CHAPTER 8

Between Perfect -Competition and Monopoly

By the end of this chapter you will be able to:

- Identify the features of a monopolistically competitive firm and industry.
- Define product differentiation and explain how it occurs.
- Explain why the monopolistically competitive firm will make only normal profits in long-run equilibrium.
- Identify and analyze the factors in monopolistic competition that cause inefficiency and resource misallocation.
- Identify the characteristics of an oligopolistic firm and industry.
- Discuss the behavioral implications of the cartel model and the price leadership model.
- Outline the kinked demand curve model and explain how it explains price stickiness.
- Describe ways in which an oligopolistic industry may be inefficient.
- Describe how the contestable market model affects the perspective on oligopolistic inefficiency.
- Use game theory to analyze the strategies available to rivals in a two-person game.
- Explain what the Herfindahl–Hirschman Index is and how it is used in antitrust cases.

When you visit the Food Court at your local mall, dozens of -businesses vie with one another to attract you (and your wallet). Similarly, -clothing stores, shoe stores, and electronics stores await beyond the Food Court. None of these firms is perfectly competitive; none is a monopoly. The -presence of advertising and brand names places these firms -outside the perfectly competitive model and the presence of close substitutes places them beyond the bounds of pure monopoly. These firms are either monopolistically competitive or oligopolistic in nature. What distinguishes firms such as these, and how well do they cater to our needs?

Chapter Preview: In Chapters 5 and 6, we set up and examined "-perfect competition," a model of a market that assumes many firms with free entry into the market. We discovered that, in general, perfectly competitive markets serve society's needs very effectively. In Chapter 7, we moved to the other extreme, looking at "monopoly" industry, wherein there is only one firm, which preserves its unique position through the imposition of substantial barriers to entry. With some qualifications, we -concluded that monopoly does not usually serve society well.

Most firms, however, operate in neither a perfectly competitive -environment nor a monopolistic one. In this chapter, we look at the two intermediate "market structures" of monopolistic competition and -oligopoly and assess how effectively they address the issues of productive efficiency and allocative efficiency.

Economists who study industrial organization use three broad categories for their investigations into an industry's behavior—market structure, conduct, and performance. *Market structure* considers issues such as the number of firms, the significance of substantial economies of scale, and how dominant the four, or eight, largest firms are. *Conduct* examines how firms behave, how prices are set, and whether firms advertise. *Performance* turns on the consideration of efficiency. Keep these issues in mind as we explore monopolistic competition and oligopoly.

Brain Teaser: If you were to open a restaurant in your town, which factors would be of most concern to you to help you make your venture a success? Specifically, how would you go about cultivating a clientele and establish your identity in the market? What choices would you have to make? What methods and media might you use to differentiate your product? How closely would you monitor the activities of your competitors? By the end of this chapter, determine whether your restaurant is part of an oligopoly or is monopolistically competitive in nature.

Monopolistic Competition: Perfect Competition with Differentiated Products

Characteristics of Monopolistic Competition

Like perfect competition, a monopolistically competitive industry contains a large number of small firms operating independently of one another. Unlike perfect competition, each firm faces a highly elastic (but not perfectly elastic) demand because each firm is selling a product for which there are a number of close substitutes—restaurants are an excellent example of monopolistic competition. Consumers are sensitive to prices, but, because there is some degree of product differentiation, each firm does have some limited ability to adjust its price. There are few barriers to entry in monopolistic competition, so, in the long run, it is fairly easy to enter a monopolistically competitive industry. Firms in monopolistically competitive industries do not benefit from substantial economies of scale.

Production Differentiation

The perfectly competitive firm has nothing to advertise—each firm sells the identical product at exactly the same price. In contrast, the monopolistically competitive firm is keen to make potential customers aware of the special features of its own product or service—product differentiation is a hallmark of monopolistic competition. Product differentiation occurs when a product is distinguished from its alternatives in some positive way in the minds of consumers.

THINK IT THROUGH: What might help distinguish one company's product from that of its rivals? Advertising in all its forms—billboards, junk mail, radio and TV jingles—can let consumers know what options are available and may also shape their preferences. Radio stations become known for a particular style of music—country, rock, gospel. Restaurants offer specialized cuisines—Chinese, French, seafood—and may signal this by the choice of the restaurant's name. Brand names, to be sure, reinforced through advertising, may be an important factor in determining a -customer's choice. Location, hours of operation, expertise, credit facilities, and so on, may all be features that distinguish one firm from its rivals. Higher quality of product may be signaled through higher prices or by celebrity endorsements or testimonials from "satisfied" customers. Can you think of other distinguishing features?

Monopolistic Competition in the Short Run: The Four Short-Run Cases Revisited

When we looked at perfect competition in Chapter 5, we found that the firm's "short-run cost picture" was determined by the "specialization effect" and the "congestion effect." There is nothing new to learn on the cost side of the analysis. The monopolistically competitive firm experiences similar effects and has a similar short-run cost picture, as shown in Figure 8-1.

