the number of doctors per capita rose by almost 50 percent between 1965 and the early 1980s. Noether (1986) estimates that the increased supply reduced the annual income of doctors by about $23,000 in 1981 dollars.

In 1996, the Institute of Medicine (part of the National Academy of Sciences) issued a doctor-written report that urged federal and state governments to restrict the entry of foreign-trained doctors into the United States. The doctors were alarmed that the number of active physicians in the United States rose from 308,487 (151.4 per 100,000 population) in 1970 to 627,723 (245 per 100,000) in 1992.

They concluded that this increase was due to an influx of foreign-trained doctors because the annual number of graduates from U.S. medical schools has been stable at 17,000 over the past couple of decades. Hospital demand for residency interns each year exceeds the 17,000 figure by 6,000 to 7,000, and these doctors—who work 80 weeks for $25,000 to $30,000 a year—are foreign-trained and mostly foreign-born.

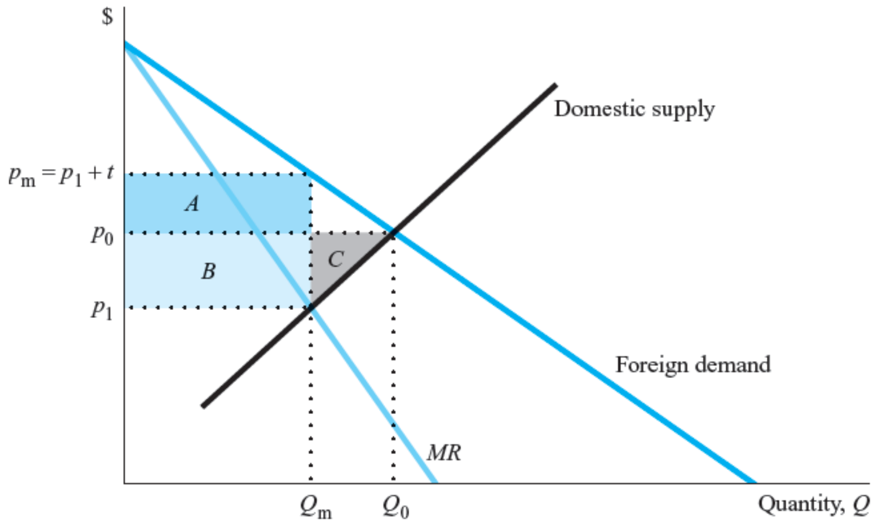
The 12 members of the committee unanimously recommended that the government curb the inflow of foreign-trained physicians. The doctors' warning on foreign physicians was based on a concern that rising numbers of immigrants will depress opportunities for U.S.-born doctors and consequently could "demoralize U.S. physicians."

Thus, the reason the report gives for why we should prevent immigration is that the foreign influx will leave some doctors in a bad mood. The doctors warn that the resulting drop in doctors' earnings—from an average of $150,000 a year—may convince potential U.S. medical students that a medical career is "a poor personal investment." Apparently, not many potential students have this fear: The 1999 total of 45,365 applicants to U.S. schools was about 50 percent higher than five years previously.

(At least this commission's recommendations are less sweeping than those of other recent commissions. The Pew Charitable Trusts Health Professions Commission called for closing one in five U.S. medical schools and sharply shrinking the number of doctors, nurses and pharmacists.)

Sources: Noether (1986); Keith M. Rockwell, "Medical Panel Sees a Crisis in U.S.—Too Many Foreign Doctors." *Sacramento Bee,* February 12, 1996: B7; Stuart Auerbach, "Blue-Ribbon Panel Calls for End of Subsidies for Foreign Doctors." *Houston Chronicle,* January 24, 1996: A5.

FIGURE 18.4 A Tariff Leads to a Monopoly Price



in several ways. It may go to war, exercise monopsony power, or cartelize one of its industries that exports to Country 1. Collectively, both countries are better off in a world of free trade at competitive prices than in a world with trade at *distorted* prices.

One way that an importing country could deal with a foreign cartel is to make its country's demand curve perfectly elastic at the competitive price by imposing a price ceiling at the competitive price. If it does not know the exact competitive price but only a likely range, it may try to make the demand curve very elastic in that range by imposing a nonlinear tariff. The nonlinear tariff is very high for prices above the range believed to contain the competitive price. The foreign monopoly would then choose to operate in the desired range.

If the importing country decides to levy a simple tariff on the foreign monopoly, its actions have two effects. First, the quantity sold falls and the domestic price rises, which harms consumers in the importing country. Second, it raises tariff revenues, which helps the country in general. Depending on the shape of demand, a tariff could help the country. In general, there is always either an optimal tariff or a subsidy that raises the welfare of an importing country facing a foreign monopoly.

The subsidy case is interesting because it suggests that it is sometimes optimal for the country to subsidize foreign production! As an example, suppose that the demand curve in the importing country has a constant elasticity of demand of −2. If the foreign producers set price to maximize their profits, price equals twice marginal cost (Equation 18.3). A subsidy paid to the foreign monopoly of $1 per unit lowers price in the importing country by $2. Domestic consumers gain more per unit than the cost of

EXAMPLE 18.4

Being Taken for a Ride: Japanese Cars

The Japanese share of car sales in the United States increased from under 10 percent in 1975 to over 20 percent by 1980. In response to this dramatic increase, quotas were placed on Japanese imports into the United States beginning in 1981. As a result, by 1987, Japan's share remained at about its 1980 share.

The quota raised prices, which hurt U.S. consumers and helped Japanese and U.S. auto manufacturers. By restricting the U.S. sales of Japanese cars, the quota raised the price of Japanese cars in the United States by over $2,000 per car in 1985. Due to the reduced competition from Japanese cars, the average price of a U.S. car increased by over $750. Both of these price increases harmed U.S. consumers. Applying these estimates to sales between 1980 and 1986, U.S. consumers paid an extra $80 billion as a result of the quotas.

The increase in the price of Japanese cars increased the profits of Japanese manufacturers. The U.S. quota helped the Japanese car producers act like a cartel and restrict output. The same output restrictions could have been achieved if the United States had levied a tariff, with the important difference that the extra profits would have gone to the U.S. government in the form of tariff revenues rather than to the Japanese producers.

The U.S. producers benefitted by the increase in their prices. Real profits increased steadily in the early to mid-1980s. Auto workers also gained. Wages in the auto industry were about 40 to 50 percent above the average manufacturing wage in the 1970s. That premium rose to about 50 to 60 percent in the early 1980s.

Source: Crandall (1987).

the subsidy at the current level of consumption so that the subsidy could generate a net welfare gain to the importing country, especially if consumption is already large.

Another possible response to a foreign monopoly is for the importing country to announce it will make no purchases at the monopoly price. The monopoly might respond that it will make no sales except at the monopoly price. The question then comes down to who can make the more credible commitment, the monopoly or the importing country.

Strategic Trade Policy

Recent work applying oligopoly theory to international trade has generated lots of attention from policy makers.[23] These models show that if a government can help its firms make binding commitments, these firms can compete more effectively with their

[23] See Helpman and Krugman (1985, 1989), Krugman (1989), and Baldwin (1992) for good surveys of this literature.

foreign rivals. The government is said to be using a strategic trade policy. Governments use many different types of strategic trade policies (see **www.aw-bc.com/carlton_perloff** "Strategic Trade Policies").

We have already seen the gain from commitment in some of the models of oligopoly in Chapters 6 and 11. For example, if a Stackelberg-leader firm can commit to an output level before its rival, it picks a relatively large output, which induces the follower firm to pick a relatively small output level. The leader makes a higher profit than the follower because its early commitment gives it an advantage.

In contrast to the Stackelberg model, in the static Cournot model, firms have to choose their output levels at the same time and firms cannot make credible commitments, so no one firm can convince the others that it will produce a large output. If the two firms are identical, they produce the same Cournot output. Although firms are unable to make credible commitments, a government may be able to commit its firm to produce a large quantity and thereby cause its firm to act like a Stackelberg leader.[24]

A duopoly example illustrates the strategic use of trade policy. Country 1 and Country 2 each have a firm that exports to countries other than Country 1 or Country 2. In the absence of government intervention, these firms behave as Cournot duopolists. We make the following assumptions:

- *No entry:* No other firms can enter.
- *Homogeneity:* The firms produce identical products, so that the sum of their outputs equals industry output: $Q = q_1 + q_2$, where Firm 1 (in Country 1) produces q_1 and Firm 2 (in Country 2) produces q_2.
- *Demand:* The inverse demand curve in the other countries is linear:

$$p = 46 - q_1 - q_2.$$

- *Costs:* The firms produce at constant marginal cost equal to 10.

The best-response functions of these firms are shown in Figure 18.5 and formally derived in Appendix 18A. The Cournot equilibrium is $q_1 = q_2 = 12$ and $p = 22$. Each Firm i earns a profit, π_i, of 144 $(= [p - 10]q_i)$.

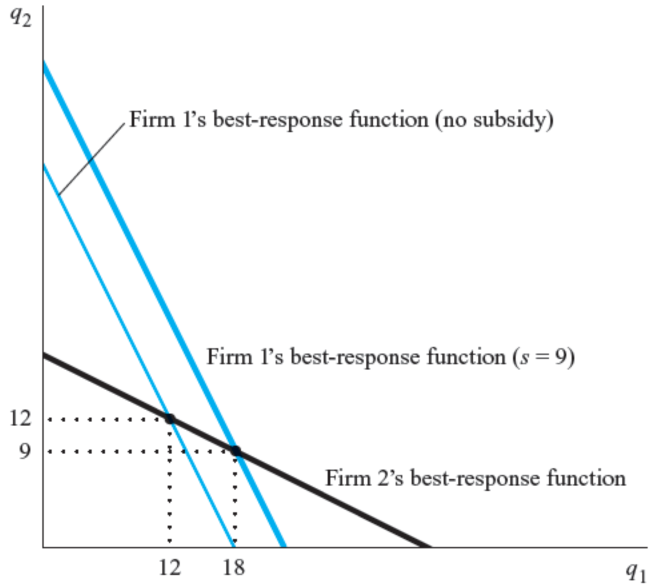
Now, suppose that the government in Country 1 can give Firm 1 a subsidy of s per unit without fear that the other government will retaliate. This subsidy encourages Firm 1 to produce more output—to be a more aggressive competitor. For example, if Firm 2 continues to produce 12 units and Firm 1 expands its output to 13 units, price falls to 21, and Firm 1's profit falls to 143 (from 144). If s is greater than 1, it pays for Firm 1 to expand its output by at least one unit.

The best-response function of Firm 1 (see Appendix 18A) is

$$q_1 = 18 - \frac{1}{2}q_2 + \frac{1}{2}s.$$

[24]Because the gain comes from the ability to commit, a government can help domestic firms remain large by taxing adjustments so as to make it costly for the firm to shrink (Karp and Perloff 1992, 1993b). The advantages to a government of these taxes over export subsidies are that they make rather than cost money and they do not violate the rules of the WTO.

FIGURE 18.5 Effects of Export Subsidy on Cournot Duopoly



The larger the subsidy, the more Firm 1 produces for any given level of q_2. That is, the best-response curve of Firm 1 shifts to the right by $s/2$ (as Figure 18.5 shows for $s = 9$).

With the subsidy, the new equilibrium occurs at the intersection of Firm 2's original best-response function and Firm 1's subsidized best-response function. In the new equilibrium, $q_1 = 18$ and $q_2 = 9$. Firm 1's before-subsidy profit is $162 (= q_1 \times [p - 10])$, plus it receives a subsidy of $162 (= q_1 \times s)$, so that its after-subsidy profit is $\pi_1 = 324$. The subsidy is a transfer from the government to the firm. Assuming the subsidy can be paid without creating deadweight loss, the welfare (profit minus the subsidy) rises to Country 1 at the new equilibrium.

The government wants to choose the subsidy to maximize domestic welfare. Table 18.2 shows output, profits, and welfare in Country $1 (= \pi_1 -$ subsidy payments) for several different values of s. Welfare in Country 1 is maximized at $s = 9$. As the table shows, Firm 1 would be delighted to receive an even larger subsidy than the one that is optimal for Country 1.[25] The subsidy raises Firm 1's profit from the free trade level,

[25] Indeed, when the per-unit subsidy exceeds the marginal cost, the first would like to produce an unlimited quantity and not even bother to sell it. In Table 18.2 where $s = 12$, we assume that the government limits the subsidy to Firm 1 at $q_1 = 20$, which is determined by the intersection of the relevant best-response functions.

TABLE 18.2 Effect of an Export Subsidy

	Country 1			Country 2		
s	q_1	π_1	Welfare	q_2	π_2	p
0	12	144	144	12	144	22
3	14	196	154	11	121	21
6	16	256	160	10	100	20
9	18	324	162	9	91	19
12	20	400	160	8	64	18

increases welfare in Country 1, harms Firm 2 and lowers welfare in Country 2, and helps consumers in importing countries because the price falls.

By choosing $s = 9$, the government in Country 1 enables Firm 1 to act like a Stackelberg leader. This equilibrium is the same as would occur if Firm 1 could commit before Firm 2 and act like a Stackelberg leader. That is, the government in Country 1 understands exactly how the game is played between Firms 1 and 2 and chooses the subsidy to manipulate the equilibrium to achieve the outcome that is best for Country 1.

Although the results from the model are logically correct, one can question the reasonableness of some of the assumptions.[26] Three assumptions are particularly crucial.

First, Government 1 must be able to act before the firms act. In this model, Firm 1 cannot act before Firm 2, but its government can.

Second, our example assumed that the firms play Cournot. Were the firms to engage in a different game, Government 1 would have to use a different policy. For example, if the firms play Bertrand and produce differentiated products, the optimal policy for Government 1 would be a tariff.

Third, nothing prevents Government 2 from retaliating (Karp and Perloff, 1995a). Government 2 could subsidize Firm 2. If both governments intervene, instead of having a game of strategy between firms, we have a game of strategy between countries. Although predicting political behavior is certainly more complicated and adds an interesting twist to an analysis of international competition, the empirical insights of game theory are few even when only firms are involved, so it is too much to expect

[26]Spencer and Brander (1983), Dixit (1984), Brander and Spencer (1985), Eaton and Grossman (1986a), Carmichael (1987), Cheng (1988), Gruenspecht (1988b), Markusen and Venables (1988), Neary (1991), and Karp and Perloff (1995a, 1995b) show that the optimal policy varies substantially with the assumptions used, such as the type of game played, the choice variables used by firms, the number of firms, barriers to entry, the exogeneity of costs, whether the firms or the government act first, whether the firms sell to domestic consumers, and whether the foreign government intervenes. See Maggi (1996) for a model where the results are less sensitive to these assumptions.

anything more than limited insights when we add political behavior to the already complicated environment.

We know from our earlier study of strategic behavior of firms that being able to credibly commit is a necessary feature of any subgame perfect equilibrium. That insight suggests that countries that engage in strategic behavior must somehow bind themselves to their proposed actions if the strategic behavior is to be effective. Countries may find it difficult to commit to long-term policies.

Most economists who have developed these strategic trade models argue strongly against their use. For a country to optimally choose such a policy, it must know how all the firms in the world will react and how other governments will behave. It must be able to credibly act first and commit to its policy indefinitely. If other countries also use strategic trade policies, it is likely that all countries will be harmed. Strategic trade policies are inherently "beggar thy neighbor" policies. It is for this reason that the WTO tries to constrain subsidies in general and explicitly forbids the use of most export subsidies (except for agriculture).

Most economists support the elimination of trade barriers. But countries can be very reluctant to overcome the political pressure to protect their powerful businesses, even though the protection may harm their own citizens. In September 2003, the WTO considered the reduction of agricultural subsidies and tariffs in developed economies. These subsidies and tariffs make it difficult for farmers in developing countries to sell their products. For example, large U.S. subsidies to U.S. cotton farmers are estimated to have reduced world prices by 20 to 40 percent, to the detriment of cotton farmers in developing countries.[27] Japan protects its rice farmers by levying high tariffs (600 percent) on rice imports, harming Japanese consumers and foreign rice farmers.

In return for lowering their protection of agricultural goods, the developed nations wanted to pursue agreements regarding competition law, investment procedures, transparency in government procurement, and increased trade—all designed to facilitate trade and foreign investment. The World Bank estimated that a successful negotiation would have raised global annual income by about $500 billion in about 10 years. Unfortunately, negotiations completely broke down as each side refused to compromise and reduce their protection of certain powerful domestic interests in their own countries.

Industries with Positive Externalities

Countries are often urged to adopt trade policies in order to assist industries that generate positive benefits to other domestic industries when the industries are not compensated for the benefits they generate (externalities). For example, research conducted in one industry may stimulate research in other sectors. An industry that generates such externalities does not expand output enough to equate the marginal social benefit

[27] Hoekman (2000); "The WTO Under Fire," *The Economist,* September 20, 2003, 26–28; Gretchen Peters, "In Cancun, A Blow to World Trade," *Christian Science Monitor,* September 16, 2003, p. 30.

to marginal cost because the firms cannot charge for the knowledge they generate. Thus, countries want to stimulate research beyond the levels that markets produce. They may use patents, prizes, or direct grants to induce firms to engage in the socially optimal amount of research (Chapter 16).

Typically, the lack of social efficiency arises because of a *domestic* distortion between marginal cost and social marginal benefit. Too little research is inherently bad—it does not matter whether the firm sells at home, sells abroad, or imports. However, arguments about externalities are often used to justify protectionist measures such as tariffs or import restrictions. The argument is that if domestic firms did not have to worry about foreign competition, they would spend more on research and generate benefits for the domestic economy. Often proponents of the measures urge that a newly emerging industry that will generate externalities needs to be protected, at least initially, until it achieves a certain scale.[28]

Even if subsidizing research in industries that create positive externalities is a good idea, trying to achieve that goal using trade policies is questionable. At best, trade policies are an indirect (and hence inefficient) solution. At worse, the distortions (monopoly pricing, trade wars) created by such policies offset the gains from additional research. A subsidy, import tariff, or quota on international trade protects an industry from competition and allows the industry to survive even if it becomes inefficient. Moreover, there is a danger that industries with powerful political support will receive subsidies or import protection rather than those industries that create many positive benefits.

Thus, as in the case of strategic intervention in trade, as a theoretical matter, subsidies or protection from foreign competition may be welfare enhancing. However, it does not follow that such policies must increase welfare. An examination of the evidence is required. Moreover, even if these policies are welfare increasing, direct subsidies are likely to achieve the same end without the accompanying distortions of trade policies.

Empirical Evidence on Intervention in International Trade

Based on the theories we have just reviewed, there are many motivations for trade policies. Some empirical evidence exists on why trade policies are used and whether they benefit the entire country or only certain interest groups.

Why Trade Policies Are Used. There are two views of why intervention in trade occurs. One view is that tariffs, subsidies, and import quotas are designed to protect certain interest groups such as domestic producers or workers at the expense of others. Another view is that these interventions are designed to increase overall domestic welfare.

[28]Firms in new industries with rapidly evolving technology areas may benefit from learning by doing (per-unit production cost falls as more is produced). These industries often petition for protection from foreign competitors until they become "established," at which time they supposedly will generate lots of spillover knowledge for the rest of the economy. For example, Japan adopted such a protectionist policy (preventing imports) in order to encourage its semiconductor industry to develop.

For example, a country may use an export tariff to help its producers monopolize an industry or use quotas to protect domestic industries that generate positive externalities.

As the strategic trade example in Table 18.2 shows, domestic firms may want to be subsidized beyond the point that is optimal for the country as a whole. Many firms and industries throughout the world lobby their governments for trade protection or subsidies.

Evidence suggests that trade restrictions are primarily used to aid domestic producers, especially in developed countries. There is little evidence that developed countries impose export tariffs to monopolize trade (Baldwin 1992). However, developing countries often try to form cartels among themselves (with varying degrees of success) to raise their output prices (Baldwin 1992).

If tariffs or quotas are pure payoffs to well-connected interest groups, they are more likely in certain circumstances. First, if they are payoffs, tariffs and quotas are likely in concentrated industries because they are easy to organize to lobby the government.[29] Second, where the victims of the higher price are many and small and thus it is costly to organize them, there should be limited opposition to such payoffs. For example, where there are many consumers instead of only a few, such payoffs are more likely (Godek 1985). Third, the call for protection should be greatest in industries where the country has little or no comparative advantage. For example, the United States has a comparative advantage in trade involving skilled labor and a comparative disadvantage in trade involving unskilled labor. Accordingly, we expect low-skilled workers to call for trade protection for the industries in which they work.[30] Although free trade increases welfare in both countries, certain groups, such as low-skilled workers in the United States, lose unless they are compensated.

Godek (1985) finds evidence consistent with each of these predictions. Godek further shows that quotas become increasingly important the larger the total protection from foreign competition the industry receives.[31] The use of quotas has greatly increased in the last two decades. One possible reason is that quotas can be viewed as a payoff to foreign producers (or countries), who keep the revenue that would have been collected by the domestic government under a tariff. If so, foreign producers must have become increasingly important interest groups that domestic governments want to please.

If trade restrictions insulate an industry from competition, we should expect to see domestic firms entering the protected industry. Because the industry is insulated from competition, inefficient firms can survive (Horstmann and Markusen 1986). There is evidence in support of this hypothesis in Canada and in less-developed countries (Eastman and Stykolt 1960, Harris 1984, Harris and Cox 1984, Caves 1989, Baldwin 1992).

[29]Frequently, quotas are requested to prevent foreign competition from undermining domestic cartels or government-imposed production restrictions. See Vercammen and Schmitz (1992) for a welfare analysis.

[30]Trade can be thought of as increasing competition among the factors of production of different countries. If all factors of production could costlessly migrate, they would compete with each other. Migration of goods is an alternative way the factors of one country compete with factors of another. Free trade in goods can be a complete substitute for the free migration of factors sometimes. As such trade occurs, the wages of workers in industries where the United States has little or no comparative advantage fall.

[31]Quotas may also be used because they are less likely than tariffs to trigger retaliatory measures under WTO rules (Sykes 1999).

The Effects of Trade Restrictions in Specific Industries. Researchers conduct empirical studies and simulations for various industries to determine who benefits from subsidies, tariffs, and quotas. Based on a study of the auto industry, Dixit (1988b) concludes that any gains to the United States from strategic tariffs or subsidies are relatively small. Baldwin and Krugman (1988a) study whether Japanese restriction on imports helped the development of random access memory (RAM) chips by the semiconductor industry. They find that, without the Japanese policy, no Japanese industry would have developed and the U.S. industry would have expanded greatly. They also conclude, however, that Japan did not benefit from this policy because Japanese production was more costly than U.S. production would have been. The Japanese policy therefore harmed both Japan and the United States. Baldwin and Krugman (1988b) find similar results for France, Germany, the United Kingdom, and Spain's Airbus (Example 18.5).[32]

Studies of only one industry ignore general equilibrium effects: An expansion of one sector of the economy must cause a contraction in another sector because total resources are limited. Harris (1984) and Harris and Cox (1984) used general equilibrium models to analyze the effects of liberalizing trade between Canada and the

EXAMPLE 18.5 *Wide-Body Aircraft*

France, Germany, the United Kingdom, and Spain own Airbus, which manufactures wide-body aircraft. Boeing is Airbus's main competitor. The industry for wide-body aircraft is characterized by high sunk cost, economies of scale, long product life, and learning by doing. Boeing claims that the owners of Airbus provide large subsidies that make it difficult for Boeing to compete. Airbus responds that the U.S. industry receives a subsidy from the U.S. government in the form of military contracts.

There is considerable controversy over how much subsidy Airbus receives. Using a model similar to the Cournot subsidy example in the text, Baldwin and Krugman (1988b) simulate the effects of the Airbus subsidy under a variety of assumptions. They find that Airbus significantly stimulated competition to the benefit of consumers worldwide. They also show that the United States was a net loser from the policy because the decline in Boeing's profits offset the increase in consumer surplus. They find that the European countries may have been net losers after paying the subsidy.

Irwin and Pavcnik (2001) estimate the demands for Boeing and Airbus aircraft. Based on these estimates, they conclude that the 1992 U.S.–E.U. agreement on trade in civil aircraft that limits subsidies resulted in a 3 percent increase in aircraft prices. This increase is consistent with a 7.5 percent increase in marginal costs after the subsidies were eliminated.

[32]Later, the British had second thoughts about using strategic trade policy. Former Prime Minister John Major told the United States that governments usually are unsuccessful when they try to manage industrial policies to encourage specific industries and that the U.K. policies had seriously damaged their economy. Craig Forman, "The Hidden Dangers of Industrial Policy." *Wall Street Journal,* March 1, 1993:1.

EXAMPLE 18.6 *Steeling from U.S. Consumers*

In March 2002, President George W. Bush imposed tariffs on steel after a Section 201 ("safeguard") investigation under the U.S. Trade Laws. The U.S. steel industry had hit hard times, with at least 35 firms declaring bankruptcy since 1998. The industry complained that a surge of cheap foreign imports had contributed to its difficulties. To protect the industry and give it time to reorganize, President Bush imposed tariffs ranging up to 30 percent on steel imports, to last for three years.

Although politically popular among steel producers, the measure was understandably unpopular among steel consumers, as the price of steel rose. One study done by the U.S. International Trade Commission (ITC) estimated that Bush's actions cost U.S. consumers more than $680 million annually. Strangely, the ITC concluded that the tariffs did not drastically hurt many steel-consuming businesses, although Francois and Baughman (2003) disagree.

The WTO ruled in 2003 that the U.S. actions violated international trade laws, even those that allow governments to help domestic industries suffering from an increase in imports. The European Union threatened to impose duties of up to 30 percent on more than $2 billion of U.S. exports. The U.S. removed the tariffs soon thereafter.

Sources: Elizabeth Becker, "In Glare of Politics, Bush Weighs Fate of Tariffs on Steel," *New York Times*, September 20, 2003:C1; Jonathan Weisman, "Tariffs Help Lift U.S. Steel Industry, Trade Panel Reports," *Washington Post*, September 21, 2003:A12; "Panel Says Tariffs on Steel Did Little Harm," *Chicago Tribune*, September 20, 2003:1; "U.S. Steel Tariffs Ruled Illegal, Sparking Potential Trade War," *Wall Street Journal*, November 11, 2003; Neil King Jr. and Carlos Tejada, "Bush Abandons Steel Tariff Plan," *Wall Street Journal*, Dec. 5, 2003:A3; Francois and Baughman (2003).

United States. They predicted that Canada's gross national product would increase about 8 to 12 percent with free trade.

Some governments claim to use trade policies to aid industries that either generate externalities or will do so once they thrive. Such policies are welfare improving only if the government is correct that the industry has (or will have) positive externalities and the appropriate subsidy or other policy is used.

As a practical matter, the government may choose to subsidize industries based on their political power rather than on their potential to generate positive externalities (see Example 18.6). The experience of other countries indicates the danger of government subsidies. For example, as one press account noted,[33]

> Strategic trade has not always served America's competitors well. Take Japan's $2.5 billion failure in the aluminum business in the 1970s. Or its government's misguided rush into steel just as low-paid Koreans and Brazilians mastered their arc furnaces. Japanese taxpayers have also taken baths on two recent flashy government-sponsored flops: artificial computing intelligence and high-definition television.

[33] Sylvia Nasar, "The Risky Allure of Strategic Trade." New York Times, February 28, 1993: Section 4, 1.

Although certain groups or even an entire country may benefit from trade restrictions, a strategic trade policy could trigger retaliation and a trade war. Trade wars often harm all countries. By ending trade, trade wars force countries to produce goods that they cannot produce efficiently. Kindleberger (1986) argues that the protectionist trade policies during the 1930s significantly contributed to the severity of the Great Depression.

If countries recognize that their actions can precipitate a trade war, and that such trade wars will harm all countries, then they might choose to bind themselves by treaty not to engage in such behavior. In fact, the rules of the WTO influence how countries trade with each other and how they respond to new tariffs or subsidies. That is, rules of the WTO can be viewed as a (weak) mechanism by which countries bind themselves not to engage in a trade war.

SUMMARY

Models of industrial organization explain certain types of trade. Models of differentiated products and scale economies explain why countries often conduct trade in products within the same industry. Free riding can also explain the volume of trade between countries for heavily promoted branded products. The free riding typically becomes most severe when exchange rate movements create large differences in the dollar equivalent retail prices for the same physical good in different countries. Models of price discrimination also explain the incentive to trade and charge prices abroad that differ from those charged domestically. There are many explanations for dumping, such as price discrimination and predatory pricing. The laws governing dumping tend to help domestic producers and harm domestic consumers.

There are many reasons motivating intervention in international trade. Many times, restrictions on international trade help domestic producers at the expense of domestic consumers. It is theoretically possible for trade intervention to help the entire country. In some cases, one country can take advantage of the collective market power of either its producers or its consumers. One country can also assist an industry that generates lots of spillover benefits to the economy. Finally, one country can assist its firms in making binding commitments that benefit its industry in the outcome of an oligopoly game. The empirical evidence suggests caution to anyone who believes that governments can actually pursue trade policies that benefit the entire country rather than protect producers from competition and harm consumers.

PROBLEMS

1. Show that if the importing country faces an upward-sloping foreign supply curve, a tariff may raise welfare in the importing country.
2. Given that the world supply curve is horizontal at the world price for a given good, can a subsidy on imports raise welfare in the importing country? Explain your answer.
3. Suppose Firm 1 in Country 1 produces Good 1 and Firm 2 in Country 2 produces Good 2. Both goods are sold only to consumers in other countries. The demand curves for the two goods are

$$q_1 = 15 - 2p_1 + p_2,$$
$$q_2 = 15 + p_1 - 2p_2.$$

Calculate the Bertrand equilibrium assuming that marginal cost is zero. Now suppose that Country 1 and Country 2 each place a \$3 export tax on their domestic firms. What are the new equilibrium prices and profits for Firms 1 and 2?

4. A competitive industry with an upward-sloping supply curve sells Q_h of its product in its home country and Q_f in a foreign country, so that the total quantity that it sells is $Q = Q_h + Q_f$. No one else produces this product. There is no cost of shipping. Using graphs, show the prices and quantities in the two countries. Now, the foreign government imposes a binding quota, $Q^*(< Q_f$ at the original price). What happens to prices and quantities in both the home and foreign markets? Finally, suppose the foreign government acts as a monopsony, and show how prices and quantities change in the two countries.

5. Suppose that all the buyers for a particular product live in Country 1, and all the firms that manufacture that product are in Country 2. The foreign supply curve is $Q = p$. The demand curve is $Q = 18 - p$. What is the competitive equilibrium? If Country 1 levies an import tariff, t, of \$2, what are the new equilibrium price, quantity, and tax revenues? What is the equilibrium if Country 1 acts like a monopsony? What is the welfare-maximizing tariff for Country 1 (in the absence of retaliation)?

Answers to odd-numbered problems are given at the back of the book.

APPENDIX 18A

Derivation of the Optimal Subsidy

Firm 1 in Country 1 and Firm 2 in Country 2 sell a homogeneous good to the rest of the world. They face an inverse demand curve of

$$p = a - b(q_1 + q_2), \tag{18A.1}$$

where a and b are positive constants, q_1 is the output of Firm 1 in Country 1 and q_2 is the output of Firm 2 in Country 2. Each firm has a constant marginal cost of production, m. In the absence of government intervention, the firms play Nash in quantities.

The government of Country 1 subsidizes Firm 1 at s per unit. Firm 1's profit is

$$\pi_1 = pq_1 - mq_1 + sq_1 = [a - b(q_1 + q_2)]q_1 - mq_1 + sq_1, \tag{18A.2}$$

where the second equality is obtained by substituting for p using Equation 18A.1. No subsidy is provided in Country 2, so Firm 2's profit is

$$\pi_2 = [a - b(q_1 + q_2)]q_2 - mq_2. \tag{18A.3}$$

Firm 1's Cournot best-response function is determined by differentiating π_1 in Equation 18A.2 with respect to q_1 and setting this expression equal to zero. After rearranging terms, this condition is

$$q_1 = (a - m + s - bq_2)/(2b). \tag{18A.4}$$

Similarly, Firm 2's best-response function is

$$q_2 = (a - m - bq_1)/(2b). \tag{18A.5}$$

The Nash-in-quantities equilibrium is obtained by solving Equations 18A.4 and 18A.5 simultaneously for q_1 and q_2 (the intersection of these two best-response functions):

$$q_1(s) = (a - m + 2s)/(3b), \tag{18A.6}$$

$$q_2(s) = (a - m - s)/(3b). \tag{18A.7}$$

[To find the presubsidy, Cournot equilibrium, set $s = 0$ in Equations 18A.6 and 18A.7.] For the particular values used in the chapter, $a = 46$, $b = 1$, and $m = 10$, $q_1(s) = 12 + 2s/3$ and $q_2(s) = 12 - s/3$. As s increases, q_1 increases and q_2 falls.

The government in Country 1 sets s to maximize its welfare, which is π_1 minus the subsidy, sq_1 (this transfer is a gain to the firm that is offset by an equal loss to the government). In choosing s, Country 1 must take into account the firms' equilibrium response to s, which is given in Equations 18A.6 and 18A.7. Thus, Country 1's problem is

$$\begin{aligned} \max_{s} \pi_1 - sq_1(s) &= (a - b[q_1(s) + q_2(s)] - m)q_1(s) \\ &= (a - m - s)(a - m + 2s)/(9b) \end{aligned} \tag{18A.8}$$

Setting the derivative of Equation 18A.8 with respect to s equal to zero, we find that the net-welfare-maximizing $s = (a - m)/4$. For our particular values, $s = 9$. Substituting this value into Equation 18A.6, we find that Firm 1 produces $q_1 = 18$. This solution is the same one we would obtain if Firm 1 could commit first and act like a Stackelberg leader.

CHAPTER 19

Antitrust Laws and Policy

The first thing we do, let's kill all the lawyers. —William Shakespeare

The U.S. government uses **antitrust laws** to limit the market power exercised by firms and to control how firms compete with each other. The antitrust laws do not make monopoly illegal, but they control how firms attain and maintain their market power. This chapter describes the antitrust laws and how they affect efficiency. It is not intended as a complete course in antitrust law; it is designed to provide an overview of the most important developments and issues in federal antitrust policy.[1]

The chapter first describes the major antitrust statutes and their major objectives. As with most laws, a literal reading of the statutes does not convey how the laws have been applied. Our discussion of court decisions concentrates on market power, which is a central focus of the antitrust laws.

The chapter then examines the two major areas of antitrust law applications. The first deals with agreements among competitors, such as price-fixing agreements and agreements to merge. The second deals with the actions of a single firm that may harm rivals. These actions involve strategic behavior such as predatory pricing, vertical relationships among firms, and tie-in sales. Next, the chapter reviews the antitrust doctrines on price discrimination. The chapter concludes with an overall economic assessment of the effect of the major antitrust doctrines on firm organization.

[1]See Posner and Easterbrook (1980), Posner (1976a), Bork (1978), Areeda and Turner (1978, 1980), and Areeda (1986) for more detailed examinations of antitrust issues. The presentation and analysis of the cases in this chapter rely heavily on Posner and Easterbrook (1980) and its supplements. Although states have antitrust laws, we concentrate on federal laws.

The seven main points we make in this chapter are

1. The interpretation of U.S. antitrust laws varies over time.
2. Antitrust laws should promote efficiency.
3. Monopoly is not prohibited, but certain activities that could lead to a firm's acquiring or exercising monopoly power are banned.
4. Price fixing is generally prohibited.
5. Certain agreements among competitors, vertical relations between firms, and various other strategic acts may increase or decrease welfare; hence, they should be evaluated on a case-by-case basis.
6. A few antitrust laws, such as the prohibition on price discrimination that allegedly reduces competition among customers, almost always lower welfare.
7. Prohibiting certain activities and not others can lead to inefficient organizations of firms.

The Antitrust Laws and Their Purposes

The antitrust laws are simple to state but have proved difficult to apply. Indeed, the Supreme Court has changed its interpretation of these laws several times. This section describes the laws, their enforcement, and their purposes. It explains who can sue under the antitrust laws and how damages are paid.

Antitrust Statutes

The three major statutes governing antitrust policy are the Sherman Act (passed in 1890), the Clayton Act (1914), and the Federal Trade Commission Act (1914). Additions, deletions, and amendments to these statutes have been made over the years.

Even prior to the passage of the Sherman Act, however, legal principles governed competition among firms. Under the common law (the precedents based on court decisions in the absence of explicit statutes), price-fixing among firms, though not illegal, was unenforceable: A court would not enforce a contract in which one firm agreed with a competitor to fix prices. Similarly, agreements not to compete that accompanied the sale of a business or an employment relationship were also unenforceable if they were judged "unreasonable." Agreements among workers either to fix wages or to strike were often held to violate the law. Practices by which firms attempted to exclude competitors (for example, predatory pricing) were not considered to violate the law unless accompanied by additional illegal actions such as fraud (Posner and Easterbrook 1980, 18).

The antitrust statutes were passed at a time of great upheaval in American industry. Around 1890, when the Sherman Act was passed, large firms became increasingly common with the birth of the modern American corporation and the creation of very large firms through mergers and scale economies. Adjusting for the size of the economy, the merger wave in the 1890s and early 1900s was the largest in our history (Chapter 2).

The *Sherman Act*, the first federal antitrust legislation, was, in part, a response to these changes in the U.S. economy. Section 1 of the Sherman Act states that

> every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. . . .

That is, Section 1 forbids explicit cartels.

Section 2 states that

> every person who shall monopolize or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony. . . .

Although one might read Section 2 as prohibiting monopoly, courts have interpreted it differently. As explained later, it is not a crime to be a monopoly as long as the monopoly does not commit "bad acts."

The courts' interpretation of the Sherman Act left doubt as to whether the Act prohibited certain industry behavior. As a result, in 1914, legislators passed additional antitrust legislation: the Clayton Act and the Federal Trade Commission Act. The *Clayton Act* is directed primarily against four specific practices. Section 2 of the Clayton Act (amended in 1936 by the Robinson-Patman Act) prevents price discrimination that lessens competition. Section 3 prohibits the use of tie-ins and exclusive dealing when the result is to lessen competition. Section 7 (amended in 1950 by the Celler-Kefauver Act) prohibits mergers that reduce competition. Section 8 deals with the creation of interlocking directorates among competing firms (that is, the control of competing firms by interrelated boards of directors). The Clayton Act also allows an injured party to recover **treble damages** (three times actual damages) plus attorneys' fees.[2]

The *Federal Trade Commission Act* created a new government agency, the Federal Trade Commission (FTC), which enforces antitrust laws and adjudicates disputes under the antitrust laws under the Federal Trade Commission Act in addition to other activities. The main antitrust provision of the FTC Act is Section 5, which prohibits "unfair" methods of competition. The FTC's other main responsibilities include consumer protection and the prevention of deceptive advertising.

It is common for an antitrust complaint to list violations of several of the antitrust statutes simultaneously. So, for example, an antitrust complaint regarding tie-in sales could list violations of both the Sherman Act and the Clayton Act.

Enforcement

Both the FTC and the U.S. Department of Justice (Justice Department) are responsible for administering the antitrust laws. A suit brought by the Justice Department is adjudicated in federal court, whereas an action brought by the FTC is heard and decided by an administrative law judge at the FTC and then reviewed by the Federal

[2] A profit-maximizing firm has an incentive to violate antitrust laws if the expected punishment is less than the expected gain. If the probability of being caught is less than one (certainty), a fine equal to the damage caused may not discourage this activity. Thus, larger (treble) damages are used. See, however, Salant (1987), who argues that trebling damages may have undesirable effects if buyers anticipate receiving damage awards.

Trade Commissioners.[3] After the FTC has completed its proceedings, defendants can appeal adverse decisions to the federal courts.

An action brought by the FTC can result in a *cease and desist* order, which prohibits specific acts. A suit brought by the Department of Justice can result in a similar type of order, an *injunction*. The Department of Justice can also bring a criminal suit, which may result in criminal fines or jail sentences. Aside from its enforcement responsibilities, the Department of Justice can sue to recover the cost of the suit plus the damages that arise when the U.S. government is a victim of an antitrust offense. A private individual or firm can bring an antitrust suit and, if victorious, receive treble damages plus the cost of the suit including attorneys' fees. Such private litigation comprises a significant share of antitrust litigation (White 1989).

Goals of the Antitrust Laws

Most economists believe the antitrust laws *should* have the very simple goal of promoting efficiency. That is, they should prevent practices or amalgamations of firms that would harm society through the exercise of market power.

Some analysts, however, argue that the actual objective of these laws is not efficiency, and that these laws were passed to help certain groups and harm others. For example, some argue that the antitrust laws are designed to help small firms that compete with large firms, whether or not efficiency is increased. In particular, the antitrust laws against price discrimination were passed in response to political lobbying by many small firms that were complaining of larger firms' ability to secure lower prices in their purchases of supplies (Ross 1984).

A group of firms that obtains a general exemption from the antitrust laws can reduce competition and thereby benefit. Many groups have succeeded in obtaining exemptions from the antitrust laws. Workers who unionize in order to raise their wages are specifically exempted from the antitrust laws, as are certain agricultural groups and export associations. Although certain regulated industries such as insurance have obtained antitrust exemptions, regulated industries are generally subject to the antitrust laws. Moreover, as Chapter 20 shows, legislators often try to protect certain groups from competition that is legal under the antitrust laws. It is legal for firms to attempt to influence legislation in order to protect themselves from competition and insulate themselves from antitrust liability (but see Example 19.1).[4]

[3]The FTC can also bring an action in federal court to obtain a preliminary injunction preventing consummation of a merger.

[4]This lobbying is protected by what is called the Noerr-Pennington doctrine: *Eastern Railroad Presidents Conference v. Noerr Motor Freight, Inc.*, 365 U.S. 127 (1961) and *United Mine Workers of America v. Pennington*, 381 U.S. 637 (1965). We cite cases primarily from the U.S. Reporter (U.S.), Federal Reporter (F.2d), and the Supreme Court Reporter (S. Ct.), which are standard legal references. For example, the Pennington citation appears in vol. 381 of the U.S. Reporter starting at page 661, and that case was decided by the Supreme Court in 1965. A case is first decided in a District Court. It can then be appealed to the Court of Appeals in the relevant region (called a Circuit Court) and after that to the Supreme Court.

EXAMPLE 19.1

Using the Government to Create Market Power: Misuse of the Orange Book

Under the Noerr-Pennington doctrine, firms have the right to petition the government for legislation and then to take advantage of that legislation. That is, a firm has the legal right to lobby for legislation that will make it difficult for others to compete with it, even though such legislation will harm consumers. Recently, the Federal Trade Commission (FTC) has succeeded in reining in firms' ability to misuse government might to create market power.

The FTC has paid particular attention to misuses related to drug approvals. If a firm wishes to make a generic version of a branded drug, it can submit an abbreviated application for a new drug and rely on previous testing of the branded drug in order to obtain approval from the Food and Drug Administration (FDA). The FDA asks makers of branded drugs to list in its "Orange Book" any patents that still apply to their drugs. The FDA will grant an automatic 30-month delay to the introduction of a generic drug that the manufacturer of a branded drug claims violates a patent listed in the "Orange Book." The FDA does not investigate whether the patents listed in its Orange Book are in fact valid. Therefore, it is possible for the manufacturer of a branded drug to list a patent that is invalid or inapplicable and to use it to delay the introduction of a generic rival.

