CHAPTER

9 Market structure and imperfect competition

LEARNING OUTCOMES

By the end of this chapter, you should understand:

- How cost and demand affect market structure
- How globalization changes domestic market structure
- Monopolistic competition
- Oligopoly and interdependence
- The kinked demand curve model
- Game theory and strategic behaviour
- Commitment and credibility
- Reaction functions and Nash equilibrium
- Cournot and Bertrand competition
- Stackelberg leadership
- Contestable markets
- Innocent and strategic entry barriers

Perfect competition and pure monopoly are useful benchmarks of the extremes of market structure. Most markets are between the extremes. What determines the structure of a particular market? Why are there 10 000 florists but only a few chemical producers? How does the structure of an industry affect the behaviour of its constituent firms?

A perfectly competitive firm faces a horizontal demand curve at the market price. It is a price-taker. Any other type of firm faces a downward sloping demand curve for its product and is *imperfectly competitive*.

> An **imperfectly competitive firm** faces a down-sloping demand curve. Its output price reflects the quantity of goods it makes and sells.

For a pure monopoly, the demand curve for the firm and the industry coincide. We now distinguish two intermediate cases of an imperfectly competitive market structure.

> An **oligopoly** is an industry with few producers, each recognizing their interdependence. An industry with **monopolistic competition** has many sellers of products that are close substitutes for one another. Each firm has only a limited ability to affect its output price.

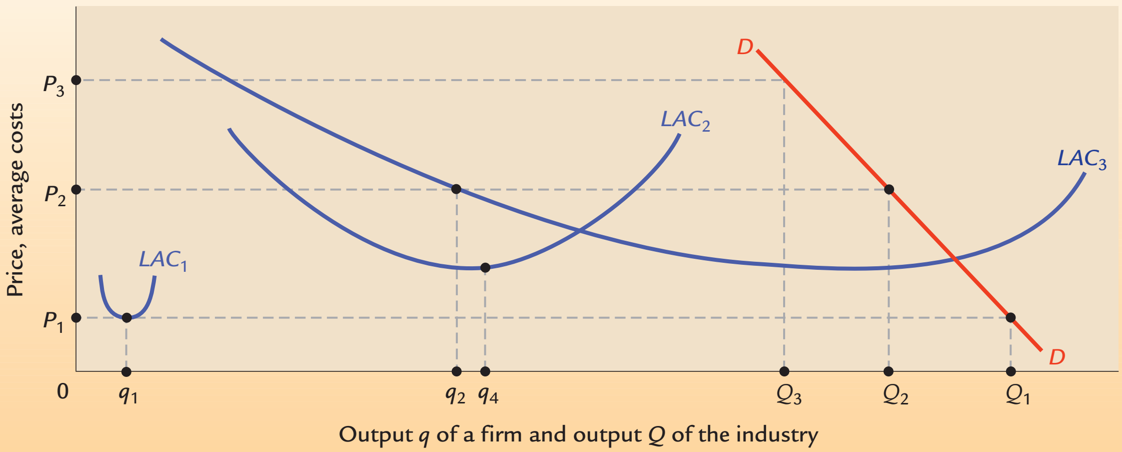
The car industry is an oligopoly. The price of Rover cars depends not only on its own output and sales, but also the output of Ford and Toyota. The corner grocer's shop is a monopolistic competitor. Its output is a subtle package of physical goods, personal service, and convenience for local customers. It can charge a slightly higher price than an out-of-town supermarket. But, if its prices are too high, even local shoppers travel to the supermarket.

As with most definitions, the lines between different market structures can get blurred. One reason is ambiguity about the relevant definition of the market. Is Eurostar a monopoly in cross-channel trains or an oligopolist in cross-channel travel?

Table 9–1 Market structure

Competition		Number of firms	Ability to affect price	Entry barriers	Example
Perfect		Lots	Nil	None	Fruit stall
Imperfect:	Monopolistic	Many	Little	Small	Corner shop
	Oligopoly	Few	Medium	Bigger	Cars
	Monopoly	One	Large	Huge	Post Office

Figure 9–1 Demand, costs, and market structure



DD is the industry demand curve. In a competitive industry, minimum efficient scale occurs at an output level q_1, when firms have average cost curves LAC_1. The industry can support a very large number of firms whose total output is Q_1 at the price P_1. When LAC_3 describes average costs, the industry will be a natural monopoly. When a single firm produces the entire industry output, no other firm can break into the market and make a profit. For intermediate positions such as LAC_2 the industry can support a few firms in the long run, and no single firm can profitably meet the entire demand. The industry will be an oligopoly.

Similarly, when a country trades in a competitive world market, even the sole domestic producer may have little influence on market price. We can never fully remove these ambiguities, but Table 9-1 shows some things to bear in mind as we proceed through this chapter. The table includes the ease with which new firms can enter the industry, which affects the ability of existing firms to maintain high prices and supernormal profits in the long run.

9–1 Why market structures differ

Some industries are legal monopolies, the sole licensed producers. Patent laws may confer temporary monopoly on producers of a new process. Ownership of a raw material may confer monopoly status on a single firm. We now develop a general theory of how demand and cost interact to determine the likely structure of each industry.

The car industry is not an oligopoly one day but perfectly competitive the next. Long-run influences determine market structures. Eventually, one firm can hire another's workers and learn its technical secrets.

Figure 9-1 shows the demand curve *DD* for the output of an industry in the long run. Suppose all firms and potential entrants face the average cost curve LAC_1. At the price P_1, free entry and exit means that each firm produces q_1. With the demand curve *DD*, industry output is Q_1. The number of firms in the industry is N_1 (= Q_1/q_1). If q_1, the minimum average cost output on LAC_1 is small relative to *DD*, N_1 will be large. Each firm has a tiny effect on industry supply and market price. We have found a perfectly competitive industry.

Next, suppose that each firm has the cost curve LAC_3. Scale economies are vast relative to the market size. At the lowest point on LAC_3, output is big relative to the demand curve *DD*. Suppose initially two firms each make q_2. Industry output is Q_2. The market clears at P_2 and both firms break even. If one firm expands a bit, its average costs fall. Its higher output also bids the price down. With lower average costs,

Table 9–2 Demand, cost, and market structure

Minimum efficient scale relative to market size		
Tiny	Intermediate	Large
Perfect competition	Oligopoly	Natural monopoly

that firm survives but the other firm loses money. The firm that expands undercuts its competitor, and drives it out of business.

This industry is a natural monopoly. Suppose Q_3 is the output at which its marginal cost and marginal revenue coincide. The price is P_3 and the natural monopoly makes supernormal profits. There is no room in the industry for other firms with access to the same LAC_3 curve. A new entrant needs a big output to get average costs down. Extra output on this scale so depresses the price that both firms make losses. The potential entrant cannot break in.

A **natural monopoly** enjoys such scale economies that it has no fear of entry by others.

Finally, we show the LAC_2 curve with more economies of scale than a competitive industry but less than a natural monopoly. This industry supports at least two firms enjoying scale economies near the bottom of their LAC_2 curves. It is an oligopoly. Attempts to expand either firm's output beyond q_4 quickly meet decreasing returns to scale and prevent a firm driving competitors out of business.

Minimum efficient scale is the lowest output at which a firm's *LAC* curve stops falling.

The crucial determinant of market structure is minimum efficient scale relative to the size of the total market as shown by the demand curve. Table 9–2 summarizes our analysis of the interaction of market size and minimum efficient scale. When the demand curve shifts to the left, an industry previously containing many firms may have room for only a few. Similarly, a rise in fixed costs, raising the minimum efficient scale, reduces the number of firms. In the 1950s there were many European aircraft makers. Today, the research and development costs of a major commercial airliner are huge. Apart from the co-operative European venture Airbus Industrie, only the American giant Boeing-McDonnell-Douglas survives.