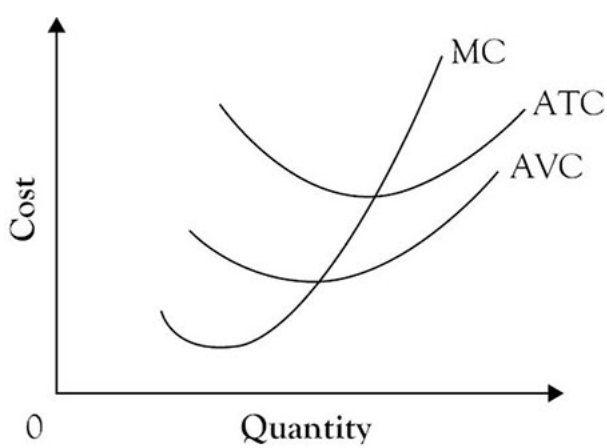

Figure 8-1. The monopolistic competitor's short-run cost picture.

Similarly, there is nothing new to learn on the revenue side of the -analysis. Because it has some control over the price it may charge for its (somewhat differentiated) product, the firm's "revenue picture" is, in principle, the same as that for a monopolist—a downward-sloping demand curve, with an associated marginal revenue (MR) curve, as shown in Figure 8-2.

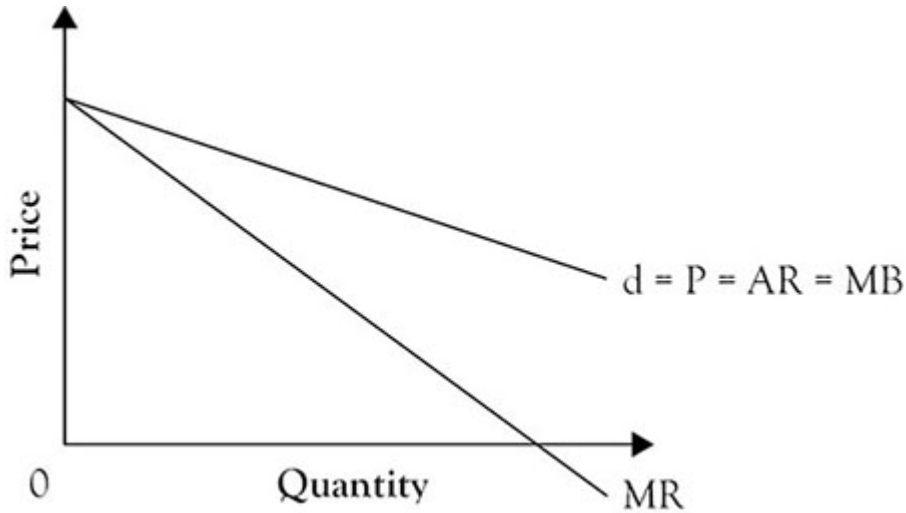

Figure 8-2. The monopolistic competitor's revenue picture.

Clearly, we are recycling established concepts! All the definitions and relationships we set out in previous chapters still hold true. The firm's demand curve, to be sure, is much more elastic than that faced by the monopolist but, because the demand curve is negatively sloped, the behavior of marginal revenue is specified.

As in perfect competition and in monopoly, there are four short-run cases for the firm in this market structure. The firm can earn an economic profit, break even, incur an economic loss but produce, or shut down. Just like the perfectly competitive firm and the monopolist, the monopolistic competitor will follow the profit-maximizing procedure presented in Chapter 5. The diagrams we used to consider the four "short-run cases" for the monopolist in Chapter 7 can be reused for the monopolistically competitive firm. The elasticity of the demand curve is different but the appearance of the diagrams is the same.

THINK IT THROUGH: You should be able to draw the four "short-run cases" yourself by this time. However, if you cannot, Figure 7-5 through -Figure 7-8 are the ones you require.

Monopolistic Competition in the Long Run

When we consider the long run, it is the similarity between monopolistic competition and perfect competition that is more pertinent. In both market structures, it is fairly easy for firms to enter or leave the industry in the long run. Because of this, the typical monopolistically competitive firm will earn only a normal profit in long-run equilibrium.

Consider a small town with, say, ten restaurants offering a mixture of different cuisines. Initially, each firm is earning a normal profit. However, consumer demand increases for some reason—for example, there is increased affluence, an influx of new residents, a change in preferences away from home-prepared meals. The demand curve faced by the typical firm ("Adam's Ribs and Bar-B-Q") shifts to the right, and each of the ten restaurants now earns a (short-run) profit. The new demand curve is shown as d_1 in Figure 8-3. The associated marginal revenue curve is MR_1.

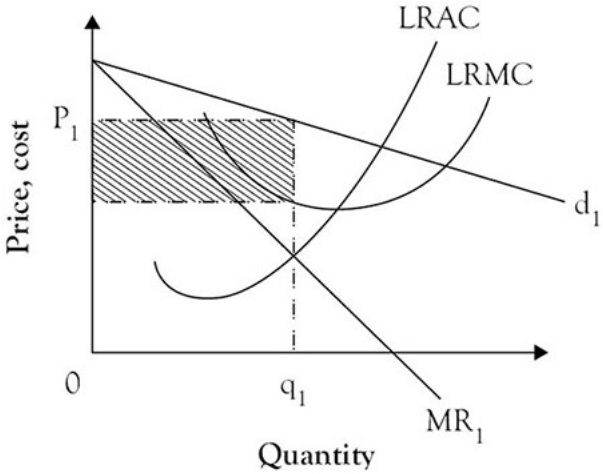

Figure 8-3. The long-run equilibrium process.