The FTC claimed that Bristol-Myers misused FDA procedures to prevent competition from generic rivals for three of its best-selling drugs, with the result that consumers for these anxiety-preventing and cancer treatment drugs were deprived of generic competition that commonly drives down drug prices by more than 50 percent. The FTC claimed that, among other things, Bristol-Myers filed a false patent to block entry, and that it acquired another patent for the purpose of preventing generic entry. The combined sales of the drugs that Bristol-Myers sought to protect exceeded $1.5 billion in the year before generics entered. The FTC and Bristol-Myers settled the case with Bristol-Myers agreeing to restrictions on its conduct.

Source: John Wilke, "Bristol-Myers Settles Patent-Law Abuse," *Wall Street Journal*, March 10, 2003.

The view that the guiding principle of the antitrust laws should be efficiency, rather than the taking of resources from one group and granting them to another, has gained increasing acceptance among legal and academic scholars. One appeal of such a simple proposition is that it provides a clearer guide as to what antitrust policy should be than does the alternative view of helping "deserving" groups.

Even if one accepts the proposition that the goal of the antitrust laws is to promote efficiency, economists often have difficulty determining which practices result in inefficient behavior. For example, suppose that two firms merge and the resulting reduction in competition causes price to rise. That sounds bad. However, suppose that, as a result of the merger, the merged firm develops a new and better product or provides the same product but offers better services or develops a lower-cost method of production than before. That sounds good. Should the antitrust laws ban all mergers if they significantly eliminate competition, or should they also pay attention to the potential efficiency gains and balance the two?

To see how the trade-off between an increased price and increased efficiency in other dimensions can be compared, suppose that, as a result of a merger, a firm raises its price from \$1 to \$1.10 because of the elimination of competition, which causes a deadweight loss (a triangle in Figure 19.1). Suppose that the merger also enables the firm to operate more efficiently and lower its constant marginal cost from \$1 to \$0.90, which results in a greater productive efficiency (a rectangle in Figure 19.1).

If the triangular area representing the deadweight loss from the price increase is smaller than the rectangular area of efficiency gain, the merger is, on balance, good for society. The relative size of these two areas depends on the particular circumstances. The larger the quantity sold in the marketplace, the more important the efficiency gains, and the larger the area of the rectangle compared to the triangle. Even small reductions in costs per unit can result in efficiency gains that swamp deadweight loss in importance.[5]

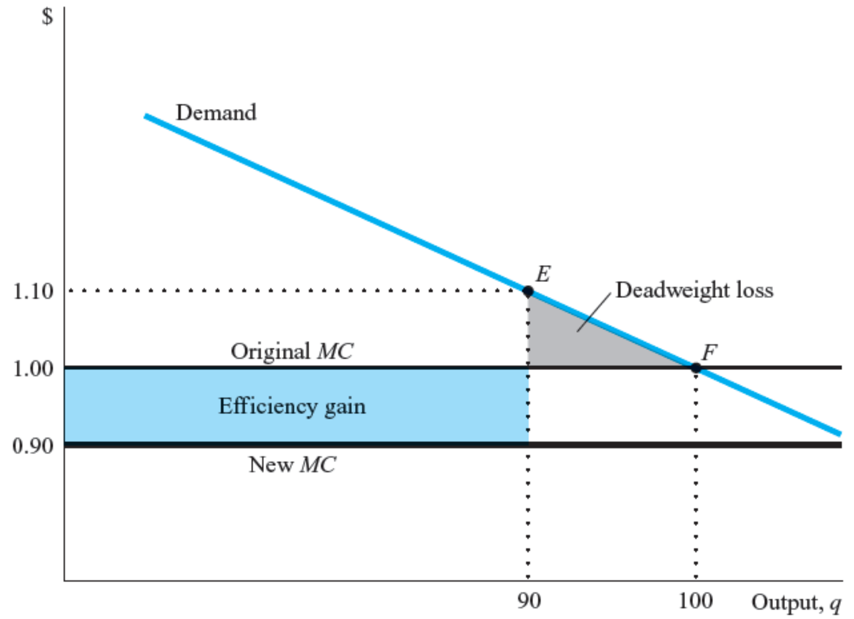
For example, suppose that the initial quantity is 100 units (initial equilibrium point F), and the postmerger quantity is 90 (equilibrium point E). Because the efficiency savings are 10¢ per unit, the efficiency gains are \$9. The deadweight loss from the price increase is approximately 50¢ ($= -1/2 \times 10¢ \times [-10] \cong -1/2\Delta p \Delta Q$). Thus, the efficiency gains outweigh the deadweight loss.

These types of calculations can be complicated, and it is a matter of debate whether courts should be charged with making such calculations in deciding the legality of a merger (Williamson 1968–69). The current policy statement of the Department of Justice and the Federal Trade Commission, the *Horizontal Merger Guidelines*, explicitly recognizes the importance of efficiency gains in evaluating mergers. However, these guidelines suggest in general that a merger would be challenged if it has an anticompetitive effect (a price increase) even if there is an offsetting efficiency gain.

Most other antitrust authorities also forbid mergers that raise price even if total efficiency (producer surplus plus consumer surplus) rises. Two notable exceptions are Australia and New Zealand, countries that rely heavily on international trade and for which efficient export industries are a key to economic prosperity. Lyons (2002) shows how a merger standard that prohibits efficiency-enhancing mergers that increase price can lead to greater efficiency than one that allows mergers as long as the merger increases efficiency. The reason is that if a firm is prevented from undertaking one efficiency-enhancing merger (a merger in which price rises), it may engage in another

[5]An efficiency gain, which depends on the total quantity produced, tends to swamp the deadweight loss, which depends on the restriction in output resulting from the merger if the output restriction is a small percentage of the total quantity produced. Notice that Figure 19.1 is based on the assumption that the price is initially set competitively. Were the price initially set higher, the deadweight loss would be a trapezoid comprising a triangle plus a rectangle whose width is 10 units and its height equals the initial gap between price and marginal cost.

FIGURE 19.1 Production Efficiency vs. Market Power Harm



merger that ultimately creates greater efficiency for society (even though profit to the merging firm will be lower).

Requiring courts to apply sophisticated economic analyses to evaluate behavior may be unrealistic. Moreover, the courts must often deal with economic problems that economists have not yet analyzed. Courts don't have the luxury of taking as much time as necessary to solve a problem. Still, it is hard to argue that economic knowledge should be ignored. Use of economics in antitrust proceedings has increased worldwide. As a result, litigation is more complicated because economic analysis can now be the centerpiece of a case, and different countries can have conflicting analyses. (See Example 19.2.)

Who May Sue?

Individuals and firms, in addition to the Department of Justice and the FTC, can bring antitrust suits. Deciding who has legal standing, which is the right to bring a suit, is complicated. Only a party that suffers an injury that the antitrust laws were designed to prevent is permitted to sue. For example, suppose that if two firms merge, they will become very efficient and reduce price. Rival firms would be harmed by the merger, yet they have no legal standing to sue to block the merger under the antitrust laws because the goal of the antitrust laws is to generate low prices to consumers.[6]

[6] *Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc.*, 429 U.S. 477 (1977) and *Cargill Inc. v. Monfort of Colorado*, 197 S. Ct. 484 (1986).

EXAMPLE 19.2

Conflict Between European and U.S. Antitrust Authorities: GE-Honeywell

In October 2000, General Electric (GE) announced plans to merge with Honeywell. GE manufactures many products, including aircraft engines for commercial aircraft. Honeywell does not produce aircraft engines, but does make products used in aviation such as weather radar, engine accessories, braking equipment, aircraft lighting, and environmental control systems. Thus, the merger would not involve both firms producing the same product or raise vertical supply relations issues because the merging firms manufactured only complementary products. How then could this conglomerate merger present an antitrust issue?

As we saw in Chapter 11, when a single firm prices two complementary products, it takes into account that lowering the price on one product will stimulate demand for the other. This demand effect creates an incentive for the firm to set lower prices for both products than would be set if each product were sold by a different firm. Thus, one should expect lower prices and consumer benefits from the GE-Honeywell merger due to more efficient pricing. Using this reasoning, U.S. antitrust authorities did not challenge the merger.

Because GE and Honeywell have large worldwide sales, their merger also fell under the scrutiny of European antitrust authorities. European authorities disagreed with U.S. authorities and prevented the merger in July 2001. The European authorities reasoned that, because the combined firm would have an incentive to lower prices, it would "dominate" the market, and hence the merger should be prevented. This convoluted reasoning is a throwback to earlier U.S. antitrust history when regulators viewed the creation of large, efficient firms as undesirable because it would drive less efficient rivals out of business even though the greater efficiency would benefit consumers. Most economists would argue that the protection of competition, not competitors, should be the focus of antitrust law.

This failed merger and the conflict among antitrust authorities has spawned efforts to harmonize antitrust enforcement and standards. Such harmonization is one of the goals of the International Competition Network, a recently formed organization comprising all major antitrust authorities. Preventing foreign antitrust authorities from repeating past mistakes of U.S. antitrust policy would be a major contribution of this organization.

Source: Nalebuff (2004) in Kwoka and White (2004).

Suppose that several manufacturing firms engage in a conspiracy to raise prices and that they sell their products to a retail department store, which then sells them to final consumers. The retail department store is not engaged in any conspiracy and simply applies the usual retail markup to the price it is charged. Who should be allowed to sue the manufacturers who are engaged in the conspiracy? The department stores, which are direct purchasers from the conspiring parties, certainly have the right to sue. Do final consumers (indirect purchasers) have a right to sue? It would be double counting to allow both consumers and retailers to collect damages from the same overcharge. In *Illinois Brick*, the Court limited the right of indirect purchasers to sue.[7] One possible justification for this decision is the difficulty of determining all of the potential indirect and direct parties who would be entitled to sue and to obtain duplicative damages for the same price overcharge from the plaintiffs (Landes and Posner 1979).

Suppose that individual consumers are the direct purchasers of a product from firms that have engaged in a conspiracy. Would an individual purchaser have the incentive to sue if all that could be recovered was the price overcharge on the product, trebled, plus attorneys' fees? Usually no. In an effort to create greater incentives to bring suits, courts allow attorneys to file class-action suits on behalf of all consumers. Attorneys are entitled to legal fees, and this provides an incentive for them to bring such suits. Of course, attorneys have an incentive to bring too many such cases if they are overcompensated.

Economic Theory of Damages

Economists use their theories to recommend the optimal amount of damages that a guilty defendant should pay. Although economic theory is widely used to determine antitrust liability, it is less commonly used to determine optimal damages.

The economic theory of damages starts from the proposition that the purpose of damages is to deter inefficient activity but not to be so burdensome as to deter efficient activity. For example, suppose that any time a firm was convicted of illegally conspiring with another firm, the firms' managers were executed. As will be shown, it is not so easy to determine when an agreement among firms is an illegal one. If the penalty were death (or otherwise extremely harsh), many firms might be dissuaded from activity that could be perfectly lawful and beneficial, such as the creation of a trade association that sets product safety standards. The optimal penalty is one that balances the beneficial and the nonbeneficial aspects of deterrence.

An optimal penalty reduces the incentive to engage in illegal activity. For example, suppose that, if a group of firms conspire, they can raise their profits by \$100. If this conspiracy could be detected with certainty and at no cost by enforcement officials, then a penalty of \$100 would suffice to deter the activity. Of course, deterrence is not perfect, and it takes resources to discover illegal activity. Because the firms know that they may not be caught, a penalty higher than \$100 may be necessary to deter cartel behavior. For example, suppose that price-fixing conspiracies are detected in only one-third of all cases. Then, as a first approximation, charging a penalty of \$300 should be enough to deter the illegal activity.[8]

An additional complication arises with an international cartel. If the purpose of a damages award is to deter, then the damages should deprive the cartel of its full profits.

[7] *Illinois Brick Company v. Illinois*, 431 U.S. 720 (1977). The word *court* spelled with a capital *C* refers to the Supreme Court of the United States.

[8] For more on optimal damages in antitrust cases, see Landes (1983) and White (1989). According to Landes, the optimal penalty equals the harm the firms impose on others, adjusted for the probability of detection.

But if some foreign country does not have an antitrust law, the cartel can earn excessive profits in that country unless foreign consumers can sue for damages in the United States or other countries with antitrust laws. The possibility of bringing suit in another country raises complicated jurisdictional issues that remain unsettled.[9]

Suppose that a group of firms is convicted of violating the antitrust laws. How should the penalties be apportioned among the firms? Should one defendant pay all of the damages, or should there be some sharing rule? In particular, suppose that of the two defendants to a lawsuit, one defendant settles with the plaintiff (for example, pays the plaintiff $100 to be dismissed from the lawsuit) before the case goes to trial. At the trial, the damage award to the plaintiff is several times the amount of the settlement. Should the remaining defendant be forced to pay the entire amount? The Court has ruled that an antitrust defendant is not entitled to **contribution**, which is a payment to a guilty defendant from other culpable parties.[10] This decision has been criticized on the grounds that it appears unfair. However, the incentive to settle will be greatest if, once the settlement is achieved, no further liability can be assumed, and therefore a large damage award can be avoided. Thus, this rule greatly increases the incentive to settle, with a resulting savings in litigation costs (Easterbrook, Landes, and Posner 1980).

The Use of U.S. Antitrust Laws

U.S. antitrust laws have been used increasingly to prosecute price-fixers, and penalties have increased.[11] From 1890 through 1974, the Justice Department brought 1,000 civil and 723 criminal cases (Posner 1976, 25). The penalty in a criminal case can be a jail sentence, but the penalty in a civil case cannot. Since World War II, Democratic and Republican administrations have brought cases at roughly the same rate (Posner 1970, 411–12). The Department of Justice wins most of the cases it brings. In every five-year period since 1910 studied by Posner (1970, 381–82), the Department won at least 64% of all its cases; since 1925 it has won at least 78%; and since 1955 it has won at least 85%.[12]

The Department of Justice loses few criminal cases (Posner 1970). Since 1890, 57% of the cases have been disposed of on *nolo contendere* ("no contest") pleas, 21% on other convictions, and only 22% resulted in acquittals and dismissals. The recent

[9]See *S.A. Emparagran, et al. v. F. Hoffman-La Roche, Ltd. et al.*, 315 F.3d 338 (D.C. Circuit, 2003). The case is before the Supreme Court in 2004.
[10]*Texas Industries, Inc. v. Radcliff Materials, Inc.*, 451 U.S. 630 (1981).
[11]Cases brought by states under their own antitrust laws were extremely infrequent prior to the 1970s. In recent years, a few states have made increasing use of their antitrust laws, but state cases are still uncommon.
[12]Posner (1970, 384) also shows that the Department of Justice has won 74% of its cases before the Supreme Court, the Federal Trade Commission has won 75%, and private claimants have won 63%. Averaged across the three groups, 70% of these cases before the Supreme Court were won by the plaintiffs.

conviction rates have been even higher (Snyder 1990). During the early 1990s, the conviction rates exceeded 90%. These high success rates may indicate that the Department only tries sure cases or that defendants plead *nolo contendere* and pay small fines (avoiding the costs of long court battles and the risks of losing). One advantage of a *nolo contendere* plea for a defendant in a government case is that it does not provide evidence of collusion that can be used subsequently in a private antitrust action seeking treble damages.

The penalties imposed by the federal antitrust laws have historically been relatively small. The FTC's only remedy is an injunction called a *cease-and-desist order,* which prohibits the behavior but does not penalize the firm for engaging in it. The maximum fine under the original Sherman Act was $5,000 and the maximum prison sentence was one year. The maximum fines were increased to $50,000 in 1955. In 1974, they were increased to $100,000 for individuals and $1 million for corporations. In the 1950–1959 period, the fines in the Justice Department's cases averaged $40,000 (0.08% of the sales involved in the conspiracy), whereas from 1960 to 1969 they averaged $131,000 or 0.21% of the sales involved in the conspiracy (Posner 1970, 1976). Gallo et al. (1994) estimate that fines averaged 1% of the present value of conspiracy sales from 1985 to 1993. The maximum fines are currently $10 million for a corporation and $350,000 for an individual. However, the fines can be increased up to twice the violator's gain or twice the victims' loss (Berkman 1997). Beginning in 1997, fines levied on individual firms and total fines across all firms increased enormously. The Department of Justice collected total criminal fines of less than $50 million per year between 1990 and 1996. However, from 1997 to 1999, total fines rose from $205 million to over $900 million per year, but they declined to $102.5 million in 2002, and to $64.2 million in 2003. The largest fines on individual firms were $500 million for Hoffman-La Roche and $225 million for BASF (1999 vitamin price-fixing case); $135 million for SGL Carbon, $134 million for Mitsubishi, and $110 million for UCAR Carbon (1999, 2001, and 1998 cases, respectively, concerning the fixing of the price of graphite electrodes used in steel furnaces); and $100 million for Archer Daniels Midland (1997 lysine and citric acid price-fixing case).[13] In addition to fines, a guilty firm must recompense private individuals, firms, and government bodies who prove in court that they were damaged from the price-fixing conspiracy. Individuals and firms are entitled to treble damages plus attorneys' fees, and the U.S. government receives damages plus attorneys' fees.

Prison sentences are rare in federal antitrust cases. There were none during the period from 1890 to 1909. From 1910 to 1974, there were 33 cases in which a prison sentence was imposed, roughly one every other year (Posner 1976, 33). Prior to 1925, most of those jailed were union organizers and officers. Until after World War II, most prison sentences for price fixing were restricted to cases involving violence. The maximum jail sentence was increased to three years in 1974. The average prison term over the period from 1955 to 1993 was about three months (Gallo et al. 1994).

[13]U.S. Department of Justice, "Sherman Act Violations Yielding a Fine of $10 Million or More," January 23, 2003: **www.usdoj.gov/atr/public/criminal/202532.htm.**

In 2002, of the 36 individuals sentenced in antitrust cases, 19 were sentenced to incarceration time for a cumulative total of 10,501 days (16 individuals were sentenced to other confinement such as house arrest or a halfway house for a total of 3,607 days).

Private Litigation

Private actions brought by individuals or firms harmed by anticompetitive behavior were rare for price-fixing cases until the electrical conspiracy of the early 1960s (see Example 5.1). In the next two decades, private actions, including class-action suits, increased substantially. These private actions, which often follow federal suits, can substantially increase the cost of conspiracy, because treble damages plus attorneys' fees may be collected.[14] For the period from 1937 to 1954, there was an average of 104 private cases per year; for the period from 1955 to 1959, the average increased to 229 cases per year. From 1960 to 1964, 1,919 cases were filed concerning electrical equipment, causing the yearly average to rise to 671 cases. For fiscal years ending June 30th, the number of private civil antitrust suits fell from 1,457 in 1980 to 1,100 in 1984 to 638 in 1989 (Salop and White 1986, Abere 1991).

Market Power and the Definition of Markets

The antitrust laws concentrate on controlling the creation and maintenance of market power. This section defines market power, discusses how to measure it, and points out that it is sometimes difficult to measure market power accurately. Some economists and lawyers argue that one should define a market and then calculate the market share of the firm under analysis as an approximation of its market power, where a high market share is interpreted as an indicator of market power. This section describes the principles that should be used to define a market and provides a background against which cases can be interpreted.

Market Power

A firm (or group of firms acting together) has market power if it is profitably able to charge a price above that which would prevail under competition, which is usually taken to be marginal cost. This ability to set price above marginal cost implicitly uses the model of perfect competition as a benchmark against which to measure the behavior of firms. If this definition is applied literally, probably every firm in the United States has at least a tiny bit of market power. The model of perfect competition is an extreme one that describes few, if any, actual industries. Therefore, presumably, when courts find that a firm has market power, they must mean the firm has a substantial

[14]According to Posner (1970, 372), in the period from 1956 to 1960, at least 278 private cases were preceded by a Department of Justice judgment, while in the period from 1961 to 1963, 880 cases followed such judgments.

amount of market power for some significant period of time. Unfortunately, the courts have not stated how much market power is needed. Does a price 5 percent above marginal cost for two years reflect substantial market power? Or 10 percent above for one year?

It is difficult to measure marginal cost and therefore difficult to measure the deviation between price and marginal cost, even if the courts stated how substantial a deviation must be to constitute significant market power. An alternative approach is to estimate the price elasticity of the residual demand (the market demand net of the quantity supplied by other firms) facing an individual firm (or group of firms). This elasticity of residual demand facing a firm summarizes the ability of a firm (or group of firms acting together) to exercise market power. The price-cost margin equals the negative of the inverse of the elasticity of demand (Chapter 4): $(p - MC)/p = -1/\epsilon$, where p is price, MC is marginal cost, and ϵ is the elasticity of residual demand.[15]

If the elasticity is large, the firm has little market power. Most empirical estimates of demand curves for individual firms selling branded products rarely find the absolute value of price elasticities to be higher than 5 to 10 (Telser 1972, 274–306). Using the price-cost margin formula, if the elasticity is -5, price is 25 percent above marginal cost; if the elasticity is -10, the price is 11 percent above marginal cost.

Whether a firm currently has market power is a much different question from whether, as a result of a merger, it could acquire and exercise *additional* market power. The first question, whether price is already elevated significantly above competitive levels, can be answered directly by comparing price and marginal cost or indirectly by looking at the elasticity of demand facing the firm. The second question, whether price will rise significantly above its current level as a result of the merger activity, can be answered directly by predicting how price will change or indirectly by predicting how the elasticity of demand facing the firm will change as a result of the merger.

For example, suppose a firm makes a differentiated product, Product A. The residual demand curve for A can be estimated as a function of the price of Product A and the price of another firm's substitute product, Product B. If the direct elasticity of A at current prices is very large, then the firm producing A has no market power. In a merger case, economists attempt to predict how the elasticity of each product will change as a result of the merger. For example, suppose the firms producing A and B want to merge. The merger between the firms will allow the merged firm to set prices jointly, and the analyst can calculate the resulting prices based on the demand curve facing the merged firm (Baker and Bresnahan 1985, Hausman et al. 1994). The

[15]In a static model, the elasticity of residual demand completely summarizes a firm's market power and determines its pricing. In a dynamic model, this simple relationship does not hold because the profit-maximizing price depends on the responses of consumers and firms over time. Moreover, in dynamic oligopoly models, the equilibrium depends on the game played by rivals. Another approach to measuring market power involves calculating the long-run rate of return. See Chapter 8 for a discussion of the caveats of using this approach.

merger increases market power if the postmerger prices are higher than the premerger ones.[16]

Sometimes economists cannot estimate a price elasticity accurately because the data are inadequate or unavailable. In an attempt to reach some workable solution to the problem of determining market power, analysts and the courts often define a market and then construct a measure of market share. If the market share of the firm (or firms) under analysis is high, the suggestion is that market power exists. In a merger case, the Justice Department or the FTC looks at whether there will be a significant increase in concentration as a result of the merger. There is no agreement as to exactly what share (or change in share) is "high," but many economists regard a share in the range of 30 to 50 percent as too low to indicate significant market power in an industry with a competitive fringe comprising the remainder of the market.

Market shares are imperfect indicators of market power, so additional analysis of the economic conditions is necessary before one can reach a conclusion about market power. For example, if entry is easy, then the industry pricing is severely constrained regardless of whether an existing firm has a large market share. Similarly, the presence of factors that make it difficult to maintain a cartel is relevant (Chapter 5).

Market Definition

In merger or other antitrust cases, economists are often called on to define a market. Were it not for these cases, it is doubtful whether such a large body of economic research would have developed on defining markets.

Alfred Marshall (1920, 324) defined a market as an area in which "prices of the same goods tend to equality with due allowance for transportation costs." Since Marshall's time, economists and lawyers have refined the definition of a market. A **market definition** specifies the competing products and geographic area in which competition occurs that determines the price for a given product. Clearly Coke and Pepsi are in the same market. But is Dr Pepper or Canada Dry Ginger Ale in that market? Is milk?

How the market is defined often determines the outcome of antitrust cases. For example, in determining whether to permit a merger, the government and the courts examine the market shares of firms, which are viewed as proxies for the firms' actual or potential market power. A firm's market share depends crucially on the market definition. Coke's share of its market will be much larger if the market is defined as colas than if it is defined as all soft drinks or all drinks. Example 19.3 discusses how the government applies the principles of market definition in its antitrust enforcement policy toward mergers.

[16]A merger simulation typically estimates demand curves; assumes that firms engage in a particular game (such as Bertrand); calculates marginal cost by using observed prices and estimated elasticities; and predicts new prices assuming that the merged firm coordinates pricing among the products it controls. See Example 7.5 and see Carlton (2003, 2004a) for a discussion and critique of this approach.

EXAMPLE 19.3 *The Merger Guidelines*

The government policy on the definition of markets is contained in the *Horizontal Merger Guidelines* that the Department of Justice and the Federal Trade Commission (FTC) issued in 1992. These *Merger Guidelines* set forth the principles that the government uses to define relevant economic markets in its enforcement of the antitrust laws regarding merger activity. These guidelines were slightly revised in 1997.

According to the *Merger Guidelines*, the government's first step in reviewing a proposed merger is to properly define the market. The *Merger Guidelines* specify that a market is the smallest group of products and the smallest geographical area such that a hypothetical monopoly of all those products in the area could raise price by a certain amount (for example, 5 or 10 percent) above any prevailing or likely future levels. One problem with this definition is that according to the definition, a small group of firms could constitute a market even though fringe firms existed that produced the identical product. Stigler and Sherwin (1985) raise other objections as well.

After defining the market, the *Merger Guidelines* require that the government determine whether the proposed merger will greatly increase concentration (and hence, presumably, market power). Concentration is measured using a Herfindahl-Hirschman Index (HHI), which is the sum of the squared market shares (expressed as percentages) of firms in the industry. The *Merger Guidelines* do not regard a merger between two firms as raising concerns about competition if the postmerger HHI in the industry is below 1000. If the postmerger HHI is between 1000 and 1800, the merger does raise concerns if the change in the HHI resulting from the merger is 100 points or more. If the industry's postmerger HHI is over 1800, the merger raises concerns about competition if the change in the HHI resulting from the merger is 50 points or more.

For example, suppose that an industry consists of four firms, each with a 25 percent market share, and two of the firms want to merge. The initial HHI is $2500 (= 25^2 + 25^2 + 25^2 + 25^2)$, and the postmerger HHI is $3750 (= 50^2 + 25^2 + 25^2)$. Because the postmerger HHI exceeds 1800 and the change in the HHI exceeds 50, concerns about competition are raised according to the *Merger Guidelines*.

The application of the *Merger Guidelines* implicitly assumes that after a merger, the firms involved will be able to maintain their premerger market shares and the merged firm will enjoy a market share equal to the sum of the premerger shares of the firms that are merging. When this assumption is not reasonable, the analysis should be modified in order to properly reflect the merged firms' market share. The *Merger Guidelines* recognize that other factors (such as ease of entry) in addition to market concentration influence market behavior. Both the Department of Justice and the FTC consider those factors before deciding to challenge a merger.

The Extent of the Product Market. A proper definition of the product dimension of a market should include all those products that are close demand or supply substitutes.[17] Product B is a *demand substitute* for A if an increase in the price of A causes consumers to use more B instead. Product B is a *supply substitute* for A if, in response to an increase in the price of A, firms that are producing B switch some of their production facilities to the production of A.[18] In both cases, the presence of B significantly constrains the pricing of A, provided that an increase in the price of A would result in either a significant decline in the quantity of A consumed as consumers switch from A to B or a significant increase in the supply of A as firms switch production from B to A.

The degree of substitution between products depends on the current prices of the two products. For example, A and B may be highly substitutable at a high price for A, but not at a low price for A. Even a monopoly may raise its price sufficiently above competitive levels so that eventually it faces some competition from other products. Just because a monopolized product faces close demand substitutes at the monopoly price, it does *not* follow that the firm producing the product has no market power (though it may not be able to raise its price further). It is only if the substitution possibilities are so large as to generate a highly elastic residual demand that the monopoly has no significant market power. Because it is difficult to determine which products to include in the market definition, market shares may be only a crude indicator of market power.

The *Cellophane* case illustrates these difficulties in defining a market.[19] The Court investigated whether du Pont had market power in the pricing of cellophane. The Court reasoned that du Pont lacked market power because, at the current market prices, a user of cellophane had many substitutes, such as paper bags, and du Pont's share of the market including these substitutes was not large. There was also evidence, however, that price substantially exceeded marginal cost. Based on the foregoing discussion, it was an error to include other wrapping materials in the market definition because they did not prevent the exercise of market power and constrain the price of

[17]The relevant economic market is not necessarily the same as the *market* that a salesperson might refer to. Substantial confusion has sometimes resulted when market definition is based on memos written by marketing personnel. For that reason, some antitrust lawyers advise companies to instruct marketing personnel to avoid the use of the word *market* in memos.

[18]The relationship between the demand elasticity facing a firm and supply and demand substitutes can be illustrated using the model of a dominant firm facing a competitive fringe (see **www.aw-bc.com/carlton_perloff** "Dominant Firm and Competitive Fringe Model" and Landes and Posner 1981). One can derive that

$$\epsilon_d = \frac{Q}{Q_d}\epsilon - \frac{Q_f}{Q_d}\eta_f,$$

where ϵ_d is the residual demand elasticity facing the dominant firm, ϵ is the market demand elasticity, Q is the market quantity, Q_d is the quantity sold by the dominant firm, Q_f is the quantity supplied by the fringe, and η_f is the supply elasticity of the fringe. As the absolute value of ϵ increases (more demand substitutes) and as η_f increases (more supply substitutes), and as the dominant firm's share (Q_d/Q) falls, ϵ_d rises in absolute value and the dominant firm has less market power.

[19]*United States v. E.I. du Pont de Nemours & Co.*, 351 U.S. 377 (1956).

cellophane to competitive levels. If, however, instead of asking whether du Pont had market power, the Court had investigated whether a proposed merger would raise the cellophane price, its market definition might have been appropriate.

In the *Brown Shoe* case, the Supreme Court articulated a laundry list of criteria that can be used to define markets.[20] It said: "The boundaries of such a submarket may be determined by examining such practical indicia as industry or public recognition of the submarket as a separate economic entity, the product's peculiar characteristics and uses, unique production facilities, distinct customers, distinct prices, sensitivity to price changes, and specialized vendors." The application of this laundry list of criteria has not led to precision in defining a market for antitrust purposes.[21]

Numerous methods are used to identify the good substitutes for a particular product. One is to interview producers in the industry who presumably know both their customers and their potential competitors from other industries.

If Products A and B are in the same economic market, then their prices should tend to move closely together. Therefore, a reasonable *first* step in defining economic markets is to examine the price correlations (a statistical measure of how closely prices move together) among different products that are under consideration for inclusion in the same product market.[22]

Although no standard levels of correlation have been established to determine if two products are in the same market, the available data may often be used to develop such standards. For example, suppose that everybody agrees that two different types of plastic materials are in the same economic market. One could compute the correlation between their prices and use it as a benchmark to determine whether some third plastic material belongs in the same economic market with the other two products.

The direct price elasticity—*not* the cross-elasticity of demand—determines market power. The **cross-elasticity of demand** is the percentage change in quantity demanded in response to a 1 percent change in the price of another product. There is a lot of discussion in court decisions as to the importance of cross-elasticity of demand in defining markets. Courts often use the term loosely to indicate that products are substitutes. There is a relationship between cross-elasticity and direct elasticity,

[20] *Brown Shoe Company v. United States*, 370 U.S. 294 (1962).

[21] The courts, in addition to defining economic markets, have occasionally attempted to define economic *submarkets* that are contained within an economic market. Presumably, competition between two products in the same economic market is more intense if the two products also belong to the same submarket. The distinction between *market* and *submarket* is not very useful, and we will not refer to it or even attempt to give an economic definition of the term *submarket*.

[22] Price correlations are a useful first step in defining markets; however, high correlations need not always indicate that two products are in the same market. For example, dissimilar products made from similar inputs may have high price correlations. Similarly, low correlations need not always indicate that products are not in the same market, provided large quantity shifts accompany the relative price shifts. If the price of one product rises, but the price of a good substitute does not, the quantity demanded of the first product sharply declines.

however. All else the same, the larger a cross-elasticity of demand, the larger in absolute value is the direct elasticity of demand.[23]

To intelligently discuss a cross-elasticity, one must specify whether it is the cross-elasticity of Product A with respect to the price of Product B or vice versa. Although these two different cross-elasticities are usually not distinguished in court decisions, they are not equal in general.[24] The relevant cross-elasticity of demand when the question is whether the market for Product A should include Product B is the cross-elasticity of demand for Product A with respect to the price of Product B.

The Extent of the Geographic Market. The geographic limit of a market is determined by answering the question of whether an increase in price in one location substantially affects the price in another. If so, then both locations are in the same market. The process of determining these limits proceeds along the same lines as discussed for the product market definition and involves similar reasoning. For example, consider the consumption of oranges in Chicago. Oranges are shipped to Chicago from outside the city limits. The geographic areas that ship to Chicago (or could profitably do so if price rose slightly) are in the same economic market as Chicago because they contain orange producers whose output significantly influences the price of oranges in Chicago. Notice that these same orange producers could also significantly affect the price of oranges in Milwaukee. Thus, Milwaukee and Chicago could be in the same economic market, and the price of oranges in Chicago would generally be closely related to the price of oranges in Milwaukee.[25]

Cooperation Among Competitors

This section explores the restrictions that the antitrust laws place on cooperation among competitors. We first examine explicit agreements to set price or output and then explicit agreements that lead to new products being produced, as well as informa-

[23]This result follows because the sum of the direct elasticity plus all cross-elasticities of demand equals 0. Let the cross-elasticity of demand of Product A with respect to the price of B be $\epsilon_{AB} \equiv (\partial Q_A/\partial p_B)(p_B/Q_A)$, where Q_A is the (income-compensated) demand for A, and p_B is the price of B. Then, $0 = \epsilon_{AA} + \sum_B \epsilon_{AB}$, where ϵ_{AA} is the own (direct) price elasticity of demand for product A (Henderson and Quandt 1980, 31–33). The cross-elasticity of demand is positive for substitutes, and the direct price elasticity is negative. The direct elasticity can be large even if no individual cross-elasticity is large.

[24]From demand theory, $\partial Q_A/\partial p_B = \partial Q_B/\partial p_A$. This last relationship does not imply that the cross-elasticities of demand (defined in the previous footnote) ϵ_{AB} and ϵ_{BA} are equal (Henderson and Quandt 1980, 30).

[25]See Carlton (2003, 2004a), Landes and Posner (1981), Scheffman and Spiller (1987), and Stigler and Sherwin (1985) for further analysis of market definition and its use in antitrust cases.

tion sharing among rivals. We then analyze oligopoly behavior in which firms behave similarly, though not as a result of explicit agreements. Finally, we examine mergers among competitors.

Price-Fixing and Output Agreements

The Court's views on price-fixing and output agreements are that an agreement whose sole purpose is to eliminate competition and raise prices above competitive levels—that is, a "naked" agreement to eliminate competition—is illegal. No inquiry as to the reasonableness of the price set is necessary to reach the conclusion that the agreement violates the law. When no additional inquiry is necessary to analyze the facts of a situation in order to determine the legality of the conduct, the conduct is said to be *per se* illegal. Therefore, it is often said that price-fixing and output-fixing agreements are per se violations of the antitrust laws.[26] Example 19.4 discusses the approach that other countries have taken toward such agreements among competitors.

Soon after the passage of the Sherman Act, the courts considered two cases of firms that cooperatively set prices and allocated customers. In *Trans-Missouri Freight Association,* a group of competing railroads entered into agreements about what rates to charge.[27] The railroads claimed that the rate agreements resulted in reasonable rates that prevented ruinous competition. The Court rejected these arguments and instead ruled that "the claim that the Company has the right to charge reasonable rates and that therefore it has the right to enter into a combination with competing roads to maintain such rates cannot be admitted. . . . Competition will itself bring charges down to what may be reasonable. . . ."

After the decision limiting their ability to fix rates, railroads continued to push for the ability to set their rates and avoid competition. They were ultimately allowed to do so by legislation. The Staggers Act of 1980 eliminated many of the restrictions on competition. Apparently as a result, many railroad mergers followed.

Considered at almost the same time as *Trans-Missouri,* the *Addyston Pipe* case also involved price fixing.[28] A group of manufacturers of cast-iron pipe met to set price terms in certain geographic areas. Their defense was that the prices they set were fair and reasonable and restrained the deleterious effects of ruinous competition. The

[26] It is ironic that an agreement among two small competitors in a very competitive industry where the two together cannot affect the market price is a per se violation of the antitrust laws while a merger of the two firms is legal. If agreements among competitors can never generate efficiencies, then it lowers enforcement costs to ban both effective and ineffective agreements to fix price among competitors. However, just like mergers, agreements among competitors can generate efficiencies, so it is peculiar to distinguish between the two, unless one could claim that efficiencies are more likely from a merger than from a price-fixing agreement. As we discussed in Chapter 5, it is often unclear what the word *agreement* means. Here, we refer to explicit communication among firms about what specific price to charge or output to produce. See Carlton, Gertner, and Rosenfield (1997).

[27] *United States v. Trans-Missouri Freight Association*, 166 U.S. 290 (1897).

[28] *United States v. Addyston Pipe & Steel Co.*, 175 U.S. 211 (6th Cir. 1899).

EXAMPLE 19.4 *Antitrust Laws in Other Countries*

Many countries took a much different view toward agreements among competitors than that taken in the United States. For example, Germany, Japan, and the United Kingdom allowed the formation of cartels that the government believed would promote efficiency. Although competition was generally viewed as desirable, these countries also believed that in certain circumstances it would not lead to efficiency. For example, West Germany and Japan both allowed for cartelization so that firms could reduce capacity during periods of excess capacity. Audretsch (1987) showed that in West Germany, prices rose during the cartelization period and fell after the cartel dissolved.

In addition to having their own laws, countries belonging to the European Union (EU) are also governed by antitrust provisions under the Treaty of Rome as well as by the European Commission Merger Regulation. The main antitrust provisions under the Treaty of Rome are Articles 85 and 86. Basically, Article 85 prevents anticompetitive harms resulting from contracts (such as those that restrict distribution terms) or from agreements (such as cartels). Similarly, Article 86 prevents anticompetitive harm from "abuse of dominant position" (such as from predatory pricing). The EU now uses its antitrust laws to question mergers and its competition policy to prevent price fixing and other similar activities. Thus, the EU laws now more closely resemble U.S. law in enforcing competition. The eastern and central European countries, formerly in the Soviet bloc, are adopting laws similar to those of the European Union.

The International Competition Network, an organization comprised of the antitrust authorities of over 85 countries, was recently formed to promote the development of antitrust laws throughout the world.

Sources: Audretsch (1987) and Swann et al. (1974).

Court reaffirmed its rejection of this type of argument. Several months after the adverse decision, all of the defendants merged into a single firm. The government did not challenge the merger. Therefore, the firms were able to achieve through merger what they were unable to achieve through horizontal agreements. These two early important price-fixing cases both involved industries with high fixed costs that made claims of ruinous competition.[29]

Nearly three decades later, the Court reinforced the prohibition against price fixing in *Trenton Potteries*.[30] The firms that manufactured and distributed 82 percent of the

[29]It is possible in high-fixed-cost industries for no equilibrium to exist without additional restrictions on competition (see **www.aw-bc.com/carlton_perloff** "Theory of the Core"). See Bittlingmayer (1982) for an analysis of the *Addyston Pipe* case from this point of view.
[30]*United States v. Trenton Potteries Co.*, 273 U.S. 392 (1927).

bathroom fixtures produced in the United States attempted to set list prices and urged adherence to these prices. Without investigating whether the agreement could successfully affect prices, the Court ruled that the reasonableness of price was no justification for price fixing.

During the 1930s, there was a widespread belief that the forces of competition were, in large part, the cause of the Great Depression. In 1933, in an apparent response to the current thinking of the time, the Court contradicted its previous rulings on price fixing and ruled in *Appalachian Coals* that a price-fixing cartel could be desirable if it prevented financial ruin. This anomalous decision was overruled by the Supreme Court in 1940. In *Socony-Vacuum,* the Court reaffirmed its previous views regarding price agreements among competitors.[31] In that case, a group of oil producers formed an organization designed to raise prices in order to rescue the industry from its serious financial plight. The Court ruled that "the elimination of so-called competitive evils is no legal justification" for such programs.

The reduction in the number of cartels is likely the most important achievement of U.S. antitrust laws. Cartels can significantly raise prices to consumers. So, for example, bid rigging conspiracies led to a price increase of about 6.5 percent for milk (Porter and Zona 1999; see also Pesendorfer 2000), 19 percent for highway construction in North Carolina (Brannman and Klein 1992), and 23–30 percent in Defense Department auctions for frozen fish (Froeb, Koyak, and Werden 1993). (See Chapter 5 and Connor 2003 for many additional examples involving international cartels in citric acid, vitamins, and other goods.) Consumers benefited greatly from the prosecution and elimination of these cartels.[32]

Not All Agreements Among Competitors Are Illegal

Although it is true that an agreement whose sole purpose is to fix prices or restrict output is a per se violation of the antitrust laws, it is not true that every agreement that results in prices being fixed is illegal per se. The Supreme Court has indicated that if the price fixing is ancillary to achieving another procompetitive purpose, then the agreement may well be deemed lawful. In such situations, it is necessary to investigate whether the price-fixing agreement is necessary to achieve the procompetitive purpose that underlies an agreement.

The Court long ago recognized that competitors sometimes must cooperate for the sake of efficiency and that this cooperation could involve pricing. Rather than applying a per se rule of illegality to such agreements, the courts apply a *rule of reason* analysis, in which the reasonableness of the cooperation is analyzed. One famous early case in which the rule of reason is eloquently articulated is *Chicago Board of Trade.*[33] In that

[31] *United States v. Socony-Vacuum Oil Co.*, 310 U.S. 150 (1940). This case is also referred to as *Madison Oil* because it was tried in Madison, Wisconsin.

[32] In contrast to these findings, Sproul (1993) found that Department of Justice prosecutions between 1973 and 1985 had little effect on prices. However, Sproul used less detailed data than those used in the studies cited in the text.

[33] *Board of Trade of City of Chicago v. United States*, 246 U.S. 231 (1918). *Standard Oil Co. of New Jersey v. United States* 221 U.S. 1 (1911) is the first case to employ a rule of reason.

case, members of the Board of Trade (who compete with each other to buy and sell contracts involving grains) agreed among themselves that after the Board had closed, no member of the Board of Trade could transact in a certain type of grain at a price other than the closing price that day. The Board of Trade was open during the early part of each day, and during that time, members transacted at prices that were determined by their willingness to buy or sell. The last price of the day was the closing price. The rule that no members could trade after the Board had closed except at the closing price made it more difficult for members to transact after closing, because supply and demand were likely to have moved the equilibrium price away from the closing price. The effect of this rule, therefore, was to create an incentive for members who wanted to trade to do so when the Board was open.

An organized exchange provides a valuable service. It amalgamates the information flows of buyers and sellers in such a way as to create a market price. An exchange is compensated for its activities by charging in some way for each trade that occurs. If one could costlessly observe the prices at the Board of Trade without having to pay any fees to it, one could free ride on the informational activities at the Board of Trade. By waiting to trade until after hours, one could use the information generated during the trading session by the Board of Trade yet avoid paying any fee. Therefore, this rule had two effects. First, it created an incentive to conduct more trades during the day on the exchange, making the market a larger one that can process more information. Second, it reduced the free-riding problem by discouraging trading after hours.

The Court ruled that this agreement was not a per se violation of the antitrust laws. The opinion, written by Justice Brandeis, said that

> Every agreement concerning trade, every regulation of trade, restrains. . . . The true test of legality is whether the restraint imposed is such as merely regulates and perhaps thereby promotes competition or whether it is such as may suppress or even destroy competition.

