CHAPTER

14 Pricing

Learning objectives

This chapter covers the following topics:

- cost plus pricing
- first-degree, second-degree and third-degree price discrimination
- price discrimination in practice
- peak-load pricing
- transfer pricing under various market conditions
- price dispersion

Key terms

Cost plus pricing
Dumping
First-degree price discrimination
Intertemporal price discrimination
Metering
Peak-load pricing
Perfect price discrimination
Price dispersion
Second-degree price discrimination
Third-degree price discrimination
Transfer pricing
Two-part tariff

14.1 Introduction

Price determination is an essential component of most of the theories of decision-making and resource allocation at firm and industry level that have been developed in the previous chapters of this book. For example, price formation in perfectly competitive, imperfectly competitive and monopolistic market conditions is one of the central themes of Chapters 3, 7 and 8. Chapter 14 examines a number of further aspects of pricing behaviour, from both a theoretical and a practical perspective.

The neoclassical theory of the firm can be criticised by questioning whether firms have sufficient information in practice to determine their prices by applying the profit-maximizing rule marginal revenue *equals* marginal cost. Section 14.2 examines an alternative pricing rule known as cost plus pricing, whereby price is determined by adding a percentage markup to average variable cost. The markup includes a contribution towards the firm's fixed costs, and a profit margin. The relationship between profit-maximizing pricing and cost plus pricing is considered, and the conditions are identified under which both methods produce similar outcomes.

The pricing models developed earlier in this book are based on an assumption that firms set uniform prices that are identical for all consumers, and are identical no matter what quantity each consumer buys. Section 14.3 examines a pricing policy known as price discrimination, under which a firm either sells at different prices to different consumers, or makes the price per unit each consumer pays dependent on the number of units purchased. For such a policy to be possible, the firm must enjoy some degree of market power, and the market must be divisible into submarkets between which secondary trade or resale is not possible. Three types of price discrimination, known as first-, second- and third-degree price discrimination, are considered. Several examples of price discrimination commonly encountered in practice are identified. Section 14.4 examines the related (but conceptually distinct) practice of peak-load pricing, in which a supplier facing a level of demand that varies at different times of the day or on different days of the year can vary its prices accordingly, but must also decide on a fixed capacity level that is the same for all periods.

In multidivisional organizations, the choice of transfer prices at which intermediate products are traded internally between divisions affects the imputed divisional profitability. Decisions taken at divisional level with a view to the maximization of divisional profits do not necessarily ensure the maximization of the firm's aggregate profits. Section 14.5 develops several profit-maximizing models of transfer pricing. The analysis suggests that incentives for divisional managers, and decisions concerning the viability of loss-making divisions, should not be based solely on imputed divisional profitability, but should reflect the implications for the profitability of the firm as a whole.

The growth of online retailing has stimulated interest in the topic of price dispersion. Given that online consumers can shop around and compare the prices of similar or identical products at the click of a mouse, how much scope remains for different retailers to charge different prices for the same product or service? This chapter concludes in Section 14.6 with a review of a number of recent empirical studies of price dispersion in traditional and online retailing.

14.2 Cost plus pricing

According to the neoclassical theory of the firm, under the assumption of profit maximization price is determined through the application of the behavioural rule marginal revenue *equals* marginal cost (MR = MC). As shown in Section 4.2,

from an early stage in the development of the neoclassical theory, some economists questioned whether firms have sufficient information to apply this rule in practice. In a highly influential study, Hall and Hitch (1939) report the results of interviews with the managers of 38 businesses, 30 of whom reported the use of some form of **cost plus pricing** formula. Under cost plus pricing, the firm calculates or estimates its AVC (average variable cost), and then sets its price by adding a percentage markup that includes a contribution towards the firm's fixed costs, and a profit margin:

$$\text{Price} = \text{AVC} + \%\,\text{markup}$$
$$\text{or } P = (1 + m)\text{AVC}$$

where P denotes price, and the markup (expressed as a percentage) is $100 \times m$ per cent. A number of advantages are claimed for cost plus pricing over pricing using the profit-maximizing rule MR = MC.

- The cost plus pricing formula is simple to understand, and can be implemented using less information than is required for profit-maximizing pricing. For the latter, the firm requires detailed information about its MC, MR and AR (demand) functions. For cost plus pricing, the firm only requires an estimate of its AVC, and a decision concerning the size of the markup.
- Cost plus pricing may produce greater price stability than profit-maximizing pricing. The latter implies price should change every time there is a minor variation in demand. In contrast, with cost plus pricing, provided AVC is relatively flat over the relevant range of output levels, minor variations in the level of demand need not lead to changes in price. Price stability may be valued by consumers, as it reduces their search costs, and by producers, as it reduces the likelihood that destructive price competition may break out.
- Cost plus pricing appeals to a sense of fairness: in determining its markup, the firm can claim to allow for a reasonable profit margin, rather than the maximum profit. Price changes can be attributed solely to changes in costs, rather than fluctuations in market demand.

However, in some cases these claimed advantages might be open to question. Fluctuations in demand can only be ignored safely when setting price if AVC is constant over the relevant range of output levels. If AVC varies with output, the firm needs to know its output level before it can determine its price. This means it needs to estimate its demand function. Cost plus pricing does not imply price stability if costs are changing, or if there are fluctuations in demand and AVC varies with output. Cost plus pricing may not be simple to implement for a multi-product firm, since it may be difficult to apportion fixed and variable costs accurately between a number of product lines (Hanson, 1992).

Finally, the question arises as to what profit margin to include in the markup. If the size of the profit margin varies with market conditions, the difference between cost plus pricing and pricing for profit maximization using the rule MR = MC might not be as large as it first appears. Suppose the cost plus pricing firm always selects approximately the same profit margin as a profit-maximizing

firm would achieve by applying the rule MR = MC. Naturally, this profit margin tends to be higher when demand conditions are strong, and lower when demand is weak. In this case, cost plus pricing and profit-maximizing pricing would both yield approximately the same outcome. The widespread reported use of cost plus pricing might suggest that it serves as a convenient rule-of-thumb for firms that are really profit maximisers, even if they do not themselves explicitly recognise this form of behaviour.

Under what conditions do cost plus pricing and profit-maximizing pricing using the rule MR = MC produce identical results? In Section 2.3, it is shown that MR can be written as follows:

$$\text{MR} = P\left(1 - \frac{1}{|\text{PED}|}\right)$$

where $|\text{PED}|$ is the absolute value of the firm's price elasticity of demand. A necessary condition for MR > 0 is $|\text{PED}| > 1$, or PED < -1. Rearranging the previous expression:

$$\text{MR} = P\left(\frac{|\text{PED}| - 1}{|\text{PED}|}\right)$$

Under the profit-maximizing rule MR = MC:

$$\text{MR} = P\left(\frac{|\text{PED}| - 1}{|\text{PED}|}\right) \Rightarrow P = \left(\frac{|\text{PED}|}{|\text{PED}| - 1}\right)\text{MC}$$

If it is assumed that AVC is approximately constant over the range of output levels within which production takes place, then MC $\cong$ AVC. Under this assumption:

$$P = \left(\frac{|\text{PED}|}{|\text{PED}| - 1}\right)\text{AVC}$$

Using the cost plus pricing formula $P = (1 + m)$AVC:

$$1 + m = \frac{|\text{PED}|}{|\text{PED}| - 1} \Rightarrow m = \frac{1}{|\text{PED}| - 1}$$

Therefore, cost plus pricing is equivalent to profit-maximizing pricing if AVC is approximately constant, and the markup is set to a value of $1/(|\text{PED}| - 1)$. Note that this formula for the markup only produces a positive (and therefore meaningful) value for the markup in the case $|\text{PED}| > 1$, the same condition that is required for MR > 0. The more price inelastic the firm's demand, the larger the markup required for profit maximization. When economic conditions are depressed, $|\text{PED}|$ is likely to be high, in which case the markup consistent with profit maximization is small. When economic conditions are more buoyant, the markup consistent with profit maximization is larger. Similarly, when competition is intense, $|\text{PED}|$ is likely to be high, in which case the markup consistent with profit maximization is small. When competition is weaker, the markup consistent with profit maximization is larger.

Since Hall and Hitch's (1939) original paper on cost plus pricing, several researchers have investigated firms' pricing practices, mostly using survey methods. In a survey of 728 UK manufacturing firms, Shipley (1981) asked respondents to assess the importance of various objectives that might be considered when formulating prices. These included: target profitability; target sales revenue; target market share; price stability; stability of sales volume; comparability of own prices with those of competitors; and prices perceived as fair by customers. Many firms reported considering multiple objectives when pricing their products. While profitability was important, it was not the only consideration. Firms were more likely to be profit-oriented in industries where competition (measured by the number of competing firms) was more intense. Large firms (measured by the number of employees) were more likely than small firms to admit to profit-maximizing behaviour. However, only 16 per cent of all firms considered profit maximization to be an overriding objective.

Hall *et al*. (1996, 2000) report a survey of 654 UK firms, which were asked to assess the most important factors they consider when setting prices. The results are summarised in Table 14.1. Market conditions were the most important factor, especially in the case of firms in the construction industry. Competitors' pricing policies were also important, especially in retailing. Around 40 per cent of the firms surveyed reported the use of a cost plus pricing method. Smaller firms in particular were unlikely to have collected sufficient data on demand conditions to be able to use a profit-maximizing (MR = MC) pricing rule.

Álvarez and Hernando (2006) classify pricing practices as either: (i) cost plus pricing; (ii) prices set according to competitors' prices; and (iii) other, where the pricing decision is taken by a third-party stakeholder such as a government department or quango, a corporate parent company, the main customers, or the suppliers. Table 14.2 summarises the results of a survey of euro area firms. Fifty-four per cent of respondents used cost plus pricing, setting their prices by applying a markup to average cost; 27 per cent based their prices on those of competitors; while 19 per cent claimed they had no autonomy in determining their prices.