Producing at the output level (q_1) where MR = MC, the firm will set a price of P_1 and earn an economic profit as shown by the shaded area in the diagram. Attracted by the higher-than-normal profits, new firms enter the industry in the long run. The opening of new restaurants in town has two effects on Adam's Ribs. First, his market share will be diminished. If there are now 20 restaurants instead of 10, then Adam's market share will have decreased from ten percent to five percent. This shows up as a leftward shift of Adam's demand curve. Second, because patrons now have more—and closer—choices than before, the price elasticity of demand for Adam's Ribs will increase. Whereas previously there may have been no other barbecue restaurants in town, it is now more likely that a close rival will be present. Customers can be choosier.

Firms will continue to enter the industry as long as economic profits exist and Adam's demand curve will be forced farther to the left. The process will stop only when the typical firm's demand curve (d_2) is tangent to the long-run average cost curve as shown in Figure 8-4. If the industry "overshoots" by having too many firms enter the industry, then each firm's demand curve will be pushed too far to the left, losses will be incurred, causing some firms to leave the industry and the demand curve of each surviving firm to shift back to the right until a normal profit is earned at an output level, q*, and a price, P*. As with perfect competition, it is the condition of easy entry and exit that guarantees that only a normal profit will be earned in long-run equilibrium.

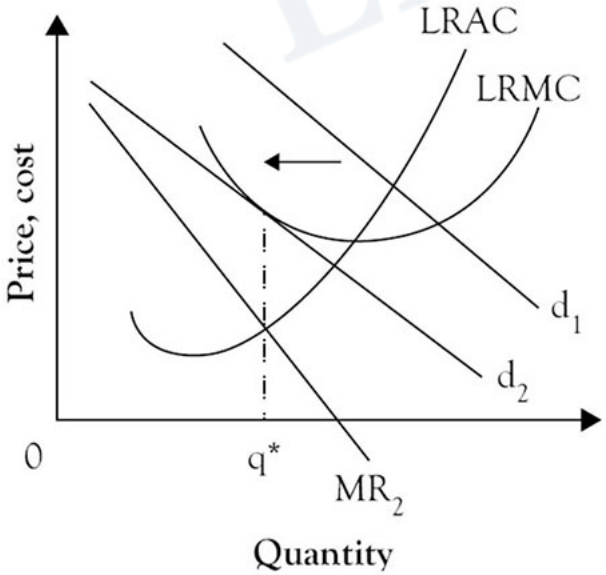

Figure 8-4. Long-run equilibrium.

The Monopolistic Competitor and Performance Criteria

In long-run equilibrium, the firm's output level is q* and its price is P* as shown in Figure 8-4. Turning our attention to the three performance criteria we developed in Chapter 6, we can see that, although the typical firm does earn only a normal profit (Criterion 1), it is neither productively efficient (Criterion 2) nor allocatively efficient (Criterion 3) and, therefore, appears inferior to perfect competition. Consider Figure 8-5.

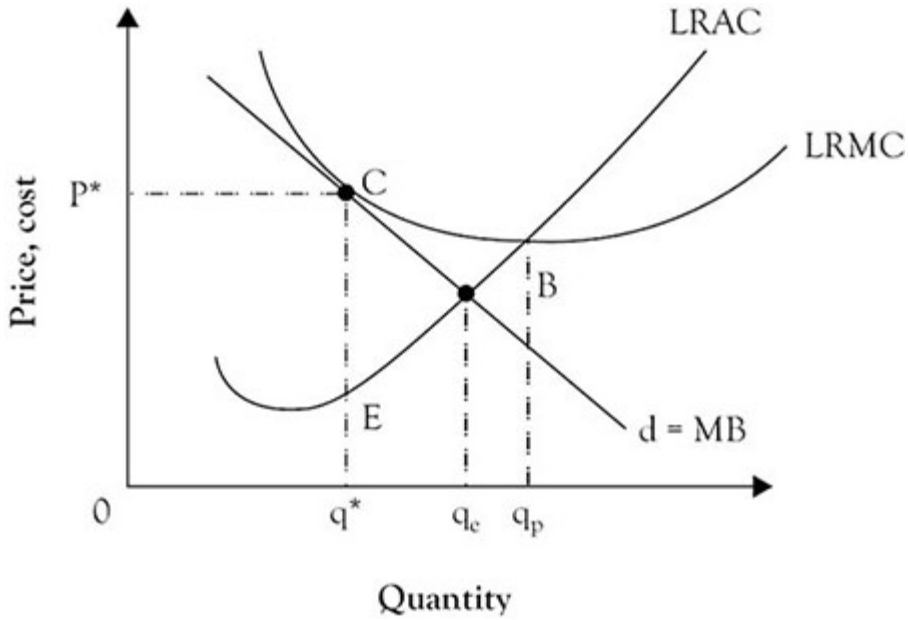

Figure 8-5. Long-run equilibrium and efficiency.

Productive efficiency: A firm is deemed to be productively efficient if it produces at the minimum point on the long-run average cost curve. In Figure 8-5, this occurs at the output level, q_p. The monopolistically competitive firm in long-run equilibrium, which will choose to restrict output to q*, therefore, is not productively efficient. Relative to perfect competition, monopolistic competition fails to pass muster. Because the firm (and industry) is failing to take full advantage of economies of scale, it can be argued that the monopolistically competitive industry suffers from excess capacity. Given the overall level of demand, if there were fewer firms, each with a somewhat higher level of output, then the product's unit costs would be reduced and scarce resources could be reallocated. Monopolistic competition, it could be argued, underutilizes and squanders our scarce resources.