Thus, the Court clearly believed that a cooperative agreement among rivals about pricing can promote competition sometimes.

In *Broadcast Music, Inc. (BMI),* the Supreme Court investigated the way in which music is licensed.[34] Copyright owners of musical scores have property rights to their material. No one is allowed to use that material without permission and the payment of the agreed-upon fees. For example, any time a copyrighted song is played on the radio or on television, the copyright owner of that musical score must be compensated. It would be very costly for television and radio stations to locate and pay the copyright owner of each of the musical scores that it uses. Similarly, it would be very difficult for individual copyright owners to constantly monitor radio and television to determine if their musical scores were being performed.

To get around these horrendous transaction problems, two organizations were formed. One is the American Society of Composers, Authors, and Publishers (ASCAP) and the other is Broadcast Music, Inc. (BMI). Copyright owners belong to one

[34] *Broadcast Music, Inc. v. Columbia Broadcasting System, Inc.*, 441 U.S. 1 (1979).

or both of these organizations and rely on them to collect revenues on their behalf. These organizations monitor musical productions and issue blanket licenses that enable the licensee to use any song listed in the blanket license. Fees for blanket licenses are ordinarily flat dollar amounts or percentages of total revenues. Therefore, ASCAP and BMI do fix prices in some sense, and they are, of course, organizations of competitors, handling the many songwriters.

The Supreme Court realized that ASCAP and BMI were providing an important service that lowered transaction costs and that the only way they could provide it was to set the price. In this sense, then, both BMI and ASCAP were performing procompetitive functions, and, by lowering transaction costs, they were expanding the amount of consumption that could occur. The Supreme Court therefore recognized that the per se rule was not appropriate here; instead, it decided that a rule of reason was necessary to analyze the reasonableness of the restraint. This case emphasized that cooperative agreements regarding price need not always violate the antitrust laws. (See Carlton and Klamer 1983, Halverson 1988, and Example 19.5 for an alleged price-fixing case involving not-for-profit colleges and universities.)

Information Exchanges Among Competitors

A common and natural form of association among competitors is a trade association, which is an organization composed of firms in similar businesses. Trade associations often collect information on the industry that is valuable to its members. Of course, trade associations can also serve as a vehicle by which prices are fixed (Chapter 5). However, it is important to recognize the legitimate information-generating services that trade associations can provide, such as revealing cost information to their members, or even revealing transaction prices to market participants, provided there is not collusion.

In the *Hardwood* case, the Court investigated the activities of the American Hardwood Manufacturers' Association, which had about 400 members.[35] The association engaged in gathering and reporting information about the sales, production, inventory, and pricing activities of each member and making such information available to the members. Moreover, at their meetings, members frequently discussed business conditions and the suitability of increases or decreases in industry production in light of these conditions. This behavior is consistent with that of a cartel. A cartel with 400 members, however, would be a difficult one to police and is therefore not likely to be successful in raising price for long. Therefore, it is likely that the exchanged information probably improved the knowledge of market conditions without increasing price. Nonetheless, the Court ruled that these activities were illegal (see Example 11.8).

Justice Brandeis disagreed with his colleagues on the Supreme Court about the *Hardwood* case. He explained that had there been a centralized market, much of the information collected by the trade association would have been automatically available. The provision of information was viewed by Brandeis as a beneficial, procompetitive effect of the trade association.

[35] *American Column & Lumber Company v. United States,* 257 U.S. 377 (1921).

EXAMPLE 19.5

Colleges and Antitrust: Does Your School Belong to a Cartel?

In the 1950s, some Ivy League schools met and agreed not to offer aid to star athletes except on the basis of the financial need of the athlete. Soon, the agreement was extended to cover star students. By the 1980s, twenty-three elite schools in the Northeast were participating in this agreement, which was called the Overlap agreement. Under the Overlap agreement, each school would (1) agree to provide aid to students only on the basis of need, (2) adopt similar procedures to define need, and (3) meet to examine the actual awards made to each student who was admitted to at least two of the schools participating in the Overlap agreement and adjust aid offers if they differed.

The schools claimed that the Overlap agreement allowed them to conserve their financial resources to concentrate aid on poor students so as to achieve the twin goals of (1) having admission decisions based only on merit, and (2) guaranteeing full financial aid (based on need) to every admitted student. Few schools outside of those participating in the Overlap agreement adhered to these twin goals. The schools also claimed that their Overlap policies were fully consistent with federal education policies, which, for the most part, forbid the use of federal funds for scholarship aid if the aid is not based on need.

In 1991, the U.S. Department of Justice sued the eight members of the Ivy League and MIT under Section 1 of the Sherman Act. The Department of Justice claimed that the Overlap agreement was a per se illegal price-fixing agreement designed to raise each school's revenue. All the Ivy League schools agreed to stop the behavior and the suit against them was dropped. MIT refused to settle and went to trial.

Although colleges might want to cooperate to raise their own revenue and thereby harm students, they also might want to cooperate to achieve a social goal such as helping poor students. After all, one of the objectives of a not-for-profit college is to benefit students. Carlton presented an econometric study of average tuition paid by all students that revealed that there was no evidence to support the view that average tuition was higher as a result of the Overlap agreement. There was no question, however, that the Overlap agreement caused some students to pay higher tuition and others to pay lower tuition than they would have otherwise paid.

The court ruled that a per se approach should not be used because of the not-for-profit nature of colleges. The court found that the Overlap behavior did result in a violation of the antitrust laws because it restrained competition—specifically, the bidding for star students. Curiously, the Department of Justice did not attack the agreement not to bid for star athletes. The case was reversed on appeal and sent back to the district court for further review. Soon after the initial district court decision, Congress passed legislation to make it legal for the schools to continue to abide by most of the Overlap agreement that had been judged illegal. The case was settled with the schools being allowed to engage in most of the conduct covered by the Overlap agreement. However, the schools never reinstituted the Overlap conduct. Subsequent research by Hoxby (2000) confirmed the predictions of the original econometric model that Overlap did not cause an increase in average tuition.

Source: Carlton, Bamberger, and Epstein (1995) and Bamberger and Carlton (2004). Carlton served as an expert witness for MIT.

A few years later, the Court again examined another trade association, the Maple Flooring Manufacturers' Association, with twenty-two members who accounted for roughly 70 percent of the total production of hardwood-type floors.[36] The association provided information on costs, freight, quantities sold, and prices received by individual members, and held meetings at which various industry members exchanged views about the state of the industry. The Court ruled that this activity was not a violation of the antitrust laws and cited the procompetitive benefits that result from a free flow of information and having industry participants apprised of market conditions. Using the economic theories about number of participants developed in our discussion of cartels, it appears that the trade association was much more likely to act successfully as a collusive device in the *Maple Flooring* case than it was in the *Hardwood* case. Despite this, the Maple Flooring Association was exonerated, but not the Hardwood Association.

Several decades later, the Court investigated exchanges of price information among producers of corrugated containers.[37] One competitor would request information from another on the most recent price that it had offered. The industry was concentrated, with the defendants accounting for about 90 percent of the shipments of corrugated containers from plants in the southeastern United States. After examining the economic factors of the industry including its concentrated structure, the Court concluded that the exchange of information was anticompetitive.

The discussion of oligopoly theory in Chapters 5 and 6 shows that exchanges of information can assist in collusion. For this reason, courts have paid careful attention to the activities of trade associations. At the same time, the courts recognize that information is a scarce commodity and that its dissemination can often be valuable. Evaluating these two offsetting effects is difficult.

Oligopoly Behavior

Noncooperative oligopoly prices may be above the competitive level because firms recognize their mutual interdependence and find it in their interests not to drive prices to competitive levels. The question the courts had to address was whether such pricing and other oligopoly behavior can be regarded as the result of an agreement among competitors that violates the antitrust laws. The enforcement of the antitrust laws often focuses on explicit agreements among competitors. The prosecution effort centers on showing evidence of an agreement (for example, incriminating documents) rather than on showing the effects of an agreement (for example, higher prices).

The Court addressed the question of when one could infer that a conspiracy or agreement had been made among competing firms in *Interstate Circuit*.[38] The Court said, "In order to establish agreement, it is compelled to rely on inferences drawn from the course of conduct of the alleged conspirators." The Court ruled that similarity in behavior was enough to constitute evidence of an agreement.

[36] *Maple Flooring Manufacturers' Association v. United States*, 268 U.S. 563 (1925).
[37] *United States v. Container Corp. of America*, 393 U.S. 333 (1969).
[38] *Interstate Circuit, Inc. v. United States*, 306 U.S. 208 (1939).

In the *American Tobacco* case, the Court examined in detail the behavior of the cigarette industry in the 1930s.[39] List prices of the three major companies (the "Big Three"), Reynolds, American, and Liggett & Myers, were identical most of the time. During the height of the Depression, the cigarette companies all raised their prices even though their costs fell.

After prices rose, new competitors entered the cigarette industry and were able to sell their brands for 10¢, which was less than the 15¢ charged for the brands of the three majors. The market shares of the Big Three started to erode, and they had lost roughly 22 percent of total cigarette sales by 1932. The Big Three responded by cutting prices, and sales of the 10¢ brands fell considerably: The market share of the 10¢ brands was reduced to around 6.5 percent by 1933. The three major cigarette companies used their influence to make sure that no retail store sold the brands of the Big Three for more than 3¢ above the price of the 10¢ brands. See Example 11.2.

The Court found that the similarity of conduct among the three major companies provided a basis to infer that an unlawful conspiracy had occurred:

> Where the circumstances are such as to warrant a jury in finding that the conspirators had a unity of purpose for a common design and understanding, or meeting of minds in an unlawful arrangement, the conclusion that a conspiracy is established is justified.

After *American Tobacco,* it was unclear exactly what type of oligopoly behavior would be subject to the antitrust laws. Was merely parallel behavior, in which firms who recognize each other's interdependence act similarly, a violation of the antitrust laws?

In a series of cases, the Court aggressively attacked oligopoly behavior involving delivered pricing (see Chapter 11). However, in 1954 the Court indicated a change in direction. In the *Theatre Enterprises* case, the Court addressed the question of parallel behavior of movie theaters.[40] A newly refurbished theater sought to obtain the rights to run first-run feature movies from several distributors. The distributors refused because they already had theaters lined up for their first-run features. The Court ruled that

> business behavior is admissible circumstantial evidence from which the fact finder may infer agreement . . . but this Court has never held that proof of parallel business behavior conclusively establishes agreement or, phrased differently, that such behavior itself constitutes a Sherman Act offense.

In other words, the common action of the distributors in refusing the movie theater the right to run first-run movies did not constitute a violation of the antitrust laws. This case is often interpreted to mean that parallel behavior ("conscious parallelism"), the kind that naturally results from a few firms' competition with each other in an oligopoly, cannot by itself lead to an antitrust violation; there must be some additional offense ("conscious parallelism plus") for the behavior to constitute an illegal action.

[39] *American Tobacco Company v. United States,* 328 U.S. 781 (1946).
[40] *Theatre Enterprises Inc. v. Paramount Film Distributing Corp.,* 346 U.S. 537 (1954).

The view that parallel behavior alone is not sufficient for an antitrust violation has been reaffirmed in several recent cases that the Federal Trade Commission has brought unsuccessfully, in which it has alleged that either markets are so-called shared monopolies (firms choose not to compete for the same customers and instead have local monopolies)[41] or are not competitive because of certain business practices adopted independently by each firm. For example, in *du Pont,* the FTC charged that the noncollusive adoption of certain common business practices, such as notification to buyers of price increases, the use of a most-favored nations clause (see Chapters 5 and 11), the use of uniform delivered pricing, and public announcements in the press all constituted business practices that facilitated noncompetitive pricing.[42] The Court of Appeals for the Second Circuit rejected such arguments as indicating violations of the antitrust laws:

> The mere existence of an oligopolistic market structure in which a small group of manufacturers engage in consciously parallel pricing of an identical product does not violate the antitrust laws.

Mergers

Prohibitions against price fixing would have little effect without limits on mergers. The antitrust laws try to prevent the creation of additional market power through mergers of competitors. The issue in a merger case is not whether the industry is currently competitive, but whether it will become less competitive as a result of a merger. Because mergers can generate efficiencies, a merger policy that overdeters merger activity imposes a significant cost on society. Conversely, too lenient a policy leads to the creation of additional market power. We first discuss mergers among competitors and then among potential competitors.

Mergers of Competitors. In an early decision, *Northern Securities Company,* the Supreme Court investigated the creation of a holding company that would control two large, competing railroads: The Great Northern Railroad Company and the Northern Pacific Railway Company.[43] The creation of this holding company, which would exercise control over these two previously competing railroads, was deemed to violate the antitrust laws. The *Northern Securities* decision in 1904 coincided with the end of the widespread merger movement in the early 1900s (see Chapter 2).

Soon after the *Northern Securities* decision, the Court reached another decision involving market power acquired through merger. In *Standard Oil,* the Court investigated the creation of the Standard Oil Company and the practices it followed in

[41] *FTC v. Kellogg et al.*, Docket No. 8883, 99 FTC Reporter 8, 1982. The FTC eventually dismissed the case. See Schmalensee (1978b) for an analysis of this case.
[42] *E.I. du Pont de Nemours & Co. v. FTC*, 729 F.2d 128 (2d Cir. 1984). This case is also sometimes called the *Ethyl* case because Ethyl was a participant. See Example 11.7 and Hay (1999).
[43] *Northern Securities Company v. United States*, 193 U.S. 197 (1904).

acquiring businesses related to petroleum products.[44] John D. Rockefeller and others were the defendants. One charge was that the defendants

> purchased and obtained interest . . . and entered into agreements with . . . various persons . . . engaged in purchasing, shipping, refining, and selling petroleum and its products . . . for the purpose of fixing the price of crude and refined oil and the produce thereof, limiting production thereof, and controlling the transportation therein, and thereby restraining trade . . . and monopolizing interstate commerce.

Another charge was that refineries that refused to enter into the agreement were driven out of business through a variety of predatory tactics such as low prices. Other charges included unfair practices against competing pipelines, contracts with competitors, espionage, and division of the United States into districts and limiting the amount of competition in each district. The Court ruled that the actions indicated "a conviction of a purpose and intent" to monopolize, and it ordered the dissolution of the combination. This case is famous because the Court refused to apply a per se ban to mergers among competitors and introduced the rule of reason, in which one had to investigate whether the resulting effect of the merger was an unreasonable restraint of trade.

In the *United States Steel* case, the Court seriously retreated from vigorously applying the antitrust laws to enjoin merger activity.[45] The case involved the creation of the United States Steel Company through the merger of approximately 180 independent firms. U.S. Steel produced 80 to 90 percent of the entire steel output of the country. The Court refused to find the creation of U.S. Steel illegal, and seemed to indicate that because U.S. Steel, unlike Standard Oil, did not engage in improper behavior, the combination was lawful.

Dissatisfaction with the Supreme Court's treatment of mergers (especially in light of a failure to block another acquisition)[46] led Congress to pass the *Celler-Kefauver Act* in 1950, which strengthened Section 7 (on merger activity) of the Clayton Act. In *Brown Shoe,* the Supreme Court applied the new standards of the amended Section 7 of the Clayton Act to block a proposed merger between G.R. Kinney Company and Brown Shoe Company.[47] Both were manufacturers and retail sellers of shoes. The language of the Court's decision indicated that a combined share of 5 percent in a city was excessive, taking into account the trend toward increasing concentration in this industry. The Court also issued its famous laundry list of criteria for defining a market, which we discussed in the section on market definition.

The Court continued its hard line on mergers by stopping a merger among banks in *Philadelphia Bank*.[48] The merged firm would have had less than 40 percent of de-

[44] *Standard Oil Company of New Jersey v. United States*, 221 U.S. 1 (1911). McGee (1958) analyzes this case.
[45] *United States v. United States Steel Corporation*, 251 U.S. 417 (1920).
[46] *United States v. Columbia Steel Company*, 334 U.S. 495 (1948).
[47] *Brown Shoe Company v. United States*, 370 U.S. 294 (1962). Peterman (1975) analyzes *Brown Shoe.*
[48] *United States v. Philadelphia National Bank*, 374 U.S. 321 (1963).

posits in the Philadelphia area. The Court also rejected a consideration of the efficiency benefits of a merger.

The Supreme Court took its strictest stance in enforcing Section 7 of the Clayton Act in *Von's*.[49] Von's Grocery Company sought to acquire Shopping Bag Food Stores, another retail grocery company operating in Los Angeles. Their combined sales accounted for only 7.5 percent of all sales in Los Angeles, yet the Supreme Court prevented this acquisition. Shortly thereafter in 1968, the Department of Justice issued very strict guidelines on which firms could likely merge without challenge (see **www.aw-bc.com/carlton_perloff** "1968 Merger Guidelines").

The more recent 1984, 1992, and 1997 Merger Guidelines (Example 19.3) recognized the potential efficiency gains from mergers. These guidelines apparently are a response to the earlier rejection by the government and the Court to using proposed efficiency gains from mergers as a defense to justify a merger that increases concentration in a market. The application by the Department of Justice and the FTC of the current merger guidelines, which recognize the value of efficiencies, suggests that efficiencies alone generally do not provide sufficient justification for a merger in which prices are expected to rise. Efficiencies, however, can provide a justification for a merger that results in increased concentration if the efficiencies would lead to lower prices.

One defense that courts have allowed in merger cases is the *failing-firm defense,* in which the firms explain that if the proposed merger is not allowed, one of the firms will go out of business. If the proposed transaction is the least anticompetitive one that can prevent the assets from leaving the industry, the Department of Justice or FTC will not challenge the merger. However, if the failing firm goes bankrupt but the creditors continue to operate the firm, then the bankruptcy does not affect competition and there is no reason to allow a failing-firm defense.

The failing-firm defense can be regarded as a recognition that current market shares may not reflect the future importance of the competitor that will vanish as a result of the merger. If a firm will go out of business unless it merges with others, then the fact that it currently has a high market share is irrelevant in considering whether the merger should go through or not. Merger policy should be forward-looking, and it is really the future competitive significance of the merging firms that is important in understanding whether a merger is anticompetitive.[50] This principle is recognized by the Supreme Court in several cases in which it finds that current market shares may be inaccurate indicators of the future competitive significance of a firm.[51]

[49] *United States v. Von's Grocery Company*, 384 U.S. 270 (1966).

[50] Suppose that there are three firms in an industry with market shares of 30%, 30%, and 40%, and that the one with 40% is failing. If it fails, the remaining firms will have 50% and 50%. If, instead, the failing firm is acquired by one of the remaining firms, the shares will be 70% and 30%. Thus, if a merger occurs, concentration as measured by the Herfindahl-Hirschman Index (HHI) increases (see Chapter 8). The comparison of the HHIs is *irrelevant* however, if the output level is not held constant. If, as a result of the acquisition, more assets remain in the industry and output is permanently higher, then consumers are better off even if market concentration increases from what it would have been if no acquisition had occurred, the failing firm had failed, and its assets had exited the industry.

[51] *United States v. General Dynamics Corporation*, 415 U.S. 486 (1974).

Thus, the criteria for analyzing mergers used by the Court and the government have evolved considerably since the Celler-Kefauver Act in 1950. As the Court has eliminated some of the inconsistencies in its opinions in defining markets, and as economists and lawyers have become more sophisticated about defining markets and understanding the effects of market concentration, government policy toward mergers has become more systematic. A merger such as that attacked in *Von's* would probably not be attacked today. Moreover, both the FTC and Department of Justice address their concerns about lack of competition resulting from a proposed merger by allowing the merging firms to restructure the proposed transaction to remedy competitive concerns (such as by selling some assets to a new entrant). They have used this "fix it first" policy extensively since the 1980s.

Mergers of Potential Competitors. Suppose two firms that do not currently compete in the same market wish to merge. Can the merger be blocked if the government thinks it is likely that the two firms would have competed in the future? Logically, there is nothing wrong with blocking a merger if it will improve future competition. Practically, it is very difficult to determine which firms are potential competitors. The decisions of the Court have evolved over time so that a merger between potential competitors is now much less likely to be challenged as anticompetitive.

An early case involving a merger between potential competitors was *El Paso Natural Gas.*[52] El Paso Natural Gas sought to acquire the assets of Pacific Northwest Pipeline Corporation. Both companies operated large natural gas pipelines. Only one of them, El Paso, delivered natural gas into California, a market in which the government contended competition would be lessened if the acquisition occurred. Even though Pacific Northwest had never sold gas in California, on several occasions it had attempted to obtain the necessary regulatory approval to deliver gas into California. Indeed, Pacific Northwest had conducted lengthy negotiations with a large customer in southern California. The result of these negotiations was to heighten competition, even though El Paso eventually won away the customer. The Court ruled that although Pacific Northwest was not a successful seller in California, it was indeed a competitor: "Unsuccessful bidders are no less competitive than the successful ones." The acquisition was barred. Because Pacific Northwest had actually bid for business, it seems more reasonable to regard this case as one between actual rather than potential competitors.

Another important case involving potential competition was *Procter & Gamble.*[53] Procter & Gamble Company acquired Clorox Chemical Company, which was the leading manufacturer of household liquid bleach and had about 50 percent of U.S. sales. Procter & Gamble did not manufacture or sell bleach, but was a major manufacturer and seller of many other household products. The Court decided that the acquisition should be blocked because Procter & Gamble was a likely entrant into the liquid-bleach market. As a result of the decision, Clorox was divested in 1969 (12 years after the original merger).

[52] *United States v. El Paso Natural Gas Company*, 376 U.S. 651 (1964).
[53] *Federal Trade Commission v. Procter & Gamble Company*, 386 U.S. 568 (1967).

The potential competition doctrine was again used by the Supreme Court in *United States v. Falstaff Brewing Corporation.*[54] Falstaff, one of the nation's largest brewers, sought to acquire Narragansett, which was the largest brewer in the New England area—an area in which Falstaff did not compete. The government argued that the merger should be enjoined because Falstaff was a likely entrant into the New England area. The district court had found that Falstaff had no intentions of otherwise entering the New England area, but the Supreme Court ruled that Falstaff may have affected competition in New England anyway because Falstaff might have been perceived as a potential entrant into the New England area and therefore might have restrained prices. The district court subsequently found that Falstaff was not perceived as a potential entrant. Although logically a perceived potential competitor could influence the market, a perceived potential competition doctrine depends on the state of mind of the competitors and not on any easily verifiable facts. Therefore, even though the doctrine is logically consistent, it turns out to be extremely complex to litigate such a case, which is based on the opinions of competitors who may be interested in preventing a merger that would result in the creation of an efficient competitor and rival.

The Supreme Court significantly constrained the application of the potential competition theory in *Marine Bancorporation.*[55] The government challenged a proposed merger between a commercial bank in Seattle and one in Spokane: two banks that were not direct competitors even though both were located in the same state. The government challenged the merger on the grounds that the acquiring bank would have found an alternative and more competitive means for entering the Spokane area. The Court was unconvinced that an alternative method of entry would achieve the same procompetitive effects as this acquisition. It appears, then, that the Court's decision requires a showing that first, the potential competitor has some unique advantage to entry, and second, that this means of entry would allow the potential competitor to enter and prosper. Since the *Marine Bancorporation* decision, the potential competition doctrine has not fared well (Posner and Easterbrook 1980, 531). Of course, if markets are broadly defined, there is little need for a potential competition doctrine because the potential competitors are considered part of the market.

Exclusionary Actions and Other Strategic Behavior

So far, this chapter has described how antitrust laws are designed to prevent agreements between competing firms, such as a price-fixing conspiracy or a merger, that can lead to the creation of market power. This section examines actions by a single firm (or firms acting collectively) that may help it maintain its monopoly or facilitate its acquisition of market power at the expense of its rivals. These **exclusionary actions** are used

[54] *United States v. Falstaff Brewing Corporation,* 410 U.S. 526 (1973). See also *United States v. Penn-Olin Chemical Co.,* 378 U.S. 158 (1964).
[55] *United States v. Marine Bancorporation Inc.,* 418 U.S. 602 (1974).

by a firm to eliminate rivals from a market or harm them, thereby either helping to maintain or create a monopoly. These actions, or bad acts, include predatory pricing, denial of key products to rivals, vertical relationships among firms, and tie-in sales. Many of these practices are a violation of Section 2 of the Sherman Act. Hence, antitrust cases alleging these actions are often called *Section 2 cases.*

Section 2 of the Sherman Act forbids firms' exclusionary conduct (bad acts) that adversely affect competition. A recurrent problem in Section 2 cases is that the Court has been unclear exactly how vigorously a dominant firm can respond to new competition. Moreover, economists cannot usually say with certainty which types of strategic behavior lead to benefits for consumers when competitors are harmed (Chapter 11). For example, a firm may strategically invest before other firms can enter an industry. Such a policy can benefit consumers even if it prevents potential competitors from entering the market. Thus, blanket prohibitions of such behavior may be harmful in some industries.

Section 2 litigation can be costly (as can all complicated litigation). One example of costly litigation is the IBM case in which the government sought to force IBM to break itself up into several firms. The government claimed that IBM practiced numerous policies designed to exclude competition. The legal fees as well as the time of IBM and government employees probably put the litigation cost in the area of hundreds of millions of dollars. The government eventually dropped the case.[56]

How vigorously should courts use Section 2 to constrain the action of firms? The answer turns on specific attributes of a market. Where entry can occur quickly, market power may be short lived, and there may be no need for Section 2 litigation. Over-vigorous enforcement of Section 2 cases, in addition to reducing market power, could dissuade firms from pursuing certain efficient policies that would benefit consumers. This efficiency loss could be large and would not diminish over time. Striking the right balance in Section 2 cases remains a difficult problem for the courts. We now examine strategic behavior by a firm with respect to both rival firms in its market and vertical relations.

Competition Between Rivals

In general, competition benefits consumers; however, some forms of competitive behavior can reduce competition, as Chapter 11 shows. This section reviews some of the main types of behavior between rivals that the Court has found to violate the antitrust laws. We begin with a general discussion of some famous cases in which the Court deemed certain behavior undesirable and then discuss the specific examples of predatory pricing and denial of key products to rivals.

Competitive Behavior Deemed Undesirable by the Court

One of the most famous Section 2 cases is *Alcoa.*[57] Alcoa produced and sold aluminum ingot and also fabricated the aluminum ingot into many finished and semifinished goods. In part because Alcoa owned or licensed many of the critical original

[56]See Fisher, McGowan, and Greenwood (1983) for a description of this lengthy litigation from IBM's perspective. See Houthakker (1985) for a different view.
[57]*United States v. Aluminum Company of America*, 148 F.2d 416 (1945).

patents, no firm could effectively compete with Alcoa prior to 1909. In the government's 1945 case, it alleged that, after 1909, Alcoa maintained its market power through a series of exclusionary tactics, among them (1) the signing of power contracts that forbade the power companies to sell power to anyone else who made aluminum; (2) explicit price-fixing agreements with foreign producers of aluminum to prevent imports into the United States; (3) a price squeeze, in which the price of aluminum ingot was raised to independent aluminum-sheet fabricators, who were then unable to make a profit fabricating the sheet and selling it in competition with Alcoa at the prices Alcoa was setting for aluminum sheet; and (4) a strategy of expanding capacity with the intention of eliminating competition. Alcoa remained the sole domestic producer of aluminum until 1945.

One of Alcoa's defenses was that the profit it earned was not very high. The court ruled that whether profits are high or low is irrelevant: "[Congress] did not condone good trusts and condemn bad ones; it forbade all."[58] The court stated that *the mere acquisition of a monopoly by itself was not necessarily illegal.*

Despite this view, which implies that efficient firms that grow should not be penalized, the court looked with disfavor on Alcoa's policy of anticipating demand and building capacity for it in advance:

> It was not inevitable that it should always anticipate increases in demand for ingot and be prepared to supply them. . . . It insists that it never excluded competitors; but we can think of no more effective exclusion than progressively to embrace each new opportunity as it opened.

The court's reasoning is perplexing. It is difficult for an economist to distinguish evil capacity expansion from desirable capacity expansion that occurs as a result of foresight.

The court also ruled that "The monopolist must have both the power to monopolize, and the intent to monopolize." By stressing intent, the frame of mind of the violator becomes relevant in an antitrust suit. Endless litigation can result when someone's frame of mind, rather than the actual effects of the economic actions, is the subject of the litigation. The court further ruled that Alcoa's price-squeeze policy was unlawful.[59]

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[58]The *Alcoa* case was decided by a court of appeals rather than the Supreme Court; the Supreme Court was unable to hear the case because of a conflict of interests involving several of the Justices. The Court of Appeals for the Second Circuit was designated as the court of last resort for the *Alcoa* case, and Judge Learned Hand wrote the decision.

[59]A fascinating issue in the *Alcoa* case was the definition of the market. Aluminum ingot, once it is made into fabricated aluminum, can be recycled as scrap aluminum. Scrap aluminum competes with primary ingot for many uses. The question arose as to whether the secondary market should properly be considered as part of the market in which virgin aluminum ingot competes. The court ruled that secondary aluminum should not be part of the market definition and concluded that a market share for virgin ingot of 90 percent would definitely indicate monopoly power; 67 percent might indicate monopoly power; but 33 percent would not. Secondary and primary products definitely compete with each other, but such competition need not erode the initial market power in the primary product. Once the primary product is sold, there may be no further monopoly profits to be made, because the secondary market does constrain the *subsequent* pricing of primary aluminum, even though it does not constrain the initial price. (See Chapter 15, "Renting Versus Selling by a Monopoly.") Another issue in the definition of the market involved whether imports should be included in the market. The court correctly decided to include them.

The Court remanded the case to the district court for reconsideration. The main antitrust divestiture order facing Alcoa, resulting from the antitrust litigation, was one regarding its Canadian properties. During the time period of the district court's reconsideration, the United States government sold off aluminum facilities built for it during World War II and thereby set up Reynolds and Kaiser as two competitors to Alcoa. The monopoly on aluminum that Alcoa enjoyed in the United States disappeared. By 1958, Alcoa's share of primary aluminum ingot capacity had fallen to 35 percent.

The *Alcoa* decision had far-reaching implications for dominant firm behavior. It was unclear if there was anything a dominant firm could do to avoid being charged with consciously seeking to maintain control of the market. Further, it was unclear how one would determine whether its monopoly condition was "thrust upon it," maintained by clever but legal business practices, or maintained by practices that the courts would find illegal.

In *United Shoe,* another major Section 2 case, the government charged that United Shoe maintained its market share of 75 to 85 percent of American shoe machinery primarily through the practice of refusing to sell its equipment, agreeing only to lease it.[60] The government maintained that United Shoe, by only leasing its equipment, created barriers to entry. The reason was that because United repaired its own equipment, there were no independent repair organizations that a competitor could rely on; therefore, if a competitor sought to enter the field, it would have to also provide repair services. The Court also ruled that the leasing system under which United leased the machines for 10 years would "deter a shoe manufacturer from disposing of a United machine and acquiring a competitor's machine." The Court ruled that the leases were "so drawn and so applied as to strengthen United's power to exclude competitors." Although the Court recognized the superiority of many of United's products and services, it felt that the leasing system contributed to its market power. The Court required United to offer for sale any machines that it leased. *United Shoe* appears to illustrate the important concept presented in Chapter 15 that a monopoly would prefer to lease rather than sell its machines; however, see Example 15.1.

The Court's views on the 10-year period of the lease are troublesome. If leases come up for renewal over time, and if there can be competition to obtain the customer whose lease has expired, then it is unclear why competition is reduced by the leases. Only if the slow turnover of customers prevents a rival from attaining some critical mass necessary for its survival as an efficient competitor would there seem to be an antitrust concern.[61] Even in that case, one would also want to consider any benefits that arise as a result of the long-term nature of the contract.

In *Griffith,* the Court considered the buying practices of chains of motion picture theaters.[62] These motion picture theaters paid for the movies through rentals that were based on the total attendance of the entire chain, rather than at any particular

[60] *United States v. United Shoe Machinery Corporation*, 110 F. Supp. 295 (1953). This citation refers to the Federal Supplement, a standard legal reference in which the opinions of the district courts appear.
[61] Aghion and Bolton (1987) analyze models in which long-term contracts can create anticompetitive harm by allowing the buyers to act collectively as a monopsony.
[62] *United States v. Griffith*, 334 U.S. 100 (1948).

theater. That meant that if a chain had a theater in a town in which it was competing with a single, independent theater, the chain could obtain the same movie at a lower price than the single theater. The Court ruled that this placing of single competitors at a disadvantage was a violation of Section 2 of the Sherman Act. The Court also ruled that the effect of the action rather than the intent of the actor was a reasonable focus of inquiry.

In *Berkey,* the Court of Appeals for the Second Circuit examined the duty that a monopoly has toward its rivals.[63] In 1972, Kodak, the dominant firm in the markets for cameras and for film, introduced the 110 pocket Instamatic camera and a film format to fit that camera. Berkey was a manufacturer of cameras and a processor of film. One of Berkey's claims was that because Kodak refused to predisclose the format of its 110 film, Berkey was unable to manufacture cameras to fit the 110 format film until well after its introduction. Berkey claimed that Kodak's dominance in both film and cameras required it to predisclose to its competitors any changes in film format that would affect competition in the camera market. The court ruled that predisclosure was not a duty imposed on a dominant firm by the antitrust laws. The court recognized that the antitrust laws, especially Section 2, do not forbid monopolies. The court reiterated that the standard for a Section 2 offense is the possession of market power and the willful acquisition or maintenance of that power, as distinguished from growth or development as a consequence of a superior product, business acquisition, or historic accident.[64]

Predation. One of the classic bad acts is predatory pricing (Chapter 11); however, there is a danger of confusing predatory pricing with aggressive competition. The *Utah Pie* case involved a claim of predatory pricing.[65] Utah Pie Company sold frozen dessert pies in Utah. Continental Baking Company, Carnation Company, and Pet Milk Company sold pies in competition with Utah Pie. The Salt Lake City market was the scene of dramatic price competition, and there was evidence to show that prices of the defendants' products were lower in Salt Lake City than they were elsewhere. Evidence suggested that the prices of the defendants' products, at least some of them, were below their direct cost plus an allocation for overhead. There was evidence that one of the defendants had employed an industrial spy to infiltrate the Utah Pie plant to obtain information. The Court ruled that such price discrimination eroded competition and, therefore, was predatory and in violation of the law.[66]

In *Telex,* the Court of Appeals for the Tenth Circuit investigated IBM's pricing behavior with regard to peripheral devices (such as disk drives) that plugged into an IBM

[63] *Berkey Photo, Inc. v. Eastman Kodak Company*, 603 F.2d 263 (2d Cir. 1979) cert. denied, 444 U.S. 1093 (1980).
[64] See also *United States v. Grinnell Corp.*, 384 U.S. 563 (1966).
[65] *Utah Pie Company v. Continental Baking Company*, 386 U.S. 685 (1967). Elzinga and Hogarty (1978) provide an economic analysis of this case.
[66] The language of *Utah Pie* suggests that price discrimination can violate Section 2, even if prices exceed average cost. As discussed in Chapter 11, fully allocated cost is an inappropriate standard to use in determining if prices are predatory.

central processing unit.[67] Telex claimed that IBM violated the antitrust laws by its decision to slash prices on its peripheral devices in order to compete with Telex. The court found that because the price was not below IBM's production costs, there were no grounds to the complaint.

In *Matsushita,* the Supreme Court again investigated a charge of predatory pricing.[68] This case involved a claim that certain Japanese manufacturers engaged in predatory pricing over a 20-year period. The Court recognized the irrationality of such a scheme—it would obviously be unprofitable to lose money for 20 years—and dismissed the case (Example 11.1). Alleged predatory behavior must be credible to be found to violate the law.

In *Brooke Group v. Brown and Williamson Tobacco* (113 S. Ct. 2578 (1993)), Liggett (Brooke), which pioneered the development of low-price generic cigarettes, charged that Brown and Williamson introduced its generic cigarettes at predatory prices. The Court held that a successful predation claim required proof that price was set below some measure of cost and the alleged predator had a reasonable likelihood of recouping its losses from predating. The Court found that the market structure for the sale of generic cigarettes would not allow Brown to recoup any predatory losses. The Court ruled that with no possibility of recouping its losses, even below-cost pricing does not support a claim of predatory pricing. Because the parties agreed to use average variable cost as the measure of costs, the Court declined to rule on what the appropriate cost measure should be in predation cases. Thus, there still is no Supreme Court precedent on that important issue.

Refusals to Deal and Essential Facilities. When a group of firms collectively decide to boycott or refuse to deal with a rival, thereby denying the rival access to certain markets, their actions can violate Section 1 in addition to Section 2. For example, in *Eastern States,* the Court condemned the actions of a group of retail lumber dealers who refused to deal with any wholesale lumber dealers who also sold at retail.[69]

Frequently, the courts have treated collective action involving a refusal to deal with certain firms as a per se violation. Two recent cases may indicate a change in view. In *Northwest Wholesale Stationers, Inc. v. Pacific Stationery and Printing Company,* the Court refused to apply the per se rule to a case involving an agreement among competitors.[70] This case involved the expulsion of one member from a cooperative buying agency (a group of firms that buy products as one purchaser). The Court determined that the cooperative buying agency, through an agreement among competitors, did not necessarily engage in a per se violation by expelling the plaintiff and refusing to deal with that firm. The Court ruled that in the absence of proof that the cooperative

[67] *Telex Corp. v. International Business Machines Corp.*, 510 F.2d 894 (1975).
[68] *Matsushita Electric Industrial Co. v. Zenith Radio Corporation*, 106 S. Ct. 1348 (1986).
[69] *Eastern States Retail Lumber Dealers Association v. United States*, 234 U.S. 600 (1914).
[70] *Northwest Wholesale Stationers, Inc. v. Pacific Stationery and Printing Company*, 105 S. Ct. 2613 (1985).

had market power or unique access to a critical resource necessary for effective competition, it was not appropriate to treat the conduct as a per se violation, and instead it had to be subjected to a rule of reason.[71]

In deciding refusal to deal cases, courts often emphasize the role of **essential facilities**: scarce resources that a rival needs to use to survive. For example, a trucking firm that owns the sole bridge leading to an island owns a facility that is essential to rival trucking firms that deliver to the island. Under the essential facilities doctrine, the owner of the essential facility must sometimes make the facility available to competitors.

In *Terminal Railroad,* all the railroad bridges in St. Louis were owned by a group of railroads.[72] The concern was that this control could allow the owning railroad companies to harm rival railroads (Reiffen and Kleit 1990). The Court ruled that the owning group had to provide access to rival railroads on reasonable terms.

Collective action receives close scrutiny under our antitrust laws because of the danger that competitors will agree to restrict competition. For that reason, many joint ventures that limit entry (such as sports leagues) face antitrust concerns regarding exclusionary acts that would not arise in the context of a single firm. Under *Colgate,* a single firm supposedly can decide with whom it deals.[73] But that doctrine has not always been followed and even single firms may have a duty to deal with rivals. For example, in *Aspen Ski Company v. Aspen Highland Skiing Corporation,* 472 U.S. 585 (1985), the Court ruled that an owner of three ski mountains had to continue its historical practice of cooperating with the owner of a fourth mountain in issuing lift tickets that allow skiers access to all four mountains. The reasoning seems to put a higher burden on a monopoly that once dealt with a rival than one that never did. In *Kodak,* the Court reiterated its view in *Aspen* that a monopoly may refuse to deal with its rivals "only if there are legitimate competitive reasons for the refusal."[74] See Carlton (2001) for further analysis.

The context of many cases involving refusals to deal and essential facilities is that one firm owns a scarce resource that its rivals need in order to compete. These cases, therefore, have a vertical element and can best be viewed in the context of the models of Chapter 11 involving raising rivals' costs or the natural advantage of an incumbent. For example, by denying access to or by raising the toll on the only bridge to an island, the railroad that owns the bridge can put its rival at a competitive disadvantage.

There are two noteworthy features about forcing one firm to provide supplies to its rival. First, the Court must be concerned that the firm with the scarce resource does not charge too high a price; otherwise, no rival will be able to compete even if it has

[71] See also *Federal Trade Commission v. Indiana Federation of Dentists*, 106 S. Ct. 2009 (1986).

[72] *United States v. Terminal Railroad Association of St. Louis*, 224 U.S. 383 (1912). See also *Otter Tail Power Co. v. United States*, 410 U.S. 366 (1973).

[73] *United States v. Colgate & Co.*, 250 U.S. 300 (1919).

[74] *Eastman Kodak Co. v. Image Technical Services, Inc.*, 112 S. Ct. 2091 (1992) n. 32. Recent cases such as the FTC's suit against Intel and the Department of Justice's case against Microsoft have raised antitrust concerns about the way in which an allegedly powerful firm can deal with its customers when those customers are also its rivals in some products.

access to the scarce resource. Second, a firm with monopoly power is usually allowed to charge any price it likes. It is unclear why that principle should be different here for the single firm that owns the scarce resource just because the scarce resource is an input for its rival.

Vertical Arrangements Between Firms

So far, the section has described how one firm (or a group of firms acting collectively) can harm a competitor through bad acts. The antitrust laws also characterize certain types of vertical relationships among noncompeting firms, typically a manufacturer and a distributor, as bad acts that harm competitors. We now analyze vertical integration and vertical restraints (resale price maintenance, exclusive territories, and exclusive dealing). The area of the law dealing with vertical relationships has changed significantly, and certain aspects of the law appear to be inconsistent with economic theories. See Carlton (2001) for a detailed analysis.

Vertical integration and vertical restrictions are not necessarily anticompetitive (Chapter 12). Even when a manufacturer is a monopoly, it is not at all clear that the vertical restrictions it may impose on a distributor reduce consumer welfare. It is not possible to prove definitively that vertical integration or restrictions always improve society's welfare, but neither is it possible to prove that a monopoly's choice of quality or any other product dimension always improves consumer welfare. Moreover, it is typically costly to examine a particular case of a vertical relation or quality choice, and, even after lengthy examination, it may still be difficult to reliably predict the effect of the vertical relation or quality choice on consumer welfare. Few argue that the antitrust laws should be used to control how a monopoly chooses quality or manufactures its product, yet there is usually no greater justification for interfering in the monopoly's choice of distribution than for interfering in its choice of quality or production.

In some markets, however, vertical integration or restrictions reduce competition and harm society, and those are the ones the antitrust laws should try to prevent. We now discuss those situations.

Exclusive dealing can harm society if it prevents or impedes rivals from obtaining distribution of their product. The same is true for vertical integration into distribution. However, as long as other efficient methods of distribution are available to rivals, neither exclusive dealing nor vertical integration restrain the entry of rivals.

Other vertical restrictions, such as exclusive territories, can have anticompetitive effects if they are forced on a manufacturer by a dealer cartel. That is, the exclusive territories could be part of an agreement among competing dealers on how to allocate territories.[75] Only if the dealers have monopsony power, however, does such a claim make sense (Chapter 12). No manufacturer would willingly take part in such a conspiracy of its dealers, because it would raise the manufacturer's distribution costs.

Antitrust policy toward vertical relationships has implications for the ability of a firm to price discriminate. Vertical integration and restrictions may enable price dis-

[75]Vertical integration and vertical restrictions can also be used by manufacturers to facilitate collusion by making it easier to detect cheating on a cartel of manufacturers (see Chapter 5).

crimination to take place (Chapter 9). For example, a manufacturer that wants to charge different prices in New York and California could do so if it prevents resale between the two states by requiring its distributors to sell only in their own territories. Because it is unclear whether society is, in general, harmed or helped by imperfect price discrimination (Chapter 9), it seems unwise to apply a per se ban. Moreover, to examine every instance of price discrimination under a rule of reason would be costly, and even after the analysis, it probably would be difficult to predict reliably the welfare effects of the discrimination.