Monopolistic competition lies between oligopoly and perfect competition. Monopolistic competitors supply different versions of the same product, such as the particular location of a newsagent.

Table 9–3 Concentration and scale economies

	UK		France		Germany	
Industry	***CR***	***NP***	***CR***	***NP***	***CR***	***NP***
Refrigerators	65	1	100	2	72	3
Cigarettes	04	3	100	2	94	3
Refineries	79	8	60	7	47	9
Brewing	47	11	63	5	17	16
Fabrics	28	57	23	57	16	52
Shoes	17	165	13	128	20	197

Note: Concentration ratio *CR* is % market share of 3 largest firms; number of plants *NP* is market size divided by minimum efficient scale.
Sources: F. M. Scherer *et al.*, *The Economics of Multiplant Operation*, Harvard University Press, 1975; and F. M. Scherer, *Industrial Market Structure and Economic Performance*, Rand McNally, 1980.

Evidence on market structure

The larger the minimum efficient scale relative to the market size, the fewer are the number of plants – and probably the number of firms – in the industry. What the number of plants (*NP*) operating at minimum efficient scale does a market size allow? Chapter 7 discussed estimates of minimum efficient scale in different industries. By looking at the total purchases of a product we can estimate market size. Hence we can estimate *NP* for each industry.

Even industries with only a few key players have some small firms on the fringe. The total number of firms can be a misleading indicator of the structure of the industry. Economists use the *N-firm concentration ratio* to measure the number of key firms in an industry.

The ***N*-firm concentration ratio** is the market share of the largest *N* firms in the industry.

Thus, the 3-firm concentration ratio tells us the market share of the largest three firms. If there are three key firms, they will supply most of the market. If the industry is perfectly competitive, the largest three firms will only have a tiny share of industry output and sales.

It would be nice to look at cross-country evidence to see if market structures always obey our theory. If this is to be an independent check, we really need national data before globalization and European integration became important. Table 9–3 examines evidence for the UK, France, and Germany for the mid-1970s.

CR is the 3-firm concentration ratio, the market share of the top three firms. *NP* is the number of plants at minimum efficient scale that the market size allows. If our theory of market structure is correct, industries with large-scale economies relative to market size, and thus a small number of plants *NP*, should have a large concentration ratio *CR*. Such industries should have few key firms. Conversely, where *NP* is very high, economies of scale are relatively unimportant and the largest three firms should have a much smaller market share. *CR* should be low.

Table 9–3 confirms that this theory of market structure fits these facts. Industries such as refrigerator and cigarette manufacture had room for few plants operating at minimum efficient scale; these industries had high degrees of concentration. The largest three firms controlled almost the whole market. Scale economies still mattered in industries such as brewing and petroleum refining: the top three firms had about half the market. Industries such as shoemaking quickly met rising average cost curves; they had room for many factories operating at minimum efficient scale, and thus were much closer to competitive industries. The top three firms in shoemaking had under one-fifth of the market.

Globalization and multinationals

Table 9–3 showed data before the rise of globalization and multinationals.

> **Globalization** is the closer integration of markets across countries. **Multinationals** are firms operating in many countries simultaneously.

Globalization reflects cheaper transport costs, better information technology, and a deliberate policy of reducing cross-country barriers in order to get efficiency gains from large scale and specialization. Multinationals sell in many countries at the same time. They may, or may not, also produce in many countries.

Multinationals affect the analysis implied by Figure 9–1 and Table 9–3. To what market size should we compare minimum efficient scale to estimate the number of plants that can survive in the long run? Multinationals can produce on a large scale somewhere in the world, where production is cheapest, enjoy all the benefits of scale economies, but still sell small amounts in many different markets.

This has three effects. First, it reduces entry barriers in a particular country. A foreign multinational entrant need not achieve a large market share, and therefore need not bid down the price a lot, to achieve scale economies. These now arise because of success in selling globally. Second, small domestic firms, previously sheltered by entry barriers, now face greater international competition and may not survive. Third, greater competition by low-cost producers leads *initially* to lower profit margins and lower prices.

However, if there are only a few multinationals, they may drive the higher cost domestic firms out of business but then collude among themselves to raise prices again. Some of the debate about globalization hinges on which of these two outcomes dominates: the initial price fall or a possible subsequent price increase. We return shortly to the analysis of collusion. First, we study a simpler case.

Box 9–1 Packaging holidays

In the UK the market for package summer holidays is now worth £7bn a year as people jet off in search of sand and sun. Whereas in 1986 the top five chains of travel agents had a combined market share of 25%, within two years it had soared to 87%. Evidence of huge economies of scale? Not necessarily.

The industry integrated vertically, as travel agents (retail outlets) combined with tour operators (supplying airline and hotel services). Vertical integration can cut costs by allowing better coordination between different stages of the production chain, but it can also enhance market power. The two largest tour operators Thomson and Airtours bought the two largest travel agents (Lunn Poly and Going Places). Together, these two firms market share rose to 49%.

The market leaders were accused of unfair practices. In 1996 Lunn Poly refused to display brochures of First Choice for 4 months until a new agreement on commissions for travel agents was reached. Small operators had to pay up to 19% commission to Lunn Poly, while Thomson paid only 10%. Thomson and Airtours argued that their size let them keep prices lower, and that smaller competitors couldn't compete.

UK pagkage tours (% market share 1998)

Thomson	28
Airtours	21
Thomas Cook	19
First Choice	17
Other	15

Source: The Observer, 19 September 1999.

9–2 Monopolistic competition

The theory of monopolistic competition envisages a large number of quite small firms so that each firm can neglect the possibility that its own decisions provoke any adjustment in other firms' behaviours. We also assume free entry and exit from the industry in the long run. In these respects, the industry resembles *perfect* competition. What distinguishes *monopolistic* competition is that each firm faces a *downward*-sloping demand curve.

Monopolistic competition describes an industry in which each firm can influence its market share to some extent by changing its price relative to its competitors. Its demand curve is not horizontal because different firms' products are only limited substitutes, as in the location of local shops. A lower price attracts some customers from another shop, but each shop always has some local customers for whom convenience is more important than a few pence on the price of a jar of coffee.

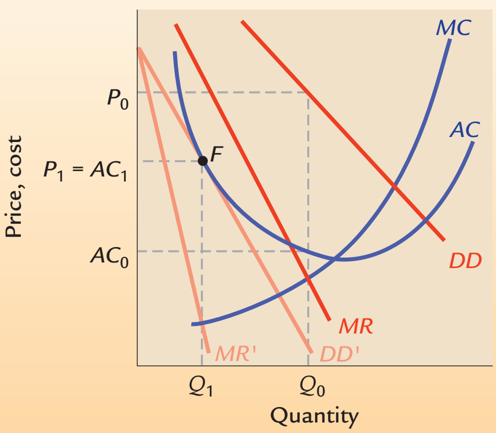
Monopolistically competitive industries exhibit *product differentiation*. Corner grocers differentiate by location, hairdressers by customer loyalty. The special feature of a particular restaurant or hairdresser lets it charge a slightly different price from other firms in the industry without losing all its customers.

Monopolistic competition requires not merely product differentiation, but also limited opportunities for economies of scale. Firms are small. With lots of producers, each can neglect its interdependence with any particular rival. Many examples of monopolistic competition are service industries where economies of scale are small.

The industry demand curve shows the total output demanded at each price if all firms in the industry charge that price. The market share of each firm depends on the price it charges and on the number of firms in the industry. For a given number of firms, a shift in the industry demand curve shifts the demand curve for the output of each firm. For a given industry demand curve, more (fewer) firms in the industry shifts the demand curve of each firm to the left (right) as its market share falls (rises). But each firm faces a downward-sloping demand curve. For a given industry demand curve, number of firms, and price charged by all other firms, a particular firm can raise its market share a bit by charging a lower price.