Monopolistically competitive industries suffer from excess capacity and, in the previous paragraph, we argued that this is inefficient. But it is? Consider what is implied for the customer by the presence of excess capacity. When your car breaks down, you wish for instant service from the mechanic, not a two-week delay. At the restaurant, the customer wishes to be seated immediately instead of having to queue with a beeper. Once seated, the customer's preference is not to be surrounded by other tables and chairs, hordes of other diners (and their children), overworked wait-staff, and the sense that one should eat up and get out as quickly as possible because the table is needed for the next customer. We prefer service and choice and, if it is inefficient to have mechanics, plumbers, and restaurants waiting with idle resources for us to decide to call on their services, then so be it! Similarly, it would be most frugal with resources if we all wore the same style and color of "one size fits all" -clothing, but we are willing to sacrifice efficiency for choice and individuality. And, beyond all other market structures, choice is what -monopolistic competition delivers.

Allocative efficiency: A firm is allocatively efficient if it produces at the output level where price (marginal benefit) equals long-run marginal cost. In Figure 8-5, this output level is q_e. Again, the firm, in pursuit of profit, will opt to produce at the lower output level, q*. The deadweight loss of this choice is the area CEB.

The general theme of our theoretical argument is that, like monopoly, monopolistic competition is inefficient relative to perfect competition. However, against that conclusion, we must set the fact that monopolistic competition offers abundant variety that appeals to our individualism. Also, we must not forget the issue of product innovation. Much of the innovation in

American industry springs from basement inventors and weekend hobbyists whose interests and skills carry them to develop new products or new twists on existing products. Giants such as Bill Gates and Steve Jobs once were "small" innovators and Facebook began as a dormroom experiment. There is little incentive to innovate in perfect competition because no form of product differentiation, such as branding or trademarks, is possible. Similarly, the monopolist has little wish to shake up his market with new products. Although large oligopolistic firms indulge in research and development programs, many of the patents granted by the Patent Office are the result of the activities of small entrepreneurs with big dreams.

Review of Monopolistic Competition

Monopoly has *one* firm, oligopoly (as we shall see) has a *few*, perfect competition and monopolistic competition *many*. Monopolistic competition's distinguishing characteristic is product differentiation—the monopolistically competitive firm lives and dies by its ability to attract customers in a crowded marketplace. Despite the downward-sloping demand and marginal revenue curves, the short-run and long-run equilibration stories for perfectly competitive and monopolistically competitive firms are very similar. Monopolistic competition differs from monopoly and oligopoly in that firms in monopolistically competitive industries can't influence the market price by virtue of their size. Relative to perfect competition, the presence of monopolistic competition bestows variety for the consumer but with higher-than-necessary costs and a deadweight loss.

Brain Teaser Solution: Almost certainly your restaurant will be monopolistically competitive—with many close substitutes, low barriers to entry, and highly elastic demand. Product differentiation ought to be important to you and knowledge of local market conditions may be critical to your survival. Note that your restaurant is selling not only food—you are offering an entire "dining experience" that will include elements such as location, decor, and quality of service.

Oligopoly: Burgers, Banking, and Beer

The final of the four market structures—oligopoly—lies closer to -monopoly than to perfect competition and, sometimes, oligopolistic firms find it advantageous to group together into a *cartel* and behave, in effect, like a monopoly in order to maximize their joint profits. In other cases, -competition between rivals may be aggressive—burger wars, for instance. In other industries, firms may deemphasize rivalry, preferring less-threatening methods of attracting customers.

THINK IT THROUGH: If you wish to identify probable oligopolists, think about the sponsors of "big" events, such as the Superbowl or the -Olympics, or the advertisers in*Time* or *Newsweek*. Almost certainly, the firms you see are in oligopolistic industries.

Characteristics of Oligopoly

An oligopolistic industry has a "few" large interdependent firms within a market—the market may be local, national, or international. Usually (but not always), each firm has substantial market power and can impose strong barriers to entry, often because of significant economies of scale. Products may be differentiated (cars or burgers) or standardized (oil and other chemicals). Firms may compete in terms of price or they may not. A key characteristic of oligopoly is *mutual interdependence*—the behavior of each firm affects and depends on the expected reactions of its rivals. Because each firm's actions depend on the expected reactions of its rivals, this market structure requires complex analysis and several models have been developed.

Short-Run Cases and Long-Run Equilibrium

The models that follow may look quite different from those in the previous chapters, but the relevant principles remain unchanged. As with the other market structures, the oligopolistic firm faces four possible "short-run cases," and will apply the same techniques as we saw firms in the other markets use in order to deal with each eventuality. Because of substantial barriers to entry, we would expect to see firms earning an economic profit in long-run equilibrium—just like monopoly—although, in the case of contestable markets discussed as follows, this may not occur.

When an oligopoly consists of only two firms it is called a *duopoly*. Suppose that you sell ice cream in a two-dimensional world, such as a stretch of beach, as shown in Figure 8-6. The "market" is 200 yards long and potential customers are evenly distributed along the beach. You plan to set up your stall at the midpoint of the beach in order to maximize sales. However, when you arrive, you discover that a rival has already claimed that prime location! Where should you set up now? Should you move farther along the beach?