Vertical Integration: The Court's early views on vertical relations in general and vertical integration in particular were unclear at best. Apparently, the Court was concerned with *foreclosure of competition.* For example, if a firm that manufactures shirts vertically integrated backward into producing buttons, the firm would have foreclosed competition in the button market because other button manufacturers could now no longer sell to that firm.

In *Yellow Cab,* the Court suggested that vertical integration through merger might be per se illegal.[76] However, soon thereafter, it reached the opposite (and more reasonable) conclusion in *Columbia Steel* that "it is clear to us that vertical integration, as such without more, cannot be held violative of the Sherman Act."[77]

The next major vertical integration case was *du Pont.*[78] Since 1920 (or earlier), du Pont, a major supplier to General Motors of automotive finishes and fabrics, had owned a 23 percent stock interest in General Motors. The U.S. government brought suit, claiming that the vertical relationship violated the antitrust laws. Although it was unclear how consumers would be adversely affected by this vertical ownership, the Court ruled that du Pont's ownership violated the antitrust laws.

It appears that since the *du Pont* case, enforcement policy toward vertical mergers has been in line with the reasonable economic logic of *Columbia Steel.* The vertical guidelines of the Department of Justice (repudiated by the Clinton administration) emphasized that vertical integration alone is not objectionable; instead, they focus on whether the vertical integration could be used to increase market power.

Although the FTC and the Department of Justice are less hostile to vertical integration than in the past, the courts have not always concurred. For example, in *Fotomat,* the Court of Appeals for the Seventh Circuit ruled against a franchisor that sought to open outlets in competition with its own franchisee.[79] It is difficult to understand why vertically integrating forward into distribution is an antitrust violation simply because independent dealers face additional competition.

Vertical Restraints: Using contracts, a firm may impose vertical restraints on another firm instead of vertically integrating to directly control that firm. Were vertical

[76] *United States v. Yellow Cab Co.,* 332 U.S. 218 (1947).
[77] *United States v. Columbia Steel Company,* 334 U.S. 495 (1948).
[78] *United States v. E.I. du Pont de Nemours & Company,* 353 U.S. 586 (1957).
[79] *Photovest v. Fotomat Corp.,* 606 F.2d 704 (7th Cir. 1979).

restraints to be outlawed but vertical integration allowed, firms would have an increased incentive to vertically integrate. Important vertical restraints include resale price maintenance, exclusive territories, and exclusive dealing.

Resale Price Maintenance: A manufacturer may set a minimum (or maximum) price that retailers may charge, called *resale price maintenance,* because the manufacturer wants to control the retail price at which its product is sold to consumers (Chapter 12). In 1911, the Court addressed whether a manufacturer could place pricing restrictions on its distributors. In *Dr. Miles,* John D. Park, a distributor, refused to enter into a contract that established minimum prices at which Dr. Miles's drug products could be sold.[80] The Court ruled that this pricing agreement was illegal because it suppressed competition among dealers and was equivalent to the fixing of price.

This ruling was unpopular, and the antitrust laws were eventually amended to allow resale price maintenance for certain products. In 1937, Congress passed the Miller-Tydings Resale Price Maintenance Act and in 1951, the McGuire Act. These acts gave manufacturers the right to set retail prices free of any antitrust liability provided the states had a *fair-trade* statute that allowed resale price maintenance (which would allow products to be sold at a "fair" price). Many states passed such fair-trade laws. In states without fair-trade laws, it was easier for one distributor to free ride on the promotional efforts of other distributors, because resale price maintenance is one way to control free riding (Chapter 12). The laws allowing resale price maintenance were repealed in 1975, and all resale price maintenance again became per se illegal.

The procompetitive logic of resale price maintenance is that resale price maintenance is one way for a manufacturer to induce its distributors to promote its products (Chapter 12). This logic was not understood by most economists prior to the 1960s. Since the 1960s, economists have discussed the competitive benefits of restraints that manufacturers want to place on the distributors of their products. These economists make no distinction between pricing restrictions and other restrictions that manufacturers might want to place on their distributors. Both can promote competition and prevent free riding (Posner 1981). Resale price maintenance can be anticompetitive, however, if it facilitates collusive behavior.

With the repeal of the laws permitting resale price maintenance in 1975, manufacturers can no longer set price floors for distributors.[81] However, a recent decision by the Supreme Court may indicate relaxation of this ban.[82] The Court analyzed a case in which a retailer that had cut prices had its supply terminated. The retailer claimed that termination occurred because of the price-cutting and that the termination constituted a violation of the antitrust laws. Although the Court stated that vertical agreements on resale prices are illegal per se, it ruled that because there was no agreement on price among the other competing retailers and the manufacturer, there was no violation of

[80] *Dr. Miles Medical Company v. John D. Park & Sons Company*, 220 U.S. 373 (1911).
[81] The setting of maximum prices is judged under the rule of reason. See *State Oil v. Kahn*, 522 U.S. 3 (1997).
[82] *Business Electronics Corporation v. Sharp Electronics Corporation*, 485 U.S. 717 (1988).

the antitrust laws. Therefore, although apparently the Court did not overrule its per se prohibition on vertical price fixing, its decision in this case reaches the conclusion of many economists that a manufacturer's control of pricing should not necessarily be an antitrust violation.

Exclusive Territories: A manufacturer may find it profitable to assign a geographic area, an *exclusive territory,* to one of its dealers and not allow its other dealers to locate in that area (Chapter 12). Exclusive territories provide dealers with incentives to promote the product and prevent one dealer from free riding on the promotional efforts of another. Exclusive territories can also adversely affect competition if they facilitate a cartel. Obviously, a territorial restriction on the ability of a manufacturer's dealers to compete literally restricts competition, even though the purpose of the territorial restriction may be to promote competition and the sale of the product.

In 1963, the Court addressed the issue of territorial restrictions in *White Motor*.[83] A truck manufacturer limited the territory in which its distributors could sell the product. The Court ruled that such territorial restrictions do not necessarily violate the antitrust laws and their legality should be determined only after examining their effects.

In *General Motors,* the Court investigated the location clauses that General Motors had in its dealers' contracts that prevented dealers from moving from one territory to another.[84] General Motors also tried to prevent its dealers from reselling cars to discount dealers, who sold them without the same promotional activities as other dealers. The Court ruled that the efforts of General Motors "to eliminate sales of new Chevrolet cars by discounters was to protect franchise dealers from real or apparent price competition." Accordingly, the Court ruled that this behavior violated the antitrust laws.

In *Schwinn,* the Court ruled that exclusive territories "are so obviously destructive of competition that their mere existence is enough."[85] This important case made the use of exclusive territories a per se violation of the antitrust laws.

In *Sealy* and *Topco,* the Supreme Court interpreted territorial restrictions as agreements to limit competition among rivals.[86] In both cases, groups of firms combined and agreed to territorial restrictions as part of an effort to promote their products and a common trademark and to avoid free-rider problems. The Court held that in both cases, these agreements were per se violations of Section 1 of the Sherman Act. However, to the extent that in both cases the territorial restrictions were necessary to develop a new trademarked product, it would seem that the subsequent ruling in the *BMI* case (agreements among firms are acceptable if they are necessary to provide the product) would mean that the *Sealy* and *Topco* cases would, if examined now, be analyzed under the rule of reason and not viewed as per se violations.

[83] *White Motor Company v. United States,* 372 U.S. 253 (1963).
[84] *United States v. General Motors Corp.,* 384 U.S. 127 (1966).
[85] *United States v. Arnold, Schwinn & Company,* 388 U.S. 365 (1967).
[86] *United States v. Sealy, Inc.,* 388 U.S. 350 (1967) and *United States v. Topco Associates Inc.,* 405 U.S. 596 (1972).

In 1977, the Court overruled *Schwinn* in *GTE Sylvania.*[87] Sylvania imposed locational restrictions on its distributors. The Court recognized that vertical restrictions improved the ability of a manufacturer to sell its product and provided a way to overcome certain free-rider problems (Chapter 12). Therefore, the Court overruled *Schwinn*'s per se prohibition against territorial restrictions and instead instituted a rule of reason under which vertical restrictions should be judged.

In *GTE Sylvania,* the Court's reasoning was based on the promotion of interbrand competition (competition among different products) at the expense of restricting intrabrand competition (competition among dealers of the same product). The use of this distinction is misleading. Vertical restrictions can indeed promote interbrand competition by making it profitable for dealers to promote and service each product, but it is not obvious that there is an undesirable effect on intrabrand competition. Although it is true in the literal sense that exclusive territories restrict the ability of one distributor to compete with another distributor, it is not true that a single manufacturer uses exclusive territories to restrict competition solely to raise the retail price and inflict an anticompetitive injury on consumers (Chapter 12).

After all, a manufacturer can raise the retail price (assuming no constraint from other products) by raising the wholesale price even without vertical restrictions. Through its control of the wholesale price, the manufacturer affects the retail price everywhere its product is sold. Rather than allowing the manufacturer to control only price, vertical restrictions give the manufacturer more control over promotional activities and service. By instituting a rule of reason criterion in *GTE Sylvania,* the Court acknowledged that vertical restraints can promote competition. See Example 19.6.

Exclusive Dealing: The Court has also analyzed *exclusive dealing* in which a manufacturer prevents its distributors from selling competing brands. Exclusive dealing allows manufacturers to overcome a different type of free-riding problem than the one overcome through the use of exclusive territories (Chapter 12). Exclusive territories address free riding of one dealer on the efforts of another; exclusive dealing addresses free riding of one manufacturer on the efforts of another. Exclusive dealing can also be used to raise entry barriers of rivals by raising distribution costs.

In 1922, the Supreme Court refused to enforce a manufacturer's contract with a retailer that forbade the retailer to sell brands of other manufacturers.[88] In 1949, in *Standard Stations,* the Court again addressed the problem of exclusive dealing.[89] Standard Oil of California required its independent dealers to purchase petroleum products and automobile accessories only from it. Rather than applying a rule of reason, the Supreme Court concluded that it would be too great a burden to show that competition had actually been diminished by the exclusive dealing and therefore it ruled that "Section 3 [of the Clayton Act, which forbids exclusive dealing] is satisfied by proof that competition has been foreclosed and a substantial share of the line of com-

[87] *Continental TV Inc. v. GTE Sylvania Inc.,* 433 U.S. 36 (1977). See Preston (1994).
[88] *Standard Fashion Company v. Magrain-Houston Co.,* 258 U.S. 346 (1922).
[89] *Standard Oil Company of California v. United States,* 337 U.S. 293 (1949).

EXAMPLE 19.6 *The FTC Plays with Toys 'Я' Us*

Toys 'Я' Us told toy manufacturers that if an *identical* toy were sold to warehouse clubs (very large stores that sell, often in bulk, at low prices), Toys 'Я' Us would consider not carrying those particular toys. The FTC charged that this policy was designed to eliminate rival toy retailers in an effort to restrict competition.

Toys 'Я' Us responded by claiming that they had no market power in toy retailing and that their policy was designed to limit free riding on their promotional activities by warehouse stores. It is difficult to predict which toys will be the Christmas season's big hits. Typically, toy manufacturers do not raise the price of the hits. Instead, the manufacturers ration them to retail toy stores. An allocation of hits can be viewed as a payment by the manufacturers to toy stores that engage in extensive promotional activities, provide showroom services, and sell toys year round.

Toys 'Я' Us engages in promotion and collaborates with manufacturers in designing toys. It stocks several thousand individual toy items in each store throughout the year, even though over 60 percent of toy sales occur in the last quarter of the year, the Christmas season. In contrast, warehouse clubs engage in little or no promotional activities and typically stock 100 to 150 toy items only at the end of the year.

Toys 'Я' Us had about a 20 percent share of retail toy sales, while warehouse clubs had less than 5 percent. According to statistical evidence presented at trial, Toys 'Я' Us did not have a statistically significant ability to raise retail prices even in areas where it faced only one major rival.

Despite this evidence, Toys 'Я' Us lost the case. Its market share of toys has continued to fall and was about 17.5 percent in 2003.

Note: Carlton served as an expert witness for Toys 'Я' Us.

Source: Carlton and Sider (1999); George James, "For Toys 'Я' Us, A Time to Rebuild," *New York Times*, January 14, 2004:1.

merce affected." Justice Jackson dissented, arguing that the Court had made an error in economic reasoning and that exclusive dealing can be "a device for waging competition."[90] The Court's future treatment of exclusive dealing will presumably incorporate its *GTE Sylvania* decision, in which it recognized that vertical restrictions can promote competition sometimes.

Litigating Vertical Restraint Cases. In many cases, a distributor complains that a vertical agreement between some distributors and a manufacturer is intended to eliminate or prevent competition by other distributors. Plaintiffs phrase the complaint in

[90]See also *Tampa Electric Company v. Nashville Coal Company*, 365 U.S. 320 (1961).

this way so as to characterize the behavior as a conspiracy involving price-fixing or output restrictions. The reason for this is that plaintiffs hope to apply the per se rules of the antitrust laws against price and output agreements and to obtain treble damages. If only breach of contract or other contract law violations were alleged, for example, they would receive only single damages. Thus, a terminated dealer may claim that the termination violates the antitrust laws rather than contract law in order to recover greater damages.

One example of an attempt to turn a vertical restriction case into a conspiracy case is *Klor's,* concerning the inability of a Klor's appliance store to obtain supplies from the same sources as its competitors.[91] Klor's was located close to a Broadway Hale department store, which distributed appliances. Many well-known brands of appliances were sold to Broadway Hale, but not to Klor's. Klor's claimed that there was a conspiracy among Broadway Hale and the appliance manufacturers to drive it out of business. Klor's claimed that Broadway Hale used its market power to prevent manufacturers from selling to Klor's. Broadway Hale's defense indicated that numerous other retailers located close to Broadway Hale also sold the appliances of major manufacturers. The important economic question is whether Broadway Hale had sufficient buying power over the manufacturers to prevent them from selling to Klor's. If it did not, then a likely alternative explanation for the manufacturers' behavior is to control free-rider problems (see Chapter 12).

Price Discrimination

Many forms of price discrimination have been challenged under the antitrust laws. For example, predation can involve a firm's charging a lower price in a market where it faces a rival than in another market where it does not. Such price discrimination that harms direct competitors is called *primary-line price discrimination* (see for example, *Utah Pie*). A second form of price discrimination, *secondary-line price discrimination,* is one that leads to harm among the customers. The Robinson-Patman Act forbids both types of price discrimination. A third form of price discrimination that is restricted under antitrust laws is tie-in sales. This section discusses secondary-line discrimination and tie-in sales.

Price Discrimination Under Robinson-Patman

The Robinson-Patman Act prohibits a firm from price discriminating if it harms competition among the firm's customers (secondary-line discrimination). The Robinson-Patman Act (which amended Section 2 of the Clayton Act in 1936) was passed in response to political pressure from small retail stores (for example, grocery stores) that complained that larger chains were able to purchase supplies on more favorable terms

[91] *Klor's, Inc. v. Broadway Hale Stores Inc.*, 359 U.S. 207 (1959).

and thereby charge lower prices (Ross 1984). Many economists view the Robinson-Patman Act as special-interest legislation designed to protect small firms from competition from larger, more efficient firms that would be able to purchase supplies at low cost in the absence of the Act (Posner 1976b, Ross 1984).

One consequence of the Robinson-Patman Act is higher prices to consumers, who are deprived of the benefits of economies of scale in purchasing that the chain stores would otherwise be forced by competition (among themselves) to pass along to consumers (Ross 1984). The Robinson-Patman Act has led to substantial litigation (although government litigation has waned recently) and has also distorted pricing in many markets (Elzinga and Hogarty 1978). This law has harmed consumers. Although the FTC has brought relatively few cases in recent years, private actions are still brought.

Tie-in Sales

The antitrust laws have been used to prevent a firm from using *tie-in sales* in which the sale of one product is conditioned upon the purchase of another. The courts often characterize tie-in sales as a way of denying competitors the opportunity to make sales. Tie-in sales can arise for efficiency reasons or because a firm has some market power in one market and by the use of tie-in sales is able to earn higher profits than if it could only charge for one product (Chapter 10). Tie-in sales, then, can be a variant of price discrimination. They raise the return to being a monopoly in an industry. They do not necessarily create greater inefficiency losses and could result in output expansion. However, as discussed in Chapter 11, tie-in sales can also be used strategically as a tool to harm rivals. Curiously, courts have focused on cases more closely related to price discrimination.

Aside from the price discrimination motive, many products are naturally and efficiently tied together or bundled. For example, a car consists of many component parts, as does a radio. Consumers would be extremely unhappy if the government prohibited such efficient bundling of components. There are, however, some cases where tie-ins are anticompetitive. For example, tie-in sales could be used to raise entry costs (by tying repair to a machine, no independent repair shops arise and entrants are disadvantaged). However, the courts do not focus solely on these types of cases in their decisions to prohibit tie-in sales.

In early cases involving patented products, the Supreme Court ruled that tie-in sales were indeed legal. For example, in *A. B. Dick,* the Court did not find fault with A. B. Dick's practice of selling its patented mimeograph machines with a requirement that only ink purchased from A. B. Dick Company, as well as other supplies made by A. B. Dick, could be used.[92] Such a tie-in could enable A. B. Dick to identify and extract more money from those who used the machine most intensively (Chapter 10).

The Clayton Act, passed in 1914, contained a section outlawing tie-in sales that had the effect of reducing competition. Soon thereafter, the Court overruled the *A. B.*

[92] *Henry v. A. B. Dick Company,* 224 U.S. 1 (1912).

Dick case in *Motion Picture Patents.*[93] In two subsequent cases, the Supreme Court refused to alter its prohibition against tie-ins. In another, *IBM,* the United States attacked IBM's practice of selling key-punch machines with the requirement that the purchaser use only IBM tabulating cards.[94] IBM granted a special exception to the government that allowed it to use tabulating cards of its own manufacture provided the government paid an extra 15 percent rent. The Supreme Court used the government's experience to reject IBM's claim that its reputation would be damaged unless its tabulating cards were used because otherwise its machines might malfunction.

In *International Salt,* the Court investigated the requirement by International Salt Company that its purchasers use salt provided by International Salt in some machines that International Salt provided.[95] As in *IBM,* the Court rejected International Salt's claim that its reputation would be damaged if low-quality salt were used, with resulting damage to its machines. The Court ruled that since a substantial amount of the salt market was "foreclosed" to competitors, the tie-in was per se illegal.

In *Northern Pacific,* the Court ruled that the Northern Pacific Railway Company's requirements that lessees of certain lands be required to use its railway to ship under certain conditions was a per se violation:[96]

> Tying agreements serve hardly any purpose beyond the suppression of competition. They deny competitors free access to the market for the tied product, not because the party imposing the tying requirement has a better product or a lower price, but because it has power leverage in another market.

The Court found that the defendant possessed substantial economic power and concluded that the tie-in was illegal. In *Fortner II,* the Court stated that "for a tie-in to be illegal, the seller must have some advantage not shared by his competitors in the market for the tie-in product."[97]

Another important case involving tie-ins is *Hyde*.[98] A hospital had contracted for the provision of anesthesiology services from a private firm. The hospital agreed to use only that firm in the provision of anesthesiology services to its patients. An anesthesiologist sued and charged the hospital with tying anesthesiology to its other hospital services. The Court states that the requirements for an illegal tie are (1) the existence of two products, (2) market power in one product, and (3) *forcing.* By forcing, the Court means that products get sold together that would not be sold together without the tie. The Court said, "It is far too late in the history of our antitrust jurisprudence to question the proposition that certain tying arrangements pose an unacceptable risk of stifling competition. . . ." The Court did not find that

[93] *Motion Picture Patents v. Universal Film Manufacturing Co.*, 243 U.S. 502 (1917).
[94] *IBM Corporation v. United States*, 298 U.S. 131 (1936).
[95] *International Salt Company v. United States*, 332 U.S. 392 (1947). See Peterman (1979) for an economic analysis of this case.
[96] *Northern Pacific Railway Company v. United States*, 356 U.S. 1 (1958).
[97] *United States Steel Corporation v. Fortner Enterprises, Inc.*, 429 U.S. 610 (1977).
[98] *Jefferson Parish Hospital District No. 2 v. Hyde*, 466 U.S. 2 (1984). Lynk (1994a) analyzes this case.

the questioned conduct was illegal, apparently because the hospital lacked market power.

Kodak is an important tie-in case.[99] Kodak sells photocopiers in competition with many other firms. Kodak also provided Kodak parts and service to its customers. Kodak refused to supply certain parts to independent repair shops and was charged with illegally tying the sale of its photocopiers with its parts and service. Kodak asked that the case be dismissed because both sides agreed that Kodak faced lots of competition in the initial sale of photocopiers. If there is competition initially, then customers will not buy from Kodak if they know that they will be overcharged on repair parts and service. The Court rejected Kodak's argument. According to the Court, even if Kodak lacked market power initially in photocopiers, it is theoretically possible that either consumers are uninformed or that they are unable to forecast their repair cost. Essentially, the Court ruled that any equipment manufacturer could be considered a monopolist of its own unique repair parts and that a factual investigation is necessary to resolve a tie-in case even if there are hundreds of competing manufacturers of equipment. The Court failed to explain how any consumer would benefit if Kodak were forced to sell repair parts to independent repair shops at a price that Kodak could choose.

The courts' rulings regarding tie-in sales, especially those between franchisors and franchisees, have been inconsistent with the economic theory described in Chapter 12. A franchisor may place many types of restrictions on a franchisee in order to obtain certain desired economic performance. The franchisor also needs to be compensated for its efforts. One method by which a franchisee can compensate the franchisor is through various tie-in sales. For example, the franchisor could require that it be the sole supplier of napkins to the franchisee in lieu of charging a franchise fee based on sales. This conduct, however, has been attacked as a means to foreclose competition in napkins, using antitrust laws that ban tie-in sales.[100]

Effects of Antitrust Laws on the Organization of Unregulated and Regulated Firms

When laws prohibit firms from taking particular actions, firms seek alternate routes to accomplish their objectives. Because the antitrust laws inhibit agreements between independent firms both horizontally and vertically, some firms merge or simply grow large and do everything themselves. Thus, the antitrust laws can encourage firms to

[99] *Eastman Kodak Co. v. Image Technical Services, Inc.*, 112 S. Ct. 2072 (1992). See Calkins (1993) and Carlton (2001) for analyses of this case. See also the discussion of the Microsoft case, Example 11.5.

[100] See, for example, *Siegel v. Chicken Delight Inc.*, 448 F.2d (9th Cir. 1971) cert. denied, 405 U.S. 955.

merge or grow larger than would otherwise occur. For example, Bittlingmayer (1985) explains that many firms merged around the turn of the century when antitrust laws first forbade agreements among firms but did not forbid mergers.

Similarly, some of the decisions of the Supreme Court to forbid certain types of contractual vertical restrictions create an incentive for vertical integration.[101] Several states have responded by adopting statutes that prevent certain manufacturers from integrating forward into distribution. For example, several states prevent oil companies from owning and operating their own gasoline stations.

The antitrust laws, as already mentioned, affect how a franchisor can deal with a franchisee. The effect of the antitrust laws (and several state franchise laws) is to transfer certain rights from franchisors to franchisees and to make the franchise arrangement less attractive as a method of distribution (Smith 1982). If laws make it difficult for franchisors to control franchisees' actions, the incentive to use this mode of organization is diminished. Where antitrust laws encourage firms to alter their organizational form, it is likely that the new form will be less efficient.

Antitrust laws can have a large impact on regulated firms. The intersection of antitrust law and regulation is a complicated and contentious subject. Courts do not accept the argument that regulation immunizes a firm from antitrust actions because it is under the watchful eye of a regulator. Indeed, it was application of the antirust laws that eventually forced the break-up of the AT&T phone monopoly in the early 1980s.[102]

However, courts do accept the principle that regulation can immunize some actions of a regulated firm, especially when those actions are essential to the regulatory purpose. See for example, *Silver v. New York Stock Exchange*, 373 U.S. 341. In a case in 2003 (*in re: Stock Exchanges Options Trading Antitrust Litigation*, 317 F.3d 134), the Court ruled that the antitrust laws could not be used to attack the exchanges where options are traded for certain behavior because their actions were closely monitored by the Securities and Exchange Commission, the regulatory body charged with overseeing the operations of U.S. financial markets.

If a regulator imposes on a regulated firm a duty to deal with its rivals, then the rivals will be more formidable competitors. If a regulated firm misbehaves toward its rivals, should it be subject to antitrust sanctions or only to sanctions imposed by the regulator? The Supreme Court has recently ruled that the antitrust laws do not apply in cases where a firm is forced by regulation to deal with its rivals when it would not have done so in the absence of regulation.[103]

[101] Alternatively, firms could use devices whose legality turns on legal technicalities. For example, a distributor may sell a good on consignment (which means that the manufacturer, not the distributor, owns the good) rather than owning the good and reselling it. The restrictions that can be placed on consignment sales can differ from those on nonconsignment sales.

[102] *U.S. v. AT&T Co.*, 552 F. Supp. 131 (1982). See also **www.aw-bc.com/carlton_perloff** "The Breakup of AT&T."

[103] See *Goldwasser v. Ameritech Corp.* 222 F.3d 390 (Seventh Circuit 2000) and *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko,* 540 U.S. (2004).

SUMMARY

The major federal antitrust statutes are the Sherman Act, the Clayton Act, and the Federal Trade Commission Act. The interpretation of these statutes has varied considerably over time. There has been an increasing emphasis on the use of economic analysis in deciding what the antitrust laws should prohibit. Economists stress using antitrust laws to achieve efficiency.

It is a common mistake to think that the antitrust laws prohibit monopoly. They do not; however, they do prohibit certain actions that could allow a firm to acquire or maintain monopoly power.

Many antitrust cases revolve around whether a firm has market power, which is the ability to set price profitably above the competitive price. It is often difficult to assess directly whether a firm has market power. Courts and economists often use market share as a rough guide to whether a firm has market power. For this calculation of market share to be meaningful, the market must be properly defined. The market definition should include all those products whose presence significantly constrains the price of the product under analysis.

The courts use both per se rules and rules of reason. A per se rule prohibits certain acts without regard to the effect of the acts. For example, a price-fixing conspiracy whose sole purpose is to raise price is a per se violation. A rule of reason requires an investigation of the effect of the challenged conduct. Vertical restraints, other than on price, are now judged under a rule of reason.

The antitrust laws severely limit the types of cooperative behavior in which competitors can engage. For example, any attempt to fix price or limit output so as to harm consumers is a per se violation. That is, even unsuccessful attempts to fix price violate the law. There are some instances, however, where the courts allow cooperative behavior, even with respect to price, if the cooperative behavior is essential to producing the product. Mergers among competitors can be prevented if the effect of the merger is to create additional market power. Curiously, two firms with no market power are allowed to merge even though those same two firms would violate the law if they remained independent but spoke to each other and set price together.

The antitrust laws also constrain actions designed to hamper a firm's rivals. For example, strategic behavior, such as predatory pricing, designed to drive a rival out of business is illegal. The problem with antitrust enforcement in this area is that it is difficult to distinguish vigorous competition from strategic behavior that harms consumers. Overzealous enforcement could deprive consumers of the benefits of competition.

An important application of the antitrust laws has been to vertical relations between firms. The Court's reasoning has often been confused and has relied on a foreclosure of competition doctrine in which one firm that, say, vertically integrates into steel production is said to foreclose other steel producers from selling steel to the first firm.

There is a variety of reasons why a firm vertically integrates or imposes vertical restraints on its distributors. Many, but not all, of these reasons promote competition. Recently, the Court has recognized the possible procompetitive effect of nonprice vertical restrictions, but still regards vertical restrictions on price as a per se violation.

It is impossible to prove that vertical restrictions always benefit each consumer. The welfare effect of some vertical restrictions is ambiguous. Even after careful study, an analyst may be unable to decide whether a particular vertical restriction harms consumers. A vertical restriction may help some consumers and harm others. But the same could be said of the choice of product quality. There is often no greater justification for controlling how a manufacturer distributes its product than there is in dictating the quality of product that the monopoly produces.

There are, however, cases where vertical integration or restrictions harm consumers. Where the vertical integration or restrictions significantly impede or foreclose entry by rivals or where they allow distributors or manufacturers to act like a cartel, they harm consumers.

The welfare effects of price discrimination and tie-in sales designed to achieve price discrimination are generally ambiguous. As in the case of certain vertical restrictions, it is often costly and difficult to determine conclusively whether consumers are harmed in a particular situation. Pursuing strenuous general antitrust enforcement in areas with ambiguous welfare effects is unwise.

Using the antitrust laws to control some activities but not others can lead firms to adopt inefficient organizational forms. For example, if antitrust laws do not allow certain vertical restrictions but do allow vertical integration, firms may choose to vertically integrate to achieve their goals even if vertical integration is more costly than relying on vertical restrictions. Application of the antitrust laws to regulated industries can have large impacts on its market structure.

PROBLEMS

1. A product has a world market. The firms engage in a price-fixing conspiracy. Under U.S. antitrust laws, consumers of the product can be compensated for their U.S. purchases. Suppose most consumers live in other countries without antitrust laws. What does this imply about the optimal penalty?
2. Some foreign antitrust authorities can impose penalties, if they determine that prices are excessive. What effects do these laws have?
3. Suppose there are some industries in which the competitive equilibrium does not exist (the core does not exist—see **www.aw-bc.com/carlton_perloff** "Theory of the Core"). Should firms in these industries be allowed to collude under the antitrust laws?
4. Where demand curves are compensated (adjusted for income effects), it can be shown that
$$\frac{\partial Q_j}{\partial p_i} = \frac{\partial Q_i}{\partial p_j},$$
where Q is the quantity demanded, p is the price, and subscripts indicate the products i or j. Suppose $p_i = p_j$ but $Q_i = 100Q_j$. What are the relative sizes of the two relevant cross-elasticities of demand? Why does it matter which one is used in the analysis of market definition?
5. It can be shown that
$$\frac{p_i}{Q_i}\frac{\partial Q_i}{\partial p_i} = -\sum_{j \neq i} \frac{p_j}{Q_i}\frac{\partial Q_i}{\partial p_j},$$

where Σ is a summation sign (sum over all products j other than product i), p is price, and Q is the compensated demand. Explain how this relation can be used to relate the elasticity of demand to cross-elasticities of demand. Use the formula to determine which cross-elasticity an analyst investigating market power in Product A should examine to determine whether Product B constrains the pricing of Product A.

Answers to the odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

Kwoka and White (2004) is an easy-to-read collection of articles providing economic analysis of some recent antitrust cases. Interesting books on the economics of antitrust law include Posner (2001), Posner and Easterbrook (1980) with subsequent supplements, and Williamson (1987). The Areeda and Hovenkamp (1997) treatise on antitrust provides an exhaustive analysis of antitrust issues. Pittman (1992) discusses merger law in Central and Eastern Europe, as do numerous, Web sites sponsored by the International Competition Network. Carlton (2004b) discusses the lessons foreign countries have learned from U.S. antitrust experience.

CHAPTER 20

Regulation and Deregulation

If it moves, tax it.
If it still moves, regulate it.
If it stops moving, subsidize it. —*Ronald Reagan*

Government regulation of firms may increase welfare in markets that are not perfectly competitive. Unfortunately, actual regulation often deviates considerably from optimal regulation and exacerbates market inefficiencies.

A prime example of an inefficient market is a monopolized industry, which charges too high a price. Optimal regulation can force a monopoly to set the competitive price. However, if a monopoly is badly regulated, shortages occur, or the monopoly is encouraged to produce inefficiently. Even where regulations are properly applied, the cost of administering them may exceed the benefits.

In addition, some regulations create problems where none would otherwise exist. For example, federal and state government marketing orders permit otherwise competitive firms to price discriminate and restrict output (Appendix 9A).

Regulation of monopolies is only one type of regulation commonly seen in Western economies. For example, in Germany, the hours that firms may stay open are strictly limited. Large U.S. regulatory agencies with budgets over $200 million per year are listed in Table 20.1, the largest of which is the Transportation Security Administration, which was created in 2001 in response to the 9/11 tragedy. The Environmental Protection Agency (EPA) controls pollution. The Occupational Safety and Health Agency (OSHA) protects workers. The Consumer Product Safety Commission (CPSC), the Federal Trade Commission (FTC), and the Food and Drug Administration (FDA) protect consumers (see also Example 20.1). The regulation of advertising and disclosure laws by the FTC and others is discussed in Chapter 14.

TABLE 20.1 U.S. Regulatory Agencies with Budgets of at Least $200 Million in Fiscal Year 2002

Agency	Year Created	Budget ($ Millions)	Responsibility
Social Regulation			
Consumer Safety and Health			
Department of Agriculture			
Animal and Plant Health Inspection Service	1972	948	Meat and poultry packing plants
Food Safety and Inspection Service	1981	808	Meat, poultry, and egg products
Department of Health and Human Services			
Food and Drug Administration	1906	1,574	Safety of food and drugs (since 1906) and cosmetics (since 1938); effectiveness of drugs (since 1962)
Department of Justice			
Bureau of Alcohol, Tobacco, Firearms, and Explosives	1972	795	Alcohol, firearms, and explosives
Transportation			
Department of Homeland Security			
Coast Guard	1915	2,127	Vessel safety
Transportation Security Administration	2001	4,080	Airport baggage screening
Department of Transportation			
Federal Aviation Administration	1958	1,436	Airline safety and air traffic control
Federal Motor Carrier Safety Administration	2000	367	Motor carrier safety, including transport of hazardous materials
National Highway Traffic Safety Administration	1970	242	Automobile safety; automobile fuel economy (since 1975)
Job Safety and Other Working Conditions			
Department of Labor			
Employment Standards Administration	1972	247	Legally mandated wages and working conditions
Mine Safety and Health Administration	1977	254	Safety and health in mining, especially coal mines
Occupational Safety and Health Administration	1971	446	Industrial safety and health
Equal Employment Opportunity Commission	1964	320	Job discrimination
National Labor Relations Board	1935	226	Unfair labor practices by unions or employers

(continued)

TABLE 20.1 **U.S. Regulatory Agencies with Budgets of at Least $200 Million in Fiscal Year 2002 (continued)**

Agency	Year Created	Budget ($ Millions)	Responsibility
Social Regulation			
Environment			
Department of Agriculture			
Forest and Rangeland Research	N.A.	290	Vegetation management and protection
Department of Interior			
Fish and Wildlife Service	1940	283	Fish, wildlife, plants, and their habitats
Office of Surface Mining Reclamation and Enforcement	1977	454	Coal mines
Environmental Protection Agency	1972	4,758	Air, water, and noise pollution
Energy			
Nuclear Regulatory Commission	1975	553	Nuclear materials and commercial nuclear reactors
Economic Regulation			
Finance and Banking			
Department of the Treasury			
Comptroller of the Currency	1863	417	National banks
Federal Deposit Insurance Corporation	1933	593	Banks and thrift institutions
Federal Reserve System			
Federal Reserve Banks	1913	471	State-chartered member banks and bank holding companies
Industry-Specific Regulation			
Department of Agriculture			
Agricultural Marketing Service	1972	219	Cotton, fruits and vegetables, livestock and seed, poultry, and tobacco
Federal Communications Commission	1934	333	Interstate telephone and broadcasting (since 1934); cable television (since 1968)
General Business			
Department of Commerce			
Patent and Trademark Office	1825	1,144	Patents and trademarks
Securities and Exchange Commission	1934	489	Public security issues and security exchanges, and public utility holding companies

Sources: Dudley and Warren (2003), **www.multied.com/Civics/Index.html**; various government agency Web sites.

Spending at 60 U.S. federal social and economic regulatory agencies was approximately $26.2 billion in 2002, almost five times what it was in 1970, after adjusting for inflation (Dudley and Warren 2003). The regulatory system was staffed by about 133,000 people, up from less than 70,000 in 1970 and 122,000 in 1980. The economic regulation

EXAMPLE 20.1

Pizza Protection

On average, each American adult and child eats seven pizzas a year. To protect these consumers, 310 separate rules, filling over 40 pages of federal documents, govern what goes on a pizza and how these toppings may be described on labels and menus. A few of these rules are

- *Crust:* There must be 2.9 milligrams of thiamine, 24 milligrams of niacin, and at least 13 (but not more than 16) milligrams of iron in each pound of flour.
- *Mozzarella cheese:* The cheese must contain at least 30%, but no more than 45%, fat and must be made from pasteurized cow's milk.
- *Anchovies:* Imports from Spain, Portugal, and Morocco must be packed in oil and in a solution of at least 12% salt.
- *Green peppers:* Salt preservatives, such as calcium chloride, in canned green peppers must not exceed .026% of the food's weight.
- *Onions:* Only if the onions come from the bulb of the plant rather than the stalk may canned onions be used.
- *Beef:* Fat must constitute no more than 30% of ground beef.
- *Italian sausage:* To be called that, sausage must be uncured and contain at least 85% meat. If more than 13% extenders are used, sausage must carry the notice "texturized soy flour added."

These regulations affect the final product in many ways. For example, the labeling division of the U.S. Department of Agriculture (USDA) initially concluded that the frozen trendy pizza of famous Los Angeles chef Wolfgang Puck could not be called a pizza because it did not have tomatoes on it. Puck said, "I think it's ridiculous that some bureaucrat in Washington thinks they are going to tell us what a pizza is. Tomato sauce has a cheap image on pizza and we decided to have fresh ingredients." Nonetheless, Puck agreed to add some tomato chunks to the basil-pesto sauce. The USDA also discovered that the "country sausage" on the label was made in the City of Commerce, which is not a rural area. Puck agreed to change the label to "Spago's Original Sausage and Herbs." Today, a dozen agencies enforce 35 different laws concerning food safety.

Sources: "The Pizza Principles," *San Francisco Examiner*, June 6, 1982: "This World" Section, 15; Garchik, Leah. "Federal Ruling on Pizza Without Tomatoes." *San Francisco Chronicle*, November 11, 1987: A10, Jennifer Kabbany, "Armey Targets Waste in Federal Agencies," *Washington Times*, February 12, 1999.

spending is split between finance and banking (39%), industry-specific regulation (17%), and general business (44%). The annualized real growth rate in regulation spending under the current Bush administration (based on its 2004 budget request) is 9.40%, far more than under the Clinton (1.88%), previous Bush (5.26%), and Reagan (1.34%) administrations. Congress created the Transportation Security Administration in November 2001, adding more than 56,000 new employees as airport baggage screeners.

This chapter focuses on regulations that directly affect price, quantity, quality, or entry. We begin by considering the objectives of the regulators and then look at the regulations that make monopolistic industries more competitive and those that make competitive industries more monopolistic. Finally, the chapter considers the effects of recent deregulation efforts.

The main questions examined in this chapter are

1. What are the objectives of regulators?
2. Under what conditions is regulation most likely to raise welfare?
3. What types of regulation are most likely to lower welfare?
4. What has been the effect of deregulation?

The Objectives of Regulators

Man is the only animal that laughs and has a state legislature.

—Samuel Butler

There are two contradictory views about regulation and its effects. One view holds that government should and can regulate to correct market inefficiencies. The opposing view is that either the government lacks the information necessary to regulate optimally or that special-interest groups pressure legislatures and regulators so that regulations create market inefficiencies.

Market Inefficiencies

The most common justification for regulation is to correct a deviation from perfect competition, a market inefficiency. As discussed at length throughout this book, there are many causes of market inefficiencies. Commonly observed causes of market inefficiencies include monopoly power, externalities such as pollution, uncertainty, and various forms of opportunistic behavior.

Williamson (1975) contends that market imperfections are caused by human and environmental factors. Human factors that are likely to lead to market inefficiencies include bounded rationality and opportunism. Environmental factors include small numbers of firms and uncertainty. For example, *bounded rationality* limits people's ability to analyze and deal with uncertain or complex situations. Thus, market inefficiencies are more likely where transactions are complex or the outcome is uncertain. Opportunism leads to problems when there are few buyers or sellers (market power) or asymmetric information.

Unfortunately, the same factors that make market inefficiencies frequently make correcting the inefficiencies difficult. Moreover, not all inefficiencies can be corrected even by optimal government intervention. For example, if the inefficiency stems from limited information, the government may not be able to obtain and disseminate the relevant information cost effectively. That is, the world would be better off with full information, but that is not a viable option.

Correcting Market Inefficiencies

Consumer advocates such as Ralph Nader argue for regulations that are designed to promote or protect the public welfare.[1] Legislators pass such laws believing that government can increase welfare.

Of course, even such people of goodwill differ as to the appropriate objectives for government actions. There are two chief alternative points of view:

- Many, if not most, economists argue that the chief objective of government regulation should be to promote *economic efficiency* by eliminating market inefficiencies (Schmalensee 1979b; Kahn 1970, 1975).
- Other economists and consumer advocates argue that regulation should be used to *redistribute income*.

Although some economists believe that regulations can be used to redistribute income (Feldstein 1972a, 1972b), others believe that trying to use regulation to redistribute income is difficult, and possibly counterproductive (Kahn 1975, Peltzman 1976). As Schmalensee (1979b, 23) concludes, evaluating distributional issues may be possible in principle but is extremely difficult in practice. Thus, for the rest of this chapter, we concentrate on the use of regulations to promote economic efficiency.

Capture Theory and Interest-Group Theory

But who would guard the guards themselves? —*Juvenal*

One cynical—or realistic (depending on your viewpoint)—explanation for regulation is **capture theory**: The firms in an industry want to be regulated because they can then "capture" (persuade, bribe, or threaten) the regulators, so that the regulators do what the industry wants. Regulation, according to this theory, protects firms from competition. Although these economists typically believe that the appropriate objective of regulation is to correct market inefficiencies, they think that even if an appropriate law were passed, the affected industry would subvert the purpose of the law by capturing the regulators.

A generalization of this theory is that various interest groups are affected differently by regulation and compete to influence legislation. Those that are the best organized and most affected by regulation spend the most money attempting to promote their own interest through legislation and sympathetic regulators. In this more general **interest-group theory**, firms, consumers, or other groups can influence a regulatory body (Stigler 1971; Posner 1971, 1974; Peltzman 1976, 1989; Becker 1983). In some cases, one consumer group benefits at the expense of another (see Example 20.2).

A prime example of this self-interest theory is occupational licensing. Here, the regulated occupations—such as plumbers, electricians, doctors, lawyers, and beauticians—lobby for licensing laws and set the rules themselves (Example 20.3, Chapter 13).

[1] See Joskow (1974) on the efforts environmentalists direct at electric utility regulation.

EXAMPLE 20.2 *Cross-Subsidization*

Many public utilities cross-subsidize rates. For example, they price discriminate, charging one group higher rates than another for identical services. The high-price users are said to be cross-subsidizing the low-price users. In another common form of price discrimination, two groups pay the same rate, even though the cost of providing the service is more to the subsidized group. For example, urban and rural phone rates are often the same, even though the costs of providing the service in rural areas are higher.

Regulators often force a public utility to cross-subsidize. Why? One explanation is that a powerful group of consumers takes advantage of a less powerful group through pressuring the regulators to subsidize them.

The hypothesis that regulators impose cross-subsidies was tested using data from a period when there still were several unregulated states. Industrial users consume larger amounts of electricity than residential customers and are relatively few in number, so they can more effectively lobby regulators. Thus, under this hypothesis, the ratio of the residential price to the industrial price is higher in regulated states. Presumably, any cost differences in providing the services to the two groups are not substantial across regulated and unregulated states.