Table 14.1 How UK firms set their prices

Pricing method	All	Manufacturing	Construction	Retail	Other services
Reference to market conditions	39	41	51	18	48
Competitor prices	25	26	11	30	23
Direct cost + variable markup	20	20	22	21	17
Direct cost + fixed markup	17	16	19	24	14
Customer set	5	6	3	0	6
Regulatory agency	2	1	0	0	3

Note: Data are percentages of sample firms reporting use of the method shown in the left-hand column. Percentages may exceed 100 per cent because firms are permitted to indicate more than one choice.

Source: Adapted from Hall, S., Walsh, M. and Yates, A. (1996) How do UK companies set prices? *Bank of England Quarterly Bulletin,* May, 36, 180–92, Table A, 13.

Table 14.2 Price-setting strategies of firms in the euro area

Country [1]	Cost plus pricing	Rivals' prices	Other
Belgium:			
All firms	45.9	36.4	17.7
Low competition	–	–	–
High competition	–	–	–
France:			
All firms	40.0	38.0	22.0
Low competition	49.8	24.4	25.9
High competition	36.0	47.6	16.4
Germany:			
All firms	73.0	17.0	10.0
Low competition	78.9	9.4	11.7
High competition	69.8	22.5	7.6
Italy:			
All firms	42.4	31.7	25.9
Low competition	57.6	14.5	27.9
High competition	33.6	42.6	23.7
Netherlands:			
All firms	56.4	22.3	21.3
Low competition	56.6	15.3	28.2
High competition	56.5	25.4	18.1
Portugal:			
All firms	64.5	12.6	22.9
Low competition	78.7	2.9	18.4
High competition	59.9	17.6	22.4
Spain:			
All firms	51.9	26.6	21.5
Low competition	61.3	11.8	27.0
High competition	44.1	40.5	15.3
Euro area			
All firms	54.3	27.1	18.7
Low competition	63.6	14.7	21.7
High competition	49.8	35.1	15.1

[1] *Sources*: Álvarez, L.J. and Hernando, I. (2006) Competition and price adjustment in the euro area, Bank of Spain Working Paper, No. 0629, p. 14. Data derived for individual country level studies of price setting strategies for Belgium (Aucremanne and Druant, 2005); France (Baudry *et al.*, 2004); Germany (Hoffman and Kurz-Kim, 2005); Italy (Veronese *et al.*, 2005); Netherlands (Jonker *et al.*, 2004); Portugal (Dias *et al.*, 2004); and Spain (Álvarez and Hernando, 2005).

Pricing practice often depends upon whether a firm operates in a highly competitive market, or in an uncompetitive market. Where competition is less intense, cost plus pricing tends to be prevalent, and firms are less likely to take competitors' prices into account. These results are consistent across most euro area countries.

Fabiani *et al.* (2006) examine the processes and information used by euro area firms when reviewing their pricing policies, in response to changes in cost and

demand conditions. For example, is the decision to review prices state-dependent (in response to a large shock to demand or costs) or time-dependent (with reviews held at regular intervals)? Around two-thirds of the firms surveyed held state-dependent reviews, while the remainder held time-dependent reviews. Around half of the firms surveyed stated that past and expected future economic developments were taken into account when reviewing prices, but only one-third used past data to inform current decisions. Prices were reviewed rather infrequently (between one and three times per year), with more frequent reviews being typical where competitive pressure was most intense and in service industries. Cost plus pricing was the dominant pricing method, followed by pricing with reference to competitors' prices.

14.3 Price discrimination

In most of the theoretical models of firms' production and pricing decisions that have been considered previously in this book, it is assumed the firm sets a uniform price which is the same for all consumers, and the same no matter how many units of the product each consumer buys. In practice, however, a firm that enjoys some degree of market power might consider adopting a more complex pricing policy. Consider a product that is produced under uniform cost conditions. It might be in the firm's interest to sell at different prices to different consumers, or to make the price per unit that any consumer pays dependent on the number of units purchased. The policy of selling different units of output at different prices is known as price discrimination (Pigou, 1920; Phlips, 1983).

Price discrimination is possible only in cases where there are variations in the prices charged for a product that is supplied under an identical cost structure no matter who the buyer is, or how many units are produced and sold. For example, a petrol retailer who charges different prices at an inner-city petrol station and at a remote rural petrol station does not adopt a policy of price discrimination if the price differential is proportional to the difference in costs (transport costs perhaps being higher in the rural location). Conversely (and perhaps paradoxically), a petrol retailer who charges the same price in two locations where there *is* a cost difference *does* practice price discrimination, favouring consumers in the high-cost location who under a uniform pricing policy would pay a higher price to reflect the cost difference. This pricing practice is known as free-on-board pricing (see below).

There are three types of price discrimination:

- **First-degree price discrimination**, also sometimes known as **perfect price discrimination**, involves making the price per unit of output depend on the identity of the purchaser *and* on the number of units purchased. First-degree price discrimination is a theoretical construct that is encountered only rarely in practice. A possible example would be a private doctor in a small village who does not operate a fixed price structure, but instead simply charges their patients on the basis of an assessment of their ability to pay.

- **Second-degree price discrimination** involves making the price per unit of output depend on the number of units purchased. However, the price does not depend on the identity of the purchaser: all consumers who buy a particular number of units pay the same price per unit. Discounts for bulk purchases are a common form of second-degree price discrimination. Other examples of industries that adopt this type of pricing structure include the utilities (water, gas and electricity) and some high technology industries such as mobile telephones and internet services.
- **Third-degree price discrimination** involves making the price per unit depend on the identity of the purchaser. However, the price does not depend on the number of units purchased: any consumer can buy as few or as many units as they wish at the same price per unit (Schmalensee, 1981). Common examples of third-degree price discrimination include the practice of offering discounts to children, students or senior citizens for products such as transport or entertainment. Firms that trade internationally sometimes adopt this type of price structure. The term **dumping** describes the practice of charging a lower price to consumers in poorer countries than to those in richer ones.

For a policy of price discrimination to be possible, two conditions must be satisfied. First, the price discriminating firm must enjoy some degree of market power, so that it has the discretion to choose its own price structure. For a perfectly competitive firm, a policy of price discrimination is not possible. If the firm attempts to charge a price in excess of its marginal cost to any segment of the market, entry takes place and the increase in supply forces price down until price *equals* marginal cost at the perfectly competitive equilibrium. The successful exercise of price discrimination is sometimes interpreted as proof of market power.

The second necessary condition for successful price discrimination is that the market for the product must be divisible into submarkets, within which there are different demand conditions (or different price elasticities of demand). These submarkets must be physically separate either through space or time, so that secondary trade or resale between consumers in different submarkets is not possible. A firm cannot force Jack to pay more than Jill if it is possible for Jill to purchase at the lower price on Jack's behalf. For example, in the markets for accounting, legal and medical services, there is often simultaneity between production and consumption, making it difficult or impossible for consumers to resell the service between themselves. Similarly, simultaneity between production and consumption enables a cinema to offer discounted admission to children, because it is not possible for a child to purchase the right to watch the film at the cheaper price and then pass on or resell this right to an adult. But, on the other hand, the cinema does not allow children to buy ice cream at a discounted price, because it would be easy for children to buy ice cream on their parents' behalf.

Simultaneity between production and consumption is not the only way in which effective separation of submarkets can be achieved. Some newspapers are made available to students at a discounted price, despite the fact that resale would be possible in theory. However, in practice it would not be worthwhile incurring the transaction costs involved in organizing the resale of a newspaper for which a cover price discount of (say) 50 per cent represents a saving of only a

few pence. Significant transport costs can also help achieve an effective physical separation of submarkets. For example, the practice of dumping surplus agricultural produce in poorer countries relies on transport costs being prohibitive if the consumers in poorer countries attempted to resell to their counterparts in the richer countries.

First-degree price discrimination

Figure 14.1 illustrates a policy of **first-degree price discrimination,** exercised by a monopoly supplier. First, consider the polar case where the market demand function represents a large number of consumers. Depending on the price, each consumer either buys one unit of the good, or abstains from buying altogether. Each consumer's reservation price is the maximum price the consumer is willing to pay. It is helpful to imagine the consumers arrayed along the horizontal axis of Figure 14.1, in descending order of their reservation prices or willingness to pay. Therefore the first consumer has a reservation price of P_1; the second consumer has a reservation price of P_2; and so on. In the standard case where the monopolist charges the same price to each consumer, the profit-maximizing price and quantity is (P_M, Q_M). Notice that if the monopolist did not have to offer the same price to all consumers, it would be worthwhile to supply the consumer located just to the right of Q_M, whose reservation price or willingness to pay is slightly lower than P_M but still higher than the monopolist's marginal cost. But, in the standard case, the monopolist would have to offer the same price cut to all of its existing Q_M consumers who are located to the left of this point. The loss of revenue this would entail exceeds the benefit the monopolist would gain by attracting the additional customer. By implementing a policy of first-degree price discrimination, however, the monopolist can exploit the differences in willingness to pay, by charging each consumer their own reservation price. Therefore the first consumer pays a price of P_1, the second consumer pays a price of P_2 and so on.

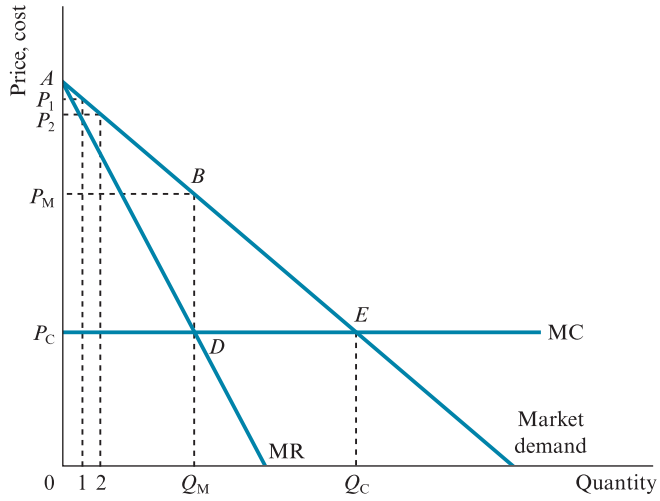

Figure 14.1 First-degree price discrimination

It is worthwhile for the monopolist to supply all consumers whose reservation prices exceed the monopolist's marginal cost. Therefore total output is Q_C and the most marginal consumer pays a price of P_C.