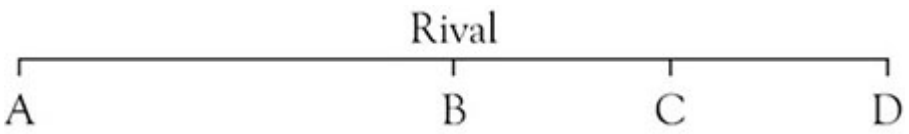

Figure 8-6. Duopoly at the beach.

Consider Figure 8-6. If you should set up beside your competitor at Point B, then each seller will receive 50 percent of the market, assuming that prices and the products are comparable. Moving away from the midpoint to, for example, Point D, gives your rival 75 percent of the market whereas you will attract only the 25 percent between Point D and Point C. Consumers between Point A and Point B will buy from your rival, as will those between Point B and Point C. Wherever your rival locates, you should locate right beside him but closer to Point B. If he locates at Point D, then you should set up just marginally closer to the midpoint of the beach. The sellers are mutually interdependent.

Explicit Collusion—Cartels

The simplest form of oligopoly to analyze is the cartel. A cartel is a group of producers that have come together to determine price and output in order to maximize joint profits—OPEC (the Organization of Petroleum Exporting Countries) is the most widely known example. The drive to form a cartel may come from firms wishing to collude in order to prevent the risk of potentially destructive competition. However, when a cartel is operating, although it may be beneficial to the members, all the adverse effects of monopoly will ensue—consumers will pay monopoly prices, firms will reap monopoly profits, consumer surplus will be reduced, and deadweight losses will occur. Worse still, because the cartel's members produce separately, they do *not* create the cost-saving benefits that derive from economies of scale that an actual monopoly would generate. Cartels represent the worst of all possible worlds for the consumer, and price-fixing collusion is illegal under United States' antitrust laws.

In New York, milk and Italian bread have been examples of collusion—a few powerful firms conspiring to keep prices high. The milk cartel survived for 50 years and, following its demise, the price of a gallon of milk tumbled by 30 percent.

OPEC has been a successful and long-lived international cartel, but longevity such as OPEC and the milk cartel exhibit is rare. The larger the number of firms and the more diverse their production costs and -objectives (some oil-producing countries, for example, wish for rapid exploitation of their resources while others prefer a longer-term approach), the more -difficult it is to reach an agreement and to perpetuate it. -Policing is important. If the agreement is to work properly, each member must produce no more than the amount of product stipulated. There may be a strong temptation to cheat, either by offering covert discounted prices, or by increasing production and selling secretly, or both. Once cartel members begin even to suspect cheating, the agreement is likely to unravel.

Tacit Collusion—Price Leadership

Explicit collusion is illegal in the United States but *tacit collusion* operates in a gray area. Tacit collusion occurs when firms arrive at an "understanding," perhaps without direct discussion, and can be an attractive strategy to avoid price competition and to maintain profits. Such "gentlemen's agreements" are illegal but are often difficult to prove. It's not -surprising that real-world examples of collusion continue to surface. Some years ago, several Ivy League universities were accused of price-fixing by sharing information about qualified students and agreeing not to compete on offers of financial aid to them. The universities, which consented to -terminate the practices, justified their practices by claiming that, by preventing competition, they were allowing the students to choose the -institution that best matched their academic needs.

Price leadership involves implicit coordination between firms, with a dominant firm, often the largest or most efficient firm, setting its price and the remaining firms following its lead. For many years, Bank of America would announce interest rate changes and its rivals would follow the pattern it had established. Similarly, U. S. Steel, for many years the dominant firm in the steel industry, set the pace for its competitors with orderly price adjustments. Usually, such price changes are infrequent, clearly announced, and nonaggressive.

Price leadership has survival value. Each oligopolist controls a sizeable portion of the market and can be a formidable opponent, so a full-blown price war is a perilous activity that can be expensive for all and may be destructive for some—far better to signal intentions in a clear and structured manner.

Kinked Demand Curve Model

Given the risk involved for an oligopolist in changing her price independently of her rivals, prices in oligopolistic markets might be expected to be "sticky," that is, not subject to frequent adjustments. The kinked demand curve model has been developed to analyze this phenomenon.

Consider Figure 8-7. Point A shows the current price ($20) and -output (1,000) for an oligopolist—Olga. Point A must be on Olga's demand curve. What if Olga lowers her price to $19? We would expect quantity demanded of Olga's product to increase but the number of new customers attracted to Olga will depend on the reaction of her rivals. If the rivals do not respond to Olga's price cut, then her product will have become -relatively attractive (elastic) and there will be a substantial increase in quantity demanded, perhaps from 1,000 to 1,500. Demand curve d_{NR} is Olga's demand curve when there is "no reaction" from rivals to a price change. MR_{NR} is the associated marginal revenue curve.