As predicted, in 1917, the average ratio of the residential price to the industrial price was 1.616 in regulated states and 1.445 in unregulated states. Thus, the relative price residential consumers paid was 12 percent higher in regulated states. The corresponding ratios in 1937 were 2.459 in regulated states and 2.047 in unregulated states, so that the relative price for residential customers was 20 percent higher. In short, regulators forced residential users to subsidize industrial users.

Sources: Stigler and Friedland (1962). See Faulhaber (1975) for a precise definition of cross subsidy.

Not surprisingly, the regulations typically make entry into these occupations difficult, thereby raising the wages of regulated occupations.

Industries may capture regulatory bodies directly or indirectly. First, firms in an industry may lobby legislatures to be regulated (Noll 1989). Occupational licensing, and the regulation of railroads, trucking, and inland water shipping are often presented as examples. Second, firms in an industry may capture the staff of the regulatory agency.

There are at least three reasons why regulatory agencies are likely to become captured (Asch and Seneca 1985, 316–17). First, regulatory commissions are usually staffed by experts on the regulated industry who, typically, worked in the industry or related government agencies and hence tend to be sympathetic to the interests of firms within the industry (see **www.aw-bc.com/carlton_perloff** "Building Codes"). Second, regulatory staff members often expect to receive attractive jobs in the industry after leaving the regulatory agency. After all, their services are valuable to firms because they are experts on regulations. These prospective job candidates may act as sympa-

EXAMPLE 20.3

Legal Monopolies

Lawyers throughout the world obtain market power by restricting entry into the profession and fixing prices. In virtually all of the member countries (most European and Scandinavian countries, Australia, Canada, Japan, New Zealand, and the United States) of the Organization for Economic Cooperation and Development (OECD), lawyers must earn a degree from a recognized law school and obtain a license in order to practice their trade. They are often also required to join the bar association or law society, as in the Netherlands.

As an OECD (1985, 35) report notes,

> Control of the licensing process by Bar Associations may in most countries operate, directly or indirectly, to limit the numbers of new entrants to the legal profession. Requirements that candidates be of "good conduct" allow for subjective decisions as to who will be permitted to practice.

In the United States and other countries, bar associations have authority over the grading of exams. Because practicing lawyers make up the bar association, it is not surprising that, although applicants for the bar exam are graduates of accredited law schools, the average failure rate is 25 to 30 percent.

Many countries also have quotas for entrance to law schools. For example, there are only 150 places annually for solicitors in Ireland. Some countries, such as Belgium and France, have quotas on the number of entrants and practitioners of certain public legal functions.

The geographic mobility of lawyers is limited in most OECD countries. These limits allegedly ensure that lawyers are familiar with local laws and regulations. In the United States, lawyers must be licensed in each state in which they practice. Reciprocity between states is limited. In the United Kingdom, there is reciprocity, after three years of practice, between Scotland, Northern Ireland, England, and Wales. In Canada, there are restrictions on practicing in other provinces. Indeed, in Alberta, provincial regulations prevent local lawyers from practicing with lawyers from other provinces.

Traditionally, most OECD countries have barred lawyers from advertising (which increases price competition), seeking free publicity in the media, and other means of attracting new business. However, in recent years, several countries, including Denmark, Sweden, and the United States, modified or rescinded advertising restrictions. Other countries still have restrictive rules, such as Belgium, the United Kingdom, Finland, Germany, Japan, Norway, and Spain.

Fee schedules, otherwise known as price fixing, are common in OECD countries. Typically the fees are set by the bar association, often under government authority. Ireland sets fees by statute and association rules. Fees are set locally or regionally in Canada. Germany sets upper limits. The courts or other authorized bodies in Australia set fee schedules. Some countries, such as the United Kingdom, however, do not set fees. Government competition officials have challenged fee scales in Denmark and France, and court decisions have sharply restricted fee setting by lawyers in the United States. Thus, some of lawyers' most monopolistic practices have eroded.

Source: Organization for Economic Cooperation and Development (1985).

thetic regulators of the industry. Third, because regulatory commissions often have limited resources, they may rely on well-financed regulated firms to cover many of their expenses. These expenses may then be "reimbursed" in the form of higher allowed profits to the regulated firms.

Of 174 people appointed and confirmed to the Civil Aeronautics Board (CAB), Federal Communications Commission (FCC), or Interstate Commerce Commission (ICC) by the end of 1977, 48% had some precommission experience in a related public sector, whereas 21% previously held related private-sector jobs (Eckert 1981). Of the 142 commissioners whose postcommission jobs are known, 51% took private-sector jobs in the regulated industry, and 11% of ex-commissioners took related public-sector jobs. These jobs, deaths in office, and retirements account for 70% of all commissioners. In short, commissioners were twice as likely to come from the related public sector as the related private sector. However, they were nearly five times as likely to leave their jobs for related private-sector jobs than for related public-sector jobs. Almost half (49%) of the commissioners who were patronage appointees went to work for the regulated industry, whereas only a third of the regulators who came from the private sector did so (Spiller 1990).

A spectacular example of the capture of a regulatory body by railroads occurred when trucks first started competing with railroads for long-distance freight-moving business in the early 1930s (Stigler 1971, 8). Texas and Louisiana placed a 7,000-pound payload limit on trucks serving two or more railroad stations (and hence competing with railroads), but applied a 14,000-pound limit to trucks serving only one station (and hence not competing directly with railroads).

Of course, not all regulations benefit regulated firms.[2] Where several agencies regulate a single industry, capturing regulators is more difficult. For example, many agencies have jurisdiction over genetically altered products created by the new biotechnology industry: the Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), Food and Drug Administration (FDA), Occupational Safety and Health Administration (OSHA), and the National Institutes of Health (NIH). Any of these may decide that certain risks are unacceptable and ban a product. In addition, the National Environmental Policy Act (NEPA) of 1969 empowers courts to review agency actions that will have a "significant impact" on the environment.[3] Moreover, in some industries, both federal and state agencies may regulate.

Djankov et al. (2002) examine the relationship of regulation to a country's economic development using data from 85 countries. They calculate the time and cost required for a legitimate business to obtain all the necessary permits to enter an industry.

[2]For example, Isé and Perloff (1997) show that granting exclusive rights to portions of the electromagnetic spectrum gave billions of dollars in extra profits to television stations, but Federal Communications Commission rules prohibiting cigarette advertising and restricting station ownership, programming, and syndication reduced these profits by about a third.

[3]Peter W. Huber, "Biotechnology and the Regulation HYDRA," *Technology Review* 1987:57–65. Following a study by the White House Office of Science and Technology in June 1986, some order in the system emerged. Where one agency has statutory authority, the report establishes a lead agency and provides for coordinated regulatory review. At least one interagency group was also established.

The time to enter varies widely, from a low of two days in Australia and Canada to a high of 152 days in Madagascar. Costs also vary significantly, from less than half a percent of annual per capita income in the United States to more than 4.6 times annual per capita income in the Dominican Republic. Countries with onerous entry requirements have lower income, less competition, more corruption, and a larger illegal sector than countries with low entry requirements. Moreover, countries with greater regulation have lower-quality products and poorer environments. In short, their evidence overwhelmingly rejects the public interest theory of regulation.

The rest of this chapter ignores the original or declared intent of the enabling legislation and the objectives of individual regulators, and concentrates on the market effects of specific types of regulations. We start with regulations designed to create competition and then examine regulations designed to decrease competition.

Making Monopolies More Competitive

In most monopolized industries, resources are not efficiently allocated because the monopoly price is greater than marginal cost. This distortion is often used to justify regulating all monopolies. The danger in this reasoning is the failure to understand how a firm becomes a monopoly. There are three cases where regulation is unnecessary or harmful.

First, firms have an incentive to develop a new product, make a new discovery, or obtain a more efficient technology than anyone else so as to become a monopoly. Regulation that removes this incentive to innovate without replacing it with other incentives may be harmful (see Chapter 16). Second, if a market is competitive or *contestable* (Baumol, Panzar, and Willig 1982)—entry and exit are costless and instantaneous—there is little or no need to regulate because market pressures eliminate monopoly power. Third, the cost of regulation may be so high or regulators so inept that society is harmed by regulations.

Where a monopoly is not likely to be eliminated quickly by entry and where it does not serve as an incentive to innovate, government intervention may be useful. In particular, a monopoly created by an arbitrary restriction on entry usually results in a serious market failure. The case for regulation is especially strong if the government chooses to allow only one firm in an industry (Kahn 1970, 1975; Schmalensee 1979b; and Joskow and Noll 1981). These monopolies typically have one of two causes. Either they are created by a government, which blocks entry by other firms, or they are the result of the cost structure in the industry.

The problem of monopoly is inherent in industries in which it is efficient for only one firm to provide all the output because of economies of scale. When a single firm can produce the market quantity at lower cost than two or more firms, it is called a *natural monopoly* (Chapter 4). Natural monopolies always occur when a firm has a declining long-run average cost curve, but they can occur in other circumstances as well, as discussed below. Competition among several firms is inefficient in such a market, but an unregulated natural monopoly is also inefficient because it sets the price above marginal cost. Concern over the pricing of (possible) natural monopolies provides one justification for the regulation of many public utilities such as telephone service, electricity, and natural gas. There are several approaches to regulating such monopolies. One approach is direct government ownership. Alternatively, several different price or rate-of-return regulations have been used to increase the competitiveness of such markets. After examining these types of regulations, we consider some of their unintended side effects.

Government intervention need not take the form of regulation. For example, if a monopoly is created through the merger of many firms, then the appropriate response is to restore competition (or prevent monopoly through mergers), rather than to regulate. In general, the antitrust laws are designed to prevent actions that reduce competition, whereas regulation can be used to control natural monopolies. Let us now discuss the various types of regulations of natural and other monopolies.

Government Ownership

One approach to regulating a natural monopoly is to have the government own it and set prices to maximize welfare rather than profits. Most governments own many monopolies.

Public ownership of utilities is common in the United States. Seventy-five percent of the population use publicly owned water, and 20% get their electricity from publicly run firms. In the United States, 28% of the employees in the utility sectors (electricity, gas, water, and sanitation) are public employees, compared to 20% in Japan, 43% in West Germany, and 60% in Switzerland (Schmalensee 1979b, 85). In most countries, postal services are publicly owned. The British government owned many industries at one time or another in the post–World War II period, although it has led the divestiture movement in recent years. Venezuela's state-owned oil company, Petróleos de Venezuela S.A., contributed 63% of the government's budget in 1996 and 50% in 1997.[4]

Unfortunately, there is little evidence that government monopolies behave optimally. Often, government-owned firms are less efficient than privately owned firms (Example 20.4). Managers have less of an incentive to maximize profits under public ownership (Williamson 1967). Pashigian (1976) finds that public urban transit systems have lower profit rates than private ones. There is little evidence that government-owned firms set prices to maximize welfare.[5]

Privatizing

Because the government does not tend to run businesses efficiently, there has been a worldwide trend in recent years to privatize many state-owned monopolies. For example, Khadafy privatized Libya's camel industry, transferring 6,000 government-owned camels to the private sector, to save millions of dollars per year in subsidy costs.[6]

[4]Larry Rohter, "Hasta la Vista, Oil Kings," *New York Times*, April 17, 1999:B1, B14.
[5]However, see DeAlessi (1974), who surveys much of the earlier literature. He also notes that rates to various classes of customers vary between publicly and privately owned utilities. See also Peltzman (1971) who finds that, although municipal utilities charge lower prices on average, this difference is due to the government firms' tax exemptions.
[6]Jonathan Marshall, "Taking Lessons from Khadafy," *San Francisco Chronicle*, October 23, 1995:E1, E2.

EXAMPLE 20.4

Public, Monopolistic, and Competitive Refuse Collection

In some cities, public monopolies collect household refuse, whereas, in other cities, either private monopolies or unregulated firms that compete with each other provide this service. All three market organizations are common. New York City has a public monopoly; Boston pays a private firm to collect refuse; and Portland, Oregon, has private firms collect from some, but not all, households in an area.

If there are scale economies in collecting refuse, then a monopoly can collect it at lower unit cost, so that refuse collection is a natural monopoly. If there are no scale economies, then competition among many firms keeps the competitive price as low as possible. Some scale economies are expected in collecting refuse because it should be cheaper for one firm to collect from all the houses on a block than for two firms to collect from, say, every other house.

Using data from 340 public and private firms in as many cities across the United States, Stevens (1978) estimates cost functions, holding service levels constant and taking market structure as given. She draws four main conclusions:

1. There are economies of scale for cities with populations of less than 20,000 (or cities served by fewer than four trucks).
2. In all cities, the competitive arrangement is from 2% to 48% more costly than the private monopoly arrangement, perhaps due to higher billing expenses and the extra costs due to nonexclusivity within a market area.
3. For cities with populations up to 50,000, the price charged by the private monopoly is equivalent to the cost of the public monopoly.
4. For larger cities, public monopoly or the competitive arrangement are from 27% to 37% more expensive than the private monopoly.

One reason for this last result is that labor productivity in a public monopoly is lower than that of the private monopoly, and this difference increases with city size. The mean crew size for the public monopoly is 3.26 compared to 2.15 for the comparable private monopoly. Similarly, the public monopoly uses trucks with smaller capacity: 20.63 cubic yards compared to 27.14.

More recent studies and studies from around the world confirm these results. Dijkgraaf and Gradus (2003) report 15% to 20% cost savings for contracting out refuse collection in the Netherlands. Reeves and Barrow (2000) estimate that in the Republic of Ireland, cost savings for contracting out refuse collection are around 45%, primarily due to real efficiency gains.

Great Britain led the way in Europe. The Thatcher government started by privatizing British Gas in 1986, creating a free market for the first time as of 1996 whereby consumers could choose their gas supplier. Gas prices in real terms were 35% lower in 1999 than in 1986. As of January 1, 1998, France's four-centuries-old art and antiquities auction monopoly ended (as they lost business to London and New York). The dismantling of communism in the former Soviet Union and Eastern Europe has led to massive efforts to privatize former government monopolies (Shleifer and Vishny 1999).

Megginson and Netter (2001) survey the effects of the worldwide movement away from state-owned enterprises (SOEs) over the last 20 years, especially in developing countries. During this period, the fraction of world income produced by SOEs declined from 10% to 6%, while that same fraction in low-income countries fell from 16% to 7%. Private firms are more efficient by about 2%, require fewer workers, are less likely to engage in cross-subsidization of different consumer groups, are less likely to rely on government subsidies, write long-term contracts at lower cost, and rely much less on debt than do SOEs. How well privatization works in specific cases depends on a host of factors. For example, efficiency improves, especially if the privatized firm faces competition or if substantial deregulation occurs. Regulation may be necessary for privatized firms that are natural monopolies, and the form of regulation largely determines the success of the privatization. As we discuss later in this chapter, regulation that creates incentives for cost cutting can significantly improve efficiency. Experience with privatization in which there are many small shareholders and where labor has a powerful voice in the control of the firm, or where incumbent managers retain control, has been poor compared to instances where a new management comes in and has concentrated ownership. Laws protecting shareholder rights and corporate governance can be an important factor in achieving a successful privatization.

Franchise Bidding

Governments may privatize monopolies by selling them, using **franchise bidding**: A government sells the right to a monopoly to the highest bidder.[7] Thus, instead of having the government give monopoly rights to firms (as in the assignment of television and radio station rights in the United States), the government captures the monopoly rents through a bidding process. Franchise bidding was used for water supply and funeral services in France for over 100 years. Bidding was also used in New York City around the turn of the century (Schmalensee 1979, 71).

The government may use bidding to capture the monopoly profit from a private monopoly, as Chicago and San Francisco do to a large extent with private towing companies and many cities do when they grant monopoly rights to operate stores at airports. Alternatively, the government may require, as a condition of bidding, that the firm operate so as to increase welfare over the monopoly level.[8] For example, in deciding to whom to award the franchise, a government agency could consider not only the fee for the right to operate that a bidder will pay, but also the price that the bidder will charge consumers. If bidders are forced to charge these low prices, monopoly profits are eliminated (Demsetz 1968; Posner 1972; Baumol et al. 1982). That is, instead of awarding the franchise to the highest bidder for a lump-sum payment (which allows

[7]John Stuart Mill introduced this approach in 1848 (Schmalensee 1979, 68–73).
[8]Analogously, Spiller (1988) discusses allowing potential regulators to bid for jobs, as they eventually will be rewarded or "bribed" by the regulated industry.

the government to capture the expected monopoly profits), the franchise is awarded to the firm that offers to produce in the manner that is best for consumers (see **www.aw-bc.com/carlton_perloff** "Cable Television"). A century ago, railroad franchises were awarded to firms offering to charge the lowest rates (Chadwick 1859).

Under the Local Government Act of 1988, local U.K. governments put refuse collection services out to bid rather than using a government agency as they had previously done. The lowest bid wins, and the winner must provide services at the bid rate. Gomez-Lobo and Szymanski (2001) find that the larger the number of bids, the lower the cost of service, controlling for other factors. Compared to having only one bidder, two bidders lower the cost by about 7 percent and four bidders by about 13 percent. (Given that the British government elected in 1997 abolished this bidding procedure, Gomez-Lobo and Szymanski predict that local authorities' refuse collection expenditures will rise.)

Traditionally, the Federal Communications Commission (FCC) allocated the frequency spectrum to specific uses (radio, television, mobile phones, law enforcement, public defense), and then assigned licenses by comparative hearings or, beginning in the 1980s, lotteries. Total FCC fees for renewals and for lotteries in 1991 were $46.6 million. For example, comparative hearing fees for a new applicant for land-mobile services was $6,760 in 1991. Some lottery winners of cellular telephone licenses never intended to provide services and sold their licenses at enormous profit to firms that did, including one payment of $41 million in 1990 for a Cape Cod, Massachusetts, service area. In 1993, Congress passed a bill to auction off, for the first time, part of the frequency spectrum for new personal communication services such as smaller handheld telephones and pagers. By the end of 2003, the auction proceeds exceeded $41.8 billion.[9]

Franchise bidding, although it may transfer monopoly profits to governments, does not necessarily result in efficient pricing (Telser 1969, Williamson 1976, Schmalensee 1979b, Williamson 1985). Efficiency requires that a firm set price equal to marginal cost, but if the firm is a natural monopoly, it may lose money at that price (Chapter 4). As a result, none of the bidders for a natural monopoly are willing to price efficiently (unless they are allowed to price discriminate, use nonlinear prices such as access fees plus usage fees or are subsidized). Moreover, this approach does not eliminate the need for regulation: The government may need to confirm regularly that the winning firm is keeping its agreement and not raising prices or reducing service.[10] A further problem is that the economic environment changes over time, so that the initial agreement may not be desirable in the future. Thus, repeated bidding may be required, and the incumbent may gain an advantage in subsequent bidding because of its experience (Williamson 1976, 1985).[11]

[9]See: **http://wireless.fee.gov/auctions/summary.html**.
[10]Ellingsen (1991) points out that buyers may also lobby to control prices. Bidders for a monopoly, anticipating such actions, would bid less than otherwise.
[11]But see Zupan (1989) and Prager (1990), who analyze cable TV franchises and find that opportunistic behavior by the incumbent may not be a serious problem.

Riordan and Sappington (1987) propose an optimal policy to maximize expected consumer welfare where potential firms possess imperfect information about production costs. They recommend awarding the franchise to the producer with the lowest expected costs, but allowing prices to exceed realized marginal costs to encourage more competitive bidding.

Price Controls

Governments frequently use **price controls**—limits on how high firms may set prices—to attempt to control inflation or to keep prices in a particular industry low. The discussion here concentrates on the effects of price regulation on a monopoly.

Many methods are used to control prices. Many countries use direct controls, taxes, or subsidies that affect the prices that monopolies charge. In most Western countries, special agencies often regulate the prices of monopolies. Typically, a regulatory board sets the price explicitly or must approve one proposed by a monopoly.

In the following example, the board fixes the maximum price that the monopoly may charge. We start by examining the effect of price regulation on a monopoly with increasing marginal costs, and then examine the effect of regulation on one with constant or decreasing marginal costs.

Price Regulation of an Increasing Marginal Cost Monopoly. Price regulation of a monopoly has efficiency and redistribution effects. A moderate reduction in a monopoly's price increases the quantity sold and raises efficiency. An excessive reduction in price creates shortages and can decrease the quantity sold. Lowering prices also redistributes wealth from the monopoly to consumers. As a result, monopolies dislike price regulations and consumers generally applaud them.

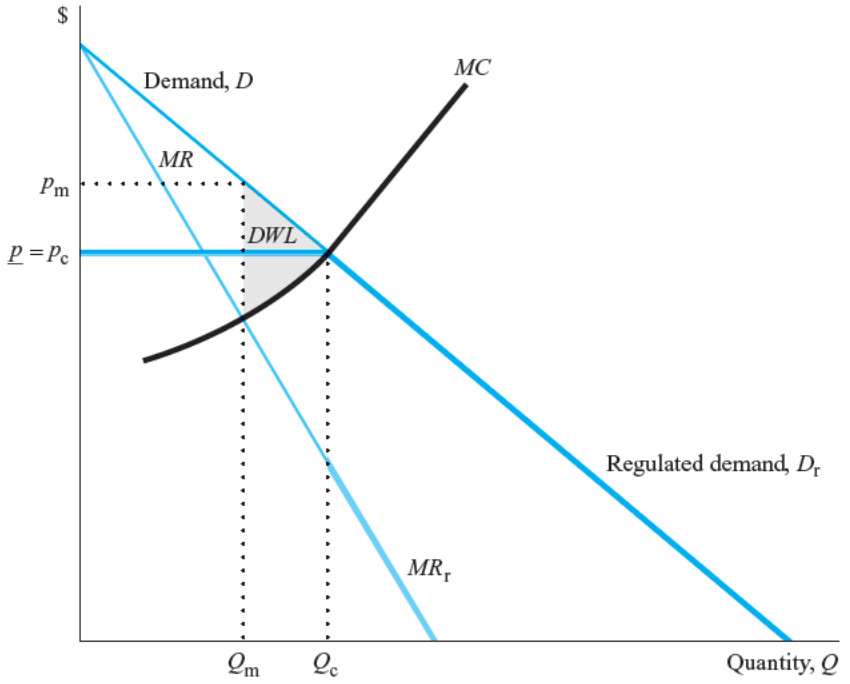
Figure 20.1 shows the demand and marginal revenue curves facing a monopoly with an upward-sloping marginal cost curve. In the absence of regulation, the monopoly profitably charges price p_m and sells Q_m units of output, which is determined by the intersection of the marginal revenue and marginal cost curves (Chapter 4).

The deadweight loss (*DWL*) to society is the shaded triangle below the demand curve, above the marginal cost curve, and to the right of Q_m. This deadweight loss reflects the loss in both consumer and producer surplus due to the relatively few units of output sold. If this market were competitive, the competitive price, p_c, would equal marginal cost and consumers would purchase a larger quantity, Q_c. Thus, the inefficiency of monopoly is due to setting the price p_m above the marginal cost and restricting output below Q_c.

If the regulatory board sets the maximum price that the monopoly may charge, $\bar{p}$, above p_m, so that the monopoly is not constrained, the regulation has no effect.[12] We first show that if $\bar{p}$ is set equal to marginal cost (the competitive or efficient price), welfare is maximized. Then we show that if a lower $\underline{p}$ is set, shortages may occur.

[12]There is no need to regulate unless there is a market failure. Thus, there is no reason to regulate a competitive market. In this section, we assume that the market is not competitive.

FIGURE 20.1 Efficient Price Regulation



If the regulatory board sets $\underline{p} = p_c$, the deadweight loss is eliminated, as we now show. Because it can no longer charge a price higher than p_c, the monopoly's regulated demand curve (thick blue line in Figure 20.1), D_r, is horizontal at p_c until it hits the original demand curve at Q_c, and is downward sloping thereafter.

The monopoly's regulated marginal revenue curve, MR_r, corresponding to this new demand curve, is horizontal and equal to the new demand curve, where the new demand curve is horizontal.[13] Where the demand curve slopes down, the marginal revenue curve also slopes down. Indeed, for this portion of the demand curve, the marginal revenue curve is the same as in the unregulated case, as shown by the thickened line on the relevant portion of the downward-sloping marginal revenue curve. At Q_c, the marginal revenue curve is discontinuous.

[13]Its marginal revenue curve is horizontal for the same reason that a competitive firm's marginal revenue curve is horizontal: The corresponding demand curve is horizontal. Along a horizontal demand curve, additional units can be sold without lowering price, so the marginal revenue equals the average revenue or price. Mathematically, marginal revenue equals $d[p(Q)Q]/dQ = p'(Q)Q + p(Q)$, where $p(Q)$ is the inverse demand curve, $p(Q)Q$ is total revenue, and $p'(Q)$ is the (negative) slope of the demand curve. If the demand curve is horizontal at $\underline{p}$, $p(Q) = \underline{p}$ and $p'(Q) = 0$, so marginal revenue equals $p(Q) = \underline{p}$.

The regulated monopoly sets marginal revenue equal to marginal cost to determine its optimal price. If the monopoly in Figure 20.1 is regulated, its marginal revenue, MR_r, equals its marginal cost, MC, at Q_c rather than at Q_m as in the unregulated case. If the monopoly sells one fewer unit, it loses profit because its revenue falls by more than its costs. If it sells one more unit, its revenue increases by less than the increase in its costs. Its profits are lower than without regulation, but the monopoly is still maximizing its (regulated) profits.

In summary, if $\underline{p}$ is set at p_c, the efficient (competitive) solution is obtained, and deadweight loss is eliminated because price equals marginal cost. As Kahn (1970, 65) says, "The central policy prescription of microeconomics is the equation of price and marginal cost."

This type of regulation is not desirable or feasible unless three additional conditions are met. First, the monopoly must make positive profit, or else it refuses to produce.

Second, the cost of running the regulatory board should be less than the social gain (the elimination of the deadweight loss). Unfortunately, the cost of administration is often high. For example, Gerwig (1962) finds that the cost of regulating natural gas prices in interstate commerce was about 7 percent of the base price of the gas.

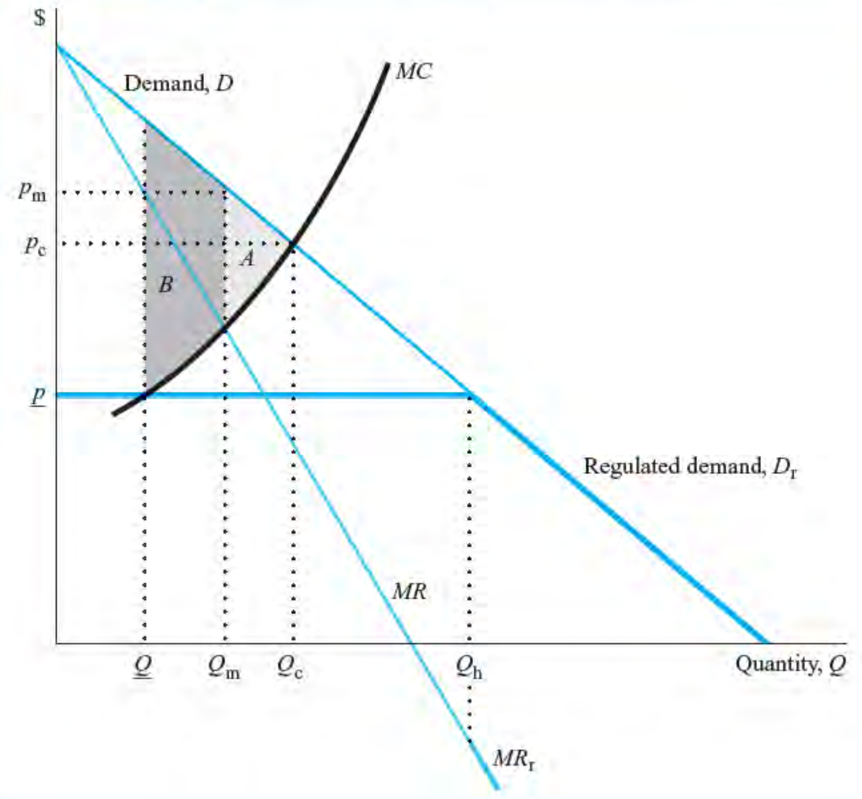
Third, the regulatory board must have enough information to set its regulations optimally. Often, the regulatory board has trouble setting $\underline{p}$ at p_c because the board does not know either costs or demand exactly. Thus, even if the board wants to set $\underline{p} = p_c$, it may set $\underline{p}$ too high or too low.[14] If the board chooses a $\underline{p}$ between p_m and p_c, the monopoly sells at that price, by the same reasoning as above.[15] Consumers are better off than in the unregulated case—they buy more units at a lower price—but not as well off as when the regulated price is set at p_c.

If the board sets too low a price, the price regulation introduces a new problem. If the price is so low that the firm shuts down (as would occur in the long run if price were below the minimum of the monopoly's average cost curve), then consumers can buy nothing, so all consumer surplus is lost. Figure 20.2 illustrates a less extreme case where the monopoly does not shut down. The demand and cost curves are the same as

[14] A number of methods to induce firms to truthfully reveal the relevant information have been devised (for example, Baron and Meyerson 1982, Riordan 1984). Regulators offer a choice of contracts to a monopoly that possesses private information about its marginal cost of production. Once the firm chooses the optimal *incentive compatible* contract, it maximizes its profit by producing the optimal quantity. According to the *revelation principle*, for any indirect regulatory mechanism (even one where the firm misrepresents its privately held information about its costs), there exists a mechanism that achieves the regulator's objective as successfully and that induces truthful revelation of the key information. When a regulator must induce a firm to reveal information, the regulator usually cannot achieve the same outcome (price and quantity) as when the regulator already and independently knows the relevant information. See Laffont and Tirole (1993).

[15] The regulated demand curve is a horizontal line at $\underline{p}$ until it hits the original demand curve at some quantity $\underline{Q}$ where ($Q_m < \underline{Q} < Q_c$), and is then downward sloping. The corresponding marginal revenue curve is horizontal up to $\underline{Q}$, then falls vertically until it hits the downward-sloping section, as in Figure 20.1. The marginal cost curve intersects the marginal revenue curve in its vertical section, so the monopoly sets price equal to $\underline{p}$ (see Problem 2).

FIGURE 20.2 Price Regulation That Causes a Shortage



in Figure 20.1, but $\underline{p}$ is set below p_c. The monopoly's new effective demand curve is horizontal at $\underline{p}$, and thereafter is downward sloping. Where the demand curve is horizontal, the marginal revenue curve is horizontal and is the same as the demand curve.

The monopoly maximizes its profit if it charges $\underline{p}$ and sells $\underline{Q}$. Consumers want to purchase $Q_h(>\underline{Q})$ units at this price. If the monopoly sells any more units, it loses money on each unit. As a result, there is a shortage of $Q_h - \underline{Q}$ units. Which consumers are lucky enough to buy at this low price depends on how the monopoly allocates its output. It could use a first-come, first-served policy, or discriminate on any other basis except price. Some consumers are better off than in the unregulated case, because they buy the good at a very low price. However, other consumers are worse off because they are unable to buy the good at all.

In Figure 20.2, there is greater deadweight loss than in the unregulated case. The deadweight loss from unregulated monopoly pricing is area A in Figure 20.2 (the area labeled DWL in Figure 20.1). The deadweight loss from setting $\underline{p}$ is area A plus area

B.[16] This increased deadweight loss results because $\underline{p}$ is much lower than p_c. If it were only slightly below p_c, only small shortages would occur, and the deadweight loss would be less than in the unregulated case.

The regulatory board should consider raising $\underline{p}$ if the monopoly chooses to shut down rather than operate at that price or if shortages occur. Of course, the board must be sure that the monopoly is not trying to trick it by causing a shortage even though $\underline{p} \geq p_c$.

To summarize, the effect of price regulation depends on where $\underline{p}$ is set:

- If $\underline{p} \geq p_m$, the regulation has no effect in a static model: price $= p_m$, quantity $= Q_m$, and there is deadweight loss.
- If $p_m > \underline{p} > p_c$, then price $= \underline{p}$, output lies between Q_m and Q_c, and deadweight loss is reduced but not eliminated.
- If $\underline{p} = p_c$, then price $= \underline{p}$, quantity $= Q_c$, and there is no deadweight loss.
- If $\underline{p} < p_c$, then price $= \underline{p}$, quantity demanded is greater than Q_c, but quantity supplied is less than Q_c. The deadweight loss may be greater or smaller than in the unregulated case.

Thus, the regulatory board can increase consumer surplus and welfare if it forces the monopoly to price at $\underline{p} = p_c$. If it guesses wrong and sets a $\underline{p}$ so low that shortages occur, it should raise $\underline{p}$. If the cost of running the regulatory board is extremely high, the best solution is to disband the board and not to regulate.

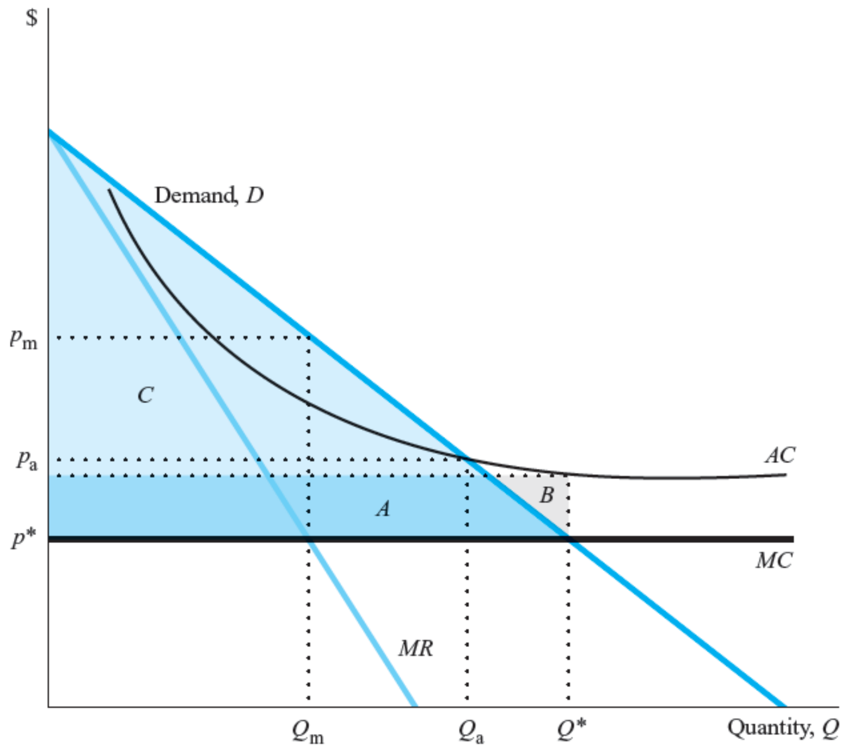
Price Regulation of a Natural Monopoly. A firm is a natural monopoly if it can produce the market quantity at a lower cost than can two or more firms (Chapter 4). A natural monopoly often has falling average costs and constant or falling marginal costs in the region in which it operates. Figure 20.3 shows a natural monopoly with constant marginal cost and falling average cost.

If the natural monopoly is not regulated, it charges p_m, sells Q_m units, and makes a large profit (because price is well above average cost). If the regulatory board sets $\underline{p} = p_a$, the price determined by the intersection of the average cost curve and the demand curve, the monopoly sells Q_a units and makes no profit. Consumers benefit from such regulation because they buy more output at a lower price.

Regulatory boards may try to set $\underline{p} = p_a$ because they know that if they set $\underline{p}$ lower, the monopoly will stop operating. Nonetheless, setting $\underline{p} = p_a$ leads to inefficient pricing because p_a is above marginal cost, *MC*. The consumer is paying more than it costs to produce the last unit of output. The efficient solution is to set $\underline{p} = p^* = MC$ and sell Q^* units. Because average costs are always falling with larger scale, there is only room for one efficient firm in this industry.

[16] We assume that those with the greatest willingness to pay obtain the goods at price $\underline{p}$. This outcome would occur if, for example, people wait in line for the good and those who value the good the most are willing to wait the longest and so line up first. We ignore the cost of standing in line in Figure 20.2.

FIGURE 20.3 Price Regulation of a Natural Monopoly



If $\underline{p} = p^*$, price is below average cost, so the monopoly loses money. Its lost profit equals $A + B$ in Figure 20.3.[17] The monopoly prefers to shut down rather than take losses.

Society could keep the monopoly operating at p^* by subsidizing it by an amount equal to the lost profit, $A + B$. At $\underline{p} = p^*$, consumer surplus, $C + A$, minus firm losses, $A + B$, equals $C - B$. If administration costs are low, welfare is maximized at p^* if welfare is defined as consumer surplus plus firm profit (or loss) minus the regulatory board's administrative costs.[18]

If it is possible to subsidize the monopoly using efficiently raised tax revenue, welfare is maximized with price equal to marginal cost and a subsidy. The subsidy is a

[17] The monopolist is covering its variable costs, because p^* = average variable cost, but not its fixed costs, F. As drawn, its costs are $C(Q) = mQ + F$, where m is its constant marginal costs and average variable costs. At $p^* = m$, its profit is $\pi(Q^*) = p^*Q^* - mQ^* - F = -F$.
[18] At any higher price, the increase in profit is less than the loss of consumer surplus (see Problem 1).

transfer of wealth from the monopoly and nonusers to consumers of the product and, as such, has no efficiency implications. Unfortunately, governments rarely, if ever, raise taxes efficiently. Most commonly used taxes, such as income and sales taxes, drive a wedge between price and marginal cost. Thus, subsidies typically have a real resource cost. We commonly see second-best regulations that set price at p_a rather than p^*.

An alternative way to keep the monopoly operating, and operating efficiently, is to allow it to price discriminate. Some consumers dislike this solution because it transfers income from them to the monopoly and treats consumers unequally.[19]

If a firm produces many products, the analysis of optimal regulation is more complicated. The regulatory prices that maximize consumer welfare subject to the requirement that revenues cover costs is called **Ramsey pricing**, after Frank P. Ramsey (1927), who first derived this result. This solution is similar to optimal monopoly price discrimination. Essentially, the optimal prices are the monopoly prices scaled down so that total revenue exactly equals costs (Baumol and Bradford 1970, Sharkey 1982).[20]

Sustainability of Natural Monopolies. Strangely, a natural monopoly may not be immune to profit-seeking entry (Faulhaber 1975; Baumol, Bailey, and Willig 1977; Panzar and Willig 1977b; Baumol et al. 1982; Sharkey 1982). Even if it is most efficient for one firm to produce the entire industry output, such a firm may not be able to simultaneously prevent entry, satisfy consumer demand, and cover its costs. A natural monopoly that can prevent entry is said to be **sustainable**.[21]

A single-product natural monopoly is sustainable at every output if and only if there are economies of scale at all outputs (Sharkey 1982, 88–90). That is, a natural monopoly with increasing returns to scale (as in Figure 20.3) that has a strictly falling average cost curve is immune to entry. A natural monopoly with a U-shaped long-run average cost curve may not be immune.

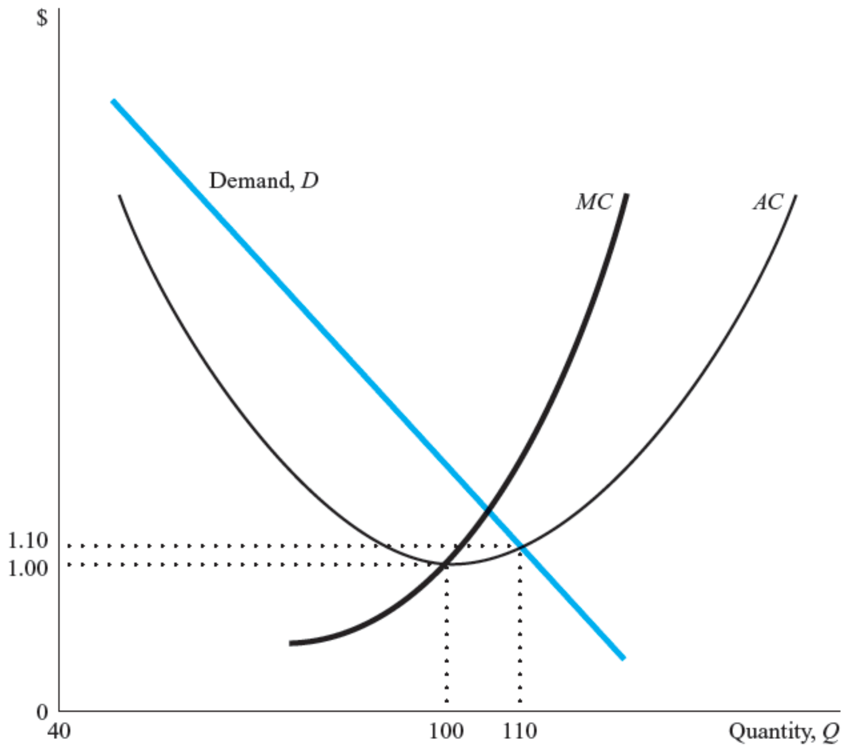
To illustrate the problem of sustainability, consider a monopoly with a U-shaped average cost function as in Figure 20.4. The demand curve crosses the average cost curve at a price of $1.10 and 110 units of output. Suppose that the monopoly is regulated to produce at that price, so that it makes no profit. In this second-best regulation,

[19]Around the turn of the century, economists started advocating a form of price discrimination called *time-of-day* pricing (see Hausman and Neufeld 1984). Since the 1970s, time-of-day (or *peak-load* pricing) and *seasonal* pricing have been widely used in regulating U.S. public utilities such as electric power and telephones (Weiss 1981). Differentiating rates over time has been particularly common in California, New York, and Wisconsin (Weiss 1981). This type of pricing is different than standard price discrimination because the costs different consumers impose on the system vary over time.

[20]See **www.aw-bc.com/carlton_perloff** “Ramsey Pricing” for a mathematical presentation.

[21]A natural monopoly is sustainable (Baumol, et al. 1977; Sharkey 1982) if, given a cost function C and a demand function D, there is a price p and an output $Q = D(p)$ such that $pQ = C(Q)$ and $p^*Q^* < C(Q^*)$ for all $p^* < p$ and all $Q^* \le D(p^*)$. A slight modification of this definition also applies if Q is a vector of different products.

FIGURE 20.4 Sustainability



the firm can charge only one price for its product, and the regulators cannot subsidize the firm. This type of regulation is inefficient—price is below marginal cost—so society is less well off than with first-best (marginal-cost pricing) regulation.

Another firm can enter profitably if it has the same cost function as the monopoly. It could produce 100 units and charge a price between \$1 and \$1.10. Although the natural monopoly could respond, this entry shows that the original regulated equilibrium is not a sustainable equilibrium.

If, instead, the demand curve in Figure 20.4 crosses the average cost curve at or to the left of the minimum point (\$1 and 100 units), then the monopoly is sustainable. In that case, the average cost curve is strictly falling at the equilibrium; hence, the firm is operating in the region of increasing returns to scale, as in Figure 20.3.

It is difficult to derive necessary and sufficient conditions to guarantee sustainability where the monopoly produces many products.[22] However, it is likely that a natural

[22]See, for example, Baumol et al. (1977). The problem is even more difficult when there are several firms, although some progress on sustainability with oligopoly has been made (Braeutigam 1984).

monopoly, earning zero profits, will be immune from entry if the monopoly may use a nonlinear pricing scheme (Chapter 10), the monopoly can respond rapidly to entry, and any potential entrant must sink substantial costs to enter.

Of course, regulators can solve the sustainability problem by forbidding entry and thereby protecting the natural monopoly. However, entry may be desirable—especially if the entrant is more efficient than the natural monopoly, which may become lax in a protected market.