It is also possible to implement a policy of first-degree price discrimination in a second polar case, where the market demand function represents one consumer who is prepared to buy any number of units of the good, but whose willingness to pay decreases as the number of units purchased increases. If the monopolist offers a price of P_1, the consumer buys only one unit. But if the monopolist offers to sell a second unit at a reduced price of P_2, the consumer buys two units. If reductions in the prices of further units are offered, the consumer is induced to buy three, four or five units, and so on. The monopolist could continue in this way until the price of the last unit sold *equals* the monopolist's marginal cost. As before, the monopolist's total output is Q_C, and the selling price is P_C. At (P_C, Q_C) the monopolist obtains a surplus of P_CAE.

An alternative way in which the monopolist could obtain the same surplus is by charging a **two-part tariff**. The monopolist offers the consumer a price structure requiring the payment of a fixed fee (which is mandatory if the consumer wishes to make any purchases at all) and an additional uniform price for each unit that is purchased. In Figure 14.1, the monopolist's optimal two-part tariff is to charge a fixed fee of P_CAE, and a uniform price per unit of P_C = MC. As before, the total quantity of output produced and sold is Q_C, and the most marginal unit is sold at a price of P_C. A two-part tariff price structure is often used by golf, tennis or bowling clubs, which charge a fixed annual membership fee, and make an additional charge for use of the facilities on each occasion. Two-part tariffs are also used by amusement parks and theme parks, such as Disneyland, where there is a fixed entry fee and an additional price charged for each ride (Oi, 1971).

Figure 14.1 can be used to compare the efficiency and welfare properties of the monopolist's standard profit-maximizing equilibrium at (P_M, Q_M), and the equilibrium that is achieved with first-degree price discrimination. With first-degree price discrimination, the total output of Q_C is higher than Q_M in the standard case of monopoly. In fact, Q_C is the total output that would be produced if the monopolist were replaced by a large number of perfectly competitive producers. Furthermore, the equilibrium achieved with first-degree price discrimination satisfies the necessary condition for allocative efficiency (see Section 3.4), that the price of the most marginal unit of output produced *equals* the marginal cost of producing the last unit.

For a non-discriminating monopolist operating at (P_M, Q_M) consumer surplus is represented by the triangle P_MAB (triangle in Figure 3.4); producer surplus is the monopolist's abnormal profit of P_CP_MBD; and the deadweight loss is DBE. With first-degree price discrimination there is no consumer surplus, because each consumer pays a price equivalent to their maximum willingness to pay for each unit. There is a producer surplus of P_CAE, which represents the total abnormal profit earned by the monopolist by selling each unit at a varying price. Finally, the deadweight loss that exists in the non-discriminating case is eliminated.

This analysis leads to what might at first sight seem a rather paradoxical conclusion. The monopolist who adopts a policy of first-degree price discrimination

earns an even higher abnormal profit than the monopolist who charges a uniform price; but, on allocative efficiency criteria, the outcome under first-degree price discrimination is preferable to the outcome in the case of monopoly with uniform pricing. The policy of first-degree price discrimination allows the monopolist to convert all of the consumer surplus that exists in the non-discriminating case into producer surplus and to eliminate the deadweight loss. In other words, the monopolist extracts all of the available surplus and earns an even higher abnormal profit. However, this outcome is superior on allocative efficiency criteria, for the following reasons:

- In the non-discriminating case, it is possible to make someone better off without making anyone else worse off, because there is a consumer who is willing to pay a price for an extra unit that would exceed the cost of producing this extra unit.
- With first-degree price discrimination it is not possible to make someone better off without making anyone else worse off, because price *equals* marginal cost for the most marginal unit produced and sold.

The paradox is resolved by noting that, for allocative efficiency, it does not matter whether the surplus accrues to consumers or to producers. Welfare economists do not make value judgements as to whether monopoly profits are good or bad. All that matters is that there should be no unexploited opportunities for welfare gains that could be achieved without causing losses elsewhere. As shown above, such opportunities do exist at the non-discriminating monopoly equilibrium (which is therefore allocatively inefficient), but no such opportunities exist at the equilibrium under first-degree price discrimination. First-degree price discrimination is sometimes known as perfect price discrimination, because all of the available surplus is extracted by the monopolist. As shown below, this is not the case with either second-degree or third-degree price discrimination.

Second-degree price discrimination

In the case where the market contains a number of consumers with different demand functions (or differences in willingness to pay), first-degree price discrimination requires the monopolist to be able to sell to different consumers on different terms. However, while the monopolist may be aware that different consumers have different demand functions, the monopolist may have no practical method for distinguishing between individual consumers. How is the monopolist to tell which consumer has which demand function? The consumers themselves are not likely to be willing to reveal this information, since doing so enables the monopolist to extract all of their consumer surplus. In the case where the monopolist cannot distinguish between consumers, the best policy is to offer the same menu of prices and quantities to all consumers, and allow the consumers to self-select. In other words, the monopolist designs a menu of prices and quantities such that each consumer chooses a price–quantity combination that is optimal for the consumer, but which also allows the monopolist to discriminate profitably between consumers.

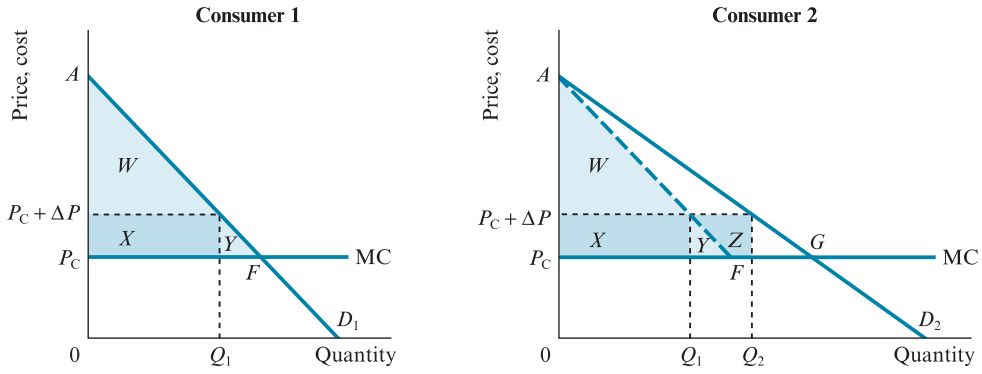

Figure 14.2 Second-degree price discrimination (two-part tariff)

The two-part tariff that was discussed above can be used to implement a policy of **second-degree price discrimination**. Suppose there are two groups of consumers with different demand functions and different price elasticities of demand. In Figure 14.2, Consumers 1 and 2 are representative consumers from each group (and for simplicity it is assumed that there are equal numbers of consumers in each group). Consumer 2 buys more units than Consumer 1 at any price, and at any given price Consumer 2 has a higher price elasticity of demand than Consumer 1. For simplicity, it is assumed that the maximum price any consumer is prepared to pay is the same for both groups; in other words, the demand functions of Consumers 1 and 2 touch the vertical axis at the same point. With a policy of first-degree price discrimination, the monopolist would set a fixed fee of $P_C AF$ for Consumer 1; a fixed fee of $P_C AG$ for Consumer 2; and a uniform price of P_C per unit purchased for both consumers. For second-degree price discrimination, however, the monopolist must offer both consumers the same menu of prices. Suppose the monopolist continues with the uniform price of P_C per unit. Which fixed fee should the monopolist set?

- If the fixed fee is set at the larger value of $P_C AG$, the monopolist extracts all of Consumer 2's surplus, but Consumer 1 drops out of the market altogether, and the monopolist fails to extract any surplus from Consumer 1.
- On the other hand, if the fixed fee is set at the smaller value of $P_C AF$, the monopolist extracts all of Consumer 1's surplus and extracts the same amount of surplus from Consumer 2, but fails to extract FAG of Consumer 2's surplus.

In fact, it can be shown that in some cases neither of these two options is optimal for the monopolist. Suppose the second of the two options is preferred to the first and the monopolist chooses to supply to both consumers (in which case $2P_C AF > P_C AG$). Using Figure 14.2, it can be shown that the monopolist can earn a producer surplus higher than $2P_C AF$ by setting a fixed fee slightly lower than $P_C AF$, and charging a uniform price per unit slightly higher than P_C. Suppose the monopolist increases the price per unit from P_C to $P_C + \Delta P$. In order for Consumer 1 to remain in the market, the fixed fee must be reduced from area $W + X + Y (= P_C AF)$ to area W. Consumer 1 purchases Q_1 units, and the

producer surplus earned from Consumer 1 is $W + X$. Previously, the producer surplus earned from Consumer 1 was $W + X + Y$. Therefore the producer loses Y from Consumer 1. However, Consumer 2 purchases Q_2 units, and the producer surplus earned from Consumer 2 is $W + X + Y + Z$. Previously the producer surplus earned from Consumer 2 was $W + X + Y$. Therefore the producer gains Z from Consumer 2. By construction, area Z exceeds area Y. This ensures that the monopolist gains overall by increasing the price per unit from P_C to $P_C + \Delta P$ and by reducing the fixed fee from $W + X + Y$ to W.

The analysis illustrated in Figure 14.2 establishes that in the case where it is profitable for the monopolist to supply both consumers, the optimal two-part tariff includes a uniform price that is set at a level higher than the monopolist's marginal cost. The precise determination of the optimal two-part tariff is a rather complex mathematical problem and beyond the scope of this book. The complexity is even greater in the more realistic case in which there is a large number of consumer types, each with their own demand functions. However, one important result is that with second-degree price discrimination, the monopolist cannot extract as much surplus as is possible with a policy of first-degree price discrimination. In Figure 14.2, if the monopolist sets a uniform menu of prices which does not vary between the two consumers, no uniform two-part tariff will enable the monopolist to extract a surplus as large as P_CAF + P_CAG. It is natural to expect that a policy of first-degree price discrimination, which is based on perfect information about consumers' preferences, is more profitable than second-degree price discrimination, which is based on imperfect information.