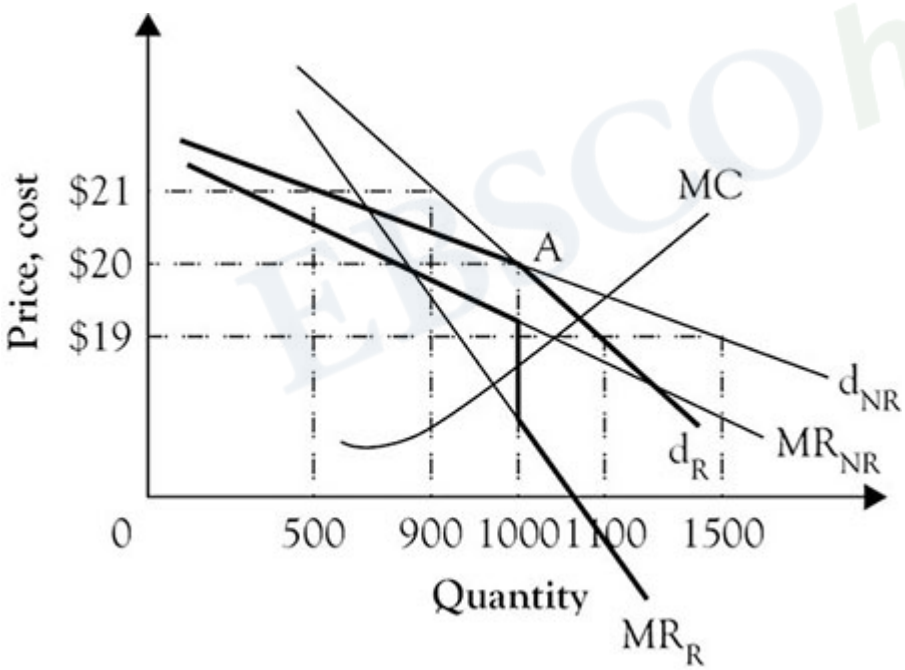

Figure 8-7. The kinked demand curve model.

If, however, rivals react to Olga's price decrease by cutting their prices by an equivalent amount, then Olga will experience a less vigorous increase in quantity demanded, perhaps from 1,000 to 1,100. Demand curve d_R is Olga's demand curve when there is a "reaction" from rivals to a price change and MR_R is the associated marginal revenue curve.

If Olga is at Point A and then raises her price from $20 to $21 but her rivals respond by raising their prices by a comparable amount, then Olga will lose a few customers who have been priced out of the market—demand will be relatively inelastic and quantity demanded might shrink from 1,000 to 900. Again, demand curve d_R is Olga's (relatively inelastic) demand curve when her rivals react to a price change. If Olga raises her price from $20 to $21 and her rivals do not respond, then Olga is

likely to see quantity demanded shrink substantially (from 1,000 to 500) as many of her customers move over to her cheaper rivals. As before, demand curve d_{NR} is Olga's (relatively elastic) demand curve when her rivals do not react to a price change.

Paul Sweezy, the originator of the kinked demand curve model, then postulated that, when considering a price change, the oligopolist would assume the worst possible outcome. If Olga cuts her price, the worst outcome for her is that her rivals will reciprocate—demand curve d_{NR} is the demand curve she will face at prices less than $20. If she raises her price, the worst outcome is that her rivals do not reciprocate—demand curve d_R is the relevant demand curve at prices above than $20. The presumed demand curve, then, has a kink in it at the current price and the associated marginal revenue curve has a vertical "gap" at the current quantity, q*.

THINK IT THROUGH (MATH): The "gap" is caused by the marginal revenue curves missing each other. However, because they have differing slopes, is it possible for the two MR curves to behave in such a manner that the discontinuity might disappear? The simple answer to this question is "no." If the demand curves have slopes as shown, then the discontinuity in the MR curve must occur—although a formal proof would take us far beyond the scope of this little book. Recall that the marginal revenue curve begins at the same point on the vertical axis as its associated demand curve and it is twice as steep as the demand curve. More complex math aside, this guarantees the presence of the gap.

The discontinuity within the MR curve is the key to explaining price stickiness. From Chapter 5, we know that the profit-maximizing firm will produce at the output level where marginal revenue equals marginal cost. It must be the case, therefore, that Olga's marginal cost curve passes through that gap—if not, then "MR = MC" would occur at a different level of output. Refer to Figure 8-7. We also know that an increase in (variable) costs will cause the marginal cost curve to shift upwards. For any other market structure, if the marginal cost curve shifts upwards, it will cause the profit-maximizing output level to decrease because the "MR = MC" intersection has changed position. In the present model, however, the marginal cost curve can shift upwards and, as long as it remains within the discontinuity, neither the profit-maximizing output level nor the profit-maximizing price will change. In the face of changing costs, price will be "sticky."

Contestable Markets

In the oligopoly models we have considered thus far, the inefficiency charges that we leveled at "artificial" monopoly can be restated with equal or greater plausibility. A brief examination of Figures 8-5 and 8-6 shows that we should expect oligopolistic firms to be allocatively inefficient and productively inefficient. In addition, many oligopolistic industries—-cigarettes, beer, cars, burgers—use resources to advertise heavily, partly as a further barrier to entry.

There is one bright spot for proponents of oligopoly—the case of contestable markets. Contestable markets can arise in any market structure when the threat of entry by potential rivals is high, including oligopoly. As with perfect competition, entry into or exit from a particular market is virtually costless, perhaps because the industry's capital stock is very mobile—the airline industry is the standard example. If new profit opportunities emerge in one market—for example, the route from San Francisco to Vancouver during the 2010 Winter Olympics or the demographic shift favoring the Sun Belt, for instance—then capital will flow in that direction until the profits are competed away. Because of the threat of easy entry into and exit from a particular market, oligopolists in perfectly contestable markets perform like perfectly competitive firms—reducing prices, earning only normal profits in the long run, and cutting costs to the bone.

