11
Imperfect Competition and Strategic Behaviour

LEARNING OBJECTIVES (LO)

After studying this chapter you will be able to

1 recognize that Canadian industries typically have either a large number of small firms or a small number of large firms.

2 explain why imperfectly competitive firms have differentiated products and often engage in non-price competition.

3 describe the key elements of the theory of monopolistic competition.

4 understand why strategic behaviour is a key feature of oligopoly.

5 use game theory to explain the difference between cooperative and non-cooperative outcomes among oligopolists.

THE two market structures that we have studied so far—perfect competition and monopoly—are polar cases; they define the two extremes of a firm's market power within an industry. Under perfect competition, firms are price takers, price is equal to marginal cost, and economic profits in the long run are zero. Under monopoly, the firm is a price setter, it sets price above marginal cost, and it can earn positive profits in the long run if there are sufficient entry barriers.

Although they provide important insights, these two polar cases are insufficient for understanding the behaviour of *all* firms. Indeed, most of the products that we easily recognize—swimsuits, cell phones, jeans, cameras, hamburgers, sunglasses, perfume, running shoes, computers, breakfast cereals, and cars, to name just a few—are produced by firms that have market power yet are not monopolists.

This chapter discusses market structures that lie between these two polar cases of perfect competition and monopoly. Before discussing the theory, however, we turn to a brief discussion of the prevalence of these "intermediate" market structures in the Canadian economy.

| 11.1 The Structure of the Canadian Economy

We can divide Canadian industries into two broad groups: those with a large number of relatively small firms and those with a small number of relatively large firms.

Industries with Many Small Firms

About two-thirds of Canada's total annual output is produced by industries made up of firms that are small relative to the size of the market in which they sell.

The perfectly competitive model does quite well in explaining the behaviour of some of these industries. These are the ones in which individual firms produce more-or-less identical products and so are price takers. Forest and fish products are two broad examples. Agriculture also fits fairly well in most ways since individual farmers are clearly price takers. Many basic raw materials, such as iron ore, tin, copper, oil, and paper, are sold on world markets where most individual firms lack significant market power.

Other industries, however, are not well described by the perfectly competitive model, even though they contain many small firms. In retail trade and in services, for example, most firms have some influence over prices. Your local grocery stores, clothing shops, nightclubs, and restaurants may spend a good deal of money advertising—something they would not have to do if they were price takers. Moreover, each store in these industries has differentiated products and also has a unique location, both of which give it some market power over its customers.

The theory of *monopolistic competition,* which we will examine in this chapter, was originally developed to help explain economic behaviour and outcomes in industries in which there are many small firms, each with some market power.

Industries with a Few Large Firms

About one-third of Canada's total annual output is produced by industries that are dominated by either a single firm or a few large ones.

The most striking cases of monopolies in today's economy are the electric utilities which are typically owned by provincial governments. The firms that provide local telephone, cable or digital TV, and Internet services are not strictly monopolies, although in some situations they may have local monopoly power—but in all cases they are subject to considerable government regulation. Other than these and a few other similar cases in which government ownership or regulation play an important role, cases of monopoly are rare in Canada today. However, there are some notable examples of monopoly (or near monopoly) from many years ago. For example, the Eddy Match Company was virtually the sole producer of wooden matches in Canada between 1927 and 1940, and Canada Cement Limited produced nearly all of the output of cement until the 1950s.

Sun Life is one of only a few large firms serving the Canadian life-insurance market. This is an oligopolistic industry.

concentration ratio The fraction of total market sales (or some other measure of market activity) controlled by a specified number of the industry's largest firms.

This type of market dominance by a single large firm is now a thing of the past. Today, most modern industries that are dominated by large firms contain several firms. Their names are part of the average Canadian's vocabulary: Canadian National and Canadian Pacific railways; Bank of Montreal, Royal Bank, and Scotiabank; Imperial Oil, Encana, and Irving; Bell, Telus, and Rogers; Loblaws, Safeway, and Sobeys; Ford, Toyota, and GM; Sony, Mitsubishi, and Toshiba; Great-West Life, Sun Life, and Manulife; and General Foods, Nabisco, and Kellogg. Many service industries that used to be dominated by small independent firms have in recent decades seen the development of large firms operating on a worldwide basis. SNC-Lavalin and Acres are two examples of very large engineering firms that have business contracts all over the world. In management consulting, McKinsey & Co., Boston Consulting Group, and Monitor are also very large firms with market power.

The theory of *oligopoly,* which we will examine later in this chapter, helps us understand industries in which there are small numbers of large firms, each with market power, that compete actively with each other.

FIGURE 11-1 Concentration Ratios in Selected Canadian Industries
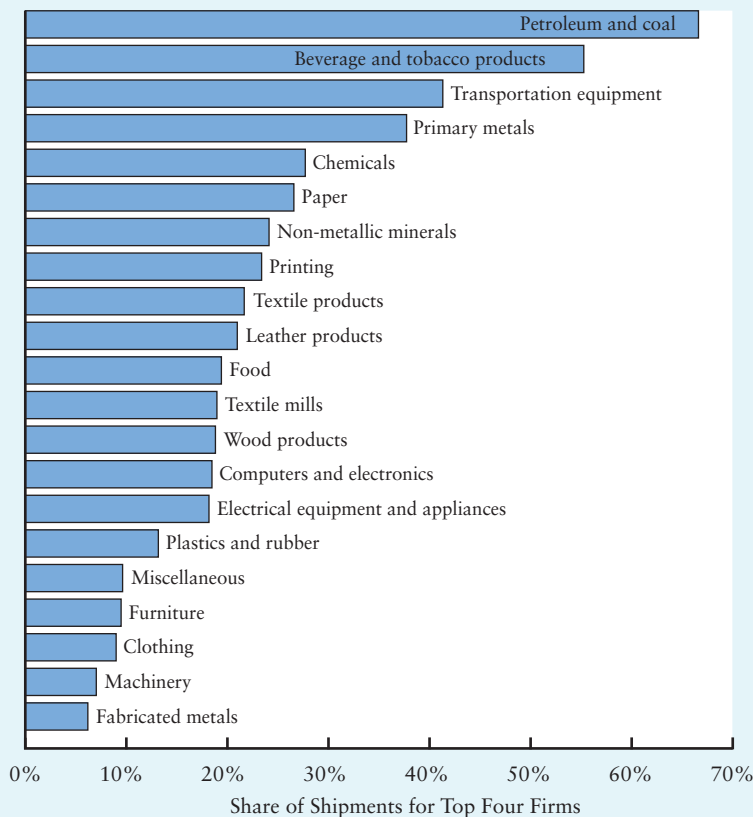
Concentration ratios vary greatly among manufacturing industries. These data show the share of total annual shipments (in dollar terms) accounted for by the four largest firms in the industry.

(*Source*: Author's calculations based on data provided by Statistics Canada.)

Industrial Concentration

An industry with a small number of relatively large firms is said to be highly *concentrated*. A formal measure of such industrial concentration is given by the *concentration ratio*.

Concentration Ratios When we measure whether an industry has power concentrated in the hands of only a few firms or dispersed over many, it is not sufficient to count the firms. For example, an industry with one enormous firm and 29 very small ones is more concentrated in any meaningful sense than an industry with only five equal-sized firms. One approach to this problem is to calculate what is called a **concentration ratio**, which shows the fraction of total market sales (or shipments) controlled by the largest sellers, often taken as the largest four or eight firms.

Figure 11-1 shows the four-firm concentration ratios in several Canadian manufacturing industries. As is clear, the degree of concentration is quite varied across these industries. In the petroleum industry, for example, the largest four firms account for about 65 percent of total sales. At the other extreme, the largest four firms

in the fabricated metals industry account for less than 10 percent of sales. These largest firms may be large in some absolute sense, but the low concentration ratios suggest that they have quite limited market power.

Defining the Market The main problem associated with using concentration ratios is to *define the market* with reasonable accuracy. On the one hand, the market may be much smaller than the whole country. For example, concentration ratios in national cement sales are low, but they understate the market power of cement companies because high transportation costs divide the cement *industry* into a series of *regional markets,* with each having relatively few firms. On the other hand, the market may be larger than one country, as is the case for most internationally traded commodities. This is particularly important for Canada.

The globalization of competition brought about by the falling costs of transportation and communication has been one of the most significant developments in the world economy in recent decades. As the world has "become smaller" through the advances in transportation and communication technologies, the nature of domestic markets has changed dramatically. For example, the presence of only a single firm in one industry in Canada in no way implies monopoly power when it is in competition with several foreign firms that can easily sell in the Canadian market. This is the situation faced by many Canadian companies producing raw materials, such as Cameco, Encana, Suncor, Canfor, Rio Tinto Alcan, and Barrick. These companies may be large relative to the *Canadian* market, but the relevant market in each case (uranium, natural gas, oil, forest products, aluminum, and gold) is the *global* one in which these firms have no significant market power.

In the cases of markets for internationally traded products, concentration ratios (appropriately adjusted to define the relevant market correctly) can still be used to provide valuable information about the degree to which production in a given market is concentrated in the hands of a few firms.