Figure 9–2 shows a firm's supply decision. Given its demand curve *DD* and marginal revenue curve *MR*, the firm makes Q_0 at a price P_0 making short-run profits $Q_0 (P_0 - AC_0)$. In the long run, these profits attract new entrants, diluting the market share of each firm in the industry, shifting their demand curves to the left. Entry stops when each firm's demand curve shifts so far left that price equals average cost and firms just break even. In Figure 9–2 this occurs when demand is *DD*′. The firm makes Q_1 at a price P_1 in the tangency equilibrium at *F*.

Figure 9–2 Equilibrium for a monopolistic competitor



In the short run the monopolistic competitor faces the demand curve *DD* and sets *MC* equal to *MR* to produce Q_0 at a price P_0. Profits are $Q_0 \times (P_0 - AC_0)$. Profits attract new entrants and shift each firm's demand curve to the left. When the demand curve reaches *DD*' we reach the long-run tangency equilibrium at *F*. The firm sets *MC* equal to *MR*' to produce Q_1 at which P_1 equals AC_1. Firms are breaking even and there is no further entry.

> In monopolistic competition, in the long-run **tangency equilibrium** each firm's demand curve just touches its *AC* curve at the output level at which *MC* equals *MR*. Each firm maximizes profits but just breaks even. There is no more entry or exit.

Note two things about the firm's long-run equilibrium at *F*. First, the firm is *not* producing at minimum average cost. It has excess capacity. It could reduce average costs by further expansion. However, its marginal revenue would be so low that this is unprofitable. Second, the firm has some monopoly power because of the special feature of its particular brand or location. Price exceeds marginal cost.

This explains why firms are usually eager for new customers prepared to buy additional output at the *existing* price. We are a race of eager sellers and coy buyers. It is purchasing agents who get Christmas presents from sales reps, not the other way round. In contrast, a perfectly competitive firm does not care if another buyer shows up at the existing price. With price equal to marginal cost, the firm is already selling as much as it wants.

9–3 Oligopoly and interdependence

Under perfect competition or monopolistic competition, there are many firms in the industry. Each firm can ignore the effect of its own actions on rival firms. However, the key to an oligopolistic industry is the need for each firm to consider how its own actions affect the decisions of its relatively few competitors. Each firm has to guess how its rivals will react. Before discussing what constitutes a smart guess we introduce the basic tension between competition and collusion when firms know that they are interdependent.

> **Collusion** is an explicit or implicit agreement to avoid competition.

Initially, for simplicity, we neglect the possibility of entry and focus on existing firms.

The profits from collusion

As sole decision-maker in the industry, a monopolist would choose industry output to maximize total profits. Hence, the few producers in an industry can maximize their total profit by setting their total output as if they were a monopolist.

Figure 9–3 shows an industry where each firm, and the whole industry, has constant average and marginal costs at the level P_C. Chapter 8 showed that a competitive industry produces Q_C at a price P_C but a multi-plant monopolist maximizes profits by making Q_M at a price P_M. If the oligopolists collude to produce Q_M they act as a *collusive monopolist*. Having decided industry output, the firms agree how to share total output and profits among themselves.

However, it is hard to stop firms cheating on the collective agreement. In Figure 9–3 joint profit is maximized at a total output Q_M and price P_M. Yet each firm can expand output at a marginal cost P_C. Any firm can expand output, selling at a little below the agreed price P_M, and make extra profit since its marginal revenue exceeds its marginal cost. This firm gains at the expense of its collusive partners. Industry output is higher than the best output Q_M, so total profits fall and other firms suffer.

Oligopolists are torn between the desire to collude, to maximize joint profits, and the desire to compete, to raise market share and profits at the expense of rivals. Yet if all firms compete, joint profits are low and no firm does very well. Therein lies the dilemma.

Cartels

Collusion between firms is easiest if formal agreements are legal. Such arrangements, called *cartels*, were common in the late 19th century, agreeing market shares and prices in many industries. Cartels are now outlawed in Europe, the United States, and many other countries. There are big penalties for being caught, but informal agreements and secret deals are sometimes discovered even today.

Cartels across continents are harder to outlaw. The most famous cartel is OPEC, the Organization of Petroleum Exporting Countries. Its members meet regularly to set price and output. Initially, OPEC succeeded in organizing quantity reductions to force up the price of oil. Real OPEC revenues rose 500 per cent between 1973 and 1980. Yet many economists predicted that OPEC, like most cartels, would

Box 9–2 War games

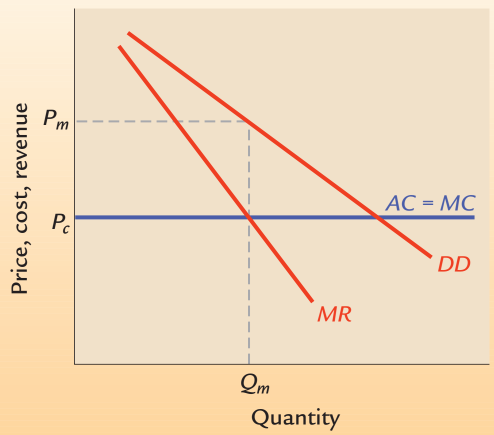
Nintendo, Sony and Microsoft are pitting their video game consoles against each other, fighting for a a global industry now worth £12 billion a year. Sony will spend £500 million in 2002 protecting its huge PlayStation franchise. Microsoft will spend even more launching its Xbox. Merrill Lynch estimates that Nintendo's 2001 profits will fall by a quarter because of money spent launching the GameCube. In the USA alone, Sony hopes to have sold at least 7 million PlayStation 2 consoles before its rivals' consoles come out.

However, the key to success is not hardware but software. Microsoft's problem is that Sony and Nintendo have a history of popular games, such as the *Twisted Metal* and *Mario* series. As a late entrant, Microsoft needs to overcome these barriers. It is betting on the Xbox's online capability, allowing players to compete remotely over the internet. Whereas, with practice, people can learn to beat the artificial intelligence of a computer, Microsoft hopes that playing unpredictable humans online will be much more interesting.

There is also a bigger picture. The Xbox may be Microsoft's Trojan horse. The ultimate fight may not be about games consoles but set-top boxes. Sony and Microsoft are battling for control of the entire home entertainment industry.

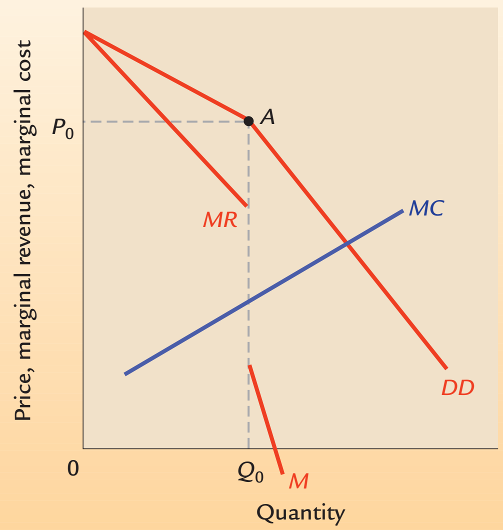
Source: *Financial Times*, 19 May 2001

Figure 9–3 Collusion versus competition



By colluding to restrict industry output Q_m, joint profits are maximized and equal to those which a multi-plant monopolist would obtain. But each firm, with a marginal cost of P_c, has an incentive to cheat on the collusive agreement and expand its output.