THINK IT THROUGH: There is a subtle point at play in our consideration of contestable markets—it is the *threat* of competition that is sufficient to make firms behave competitively, even if only one firm is actually supplying the market.

THINK IT THROUGH: Customer loyalty plans such as frequent flyer discounts, which bestow benefits on customers who do not switch between providers, have the effect of reducing contestability and preserving -profits. The corollary of this tactic—imposing costs on customers who do switch providers—also functions to disincentivize shopping around. The presence of either plan suggests that a market is contestable.

Game Theory

You may have seen the Russell Crowe movie, "A Beautiful Mind," about mathematician and economist John Nash who was responsible for introducing game theory into economics. Game theory analyzes how players might react to the actions of opponents, given certain rules of conduct and potential payoffs (rewards). Because the behavior of one firm affects the fortunes of its rivals, this approach applies easily to oligopoly.

The Prisoners' Dilemma

One familiar scenario is known as the "prisoners' dilemma." In this game, each prisoner must decide whether it is in his or her own best interests to confess to a crime or to stonewall. Consider Figure 8-8, which shows the payoff matrix (in this case, a punishment matrix) facing the two -perpetrators—Bonnie and Clyde.

		Clyde's Action	
		Don't Confess	Confess
Bonnie's Action	Don't Confess	Both 4 years	Clyde gets 2 years Bonnie gets 10 years
	Confess	Clyde gets 10 years Bonnie gets 2 years	Both get 6 years in jail

Figure 8-8. The prisoners' dilemma.

The police tell Bonnie that, if she confesses to the bank heist but Clyde does not confess, then the charge will be reduced to two years for her, but he will get a ten-stretch. If both confess, then each will get six years. If neither confesses, then they both get five years, because there may be other evidence to link them to the crime.

If both prisoners wish to minimize the damage that the other can do to them, they both should confess. From Bonnie's viewpoint, Clyde may confess or may not confess. If Clyde confesses then, to minimize her -sentence, Bonnie should also confess—six years is better than ten years. If, however, Clyde doesn't confess, then it is still in Bonnie's best interest to confess. If she confesses then she'll get two years but, if she doesn't, then she'll get four years.

Confessing, then, is Bonnie's best option regardless of Clyde's decision. An action is known as a **dominant strategy** if it is the best option regardless of the decision of the other party. In this example, the dominant strategy for both Bonnie and Clyde is to confess. Given the actions of the rival, if each player employs the best strategy, then the result is known as a **Nash (or non-cooperative) equilibrium**. The important point to note is that, by each individual pursuing his or her own self-interest (trying to minimize their own jail time), both individuals receive longer sentences.

Honor Among Thieves?

Clearly, it would be better for both Bonnie and Clyde if they could agree to stonewall, because then both would get four years. If the prisoners trusted each other to look after their common interests or if an underworld code of conduct—"don't rat on your friends"—were vigorously adhered to, then stonewalling would seem to be preferred. However, it would then be in Bonnie's best interest to pretend to stonewall (in order to ensure that Clyde did not confess), and then confess anyway. The more strongly that Bonnie suspects that Clyde will cheat by confessing, the greater the likelihood that she, herself, will cheat.

Application of Game Theory to Oligopoly

Let us suppose we have a soft-drinks duopoly, with PensaCola and OkraCoke as the two firms. Each firm must decide whether or not to maintain or end an expensive advertising campaign. If both companies continue to advertise, then the two campaigns will attract customers, and -profits will be $200 million for each company. If both firms abandon their advertising campaigns then, because of the cost saving, profits will be $500 -million for each company. If PensaCola advertises and OkraCoke does not, then Pensacola's profit will be $700 million whereas OkraCoke's will be $100 million. The payoffs are shown in Figure 8-9.

		PensaCola's Action	
		Don't Advertise	Advertise
OkraCoke's Action	Don't Advertise	OkraCoke: +$500 million PensaCola: +$500 million	OkraCoke: +$100 million PensaCola: +$700 million
	Advertise	OkraCoke: +$700 million PensaCola: +$100 million	OkraCoke: +$200 million PensaCola: +$200 million

Figure 8-9. Soda wars.

This is similar to the previous example in that each company has a dominant strategy and that strategy is to continue to advertise. If PensaCola stops its campaign, then OkraCoke should still advertise—$700 million is better than $500 million. If, however, PensaCola does continue to advertise, then OkraCoke should also persist—$200 million is preferable to $200 million. The Nash equilibrium is in the lower right-hand cell of the matrix.

Collusion

Self-interested behavior has led PensaCola and OkraCoke to pursue a strategy (advertising) that has reduced their joint profits. If the two firms could collude and agree not to advertise, then their joint profits would increase from $400 million to $1,000 million. Because of the suspicion that the other firm might cheat and advertise anyway, this option is unlikely to go forward unless the agreement can be assured. In fact, in the 1970s, the cigarette industry achieved just this result by strongly supporting moves that led Congress to ban cigarette ads from television.

THINK IT THROUGH: Must there always be a dominant strategy for a player?