11.2 What Is Imperfect Competition?

We have identified two types of industries that are not well described by the theories of perfect competition or monopoly. In one type, there is a large number of small firms, but the theory of perfect competition is not appropriate because each of the many firms has some market power. In the other type, there is a small number of large firms, each with considerable market power. That these industries have more than a single firm makes the theory of monopoly inappropriate. We need theories to understand these market structures *between* the polar cases of perfect competition and monopoly.

The market structures that we are now going to study are called *imperfectly competitive*. The word *competitive* emphasizes that we are not dealing with monopoly, and the word *imperfect* emphasizes that we are not dealing with perfect competition (in which firms are price takers). Let's begin by noting a number of characteristics that are typical of imperfectly competitive firms. To help organize our thoughts, we classify these under two main headings. First, firms choose the *variety* of the product that they produce and sell. Second, firms choose the *price* at which they will sell that product.

Firms Choose Their Products

If a new farmer enters the wheat industry, the full range of products that the farmer can produce is already in existence. In contrast, if a new firm enters the smartphone or tablet industry, that firm must decide on the characteristics of the new products it is to design and sell. It will not produce smartphones that are identical to those already in production. Rather, it will develop variations on existing products or even a product with a whole new capability. Each of these will have its own distinctive characteristics including colour, size, shape, screen quality, video capability, and so on. As a result, firms in the smartphone and tablet industries sell an array of differentiated products, no two of which are identical.

differentiated product A group of commodities that are similar enough to be called the same product but dissimilar enough that all of them do not have to be sold at the same price.

The term **differentiated product** refers to a group of commodities that are similar enough to be called the same product but dissimilar enough that they can be sold at different prices. For example, although one brand of shampoo is similar to most others, shampoos differ from each other in chemical composition, colour, smell, brand name, packaging, and reputation. All shampoos taken together can be regarded as one differentiated product.

> **Most firms in imperfectly competitive markets sell differentiated products. In such industries, the firm itself must choose which characteristics to give the products that it will sell.**

Firms Choose Their Prices

Whenever different firms' products are not identical, each firm must decide on a price to set. For example, no market sets a single price for cars or TVs or jeans by equating overall demand with overall supply. What is true for cars and TVs is true for virtually all consumer goods. Any one manufacturer will typically have several product lines that differ from each other and from the competing product lines of other firms. Each product has a price that must be set by its producer.

price setter A firm that faces a downward-sloping demand curve for its product. It chooses which price to set.

Firms that choose their prices are said to be **price setters**. Each firm has expectations about the quantity it can sell at each price that it might set. Unexpected demand fluctuations then cause unexpected variations in the quantities that are sold at these prices.

> **In market structures other than perfect competition, firms set their prices and then let demand determine sales. Changes in market conditions are signalled to the firm by changes in the firm's sales.**

One striking contrast between perfectly competitive markets and markets for differentiated products concerns the behaviour of prices. In perfect competition, prices change continually in response to changes in demand and supply. In markets where differentiated products are sold, prices change less frequently.

Modern firms that sell differentiated products typically have hundreds of distinct products on their price lists. Changing such a long list of prices is often costly enough that it is done only infrequently. The costs of changing the prices include the costs of printing new list prices and notifying all customers, the difficulty of keeping track of frequently changing prices for purposes of accounting and billing, and the loss of customer and retailer goodwill because of the uncertainty caused by frequent changes

in prices. As a result, imperfectly competitive firms often respond to fluctuations in demand by changing output and holding prices constant. Only after changes in demand are expected to persist will firms incur the expense of adjusting their entire list of prices.

Since the advent of the Internet, however, some firms find it much easier to change prices almost continuously, just as would happen in perfect competition. For example, airlines have websites on which they post their prices, which change very frequently, even hourly. And for retailers who use the Internet or social networking to contact their customers, "flash sales" are now common, whereby the store advertises special sale prices that last for one day or even one hour.

These breakfast cereals are different enough that each can have its own price, but they are similar enough to be called the same product—they are a differentiated product.

Non-Price Competition

Firms in imperfect competition behave in other ways that are not observed under either perfect competition or monopoly.

First, many firms spend large sums of money on advertising. They do so in an attempt both to shift the demand curves for the industry's products and to attract customers from competing firms. A firm in a perfectly competitive market would not engage in advertising because the firm faces a perfectly elastic (horizontal) demand curve at the market price and so advertising would involve costs but would not increase the firm's revenues. A monopolist has no competitors in the industry and so will not advertise to attract customers away from other brands. However, in some cases a monopolist will still advertise in an attempt to convince consumers to shift their spending away from other types of products and toward the monopolist's product.

Second, many firms engage in a variety of other forms of non-price competition, such as offering competing standards of quality and product guarantees. In the car industry, for example, Toyota and GM compete actively in terms of the duration of their "bumper-to-bumper" warranties. Many firms also compete through the services they offer along with their products. The car industry is again a good example, with manufacturers and dealers competing in their "after-sales" services provided to the customer, ranging from oil changes and car washes to emergency on-road assistance.

Third, firms in many industries engage in activities that appear to be designed to hinder the entry of new firms, thereby preventing the erosion of existing profits by entry. For example, a retailer's public commitment to match any price offered by a competing retailer may convince potential entrants not to enter the industry.

Two Market Structures

Our discussion in this section has been a general one concerning firms in imperfectly competitive market structures. We now go into a little more detail and make a distinction between industries with a large number of small firms and industries with a small number of large firms.

Behaviour in the first group of industries can be understood with the theory of *monopolistic competition.* To understand behaviour in the second group we use the theory of *oligopoly,* in which *game theory* plays a central role. As you will see in the remainder of this chapter, a key difference between these two market structures is the amount of *strategic behaviour* displayed by firms.

11.3 Monopolistic Competition

monopolistic competition Market structure of an industry in which there are many firms and freedom of entry and exit but in which each firm has a product somewhat differentiated from the others, giving it some control over its price.

The theory of **monopolistic competition** was originally developed to deal with the phenomenon of product differentiation. This theory was first developed by U.S. economist Edward Chamberlin in his pioneering 1933 book *The Theory of Monopolistic Competition.*

This market structure is similar to perfect competition in that the industry contains many firms and exhibits freedom of entry and exit. It differs, however, in one important respect: Whereas firms in perfect competition sell an identical product and are price takers, firms in monopolistic competition sell a differentiated product and thus have some power over setting price.

Product differentiation leads to the establishment of brand names and advertising, and it gives each firm a degree of market power over its own product. Each firm can raise its price, even if its competitors do not, without losing all its sales. This is the *monopolistic* part of the theory. However, each firm's market power is severely restricted in both the short run and the long run. The short-run restriction comes from the presence of similar products sold by many competing firms; this causes the demand curve faced by each firm to be very elastic. The long-run restriction comes from free entry into the industry, which permits new firms to compete away the profits being earned by existing firms. These restrictions comprise the *competition* part of the theory.

Many of the small, service-based businesses located in your neighbourhood are monopolistic competitors—corner stores, dry cleaners, hair stylists, restaurants, auto mechanics, shoe-repair shops, grass-cutting and snow-removal services, home-renovation firms, and plumbers, electricians, and painters. In each case, the firm tries to differentiate its product by offering more convenient hours, better workmanship, guarantees of some kind, or perhaps just nicer people. And in each case the firm has some ability to set its own price—but its market power is limited by the nearby presence of other firms selling similar products.

The Assumptions of Monopolistic Competition

The theory of monopolistic competition is based on four key simplifying assumptions.

1. Each firm produces its own version of the industry's differentiated product. Each firm thus faces a demand curve that, although negatively sloped, is highly elastic because competing firms produce many close substitutes.

2. All firms have access to the same technological knowledge and so have the same cost curves.

3. The industry contains so many firms that each one ignores the possible reactions of its many competitors when it makes its own price and output decisions. In this

respect, firms in monopolistic competition are similar to firms in perfect competition.

4. There is freedom of entry and exit in the industry. If profits are being earned by existing firms, new firms have an incentive to enter. When they do, the demand for the industry's product must be shared among the increased number of firms.

Predictions of the Theory

Product differentiation, which is the *only* thing that makes monopolistic competition different from perfect competition, has important consequences for behaviour in both the short and the long run.

Most of the service-based businesses in your neighbourhood, such as hair salons, exist in monopolistically competitive markets.