Figure 9–4 The kinked demand curve



An oligopolist believes rivals will match price cuts but not price rises. The oligopolist's demand curve is kinked at *A*. Price rises lead to a large loss of market share, but price cuts increase quantity only by increasing industry sales. Marginal revenue is discontinuous at Q_0. The oligopolist produces Q_0, the output at which *MC* crosses the *MR* schedule.

quickly collapse. Usually, the incentive to cheat is too strong to resist, and once somebody breaks ranks others tend to follow.

One reason that OPEC was successful for so long was the willingness of Saudi Arabia, the largest oil producer, to restrict its output further when smaller members insisted on expansion. By 1986 Saudi Arabia was no longer prepared to play by these rules, and refused to prop up the price any longer. The oil price collapsed from just under \$30 to \$9 a barrel. During 1987–98, apart from a brief period during the Gulf War, oil prices fluctuated between \$8 and \$20 a barrel. Only after 1998 did OPEC recover the cohesion it displayed during 1973–85.

The kinked demand curve

Collusion is much harder if there are many firms in the industry, if the product is not standardized and if demand and cost conditions are changing rapidly. In the absence of collusion, each firm's demand curve depends on how competitors react. Firms must guess how their rivals will behave.

Suppose that each firm believes that its own price cut will be matched by all other firms in the industry, but that a rise in its own price will not induce a price response from competitors. Figure 9–4 shows the demand curve *DD* that each firm then faces. At the current price P_0 the firm makes Q_0. If competitors do not follow suit, a price rise leads to a large loss of market share to other firms. The firm's demand curve is elastic above *A* at prices above the current price P_0. However, any price cut is matched by other firms, and market shares are unchanged. Sales rise only because the whole industry moves down the market demand curve as prices fall. The demand curve *DD* is much less elastic for price cuts from the initial price P_0.

In Figure 9–4 marginal revenue *MR* is discontinuous at the output Q_0. Below Q_0 the elastic part of the demand curve is relevant. At the output Q_0 the firm hits the inelastic portion of its kinked demand curve and marginal revenue drops. Q_0 is the profit-maximizing output for the firm, given its belief about how competitors respond.

Suppose the *MC* curve of a single firm shifts up or down by a small amount. Since the *MR* curve has a discontinuous vertical segment at Q_0, it remains optimal to make Q_0 and charge the price P_0. In contrast, a monopolist facing a continuously downward-sloping *MR* curve would adjust quantity and price when the *MC* curve shifted. The kinked demand curve model may explain the empirical finding that firms do not always adjust prices when costs change.

It does not explain what determines the initial price P_0. One interpretation is that it is the collusive monopoly price. Each firm believes that an attempt to undercut its rivals will provoke them to co-operate among themselves and retaliate in full. However, its rivals will be happy for it to charge a higher price and see it lose market share.

If we interpret P_0 as the collusive monopoly price, we can contrast the effect of a cost change for a single firm and a cost change for all firms. The latter shifts the marginal cost curve up for the entire industry, raising the collusive monopoly price. Each firm's kinked demand curve shifts up since the monopoly price P_0 has risen. Hence, we can reconcile the stickiness of a firm's price with respect to changes in its own costs alone, and the speed with which the entire industry marks up prices when all firms' costs increase. Examples of the latter are higher taxes on the industry's product, or a union wage increase across the whole industry.

9–4 Game theory and interdependent decisions

A good poker player sometimes bluffs. You can win with a bad hand if your opponents misread it for a good hand. Similarly, by having bluffed in the past and been caught, you may persuade opponents to bet a lot when you have a terrific hand.

Like poker players, oligopolists try to anticipate their rivals' moves to determine their own best action. To study interdependent decision-making, we use *game theory*.

> A **game** is a situation in which intelligent decisions are necessarily interdependent.

The *players* in the game try to maximize their own *payoffs*. In an oligopoly, the firms are the players and their payoffs are their profits in the long run. Each player must choose a strategy. Being a pickpocket is a strategy. Lifting a particular wallet is a move.

> A **strategy** is a game plan describing how a player acts, or moves, in each possible situation.

As usual, we are interested in equilibrium. In most games, each player's best strategy depends on the strategies chosen by other players. It is silly to be a pickpocket when the police have TV cameras, or to choose four centre backs when the opponents have no proven goalscorers.

> In **Nash equilibrium**, each player chooses the best strategy, *given* the strategies being followed by other players.

Nobody then wants to change strategy, since other people's strategies were already figured into assessing each player's best strategy. This definition of equilibrium, and its application to game theory, was invented by a Princeton University mathematician John Nash.[1]

Figure 9–5 The Prisoners' Dilemma Game

		Firm B output			
		High		Low	
Firm A output	High	1	1	3	0
	Low	0	3	2	2

The coloured and black numbers in each box indicate profits to firms A and B, respectively. Whether B pursues high or low output, A makes more profit going high; so does B, whichever A adopts. In equilibrium both go high. Yet both would make greater profits if both went low!

Dominant strategies

Sometimes, but not usually, a player's best strategy is independent of those chosen by others. We begin with an example in which each player has a dominant strategy.

> A **dominant strategy** is a player's best strategy *whatever* the strategies adopted by rivals.

Figure 9–5 shows a game[2] between the only two members of a cartel. Each firm can select a high-output or low-output strategy. In each box of Figure 9–5 the coloured number shows firm A's profits and the black number, firm B's profits for that output combination.

When both have high output, industry output is high, the price is low, and each firm makes a small profit of 1. When each has low output, the outcome is like collusive monopoly. Prices are high and each firm does better, making a profit of 2. Each firm does best (a profit of 3) when it alone has high output; the other firm's low output helps hold down industry output and keep up the price. In this situation we assume the low-output firm makes a profit of 0.

[1] Nash, who battled with schizophrenia, won the Nobel Prize in Economics for his work on game theory. A film about his life, *A Beautiful Mind*, starring Russell Crowe, was released in 2002.

[2] The game, called the Prisoners' Dilemma, was first used to analyse the choice facing two people arrested and in different cells, each of whom could plead guilty or not guilty to the only crime that had been committed. Each prisoner would plead innocent if only he or she knew the other would plead guilty.

Now we can see how the game will unfold. Consider firm A's decision. It first thinks what to do if firm B has a high-output strategy. Firm A will thus be in one of the two left-hand boxes of Figure 9–5. Firm A gets a profit of 1 by choosing high but a profit of 0 by choosing low. If Firm A thinks firm B will choose high output, firm A prefers high output itself. But firm A must also think what to do if firm B chooses a low-output strategy. This puts firm A in one of the two right-hand boxes. Firm A *still* prefers high output for itself, which yields a profit of 3 whereas low yields a profit of only 2. Firm A has a dominant strategy. Whichever strategy B adopts, A does better to choose a high-output strategy.

Firm B also has a dominant strategy to choose high output. If firm B anticipated that firm A will go high, facing a choice of the two boxes in the top row, firm B prefers to go high. If B thinks A will go low, B faces a choice from the two boxes in the bottom row of Figure 9–5, but B still wants to go high. Firm B does better to go high whichever strategy A selects. Both firm A and firm B have a dominant strategy to go high. Equilibrium is the top left-hand box. Each firm gets a profit of 1.

Yet both firms would do better, getting a profit of 2, if they colluded to form a cartel and both produced low – the bottom right-hand box. But neither can risk going low. Suppose firm A goes low. Firm B, comparing the two boxes in the bottom row, will then go high, preferring a profit of 3 to a profit of 2. And firm A will get screwed, earning a profit of 0 in that event. Firm A can figure all this out in advance, which is why its dominant strategy is to go high.

This shows vividly the tension between collusion and competition. In this example, it appears that the output-restricting cartel will never get formed, since each player can already foresee the overwhelming incentive for the other to cheat on such an arrangement. How then can cartels ever be sustained? One possibility is that there exist binding commitments.