Third-degree price discrimination

In the case of second-degree price discrimination, the monopolist cannot segment the market by distinguishing between consumers, and must offer the same menu of prices to each consumer. However, the menu of prices is constructed in such a way that the price per unit that each consumer pays depends on the number of units purchased. This is true even in the case of the two-part tariff: if a larger quantity is purchased, the average price per unit is lower because the fixed fee is spread over a larger number of units. In contrast, with a policy of **third-degree price discrimination,** the price per unit that each consumer pays is constant, but the monopolist can segment the market by offering different prices to different consumers.

In practice, the monopolist is unlikely to have sufficient information to achieve complete market segmentation, since this would require perfect information about each consumer's individual demand function. However, partial market segmentation may be achieved quite easily in cases where consumers can be divided into groups based on easily identifiable characteristics, such as age or membership of particular groups such as students or pensioners. For partial market segmentation to be effective, the nature of the individual's demand function must be correlated with the identifying characteristic. This condition is often satisfied. A child's demand for admission to a cinema is likely to be more price elastic than that of an adult. A pensioner's demand for bus travel, or a student's demand for a newspaper, is more price elastic than that of other adults.

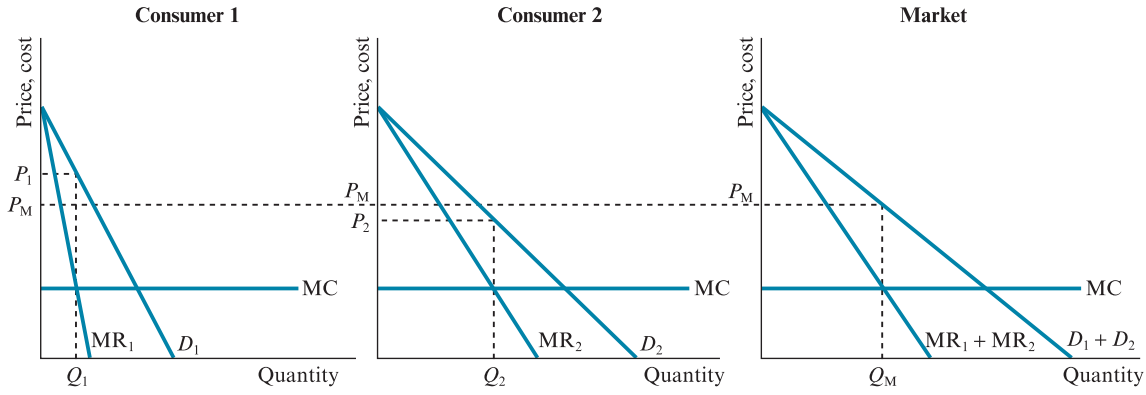

Figure 14.3 Third-degree price discrimination

Therefore, with third-degree price discrimination, the monopolist segments the market into groups, charges the same price per unit sold within each group, but charges different prices to members of different groups. Figure 14.3 illustrates the case where there are two groups of consumers. As before, Consumers 1 and 2, shown in the two left-hand diagrams, are representative consumers from each group. It is assumed that Consumer 2's demand is more price elastic than that of Consumer 1. Since the price must be uniform within each submarket but the submarkets are perfectly segmented, it turns out that the monopolist's optimal pricing policy is to operate as a monopoly supplier to each submarket. The monopolist should select the price–quantity combination for each submarket at which the submarket's marginal revenue *equals* the monopolist's marginal cost. Therefore, in Figure 14.3, the monopolist charges a relatively high price of P_1 to Consumer 1 whose demand is price inelastic, and a relatively low price of P_2 to Consumer 2 whose demand is price elastic. For reference, in Figure 14.3 the right-hand diagram shows the market demand function (obtained by summing the consumers' individual demand functions horizontally), and the profit-maximizing price–quantity combination (P_M, Q_M) in the standard case, where the monopolist charges a uniform price to all consumers.

It is not possible to draw many general conclusions about the welfare effects of third-degree price discrimination. In comparison with the non-discriminating case (where the monopolist charges a uniform price to all consumers regardless of subgroup membership) the sum of producer surplus and consumer surplus may be higher, lower or the same, depending on the exact positions of the submarket demand functions. However, two unequivocal conclusions are possible. First, the monopolist's abnormal profit (producer surplus) is always higher in the case of third-degree price discrimination than in the non-discriminating case. The monopolist does not segment the market and charge different prices to different submarkets unless it is profitable to do so. Second, in the case where there are two submarkets, one price will always be higher and the other price lower than the uniform monopoly price in the non-discriminating case. Consumers in the submarket with the higher price have less consumer surplus and are always worse off than in the non-discriminating case; conversely, consumers in the submarket

with the lower price have more consumer surplus and are always better off than in the non-discriminating case (Yamey, 1974; Layson, 1994). Appendix 1 contains a mathematical derivation of profit maximization under third-degree price discrimination.

Examples of price discrimination

Section 14.3 concludes by identifying a number of examples of price discrimination other than those that have been discussed previously in this section, and Case Study 14.1 identifies some practical applications to ticket pricing in football's Premier League.

Case study 14.1

Price discrimination in ticket price structures for English Premier League football

In Case Study 2.2, it was shown that understanding the determinants of spectator demand is important to clubs when making decisions about stadium capacity and ticket pricing. In a survey of English Premier League football clubs carried out during the 1998–9 season, Clowes and Clements (2003) find clubs use a wide range of sophisticated ticket-pricing structures.

In accordance with the economic theory of price discrimination, several of these price structures are designed to extract more value from spectators with differing degrees of willingness-to-pay than would be possible with a uniform ticket price structure. Several examples can be found of both second-degree price discrimination (charging different prices depending on the number of matches attended) and third-degree price discrimination (charging different prices to different spectators or groups of spectators).

Season tickets

Buying an annual season ticket normally offers three benefits:

- A guaranteed seat for every home match.
- Priority allocation of tickets for away matches, cup finals, and so on.
- An effective discount on the price of buying tickets for each match individually (second-degree price discrimination).

In the 1998–9 survey, the size of the discount varied from zero to about 35 per cent. Two clubs charged season ticket premiums: a policy that might be justified in economic terms if the stadium is regularly filled to capacity.

Membership schemes

Membership schemes that require payment of a fixed membership fee, but then allow members to purchase match tickets at a discounted price, are a form of two-part tariff (second-degree price discrimination).

Some clubs run separate membership schemes for juniors, with separate prices. Some junior membership schemes give members the right to receive a package of 'free' merchandise.

Personal seat licence (PSL)

In the US, some major league teams charge a fee that guarantees the right to purchase a season ticket for a particular seat over the long term (20 or 30 years). PSLs typically lapse if the holder dies or fails to renew the season ticket (Sandy *et al.,* 2004). A PSL is also a form of two-part tariff (second-degree price discrimination).

In the US, PSLs are common among new (expansion) teams or teams that have relocated to a new city. Unsurprisingly, the idea has been more difficult to sell to the existing season ticket holders of established teams. Several attempts to introduce similar schemes by English football clubs in the early 1990s were unpopular with spectators, and the idea failed to take off.

Price concessions

Price concessions to specific groups are a form of third-degree price discrimination. The 1998–9 survey found that all Premier League clubs that responded offered discounts on season tickets or match-day tickets (or both) to juniors, pensioners and people with disabilities. Some (but not all) clubs offered discounts to students and the unemployed. However, perhaps surprisingly only a small number of clubs offered discounts to family groups.

Price banding

In the 1998–9 survey, seven English Premier League clubs indicated that ticket prices were dependent on the attractiveness of the opposition, with home fixtures classified into two or three price bands.

This practice is consistent with profit maximization. If the PED (price elasticity of demand) is lower for a fixture against Manchester United than for a fixture against average Premier League opposition, the profit-maximizing club should charge a higher price for the more attractive fixture. This policy is not price discrimination, since different prices are charged for different matches with different characteristics.

Good and bad seats

Most English football clubs charge different prices for seats in different locations within the stadium. This policy is not price discrimination, since different prices are charged for what are essentially different products.

The demand functions for seats in different locations are likely to be interdependent:

- If the club sets too large a price differential, there is likely to be excess demand for the cheaper seats.
- If the price differential is too small, demand will tend to switch towards the dearer seats.

Most clubs tend to rely on experience or trial-and-error in order to determine the most appropriate price differential.

Price bundling

In the 1998–9 survey, eight English Premier League clubs operated a policy of bundling. Either tickets for two or more matches must be bought simultaneously, or proof of purchase of a ticket for one match is required to purchase a ticket for another match.

A common practice is to bundle a sell-out match together with a match that is unlikely to sell out. Bundling is also justified as an attempt to reduce the possibility of away supporters of popular teams purchasing tickets in the home sections of the stadium.

Source: Clowes, J. and Clements, N. (2003) An examination of discriminatory ticket pricing practice in the English football Premier League, *Managing Leisure,* 8, 105–20. Reprinted by permission of the publisher, Taylor & Francis Ltd, http://www.tandf.co.uk/journals.

Intertemporal price discrimination

With **intertemporal price discrimination**, the supplier segments the market by the point in time at which the product is purchased by different groups of consumers. Video games, mobile telephone handsets, books, CDs and DVDs are examples of goods that are often more expensive if they are purchased earlier, but cheaper for consumers who are prepared to delay purchase. In the case of books, there is a physical difference between the expensive hardback edition that is available when the book is first published, and the cheaper paperback edition that appears several months later. However, the retail price differential is usually much larger than the difference in production costs between hardbacks and paperbacks. Therefore despite the physical difference, this case conforms to the model of intertemporal price discrimination. Case study 14.2 which examines cinema ticket pricing is an example of intertemporal price discrimination.