The Short-Run Decision of the Firm In the short run, a firm that is operating in a monopolistically competitive market structure is similar to a monopoly. It faces a negatively sloped demand curve and maximizes its profits by choosing its level of output such that marginal costs equal marginal revenue. The firm shown in part (i) of Figure 11-2 makes positive profits, although in the short run it is possible for a monopolistically competitive firm to break even or even to make losses.
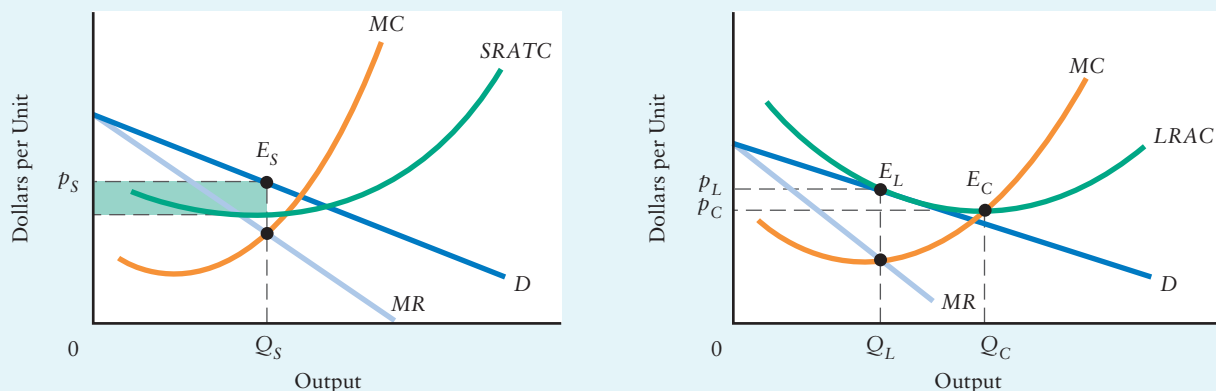
The Long-Run Equilibrium of the Industry Profits, as shown in part (i) of Figure 11-2, provide an incentive for new firms to enter the industry. As they do so, the total demand for the industry's product must be shared among this larger number of firms; thus, each firm gets a smaller share of the total market. Such entry shifts to the left the demand curve faced by each existing firm. Entry continues until profits are eliminated. When this has occurred, each firm is in the position shown in part (ii) of Figure 11-2. Its demand curve has shifted to the left until the curve is *tangent* to the long-run average cost (*LRAC*) curve. Each firm is still maximizing its profit, but its profit is now equal to zero.[1]

To see why this "tangency solution" provides the only possible long-run equilibrium for an industry that fulfills all of the theory's assumptions, consider the two possible alternatives. First, suppose the demand curve for each firm lies below and never touches its *LRAC* curve. There would then be no output at which costs could be covered, and firms would leave the industry. With fewer firms to share the industry's demand, the demand curve for each *remaining* firm shifts to the right. Exit will continue until the demand curve for each remaining firm touches and is tangent to its *LRAC* curve. Second, suppose the demand curve for each firm *cuts* its *LRAC* curve. There would then be a range of output over which positive profits could be earned. Such profits would lead firms to enter the industry, and this entry would shift the demand curve for each existing firm to the left until it is just tangent to the *LRAC* curve, where each firm earns zero profit.

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[1] A standard assumption in this theory is that the industry is symmetric in the sense that when a new firm enters the industry, it takes demand away equally from all existing firms, thus ensuring that all industry profits are eliminated in the long run. The asymmetric case, in which the industry's differentiated products have varying degrees of substitutability for each other, making long-run profits possible for some of the firms, is discussed in advanced courses in industrial organization.

FIGURE 11-2 Profit Maximization for a Firm in Monopolistic Competition

(i) A typical firm in the short run

(ii) A typical firm when the industry is in long-run equilibrium

The short-run position for a monopolistically competitive firm is similar to that of a monopolist—profits can be positive, zero, or negative. In the long run, firms in a monopolistically competitive industry have zero profits and excess capacity. Note the very elastic demand curve—this reflects the fact that each firm produces a good for which there are many close (but not perfect) substitutes. Short-run profit maximization occurs in part (i) at E_S, the output for which $MR = MC$. Price is p_S and quantity is Q_S. Profits or losses may exist in the short run; in this example profits are positive and are shown by the shaded area. Starting from the short-run position shown in part (i), entry of new firms shifts each firm's demand curve to the left until profits are eliminated. In part (ii), point E_L, where demand is tangent to $LRAC$, is the position of each firm when the industry is in long-run equilibrium. Price is p_L and quantity is Q_L. In such a long-run equilibrium, each monopolistically competitive firm has zero profits and excess capacity of $Q_L Q_C$.

The Excess-Capacity Theorem Part (ii) of Figure 11-2 makes it clear that monopolistic competition results in a long-run equilibrium of zero profits, even though each individual firm faces a negatively sloped demand curve. It does this by forcing each firm into a position in which it has *excess capacity*; that is, each firm is producing an output less than that corresponding to the lowest point on its *LRAC* curve. If the firm were to increase its output, it would reduce its cost per unit, but it does not do so because selling more would reduce revenue by more than it would reduce cost. This result is often called the **excess-capacity theorem**.

excess-capacity theorem The property of long-run equilibrium in monopolistic competition that firms produce on the falling portion of their long-run average cost curves. This results in excess capacity, measured by the gap between present output and the output that coincides with minimum average cost.

> **In long-run equilibrium in monopolistic competition, goods are produced at a point where average total costs are not at their minimum.**

In contrast, the long-run equilibrium under perfect competition has price equal to the minimum of long-run average costs. In part (ii) of Figure 11-2, this is shown as point E_C, with price p_C and output Q_C. (Recall that with perfect competition, each firm faces a horizontal demand curve at the market price, so at price p_C each firm would be on its MC curve at point E_C.)

The excess-capacity theorem once aroused passionate debate among economists because it seemed to show that all industries selling differentiated products would produce them at a higher cost than was necessary. Because product differentiation is a characteristic of virtually all modern consumer goods and many service industries, this

theorem seemed to suggest that modern market economies were systematically inefficient.

Subsequent analysis by economists has shown that the charge of inefficiency has not been proven. The excess capacity of monopolistic competition does not necessarily indicate a waste of resources because some benefits accrue to consumers who can choose among the variety of products.

Saying that consumers value variety is not saying that *each* consumer necessarily values variety. You might like only one of the many brands of toothpaste and be better off if only that one brand were sold at a lower price. But other consumers would prefer one of the other brands. Thus, it is the differences in tastes *across many consumers* that give rise to the social value of variety, and the cost of achieving that greater variety is the higher price per unit that consumers must pay.

The Canadian wine-making industry contains many firms producing similar but differentiated products. It is a monopolistically competitive industry.

> **From society's point of view, there is a tradeoff between producing more brands to satisfy diverse tastes and producing fewer brands at a lower cost per unit.**

Monopolistic competition produces a wider range of products but at a somewhat higher cost per unit than perfect competition (which produces only one type of each generic product). As consumers clearly value variety, the benefits of variety must be matched against the extra cost that variety imposes. Product differentiation is wasteful only if the costs of providing variety exceed the benefits of the variety itself.

11.4 Oligopoly and Game Theory

Industries that are made up of a small number of large firms have a market structure called *oligopoly,* from the Greek words *oligos polein,* meaning "few to sell." An **oligopoly** is an industry that contains two or more firms, at least one of which produces a significant portion of the industry's total output. Whenever there is a high concentration ratio for the firms that are serving one particular market, that market is oligopolistic. The market structures of oligopoly, monopoly, and monopolistic competition are similar in that firms in all these markets face negatively sloped demand curves.

oligopoly An industry that contains two or more firms, at least one of which produces a significant portion of the industry's total output.

Profit Maximization Is Complicated

Like firms in other market structures, an oligopolist that wants to maximize its profits produces the level of output where its marginal revenue equals its marginal cost. But determining this level of output is more complicated for an oligopolist than it is for any other kind of firm because the firm's marginal revenue depends importantly on what its rivals do. For example, if Toyota decides to increase its production of compact cars

in an attempt to equate its *MR* with its *MC,* Ford and Nissan may respond by aggressively increasing their output of compacts—thus reducing Toyota's marginal revenue. Alternatively, Ford and Nissan might *reduce* their output of compacts and instead focus their attention on market niches in which Toyota plays a smaller role. Or they might leave their output levels unchanged and introduce new options on their compact cars in an attempt to attract consumers to their products.

The general point is that determining the level of output that maximizes profits is complicated for an oligopolistic firm because it must consider its rivals' likely responses to its actions. Economists say that oligopolists exhibit **strategic behaviour**, which means that they take explicit account of the impact of their decisions on competing firms and of the reactions they expect competing firms to make. In the remainder of this section we examine the strategic behaviour practised by oligopolistic firms.

strategic behaviour Behaviour designed to take account of the reactions of one's rivals to one's own behaviour.

> Oligopolistic firms often make strategic choices; they consider how their rivals are likely to respond to their own actions.

The Basic Dilemma of Oligopoly

The basic dilemma faced by oligopolistic firms is very similar to the dilemma faced by the members of a cartel, which we studied in Chapter 10. There we saw that the cartel as a whole had an incentive to form an agreement to restrict total output, but each individual member of the cartel had the incentive to cheat on the agreement and increase its own level of output.

For the small number of firms in an oligopoly, the incentives are the same. We say that firms can either *cooperate* (or *collude*) in an attempt to maximize joint profits, or they can *compete* in an effort to maximize their individual profits. Not surprisingly, the decision by one firm to cooperate or to compete will depend on how it thinks its rivals will respond to its decision.

When thinking about how firm behaviour leads to market outcomes, we distinguish between *cooperative* and *non-cooperative* behaviour. If the firms cooperate to produce among themselves the monopoly output, they can maximize their joint profits. If they do this, they will reach what is called a **cooperative** (or **collusive**) **outcome**, which is the position that a single monopoly firm would reach if it owned all the firms in the industry.

cooperative (collusive) outcome A situation in which existing firms cooperate to maximize their joint profits.

If the firms are at the cooperative outcome, it will usually be worthwhile for any one of them to cut its price or to raise its output, so long as the others do not do so. However, if every firm does the same thing, they will be worse off as a group and may all be worse off individually. An industry outcome that is reached when firms proceed by calculating only their own gains without cooperating with other firms is called a **non-cooperative outcome**.

non-cooperative outcome An industry outcome reached when firms maximize their own profit without cooperating with other firms.