A **commitment** is an arrangement, entered into voluntarily, that restricts future actions.

If both players in Figure 9–5 could simultaneously sign an enforceable contract to produce low output they could achieve the co-operative outcome in the bottom right-hand box, each earning profits of 2. This beats the top left-hand box, which shows the Nash equilibrium of the game when collusion cannot be enforced. Without a binding commitment, neither player can go low because then the other player goes high. Binding commitments, by removing this temptation, let both players go low. Both players gain.

This idea of commitment is important, and we shall encounter it many times. Just think of all the human activities that are the subject of legal contracts, a simple commitment simultaneously undertaken by two parties or players.

Although this insight is powerful, its application to oligopoly requires care. Cartels within a country are usually illegal, and OPEC is not held together by a contract enforceable in international law! Is there a less formal way in which oligopolists can avoid cheating on the collusive low-output solution to the game? If the game is played only once, this is difficult.

Repeated games In the real world, the game is repeated many times: firms choose output levels day after day. Suppose two players try to collude on low output: each announces a *punishment strategy*. If firm A ever cheats on the low-output agreement, firm B says that it will subsequently react by raising its output. Firm A makes a similar promise.

Suppose the agreement has been in force for some time and both firms have stuck to their low-output deal. Firm A assumes that firm B will go low as usual. Figure 9–5 shows that firm A makes a *temporary* gain today if it cheats and goes high. Instead of staying in the bottom right-hand box with a profit of 2, it can move to the top right-hand box and make 3. However, from tomorrow onwards, firm B will also go high, and firm A can then do no better than continue to go high too, making a profit of 1 for evermore. But if A refuses to cheat today it can continue to stay in the bottom right-hand box and make 2 forever. In cheating, A swaps a temporary gain for a permanent reduction in future profits. Thus, punishment strategies can sustain an explicit cartel or implicit collusion even if no formal commitment exists.

It is all very well to promise punishment if the other player cheats. But this will affect the other player's behaviour only if your threat is credible.

A **credible threat** is one that, after the fact, is still optimal to carry out.

In the preceding example, once firm A has cheated and gone high, it is then in firm B's interest to go high anyway. Hence a threat to go high if A ever cheats is a credible threat.

These insights shed light on the actual behaviour of OPEC in 1986, when Saudi Arabia dramatically raised its output, leading to a collapse of oil prices. In the 1980s, other members of OPEC had gradually cheated on the low-output agreement, trusting that Saudi Arabia would still produce low to sustain a high price and the cartel's prestige. They hoped Saudi threats to adopt a punishment strategy were empty threats. They were wrong. Figure 9–5 shows that, once the others went high, Saudi Arabia had to go high too.

9–5 Reaction functions

In the previous example, in a one-off game each player had a dominant strategy, to produce high output whatever its rival did. This led to a poor outcome for both players, because they were not co-operating despite being interdependent. When the game is repeated, commitments and punishment strategies help players co-operate to find an outcome that is better for both of them.

In punishing a rival, a player's actions change in response to bad behaviour by the rival. Dominant strategies are rare. More usually, each player's best action depends on the actual or expected actions of other players. How a player reacts depend on what it assumes about its rivals' behaviour. For simplicity we analyse *duopoly* in which there are only two players.

Cournot behaviour

In 1838 French economist Augustin Cournot analysed a simple model of duopoly.

> In the **Cournot model**, each firm treats the ***output*** of the other firm as given.

Imagine a duopoly in which both firms have the same constant marginal costs *MC*. Figure 9–6 draws the decision problem for firm A. If firm A assumes that firm B produces 0, firm A gets the whole industry demand curve D_0. This shows what output firm A can sell given the prices that it charges. From this, firm A calculates the marginal revenue MR_0, and produces Q_0 to equate its marginal cost and marginal revenue.

If instead firm A assumes that firm B makes 3 units, firm A faces a demand curve D_3 obtained by shifting the market demand D_0 to the left by 3 units. Firm B gets 3 units and the residual demand is available for firm A. For this demand curve D_3, firm A computes the marginal revenue curve MR_3, and chooses output Q_3 to equate marginal cost and marginal revenue.

Similarly, if firm A expects firm B to make 5 units, firm A shifts D_0 to the left by 5 units to get D_5, and produces Q_5 in order to equate marginal cost and its marginal revenue MR_5. The larger the output that firm 2 is expected to make and sell, the smaller is the optimal output of firm A. Q_5 is smaller than Q_3 which is smaller than Q_0.

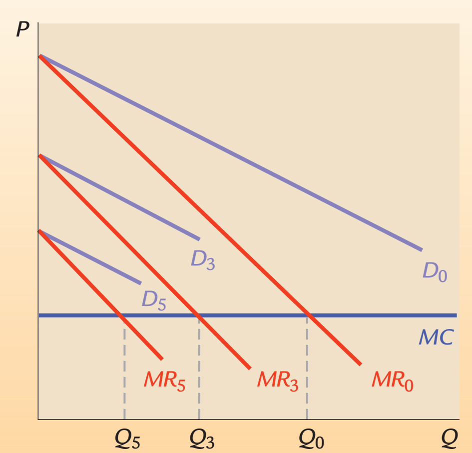
By repeating this exercise for every possible belief that firm A has about the output of firm B, yields the reaction function of firm A

> A firm's **reaction function** shows how its optimal output varies with each possible action by its rival.

In the Cournot model, a rival's action is its output choice. Figure 9–7 shows the two outputs Q^A and Q^B. From Figure 9–6, firm A makes less the more it thinks that firm B will make. In Figure 9–7 firm A's optimal output choice is the reaction function R^A. If firm B is expected to produce 1 unit less, firm A chooses to raise output by less than 1 unit. This ensures total output falls, raising the price. Because this lets firm A earn more on its previous output units, it is not worth raising its output by as much as it expects the output of B to fall. Equivalently, in Figure 9–6 firm A's demand curve shifts more than its marginal revenue curve, hence its output rise is smaller than the conjectured fall in the output of firm B.

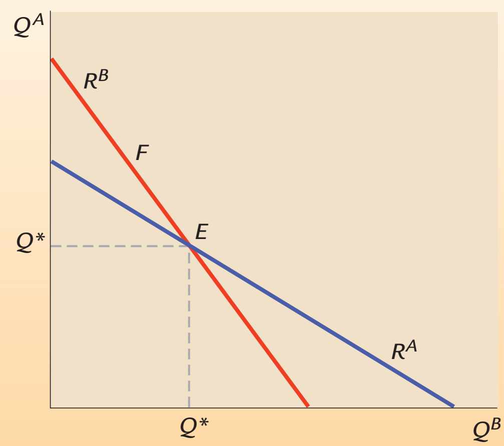
In the duopoly, both firms are the same. Hence firm B faces a similar problem. It makes guesses about the output of firm A, calculates the residual demand curve for firm B, and chooses its best output. Figure 9–7 shows the reaction function R^B for firm B, which also makes less the more that it assumes its rival will produce.

Figure 9–6 Cournot behaviour



Assuming firm B makes 0, firm A faces the market demand curve D_0 and maximizes profits by producing Q_0 to equate marginal cost and marginal revenue. If firm B is assumed to make 3 units, firm A faces the residual demand curve D_3 lying 3 units left of D_0. Firm A then makes Q_3. If firm B is assumed to make 5 units, firm A faces D_5 and makes Q_5. Optimal output for firm A is lower the higher the output that it assumes firm B will make.