Entry by a new competitor into a market with a natural monopoly does not guarantee efficiency because it is efficient to have only one firm producing. Competition of potential entrants may provide a check on a firm's behavior, but even here there can be problems. Suppose that each potential entrant competes by announcing the price it would charge if it were the sole firm. Further suppose that average cost declines everywhere with output. Because the average cost curve is falling, marginal cost must be below average cost, so setting price equal to marginal cost yields losses. In this case, there is no way to set price equal to marginal cost and earn zero profits. One possible solution is to have each firm announce a *two-part price* consisting of a fixed charge plus a usage charge. The usage charge could be based on marginal cost, and the fixed fee could be chosen to yield zero profits. Another solution is to have the firm charge an average cost that is above marginal cost, but there is a deadweight loss due to the gap between price and marginal cost.

Even if it were possible to determine what pricing scheme to use to earn zero profits, a related problem is that no monopoly is content to earn zero profits if greater profits are possible. Once a firm has been established as the natural monopoly, it is likely to develop advantages over potential entrants who can then no longer adequately constrain prices. Therefore, regulation of the price of the natural monopoly may be necessary to protect consumers, even though regulation is often difficult and creates its own problems.

Although it is theoretically possible that natural monopolies are unsustainable, there is little empirical evidence in most regulated industries showing that sustainability problems might justify regulators forbidding entry.

However, regulators may create sustainability problems. For example, suppose that regulators decide to charge high prices for long-distance telephone calls and use the extra revenues to subsidize local service. This pattern of pricing prevailed prior to the breakup (divestiture) of AT&T. Given this cross subsidy, where the revenues earned from one product are used to pay for the cost of providing another, there is an incentive for alternative providers of long-distance service to enter and charge a lower price, even if they have higher costs than the natural monopoly (Faulhaber 1975). Indeed, before the breakup of AT&T, firms offering only long-distance service entered the market and underpriced AT&T (see **www.aw-bc.com/carlton_perloff** "Price Umbrella").

If regulators insist on cross subsidizing, they must prevent entry.[23] In 1984, entry was permitted in the telephone industry (indeed the number of companies offering long-distance service, excluding wireless service providers, increased from 321 in 1993

[23]For a variety of views on this policy, see Baseman (1981), comments by Baumol (1981, 361–64), Panzar (1981, 365–69), and Brock and Scheinkman (1983).

to 1072 in 2002), thereby reducing cross subsidization.[24] Of course, if a monopoly is protected against entry and its prices or profits are regulated, its incentives to hold down prices and produce efficiently are reduced.

Regulatory Lag. Inducing regulated firms to produce efficiently may be a problem. Regulated firms are not rewarded when they achieve lower costs because their regulated price is lowered accordingly. For this reason a number of economists argue that regulatory lag, a delay in instituting and enforcing regulations, is desirable (Baumol 1967, Williamson 1971, Bailey 1973, Wendel 1976). They reason that if regulators are slow to react, then regulated monopolies earn increased profits when costs fall, and the short-term gains give them an incentive to cut costs. In the 1960s, intervals between electric power rate cases were long, although possibly for other reasons (Joskow 1974).

Obviously, there are mechanical problems in determining the best interval of time between setting new prices because there is a trade-off between lower costs in the long run and the lowest possible price at any given time. Insisting on the lowest possible price could so deprive a firm of incentives to behave efficiently that consumers are harmed in the long run.

Regulatory lag may be unattractive during periods of rapid increases in the costs of factors of production, as with energy costs in the 1970s. Under those conditions, delays in allowing prices to rise cause regulated firms to lose money for long periods of time. When regulators finally act, they may be tempted to grant extremely large price increases to make up for these lost profits, resulting in prices that were too high in some periods and too low in others.

Regulators often intervene only when pressured by the firm or consumers (Joskow 1974). From 1963 to 1967, when declining fuel prices and improvement in technology reduced costs for electric utilities, there were only 17 electric utility rate cases, so prices did not fall quickly. During the rapid inflation of 1973–77, however, there were 119 rate cases (Braeutigam and Quirk 1984). Many utilities reported that they voluntarily reduced rates in the 1960s, so the asymmetry in regulation may not be quite as extreme as it appears at first. Fitzpatrick (1987) uses a statistical model to show that the utilities "voluntarily" lowered their prices to keep consumers from complaining to rate commissions and demanding even greater rate reductions.

A variant of price regulation is *price cap* regulation, where a maximum price that can be charged is set and not changed for several years. During the period when the maximum price cannot be changed, the regulated firm has an incentive to lower its costs because it keeps the resulting profits (Symposium on Price Cap Regulation 1989). Such price cap regulation is especially common for local phone rates in the United States and the United Kingdom.

Price Regulation May Not Lower Price. Although lowering the price set by a monopoly is desirable, there is considerable doubt that regulatory boards do lower prices.

[24]Federal Communications Commission, "Statistics of the Long Distance Telecommunications Industry," Industry Analysis and Technology Division, Wireless Competition Bureau (May 2003).

The regulation of electrical rates provides an example. Today most states have commissions to regulate rates of electric utilities, but only 6 states had such commissions prior to 1910, and only 29 adopted commissions between 1910 and 1920 (Stigler and Friedland 1962). By 1937, 39 states had regulating commissions. Thus, using historical data, we can test whether regulatory boards lower prices.

The average price per kilowatt-hour (KWH) was 1.88¢ in regulated states and 3.20¢ in unregulated states in 1917, or 41 percent lower in the regulated states. However, this comparison is not terribly informative because the rates were relatively low in the regulated states before regulation went into effect.

Stigler and Friedland's statistical analyses separate the effects of regulation from those of variations in urban population, per capita income, and the proportion of energy from hydroelectric sources. They analyzed data for the years 1912, 1922, 1932, and 1937, and found that only in 1937, after controlling for other factors, did regulation have a statistically significant effect on price, lowering it by 9.7 percent.

Possibly, the reason that more dramatic effects are not found when the average price of electricity is examined is that regulation only helps certain classes of consumers (Example 20.2). Based on statistical analyses for subgroups, in 1932, regulation did not statistically significantly lower the price of electricity to either domestic or commercial and industrial customers. In 1937, regulation did not statistically significantly lower price to domestic customers, but statistically significantly lowered the rates for commercial and industrial customers by 8.8 percent. Apparently regulation helped commercial and industrial users at the expense of households.

Thus, it appears that regulations did not lower electricity prices in the first several decades they were in place, with the possible exception of lowering prices for businesses in 1937. It is possible that utilities in unregulated states kept their prices down to prevent regulation.

If regulation does lower price, it must lower the profitability of the monopoly. Similarly, if regulatory boards act slowly, regulatory lag keeps prices from keeping pace with cost increases, lowering profitability. Thus, an alternative test of the effect of regulation is whether the stock values of the electric companies in regulated states were lower than in unregulated states. Statistical analyses that control for the growth in sales do not show a statistically significant effect of regulation on stock prices.[25]

The Stigler-Friedland study led to a massive outpouring of research on the effects of regulation. Generally, those numerous studies confirm Stigler and Friedland's thesis that regulation often does not lower price. This confirmation is all the more striking in light of a subsequent data error found in the original Stigler-Friedland study, which when corrected shows electricity rates to domestic consumers lower in regulated states by about 25 percent (not under 5 percent as originally reported), though the results are still statistically insignificant (Peltzman 1993).

Some studies of electrical utilities in later periods do find statistically significant effects of other types of regulations, such as rate-of-return regulation. We now turn to this very common form of nonoptimal, indirect price regulation.

[25]Schwert (1981) criticizes this approach, however, for failing to control for changes in risk.

★Rate-of-Return Regulation

Don't get the idea that I'm knocking the American system. —*Al Capone*

In the United States, regulatory boards often used rate-of-return (ROR) regulation to limit the rate of return to capital of utility monopolies, such as electric and gas companies, instead of controlling prices directly. Although ROR regulation may help consumers, it does not encourage firms to behave efficiently. One commonly cited inefficiency, called the Averch-Johnson effect, is the tendency to overinvest in capital (Averch and Johnson 1962).

The effects of ROR regulation can be illustrated using a model of a public utility that uses labor, L, and capital, K, as inputs to produce electric power.[26] If unregulated, this monopoly restricts output but uses labor and capital to produce that output as efficiently as possible. That is, the firm hires workers up to the point where the last dollar spent on labor adds $1 to revenues, and similarly for capital. The firm chooses its output level through its choice of labor and capital so as to maximize its profits at the monopoly level.[27]

A firm's ROR is usually defined as a ratio of its profit (revenue minus operating cost, including capital depreciation), π, to the value of the capital stock, $p_k K$:

$$ROR = \frac{pQ - wL - uK}{p_k K}, \tag{20.1}$$

where w is the wage the firm pays to hire one unit of labor, u is the user cost of capital (the cost of using or renting the capital for one period),[28] and p_k is the purchase price of a unit of the capital stock.[29]

One reason for the use of the ROR is to facilitate comparisons of profits across different-sized firms. For example, a firm with a big factory may have a higher profit level than one with a smaller factory, but they may have identical RORs if their profits per square foot of factory are equal.

[26]For a mathematical analysis, see **www.aw-bc.com/carlton_perloff** "Averch Johnson," which is based on Takayama (1969). The corresponding graphic analysis follows Zajac (1970) and Baumol and Klevorick (1970). However, in our graphs, the firm is assumed to be a natural monopoly, whereas in their diagrams, a decreasing-returns-to-scale production function is implicitly assumed.

[27]The relation between output and labor and capital is described by a production function: $Q = f(L, K)$. Profit is a function of output, so that profit is also a function of labor and capital: $\pi(Q) = \pi(f(L, K))$. By choosing L_m units of labor services and K_m units of capital services, the firm maximizes its profit at the monopoly level, $\pi_m(f(L_m, K_m))$.

[28]The user cost of capital (**www.aw-bc.com/carlton_perloff** "Turning an Asset Price into a Rental Rate") is $u = (r + \delta - \dot{p}_k/p_k)p_k$, where r is the interest rate, δ is the depreciation rate of the capital (the rate at which the capital stock is used up), $\dot{p}_k$ is the change in the price of the capital asset over time (the derivative with respect to time), and $\dot{p}_k/p_k$ is the appreciation rate of the stock of capital (the percentage change in the price of the capital asset over the period).

[29]Some analysts (for example in Table 20.2) alternatively define the ROR by replacing u in Equation 20.1 with the depreciation rate of capital.

Given the definition in Equation 20.1, an ROR of zero is a normal or competitive rate of return (that is, no unusual economic profit). An unregulated monopoly generally has a higher ROR than competitive firms. Many regulatory boards limit the ROR of monopolies to a *fair rate of return,* a phrase that is not usually clearly defined. Some boards may set this rate at the average ROR in the unregulated sectors of the economy. Table 20.2 shows the rates of return in a number of regulated industries in the mid-1970s, before the recent deregulation movement.

A regulated firm may lower its ROR from the monopoly level either by lowering its profit or by increasing its capital (or both). Moreover, if the allowed rate of return is above the competitive return, then the firm earns more by investing more in capital. Thus, as Averch and Johnson (1962) point out, a regulated firm has an incentive to increase its capital relative to the amount of labor it uses (and thereby produce inefficiently) in order to maximize its profits. That is, the monopoly could produce at lower cost using a lower capital/labor ratio. Normally a firm buys labor and capital in proportions that minimize the cost of producing a given level of output. However, with ROR regulation, capital has an additional value to the firm. The more capital, all else the same, the lower the ROR (see Equation 20.1), so that the firm can have a higher level of profit and keep its ROR below the specified level. This overcapitalization result is illustrated in the following numerical example.

An Example. The local monopoly power company produces electricity using labor and capital. Suppose that the inverse demand curve facing the firm is

$$p(Q) = 100 - Q, \tag{20.2}$$

where p is the price and Q is the quantity of electricity sold.

The wage, w, and the user cost of capital, u, are \$168. The interest rate, r, is 10 percent, and there is no depreciation. The price of capital is \$1,680.

The quantity of electricity that the firm can produce is a function of the labor and capital inputs it uses:

$$Q = f(L, K) = LK. \tag{20.3}$$

This production function exhibits increasing returns to scale. If both labor and capital are doubled, output, instead of doubling, rises fourfold: $(2L)(2K) = 4LK = 4Q$. That is, this firm is a natural monopoly, with downward-sloping average and marginal cost curves, as Figure 20.5 shows.

Table 20.3 shows how much output the firm can produce with various levels of labor and capital. If the monopoly is unregulated, it maximizes its profit at \$288 by using 6 units of labor and 6 units of capital to produce 36 units of output.

Because the wage of labor equals the per-unit cost of capital and the production function is symmetric in L and K, the least expensive way for the firm to produce is to use labor and capital in equal proportions, so the ratio of capital to labor equals one ($K/L = 1$). For example, at the profit-maximizing level of 36 units of output, the firm uses 6 units each of labor and capital. If the firm uses equal amounts of labor and capital to produce 36 units of output, its factor costs are \$2,016 $= wL + uK = (168 \times 6) + (168 \times 6)$. If, for example, the 36 units of output were

TABLE 20.2 Rates of Return (%) in Regulated Industries, 1974–1977

Industry	On Book Value of Assets[a]	On Investors' Value[b]
Electricity	8.3	5.8
Gas transportation	9.7	5.7
Gas utilities	10.9	6.1
Telephone	8.7	5.8
Railroad transportation	6.0	4.2
Airline transportation	5.0	3.7
Motor-freight transportation	7.9	6.1
Market return	5.8	
Unregulated service industries		6.6

[a]The rate of return is the book-value weighted average of retained earnings plus dividends plus interest payments divided by the book value of assets.

[b]The rate of return on investors' value is the market-value weighted average of all interest and dividends plus price appreciation divided by the market value of all securities (such as stocks and bonds) for that industry.

Source: MacAvoy (1979, Table 2.13 and Appendix C).

produced using 4 units of labor and 9 units of capital, the firm's costs would be $\$2{,}184 = (168 \times 4) + (168 \times 9)$, which is 8.33% higher (Table 20.3).

The levels of capital and labor that maximize profit do not maximize ROR (Table 20.3). For example, where profit is maximized, $K = 6$, $L = 6$, $K/L = 1$, and the ROR is 2.86%. In contrast, where $K = 5$ and $L = 7$, the ROR is higher at 3.08%, although the profit is only \$259.

If the regulatory board sets the fair rate of return at 1.61%, the monopoly tries to maximize its profit subject to the constraint that its ROR is less than or equal to 1.61. It must lower π or raise K or both.

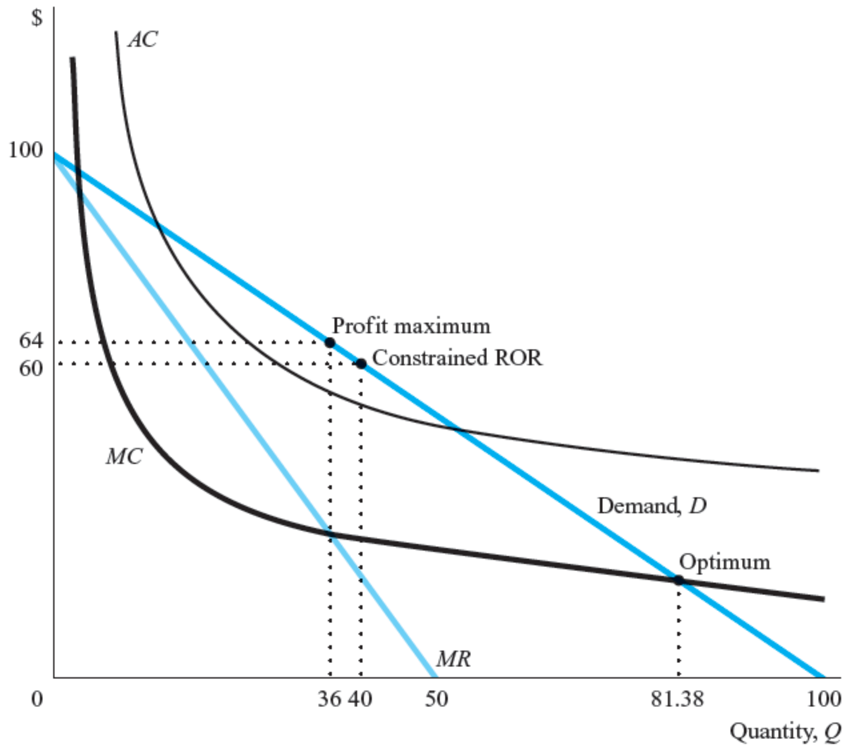
The monopoly can satisfy this regulatory constraint by raising capital from $K = 6$ to $K = 8$, lowering labor from $L = 6$ to $L = 5$. By so doing, the firm increases its output by 11.1% (from 36 to 40 units). To sell this extra output, it must drop its price from \$64 to \$60. Its profit falls from \$288 to \$216. Thus, by lowering profits and raising capital, the firm lowers its rate of return from 2.86% to 1.61%, the fair rate of return.

The regulated firm is producing inefficiently because its capital/labor ratio is 1.6 instead of 1. It costs the firm \$2,184 to produce 40 units of output using $L = 5$ and $K = 8$. It costs the firm only \$2,125 (2.8% less) to produce 40 units of output using 6.32 units each of labor and capital.

As predicted, the firm responds to the regulation by overcapitalizing.[30] Consumers are better off because the price is lower. Consumer surplus rises by 23% and welfare

[30]Several economists have argued that rate-of-return regulation may lead to undercapitalization rather than overcapitalization if firms maximize sales revenue instead of profits (Bailey 1973, Ch. 5) or because of dynamic considerations (Gilbert and Newbery 1988, Dechert 1984).

FIGURE 20.5 Rate-of-Return Regulation



(consumer surplus plus producer surplus or profit minus administrative costs) rises by 8.5% if the regulatory board's administrative costs are negligible.

Graphical Analysis. Figure 20.5 shows the three equilibria that appear in bold text in Table 20.3. The unregulated, profit-maximizing equilibrium ($Q = 36$) is determined by setting marginal revenue equal to marginal cost. The ROR-regulated equilibrium has more output ($Q = 40$), so consumers are better off. The welfare-maximizing solution ($Q = 81.38$) occurs where price equals marginal cost. The least-cost way to produce 81.38 units is to use 9.02 units each of capital and labor. Although production and consumption are efficient in the welfare-maximizing solution, the firm must be subsidized by \$1,515.40 (Table 20.3), because price is below average cost (Figure 20.5).

In this example, the best type of regulation more than doubles output obtained under the fair-rate-of-return regulation: 81.38 versus 40. Could the fair-rate-of-return

TABLE 20.3 **Rate-of-Return (ROR) Regulation**

Capital (K)	Labor (L)	Output (Q)	Price (p)	Profit (π)	Capital/Labor (K/L)	Rate of Return (ROR)	Consumer Surplus (CS)	Welfare (W)
5	4	20	80	88	1.25	1.05%	200.0	288.0
5	5	25	75	195	1.00	2.32	312.5	507.5
5	6	30	70	252	0.83	3.00	450.0	702.0
5	7	35	65	259	0.71	3.08	612.5	871.5
5	8	40	60	216	0.62	2.57	800.0	1016.0
5	9	45	55	123	0.56	1.46	1012.5	1135.5
6	4	24	76	144	1.50	1.43	288.0	432.0
6	5	30	70	252	1.20	2.50	450.0	702.0
6	**6**	**36**	**64**	**288**	**1.00**	**2.86**	**648.0**	**936.0**
6	7	42	58	252	0.86	2.50	882.0	1134.0
6	8	48	52	144	0.75	1.43	1152.0	1296.0
6	9	54	46	−36	0.67		1458.0	1422.0
7	4	28	72	168	1.75	1.43	382.0	560.0
7	5	35	65	259	1.40	2.20	612.5	871.5
7	6	42	58	252	1.17	2.14	882.0	1134.0
7	7	49	51	147	1.00	1.25	1200.5	1347.5
7	8	56	44	−56	1.14		1568.0	1512.0
7	9	63	37	−357	0.78		1984.5	1327.5
8	4	32	68	160	2.00	1.19	512.0	672.0
8	**5**	**40**	**60**	**216**	**1.60**	**1.61**	**800.0**	**1016.0**
8	6	48	52	144	1.33	1.07	1152.0	1296.0
8	7	56	44	−56	1.14		1568.0	1512.0
8	8	64	36	−384	1.00		2048.0	1664.0
8	9	72	28	−840	0.89		1592.0	1752.0
9	4	36	64	120	2.25	0.79	648.0	768.0
9	5	45	55	123	1.80	0.81	1012.5	1135.5
9	6	54	46	−36	1.50		1458.0	1422.0
9	7	63	37	−357	1.29		1984.5	1627.5
9	8	72	28	−840	1.12		2592.0	1752.0
9	9	81	19	−1485	1.00		3280.5	1795.5
9.02	**9.02**	**81.38**	**18.62**	−1515.4	**1.00**		**3311.4**	**1796.5**
10	10	100	0	−3360			5000.0	1640.0

Notes: The ROR is not shown if it is negative.

$w = u = 168$.
r = interest rate = 10 percent.
In calculating the welfare measure, consumer surplus plus profit, we assume that administrative costs are zero.

type of regulation achieve close to the optimal level of output? No, it cannot, as long as a positive fair rate is set. As Table 20.3 and Figure 20.5 show, profit is negative at the welfare maximum; hence, the rate of return is negative as well.

Despite its inefficiency, ROR regulation may increase welfare if the loss from inefficiency in production is offset by the gain from greater output and lower prices.[31] However, optimal direct price regulation can lower the price without inducing production inefficiencies, so optimal direct price regulation is preferable theoretically.

Empirical Evidence. Three empirical studies from the early 1970s found that ROR regulation substantially affected electric utilities (Courville 1974, Petersen 1975, Spann 1974). For example, Courville (1974) estimated an average overcapitalization of nearly 12 percent. These studies have been criticized on technical grounds (McKay 1977).

Other studies fail to find overcapitalization (Smithson 1978) or find evidence of undercapitalization (Baron and Toggart 1977). In short, the empirical evidence on overcapitalization is mixed. However, there is a general consensus that production under ROR regulation is likely to be inefficient. Regulators in the United States have been moving away from ROR regulation in recent years; however, this type of regulation is still common in other countries.

Quality Effects

There we were, one foot on a bar of soap and the other in the gutter.
—Commander Pursey, M.P. (attributed)

Even if price controls and ROR regulation lower prices, they may cause some vexing problems. For example, they may alter the quality of the product regulated or reduce the variety of products from which a consumer may choose (Archibald 1964, Stigler 1968d, White 1972, **www.aw-bc.com/carlton_perloff** "Drugs"). Unless more sophisticated regulations than pure price and entry controls are used, society must choose between two unattractive alternatives: high price and high quality versus low price and low quality.

For the purposes of this discussion (based on White 1972), suppose that quality is a second output of a firm. For example, if a firm's primary output is air transportation, the second output could be in-flight meals or in-flight movies.

The second output (quality) of the firm influences the demand for the firm's primary output and may be jointly produced and consumed. For example, a consumer may be more likely to fly on a given airline, all else the same, if a meal is served on board. Moreover, an in-flight meal can be consumed only while simultaneously flying, by definition.

[31] See Klevorick (1971), Bailey and Coleman (1971), and Sheshinski (1971).

Price and entry restrictions affect the number or tastiness of meals (or other similar quality measures).[32] Suppose, initially, that airlines are unregulated and that travel and meals can be purchased separately. The number of flights demanded, Q_F, and the quantity of meals demanded per passenger per trip, Q_M, vary with the price of a flight, p_F, and the price of a meal, p_M:

$$Q_F = Q_F(p_F, p_M),$$
$$Q_M = Q_M(p_F, p_M).$$

The total quantity of meals demanded is $Q_M Q_F$. Assume, also, that the average and marginal cost of producing a trip, m_F, or a meal, m_M, are constants.

If there are a substantial number of airline firms, then the industry is competitive. The price of basic transportation and of meals equal the corresponding marginal costs: $p_F = m_F$ and $p_M = m_M$. If each industry is monopolized, prices are likely to be higher than the corresponding marginal costs: $p_F > m_F$ and $p_M > m_M$.

A competitive industry provides a wide choice of quality levels. Flights with 1, 2, 3, or more meals are offered, where flights with more meals (or better tasting meals) cost more. For example, first class costs more than coach because first class provides better meals, bigger seats, and so forth. A monopoly may provide a different choice of qualities than a competitive industry (see the discussion of bundling, Chapter 11).

If regulatory authorities forbid new entry and set a single price, p_F^*, that must be charged regardless of the level of quality provided, the demand for flights depends only on the fixed price and the level of meals, $Q_F = Q_F(p_F^*, Q_M)$.

Firms can only attract business from their competitors by providing higher quality flights; they cannot compete on price. If an extra meal generates positive profits, the firm increases the number of meals. Each firm adds meals until the added profits made on each customer are driven to zero. That is, the net revenue from each passenger, $p_F^* - m_F$, from basic transportation just equals the marginal cost of providing that number of meals, $Q_M m_M$.

Thus, regulated competitive firms increase quality as long as they can profitably take customers from their competitors. This competition drives profits to zero because meals are provided at constant marginal cost. Because only one price, p_F^*, is charged, each firm chooses the same quality level: $Q_M = (p_F^* - m_F)/m_M$. In contrast to the unregulated case, no variability in quality is observed across flights within a given market.

A regulated monopoly offers a lower level of quality per passenger than a regulated competitive industry, holding the regulated price constant. Each regulated competitive

[32]White (1972) shows that analogous results are obtained for other quality variables such as luxurious waiting rooms or in-flight films. Schmalensee (1977) and Panzar (1979) discuss other quality measures of airlines, such as load factors and flight frequencies. See also Douglas and Miller (1974).

firm believes that the increase in the number of seats sold as the number of meals is increased is infinite: The demand curve facing the competitive firm is horizontal. In contrast, the regulated monopoly knows that the industry demand curve slopes downward, so that increasing meals increases seat sales by a limited amount. As a result, the regulated competitive firm has a greater incentive to increase quality than the monopoly.[33]

There are five main results of this analysis. First, a regulated competitive industry offers more quality per passenger than does a monopoly holding the regulated price fixed. Second, as a result, a regulated competitive industry sells more seats than a monopoly. Third, the higher the regulated price, p_F^*, the higher the quality provided by the competitive industry, because the rewards to attracting more business are higher. Fourth, regulation of a competitive industry harms fliers by eliminating different quality levels. Regulation of a monopoly may help or hurt fliers because the loss of variety in quality may be offset by a lower price. Fifth, raising the price of a regulated competitive industry does not increase profitability, because firms increase quality to compete until all extra profits are dissipated.[34]

With the Airline Deregulation Act of 1978, some of these hypotheses could be tested. For example, there should be more variety in quality level and probably a lower overall quality level now than before deregulation. The empirical evidence, discussed later in the section on airline deregulation, supports these hypotheses.

Making Competitive Industries More Monopolistic

Governments often regulate competitive industries, making them less competitive and lowering welfare. Governments may regulate poorly because of mistakes or because legislatures or regulators are captured by special-interest groups.

[33] The profits of a regulated firm, if its price per seat is regulated and it cannot charge for meals is

$$\pi = (p_F^* - m_F)Q_F - m_M Q_M Q_F.$$

The firm determines the optimal number of meals by differentiating π with respect to Q_M and setting this first derivative equal to zero:

$$\frac{\partial \pi}{\partial Q_M} = (p_F^* - m_F)\frac{\partial Q_F}{\partial Q_M} - m_M Q_M \frac{\partial Q_F}{\partial Q_M} - m_M Q_F = 0.$$

Rearranging terms, the profit-maximizing number of meals is

$$Q_m = \frac{p_F^* - m_F}{m_M} - Q_F \bigg/ \frac{\partial Q_F}{\partial Q_M}.$$

This expression holds for both regulated competitive and monopolistic firms. For competitive firms, however, $\partial Q_F/\partial Q_M = \infty$; whereas, a regulated monopoly faces a finite $\partial Q_F/\partial Q_M$. As a result, Q_M is bigger for a regulated competitive firm, all else the same.

[34] Several authors argue that regulated firms often have strong incentives to provide high-quality products, especially if quality is capital-intensive. See Schmalensee (1979b, 33), Kahn (1970, 21–26), and Spence (1975). See Crew and Kleindorfer (1978) and Telson (1975) on utilities choosing excessive levels of reliability. See Panzar (1979) on regulating monopolistic competition markets.

Earlier chapters present several examples in which regulations make markets more monopolistic. Many occupations—such as electricians, realtors, lawyers (Example 20.3), and doctors—are or have been empowered by governments to establish restrictions on entry, fix prices, and in other ways convert competitive industries into monopolies. Agricultural marketing orders (Appendix 9A) allow farmers to act collectively to reduce total crop production and to price discriminate. In some industries, laws allowed advertising about prices to be forbidden (Example 14.4). This ban on advertising gave firms information-based monopoly power and resulted in higher prices. Example 20.5 discusses how rent control can create inefficiencies as well as redistribute income. This section examines two types of government intervention that harm consumers and reduce efficiency: restrictions on the number of firms in an industry and agricultural regulations, such as price supports and quantity controls.

EXAMPLE 20.5 *Rent Control*

Regulation can reduce the efficiency of competitive markets. In many cities around the world, government agencies regulate apartment rental rates, using *rent controls* to keep rental rates below the competitive level. As a result, the demand for housing exceeds the supply.

Rent control transfers wealth from owners to renters. It also reduces the incentive to build new rental housing, exacerbating the shortage in the long run. Similarly, owners have less of an incentive to maintain rental housing, so it deteriorates faster than otherwise.

Rent control is common throughout much of the world. Large percentages of housing in Britain, Sweden, Mexico City, New York City, Berkeley, and San Francisco have been covered by rent control. In the United States, some 200 cities, including nearly 50 in California, have some type of rent control. However, California state law ended rent control in five California cities in 1999.

Olsen's (1972) empirical study finds that in New York City in 1968, occupants of rent controlled housing consumed 4.4 percent less housing services and 9.9 percent more nonhousing goods than they would have consumed in the absence of rent control. As a result, their real income was 3.4 percent higher, and poorer families received larger benefits than richer ones. The cost of rent control to landlords, however, was twice its benefit to the tenants.

Using data from New Jersey, Epple (1987) finds that the greater the rate of population increase, the more likely a community is to have rent control. Long-time renters are more likely to obtain rent-control units, so they benefit more from rent control than new arrivals. He also concludes that rent control is more likely in communities with more durable rental structures, which allow wealth to be more successfully transferred to renters when suppliers' ability to reduce supply is limited.

Sources: Olsen (1972); Epple (1987); Ray Tessler, "Rent Control Wins Decision in High Court," *San Francisco Chronicle*, February 25, 1988:1; and "Rent Control in Berkeley, Four Other Cities to End Jan. 1," **www.sfgate.com,** December 22, 1998.

Limiting Entry

Every decent man is ashamed of the government he lives under.
—H. L. Mencken

In many industries, governments restrict entry. For example, occupational licensing laws often allow current, licensed members of an occupation to write the licensing exam (Example 20.3). If they write a difficult exam, or grade unreasonably, potential entrants can be denied licenses. Automobile dealers are required to obtain a "Certificate of Need" before opening a new dealership in 18 states (Oliver 1988). Similarly, potential competitors to the U.S. Postal Service are not allowed to deliver mail to individuals' mailboxes. There are also restrictions on entry in industries as diverse as international air travel, taxicabs, health care, and public utilities. This section concentrates on government control of the number of business licenses (rights to operate in an industry), which restricts entry.[35]

By restricting entry into an industry, a government creates artificial scarcity and raises prices to consumers. The higher prices cause a transfer of wealth from consumers to firms in the industry. That is, the government creates property rights—the right to operate a firm in the industry—and often transfers these rights to a few, lucky individuals.

When the restrictions to entry are first created, governments often provide these rights or business licenses at no charge to all the firms already in the industry, which are said to be *grandfathered*. New firms are prohibited from entering the industry without business licenses. Unless the government creates additional licenses, a potential entrant can only obtain a license from a license-holder who is willing to leave the industry. As a result, the number of firms in the industry stays constant.

Any rents from these licenses go to the original owners. That is, an owner sells a license for the present discounted value of the future stream of profits. Thus, new entrants do not make excess profits on their investments, although consumers continue to pay high prices. Only those lucky enough to get the original licenses benefit.

Presumably, lobbying by firms leads to legislatures limiting the number of business licenses. Economists often refer to such lobbying efforts as *rent seeking:* the expenditure of resources to obtain government-created monopoly profits. It is worth lobbying for additional profits (rents) up to the point where the marginal cost from more lobbying equals the expected marginal gain.[36]

There are many examples of governments restricting entry by limiting business licenses. In California, a law allowing only one fish farm resulted in that firm earning a 1,200 percent return on capital in its first year. Another proposed law in California

[35]Some label such restrictions "barriers to entry." We use the term "restriction to entry" instead because we earlier defined a "long-run barrier" as an advantage that one firm has over other firms that enables it to earn excess profits in the long run. If the government requires all firms to pay a (market-determined) license fee, the government restricts entry by raising costs but does not create a long-run barrier (as we defined it) that favors some firms over others.
[36]Pittman (1988) shows that rent seeking is most likely in concentrated industries.

EXAMPLE 20.6 *Brewing Trouble*

The California Legislature overwhelmingly passed a bill to grant monopolies to beer distributors. The bill required breweries to sell beer to only a single wholesaler in any given area. Ninety percent of the beer sold by breweries to California wholesalers is under exclusive dealer contracts. Nonetheless, wholesalers wanted to make the practice state law to prevent major retailers from buying directly from breweries, perhaps to control free riding on distributors' promotional efforts. Wholesalers also feared that the courts would use antitrust laws to reject exclusive distribution contracts.

Consumer groups, large store chains, and the state's attorney general opposed the bill. Common Cause and the Consumers Union branded the bill as the worst special-interest measure of the year. When Indiana, New Jersey, and New York adopted similar laws, beer prices increased 10 to 20 percent, or 25 to 50 cents per six-pack.

Why did it pass easily? Although we don't know for sure, wholesalers were extremely generous in their campaign contributions to Republicans and Democrats alike. Of the 120 members of the state Assembly and Senate, 116 reported receiving in excess of $530,000 collectively.

The governor vetoed the bill.

Sources: Steve Wiegand, "Beer Distributors' Monopoly Bill Okd," *San Francisco Chronicle*, August 28, 1987: A10, and "Veto the Beer Bill," *San Francisco Examiner*, August 30, 1987: A18.

reflected an attempt to monopolize beer wholesaling (Example 20.6). In some states, one must have a liquor license to sell liquor, and restrictions on licenses may drive the free market price of a license over $100,000.

One well-known example of an industry with entry restrictions is taxicabs. Some city governments in virtually every country in the world limit the number of taxicab licenses. (Partially offsetting the anticompetitive effects of these restrictions to entry are price controls on rates that cabs charge.) Entry into the taxicab market is often restricted by requiring each cab to have a medallion (a physical business license) and then limiting the number of medallions. In most years, new cabs cannot enter the market unless they buy a medallion from an existing owner. As a result, the original owners capture the present value of future excess profits by charging high prices for their medallions. In the mid-1980s, it cost $100,000 to own a taxi in New York City and $140,000 in Boston, but only the cost of a jalopy in Washington, D.C. (Oliver 1988). By 1993, the price of a medallion in New York City reached $182,000, and by 2004 had reached $225,000.

A 1984 study for the U.S. Department of Transportation estimated that the annual extra cost to consumers from restrictions on the number of taxicabs throughout the United States was $800 million. This amount is an underestimate of the total lost consumer surplus, because it does not include lost waiting time and other inconveniences associated with having relatively few cabs. However, some people argue there are offsetting benefits. Other taxicab regulations are often used to offset, at least partially, the bad effect of the entry restriction, and to justify the entry restriction. Typically, a medallion owner is subject to a number of restrictions, including price and safety regulations, which may benefit consumers.

Local monopoly power of cabs can be kept in check, at least partially, by the threat of losing a medallion. Imagine that you arrive in a strange city and there is only one cab within sight. You are tired and hungry and the rain is coming down hard. The cab driver says, "I'll take you to your hotel for five times the amount on the meter." As angry as that makes you, you may still take the cab. However, if your report of this incident could cause the driver to lose the medallion, the driver would be hesitant to make such a demand.

Most of these justifications for regulation fail to explain why the number of cabs must be limited to the point where a medallion is worth hundreds of thousands of dollars. One justification for entry limitation is that, because an additional cab raises search costs of other taxis to find riders, there is excessive entry, as in fisheries (Gallick and Sisk 1984). However, it is difficult to believe that most cities operate optimally, given the high values of medallions. Presumably the main purpose of these regulations is to transfer wealth from riders to medallion owners. One explanation for why wealth is transferred in this way is the interest-group theory: Medallion owners lobby strongly for these restrictions.

An alternative explanation is that the type of regulation is determined in large part by the incentives facing regulators (Eckert 1973). The taxi industry tends to be regulated by either municipal agencies or independent commissions. Municipal agencies are run by bureaucrats who impose rules and require supervision of the industry so as to justify large salaries and staffs. Independent commissioners, in contrast, have part-time appointments. Supervising large staffs, dealing with exceptions, and so forth would require more of their time. Moreover, as they tend to be appointed for a limited term, long-run returns in bigger staffs from more regulations would aid only their successors.

Commissioners often find that they can reduce their level of regulatory effort if they only have to deal with a single "responsible" firm. Equivalently, the market may be divided into exclusive territories through regulation, creating local monopolies. Thus, according to this hypothesis, commissions prefer monopolies or market divisions more than do agency bureaucrats. Of 6 cities that Eckert studied with commissions, 5 (83.3 percent) had monopolies or market divisions. Of the 27 cities he studied with agencies, only 5 (18.5 percent) had monopolies or market divisions.

Regardless of commissioners' motives, however, cab riders lose and long-time medallion owners gain. However, these transfers are trivial compared to those in agriculture.

Agricultural Regulations: Price Supports and Quantity Controls

Most standard microeconomic textbooks point to agricultural markets as examples, possibly the only examples, of perfectly competitive markets. After all, agricultural markets are typified by a large number of small firms. Unfortunately, in virtually every country in the world, governments intervene in these markets and reduce their efficiency, driving them from the competitive equilibrium.

Why do governments engage in policies that promote inefficiency and harm consumers? One common explanation is that the government wants to transfer income to the agricultural sector but does not want to do so openly and directly by just giving farmers money. To accomplish this transfer of income, price supports and quantity controls are used.

Price Supports. During the Great Depression in the United States, farmers were struck early and hard. In response, the Federal Farm Board was established in 1929 to buy and sell farm output in order to ensure "orderly agricultural marketing."[37] The objective was to achieve *parity* in relative prices or incomes between agriculture and other sectors compared to the levels achieved in 1910–14. The board used **price supports**: By buying when prices would otherwise be low, it prevented prices from falling below certain levels called support prices. By buying large quantities at high prices, it created large stockpiles and exhausted its available funds.

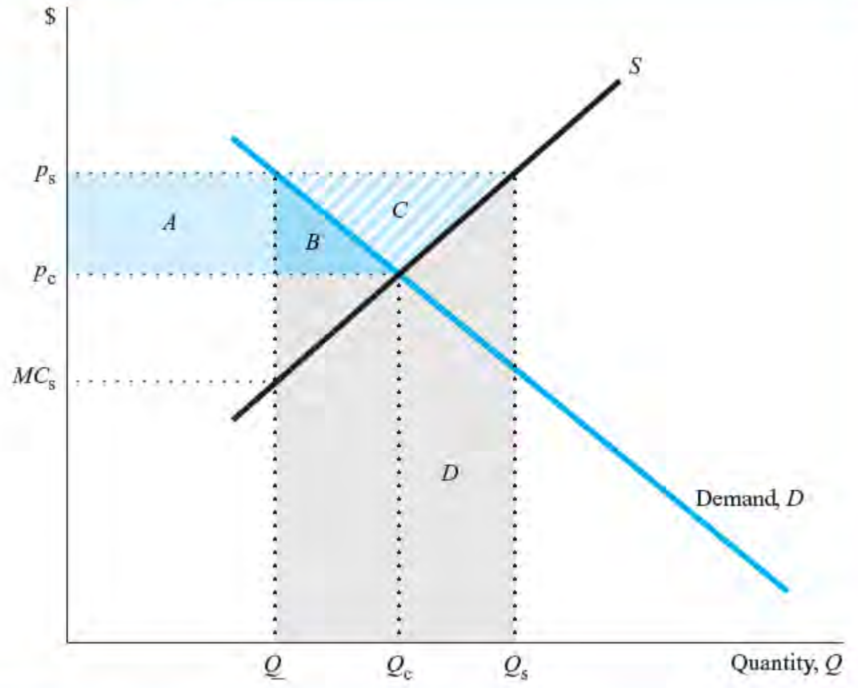
Figure 20.6 shows why. Farm price supports induce farmers to produce more than would be produced by a competitive market.[38] The competitive equilibrium is determined by the intersection of the demand curve and the supply curve, S. The competitive price is p_c and the competitive quantity is Q_c. If the government guarantees farmers a support price of $p_s > p_c$, consumers are only willing to buy $\underline{Q}$ units. Thus, the government must buy the rest of the total amount supplied, $Q_s - \underline{Q}$, and store it. The government cannot sell it domestically as long as the price remains at p_s.

This program is a very inefficient way to transfer income to farmers: It costs consumers and taxpayers much more than farmers receive. Under this program, farmers' incomes rise by $A + B + C$ in Figure 20.6. This total area represents the extra income from selling more units (Q_s rather than Q_c) at a higher price (p_s rather than p_c) less the cost of producing the extra units (the area under the aggregate supply curve from Q_c to Q_s). At the higher price, consumer surplus falls by $A + B$. The government pays $p_s(Q_s - \underline{Q})$, which equals $B + C + D$, for the extra crop and then pays to store the surplus (assuming that the government has no alternative use for the crop). Thus, the net loss to society is $B + D$ plus the cost of storage, which is the loss to consumers ($A + B$) plus the loss to the government ($B + C + D +$ storage) minus the gain to farmers ($A + B + C$).

[37]Apologists for our agricultural policy usually justify it on the grounds that it stabilizes prices. By maintaining a high price, prices are more stable (fluctuate less from year to year) than they would be otherwise. Eliminating uncertainty, proponents of such stabilization maintain, increases farmers' welfare. Why this market needs stabilizing more than manufacturing and other markets, and why this type of stabilization should be achieved through government intervention is a mystery to us, so we do not discuss it further here.

[38]During most of the history of the U.S. farm supports, explicit price supports have not been used. Rather, the Commodity Credit Corporation (CCC) makes "nonrecourse" loans with the farmer's potential crop as collateral. That is, if the farmer does not pay back the loan, the agency keeps the crop but has no further recourse to the farmer's assets if the crop does not cover the loan. If agricultural prices are below the implicit price set by the loan, the farmer defaults on the loan and the CCC claims the crop. This technique is equivalent to a formal price support but involves more paperwork.

FIGURE 20.6 Price Supports



Three distortions are created by this program. First, there is excess production. Farmers produce Q_s instead of the competitive quantity, Q_c, which is excessive because consumers do not want to consume all of it at the price p_s. Second, there is inefficiency in consumption: Consumers pay p_s for $\underline{Q}$ units of output. The marginal cost of producing that output is MC_s. Thus, the consumer is paying a price above marginal cost: $p_s > MC_s$. Third, the government is paying to store the excessive output, which is produced but not consumed. There may be a future benefit if the output is later consumed before it rots.