The behaviour of firms in an oligopoly is complex, and studying it requires much attention to detail. As in other market structures, it is necessary to think about how individual firm behaviour affects the overall market outcome. Unlike other market structures, however, in oligopoly each firm typically thinks about how the other firms in the industry will react to its own decisions. Then, of course, the other firms may respond to what the first firm does, and so on. To help us keep our thoughts organized, we will use *game theory*.

Some Simple Game Theory

Game theory is used to study decision making in situations in which there are a number of players, each knowing that others may react to their actions and each taking account of others' expected reactions when making moves. For example, suppose a firm is deciding whether to raise, lower, or maintain its price. Before arriving at an answer, it asks, "What will the other firms do in each of these cases, and how will their actions affect the profitability of whatever decision I make?"

game theory The theory that studies decision making in situations in which one player anticipates the reactions of other players to its own actions.

> When game theory is applied to oligopoly, the players are firms, their game is played in the market, their strategies are their price or output decisions, and the payoffs are their profits.

An illustration of the basic dilemma of oligopolists, to cooperate or to compete, is shown in Figure 11-3 for the case of a two-firm oligopoly, called a *duopoly*. In this simplified game, we assume that both firms are producing the same product, and so there is a single market price. The only choice for each firm is how much output to produce. If the two firms "cooperate" to jointly act as a monopolist, each firm produces one-half of the monopoly output and each earns large profits. If the two firms "compete," they each produce more than half (say two-thirds) of the monopoly output, and in this case both firms earn low profits. As we will see, even this very simple example is sufficient to illustrate several key ideas in the modern theory of oligopoly.

A Payoff Matrix Figure 11-3 shows a *payoff matrix* for this simple game. It shows the profits that each firm earns in each possible combination of the two firms' actions. The upper-left cell in this example shows that if each firm produces one-half of the monopoly output, each firm will earn profits of 20. The lower-right cell shows that if each firm produces two-thirds of the monopoly output, each firm will earn a profit of 17. Since *joint* profits must be maximized at the monopoly output, the total profit in the upper-left cell (40) is greater than the total profit in the lower-right cell (34).

The upper-right and lower-left cells show the profits in the case where one firm produces one-half of the monopoly output and the other firm produces two-thirds of the monopoly output. Note that in these cells, the firm that produces more earns the greater profit. The firm that produces one-half of the monopoly output is helping to restrict output and keep prices high. The firm that produces two-thirds of the monopoly output then benefits from the first firm's output restrictions.

FIGURE 11-3 The Oligopolist's Dilemma: To Cooperate or to Compete?

		Firm A's output	
		One-half monopoly output	Two-thirds monopoly output
Firm B's output	One-half monopoly output	20 20	15 22
	Two-thirds monopoly output	22 15	17 17

Cooperation to determine the overall level of output can maximize joint profits, but it leaves each firm with an incentive to cheat. The figure shows a payoff matrix for a two-firm game. Firm A's production is indicated across the top, and its payoffs are shown in the green circles within each cell. Firm B's production is indicated down the left side, and its payoffs are shown in the red circles within each cell.

If A and B cooperate, each produces one-half the monopoly output and receives a payoff of 20. If A and B do not cooperate, they each end up producing two-thirds of the monopoly output and receiving a payoff of 17. In this example, this non-cooperative outcome is a Nash equilibrium.

Strategic Behaviour The payoff matrix shows the profit each player earns with each combination of the two players' moves. But what will actually happen? To answer this question, we must first know what type of game is being played. Specifically, can the players *cooperate* or is the game a *non-cooperative* one?

Cooperative Outcome. If the two firms in this duopoly can cooperate, the payoff matrix shows that their highest *joint* profits will be earned if each firm produces one-half of the monopoly output. This is the cooperative outcome. The payoff matrix also shows, however, that if each firm thinks the other will cooperate (by producing half of the monopoly output), then it has an incentive to cheat and produce two-thirds of the monopoly output. Thus, the cooperative outcome can only be achieved if the firms have some effective way to enforce their output-restricting agreement. As we will see in Chapter 12, explicit output-restricting agreements are usually illegal.

Non-Cooperative Outcome. Now suppose that firms believe cooperation to be impossible because they have no legal way of enforcing an agreement. What will be the non-cooperative outcome in this duopoly game? To answer this question, we must examine each player's incentives, given the possible actions of the other player.

   Firm A reasons as follows: "If B produces one-half of the monopoly output (upper row of the matrix), then my profit will be higher if I produce two-thirds of the monopoly output. Moreover, if B produces two-thirds of the monopoly output (bottom row of the matrix), my profit will be higher if I also produce two-thirds of the monopoly output. Therefore, no matter what B does, I will earn more profit if I produce two-thirds of the monopoly output." A quick look at the payoff matrix in Figure 11-3 reveals that this game is *symmetric,* and so Firm B's reasoning will be identical to A's: It will conclude that its profit will be higher if it produces two-thirds of the monopoly output no matter what A does.

   The final result is therefore clear. Each firm will end up producing two-thirds of the monopoly output and each firm will receive a profit of 17. This is the non-cooperative outcome. Note that each firm will be worse off than it would have been had they been able to enforce an output-restricting agreement and thus achieve the cooperative outcome. This type of game, in which the non-cooperative outcome makes *both* players worse off than if they had been able to cooperate, is called a *prisoners' dilemma*. The reason for this curious name is discussed in *Extensions in Theory 11-1*.

Nash equilibrium An equilibrium that results when each player is currently doing the best that it can, given the current behaviour of the other players.

Nash Equilibrium. The non-cooperative outcome shown in Figure 11-3 on page 265 is called a **Nash equilibrium**, after the U.S. mathematician John Nash, who developed the concept in the 1950s and received the Nobel Prize in economics in 1994 for this work. (The 2002 movie *A Beautiful Mind* is about John Nash's life and contains a few fascinating bits of game theory!) In a Nash equilibrium, each player's best strategy is to maintain its current behaviour *given the current behaviour of the other players*.

   It is easy to see that there is only one Nash equilibrium in Figure 11-3.[2] In the bottom-right cell, the best decision for each firm, given that the other firm is producing two-thirds of the monopoly output, is to produce two-thirds of the monopoly output

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[2] In general, an economic "game" may have zero, one, or more Nash equilibria. For an example of an economic setting in which there are two Nash equilibria, see Study Exercise #12 on page 279.

EXTENSIONS IN THEORY 11-1

The Prisoners' Dilemma

The game shown in Figure 11-3 on page 265 is often known as a prisoners' dilemma game. This is the story behind the name:

Two men, John and William, are arrested on suspicion of jointly committing a crime and, in the absence of witnesses, are interrogated separately. They know that if they both plead innocence, they will get only a light sentence, and if they both admit guilt they will both receive a medium sentence. Each is told, however, that if either protests innocence while the other admits guilt, the one who claims innocence will get a severe sentence while the other will be released with no sentence at all.

Here is the payoff matrix for that game:

		John's Plea	
		Innocent	Guilty
William's Plea	Innocent	J light sentence / W light sentence	J no sentence / W severe sentence
	Guilty	J severe sentence / W no sentence	J medium sentence / W medium sentence

John reasons as follows: "William will plead either guilty or innocent. If he pleads innocent, I will get a light sentence if I also plead innocent but no sentence at all if I plead guilty, so guilty is my better plea. If he pleads guilty, I will get a severe sentence if I plead innocent and a medium sentence if I plead guilty. So once again guilty is my preferred plea."

William reasons in the same way and, as a result, they both plead guilty and get a medium sentence. Note, however, that if they had been able to communicate and coordinate their pleas, they could both have agreed to plead innocent and get off with a light sentence.

The prisoners' dilemma arises in many economic situations. We have already seen an example of a two-firm oligopoly. Economists use the basic structure of this simple game to think about how firms compete in their decisions to build new factories, launch advertising campaigns, and adjust the prices of their differentiated products.

Simple game theory and the prisoners' dilemma also figure prominently in the study of political science. Robert Axelrod's 1984 book *The Evolution of Cooperation* discusses how the key insights from the prisoners' dilemma have been used in the analysis of elections (where candidates' choices are their electoral platforms) and the nuclear arms race (in which national governments' choices are their decisions to build and stockpile weapons).*

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*For those interested in a very readable treatment of game theory applied to many aspects of life, see *Thinking Strategically* (Norton, 1993) by Avinash Dixit and Barry Nalebuff, two leading economists.

itself. Between them, they produce a joint output of 1.33 times the monopoly output. Neither firm has an incentive to depart from this position (except through enforceable cooperation with the other). In any other cell, each firm has an incentive to change its output *given the output of the other firm*.

The basis of a Nash equilibrium is rational decision making in the absence of cooperation. Its particular importance in oligopoly theory is that it is a self-policing equilibrium. It is self-policing in the sense that there is no need for group behaviour to enforce it. Each firm has a self-interest to maintain it because no move will improve its profits, given what other firms are currently doing.

If a Nash equilibrium is established by any means whatsoever, no firm has an incentive to depart from it by altering its own behaviour.