Figure 9–7 Nash–Cournot equilibrium



R^A is the reaction function of firm A, showing how its optimal output varies with the output it assumes firm B will make and sell. Since firms are similar, R^B is the similar reaction function for firm B, showing its best output given the assumed output by firm A. With these Cournot assumptions about its rival's behaviour, point *E* is the Nash equilibrium. Each firm's guess about its rival's behaviour is then correct, and neither firm wishes to change its behaviour. If the firms are identical, their reaction functions are asymmetric, and both make the same output Q^*.

Nash equilibrium is where the two reaction functions intersect.

Along each reaction function, each firm makes its best response to the assumed output of the other firm. Only in equilibrium is it optimal for the other firm to actually behave in the way that has been assumed. In Nash equilibrium, neither firm wishes to alter its behaviour even after its conjecture about the other firm's output is then confirmed.

Since both firms face the same industry demand curve, their reaction functions are symmetric if they also face the same marginal cost curves in Figure 9–6. The two firms then produce the same output Q^* as shown in Figure 9–7. If costs differed, we could still construct (different) reaction functions, and their intersection would no longer imply equal market shares

Suppose the marginal cost curve of firm A now shifts down in Figure 9–6. At each output assumed for firm B, firm A now makes more. It moves further down any *MR* schedule before meeting *MC*. Hence in Figure 9–7 the reaction function R^A shifts up, showing firm A makes more output Q^A at any assumed output Q^B of its rival. The new intersection of the reaction functions, say at point *F*, shows what happens to the Nash equilibrium in the Cournot model.

It is no surprise that the output of firm A rises. Why does the output of firm B fall? With lower marginal costs, firm A is optimally making more. Unless firm B cuts its output, the price will fall a lot. Firm B prefers to cut output a little, in order to prop up the price a bit, preventing a big revenue loss on its existing units.

As in our discussion of the Prisoners' Dilemma game in Section 9–4, the Nash–Cournot equilibrium does not maximize the joint payoffs of the two players. They fail to achieve the total output that maximizes joint profits. By treating the output of the rival as given, each firm expands too much. Higher output bids down prices for everybody. In neglecting the fact that its own expansion hurts its rival, each firm's output is too high.

Each firm's behaviour is correct given its assumption that its rival's output is fixed. But expansion by one firm induces the rival to alter its behaviour. A joint monopolist would take that into account and make more total profit.

Bertrand behaviour

To show how the assumption about rivals' behaviours affects reaction functions and hence Nash equilibrium, consider a different model suggested by another French economist, Joseph Bertrand.

In the **Bertrand model** of oligopoly, each firm treats the ***prices*** of rivals as given

Each firm decides a price (and hence an output), reflecting the price it expects its rival to set. We could go through a similar analysis to the Cournot model, find reaction curves showing how the *price* set by each firm depends on the *price* set by its rival, and hence find the Nash equilibrium in prices for the Bertrand model. Knowing the equilibrium price, we could work out equilibrium quantity. If the firms are identical, again they divide the market equally.

However, in the Bertrand model, it is easy to see what the Nash equilibrium must be. It is the perfectly competitive outcome! Price equals marginal cost. How do we know?

Suppose firm B sets a price above its marginal cost. Firm A can grab the whole market by setting a price a little below that of firm B. Since firm B can anticipate this, it must set a lower price. This argument keeps working until, in Nash equilibrium, both firms price at marginal cost and split the market between them. There is then no incentive to alter behaviour.

Comparing Bertrand and Cournot

Under Bertrand behaviour, Nash equilibrium entails price equal to marginal cost, so industry output is high. Under Cournot behaviour, Nash equilibrium entails lower industry output and a higher price. Because marginal and average costs are constant, each firm makes profits since the price is higher. But the firms do not co-operate. A joint monopolist would make more profit by co-ordinating output decisions. Industry output would be even lower, and the price even higher.

Thus, Nash equilibrium depends on the *particular* assumption each firm makes about its rival's behaviour. Generally, economists prefer the Cournot model. In practice, few oligopolies behave like a perfectly competitive industry, as the Bertrand model predicts.

Moreover, since prices can be changed rapidly, treating a rival's *price* as fixed does not seem plausible. In contrast, we can interpret the Cournot model as saying that firms first choose *output capacity*, and then set price. Since capacity takes time to alter, this makes more sense.

First mover advantage

So far we assumed that the two duopolists make decisions simultaneously. Suppose one firm can choose output before the other. Does it help to move first?

> In the **Stackelberg model**, firm B can observe the output already fixed by firm A. In choosing output, firm A must thus anticipate the subsequent reaction of firm B.

To anticipate how firm B behaves once the output of firm A is fixed, firm A examines the reaction function of firm B as derived in Figures 9–6 and 9–7. In setting output, firm A then takes account of how its own output decisions *affect* output by firm B.

Firm A thus has a different reaction function. Figure 9–7 showed the Cournot reaction function R^A treating Q^B as chosen independently of Q^A. Now firm A uses the reaction function R^B to deduce that a higher output Q^A induces a *lower* output Q^B. Hence, Firm A expects its own output expansion to bid the price down *less* than under Cournot behaviour. Its marginal revenue schedule is higher up. Firm A knows that firm B will help prop up the price by cutting Q^B in response to a rise in Q^A.

Facing a higher *MR* schedule as a *Stackelberg leader* than under Cournot behaviour, firm A produces more than under Cournot behaviour. Firm B makes less because it must react to the fact that a high output Q^A is already a done deal. Firm A ends up with higher output and profits than under Cournot behaviour, but firm B has lower output and lower profit. Firm A has a first-mover advantage.

> A **first-mover advantage** means that the player moving first achieves higher payoffs than when decisions are simultaneous.

Moving first acts like a commitment that prevents your subsequent manipulation by the other player. Once firm A has built a large output capacity, firm A has to live with the reality that firm A will make large output. The best response of firm B is then low output. By propping up the output price, this helps firm A. Being smart, firm A had already figured all that out.

In some industries, firms are fairly symmetric and Cournot behaviour is a good description of how these oligopolists behave. Other industries have a dominant firm, perhaps because of a technical edge or privileged location. That firm may be able to act as a Stackelberg leader and anticipate how its smaller rivals will then react.

9–6 Entry and potential competition

So far we have discussed imperfect competition between existing firms. To complete our understanding of such markets, we must also think about the effect of potential competition from new entrants to the industry on the behaviour of existing or incumbent firms. Three cases must be distinguished: where entry is trivially easy, where it is difficult by accident, and where it is difficult by design.

Contestable markets

Free entry to, and exit from, the industry is a key feature of perfect competition, a market structure in which each firm is tiny relative to the industry. Suppose, however, that we observe an industry with few incumbent firms. Before assuming that our previous analysis of oligopoly is needed, we must think hard about entry and exit. The industry may be a contestable market.

> A **contestable market** has free entry and free exit.

By free entry, we mean that all firms, including both incumbents and potential entrants, have access to the same technology and hence have the same cost curves. By free exit, we mean that there are no *sunk* or irrecoverable costs: on leaving the industry, a firm can fully recoup its previous investment expenditure, including money spent on building up knowledge and goodwill.

A contestable market allows *hit-and-run* entry. If the incumbent firms, however few, do not behave as if they were a perfectly competitive industry ($p = MC =$ minimum LAC), an entrant can step in, undercut them, and make a temporary profit before quitting again.

As globalization proceeds, we should remember that foreign suppliers are important potential entrants. This can take two forms. First, if monopoly profits are too high in the domestic market, competition from imports may augment supply, bidding down prices and profits in the domestic market. In the extreme case, in which imports surge in whenever domestic prices rise above the world price, we are back in the competitive world analysed in Chapter 8.