Because these programs are very costly to governments, the United States and other governments have moved away from straight price supports. For example, they may impose quantity restrictions (see **www.aw-bc.com/carlton_perloff** "Agricultural Quantity Restrictions").

The Cost of Agricultural Support Programs. Most countries use price supports and other means to keep agricultural prices high domestically. The European Community (EC) uses price supports for grains, dairy, livestock, and sugar; deficiency payments for oilseeds; production quotas for sugar; export refunds for grains, dairy, and livestock; and various import tariffs and quotas.

In some countries, government farm subsidy payments exceed the amount farmers receive from consumers for the products. The Organization for Economic Co-Operation and Development (OECD) collects information about such subsidies in its member nations, which include most European and Scandinavian countries, Australia, Canada, Japan, South Korea, Mexico, New Zealand, and the United States.[39] Farmers in OECD countries received $231 billion in subsidies in 2001, down from an average of $239 billion during the period 1986–88. These subsidies were 31 percent of the amount consumers paid in 2001 and 38 percent in 1986–88. Total subsidies to agriculture, which includes subsidies for general services (e.g., marketing and promotion, infrastructure), totaled $311 billion (1.3% of GDP) in 2001, compared to an average of $302 billion (2.3% of GDP) over the period 1986–88.

The European Union had the largest producer subsidies to agriculture, $93 billion in 2001. Producer subsidies were $49 billion in the United States and $47 billion in Japan. Among OECD nations, Switzerland's farm subsidies constituted the largest fraction of consumer payments. Their $4.2 billion of producer subsidies were 69 percent of the value of production: The Swiss government gives the farmer more than two dollars for every dollar a farmer earns from the market. Producer subsidies as a fraction of farm production have generally declined since the mid-1980s. For example, New Zealand's producer subsidies averaged 11 percent of total value in 1986–88 but only 1 percent in 2001.

The cost of these supports to the average taxpayer is substantial. As of 2001, the average citizen in the European Union pays $281 a year in total subsidies to agriculture, although the payments rise to $650 a year for the typical Swiss citizen. Japanese citizens spend $467 per person, South Koreans pay $417 each, Americans pay $346, Canadians $168, Mexicans $81, Australians $61, and New Zealanders $37.

Deregulation

In markets in which regulation is harmful rather than helpful, deregulation makes sense. In the last two decades, many major industries were deregulated (Table 20.4), especially during the Carter and Reagan administrations.[40] Industries that were partially or totally deregulated include airlines, interstate trucking, railroads, banking and savings and loans (limits on interest rates), television, and telephones. Unfortunately, there has been little deregulation in agriculture. Other countries are also deregulating. For example, the British now allow cable television companies into the telephone business while the United States now allows telephone companies to enter the cable business.[41]

Typically, there are strong supporters and opponents of any proposal to deregulate an industry. Indeed, deregulation campaigns create some strange bedfellows. Support-

[39] *Agricultural Policies in OECD Countries: Monitoring and Evaluation*, Organization for Economic Co-Operation and Development, 2002.

[40] Conversely, many new regulations were instituted. The number of final rules published in the Federal Register averaged 7,347 in the Carter administration, fell to 5,335 in the Reagan administration, fell even further to 4,405 in the George H. Bush administration, and then rose somewhat to 4,671 under the Clinton administration. In the first two years of the George W. Bush administration, the number of final rules averaged 4,150 (Crews 2003).

[41] "Now You're Talking," *The Economist*, July 25, 1992:69–70. For detailed analysis of the effects of deregulation in telephones, see Cole (1991), Crandall (1991), MacAvoy (1992), Economides (1999), and Cave and Crandall (2001).

TABLE 20.4 **Major U.S. Deregulation Decisions**

1968	The Supreme Court permits non-AT&T equipment to be connected to the Bell System.
1969	MCI is permitted to connect its long-distance network to local phone systems.
1970	Interest rates are deregulated on bank deposits of $100,000 or more.
1972	The Federal Communications Commission (FCC) establishes a domestic satellite open skies policy.
1975	The Securities and Exchange Commission ends fixed brokerage fees for stock market transactions.
	Rate bureaus for railroads and trucking firms are prohibited from protesting independent rate filings.
1976	The Railroad Revitalization and Regulatory Reform Act of 1976 partially deregulates railroads and makes rate setting more cost-based.
1977	Deregulation of air cargo gives airlines more freedom in pricing.
1978	Congress partially decontrols natural gas.
	The Occupational Safety and Health Administration revokes 928 "nitpicking" rules.
	The Civil Aeronautics Board is phased out, eliminating controls over airline entry and prices.
	The Environmental Protection Agency permits emissions trading.
1980	The FCC removes most federal regulation of cable TV and of equipment on consumers' premises.
	The Motor Carrier Act eliminates barriers for new entry and permits operators to establish fares and routes with little oversight by the Interstate Commerce Commission.
	The Depository Institutions law phases out interest rate ceilings and permits savings and loans to offer interest-bearing checking accounts.
	The Staggers Rail Act enables railroads to adjust rates without government approval and enter into contracts with shippers.
1981	President Reagan decontrols crude oil prices and petroleum allocations.
	The FCC removes many radio regulations.
1982	A new bus regulatory statute allows intercity bus companies to change routes and fares.
	The Garn-St. Germain Act allows savings and loans to make more commercial and consumer loans and removes interest-rate differentials between banks and savings and loans.
1984	As part of an antitrust settlement, AT&T agrees to divest local operating companies.
	Individual ocean shipping companies are allowed to offer lower rates and better service than shipping "conferences."
1990	Clean Air Act of 1990 allows for a free market in pollution.
1992	Energy Act lifts most of the restrictions on independent power producers, allowing them to sell power to utilities at market rates.
1994	Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 allows bank holding companies to own banks in states other than their home state without forming lower-tier bank holding companies and allows banks to own branches across state lines (except in Texas and Montana).
	The Trucking Industry Regulatory Reform Act effectively eliminates all state oversight of intrastate trucking operations.
1996	Telecommunications Act of 1996 allows increased competition in communications markets, relaxes ownership restrictions on the number of broadcast stations that can be owned by a single entity, and ends (March 1999) price regulation of cable television rates.
	California governor Pete Wilson signs legislation to open up California's electricity market to competition.
1998	The Ocean Shipping Reform Act loosens regulations, such as allowing shippers and ocean carriers to negotiate and reach confidential service contracts and eliminates tariff filing requirements for individual carriers, but retains anti-trust immunity for shipping conferences.
1999	The Gramm-Leach-Bliley Act loosens restrictions on banks' ability to underwrite securities and permits banks to underwrite insurance policies.
2003	The Federal Communications Commission sets new rules loosening restrictions on media ownership, such as one that allows the same company to own newspapers and broadcast stations in the same city and another that allows a company to own up to three television stations and eight radio stations in the largest markets. Pending litigation has blocked implementation of the rules.

Sources: Weidenbaum (1987); Lee, Baumel, and Harris (1987); Lown et al. (2000); Tang and Ma (2002); various newspapers.

ers of deregulation typically include many, but certainly not all, economists, some regulators, and some consumer groups. Opponents typically include some economists, many regulators, some consumer groups, the regulated firms, and unions that work for those firms.

Supporters of deregulation want to remove regulations that set prices and restrict entry. Proponents claim that deregulation increases efficiency and lowers prices. They point to two types of efficiency gains from removing the distortions created by price regulations. The first is a result of letting the market rather than regulators set relative prices. For example, many transportation and telephone regulations cross-subsidized people and firms in rural areas at the expense of other consumers. Deregulation, by allowing these rates to adjust, increases consumption along major transportation routes or phone usage in urban areas and decreases it on minor routes and in the boondocks, increasing efficiency. Even though society may collectively benefit from deregulation, some consumers may lose from these adjustments.

Second, proponents claim that deregulation lowers prices overall. In many industries, regulated prices are set well above marginal costs. Because prices are regulated but service levels may not be, regulated firms compete by increasing product quality or the frequency of their service, thereby driving their costs up to the level of the regulated prices, rather than allowing prices to fall to low-cost levels. Moreover, to the degree that regulated prices are cost-based, firms have little incentive to cut costs. Further, because regulators restrict entry, deregulation leads to lower prices due to increased competition from new entrants. Thus, proponents believe that deregulation lowers prices by ceasing to prop up prices artificially, allowing quality or service levels to fall from their high levels, and increasing the number of firms.

Opponents argue that most regulated industries are inherently oligopolistic. As a result, they claim, deregulation causes prices to shoot through the ceiling because smaller firms are driven out of business and remaining ones often collude. They also contend that, without controls, service and quality fall. Opponents also object that small communities lose service under deregulation because, without the cross-subsidization, it is unprofitable to provide the same level of service as under regulation. The deregulators counter that if it is unprofitable to serve these areas, they should not be served.

In most industries, deregulation has occurred slowly over time. Slow deregulation has created inequities and inefficiencies in some markets. Under the 1978 Natural Gas Policy Act, prices on natural gas wells differed by the time of discovery, with "old" gas still regulated and "new" unregulated.

In other industries, partial deregulation caused other problems. Many controls on savings and loans and banks were removed in 1980, and insurance on accounts was more than doubled. The insurance was provided by three federal entities: the Federal Deposit Insurance Corporation (FDIC), the Federal Savings and Loan Insurance Corporation (FSLIC), and the National Credit Union Share Insurance Fund (NCUSIF).

These insurers were exposed to risks by bank and savings and loan owners and managers, yet did not charge insurance premiums that varied according to the risk exposure (White 1988). Banks and savings and loans could take extremely high risks, knowing that the insurers would protect the depositors if they failed, but they could keep the high returns if they succeeded.

Aside from the failure to charge risk-based premiums, the regulation of banks was governed by the use of accounting conventions whereby the market value of the assets of a bank could bear no relation to the accounting value used for regulatory purposes. In 1982, the estimated market value of the net worth of the savings and loan industry was negative $100 billion or lower (White 1991, 77), yet federal agencies closed relatively few financial institutions.

In addition to deregulation, there were many other reasons for the plight of the financial institutions, including unexpected changes in interest rates (White 1991). Finally, especially when real estate values declined in the 1980s, many financial institutions were declared insolvent. According to the Federal Home Loan Bank Board, 520 savings and loan institutions were declared insolvent in 1987, and 434 in 1988, compared to 43 in 1980. From 1981 to 1987, there was nearly a fivefold increase in the number of thrifts declared insolvent.

Nonetheless, in several major industries, decontrol was rapid and fairly complete. Although all evidence is not in yet, many studies of deregulation in these industries find overall efficiency gains. The following sections examine deregulation in three transportation industries—airlines, trucking, and railroads—in more detail. Example 20.7 examines deregulation in electricity markets, while Example 20.8 examines deregulation in telecommunications. Peltzman and Winston (2000) and Winston (1993) provide an overview of the effects of deregulation across a broad range of industries.

Airlines

In 1938, Congress established the Civil Aeronautics Administration, which later became the Civil Aeronautics Board (CAB). The CAB controlled the interstate airlines industry, including entry by airline companies, air routes, fares, and agreements between airlines. The CAB also provided subsidies to promote air transportation. By the late 1970s, however, the CAB started to deregulate the industry and permitted free entry of any certified carrier to a few selected routes. Several major airlines were initiating suits against the CAB for violating its congressional mandate by allowing too much competition when Congress passed the Airline Deregulation Act of 1978 (Borenstein 1992).

Many economists and others believed that the CAB kept pricing far above competitive levels. Indeed, in the early 1970s, intrastate flights in California that were not regulated had prices that were about 40 percent less than fares in comparable eastern interstate markets, primarily due to flying fuller planes (Breyer 1982).

Proponents of deregulation argued prices would fall as a result of deregulation. They claimed that a deregulated airline travel market is contestable. That is, because planes can be moved easily to different locations, there are many potential entrants on each route, even though the number of actual competitors is small. Indeed, because regulators prevented entry, entry should be facilitated by deregulation. They also claimed that deregulated firms would offer better mixes of quality and be more responsive to the fluctuating desires of the public.

President Carter's chairman of the CAB, Alfred Kahn, an expert on the economics of regulation, was a forceful advocate of airline deregulation. When airlines were first deregulated, he observed, "I have more faith in greed than in regulation."[42]

[42] *New York Times,* October 7, 1980.

Opponents included the major airlines and their unions.[43] They feared economic harm. Some opponents argued that the airlines would become unsafe. Despite these objections, President Carter signed the Airlines Deregulation Act in 1978, which took pricing and route decisions from the CAB and allowed airlines to make these decisions. The CAB rapidly implemented the Airlines Deregulation Act, permitting entry routinely. The Act eliminated the CAB at the end of 1984.

To deal with one of the largest fears about deregulation, however, service to smaller communities was guaranteed for 10 years. The Essential Air Service Program, designed to cover a 10-year "phased transition" to a completely unregulated and unsubsidized market, cost $71 million to subsidize 202 communities in the continental United States in its first year of operation. By 1987, only 102 communities were being subsidized at a cost of $21 million.[44]

The deregulation of airlines had several major effects. Fares fell and passenger travel increased; industry profits fell; the airline industry developed hub-and-spoke networks and became increasingly concentrated; productivity increased; more price and quality choices became available to consumers; and there was no decline in safety. Morrison and Winston (1986) estimate the annual benefits from airline deregulation to be about $6 billion (in 1977 dollars).[45]

Average fares paid (in real terms) dropped by about 20 percent from 1980 to 1989, although fares rose in the late 1980s. The number of passenger miles flown by U.S. carriers more than doubled from the late 1970s to 1990.[46]

The long-term fall in prices lowered the profits of airlines. Price wars caused rates of return to be very low or negative. Several carriers exited the industry (Braniff, Midway, Pan Am, Eastern) and several continued operating under protection of the bankruptcy code (America West, Continental, TWA, United, and US Air). (See Borenstein and Rose 2003.) Airline workers suffered a 10 percent loss in relative earnings following deregulation (Card 1998).

Airlines developed extensive hub-and-spoke networks, sometimes by merging with other carriers (Brueckner and Spiller 1991). (The successful low-cost airline Southwest Airlines is a notable exception to the development of hub-and-spoke networks.) Following deregulation, there was new entry. But there were also several subsequent exits

[43]Spiller (1983) points out that, based on history during the regulatory period, some airlines could be predicted to profit from deregulation and others to lose. Moreover, potential entrants expected to gain from deregulation. As a result, some firms favored deregulation.

[44]According to a Department of Transportation (DOT) analysis, without the subsidies, about 70 of the 102 communities would not have air service. Of the 70, however, 43 serve fewer than five passengers a day and 33 are within 75 highway miles of airports with scheduled, unsubsidized flights. At the end of 1987, Congress voted to extend the subsidy, which still exists. Jack Anderson, "The High Cost of Air Travel," *San Francisco Chronicle*, December 1, 1987:A23.

In fiscal 1989, Congress appropriated $25 million for the program—$6.6 million less than necessary to maintain the existing level of support. DOT announced cutbacks eliminating service to up to 56 communities in as many as 39 states, but exempting Alaska and Hawaii because air service is often the only feasible transportation mode in those states. "Subsidy Cuts Threaten Rural Air Service," *San Francisco Chronicle*, January 4, 1989:A10.

[45]See also Kahn (1988), Meyer et al. (1987a, b), and Moore (1986).

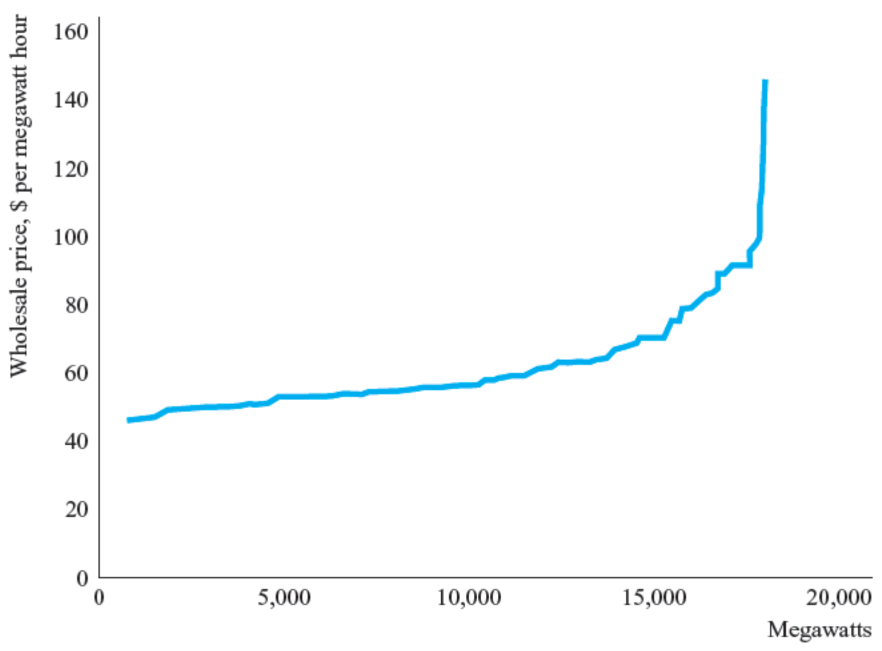
[46]Gene Koretz, "Why Booking Air Travel Isn't Lifting Airlines," *Business Week*, October 12, 1992:24.

EXAMPLE 20.7

Deregulating Electricity: California in Shock

Until recently in California, regulated local monopoly utilities produced and distributed electricity. California had one of the United States' highest electricity rates. In 1996, in an effort to improve efficiency, the state legislature passed a "deregulation" bill that separated generation from transmission and distribution. The bill permitted independent generators to compete to produce power, a change that ideally would have increased competition and market efficiency. However, the industry remained highly regulated in many ways, for example, through explicit price controls on wholesale prices during many periods.

In the short run, the electricity supply curve is virtually horizontal up to the point where production capacity is reached, where it becomes nearly vertical. The figure (based on Borenstein 2002) shows California's thermal-generation supply curve for August 2000. The electricity wholesale demand curve is inelastic (nearly vertical) in the short run because retail prices are generally fixed; however, the wholesale demand



and at least 24 mergers. Thus, the initial influx of new carriers after deregulation was offset by exits and mergers, so that the industry became more concentrated, especially along routes that are not heavily traveled. The four-firm concentration ratio for the curve shifts to the right substantially in warm weather and during daytime hours. A small rightward shift of the demand curve in the horizontal portion of the supply curve has little effect on the wholesale price. However, if the demand curve is near the full-capacity quantity, a small shift in the demand curve can create large swings in the wholesale price. In this situation, if even one generator significantly cuts back the power it supplies, it can have a powerful effect on price.

When demand for electricity exceeds available supply (too many people flip on a switch), the system can fail partially or totally. Modern systems adopt procedures to shed demand (ration customers) so as to avoid system failure. In California in 2000, the system operator mandated partial shutdowns on several occasions to prevent a catastrophic system failure.

In 2000, California's wholesale energy prices started to soar. By the spring of 2001, the wholesale price of energy was more than 10 times its value in the previous year. To make matters worse, the retail price of electricity was regulated, so that utilities were sometimes forced to sell at retail at about 6¢ per kilowatt-hour when they were buying electricity at a wholesale rate of 10¢. The state's largest utility, Pacific Gas and Electric, filed for bankruptcy. The state stepped in and entered into long-term contracts for wholesale power that it then made available to the utilities. Soon thereafter, the price of natural gas (an input into electricity generation) fell, leaving California in the unfortunate position of having signed long-term contracts at prices that may have been double the expected wholesale price.

There have been many analyses of the causes of the California crisis, and these point to several contributing factors in addition to the capacity problem. Two other important factors are that the government continued to regulate retail prices and continued to forbid long-term contracting by utilities. Because households and most firms faced fixed retail prices, they had no price incentive to cut back consumption during crisis periods. Utilities could not sign long-term supply contracts for wholesale power, and so they could not use these contracts to mitigate short-run fluctuations in prices due to hot weather, higher natural gas prices, or other causes. Moreover, if utilities could have contracted in advance, they would not have been so much at the mercy of any one generator or group of generators in the short run.

Unfortunately, many people have drawn the false conclusion from the California crisis that deregulation is harmful. Actually, there was substantial regulation before and after the change in 1996, and most of the worst problems in 2000 stemmed from continuing or new regulation and fixed capacity rather than from the very limited deregulation itself.

Sources: Borenstein (2002), Joskow (2000a).

domestic airline industry was 56.2 percent in 1977, 64.8 percent in 1987 (Borenstein 1992), 55 percent in 2000, and 54 percent in 2003 (authors' calculations). Thus, the domestic industry is now slightly less concentrated than before deregulation. A study

EXAMPLE 20.8

International and U.S. Deregulation in Telecommunications

In 1980, most countries had state-owned telecommunications companies, with the exception of North American nations. By 1998, data from 167 countries indicated that 42 percent had replaced state ownership with some form of partial or total private ownership together with regulation. The first big event was British prime minister Margaret Thatcher's decision in the early 1980s to privatize British Telecom, to reject the U.S. model of rate of return regulation in favor of price cap regulation, and to introduce competition. Along with privatization, many countries have allowed various forms of competition, with the necessary interconnections that competitors require being under regulatory control.

Most existing evidence is consistent with the view that privatization and competition have each been important sources of efficiency and growth in telecommunications. Privatization, where profit-maximizing firms replace a government entity, leads to lower costs. But regulation plus competition is also needed to ensure that consumers reap the rewards of the improved efficiency. For example, one study finds that between 1990 and 1998, privatization together with competition caused output to rise by over 17%, with each contributing about equally. Similarly, privatization together with competition caused investment per capita to rise over the 1990–98 period by more than 40%. In each case, there is an interaction between privatization and competition that shows that competition makes privatization more effective in instilling efficiency.

In the United States, partial deregulation of telecommunications has led to significant benefits to consumers. The break-up of the nationwide AT&T phone monop-

of individual airports, however, indicates that the Herfindahl-Hirschman Index (HHI) at the top 100 airports was lower, on average, in 1989 than in the late 1970s.[47] Although concentration at hub airports did increase, concentration at nonhub airports declined so that on average, concentration at individual airports fell.[48] This finding is similar to Morrison and Winston's (1990) finding that the number of effective competitors on individual routes rose by about 30 percent between 1978 and 1988. Bailey and Williams (1988) show that in certain local markets, one or a few airlines have virtual monopolies. Bailey, Graham, and Kaplan (1985) and Hurdle et al. (1989) conclude that city pairs are not generally perfectly contestable (price is above marginal cost), so that high concentration on some routes does lead to higher fares.

Deregulation also led to greater efficiency, which helped lower prices (Sickles et al. 1986). A comparison of U.S. airlines to those in other countries also reveals a substan-

[47]Borenstein (1989, 1990) and Berry (1990) show that average price rises with airport concentration. Bamberger and Carlton (1993) show that average price rises as an airline adds more of its own feeder traffic on a route. Call and Keeler (1985) and Moore (1986) show that entry lowers prices.
[48]Based on a tabulation of originating passengers; see Bamberger and Carlton (2003).

oly in 1984 spurred the creation of competition in long-distance telephony. AT&T's share of long-distance calls, which exceeded 90% in 1984, fell to 65% by 1990 and to 38% by 2000. Corresponding to improvements in technology and to increased competition from rivals such as MCI and Sprint, average long-distance rates fell from 55 cents per minute in 1984 to 27 cents per minute in 1990 and to 12 cents per minute in 2000. The 1996 Telecommunications Act attempted to create competition in local telephony by requiring the incumbent local phone providers to make some of their facilities available to rivals. As of December 2002, the share of local lines handled by nonincumbent phone providers (called Competitive Local Exchange Carriers, or CLECs) was 13.2%, of which only about 3% was provided by CLECs using their own equipment.

Competition from wireless providers of phone services has deepened competitive pressures on both local and long-distance rates. Roughly half of the U.S. population have cell phones. Moreover, the Internet holds out the possibility of providing competition using the Voice Over Internet Protocol (VOIP), and cable can now provide phone service. Thus an industry that once was a monopoly that provided local and long-distance phone service over traditional phone lines is rapidly becoming an industry with many players using a variety of rapidly developing technologies to provide consumers with local and long-distance phone service. In such an industry, regulation can distort or delay the introduction of new technologies, to consumers' detriment. According to one estimate, the FCC's delay in authorizing cellular service in the 1990s imposed annual costs of about $34 billion (in $1994) over a 10-year period.

Sources: Statistics of the Long Distance Telecommunications Industry, FCC May 2003; *CTIA Wireless Industry Indices*, April 2003; *FCC Trends in Telephone Service*, May 2002; Hausman (1997b); Li and Xu (2002).

tial increase in efficiency from deregulation (Caves et al. 1987). In the postregulation period, the rate of growth in productive efficiency for U.S. airlines was at least as high as before deregulation, whereas the rate of growth for airlines in other countries declined by nearly 40 percent. Assuming the United States would have had the same experience as in other countries had deregulation not occurred, deregulation lowered U.S. airline unit costs by 10 percent by 1983, a saving of over $4 billion.

A full continuum of price/quality choices is now offered (Bailey and Williams 1988). In particular, in contrast to the regulated period, low-price, low-quality service is now offered. Improved service is also available for higher fares (Moore 1986). Overall, however, service has declined—there are greater travel delays, longer travel times, and more lost luggage. Many, if not most, of these problems stem from greater congestion in hub cities and relatively fewer air traffic controllers, due to lack of action by Congress and the Department of Transportation (Moses and Savage 1987). Not only do price and quality now vary more, but there appears to be more price discrimination (Borenstein and Rose 1989).

There are now more types of fares, and they change more frequently. Under regulation, there were relatively few rates, which changed infrequently. In the old days, the

Airline Tariff Publishing Co., a cooperative venture owned by the airlines to process changes in ticket prices, considered 25,000 daily fare changes a large number. By 1988, 40,000 to 60,000 changes were not unusual, and in one week, nearly 600,000 were processed.[49]

Despite the congestion, especially at hub airports, the failure to provide traffic controller support at the level of the previous era, and the failure to increase the number of Federal Aviation Administration (FAA) inspectors, the long-term trend in improvement in airline safety continued after deregulation.[50] During the 1972–78 period, there were 2.35 accidents per 100,000 flight hours, whereas from 1979–86, there were 1.73 per 100,000 hours (Weidenbaum 1987). However, Rose (1989), using a statistical study that controls for a number of factors, finds that lower profitability is correlated with higher accident and incident rates, particularly for smaller carriers. Thus, the safety record after deregulation may become uneven across airlines as variability in profitability increases. In contrast, Kanafani and Keeler's (1989) statistical analysis shows no difference between the safety of new entrants and established carriers. McKenzie and Womer (1991) find, if anything, that safety increased marginally after deregulation.

Overall, consumers have benefited significantly from airline deregulation. Consumers fly more at lower prices on aircraft that apparently are as safe as during the regulated period.

However, concerns about competition among airlines continues. In 1998, the U.S. Department of Transportation (DOT) released a study showing that the number of city-pair markets where at least two airlines compete for passengers declined by 28 percent since 1992. According to this study, the cost of a one-way ticket for travel under 500 miles is on average $165 at airports without competition and $75 at airports with competition. In 1999, the Department of Transportation and the Department of Justice investigated the possibility of predatory actions by established carriers aimed at entrants, and the Department of Justice unsuccessfully sued American Airlines for predation (140 F. Supp. 2d 1141(2001)).

International airline competition is more regulated than domestic airline competition. By the early 1990s, talks were underway between nations on international deregulation.[51] See Example 20.9 on European airline deregulation.

Ground Transportation

The 1887 Act to Regulate Commerce created the Interstate Commerce Commission (ICC), an independent agency of the U.S. government. The ICC was the first regulatory commission in the United States. Over time, it was given jurisdiction over freight

[49]Martha M. Hamilton, "Airline Pricing: Highly Complex, Hotly Competitive," *Washington Post*, November 20, 1988:H1, H16.

[50]Although the number of flights has significantly increased since deregulation, the number of FAA inspectors has increased by only 2, according to the FAA (cited in Lapham, Pollan, and Etheridge 1987).

[51]Andrea Rothman, Seth Payne, and Paula Dwyer, "One World, One Giant Airline Market?" *Business Week*, October 5, 1992:56–57.

EXAMPLE 20.9

European Deregulation of Airlines

Europe trailed the United States in deregulating airlines. In 1992, the European Union lifted most restrictions on the routes airlines could fly within Europe and what they could charge. The European Community agreed to allow unrestricted competition throughout the community starting on April 1, 1997. With the end of regulation, a few low-price, no-frills airline services became available in Europe for the first time. Entrants included Debonair and Easy Jet in the United Kingdom, Denim Air in Holland, Air Liberte and Air Jet in France, Virgin Express in Belgium, and Air One and Azzurra Air in Italy. However, many carriers, such as Air France, remain state owned and are just starting to cut their operating costs. They survive due to government subsidies: Iberia received $705 million from the Spanish Government in 1995 and Air France received $4 billion.

High landing fees (which make up 5 to 10 percent of airline costs) and limits on landing slots help restrict further entry. As a result, fares remained very high relative to those in the United States.

One study by American Express found that fares within Europe are roughly twice as high as those for comparable distances in the United States. For example, the Washington to New York route is 216 miles, while London to Paris is 211 miles, yet a one-way trip over the European route costs over a third more. More striking, a flight from Copenhagen to Oslo (311 miles) costs 3.3 times as much as one between Houston and New Orleans (302 miles). It remains to be seen how long it will take for Europe to benefit from deregulation in the form of lower prices.

Sources: "Why Heathrow Is Hell," *The Economist*, 336(7929) August 26, 1995:47–48; Dirk Beveridge, "'No Frills' Airline Service Finally Gets to Land in Europe," *San Francisco Chronicle*, March 3, 1995:D2; Richard W. Stevenson, "Still Worlds Apart on Air Fares," *New York Times*, December 20, 1995:C1, C2; John Tagliabue, "American Aces of the Foreign Sky," *New York Times*, June 6, 1997:C1, C2.

service transportation, now including railroads, trucking companies, bus lines, freight forwarders, water carriers, oil pipelines, transportation brokers, express agencies, telegraph, telephone, wireless, and cable companies.

The Transportation Act of 1920 gave the ICC the power to fix rates that would yield "a fair return upon the aggregate value of the railway property of the country." The ICC's price regulations led to more uniform pricing by railroads and essentially eliminated price wars. The ICC also had power to approve or block mergers. Indeed, it was supposed to plan the consolidation of railroads into a small number of integrated systems. The Motor Carriers Act of 1935 gave the ICC control over pricing and entry into the bus and trucking industries. The licenses required to operate were valuable, indicating significant restraints on entry. The ICC-certified general freight carriers could discuss and agree on rates, which were then presented to the ICC for approval (Moses and Savage 1987). As a result, firms competed on quality. There was also substantial cross-subsidization. The Motor Carrier Act of 1980 (trucking) and the

Staggers Act of 1980 (railroads) continued the movement toward deregulation of surface transport, which began in the late 1970s.

Trucking. Trucking deregulation led to entry, improved safety, greater efficiency, a drop in union drivers' wages, and lowered trucking rates. Keeler (1989) finds that deregulating trucking allows efficient firms to expand, where previously their routes were limited. As a result, efficient firms now expand to optimal size, taking advantage of economies of scale. The largest firms (those with over 5% of the market) increased their collective share of the market from 11.6% to 20.8% of the market from 1980 to 1984.

Keeler (1989) calculates that deregulation reduced trucking rates from the start and that the effect grew stronger over time, presumably as entry occurred and firms became more efficient, so that rates were ultimately reduced by 22% from what they would have been with regulation. In related research, Ying and Keeler (1991) estimate that deregulation cut rates 22% by 1983.

Boyer (1987) does not find a statistically significant effect on real trucking rates. He finds, though, that deregulation's effect on shares of freight (over rail, for-hire motor carrier, and other surface modes) was statistically significant. In the first four years of deregulation, the for-hire motor carrier industry gained 5.6 points and the private (unregulated) carriers lost 7.1 points (Boyer 1987, 412–14).

Rose (1987) shows that, before deregulation, union drivers captured up to 75% of total industry rents (profits in excess of the usual rate of return), but nonunion drivers did not capture a significant share of regulatory rents. After deregulation, there were substantial reductions in union wages. The union markup over nonunion wages fell from 50% to less than 30%, implying that union workers lost, in aggregate, between $950 million and $1.6 billion. The individual union driver's compensation fell by between 10% and 20% of what it would have been if the 50% wage differential had been maintained.

Safety improved under deregulation (Moses and Savage 1987). Adjusting for changes in the quality of goods carried, an accidents index fell substantially from 100 in 1978 to 69 in 1985. An index of auto fatalities in truck-related accidents per mile of automobile usage also fell by 21% from 1978 to 1985. These reductions occurred despite the higher accident record of new firms. New firms in 1985 had 0.246 accidents per million miles, whereas firms established in 1980–81 had an accident rate of 0.167 in 1985.

Deregulation by states trailed federal action. For example, prior to 1990, it cost $123 to send a ton load from Reno to San Francisco, but $136 (11 percent more) to send it across the bridge from Oakland to San Francisco. In 1990, the California Public Utilities Commission relaxed its hold on rates, allowing truckload shipping costs to fall 10%. Still, 20 other states maintained controls, which, according to studies prepared for the U.S. Department of Transportation, cost between $3 billion and $8 billion a year. A federal law ended state regulation of trucking in 1994.

Railroads. Deregulation of the railroads started with the Railroad Revitalization and Regulatory Reform Act of 1976 (4-R Act), which called for more competition and cost-based rate setting. The Staggers Rail Act of 1980 further deregulated the industry, giving firms substantial freedom to set rates. In combination with administrative actions by the ICC, this legislation gives railroads virtually unlimited rights to lower rates, and companies that are not "market dominant" can raise them. In practice, the

ICC only exercises rate-setting powers over certain bulk commodities where railroads are not subject to truck competition. Trucking competition is taken as evidence that railroads are not dominant in a market (Boyer 1987).

Lee, Baumel, and Harris (1987) show a statistically significant decrease in the rate per ton-mile for Class I (large) railroads of 18% during the 4-R years and 23% in the first four years after the Staggers Act.[52] By 1990, the rates for transporting all types of commodities (except primary forest products) fell up to 34% from the 1980 levels (Friedlaender et al. 1992).

Because more than one-third of total railroad costs are fixed (including tracks, rights-of-way, and locomotive power), railroad lines are often natural monopolies (Willig and Baumol 1987, 29). If, during regulation, prices had been set equal to marginal costs, railroads would have suffered losses. Willig and Baumol (1987, 30–31) argue that the ICC "undermined competition through protectionist rules, froze rail business into inefficient and outdated patterns, interfered with and delayed private decisions, and, ironically, virtually precluded the financial viability of railroads. . . . The commission protected rival transport modes from price competition by setting inflated floors below which individual rates were not permitted to fall. . . . The railroads were generally unable to abandon services—even services with such limited demand that there was no prospect of profitable operation."

Thus, many of the gains from deregulation are likely to come from letting more efficient firms expand, by allowing firms to abandon unused track, and by eliminating cross subsidization. The studies to date typically find that deregulation had modest to large positive efficiency effects. Boyer (1987) calculates gains of at most $93 million, whereas Barnekov and Kleit (1988) estimate that deregulation created billions of dollars worth of efficiency gains. Stansell and Hollas (1988) also find a significant drop in industry costs in the postregulation period. Lee et al. (1987) find that operating expenses per ton-mile fell by 17% during the 4-R years and 29% during the first four years of the Staggers Act. McFarland (1989) concludes that the annual rate of growth in labor productivity increased by about 0.9% annually after deregulation. Deregulation also had dramatic effects on the mode of transit used (Boyer 1987). Unlike trucking, where labor earnings for union workers fell sharply after deregulation, Peoples (1998) finds little effect on wages in railroads.

Deregulation decreased rail's share (compared to that of motor vehicles) by 5.2 points during the first four years of deregulation. After a decade of deregulation, the number of Class I railroads fell from 37 to 14, rail employment fell 52%, and rail route mileage dropped 29% (Friedlaender et al. 1992).

The chief fear about deregulating railroads was that monopoly prices would be charged, at least in some markets. Although the 1980 Staggers Rail Act allows higher rates in less competitive markets as long as they are "reasonable," some carriers may be charging monopolistic rates. (In a natural monopoly, even monopoly prices may not generate supracompetitive rates of return.) For example, an Interior Department study finds that rates charged utility buyers by the one railroad serving much of the Wyoming and Montana coal fields were "monopolistic"—a charge denied by the

[52] See Boyer (1987) for an alternative view.

railroad. Yet when a competitor ran a spur line to one section, rates there fell by 20%.[53]

One test of whether railroads earn monopoly profits is to compare the ratio of a railroad's market value to the replacement cost of its assets, a measure called Tobin's q (Chapter 8), to that of other nonfinancial firms (McFarland 1987). This test finds that railroads do not earn supracompetitive profits, and that their Tobin's q is lower than for other nonfinancial firms. Rates of return remained low during the first decade of deregulation (Friedlaender et al. 1992).

In summary, deregulation has changed the trucking and railroad industries. Deregulation has eliminated many of the harms resulting from previous regulation and has resulted in more efficient and lower-price industries.

SUMMARY

How many economists does it take to screw in a light bulb?
Economist: None, the market will do it.
Consumer Advocate: None, the regulators will do it.

Optimal regulation, if feasible, can eliminate market inefficiencies and increase welfare. Nonetheless, due to problems of limited information, uncertainty, sustainability, human frailties, and institutional weakness, regulators often apply regulations badly or use regulations that create harmful distortions in order to help special-interest groups. It is difficult to find an example of optimal regulation, although there are many examples of markets in which nonoptimal regulations help.

Particularly disturbing are regulations that convert efficient, competitive markets into inefficient monopolistic markets. In some extreme examples, the regulations appear designed to redistribute wealth from consumers to special-interest groups that have successfully pressured or captured legislators or regulators. In some of these examples, such as agriculture, the social losses are enormous.

The recent trend toward deregulation is an attempt to remove particularly harmful regulations and "let markets work." In recent years, regulators and legislators who recognized these harms have improved or eliminated regulations in several markets. As a result, in many, if not most, of these markets, consumers gained on average as prices fell, output increased, cross-subsidization ended, the rate of entry increased, and production efficiency increased.

PROBLEMS

1. States may 'regulate' firms within their state. By doing so, they can enable firms in their state to form a cartel that sells to consumers in the other states. What is the consequence if states do that?

[53] Chris Welles with Seth Payne, France Seghers, and Tom Ichniowksi, "Is Deregulation Working?" *Business Week*, December 22, 1986:50–55.

2. Why do so many industries have protections from entry if such protections harm consumers?
3. A government providing an agricultural price support may impose an acreage quota on farmers. What effect would an acreage quota have on the supply curve and on the government's expenses?
4. Which of the following two agricultural policies will cost the government (taxpayers) more? (a) A program with price supported at $p_s (> p_c$, the competitive price) and with a quota equal to the competitive output level, Q_c. (b) A target price program in which farmers sell Q_c units at the competitive price, p_c, and the government gives them a subsidy equal to $(p_s - p_c)Q_c$. [*Note:* The elasticity of demand for most agricultural goods is inelastic.]
5. Suggest an alternative agricultural policy that eliminates the inefficiencies in price-support or quota programs and yet transfers an equivalent amount of income to farmers. Why is your program better?
6. Several years ago, MCI started competing with Bell Telephone by offering lower rates on long-distance calls. Many people thought that Bell's long-distance service was a natural monopoly. Nonetheless, MCI may have been able to cover its costs. Is that possible? Should MCI's entry have been encouraged or prohibited by regulators? Why or why not? (When MCI started, it only provided service to a limited number of areas. Although MCI's pricing was not constrained, Bell was required to use distance-based pricing.)
7. Under rate-of-return regulation, a firm that earns too high a rate of return must give some of it back to ratepayers, but a firm that fails to earn the target rate of return bears the shortfall itself. Explain how this asymmetry affects a firm's incentive to innovate. Is rate-of-return regulation more or less appropriate for an industry undergoing technological change?
8. Compute an example of the effects of rate-of-return regulation (similar to Table 20.3) where the production function is Leontief: $Q = \min(L, K)$ and labor and capital cost are the same. (This production function implies that efficient production involves equal amounts of labor and capital. It takes 1 unit of each to produce 1 unit of output, and 2 units of each to produce 2 units of output.) What effect does rate-of-return regulation have on output, profits, consumer surplus, and capital/labor ratio? [*Note:* This question can be answered without using mathematical analysis or calculating a table.]

Answers to odd-numbered problems are given at the back of the book.

SUGGESTED READINGS

This chapter only scratches the surface of the economics of regulation. Viscusi, Vernon, and Harrington (2000) is a good undergraduate text, and Spulber (1989) is a good graduate text. Joskow and Rose (1989), Peltzman (1989), Winston (1993), and Viscusi (1996) provide clear discussions of the effects of economic regulation and deregulation. Joskow (2000b) is a collection of classic articles on regulation and its reform. Peltzman and Winston (2000) contains recent studies of the deregulation of the airline, railroad, telecommunications, and electric power industries in the United States. Economides (1999) analyzes the impact of the 1996 Telecommunications Act. MacAvoy (2000) discusses the regulation and deregulation of natural gas. Gonenc and Nicoletti (2000) and Williams (2002) discuss international airline deregulation. Cummins (2002) contains a collection of articles on deregulation in the property-liability insurance industry. Braeutigam (1989) discusses the regulation of natural monopoly. Laffont and Tirole (1993) provides an advanced theoretical treatment of incentives under regulation.

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Glossary

adjustment costs: the expenses associated with changing the combination of inputs used in production.

administered prices: prices are under the control of firms and not subject to the laws of supply and demand.

adverse selection: only consumers with the least desirable characteristics, which are unobservable to the firm, buy the firm's product. For example, only the worst risks buy an insurance policy.

amortized: costs are allocated over the useful life of a machine.

antitrust laws: statutes that limit the market power exercised by firms and control how firms compete with each other.

asymmetric information: one party to a transaction knows a material fact the other party does not know.

average cost (AC, average total cost, ATC): total cost divided by output: $ATC = C(q)/q$.

average fixed cost (AFC): fixed cost divided by output: $AFC = F/q$.

average variable cost (AVC): variable cost divided by output: $AVC = VC(q)/q$.

avoidable costs: expenses, including fixed costs, that are not incurred if operations cease.

barrier to entry: anything that prevents an entrepreneur from instantaneously creating a new firm in a market (see long-run barrier to entry).

best-response (reaction) function: the relationship between the best (highest profit) action by a firm and the action taken by its rival.

bond covenants: restrictions imposed by bond holders on a corporation's operations, such as choices of investment projects or further financing.

bounded rationality: people's limited ability to enumerate and understand all future possibilities.

break the equilibrium: firms benefit from deviating from a proposed equilibrium, so it is not an equilibrium.

bundling: two or more goods are sold only in fixed proportions.

capital asset: something (such as a machine, building, or reputation) that lasts for many periods and that provides a service in each period.

capital costs: the total rental fees if all the capital assets were rented.

capture theory: an industry "captures" (persuades, bribes, or threatens) the regulators, so that the regulators do what the industry wants (see *interest-group theory*).

cartel: an association of firms that explicitly agree to coordinate their activities, typically to maximize joint profits (*cooperative oligopoly*).

certification: an assurance that a particular product has been found to meet or exceed a given standard.

characteristic space: there is an axis showing the amount of each characteristic or attribute. Each brand and each consumer's preferred product can be located in this space according to its characteristics.