Extensions in Game Theory

The simple game that we have just described helps us understand the dilemma faced by oligopolists producing identical products, such as steel, aluminum, cement, newsprint, and copper pipe. But game theory can also be used in other settings, such as

- examining how oligopolists interact when they charge different prices for their differentiated products, such as Nike and Reebok for running shoes, Coke and Pepsi for soft drinks, or Toshiba and Dell for personal computers

- examining how oligopolists interact when the decision is not about how much to produce or what price to charge, but rather whether to develop a new product, such as GM's and Toyota's decisions to introduce an electric car, or Research in Motion's and Apple's decisions to introduce a new wireless device

For almost any oligopolistic business decision you can imagine, it is possible to describe and analyze the firms' decisions by using game theory. Sometimes the game and the solution are relatively simple, as in Figure 11-3. Often, however, the game and solution are much more complicated. If you take an advanced course in industrial organization you will encounter some of these situations. Until then the straightforward intuition developed in our simple game can help explain a great deal of real-world behaviour.

11.5 Oligopoly in Practice

We have examined the incentives for firms in an oligopoly to cooperate and the incentives for firms to cheat on any cooperative agreement. We can now look at the behaviour that we actually observe among oligopolists. How do they cooperate? How do they compete?

Types of Cooperative Behaviour

collusion An agreement among sellers to act jointly in their common interest. Collusion may be overt or covert, explicit or tacit.

When firms agree to cooperate in order to restrict output and raise prices, their behaviour is called **collusion**. Collusive behaviour may occur with or without an explicit agreement to collude. Where explicit agreement occurs, economists speak of *overt* or *covert collusion,* depending on whether the agreement is open or secret. Where no explicit agreement actually occurs, economists speak of *tacit collusion*. In this case, all firms behave cooperatively without an explicit agreement to do so. They merely understand that it is in their mutual interest to restrict output and to raise prices.

Explicit Collusion The easiest way for firms to ensure that they will all maintain their joint profit-maximizing output is to make an explicit agreement to do so. Such collusive agreements have occurred in the past, although they have been illegal among privately owned firms in Canada for a long time (with some exceptions made for firms exporting their product). When they are discovered today, they are rigorously prosecuted. We will see, however, that such agreements are not illegal everywhere in the world, particularly when they are supported by national governments.

We saw in Chapter 10 that when several firms get together to act in this way, they create a *cartel*. Cartels show in stark form the basic conflict between cooperation and competition that we just discussed. Cooperation among cartel members allows them to restrict output and raise prices, thereby increasing the cartel members' profits. But it also presents each cartel member with the incentive to cheat. The larger the number of

firms, the greater the temptation for any one of them to cheat. After all, cheating by one small firm may not be noticed because it will have a small effect on price. Conversely, a cartel made up of a small number of firms is more likely to persist because cheating by any one member is more difficult to conceal from the other members.

As we mentioned in Chapter 10, DeBeers is an example of a firm that has been able to assemble a cartel in the world's diamond industry. Through its own Diamond Trading Company (DTC), DeBeers markets approximately 40 percent of the world's annual diamond production. With such influence over the market, it is able to manage the flow of output, in response to changes in world demand, to keep prices high. In recent years, however, the discovery of large diamond mines by firms that wanted to remain independent of DeBeers has led to a reduction in DeBeers' ability to set the market price. In fact, the independent producers—in particular, Canadian producers—have been successful at establishing their own "brand" of diamonds. This has led DeBeers to reduce its efforts through the DTC to manage market prices and instead focus more of its efforts on creating its own brand of diamonds and other luxury products.

The most famous example of a cartel—and the one that has had the most dramatic effect on the world economy—is the Organization of the Petroleum Exporting Countries (OPEC). OPEC's explicit cooperation over the past four decades, as well as its failure to always sustain such cooperation, is discussed in *Lessons From History 11-1*.

For more information on OPEC, check out its website: www.opec.org.

Tacit Collusion Although collusive behaviour that affects prices is illegal, a small group of firms that recognizes the influence that each has on the others may act without any explicit agreement to achieve the cooperative outcome. In such tacit agreements, the two forces that push toward cooperation and competition are still evident. First, firms have a common interest in cooperating to maximize their joint profits at the cooperative solution. Second, each firm is interested in its own profits, and any one of them can usually increase its profits by behaving competitively.

In many industries there is suggestive evidence of tacit collusion, although it is very difficult to prove rigorously. For example, when one large steel company announces that it is raising its price for a specific quality of steel, other steel producers will often announce similar price increases within a day or two. Or when one Canadian bank announces an increase in its interest rate for five-year mortgages, other banks usually increase their rates within a few days. These seemingly coordinated actions may be the result of a secret explicit agreement or of tacit collusion. However, the firms that followed the first firm's price or interest-rate increase could easily argue (and usually do in such cases) that with their competitor raising prices, and thereby driving some customers toward them, the natural response is to raise their own prices.

Types of Competitive Behaviour

Although the most obvious way for a firm to violate the cooperative solution is to produce more than its share of the joint profit-maximizing output, there are other ways in which rivalrous behaviour can occur.

Competition for Market Share Even if *joint* profits are maximized, there is still a question of how the profit-maximizing level of sales is to be divided among the colluding firms. Competition for market share may upset the tacit agreement to hold to joint profit-maximizing behaviour. Firms often compete for market share through various forms of non-price competition, such as advertising and variations in the quality of their product. Such costly competition may increase one firm's profits only by decreasing profits for other firms, but since the activities are costly, total industry profits would be reduced.

LESSONS FROM HISTORY 11-1

Explicit Cooperation in OPEC

The experience of the Organization of the Petroleum Exporting Countries (OPEC) in the 1970s and 1980s illustrates the power of cooperative behaviour to create short-run profits, as well as the problems of trying to exercise long-run market power in an industry without substantial entry barriers.

OPEC did not attract worldwide attention until 1973, when its members voluntarily restricted their output by negotiating quotas among themselves. In that year, OPEC countries accounted for about 70 percent of the world's supply of crude oil. Although it was not a complete monopoly, the cartel came close to being one. By reducing output, the OPEC countries were able to reduce the world supply of oil and thereby increase its world price by almost 300 percent. Their actions resulted in massive profits both for themselves and for non-OPEC producers, who obtained the high prices without having to limit their output. After several years of success, however, OPEC began to experience the typical problems of cartels.

High Prices Lead to Entry

Entry became a problem for the OPEC countries. The high price of oil encouraged the development of new supplies, and within a few years, new productive capacity was coming into use at a rapid rate in non-OPEC countries. The development of North Sea oil by the United Kingdom, the oil sands in Alberta, and the Hibernia oil field in Newfoundland and Labrador are three examples of this new productive capacity.

Long-Run Adjustment of Demand

The short-run demand for oil proved to be highly inelastic. Over the long run, however, adaptations to reduce the demand for oil were made within the confines of existing technology. Homes and offices were insulated more efficiently, and smaller, more fuel-efficient cars became popular. This is an example of the distinction between the short-run and long-run demand for a commodity first introduced in Chapter 4.

Innovation further reduced the demand for oil in the very long run. Over time, technologies that were more efficient in their use of oil were developed, as were alternative energy sources.

This experience in both the long run and the very long run shows the price system at work, signalling the need for adaptation and providing the incentives for that adaptation. It also provides an illustration of Joseph Schumpeter's concept of creative destruction, which we first discussed in Chapter 10. To share in the profits generated by high oil prices, new technologies and new substitute products were developed, and these reduced much of the market power of the original cartel.

Cheating in the Early 1980s

At first, there was little incentive for OPEC countries to violate their production quotas. Member countries found themselves with such undreamed-of increases in incomes that they found it difficult to use all of their money productively. As the output of non-OPEC oil grew, however, OPEC's output had to be reduced to maintain the high prices. Furthermore, as the long-run adjustments in demand occurred, even larger output restrictions by OPEC were required to prop up the price of oil. Incomes in OPEC countries declined as a result.

Many OPEC countries had become used to their enormous incomes, and their attempts to maintain them in the face of falling output quotas brought to the surface the instabilities inherent in all cartels. In 1981, oil prices reached U.S.$35 per barrel. In real terms, this was about six times as high as the 1972 price, but production quotas were less than one-half of OPEC's capacity. Eager to increase their oil revenues, many individual OPEC members gave in to the pressure to cheat and produced in excess of their production quotas. In 1984, Saudi Arabia indicated that it would not tolerate further cheating by its OPEC partners and demanded that others share equally in reducing their quotas yet further. However, agreement proved impossible. In December 1985, OPEC decided to eliminate production quotas altogether and let each member make its own decisions about output. The end of the production quotas effectively meant the end of the cartel.

After the Collapse

OPEC's collapse as an output-restricting cartel led to a major reduction in world oil prices. Early in 1986, the downward slide took the price to U.S.$20 per barrel, and it fell to U.S.$11 per barrel later in the year. In real terms, this was still double the price that had prevailed just before OPEC introduced its output restrictions in 1973. Following the 1986 collapse, and for the next decade or so, the world price of oil fluctuated between U.S.$15 per barrel and U.S.$25 per barrel. With the continuing expansion of output from non-OPEC producers, OPEC's share of world output steadily fell, reaching approximately 35 percent by the mid-1990s, where it remains today.