It is possible that a player may not have a dominant strategy—one that is best regardless of the action of his rival. Suppose that, if -PensaCola did not advertise, then OkraCoke's profits when advertising were $400 million (instead of $500 million). The payoffs are shown in Figure 8-10.

		PensaCola's Action	
		Don't Advertise	Advertise
OkraCoke's Action	Don't Advertise	OkraCoke: +$500 million PensaCola: +$500 million	OkraCoke: +$100 million PensaCola: +$700 million
	Advertise	OkraCoke: +$400 million PensaCola: +$100 million	OkraCoke: +$200 million PensaCola: +$200 million

Figure 8-10. Soda wars revisited.

In this case, OkraCoke would gain more by refraining from advertising, so what should the executives at OkraCoke do? Advertise! OkraCoke can expect its rival to follow its dominant strategy and PensaCola's dominant strategy is to advertise. Because PensaCola can be counted on to advertise, OkraCoke will advertise, because $200 million is preferable to $100 million.

Price Stickiness and Game Theory

When we examined the kinked demand curve model, we met Olga, who was considering changing the price of her product. To simplify the analysis, let us suppose that Olga has only one rival (Oleg) and that they are restricted to either maintaining their current price of $20 or cutting it to $19. Currently, Olga and Oleg each have 1,000 customers and each generates $20,000 in revenue.

On the basis of Figure 8-7, we can build up a payoff matrix as shown in Figure 8-11. If Olga were to cut her price to $19 but Oleg did not, then Olga's quantity demanded would expand to 1,500 customers and her revenue would increase to $28,500. Assuming that Olga attracted the additional customers from Oleg, then his revenue would fall from $20,000 to $10,000.

		Oleg's Action	
		Cut Price	Maintain Price
Olga's Action	Cut Price	Olga's revenue $20,900 Oleg's revenue $20,900	Olga's revenue $28,500 Oleg's revenue $10,000
	Maintain Price	Olga's revenue $10,000 Oleg's revenue $28,500	Olga's revenue $20,000 Oleg's revenue $20,000

Figure 8-11. Revenue maximization.

If Olga were to cut her price to $19 and Oleg followed suit, then each firm would attract 100 more customers, and each would see revenue increase from $20,000 by $900 (1,100 × $19).

What should the duopolists do? For both, the dominant strategy is to cut price. By doing so, total revenue will increase from $20,000 to $20,900.

THINK IT THROUGH: From our study of elasticity in Chapter 4, we should expect total revenue to increase. We know that demand must be price-elastic, otherwise marginal revenue would not be positive. Therefore, with an elastic demand, and a decrease in price, total revenue will increase.

The kinked demand curve model suggests that the firm will wish to maintain price, not reduce it. Clearly, despite the increase in total revenue, if marginal cost increases as output expands, then total economic profit may decrease and it would be in the firms' common interest to maintain price at $20.

Repeated Games

Managers learn. If one firm makes a change in price or service and its rivals fall in line, then an expectation is built up. For example, the airline industry has progressively reduced in-flight service. Fees for checked baggage are commonplace. In banking, market leader Bank of America began charging fees for withdrawals at ATMs—other banks followed suit. Similarly,

following the financial disruption of the Great Recession, Bank of America was the first to charge fees on zero-balance credit cards.

Over time, industry expectations may be established and cooperation may become easier to achieve and sustain. As the "game" is played repeatedly, participants may learn to signal intent and to accommodate each other. Rules of conduct may emerge—game theorists refer to a *tit-for-tat* strategy as a frequently developed understanding—a case of "one good (or bad) turn deserves another." Accordingly, the ability of oligopolists to maximize joint profits may be durable.

Policy Response to Oligopoly

The Clayton Act of 1914 allows the government to limit mergers that might substantially lessen competition in an industry. The Herfindahl–Hirschman Index (HHI) is a measure of market concentration and is used by the Antitrust Division of the Department of Justice as a guide to determine whether a proposed merger may be undesirable.

The HHI for an industry is calculated by taking each firm's market share, expressed as a percentage, squaring each of these values, and -summing them. In an industry with four equal-sized firms, the HHI would be 2,500 ($25^2 + 25^2 + 25^2 + 25^2$). A pure monopoly would register a value of 10,000 (that is, 100^2) whereas the HHI for an -industry with 100 firms, each with a market share of one percent, would be 100.

An industry with an HHI in excess of 1,800 is considered "highly concentrated." A proposed merger that would raise the HHI above 1,800 might be challenged if it would raise the industry's index by more than 50, and almost certainly would be challenged if it would raise the industry's index by more than 100. An important element of the Antitrust Division's scrutiny is whether the proposed merger will enhance the ability of firms to engage in "coordinated interaction," whether lawful or not.

Mergers in highly concentrated industries may be approved in particular circumstances such as if there is significant foreign competition, or if one of the firms is in financial trouble, or if it would enhance -efficiency. Firms basing their application to merge on the claim that efficiency will be improved bear the burden of substantiating their claim.

Review of Oligopoly: Of the four market structures, oligopoly is the most difficult to pin down. Firms may or may not sell differentiated products. They may or may not advertise heavily. They may or may not earn substantial long-run economic profits. They may or may not collude, openly or otherwise. They may or may not be efficient—although they are likely not to be, except in the case of contestable markets.

An oligopolistic industry is typified by a small number of mutually interdependent firms. Game theory gives us some fresh insights into how these firms may negotiate with each other.