Figure 14.4 shows the market demand function in the case where there is a large number of consumers, each of whom either buys one unit of the good or abstains from buying altogether (as in Figure 14.1). Each consumer's reservation price is the maximum price the consumer is willing to pay, and as before it is helpful to imagine the consumers arrayed along the horizontal axis of Figure 14.4 in descending order of their reservation prices or willingness to pay. For the model

Case study 14.2

Flexible cinema seat pricing may be a force to be reckoned with

FT

After a fallow 2014, Hollywood last year released a plethora of blockbuster movies: between them, the new James Bond, *Marvel Avengers* and *The Hunger Games* films, *Jurassic World* and the Pixar smash *Inside Out* took £274m at the UK box office. Then there was *Star Wars: The Force Awakens.* Released at the end of the year, it made £108m in its first month, a new record in the UK.

The challenge for cinemas is to make hay while the sun shines — and that involves being more sophisticated about how they price tickets and sell out their theatres. 'The seats you do not sell today do not make you any money tomorrow,' says Ian Shepherd, the chief commercial officer of Odeon, the UK's largest cinema chain by the number of venues. 'From our company's point of view, you want as many people filling as many seats as possible.' Until now, he says, the cinema industry has solved its problem in a simple way. Prices have varied a little bit depending on time or day of the week and whether the customer is a student, a child or a pensioner. Other than that, pricing has been pretty static, he says, adding: 'What we have been doing for the past year is to say that this simple solution is suboptimal for everyone.'

The Odeon group is experimenting with a flexible ticketing model, pioneered by airlines and hotels. This will see prices change in real time depending on demand. 'We are experimenting in a small way in one or two cinemas that are not in the UK,' says Mr Shepherd. 'The early results have been very positive.' But while he suggests the chain would eventually move to a fully dynamic pricing system, this is still some way off. Until then, Odeon and other cinema companies have started to price their tickets to reflect the value to customers of being one of the first to see a newly released blockbuster. 'In the opening couple of weeks of a very large film, when you know you are going to be sold out, we are adding £1 on a ticket, sometimes a tiny bit more. The logic that says tickets are more expensive when there is lots of demand is something that people get,' he says. Some seats may become more expensive than others. Mr Shepherd points out that it is normal in Germany for every seat to be individually priced.

The chain is also being cleverer about selling tickets to less popular films. 'We are doing Groupon deals, online flash sales and time-banded promotions. We use social media or email to put out a flash sale. As a result, our market share has increased,' he says. The logic that says tickets are more expensive when there is lots of demand is something that people get.

Abridged

Source: FT February 3, 2016 Malcolm Moore

of intertemporal price discrimination, it is assumed that each consumer is willing to make their purchase in one of two time periods. Consumers who make a purchase in period 1 do not make a repeat purchase in period 2, but consumers

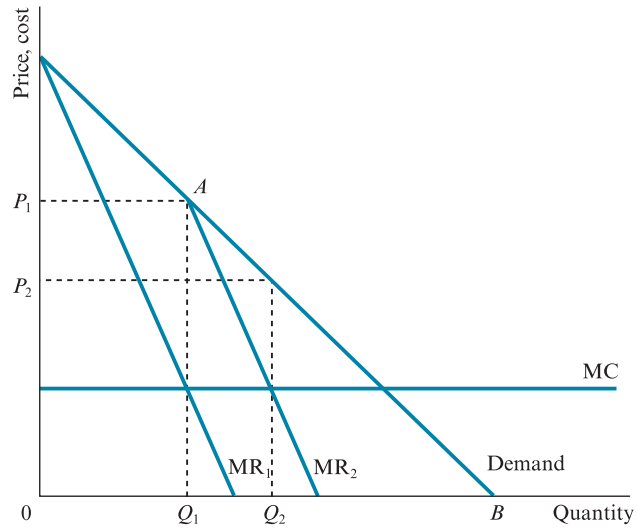

Figure 14.4 Intertemporal price discrimination

who abstain from purchasing in period 1 (because the period 1 price exceeds their reservation price) still have the same reservation price in period 2. It is also assumed that consumers who purchased in period 1 do not subsequently resell to consumers who abstained from purchasing in period 1.

For simplicity, in Figure 14.4 it is assumed that a monopoly supplier has a constant marginal cost function. In period 1, the monopolist's profit-maximizing price and output combination is (P_1, Q_1). However, under the conditions outlined above, in period 2 the monopolist effectively faces a residual demand function comprising all consumers whose reservation price is below P_1, equivalent to the triangle Q_1AB. MR_2 is the marginal revenue function associated with the residual demand function, and in period 2 the profit-maximizing price and output combination is (P_2, $Q_2 - Q_1$). The $Q_2 - Q_1$ consumers who purchase in period 2 pay a lower price than the Q_1 consumers who purchase in period 1. If the model were extended over further periods with similar assumptions, more consumers (to the right of Q_2) could be induced to make purchases by means of further price cuts.

Coase (1972) points out that the ability of a monopolist to practise intertemporal price discrimination may be limited by strategic behaviour on the part of consumers. If the monopolist acquires a reputation for price-cutting, even those consumers with a high willingness to pay may decide to delay their consumption, so as to obtain an increased surplus by purchasing at the reduced price at a later date. The extent to which consumers are prepared to do so depends on the durability of the good (is it worth the same tomorrow as it is worth today?) and the discount rate consumers use to evaluate the present value of future consumption. In an extreme case in which the good is perfectly durable and the discount rate is zero (consumers are indifferent between present and future consumption), the monopolist is forced to charge the competitive price in all periods. Anticipating that the monopolist will eventually reduce the price to the perfectly competitive

level, all consumers decide to delay purchase rather than pay more than the perfectly competitive price. This forces the monopolist to charge the perfectly competitive price from the outset.

Brand labels

The practice of charging different prices for similar or identical goods differentiated solely by a brand label can be interpreted as a form of price discrimination. In supermarkets, value brands sell at a substantial discount relative to the brands of recognised manufacturers, even though in some cases the difference in quality is small or non-existent. In the clothing market, some consumers are willing to pay £20 or £30 more for a small badge or emblem sewn onto an otherwise identical T-shirt or pair of jeans. But it can be argued that branding does not conform to the model of price discrimination, because the status or prestige conferred by the purchase or ownership of the branded product should be recognised as a genuine product characteristic, for which suppliers of branded products are entitled to charge if consumers are willing to pay.

Loyalty discounts

Major airlines offering air miles schemes that can be used by frequent travellers to earn free tickets, practise a form of second-degree price discrimination. Consumers who travel frequently pay a lower average price per journey than consumers who make only single or occasional journeys. Many airlines allow air miles to be earned from purchases of other products, making it possible to travel without ever paying directly for a ticket. Supermarkets, such as Tesco, which operate loyalty or bonus points schemes providing coupons or rebates to regular customers, operate a similar form of second-degree price discrimination.

Coupons

Some retailers supply coupons that provide price discounts, perhaps through advertisements printed in the newspapers or through leaflets delivered directly to people's homes. In principle, the price discount is available to any consumer but, in practice, only those consumers willing to spend the time and make the effort required to cut out, retain and present the coupon will obtain the discount. This practice can be interpreted as a form of price discrimination, favouring those consumers with more time or lower opportunity costs, who are prepared to make the effort to collect and present the coupon.

Stock clearance

A department store that conducts a sale in which the price of merchandise is successively reduced until all sale items have been purchased exercises a form of price discrimination, if this practice results in different consumers paying different prices on different days for identical goods. This pricing practice can be

interpreted as a form of intertemporal price discrimination. For a single item that is successively reduced in price until it is eventually sold, this procedure for finding a buyer is known as a Dutch auction. The theory and practice of auctions is discussed in Chapter 15.

Metering

Metering price discrimination is the practice of charging consumers a relatively low price for a primary product, and a relatively high price for a secondary product that is tied to the primary product (Oi, 1971; Schmalensee, 1981; Rosen and Rosenfield, 1997; Ellison, 2005; Gil and Hartmann, 2008). Consumers who are highly price-sensitive, and who would not be willing to pay for the primary product if it were priced at a higher level, can purchase the primary product but abstain from purchase of the secondary product. Consumers who are less price-sensitive, and who would be willing to pay a higher price for the primary product, may be willing to purchase both products. The seller is compensated for the low profit margin on the primary product by realizing a high margin on the tied secondary product. Effectively, the two groups of consumers are charged at different levels for the package that each chooses to purchase: either the primary product alone, or the primary and secondary products in combination.

Examples of metering price discrimination include tickets for concerts or sporting events (the primary product) that might be priced competitively so that the stadium is filled, while food and drinks concessions located inside the stadium charge prices much higher than the local supermarket that is located outside. Retailers of white goods (electronic domestic appliances such as refrigerators and washing machines) might offer the basic product at a highly competitive price to attract consumers into the store, but then attempt to persuade customers to purchase an extended warranty or guarantee that provides the retailer with a large profit margin.

Free-on-board pricing

In some markets, producers or distributors absorb transport costs, so that all buyers within a specific geographic area (country or region) pay a uniform price, despite the variation in transport costs within this area. This pricing system is known as free-on-board pricing. As noted above, even though all prices are the same, free-on-board pricing is a form of price discrimination which favours buyers in the more remote locations where transport costs are higher. The difference in costs means these buyers should pay more. Therefore the policy of charging the same price is a form of price discrimination. From the point of view of suppliers, a uniform pricing policy may be attractive because, by eliminating price discrepancies, it reduces the risk that price competition may break out among suppliers. Free-on-board pricing removes any temptation for an individual supplier to implement a price cut, which might be justified to competitors on grounds of reduced transport costs, but might actually be motivated by an attempt to capture an increased market share.