Beginning in the late 1990s, the world price of oil began to rise again, as the accompanying figure shows. Measured in 2001 U.S. dollars, the price increased from below U.S.$20 per barrel in 1998 to just under U.S.$80 in 2008 (although it was almost U.S.$150 per barrel briefly during that year). The main cause of this significant price increase was a booming world economy that increased the world's demand for oil. The sharp price increase reflected an increase in demand at a time when the world supply curve was relatively inelastic. This supply inelasticity, in turn, reflected the fact that most oil producers—both inside and outside OPEC—were producing at or close to their capacity and thus were unable to easily respond to higher prices by increasing their output. In this setting of low global excess capacity, OPEC's ability to increase prices through output restrictions was partially restored, even though their share of world output was much less than in the 1970s.

With the arrival of a major global recession in 2008–2009, the world price fell sharply to U.S. $50 per barrel. By 2012, however, after two years of a modest economic recovery and renewed growth in world demand, the price had recovered to over U.S.$80 per barrel (in 2001 U.S. dollars), where it remains today.

OPEC members continue to negotiate output-restricting agreements in an attempt to raise (and stabilize) the world price of oil. With a global market share of only 35 percent, however, and both economic and political volatility affecting the world oil market, cartel members have a difficult task. As we have seen in this chapter, maintaining an effective cartel is quite a challenge.

The Real Price of Oil, 1970–2012
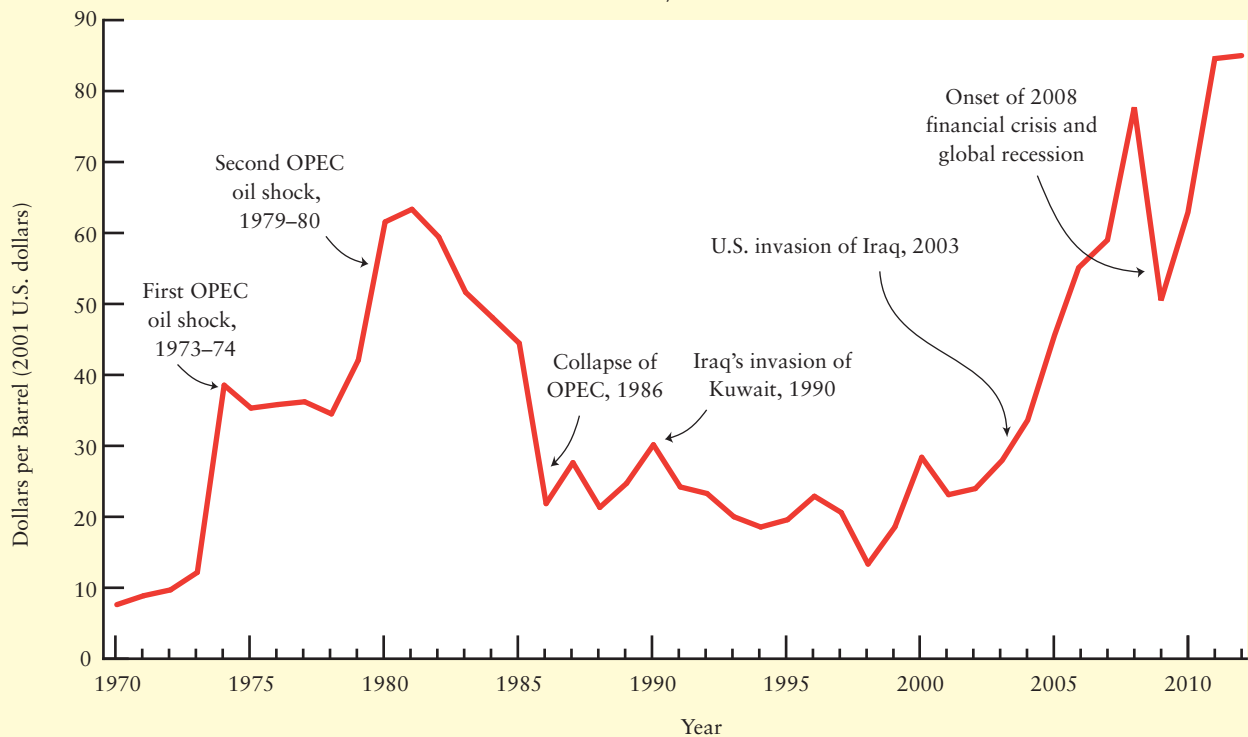
(Source: Based on author's calculations. Annual average of the nominal U.S.-dollar price of OPEC's reference basket: www.opec.org. U.S. CPI [all items]: www.bls.gov.)

Oligopolistic firms producing differentiated products often compete very little through prices. Sometimes the most aggressive competition takes place through their continual processes of innovation, as well as the introduction of new products.

In an industry with many differentiated products and in which sales are often by contract between buyers and sellers, covert rather than overt cheating may seem attractive. Secret discounts and rebates can allow a firm to increase its sales at the expense of its competitors while appearing to hold to the tacitly agreed price.

Innovation A firm may find that by innovating it can behave competitively, keeping ahead of its rivals, and thereby maintain a larger market share. In this way, it will earn larger profits than it would if it cooperated with the other firms in the industry, even though all the firms' joint profits are lower. The great Austrian economist Joseph Schumpeter called the process by which one firm attacks another's monopolistic position by developing new products "creative destruction." Such competition through innovation contributes to the long-run growth of living standards and may provide social benefits over time that outweigh any losses caused by the restriction of output at any one point in time.

Oligopolistic firms typically compete by innovating. A firm can rectify a mistake in its price-setting decisions easily, but falling behind its competitors in developing new products and new production processes can spell disaster. A reading of the business pages of any newspaper shows firms in continuous competition to outdo each other in innovations.

There are strong incentives for oligopolistic firms to compete rather than to maintain the cooperative outcome, even when they understand the inherent risks to their joint profits.

An obvious example of oligopolistic competition through innovation is Apple's ongoing development of new products. In the last decade, Apple has been highly successful with its iPod, iPhone, and iPad and is currently developing an iTV. In each case, the features and remarkable consumer appeal of the products not only took sales away from Apple's rivals (such as RIM and Nokia) but also expanded the total market by attracting consumers who previously owned no such products. But Apple's enormous success has attracted the entry of rivals, as is so often the case. Microsoft, which for many years focused only on the development of software, has now entered the market for electronic devices and is in the process of opening a network of retail stores to compete against the iconic Apple stores. The next few years should see some fascinating rivalry between these two technology titans.

The Importance of Entry Barriers

Suppose firms in an oligopolistic industry succeed in raising prices above long-run average costs and earn substantial profits that are not completely eliminated by competition among them. In the absence of significant entry barriers, new firms will enter the industry and erode the profits of existing firms, as they do in monopolistic competition. Natural barriers to entry were discussed in Chapter 10. They are an important part of the explanation of the persistence of profits in many oligopolistic industries.

Where such natural entry barriers do not exist, however, oligopolistic firms can earn profits in the long run only if they can *create* entry barriers. To the extent this is done, existing firms can move toward joint profit maximization without fear that new firms will enter the industry. We now discuss some types of *firm-created* entry barriers.

Brand Proliferation as an Entry Barrier By altering the characteristics of a differentiated product, it is possible to produce a vast array of variations on the general theme of that product, each with its unique identifying brand. Think, for example, of the many different brands of soap or shampoo, breakfast cereals or cookies, and even cars or motorcycles. In these cases, each firm in the industry produces *several* brands of the differentiated product.

Although such brand proliferation is no doubt partly a response to consumers' tastes, it can also have the effect of discouraging the entry of new firms. To see why, suppose the product is the type for which there is a substantial amount of brand switching by consumers. In this case, the larger the number of brands sold by existing firms, the smaller the expected sales of a new entrant.

Suppose, for example, that an industry contains three large firms, each selling one brand of beer, and say that 30 percent of all beer drinkers change brands in a random fashion each year. If a new firm enters the industry, it can expect to pick up one-third of the customers who change brands (a customer who switches brands now has three *other* brands among which to choose). The new firm would get 10 percent (one-third of 30 percent) of the total market the first year merely as a result of picking up its share of the random switchers, and it would keep increasing its share for some time thereafter. If, however, the existing three firms have five brands each, there would be 15 brands already available, and a new firm selling one new brand could expect to pick up only one-fifteenth of the brand switchers, giving it only 2 percent of the total market the first year, with smaller gains also in subsequent years. This is an extreme case, but it illustrates a general result.

> **The larger the number of differentiated products that are sold by existing oligopolists, the smaller the market share available to a new firm that is entering with a single new product. Brand proliferation therefore can be an effective entry barrier.**

Advertising as an Entry Barrier In addition to producing useful information about existing products, advertising can operate as a potent entry barrier by increasing the costs of new entrants. Where heavy advertising has established strong brand images for existing products, a new firm may have to spend heavily on advertising to create its own brand images in consumers' minds. If the firm's sales are small, advertising costs *per unit* will be large, and price will have to be correspondingly high to cover those costs. Consider Nike, Reebok, and their competitors. They advertise not so much the quality of their athletic shoes as images that they want consumers to associate with the shoes. The same is true for cosmetics, beer, cars, hamburgers, and many more consumer goods. The ads are lavishly produced and photographed. They constitute a formidable entry barrier for a new producer.