Globalization also raises the likelihood that foreign firms will set up production facilities in the home market, a tangible form of entry. By raising the supply of potential entrants, globalization increases the relevance of contestable markets as a description of market structure. Moreover, we normally think of an entrant as having to start from scratch. When an existing foreign firm enters the domestic market, its production and marketing expertise may already be highly developed.

Globalization may be a two-edged sword. On the one hand, it raises the size of the relevant market and makes entry easier. On the other hand, by allowing multinationals to become vast by operating in many countries simultaneously, globalization may encourage large firms that then have substantial market power wherever they operate. Coke and Pepsi are slugging it out for global dominance, and Virgin Cola provides only limited competition, even in the UK.

The theory of contestable markets remains controversial. There are many industries in which sunk costs are hard to recover or where the initial expertise may take an entrant some time to acquire, placing it at a temporary disadvantage against incumbent firms. Nor, as we shall shortly see, is it safe to assume that incumbents will not change their behaviour when threatened by entry. But the theory does vividly illustrate that market structure and incumbent behaviour cannot be deduced simply by counting the number of firms in the industry.

In the previous chapter, we were careful to stress that a monopolist is a sole producer *who can completely discount fear of entry*. We now refine the classification of Table 9–1 by discussing entry in more detail.

Innocent entry barriers

Our discussion of entry barriers distinguishes those that occur anyway and those that are deliberately erected by incumbent firms.

> An **innocent entry barrier** is one not deliberately erected by incumbent firms.

The American economist Joe Bain distinguished three types of entry barrier: product differentiation, absolute cost advantages, and scale economies. The first of these is not an innocent barrier, as we shall shortly explain. Absolute cost advantages, where incumbent firms have lower cost curves than those that entrants will face, may be innocent. If it takes time to learn the business, incumbents will face lower costs, at least in the short run; if they are smart, they may already have located in the most advantageous site. In contrast, if incumbents have undertaken investment or R&D specifically with a view to deterring entrants, this is not an innocent barrier. We take up this issue shortly.

Figure 9–1 showed the role of scale economies as an innocent entry barrier. If minimum efficient scale is

Box 9–3 Freezing out new entrants?

Unilever is a major player in many consumer products from toothpaste to soap powder. One of its big winners is Wall's ice cream, which has two thirds of the UK market and generates profits of £100 million a year; retailers' markups can also be as high as 55%. In addition to established rivals such as Nestlé (www.nestle.com) and Häagen Dazs, Unilever has faced new challenges from frozen chocolate bars. Mars has 18% of the market.

A critical aspect of these 'bar wars' is the freezer cabinets in which small shops store ice cream. As the leading incumbent, Unilever 'loaned' cabinets free of charge to small retailers. Unilever contended that its high market share reflected its marketing expertise (just one Cornetto); Mars argued that Unilever erected strategic barriers to entry, particularly effective in small shops with space for only one freezer cabinet, by requiring that only Unilever products were stocked in the cabinet they loaned to retailers.

In January 2000 the UK government ordered Unilever to stop freezing out competitors.

large relative to the industry demand curve, an entrant cannot get into the industry without considerably depressing the market price, and it may prove simply impossible to break in at a profit.

The greater are such innocent entry barriers, the more appropriate it is to neglect potential competition from entrants. The oligopoly game then reduces to competition between incumbent firms along the lines we discussed in the previous section. Where innocent entry barriers are low, one of two things may happen. Either incumbent firms accept this situation, in which case competition from potential entrants will prevent incumbent firms from exercising much market power – the outcome will be closer to that of perfect competition – or else incumbent firms will try to design some entry barriers of their own.

9–7 Strategic entry deterrence

A strategy is a game plan when decision-making is interdependent. The word 'strategic' is used in everyday language, but it has a precise meaning in economics.

> A **strategic move** is one that influences the other person's choice, in a manner favourable to one's self, by affecting the other person's expectations of how one's self will behave.

In Figure 9–8 a single incumbent firm plays a game against a potential entrant. The entrant can come in or stay out. If the entrant comes in, the incumbent can opt for the easy life, accept the new rival, and agree to share the market – or it can fight. Fighting entry means producing at least as much as before, and perhaps considerably more than before, so that the industry price collapses. In this *price war*, sometimes called *predatory pricing* by the incumbent, both firms do badly and make losses. The top row of boxes in Figure 9–8 shows the profits to the incumbent (in black) and the entrant (in colour) in each of the three possible outcomes.

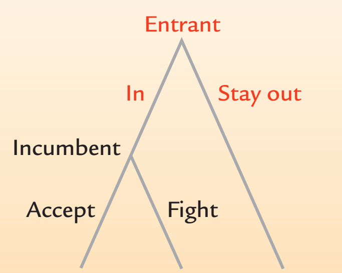
If the incumbent is unchallenged, it does very well, making profits of 5. The entrant of course makes nothing. If they share the market, both make small profits of 1. In a price war, both make losses. How should the game go?

Suppose the entrant comes in. Comparing the left two boxes of the top row, the incumbent does better to cave in than to fight. The entrant can figure this out. Any threat by the incumbent to resist entry is not a credible threat – when it comes to the crunch, it will be better to cave in. Much as the incumbent would like the entrant to stay out, in which case the incumbent would make profits of 5, the equilibrium of the game is that the entrant will come in and the incumbent will not resist. Both make profits of 1, the top left-hand box.

The incumbent, however, may have got its act together before the potential entrant appears on the scene. It may be able to invent a binding precommitment, forcing itself to resist entry and thereby scare off a future challenge. The incumbent would be ecstatic if a Martian appeared and guaranteed to shoot the incumbent's directors if they ever allowed an entry to be unchallenged. Entrants would expect a fight, would anticipate a loss of 1, and would stay out, leaving the incumbent with a permanent profit of 5.

In the absence of Martians, the incumbent can achieve the same effect by economic means. Suppose the incumbent invests in expensive spare capacity that is unused at low output. The incumbent has low output in the absence of entry or if an entrant is accommodated without a fight. Suppose in these situations the incumbent loses 3 by carrying this excess capacity. The second row of boxes in Figure 9–8 reduces the incumbent's profits by 3 in these two outcomes. In a price war, however, the incumbent's output is high and the spare capacity is no longer wasted; hence we do not need to reduce the incumbent's profit in the middle column of boxes in Figure 9–8. Now consider the game again.

Figure 9–8 Strategic entry deterrence



Profits without	1	1	−1	−1	5	0
Profits with	−2	1	−1	−1	2	0

In the absence of deterrence, if the entrant enters, the incumbent does better to accept entry than to fight. The entrant knows this and enters. Equilibrium is the top left-hand box, and both firms make a profit of 1. But if the incumbent pre-commits an expenditure of 3 which is recouped *only* if there is a fight, the incumbent resists entry, the entrant stays out, and equilibrium is the bottom right-hand box. The incumbent does better, making a profit of 2.

If the entrant comes in, the incumbent loses 2 by caving in but only 1 by fighting. Hence entry is resisted. Foreseeing this, the entrant does not enter, since the entrant loses money in a price war. Hence the equilibrium of the game is the bottom right-hand box and no entry takes place. Strategic entry deterrence has been successful. It has also been profitable. Even allowing for the cost of 3 of carrying the spare capacity, the incumbent still makes a profit of 2, which is better than the profit of 1 in the top left-hand box when no deterrence was attempted and the entrant came in.

Strategic entry deterrence is behaviour by incumbent firms to make entry less likely.

Does deterrence always work? No. Suppose in Figure 9–8 we change the right-hand column. In the top row, the incumbent gets a profit of 3 if no entry occurs. Without the pre-commitment, the equilibrium is the top left-hand box as before. But if the incumbent has to spend 3 on a spare capacity pre-commitment, it now makes a profit of 0 in the bottom right-hand box when entry is deterred. The entrant is still deterred, but the incumbent would have done better not to invest in spare capacity but to let the entrant in.