Case study 14.3

The price of being female

FT

Does a dollar in my pocket buy more than a dollar in my wife's? It seems so, according to a report released just before Christmas by New York City's Department of Consumer Affairs, which was much covered in the US media. The DCA report found that men often paid less for clothes and items such as razor blades and shampoo. Even boys' toys are cheaper than those aimed at girls. The report led with a striking example from a department store website: while a red 'My 1st Scooter Sport' costs $24.99, a pink 'My 1st Scooter Girls Sparkle' is twice as much. Beneath the paint job, the products appear to be identical — surely glitter cannot be that expensive? The sparkly scooter was sold at an astonishing mark-up but it's not a typical case. The DCA report looked at 22 bikes and scooters, finding that on average the product aimed at girls or women cost 6 per cent more. Across 800 products, the DCA found that while men sometimes paid more than women, on average women faced prices that were 7 per cent higher. Relative to profit margins this is still a large price difference but it's a long way shy of 100 per cent.

What should we make of this? One response is that perhaps the price gap isn't really there or at least not in any systematic way. Perhaps the DCA unwittingly cherry-picked examples. (Sports cars and hi-fi systems were not included.) Whether or not systematic gender-based pricing is widespread, it will always be easy to find examples that look sexist. Still, other research has reached similar conclusions. For example, a study published in *Gender Issues* in 2011 by Megan Duesterhaus and others found that 'gendered price disparities are not as widespread as . . . journalists have previously reported but it does appear that women pay more for certain goods (deodorant), services in hair salons (haircuts), and dry-cleaning of shirts'. Why? No single theory will suffice. Car insurers and nightclub owners both want to charge more to men, but not for the same reason.

Broadly, there are two types of explanation. One is that higher prices reflect higher costs. Maybe men's haircuts typically require less time and skill than women's haircuts. It's said that women's blouses cost more to clean and iron at a dry-cleaner's because they are delicate and need to be pressed by hand. Still: why not charge by the hour to provide a haircut? Or charge for hand-pressed clothes, regardless of gender? Restaurants do not charge men more on the grounds that they usually eat more; instead, they charge by the dish. I can only speculate as to why hairdressers act differently.

The alternative explanation is that companies are making fatter margins on women's products and services. Economists call this 'price discrimination', and it would suggest that women pay more than men if and when they are less sensitive to prices. Perhaps manufacturers and retailers have found that if they try to raise the price of razor blades or shampoo, men will shop elsewhere or skimp on the product, while women will willingly pay the higher price. This female insensitivity to price — if it really exists — might be driven by all kinds of things. Perhaps women tend to be busier and have less time to shop around. Or perhaps they care more about quality when it comes to deodorant or shampoo, whereas men just want something cheap.

But even if women are potentially willing to pay extortionate rates for certain kinds of goods, it doesn't mean that companies can exploit that willingness. A lot of the businesses most regularly accused of sexist pricing — hairdressers, dry cleaners and nail salons — operate in the face of almost unlimited potential competition. If all of them are operating on razor-thin margins for men and fat margins for women, shouldn't they be desperately trying to win female customers away from each other? This competitive pressure will constrain attempts to discriminate on price. It is the big brands — such as Ferrari, Hermès and perhaps Gillette — who have the power to charge different mark-ups to different customers.

As soon as a company acquires some market power, it will try to give spendthrift customers an opportunity to display their spendthriftiness by offering costly variants on basic products. Publishers ask double for a book with hard covers; coffee chains charge a lot for squirting flavoured syrup in your latte. We can hardly be surprised if some of these special variants look pink and sparkly. And as consumers, male or female, our only resort is to keep searching for the products without those frills, literal or otherwise.

Abridged

Source: FT January 15, 2016 Tim Harford

14.4 Peak-load pricing

In some markets, demand varies at different times of the day or on different days of the year. Examples of products or services for which demand is variable include: gas and electricity; public transport services; roads, tunnels and bridges; gyms and fitness clubs; and package holidays and amusement parks. In each of these cases, it is unlikely that the supplier can adjust capacity to meet the higher level of demand in peak periods, or reduce capacity in response to the lower level of demand in off-peak periods. Furthermore, none of these products or services is storable. It is not possible for consumers to build up stocks during off-peak periods, and then run down these stocks during peak periods. Under such conditions, the supplier faces a **peak-load pricing** problem. Specifically, two issues need to be addressed: first, what level of capacity should be installed; and second, for any given capacity what are the optimal peak period and off-peak period prices.

In order to develop a model to address these questions, it is assumed there are separate peak period and off-peak period market demand functions, denoted D_1 and D_2 respectively. In Figure 14.5, it is assumed these two demand functions are completely independent of one another: purchases made in one period do not in any way affect demand in the other period. Capacity can be installed and maintained at a constant marginal cost per unit of capacity of b, which allows the industry to operate in both the peak period and the off-peak period. Production costs in each period are directly proportional to output, so there is also a constant marginal production cost of c per unit of output.

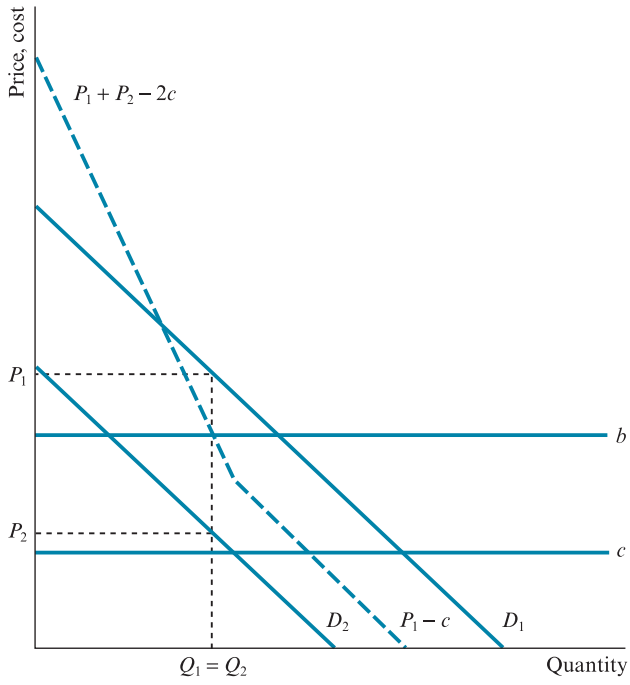

Figure 14.5 Peak-load pricing: full capacity production in both periods

In many countries, some (although not all) of the industries that are subject to the peak-load problem are either in state ownership, or in private ownership but heavily regulated. Accordingly, much of the theoretical literature on peak-load pricing is based on an assumption of social welfare maximization, rather than profit maximization. As shown in Section 3.4, the standard condition for social welfare maximization is price *equals* marginal cost. In the present case, this condition needs to be amended, because for each additional unit of capacity that is installed, one additional unit of output can be produced and sold in each of the two periods, at different prices. If the industry operates at full capacity in both periods, the equivalent condition for social welfare maximization is:

$$P_1 + P_2 = b + 2c$$
$$\text{or} \quad P_1 + P_2 - 2c = b$$
$$\text{or} \quad P_1 = b + 2c - P_2 \text{ and } P_2 = b + 2c - P_1$$

In these expressions, P_1 and P_2 are the prices charged per unit of output in the peak period and off-peak period, respectively. The first of the three expressions says the total proceeds obtained by creating an additional unit of capacity enabling the industry to produce and sell one additional unit of output in both periods, $P_1 + P_2$, *equals* the marginal cost of installing the additional capacity, b, *plus* the marginal production cost for the two additional units of output, $2c$. The second expression is a rearrangement of the first, used to identify the optimal prices and capacity in Figure 14.5. The third expression says the optimal price for each period is the total marginal cost incurred through the installation of

additional capacity and the additional production in both periods, $b + 2c$, *minus* the price charged in the other period.

In Figure 14.5, the broken line shows, for each per-period output level shown on the horizontal axis, the value of $P_1 + P_2 - 2c$ implied by the two market demand functions. Over the range of output levels where $P_1 > c$ and $P_2 > c$, the broken line is constructed by summing the two demand functions vertically, and subtracting $2c$. Over the range of outputs where $P_1 > c > P_2$, the broken line is $P_1 - c$. According to the expressions for social welfare maximization, in Figure 14.5 the optimal capacity is $Q_1 = Q_2$, and the optimal values of P_1 and P_2 are obtained from the peak and off-peak demand functions (D_1 and D_2 respectively) at this point. The peak-period consumers, whose demand or willingness to pay is stronger, are charged a higher price than the off-peak consumers. However, the willingness to pay of consumers in both periods is taken into account in determining the optimal capacity, because the system operates at full capacity in both periods.

It need not always be the case that the industry operates at full capacity in both periods. If the marginal cost of installing additional capacity were lower than is shown in Figure 14.5, it might be optimal (again in terms of social welfare maximization) to operate at full capacity during the peak period, but to maintain some spare capacity in the off-peak period. This case is shown in Figure 14.6, in which the marginal cost of installing additional capacity is lowered from b to b'. For the peak period, it is now worthwhile to install capacity of Q_1', and sell Q_1' units of output for a price of $P_1' = b' + c$. For the off-peak period, however,

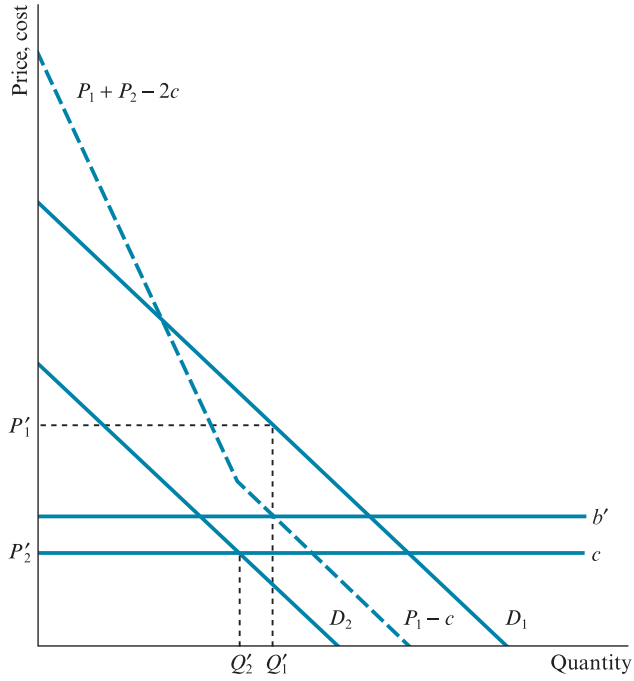

Figure 14.6 Peak-load pricing: spare capacity in off-peak period

if Q_1' units of output were produced, the price would fall below the marginal production cost of c. In the off-peak period, the industry should operate below full capacity, and sell Q_2' units of output for a price of $P_2' = c$. In this case, the willingness to pay of the off-peak consumers becomes irrelevant in determining the optimal capacity, because the system only operates at capacity during the peak period.