> **A new entrant with small sales but large required advertising costs finds itself at a substantial cost disadvantage relative to its established rivals.**

Advertising can be very informative for consumers. But by raising the costs of new entrants, advertising can also act as a potent entry barrier.

The combined use of brand proliferation and advertising as an entry barrier helps to explain one apparent paradox of everyday life—that one firm often sells multiple brands of the same product, which compete actively against one another as well as against the products of other firms. The soap and beer industries provide classic examples of this behaviour. Because all available scale economies can be realized by quite small plants, both industries have few natural barriers to entry. Both contain a few large firms, each of which produces an array of heavily advertised products. The proliferation of brands makes it harder for a new entrant to obtain a large market niche with a single new product. The heavy advertising, although directed against existing products, creates an entry barrier by increasing the average costs of a new product that seeks to gain the attention of consumers and to establish its own brand image.

Predatory Pricing as an Entry Barrier A firm will not enter a market if it expects continued losses after entry. An existing firm can create such an expectation by cutting prices below costs whenever entry occurs and keeping them there until the entrant goes bankrupt. The existing firm sacrifices profits while doing this, but it sends a discouraging message to potential future rivals, as well as to present ones. Even if this strategy is costly in terms of lost profits in the short run, it may pay for itself in the long run by creating *reputation effects* that deter the entry of new firms at other times or in other markets that the firm controls.

Predatory pricing is controversial. Some economists argue that pricing policies that appear to be predatory can be explained by other motives and that existing firms only hurt themselves when they engage in such practices instead of accommodating new entrants. Others argue that predatory pricing has been observed and that it is in the long-run interests of existing firms to punish the occasional new entrant even when it is costly to do so in the short run.

Canadian courts have taken the position that predatory pricing does indeed occur and a number of firms have been convicted of using it as a method of restricting entry.

See Industry Canada's website at www.ic.gc.ca for a discussion of predatory pricing in Canada.

Oligopoly and the Economy

Oligopoly is found in many industries and in all advanced economies. It typically occurs in industries in which both perfect and monopolistic competition are made impossible by the existence of major economies of scale. In such industries, there is simply not enough room for a large number of firms all operating at or near their minimum efficient scales.

Two questions are important for the evaluation of oligopoly. First, in their short-run and long-run outcomes, where do oligopolistic firms typically settle between the extreme outcomes of earning zero profits and earning monopoly profits? Second, how much do oligopolists contribute to economic growth by encouraging innovative activity in the very long run?

Profits Under Oligopoly Some firms in some oligopolistic industries succeed in coming close to joint profit maximization in the short run. In other oligopolistic industries,

firms compete so intensely among themselves that they come close to achieving competitive prices and outputs.

In the long run, those profits that do survive competitive behaviour among existing firms will tend to attract entry. Profits will persist only insofar as entry is restricted either by natural barriers, such as large minimum efficient scales for potential entrants, or by barriers created, and successfully defended, by the existing firms or, perhaps, created by government regulations.

Innovation Which market structure—oligopoly or perfect competition—is most conducive to innovation? As we discussed in Chapter 8, innovation and productivity improvements are the driving force of the economic growth that has so greatly raised living standards over the past two centuries. They are intimately related to Schumpeter's concept of creative destruction, which we first encountered in our discussion of entry barriers in Chapter 10.

Examples of creative destruction abound. In the nineteenth century, railways began to compete with wagons and barges for the carriage of freight. In the twentieth century, trucks operating on newly constructed highways began competing with trains. During the 1950s and 1960s, airplanes began to compete seriously with both trucks and trains. In recent years, the development of Internet banking has allowed many payments to be made online, thereby undermining the monopoly power of the postal service. Cell phones have significantly weakened the monopoly power that telephone companies had for the provision of local phone service. And the Internet has allowed consumers to download music easily (though often in violation of copyright laws), and has dramatically reduced the market power of the music production companies that sell CDs.

An important defence of oligopoly is based on Schumpeter's idea of creative destruction. Some economists argue that oligopoly leads to more innovation than would occur in either perfect competition or monopoly. They argue that the oligopolist faces strong competition from existing rivals and cannot afford the more relaxed life of the monopolist. Moreover, oligopolistic firms expect to keep a good share of the profits that they earn from their innovative activity and thus have considerable incentive to innovate.

Everyday observation provides support for this view. Leading North American firms that operate in highly concentrated industries, such as Alcoa, Apple, Canfor, Bombardier, DuPont, General Electric, Canadian National, Xerox, Research In Motion, and Boeing, have been highly innovative over many years.

This observation is not meant to suggest that *only* oligopolistic industries are innovative. Much innovation is also done by very small, new firms. If today's small firms are successful in their innovation, they may become tomorrow's corporate giants. For example, Microsoft, Research In Motion, Apple, and Intel, which are enormous firms today, barely existed 40 years ago; their rise from new start-up firms to corporate giants reflects their powers of innovation.

> Oligopoly is an important market structure in modern economies because there are many industries in which the minimum efficient scale is simply too large to support many competing firms. The challenge to public policy is to keep oligopolists competing, rather than colluding, and using their competitive energies to improve products and to reduce costs, rather than merely to erect entry barriers.

SUMMARY

11.1 The Structure of the Canadian Economy

- Most industries in the Canadian economy lie between the two extremes of monopoly and perfect competition. Within this spectrum of market structure we can divide Canadian industries into two broad groups: those with a large number of relatively small firms and those with a small number of relatively large firms. Such intermediate market structures are called imperfectly competitive.
- When measuring whether an industry has power concentrated in the hands of only a few firms or dispersed over many, it is not sufficient to count the firms. Instead,

economists consider the concentration ratio, which shows the fraction of total market sales controlled by a group of the largest sellers.
- One important problem associated with using concentration ratios is to define the market with reasonable accuracy. Since many goods produced in Canada compete in foreign markets with foreign-produced goods, the national concentration ratios overstate the degree of industrial concentration.

11.2 What Is Imperfect Competition?

- Most firms operating in imperfectly competitive market structures sell differentiated products whose characteristics they choose themselves.

- Imperfectly competitive firms usually choose their prices and engage in non-price competition.

11.3 Monopolistic Competition

- Monopolistic competition is a market structure that has the same characteristics as perfect competition except that the many firms each sell a differentiated product rather than all selling a single homogeneous product. Firms face negatively sloped demand curves and may earn profits in the short run.
- As in a perfectly competitive industry, the long run in the theory of monopolistic competition sees new firms enter the industry whenever profits can be made. Long-run equilibrium in the industry requires that each firm earn zero profits.

- In long-run equilibrium in the theory of monopolistic competition, each firm produces less than its minimum-cost level of output. This is the excess-capacity theorem associated with monopolistic competition.
- Even though each firm produces at a cost that is higher than the minimum attainable cost, the resulting product variety is valued by consumers and so may be worth the extra cost.

11.4 Oligopoly and Game Theory

- Oligopolies are dominated by a few large firms that have significant market power. They can maximize their joint profits if they cooperate to produce the monopoly output. By acting individually, each firm has an incentive to depart from this cooperative outcome.
- Oligopolists have difficulty cooperating to maximize joint profits unless they have a way of enforcing their output-restricting agreement.

- Economists use game theory to think about the strategic behaviour of oligopolists—that is, how each firm will behave when it recognizes that other firms may respond to its actions.
- A possible non-cooperative outcome is a Nash equilibrium in which each player is doing the best it can, given the actions of all other players.

11.5 Oligopoly in Practice

- Explicit collusion between oligopolists is illegal in domestic markets. But it can take place in situations where firms in global markets are supported by national governments, as is the case for OPEC.

- Tacit collusion is possible but may break down as firms struggle for market share, indulge in non-price competition, and seek advantages through the introduction of new technology.

- Oligopolistic industries will exhibit profits in the long run only if there are significant barriers to entry. Natural barriers relate to the economies of scale in production, finance, and marketing, and also to large entry costs. Firm-created barriers can be formed by proliferation of competing brands, heavy brand-image advertising, and the threat of predatory pricing when new entry occurs.

- In the presence of major scale economies, oligopoly may be the best of the feasible alternative market structures. Evaluation of oligopoly depends on how much interfirm competition (a) drives the firms away from the cooperative, profit-maximizing solution and (b) leads to innovations in the very long run.

KEY CONCEPTS

Concentration ratios
Product differentiation
Monopolistic competition
The excess-capacity theorem
Oligopoly

Strategic behaviour
Game theory
Cooperative and non-cooperative
 outcomes
Nash equilibrium

Explicit and tacit collusion
Natural and firm-created entry
 barriers
Oligopoly and creative destruction

STUDY EXERCISES

MyEconLab **Make the grade with MyEconLab: Study Exercises marked in red can be found on MyEconLab. You can practise them as often as you want, and most feature step-by-step guided instructions to help you find the right answer.**

1. Fill in the blanks to make the following statements correct.

   a. Suppose the four largest steel producers in Canada among them control 85 percent of total market sales. We would say that this industry is highly _____. We say that 85 percent is the _____ in this industry.

   b. A firm that has the ability to set prices faces a _____ demand curve.

   c. The theory of monopolistic competition helps explain industries with a _____ number of _____ firms. The theory of oligopoly helps explain industries with a _____ number of _____ firms.

   d. A firm operating in a monopolistically competitive market structure maximizes profits by equating _____ and _____. A firm that is operating in an oligopolistic market structure maximizes profit by equating _____ and _____ although its rivals' responses to its actions will affect its _____.

   e. In long-run equilibrium, and in comparison to perfect competition, monopolistic competition produces a _____ range of products but at a _____ cost per unit.