Coase Conjecture: a durable goods monopolist that sells its product has less market power—indeed, in the extreme case, no market power—when compared to a monopoly that rents the durable good.

competition: a market has many potential buyers and sellers and has no entry or exit barriers.

concentrated: an industry is said to be concentrated if a few firms make most of the sales.

conduct: behavior of firms (or other economic actors).

conglomerate merger: firms in unrelated businesses combine.

conscious parallelism (*tacit collusion*): the coordinated actions of firms in an oligopoly despite the lack of an explicit cartel agreement.

constant returns to scale: average costs do not vary with output.

consumer surplus: the amount above the price paid that a consumer would willingly spend, if necessary, to consume the units purchased.

contestable: a market is contestable if there is free entry and exit.

contribution: payments to a guilty defendant from other culpable parties.

cooperative oligopoly: a small group of firms (an oligopoly) that coordinate their actions to maximize joint profits (act like a *cartel*).

cooperative strategic behavior: actions that make it easier for firms in an industry to coordinate their actions and to limit their competitive responses.

copyright: an exclusive right granted a creator to produce, publish, or sell an artistic, dramatic, literary, or musical work.

corporations: companies whose capital is divided into shares that are held by individuals who have only limited responsibility for the debts of the company.

credible strategies: those sets of actions by a firm that are in the firm's best interest.

credible threat: a firm's strategy that its rivals believe is rational in the sense that it is in the firm's best interest to continue to employ it.

cross-elasticity of demand: the percentage change in quantity demanded in response to a 1 percent change in another product's price.

deadweight loss (*DWL*): the cost to society of a market that does not operate optimally.

decreasing returns to scale (*diseconomies of scale*): average cost rises with output.

delivered pricing: the total delivered price (inclusive of freight) that a buyer must pay is a function of the buyer's distance from a specific location (a basing point) but not from the seller's location.

depreciation: the decline in the value of an asset during the year.

discriminatory dumping: a firm charges a lower price in a foreign market than in the domestic market so as to *price discriminate.*

diseconomies of scale (*decreasing returns to scale*): average cost rises with output.

dominant firm: a price-setting firm that faces smaller, price-taking firms.

dominant strategy: a strategy that leads to as high or higher a payoff as any other regardless of the strategy chosen by a rival firm.

downstream firms: firms that produce the final good.

dumping: a firm sells its product abroad at a price below its domestic price or below its costs.

durable goods: goods that last for several time periods.

Dutch auction: an auction in which the price starts out very high and is slowly lowered until one person agrees to buy at that price.

dynamic limit pricing: a firm sets its prices (or quantities) over time so as to reduce or eliminate the incentives of rivals to enter a market.

economies of scale (*increasing returns to scale*): average cost falls as output increases.

economies of scope: it is less costly for one firm to perform two activities than for two specialized firms to perform them separately.

efficient production: given the inputs used, no more output could be produced with existing technology.

elastic: a demand (supply) curve is elastic if a 1 percent increase in price reduces (increases) the quantity demanded (supplied) by more than 1 percent (the absolute value of the elasticity of demand is greater than 1).

elasticity of demand: the percentage change in quantity demanded in response to a 1 percent change in price.

elasticity of supply: the percentage change in quantity supplied in response to a 1 percent change in price.

English auction: an auction in which bids start low and rise until there is no one willing to bid any higher.

entry condition: firms enter the market when profits are positive and exit when profits are negative.

essential facilities: scarce resources that a competitor needs to use to survive.

exchange rate: the price of one currency in terms of another currency.

exclusionary actions: what a firm does to eliminate rivals from a market or harm them, thereby either helping to maintain or create a monopoly.

exclusive dealing: a manufacturer forbids its distributors to sell the products of competing manufacturers.

exclusive territory: a single distributor is the only one that can sell a product within a particular region.

expensed: costs that are counted as they are incurred.

experience qualities: a product has these qualities if a customer must consume the product to determine its quality.

extensive-form representation of a game: a decision tree of the order in which firms make their moves, each firm's strategy at the time of its move, and the payoffs.

externality: the direct effect on the well-being of a consumer or the production capability of a firm from the actions of other consumers or firms.

fighting brand: a product that a firm sells at a low price and whose availability is limited to those areas and products where a rival is successful.

firm: an organization that transforms inputs (resources it purchases) into outputs (valued products that it sells).

firm's supply curve: the quantity that a competitive firm is willing to supply at any given price (the *MC* curve above minimum *AVC*).

first-best optimum: the unconstrained maximum (typically a solution that maximizes welfare).

first-degree price discrimination (*perfect price discrimination*): a monopoly is able to charge the maximum each consumer is willing to pay for each unit of the product.

first-mover advantage: the first firm to enter incurs lower costs (such as marketing) because it faces no rivals.

fixed costs (*F*): expenses that do not vary with the level of output.

fixed-proportions production function: inputs are always used in a particular proportion.

FOB pricing: the buyer pays a free-on-board (FOB) price, where the seller loads the good onto the transport carrier at no cost to the buyer, plus the actual freight.

franchise: the right to sell a product or use a brand name.

franchise bidding: a government or other franchisor sells the right to a monopoly or other franchise to the highest bidder.

free riding: when one agent (firm) benefits from the actions of another without paying for it.

fringe: a group of small price-taking firms in a market with a dominant firm.

game: any competition in which strategies are used.

game of imperfect information: a firm must choose an action without observing the simultaneous (or earlier) move of its rivals.

game theory: formal models are used to analyze conflict and cooperation between players.

going private: the managers buy ownership of a corporation.

greenmail: management buys back the shares of someone engaged in a hostile takeover attempt at a premium.

Herfindahl-Hirschman Index (*HHI*): the sum of the squared market shares of each firm in the industry.

heterogeneous or **differentiated** goods: related products that are viewed by consumers as imperfect substitutes.

homogeneous or **undifferentiated** goods: products that are viewed as identical by consumers.

horizontal merger: firms that compete within the same industry combine.

hostile takeover: a change in the ownership of a corporation despite opposition by the original managers or owners.

increasing returns to scale (*economies of scale*): average cost falls as output increases.

industrial organization: the study of the structure of firms and markets and of their interactions.

inelastic: a demand (supply) curve is inelastic if a 1 percent increase in price reduces (increases) the quantity demanded (supplied) by less than 1 percent (the elasticity is less than 1 in absolute value).

informational advertising: promotional activity that describes a product's objective characteristics.

interest-group theory: firms, consumers, or other groups capture a regulatory body (see *capture theory*).

internalize the externality: force someone who is causing an externality to bear the full social costs (for example, force a firm to pay for the pollution it creates).

intertemporal substitution: delaying consumption or production to a later time.

joint venture: coordinated activities by more than one firm. A research joint venture is an R&D project financed and managed cooperatively by several firms.

junk bonds: high-yield bonds that are backed by a corporation's assets and that are considered riskier than typical corporate bonds.

learning by doing: costs fall with production because workers become more skilled at their jobs due to experience or because better ways of producing are discovered.

legal standing: the right to bring a suit.

Lerner Index of market power (*price-cost margin*): a measure of the markup of price over marginal cost: $(p - MC)/p$.

leveraged buyout (*LBO*): the funds to purchase a corporation are raised through bonds based on the corporation's assets.

license: a permit granted by a patent holder to another firm to produce the product or use the new process.

limited liability: if a corporation fails (is unable to pay its bills), the shareholders need not pay for the debt using their personal assets.

limit pricing: a firm sets its price and output so that there is not enough demand left for another firm to profitably enter the market.

location (*spatial*) **models:** monopolistic competition models in which consumers view each firm's product as having a particular location in geographic or product (characteristic) space.

long run: a sufficiently lengthy period of time such that all factors of production can be costlessly varied.

long-run barriers to entry: a cost that must be incurred by a new entrant that incumbents do not (or have not had to) bear.

marginal cost (*MC*): the increment, or addition, to cost that results from producing one more unit of output.

marginal outlay schedule: the marginal cost to a monopsony of buying additional units.

marginal revenue (*MR*): the extra revenues that a firm receives when it produces one more unit of the product.

market clearing: the equilibration of the quantities supplied and demanded.

market definition: the competing products and geographic area in which competition occurs that determines the price for a given product.

market environment: all factors that influence the market outcome (prices, quantities, profits, welfare), including the beliefs of customers and of rivals, the number of actual and potential rivals, the production technology of each firm, and the costs or speed with which a rival can enter the industry.

market failures: distortions or inefficient production due to improper pricing.

market power: the ability of a firm to set price profitably above competitive levels (marginal cost).

market supply curve: the horizontal sum of the supply curves of each firm.

meeting-competition clause: a provision in a supply contract that guarantees the buyer that if another firm offers a lower price, the seller will match it or release the buyer from the contract.

merger: a transaction in which the assets of one or more firms are combined in a new firm.

minimum efficient scale (*MES*): the size plant that can produce the smallest amount of output such that long-run average costs are minimized.

monopolistic competition: a market structure in which firms have *market power,* the ability to raise price profitably above marginal cost, yet they make zero economic profits.

monopoly: a single seller in a market.

monopsony: a single buyer in a market.

moral hazard: an individual has an incentive to take an action that is unobservable to a firm and is socially inefficient in response to the firm's offer. For example, an individual with fire insurance may be tempted to burn the insured building.

most-favored-nation clause: a sales contract provision that guarantees the buyer that the seller is not selling at a lower price to another buyer.

Nash equilibrium: holding the strategies of all other firms constant, no firm can obtain a higher payoff (profit) by choosing a different strategy.

natural monopoly: a situation where total production costs would rise if two or more firms produced instead of just one firm.

negative externality: a bad that is not priced (such as pollution).

noncooperative oligopoly: a small number of firms acting independently but aware of one another's existence.

noncooperative strategic behavior: actions of a firm that is trying to maximize its profits by improving its position relative to its rivals.

nonlinear pricing: when a consumer's total expenditure on an item does not rise linearly (proportionately) with the amount purchased.

nonuniform pricing: charging different customers different prices for the same product or charging a single customer a price that varies depending on how many units the customer buys.

normal-form representation of a game: a matrix that shows all the strategies available to each player (who must choose actions simultaneously) and the payoffs to each player for each combination of strategies.

normal profit: best possible profit from an alternative use of the resource.

oligopoly: the only sellers in a market are a small number of firms and they face no threat of entry.

opportunistic behavior: taking advantage of another when allowed by circumstances.

opportunity cost: the value of the best foregone alternative use of the resources employed.

package tie-in sale: two or more goods are sold only in fixed proportions.

patent: an exclusive right granted an inventor to a new and useful product, process, substance, or design.

patent race: several firms compete to be the first to make the discovery and be granted a patent.

payoff: the reward (such as profits) received at the end of a game.

perfect competition: a market outcome in which all firms produce homogeneous, perfectly divisible output and face no barriers to entry or exit; producers and consumers have full information, incur no transaction costs, and are price takers; and there are no externalities.

perfect Nash equilibrium: a Nash equilibrium in which strategies (threats) are credible (see *subgame perfect Nash equilibrium*).

perfect price discrimination (*first-degree price discrimination*): a monopoly is able to charge the maximum each consumer is willing to pay for each unit of the product.

performance: the success of a market in producing benefits for society.

per se violation: an action that, by itself, is illegal.

persuasive advertising: promotional activities designed to shift consumers' tastes.

planned obsolescence: purposely making a durable good short-lived.

players: strategic decision makers in game theory, such as oligopolistic firms.

poison pill: if a successful hostile takeover occurs, the corporation must make available stock at bargain prices to original shareholders (but not to someone who takes over the firm).

positive externality: an uncompensated action that benefits others.

predatory dumping: a firm sets an extremely low price in a foreign country so as to predate against that country's firms (*predatory pricing*).

predatory pricing: a firm first lowers its price in order to drive rivals out of business and scare off potential entrants and then raises its price when its rivals exit the market (in most definitions, the firm lowers price below some measure of cost).

price controls: limits on how high firms may set prices.

price-cost margin: a measure of the markup of price over marginal cost: $(p - MC)/p$ (see *Lerner Index*).

price discrimination: nonuniform pricing in which a firm charges different categories of customers different unit prices for the identical good or charges each consumer a nonuniform price on different units of the good.

price dispersion: stores charge different prices for the identical good.

price rigidity: prices do not vary in response to fluctuations in cost and demand.

price setter: a firm with *market power* that can profitably set its price above the competitive price.

price supports: a price level that prices are kept at or above by government purchases.

price taker: a firm that does not have the ability (*market power*) to set its price profitably above the competitive price.

principal-agent relationship: the principal (firm or individual) hires the agent (another firm or individual) to perform an action in a manner that the principal cannot fully control.

prisoners' dilemma game: firms have dominant strategies that lead to a payoff that is inferior to what they could achieve if they cooperated.

producer surplus: the largest amount that could be subtracted from a supplier's revenues and yet leave the supplier willing to produce the product.

produce-to-order: firms wait for orders and then produce.

produce-to-stock: firms produce first, hold inventories, and then sell the inventoried products.

product differentiation: related products that do not have identical characteristics so that consumers do not view them as perfect substitutes.

production possibility frontier (*PPF*): the feasible combinations of number of brands and quantity per brand that can be produced with society's total inputs (generally, the feasible outputs that can be produced efficiently).

production technology: the relationship between inputs and output reflecting the maximum possible output that can be produced from a given set of inputs.

property rights: exclusive rights to use some asset (goods or services).

public good: something useful which, if supplied to one person, can be made available to others at no extra cost.

quality discrimination: a firm offers consumers a choice of different quality products in order to effectively price discriminate.

quantity discounts: a firm's price varies with the number of units of the good that a customer buys so that the average price paid declines as the number of units purchased increases.

quantity forcing: a sales quota that a manufacturer places on the distributor; the distributor must sell a minimum number of units.

quasi-rents: payments above the minimum amount necessary to keep a firm operating in the short run.

quasi-vertical integration (or quasi-integration or partial vertical integration): where one firm owns a specific physical asset that one of its suppliers uses.

Ramsey pricing: regulated prices that maximize consumer welfare subject to the requirement that revenues cover costs.

rate of return: a measure of how much is earned per dollar of investment.

reciprocal dumping: firms in two (or more) countries dump in the other's country.

refinements: restrictions on the possible equilibria.

rent: a payment to the owner of an input beyond the minimum necessary to cause it to be used.

rent seeking: the expenditure of resources to attain a monopoly with its associated rent or profit.

replacement cost: the long-run cost of buying a comparable quality asset.

representative consumer model: a monopolistic competition model in which the typical consumer views all brands as equally good substitutes for each other; hence brands are treated symmetrically.

requirements tie-in sale: customers who purchase one product from a firm are required to make all their purchases of another product from that firm.

resale price maintenance: the manufacturer sets a minimum price that may be charged by retailers. (Some people also use this term to refer to the setting of a maximum price.)

residual demand: the demand curve facing a particular firm, which is market demand less the quantity supplied by rival firms at any given price.

risk-adjusted rate of return: the rate of return earned by competitive firms engaged in projects with the same level of risk as that of the firm under analysis.

royalty: a payment for the right (*license*) to produce the product or use the process of a patent holder.

rule of reason: the balancing of the pro- and anticompetitive effects of an action to determine its legality; that is, the action involved is not *per se* illegal (always illegal).

search qualities: a product has these qualities if a consumer can establish the product's quality prior to purchase by inspection.

second-best optimum: the best possible outcome subject to a constraint that violates one of the conditions for a first-best outcome.

self-selection constraint: a restriction on a firm's pricing structure such that consumers in any group do not prefer another group's two-part tariff schedule.

short run: a time period so brief that some factors of production cannot be costlessly varied.

shutdown point: the price at which a firm ceases operating.

spatial (*location*) **models:** monopolistic competition models in which consumers view each firm's product as having a particular location in geographic or product (characteristic) space.

specialized asset: a piece of capital that is tailor-made for one or a few specific buyers.

spurious product differentiation: consumers mistakenly believe that physically identical brands differ.

standard: a metric or scale for evaluating the quality of a particular product.

static analysis: models of markets that last for only one period.

strategic behavior: a set of actions a firm takes to influence the market environment so as to increase its profits.

strategy: a battle plan of the actions of a player.

structure: those factors that determine the competitiveness of a market.

subgame: a new game that starts in any period t and lasts to the end of the game.

subgame perfect Nash equilibrium (*perfect Nash equilibrium*): a *Nash equilibrium* in which the original strategies are Nash equilibria (best responses) in any *subgame.*

sunk cost: the portion of fixed costs that is not recoverable.

supergames: repeated games where players know their rivals' previous actions and condition their actions in each period on these previous actions.

sustainable: an equilibrium where a natural monopoly prices such that it covers its costs yet does not induce entry.

tacit collusion (*conscious parallelism*): the coordinated actions of firms in an oligopoly despite the lack of an explicit cartel agreement.

third-degree price discrimination: a firm charges consumers in different groups different unit prices.

tie-in sale: a customer may purchase one product only if another product is also purchased.

Tobin's *q*: the ratio of the market value of a firm (as measured by the market value of its outstanding stock and debt) to the replacement cost of the firm's assets.

total costs (C): the sum of all fixed and variable costs: $C = F + VC$.

trademark: words, symbols, or other marks used to distinguish a good or service provided by one firm from those provided by other firms.

transaction costs: the expenses of trading with others besides the price.

transfer prices: prices that are set not by the market but by a firm for internal use to allocate goods among its divisions.

treble damages: three times actual damages (awarded in antitrust cases).

trigger price: cartel members agree that if the market price drops below this price, each firm will expand its output.

two-part tariff: a firm charges a consumer a fee (the first tariff) for the right to buy as many units of the product as the consumer wants at a specified price (the second tariff).

unitary elasticity: a demand curve has unitary price elasticity if a 1 percent increase in price reduces the quantity demanded by 1 percent (the absolute value of its elasticity of demand is 1).

upstream firms: firms that supply the inputs in the production process.

variable costs (VC): expenses that change with the level of output.

variable-proportions production function: one input can be substituted for another to some degree.

vertical merger: a firm buys its supplier or vice versa.

vertical restrictions: binding contractual limitations on price, other terms, or behavior that one nonintegrated firm imposes upon another firm from which it buys or to which it sells.

vertically integrated: a firm that participates in more than one successive stage of the production or distribution of goods or services.

white knight: in order to prevent a hostile takeover, an individual or firm is invited to obtain control of a corporation by its managers with the understanding that the new owner will leave current management in place.

Answers to Odd-Numbered Problems

I was gratified to be able to answer promptly.
I said I don't know. —*Mark Twain*

Chapter 2

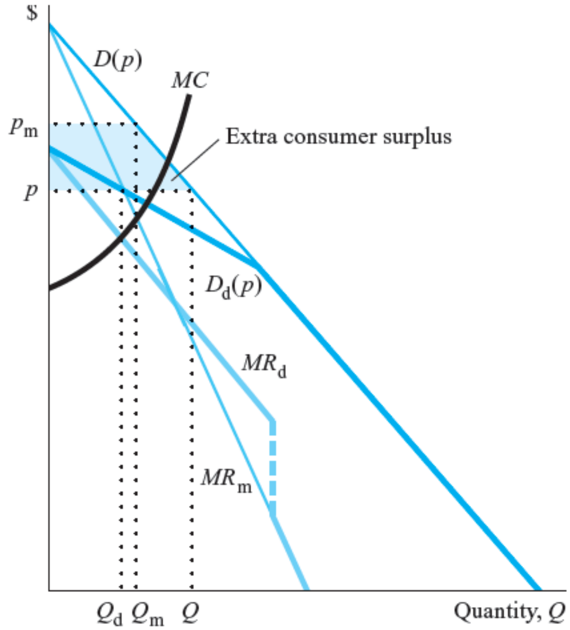
1. The opportunity cost of each pipe is the current market price at which each pipe can be sold. In this case, \$9 is the opportunity cost of each pipe. The sunk cost of each pipe is its original purchase price minus its current market price or \$10 − \$9 = \$1.
3. Transaction costs are likely to be relatively high in (a), (b), and (c). In these three cases, there is likely to be only one firm.
5. No. Even if all costs are fixed, marginal cost need not be zero. For example, if a firm is operating at full capacity and is unable to produce more output, its marginal costs are effectively infinitely large (at no finite cost can an extra unit of output be produced).
7. The marginal cost of an extra car is 70. Producing 100 cars and 200 trucks in the same plant costs \$33,000 (10,000 + (70 × 100) + (80 × 200)). Producing them in two separate plants costs \$17,000 for cars and \$26,000 for trucks. Thus, the savings from jointly producing them is \$10,000 (the extra fixed cost). The measure of scope economies is 10,000/33,000 or about 0.3.
9. If all plants are in the same area, they face similar costs. If the industry is in equilibrium, then a wide range of plant sizes indicates that the *AC* curve has a flat section over a wide range of output. If plants are located in different countries, they are likely to face different costs, so that all one can conclude is that the efficient-scale plant may vary considerably depending on cost conditions.

Chapter 3

1. When p is 30, $Q = 60 - 30 = 30$. The consumer surplus is the area below the demand curve and above $p = 30$. This area represents a triangle with base $Q = 30$, and height = the difference between the maximum p and $p = 30$. The maximum p is the price when Q is zero. The consumer surplus = $1/2 \times 30 \times (60 - 30) = 450$.
3. a. The supply curve is horizontal at $p = \$10$. The supply and demand curves intersect at $p = \$10$, $Q = 990$.
   b. If the one firm with a fixed capacity of 10 enters, that firm's entry leaves unchanged the supply curve beyond 10 units. Supply and demand intersect at the same p and Q as in (a).
   c. Positive economic profits for some firms are not inconsistent with long-run competitive equilibrium. The new firm in (b) earns a profit of \$10.
   d. The marginal cost of the last unit supplied is \$10. If demand expands or contracts, the firms with \$10 marginal costs vary their output.
   e. The less efficient firms earn 0.
   f. Yes. Otherwise additional entry or exit would occur.
5. When there are no shutdown costs, the *AC* curve coincides with the *AVC* curve, and the shutdown point becomes the minimum point of the *AC* curve.

Chapter 4

1. No, the profit will remain the same irrespective of which is chosen. A monopoly can choose either price or quantity because the price corresponding to each quantity is derived from the consumer demand curve and vice-versa.
3. Because $Q = 5/p$, $dQ/dp = -5/p^2$, and the elasticity, $(dQ/dp)(p/Q)$, is $(-5/p^2)[p/(5/p)] = -1$. Total revenue equals pQ, which always equals 5. Because revenue always equals \$5, the monopoly maximizes its profit where its total costs are as low as possible. That is, the monopoly should produce as little as possible, one unit, to maximize its profit at \$4.
5. Under competition, all 5 units are always sold, so that the supply curve is vertical at $Q = 5$. Supply equals demand at $Q = 5$, $p = 5$. The monopoly maximizes its profit. If it sells fewer than 5 units, its profit falls because its marginal revenue is positive if output is less than 5 (and hence above its marginal cost). If the monopoly sells 5 units, price equals 5. Hence, monopoly and competition produce identical results.



7. In the figure, the dominant firm sells Q_d, whereas the monopoly sells Q_m. Because the monopoly could have sold Q_d and chose not to, it must make higher profits at Q_m. The monopoly's costs to produce the extra output are the area under the MC curve between Q_d and Q_m. Its extra revenues are the area under the marginal revenue curve, MR_m, between Q_d and Q_m. Thus, by producing Q_m instead of Q_d, its profit increases by the area between the MR_m and the MC curve between Q_d and Q_m. On the first Q_d units, the monopoly's costs are the same as the dominant firm's (by assumption), and it receives a higher price, p_m instead of p. Thus, the monopoly makes more on the first Q_d units as well, and hence must make higher profits overall. The figure shows the consumers' gain.
9. In the figure in the answer to Problem 4.7 above, if the MC curve crosses the MR_d and the MR_m curves below the point where the marginal revenue curves cross, a dominant firm produces more than does a monopoly.

Chapter 5

1. In the diagram, cartel output is restricted to Q_m and as a result price is p_M. If there are "n" identical firms in the cartel, each firm will produce $q_M = Q_M/n$ output. However, an individual firm can maximize profits at p_M by producing q_0 units of output i.e. where $MC = p_M$. Therefore, this firm will overproduce even if it drives down the price of the product.
3. Your graph should show that as the demand curve becomes flatter at a given point (that is, its elasticity increases), the cartel's residual demand curve also becomes flatter. As a result, the intersection of MC and residual MR occurs at a lower quantity and a lower price.
5. Because noncartel members produce more than cartel members, shifting one of the n firms from the cartel to the noncartel group increases output, all else the same. Increasing the number of noncartel firms, j, causes the cartel's quantity to fall, as we show by differentiating Equation 5A.11:

$$\frac{dQ_m}{dj} = -\frac{(a - bd)(be + n)}{(be + 2n - j)^2} < 0.$$

This derivative is negative because $(a - bd)$ is positive (were it not, Q_m would be negative). Total output, Q, is the sum of the fringe supply, $j(p - d)/e$, and Q_m (Equation 5A.11). After substituting for p from Equation 5A.1 and rearranging terms:

$$Q = (nbe + 2nj - j^2)(a - bd)/D,$$

where $D = (be + 2n - j)(be + j)$. Differentiating this expression for Q with respect to j, we obtain

$$\frac{dQ}{dj} = \frac{2(n - j)(b^2e^2 + nbe)(a - bd)}{D^2} > 0.$$

Because total output increases, price must fall.

Chapter 6

1. In the Cournot model, each firm's production function treats its rival's output as a parameter. If there are positive fixed costs, the profit earned by each firm in what would be the equilibrium without fixed costs may be insufficient to cover those costs. Therefore, no equilibrium may exist for some parameter values. .
3. It pays for both firms to cooperate and charge the high price. Neither firm has an incentive to deviate from this strategy.
5. The modified table appears at the top of the next page.

Answer to Chapter 6, Problem 5:

Number of Firms	Market Elasticity, ϵ	Lerner's Measure	Consumer Surplus	Social Welfare	Deadweight Loss
2	−1.0833	.4615	115.2	230.4	28.8
5	−.6666	.3	180	252	7.2
10	−.5271	.1884	214.4	257.2	2.0
50	−.4166	.048	249.1	259.1	.1
1,000	−.3903	.0026	258.7	259.2	.0

Chapter 7

1. A monopolistically competitive industry is characterized by a large number of buyers and sellers. The goods produced by each firm are close substitutes of the other. Therefore, each firm attempts to differentiate its product from its rivals' goods to gain monopoly power in the market. Product differentiation helps in reducing the elasticity of demand faced by a firm. As a result, the firm can increase its price well above its marginal cost and earn high profits. High profits attract new firms to the industry further increasing the need for differentiation. However, if fixed costs are high in such an industry, each firm will earn low profit. Low profits will attract fewer firms to the industry. High fixed costs will also act as a barrier to entry for new firms. Moreover, existing loss-making firms may leave the industry in the long run. Thus, the number of firms in the industry will fall. Exit of firms from the industry will result in a decrease in the elasticity of demand for the existing firms' goods. As a result, existing firms will have less incentive to differentiate and new firms will stay away from the industry resulting in too little variety.
3. Table 7.2 shows three monopolistic competition equilibria (for F of \$6.40, \$1.60, and \$0). In the third of these equilibria ($F =$ \$0), there is an infinite number of firms; the competitive price, 28¢, is charged; and output equals 720 (using the demand curve, $Q = 1{,}000 - 1000p$). Where $F =$ \$1.60, there are 17 firms in equilibrium; the price, 32¢, is above the competitive level; and total output is only 680. However, suppose that one more firm were to produce at the same level (40 units) as the existing firms. Output would equal 720, and price would equal MC, 28¢. Similarly, at the equilibrium with $F =$ \$6.40, industry output is 640, and price is 36¢. Yet, if one more firm were to produce at the same level as these firms, industry output would equal 720, where price equals MC. Indeed, it is positive fixed costs that keep the Cournot, monopolistic competition equilibrium from being efficient. Where fixed costs are positive, there is only room for one fewer firm than would make market output equal the competitive output at $F = 0$. There is only room in the sense that if one more firm were to enter, all firms would lose money.
5. A technological innovation that lowers fixed costs has the opposite effect of a franchise tax, discussed in the answer to Problem 7.1 above. A technological change that lowers marginal cost tends to increase output, but the exact effect depends on the shapes of the demand and cost curves.

   Formally, suppose the market demand curve is linear, $p = a - bnq$, where there are n identical firms, each of which produces q units of output with total costs $mq + F$. Each firm's profits are

$$\pi_i = (a - bnq)q - mq - F.$$

If the firms play Cournot, each firm's profit-maximizing, first-order condition is $MR = MC$:

$$a - b(n + 1)q = m.$$

Free entry implies that firms enter until price equals average cost $a - bnq = m + F/q$. Combining the first-order condition and the entry condition to eliminate m and rearranging terms yields $q = \sqrt{F/b}$. Thus,

$$\frac{dq}{dF} = \frac{1}{2\sqrt{bF}} > 0.$$

That is, as F falls, $q = \sqrt{F/b}$ falls in equilibrium, as shown in Table 7.2 and discussed in the answer to

Problem 7.1 above. Using $q = \sqrt{F/b}$ and the free-entry equation,

$$n = \frac{a - m}{\sqrt{bF}} - 1.$$

Differentiating this expression with respect to F, we obtain

$$\frac{\mathrm{d}n}{\mathrm{d}F} = -\frac{(a - m)}{2F\sqrt{bF}} < 0.$$

Thus, technological progress that lowers F increases the number of firms. The change in total output is

$$\frac{\mathrm{d}nq}{\mathrm{d}F} = n\frac{\mathrm{d}q}{\mathrm{d}F} + q\frac{\mathrm{d}n}{\mathrm{d}F}$$

$$= \frac{2\sqrt{bF} - a + m}{2bF} < 0,$$

using the first-order condition and manipulating. The change in price is $\mathrm{d}p/\mathrm{d}F = -b(\mathrm{d}nq/\mathrm{d}F) > 0$. Similarly, $\mathrm{d}n/\mathrm{d}m < 0$, $\mathrm{d}q/\mathrm{d}m = 0$, $\mathrm{d}nq/\mathrm{d}m < 0$, and $\mathrm{d}p/\mathrm{d}m = 1$.

Chapter 8

1. No, the investor's purchase price will be elevated to reflect any monopoly profits so the investor will earn a competitive return.
3. The domestic concentration ratio based on data from only domestic firms is an upper bound on the relevant concentration ratio if the good is also imported. If imports in an industry increase over time, domestic concentration ratios may become less correlated with price-cost margins, because those industries are increasingly competitive.
5. In a perfectly competitive world, each firm's price equals marginal cost even in the short run. With entry, the profit of the last entrant equals zero. Firms that are relatively efficient earn profits. In a noncompetitive world (for example, one with monopolistic competition), price can exceed marginal cost. With entry, price can remain above marginal cost, but the profit of the last firm to enter typically is driven to zero in the long run.

Chapter 9

1. An adult wanting to visit Disneyland Paris will not benefit by purchasing the entry ticket from a child because he/she will not be able to use that ticket. This shows that services cannot be resold.
3. High transaction costs
5. The first consumer's demand curve forms a rectangle. It is horizontal from zero to 1 unit at \$10 and then drops to zero at 1 unit. The maximum consumer surplus that can be captured is the entire area under the demand curve. The monopoly captures this consumer surplus if it sets its price equal to \$10. Similarly, the monopoly captures all the consumer surplus of the second consumer by charging \$9. There is no consumption inefficiency because there are no further transactions between the consumers that would increase at least one consumer's welfare.

Chapter 10

1. Its price equals its marginal cost, but the firm also receives a fixed fee from each consumer.
3. The consumer's budget constraint is $Y + X^2 = 100$, so that $Y = 100 - X^2$. Utility equals $100 - X^2 + 10X$. The X that maximizes utility is 5.

5. Monopoly 1 maximizes $p_1(10 - 2p_1 + p_2)$ and Monopoly 2 maximizes $p_2(10 + p_1 - 2p_2)$. The two first-order conditions are $10 - 4p_1 + p_2 = 0$ and $10 + p_1 - 4p_2 = 0$. Solving yields $p_1 = p_2 = 10/3$. A monopoly of both products chooses p_1 and p_2 to maximize $p_1(10 - 2p_1 + p_2) + p_2\,(10 + p_1 - 2p_2)$. The two first-order conditions are $10 - 4p_1 + p_2 + p_2 = 0$ and $p_1 + 10 + p_1 - 4p_2 = 0$. Solving yields $p_1 = p_2 = 5$.
7. If you price each dish separately, you maximize your profit by charging $11 for the halibut and $8 for pie. At these prices, Customers *a* and *b* buy only pie and Customer *c* buys only halibut. You earn $7 = $8 (price of pie) − $1 (cost of pie) on each of the two dishes of pie you sell and $10 on the halibut, for a total profit of $24. If you only sell a pure bundle, you charge $12 and earn a profit of $30 = ($12 − $2) × 3, where $2 is the cost of producing both dishes. Unlike in the example in the text, you cannot do better using mixed bundling (because each customer places a value on each good that is equal to or greater than its marginal cost). Suppose you set the bundle price at $12, the price of halibut at $10.99, and the price of pie at $9.99. Customer *a* buys only the pie (the bundle costs $2.01 more and that customer only values halibut at $2), Customer *b* buys the bundle, and Customer *c* buys only the halibut (you sell 2 pies and 2 halibuts). You make $8.99 from Customer *a*, $9.99 from Customer *c*, and $10 from Customer *b* for a total of $28.98.

Chapter 11

1. As a result of this condition, each manufacturer now has an incentive to raise its price above its original level because it is less likely to lose sales to the retailer.
3. If all firms have a high debt/equity ratio, and if going bankrupt is a blot on a manager's record, then the incentive to cut price is reduced. If firms differ widely in their debt/equity ratios, if new firms can enter, or if the interest rates on debt vary widely across firms, the price level is not likely to be affected by whether a few firms have high debt/equity ratios.
5. The discounted present value of the annual loss of $1 million is $8.51 million, using the formula given in the question. The discounted present value of the annual gain of π_m from Year 21 onward is $\$1.49\pi_m$. In order for the gain to exceed the loss, π_m must exceed $5.7 million.

Chapter 12

1. Yes
3. If a pure profits tax is only collected at the retail level, there is a greater incentive to vertically integrate, even with fixed-proportions production. For example, an integrated firm could charge its own retailer a very high price for the factor it supplies. As a result, profits at the downstream level are relatively low (and hence relatively untaxed), and profits at the upstream level are relatively high. If the tax is collected both upstream and downstream, this incentive is removed. A sales tax at the retail level does not provide a similar incentive to integrate.
5. The franchiser (Kentucky Fried Chicken) uses the number of barrels to check the veracity of its retailers so as to guarantee they pay all the royalties they owe. The only obvious way to avoid this monitoring device is to sell chicken in other containers. Spot checks by the franchiser may discourage this avoidance technique. The argument for allowing this approach is that it facilitates vertical relations.

Chapter 13

1. Because it takes time to renter order information, some consumers are likely to accept shipping charges that are above normal since it is costly to search.
3. Many authors (including us) agree to royalties that are a percentage of revenues rather than profits. Such a royalty

system gives the publisher the incentive to produce too few books because the publisher incurs the full marginal cost of printing the last book but only gets a fraction of the revenues, $1 - \alpha$. As a result, joint profits are lower than they would be under the other two systems, where the publisher has the incentive to produce the optimal number of books. One possible reason that authors do not want royalties that are a percentage of profits is that they are afraid that the publisher may lie about its costs. Even without lying, authors and publishers could differ about appropriate costs because many costs of publishing are joint costs, and it is hard to allocate costs between various books. You may have read in newspapers that movie actors entitled to a percentage of profits are constantly suing producers who tell them that their hit movie produced no profits because of large costs. Publishers may be hesitant to pay authors lump-sum royalties because authors would then have little incentive to produce products that will sell well. See also the answer to Problem 12.1.

5. A consumer might reasonably infer that the brand name conveys quality. If the banana is of low quality, consumers will avoid this brand in the future. Thus, any firm that plans to remain in the market will only brand its banana if it believes consumers will view it as being better than unbranded bananas.

Chapter 14

1. Usually a firm spends on advertising (α) because it leads to an outward shift of the demand curve (D) for its product. An outward shift of its demand curve increases the equilibrium price and output of its product. As a result, the firm's profit increases. However, persuasive advertising, by enabling new firms to differentiate their products, can sometimes facilitate entry. In such a case, the demand curve for a firm's product might become flatter with the entry of new firms after an increase in advertising expenditure even though it shifts to the right as shown in the diagram. In the diagram, the initial demand and marginal curves faced by a firm are D and MR respectively. With the entry of new firms in the industry due to an increase in advertising expenditure equal to α, the demand curve for the firm has shifted to the right but has become flatter. The new demand curve is labelled as D(Q, α) and the marginal revenue curve is labelled as MR(Q, α). Since the new demand curve is more elastic, the increase in the monopolist's price and quantity is not significant. Thus, revenue does not increase significantly. If the increase in revenue is less than the advertising expenditure, it will be unprofitable for the firm to spend on advertising.

3. See Butters (1977) for an analysis of this problem. If firms are advertising that they have low prices, then the analysis is similar to that of the tourist-native model in Chapter 13. It is possible that, in equilibrium, some stores charge high prices and other stores charge low prices.

5. The monopoly's problem is

$$\max_{Q,\,\alpha} \pi = pQ - mQ - \alpha$$
$$= (a + \alpha - bQ)Q - mQ - \alpha.$$

The first-order conditions are

$$\frac{\partial \pi}{\partial Q} = a + \alpha - 2bQ - m = 0$$

$$\frac{\partial \pi}{\partial \alpha} = Q - 1 = 0.$$

That is, $Q = 1$ and $\alpha = 2b + m - a$.

Chapter 15

1. Doing that is a way to prevent resale of old editions. The instructor assigns problems and the students will have difficulty using the old edition.

3. Given high transaction costs, the demand for new tractors is not affected by the stock of old tractors if the farmers who currently need tractors are not the same ones who already own old tractors. However, if the same farmers that need tractors today already own old tractors from before, the analysis is the same as in Problem 15.1.
5. If many other firms make tractors that are close substitutes for the four-wheel-drive tractor produced by a monopoly, then the elasticity for tractor services, ϵ (defined in the answer to Problem 15.1), is high and thus the monopoly has little market power: ϵ^* is high.
7. By so doing, the artist credibly commits not to produce more prints in the future. As a result, the artist can sell the existing prints for more than if the future supply were not so limited.

Chapter 16

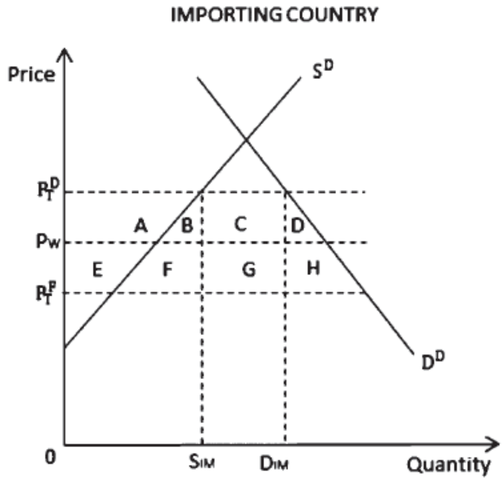
1. It creates a precedent that the patent is valid and it deprives consumers of competition.
3. In Figure 16.1, a longer patent life does not affect the cost curve, but shifts up the expected benefit curve, reflecting the longer time that the patent winner receives monopoly rents. As a result, the expected benefit and cost curves intersect further to the right (larger number of firms). Typically, the number of firms competing increases with patent life.
5. Suppose that each firm that races to make a discovery must incur a fixed cost to enter the race (for example, the expense of setting up a research lab). If there is a constant marginal cost of additional research effort, then each research firm is operating in a region of falling average costs. These fixed costs give society an incentive to reduce the number of research firms if one research firm can conduct many independent projects.

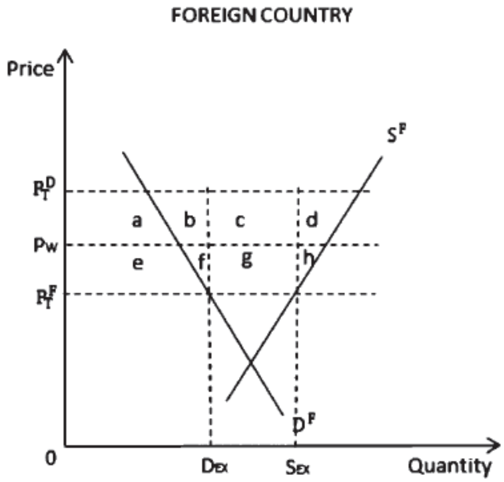
Chapter 17

1. Yes, if the minimum is set too high.
3. A competitive firm chooses quantity so that price equals marginal cost. As price rises above the shut-down point, the price-average cost margin increases.
5. If it is costly to use the price system, the variability of a customer's demand affects the supplier's cost, and so customers with different demand variabilities pay different prices. There is no price discrimination when prices vary according to costs.

Chapter 18

1. If the importing country is a large country, such that a decrease in its imports lowers world price, a tariff may raise welfare in the country. The top panel in the diagram below shows the importing country and the bottom panel shows the exporting country, which has a positive export supply curve. The table summarizes the net effect on welfare.





WELFARE EFFECTS	
Consumer Surplus	−(A + B + C + D)
Producer Surplus	+ A
Government Revenue	+ (C + G)
Net welfare	+ G − (B + D)
Net Effect	If G > (B + D), Welfare increases

3. With no tax, $p_1 = p_2 = 5$, $q_1 = q_2 = 10$, and each firm earns a profit of \$50. With the export tax, buyers pay a price of \$7, firms receive a price (after tax) of \$4, $q_1 = q_2 = 8$, and each firm earns a profit of \$32 (after paying the tax).
5. In the competitive equilibrium, $p = 9$, $Q = 9$. If $t = 2$, $Q = 8$, consumers pay \$10, and the seller receives \$8. The monopsony solution is $Q = 6$, $p = 12$. This same quantity is achieved with a tariff of \$6.

Chapter 19

1. The optimal penalty is to deter the price fixing. The U.S. penalty should be larger as the fraction of U.S. consumers falls if the goal of the penalty is to deter price fixing.
3. Unclear. In some industries, collusion could lead to efficiency gains that outweigh any harm caused by elevated collusive pricing. It may be a difficult task for an enforcement agency to identify such industries, however.
5. The formula says that the direct price elasticity of good i equals (in absolute value) the sum of all cross-elasticities of good i with respect to the price of good j. If a cross-elasticity is large and positive, the price elasticity tends to be large, and market power tends to be low. The relevant cross-elasticity, according to the formula, is the one relating the quantity of Product A to the price of Product B.

Chapter 20

1. An individual state can enable its firms to charge high prices to consumers elsewhere and thereby earn higher profits than otherwise. The states could tax some of the firms' profits and thereby gain as well.
3. An acreage quota causes farmers to use more of other inputs, such as labor and fertilizer, so that output does not fall as much as acreage. This inefficiency in production leads to deadweight loss. It also causes the supply curve to shift to the left, but by a smaller percentage than acreage falls. Holding the support price constant, the government buys less excessive crops than without acreage controls.
5. One alternative is to give farmers cash. Such a program improves farmers' well-being at lower cost than existing programs. It does not cause the production and distribution inefficiencies described in the chapter.
7. Because of the asymmetry in returns, rate-of-return regulation provides limited incentives to invent. If a firm makes an important discovery that, say, lowers its costs of production, its profit rises less than in proportion to the social gain. If it is unsuccessful in making the discovery, the firm bears the expense and has a lower profit. This problem in an industry with rapid innovation can be reduced if regulators are slow to change the cost basis in calculating the rate of return.

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