Case study 14.4

High Ho! Disneyland Paris faces Brussels pricing probe

FT

Brussels is targeting Disneyland Paris for allegedly overcharging British and German customers on the basis of where they live, in the opening salvo of a broader campaign against price discrimination in Europe. The European Commission on Tuesday told France to investigate whether the theme park is unfairly rigging prices, pointing out that in some cases, for the same premium package, French consumers will pay €1,346 while British visitors are charged €1,870 and Germans €2,447. Unless companies meet strictly defined criteria, the EU services directive in principle bans forcing consumers to pay more simply because of their nationality or country of residence.

The Brussels clampdown has broader implications for the retail and services sector: the commission is weighing complaints against Amazon, Spanish hoteliers, Austrian ski-lift operators — even Venice's public lavatory system. Consumers have accused Disneyland Paris of illegally blocking their access to cheap deals available to residents of France or Belgium. This is mostly achieved through residence-based payment and delivery rules, selective offers, or by redirecting consumers to more expensive prices on their national websites. Elzbieta Bienkowska, the EU commissioner for the single market, said a spate of complaints 'were very significant, particularly in one or two instances'. 'It is time to get to the bottom of this,' she said. 'I am interested in answers and explanations. On the face of it, I struggle to see what objective justification there could be for these practices.'

A spokesperson for BEUC, the European consumers' group, welcomed the Commission taking steps to enforce its rulebook and 'clarify what constitutes an unjustified discrimination'. 'Geoblocking can lead to price discrimination, is against single market principles and restricts consumer choice,' the spokesperson said. The initial findings found British consumers paying around 15 per cent more for one-day tickets, according to the preliminary EU assessment. French consumers also benefit from other perks, including large family discounts, special rates, annual packages, monthly payment options and offers to buy tickets at one Disneyland park rather than two.

Under EU rules prices can be varied according to nationality if there are objective reasons, such as different market conditions, seasonal fluctuations in demand or different holiday periods. Disneyland Paris says that its promotions in local markets are based on booking patterns and school holidays. However a Commission 'sweep' of Disneyland Paris'

rivals in Europe — including Denmark's Legoland and Tivoli Gardens and Germany's Europapark — found that other operators did not vary prices to the same extent.

Ms Bienkowska's assault on price discrimination is part of a broader Commission push to eradicate so-called geo-blocking in Europe, where consumer IP addresses or payment cards are used to bar them from certain services. A separate Commission competition case, launched last week, accused top Hollywood studios and Sky UK of entering illegal agreements to stop EU consumers from accessing pay-TV services available in the UK and Ireland. All the companies are contesting the charges.

If no action is taken by France against Disneyland, the Commission can ultimately take France to court. When faced with similar regulatory objections last year, car rental companies in Europe agreed to stop rerouting consumers to their national websites. Critics of the 'price discrimination' clampdown argue the practice is a legitimate pricing model that allows companies to be responsive to differences in local markets in Europe and avoid one-size-fits all prices.

Disneyland Paris defended its pricing policy, saying it ran well-justified discounts and promotions in local markets. 'When purchased directly with Disneyland Paris, the cost of a basic resort package — without promotional offers — is identical across all markets, give or take exchange rates,' the company said. 'Throughout the year we try to attract guests from different markets by offering market-specific "book-by" promotions that can include discounts. Those promotions take into consideration factors specific to people in the local market, such as their school holiday calendar and booking patterns.' It added that consumers can contact the central reservations office if they see a promotion outside their local market 'and request to make that specific booking'.

Source: FT July 28, 2015 Alex Barker

14.5 Transfer pricing

The multi-divisional or M-form organizational structure, and the holding company or H-form structure (see Section 5.3) can raise particularly difficult issues for managers when taking pricing and production decisions. It is often the case that one division will use the output of another division as one of its inputs. In the simplest case, an M-form or H-form organization might include quasi-independent production and distribution divisions. The distribution division buys the output of the production division, and sells the product to the final consumer. The question immediately arises, at what price should the trade take place between the production division and the distribution division? In general, the M-form or H-form organization requires a system of **transfer pricing** to determine the prices of intermediate products that are produced by one division and sold to another division, when both divisions form part of the same organization (Hirschleifer, 1956).

In M-form or H-form organizations where the individual divisions are quasi-independent, the choice of transfer price can be a crucial decision, because it affects the imputed revenues of the selling division, the imputed costs of the buying division, and therefore the imputed profitability of both divisions. For example, if the transfer price is set too low, the imputed profits of the distribution division are artificially inflated, and the profits of the production division are artificially depressed. This may have implications for head office's perceptions of managerial performance or labour productivity in both divisions, which in turn may affect future investment or other internal resource allocation decisions (Eccles, 1985). Moreover, suppose the divisional managers are encouraged to operate in such a way as to minimise costs or maximise profits at divisional level. Through its effect on the divisional revenue and cost functions, the transfer price affects the divisional managers' production decisions, the volume of internal trade, the quantity of inputs purchased from outside the firm or the quantity of intermediate outputs sold outside the firm and, therefore, the profitability of the firm as a whole. As shown below, when there is internal trade within the organization, decisions taken at divisional level with a view to the maximization of divisional profits do not necessarily ensure the maximization of the total profit of the firm as a whole.

Below, profit-maximizing models of transfer pricing between the production and distribution divisions of an M-form organization are developed, for the following three cases:

- In the first case, it is assumed all of the production division's output is passed on to the distribution division to be sold to final consumers. There is no alternative, external market in which the production division can sell its intermediate output. Similarly, the distribution division obtains its supplies only from the production division and has no alternative external sources.
- In the second case, it is assumed there is a perfectly competitive external market, in which the production division can sell any surplus intermediate output that is not taken up by the distribution division. Similarly, the distribution division has the option of obtaining additional supplies (over and above those it obtains from the production division) through the external market.
- In the third case, it is assumed the external market for the intermediate product is imperfectly competitive rather than perfectly competitive.

Transfer pricing with no external market for the intermediate product

Figure 14.7 presents a model of transfer pricing for trade between a production division (producer) and a distribution division (distributor) in the simplest case where there is no external market for the internally transferred product. In the left-hand diagram, MC_1 represents the producer's marginal cost function, and in the right-hand diagram D_2 and MR_2 represent the distributor's demand and marginal revenue functions. MC_2 is the marginal cost function associated with the distributor's own activities (excluding the cost of the units of output the distributor must purchase from the producer).

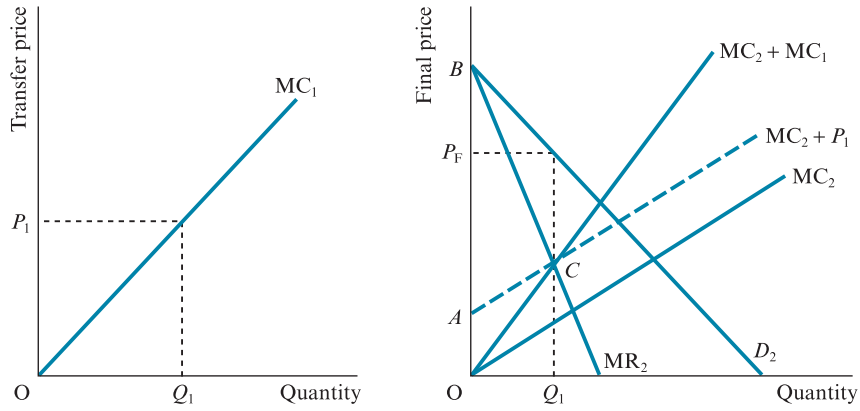

Figure 14.7 Transfer pricing: no external market for intermediate product

Suppose, initially, the distributor sets the transfer price and the producer follows price-taking behaviour in respect of this price. The distributor knows the chosen transfer price will be treated by the producer as the latter's marginal revenue function, and the producer will choose the output level at which the transfer price *equals* the producer's marginal cost, MC_1. To maximise the profit of the firm as a whole, the distributor should operate as if its total marginal cost function is $MC_2 + MC_1$, obtained by adding the value of MC_1 at each output level vertically onto MC_2. The distributor chooses the output level Q_1 at which $MC_2 + MC_1 = MR_2$. This determines the transfer price P_1, which induces the producer to produce Q_1 units of output. The distributor sells the product to the final consumers at a price of P_F.

Suppose, instead, the producer sets the transfer price, and the distributor follows price-taking behaviour. In this case, the same result is obtained. The distributor's total marginal cost function is $MC_2 + P$, where P is the transfer price chosen by the producer. The producer knows that for any value of P the producer chooses, the distributor is willing to purchase the output level at which $MC_2 + P = MR_2$. To maximise the profit of the firm as a whole, the producer should set a transfer price of P_1, as before.