This model suggests that price wars should never happen. If the incumbent is really going to fight, then the entrant should not have entered. This of course requires that the entrant knows accurately the profits of the incumbent in the different boxes and therefore can correctly predict its behaviour. In the real world, entrants sometimes get it wrong. Moreover, if the entrant has much better financial backing than the incumbent, a price war may be a good investment for the entrant. The incumbent will exit first, and thereafter the entrant will be able to cash up and get its losses back with interest.

Is spare capacity the only pre-commitment available to incumbents? Pre-commitments must be irreversible, otherwise they are an empty threat; and they must increase the chances that the incumbent will fight. Anything with the character of fixed and sunk costs may work: fixed costs artificially increase scale economies and make the incumbent more keen on high output, and sunk costs cannot be reversed. Advertising to invest in goodwill and brand loyalty is a good example. So is product proliferation. If the incumbent has only one brand, an entrant may hope to break in with a different brand. But if the incumbent has a complete range of brands or models, an incumbent will have to compete across the whole product range.

9–8 Summing up

Few industries in the real world are like the textbook extremes of perfect competition and pure monopoly.

Box 9–4 Why advertise so much?

Advertising is not always meant to erect entry barriers to potential entrants. Sometimes it really does aim to inform consumers by revealing inside information that firms have about the quality of their own goods.

When consumers can tell at a glance the quality of a product, even before buying it, there is little gain from advertising. Black rotten bananas can't be advertised as fresh. Information is freely available, and attempts to deceive consumers are detected. However, for most goods, consumers can't detect quality before purchase, and discover it only by using the good for a while.

The firm then has inside information over first-time buyers. A conspicuous (expensive) advertising campaign signals to potential consumers that the firm believes in its product and expects to make enough repeat sales to recoup the fixed cost of initial advertising. Firms whose lies are quickly discovered don't invest much in advertising.

What about goods like refrigerators, essentially a once-off purchase, usually not replaced for a decade or more? Consumers would really benefit from truthful advertising, but producers of high-quality goods have no incentive to advertise. It would pay lying advertisers to advertise too (since it is ages till they are found out). A willingness to advertise no longer signals the quality of the product. So little advertising occurs.

The table below shows advertising spending as a fraction of sales revenue for the four types of good identified above. The theory fits the facts rather well.

Advertising spending as a percentage

Quality detected	Time till buy again	Example	Advertising as % ofsales revenue
Before buy	Irrelevant	Bananas	0.4
Soon after buy	Soon	Biscuits	3.6
Long after buy	Irrelevant	CD player	1.8

Source: E. Davis, J. Kay, and J. Star, 'Is Advertising Rational?', *Business Strategy Review*, Autumn, 1991, Oxford University Press.

Most are imperfectly competitive. This chapter introduced you to types of imperfect competition. Game theory in general, and concepts such as commitment, credibility, and deterrence, allow economists to analyse many of the practical concerns of big business.

What have we learned? First, market structure and the behaviour of incumbent firms are determined *simultaneously*. Economists used to start with a market structure, determined by the extent of scale economies relative to the industry demand curve, then deduce how the incumbent firms would behave (monopoly, oligopoly, perfect competition), then check out these predictions against performance indicators, such as the extent to which prices exceeded marginal cost. Now we realize that strategic behaviour by incumbent firms can affect entry, and hence market structure, except where entry is almost trivially easy.

Second, and related, we have learned the importance of *potential* competition, which may come from domestic firms considering entry, or from imports from abroad. The number of firms observed in the industry today conveys little information about the extent of the market power they truly exercise. If entry is easy, even a single incumbent or apparent monopolist may find it unprofitable to depart significantly from perfectly competitive behaviour.

Finally, we have seen how many business practices of the real world – price wars, advertising, brand proliferation, excess capacity or excessive research and development – can be understood as strategic competition in which, to be effective, threats must be made credible by prior commitments.

SUMMARY

- **Imperfect competition** exists when individual firms believe they face downward-sloping demand curves. The most important forms are monopolistic competition, oligopoly, and pure monopoly.

- **Pure monopoly** status can be conferred by legislation, as when an industry is nationalized or a temporary patent is awarded. When **minimum efficient scale** is very large relative to the industry demand curve, this innocent entry barrier may be sufficiently high to produce a natural monopoly in which all threat of entry can be ignored.

- At the opposite extreme, entry and exit may be costless. The market is **contestable**, and incumbent firms must mimic perfectly competitive behaviour to avoid being flooded by entrants. With an intermediate size of entry barrier, the industry may be an oligopoly.

- **Monopolistic competitors** face free entry and exit to the industry, but are individually small and make similar though not identical products. Each has limited monopoly power in its special brand. In long-run equilibrium, price equals average cost but exceeds marginal revenue and marginal cost at the tangency equilibrium.

- **Oligopolists** face tension between collusion to maximize joint profits and competition for a larger share of smaller joint profits. **Collusion** may be formal, as in a cartel, or informal. Without **credible threats** of punishment by its partners, each firm faces a temptation to cheat.

- **Game theory** analyses interdependent decisions in which each player chooses a strategy. In the Prisoners' Dilemma game, each firm has a dominant strategy. With binding commitments, both players could do better by guaranteeing not to cheat on the collusive solution.

- A **reaction function** shows one player's best response to the actions of other players. In the **Nash equilibrium** reaction functions intersect. No player then wishes to change his decision.

- In **Cournot behaviour** each firm treats the output of its rival as given. In the **Bertrand behaviour** each firm treats the price of its rival as given. The Nash–Bertrand equilibrium entails pricing at marginal cost. The Nash–Cournot equilibrium entails lower output, higher prices, and profits. However, firms still fail to maximize joint profits because each neglects the fact that its output expansion hurts its rivals.

- A firm with a **first-mover advantage** acts as a **Stackelberg leader**. By deducing the subsequent reaction of its rival, it produces higher output, knowing the rival will then have to produce lower output. Moving first is a useful commitment.

- **Innocent entry barriers** are made by nature, and arise from scale economies or absolute cost advantages of incumbent firms. **Strategic entry barriers** are made in boardrooms and arise from credible commitments to resist entry if challenged. Only in certain circumstances is strategic entry deterrence profitable for incumbents.

Review questions

1 An industry faces the demand curve:

Q	1	2	3	4	5	6	7	8	9	10
P	10	9	8	7	6	5	4	3	2	1

(a) Suppose it is a monopolist whose constant $MC = 3$: what price and output are chosen? (b) Now suppose there are two firms, each with $MC = AC = 3$: what price and output will maximize joint profits if they collude? (c) Why might each firm be tempted to cheat if it can avoid retaliation by the other?

2 With the above industry demand curve, two firms, A and Z, begin with half the market each when charging the monopoly price. Z decides to cheat and believes A will stick to its old output level. (a) Show the demand curve Z believes it faces. (b) What price and output would Z then choose?

3 Vehicle repairers sometimes suggest that mechanics should be licensed so that repairs are done only by qualified people. Some economists argue that customers can always ask whether a mechanic was trained at a reputable institution without needing to see any licence. (a) Evaluate the arguments for and against licensing car mechanics. (b) Are the arguments the same for licensing doctors?

4 Think of five adverts on television. Is their function primarily informative, or the erection of entry barriers to the industry?

5 A good-natured parent knows that children sometimes need to be punished, but also knows that, when it comes to the crunch, the child will be let off with a warning. Can the parent undertake any pre-commitment to make the threat of punishment credible?

6 ***Common fallacies*** Why are these statements wrong? (a) Competitive firms should get together to restrict output and drive up the price. (b) Firms wouldn't advertise unless they expected it to increase sales.