2. Fill in the blanks to make the following statements correct.

   a. Economists say that oligopolistic firms exhibit _____ behaviour. These firms are aware of and take account of the decisions of _____.

   b. The firms in an oligopoly have a collective incentive to _____ in order to maximize joint _____; individually, each firm has an incentive to _____ in order to maximize individual _____.

   c. Oligopolistic firms exhibit profits in the long run only if there are significant _____.

   d. Three examples of non-competitive behaviour practised by firms with market power are _____, _____, and _____.

   e. An important defence of oligopoly is the idea that it leads to more _____ than would occur in either perfect competition or monopoly. The oligopolistic firm has an incentive to _____ because it can expect to keep a good share of the resulting profit.

3. Each of the statements below describes a characteristic of the following market structures: perfect competition, monopolistic competition, oligopoly, and monopoly.

Identify which market structure displays each of the characteristics. (There may be more than one.)

a. Each firm faces a downward-sloping demand curve.
b. Price is greater than marginal revenue.
c. Each firm produces at *MES* in long-run equilibrium.
d. Firms earn profit in long-run equilibrium.
e. Firms produce a homogeneous product.
f. Firms advertise their product.
g. Each firm produces output where $MC = MR$.
h. Each firm produces output where $P = MC$.
i. There is free entry to the industry.
j. Firms produce a differentiated product.

4. Do you think any of the following industries might be monopolistically competitive? Why or why not?

a. Textbook publishing (approximately 10 introductory economics textbooks are in use on campuses in Canada this year)
b. Post-secondary education

c. Cigarette manufacturing
d. Restaurant operation
e. Automobile retailing
f. Landscaping services
g. Home renovation firms

5. The following table provides annual sales for the four largest firms in four industries in Canada. Also provided are total Canadian and total world sales for the industry. (All figures are hypothetical and are in millions of dollars.)

a. Suppose Canada does not trade internationally any of the goods produced in these industries. Compute the four-firm Canadian concentration ratio for each industry.
b. Rank the industries in order from the most concentrated to the least concentrated.
c. Now suppose goods in these industries are freely traded around the world. Are the concentration ratios from part (a) still relevant? Explain.

	Firm 1	Firm 2	Firm 3	Firm 4	Total Sales (Canada)	Total Sales (World)
Forestry products	185	167	98	47	550	1368
Chemicals	27	24	9	4	172	2452
Women's clothing	6	5	4	2	94	3688
Pharmaceuticals	44	37	22	19	297	2135

6. The table below provides price, revenue, and cost information for a monopolistically competitive firm selling drive-through car washes in a large city.

a. Complete the table.
b. Plot the demand, marginal revenue, marginal cost, and average cost curves for the firm. (Be sure to plot *MR* and *MC* at the midpoint of the output intervals.)

c. What is the profit-maximizing number of car washes (per month)?
d. What is the profit-maximizing price?
e. Calculate the total maximum profit (per month).
f. How can this firm differentiate its product from other car washes?

Quantity (number of car washes per month)	Price	Total Revenue	Marginal Revenue	Total Cost	Average Total Cost	Marginal Cost	Total Profit
1000	30	_____		25 000	_____		_____
1100	29	_____	_____	26 000	_____	_____	_____
1200	28	_____	_____	27 200	_____	_____	_____
1300	27	_____	_____	28 500	_____	_____	_____
1400	26	_____	_____	30 000	_____	_____	_____
1500	25	_____	_____	32 200	_____	_____	_____
1600	24	_____	_____	35 000	_____	_____	_____
1700	23	_____	_____	38 500	_____	_____	_____
1800	22	_____	_____	43 000	_____	_____	_____

7. Draw two diagrams of a monopolistically competitive firm. In the first, show the firm earning profits in the short run. In the second, show the firm in long-run equilibrium earning zero profits. What changed for this firm between the short run and the long run?

8. The following figure shows the revenue and cost curves for a typical monopolistically competitive firm in the short run.
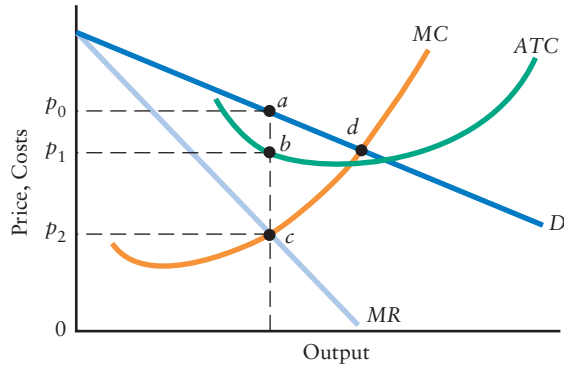
   a. Note that the firm's demand curve is shown to be quite flat. Explain which assumption of monopolistic competition suggests a relatively elastic demand curve for each firm.
   b. Show the profit-maximizing level of output for the firm on the diagram.
   c. At the profit-maximizing level of output, are profits positive or negative? What area in the diagram represents the firm's profits?
   d. Will firms enter or exit the industry? Explain.

9. The diagram below shows a typical monopolistically competitive firm when the industry is in long-run equilibrium.
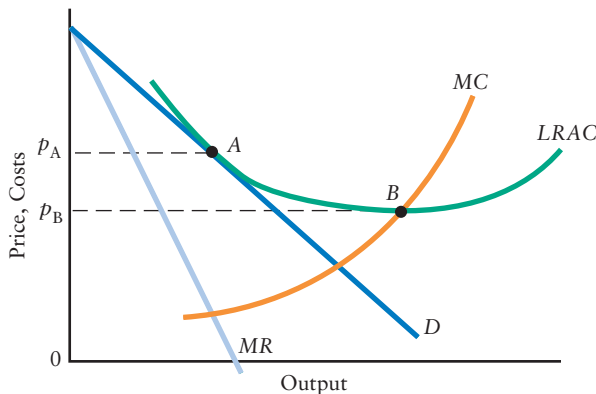
   a. Explain why free entry and exit implies that the long-run equilibrium is at point A.
   b. What is the significance of point B and price p_B?
   c. Explain the sense in which long-run equilibrium in monopolistic competition is less efficient than in perfect competition.

10. In the text we argued that a key difference between monopolistic competition and oligopoly is that in the former firms do not behave *strategically* whereas in the latter they do. For each of the goods or services listed below, state whether the industries are likely to be best described by monopolistic competition or oligopoly. Explain your reasoning.

   a. Car repair
   b. Haircuts
   c. Dry cleaning
   d. Soft drinks
   e. Breakfast cereals
   f. Restaurant meals
   g. Automobiles

11. Consider the following industries in Canada that have traditionally been oligopolistic.

   • Brewing
   • Airlines
   • Railways
   • Banking
   • Internet service providers
   • Grocery stores

   a. What are the barriers to entry in each of these industries that might explain persistently high profits?
   b. Explain in each case how technology is changing in ways that circumvent these entry barriers.

12. The table below is the payoff matrix for a simple two-firm game. Firms A and B are bidding on a government contract, and each firm's bid is not known by the other firm. Each firm can bid either $10 000 or $5000. The cost of completing the project for each firm is $4000. The low-bid firm will win the contract at its stated price; the high-bid firm will get nothing. If the two bids are equal, the two firms will split the price and costs evenly. The payoffs for each firm under each situation are shown in the matrix.

	A bids $10 000	A bids $5000
B bids $10 000	Firms share the contract	A wins the contract
	Payoff to A = $3000 Payoff to B = $3000	Payoff to A = $1000 Payoff to B = $0
B bids $5000	B wins the contract	Firms share the contract
	Payoff to A = $0 Payoff to B = $1000	Payoff to A = $500 Payoff to B = $500

   a. Recall from the text that a Nash equilibrium is an outcome in which each player is maximizing his or her own payoff *given the actions of the other players*. Is there a Nash equilibrium in this game?
   b. Is there more than one Nash equilibrium? Explain.
   c. If the two firms could cooperate, what outcome would you predict in this game? Explain.

13. The table below shows the payoff matrix for a game between Toyota and Honda, each of which is contemplating building a factory in a new market. Each firm can either build a small factory (and produce a small number of cars) or build a large factory (and produce a large number of cars). Suppose no other car manufacturers are selling in this market.

		Toyota's Decision	
		Small Factory	Large Factory
Honda's Decision	Small Factory	*High Industry Price* Honda profits: $20 million Toyota profits: $20 million	*Medium Industry Price* Honda profits: $12 million Toyota profits: $25 million
	Large Factory	*Medium Industry Price* Honda profits: $25 million Toyota profits: $12 million	*Low Industry Price* Honda profits: $14 million Toyota profits: $14 million

a. Assuming that the demand curve for cars in this new market is negatively sloped and unchanging, explain the economic reasoning behind the prices and profits shown in each cell in the payoff matrix.
b. What is the cooperative outcome in this game? Is it likely to be achievable? Explain.
c. What is Honda's best action? Does it depend on Toyota's action?
d. What is Toyota's best action? Does it depend on Honda's action?
e. What is the non-cooperative outcome in this game? Is it a Nash equilibrium?