In both cases, P_1 is the transfer price that maximises the firm's total profit. In Figure 14.7, the area OBC represents the firm's total profit; OAC represents the profit imputed to the producer; and ABC represents the profit imputed to the distributor. However, it is interesting to note that a transfer price of P_1 does not maximise the profits of either the producer or the distributor individually. In the case where the distributor sets the transfer price, the distributor maximises its own profit by choosing the output level at which the distributor's marginal outlay function *equals* MR_2 (see Figure 14.8). The distributor's marginal outlay function is steeper than $MC_2 + MC_1$, because it takes into account the fact that for each extra unit the distributor buys from the producer, the distributor pays not only the producer's marginal cost of producing that unit, but also an increased transfer price over all the other units the distributor was already buying. It would be in the distributor's private interest to buy a smaller quantity Q_1' at a lower

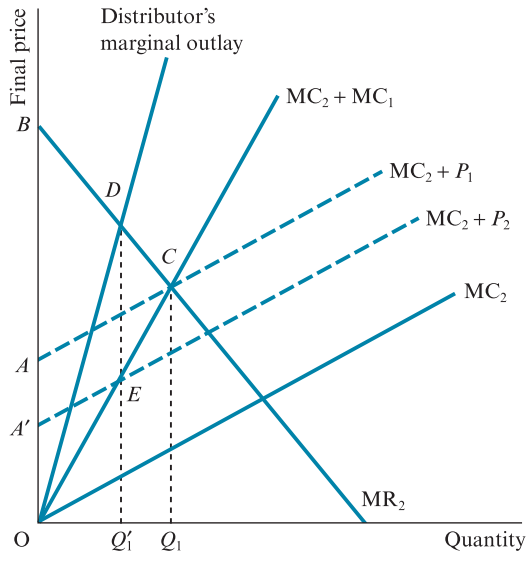

Figure 14.8 Transfer pricing: profit maximization for the distributor

transfer price of P_2, increasing the distributor's imputed profit from ABC to $A'BDE$ in Figure 14.8. The producer's imputed profit falls from OAC to $OA'E$, and the firm's total profit falls from OBC to $OBDE$.

Similarly, in the case where the producer sets the transfer price, the producer maximises its own profit by choosing the output level at which the producer's marginal revenue function *equals* $MC_2 + MC_1$. The producer's marginal revenue function takes account of the fact that at very low output levels the distributor would be willing to pay a high transfer price, but as output increases, the transfer price is reduced not only on the most marginal unit bought, but also over all the other units the distributor was already buying (see Figure 14.9). It would be in the producer's private interest to supply a smaller quantity Q_1'' at a higher transfer price of P_3, increasing the producer's imputed profit from OAC to OA″FG in Figure 14.9. The distributor's imputed profit falls from ABC to A″BF, and the firm's total profit falls from OBC to $OBFG$.

Transfer pricing with a perfectly competitive external market for the intermediate product

Some intermediate products may be traded between the divisions of an M-form or H-form firm, but may also be traded between the production divisions and external buyers from outside the firm. For example, a car manufacturer might be one division of an M-form organization, which includes a separate tyre manufacturing division. The latter sells tyres not only to the car manufacturing division, but also externally to garages and car repair shops, or direct to consumers. There are many other tyre manufacturers, so the external market for tyres is highly competitive. Returning to the previous case of the production division and

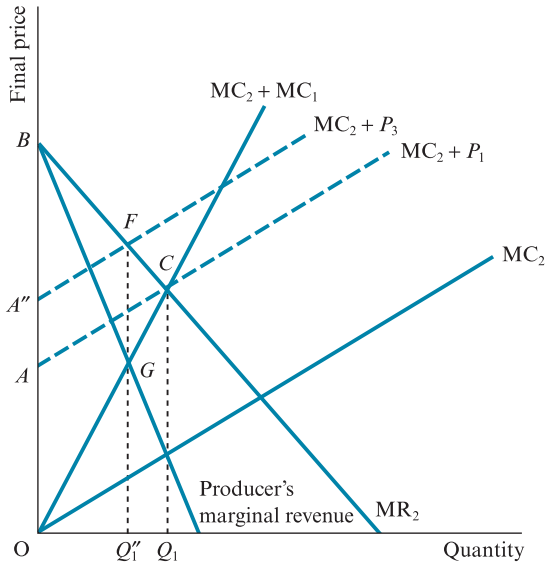

Figure 14.9 Transfer pricing: profit maximization for the producer

distribution division, if the external market is perfectly competitive the production division has the option to sell as much of the intermediate commodity as it likes on the external market at the perfectly competitive price. Similarly, the distribution division has the option to buy as much of the intermediate commodity as it likes, again at the perfectly competitive price.

Under these circumstances, the transfer price is effectively constrained to be equal to the perfectly competitive price. If the transfer price were higher than the competitive price, the distributor would prefer to make all of its purchases of the intermediate commodity on the external market; and if the transfer price were lower than the competitive price, the producer would prefer to sell all of its output on the external market. However, it is also likely that the quantity of internal trade and the quantity of production will diverge, with external trade accounting for the difference between the two. Figures 14.10 and 14.11 illustrate two possible cases.

First, in Figure 14.10 the perfectly competitive price P_C is lower than P_1 in Figure 14.7. The distributor's total marginal cost function is $MC_2 + P_C$ and the distributor selects the quantity Q_3 at which $MC_2 + P_C = MR_2$. At a price of P_C, the producer is willing to supply only Q_2 units. The distributor purchases the additional $Q_3 - Q_2$ units on the external market. In comparison with the case where the transfer price is P_1 and Q_1 units are traded, the triangle HJL represents the cost saving to the firm resulting from buying $Q_1 - Q_2$ units of the intermediate commodity on the external market rather than producing these units internally, and LJK represents the additional profit earned because the distributor's total output increases from Q_1 to Q_3 (with the extra $Q_3 - Q_1$ units also purchased on the external market).

Second, in Figure 14.11 the perfectly competitive price P'_C is higher than P_1 in Figure 14.7. The distributor's total marginal cost function is $MC_2 + P'_C$, and

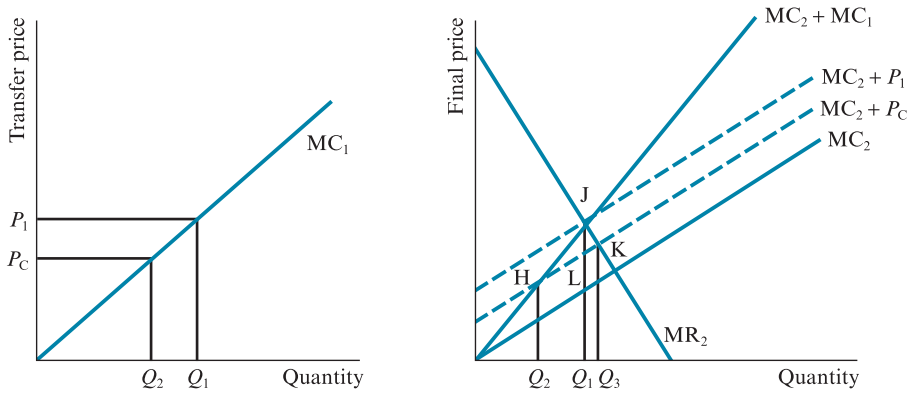

Figure 14.10 Transfer pricing: perfectly competitive external market (price below P_1)

the distributor selects the quantity Q_3' at which $MC_2 + P'_C = MR_2$. At a price of P'_C, the producer wishes to supply Q_2' units. The producer sells the additional $Q_2' - Q_3'$ units on the external market. In comparison with the case where the transfer price is P_1 and Q_1 units are traded, the triangle NRM represents the extra profit to the firm resulting from selling $Q_1 - Q_3'$ units of the intermediate commodity on the external market rather than internally, and MRS represents the additional profit earned because the producer's output increases from Q_1 to Q_2'.

The analysis shown in Figures 14.10 and 14.11 suggests that if a competitive external market exists, the firm should participate in this market. It is damaging to the firm's interests to insist that all units of the intermediate commodity used by the distributor are produced internally, if the commodity can be purchased more cheaply on the external market. And it is equally damaging to insist that the producer can only sell the intermediate commodity to the distributor, if the commodity can be produced and sold more profitably on the external market. By participating in the external market, in both cases the firm achieves an increase in its total profit. Of course, these conclusions could change if the firm had some other strategic motive for non-participation in the external market. For example,

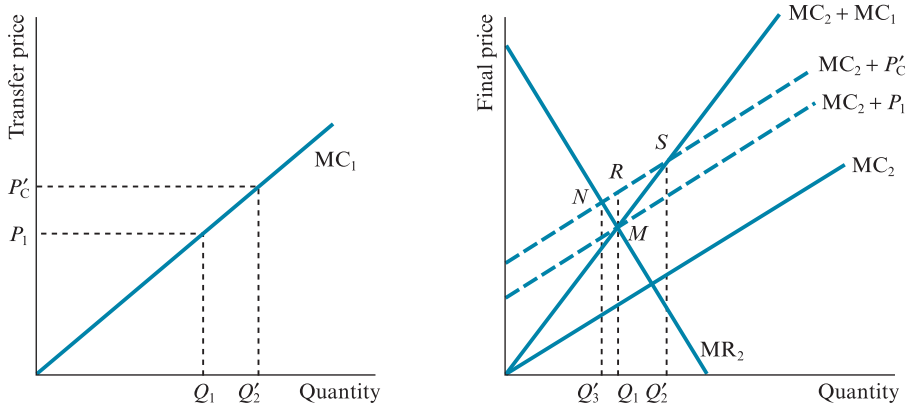

Figure 14.11 Transfer pricing: perfectly competitive external market (price above P_1)

the firm might not wish to purchase externally because it seeks to prevent a competitor from selling its output, hoping to force the competitor to exit from the production industry; or similarly, the firm might not wish to sell externally because it seeks to prevent a competitor from gaining access to supplies of the intermediate commodity, hoping to force the competitor to exit from the distribution industry.

Transfer pricing with an imperfectly competitive external market for the intermediate product

A further possibility is that the intermediate product may be traded not only between the divisions of an M-form or H-form firm, but also between the production division and one or more external buyers in an imperfectly competitive market. A car manufacturer might be one division of an M-form organization, which buys inputs from a separate division which manufactures specialised electrical components. There are very few other manufacturers of similar components, so the external market for components is imperfectly competitive.

Returning to the theoretical model, with an imperfectly competitive external market, the transfer price for internal trade between the production and distribution divisions differs from the price paid by buyers in the external market. In Figure 14.12, the analysis is restricted to the case where the transfer price, denoted P_4, turns out to be higher than P_1 in Figure 14.7. This means the producer's output of Q_5 is larger than the distributor's output of Q_4, and the producer sells the surplus output of $Q_5 - Q_4$ in the imperfectly competitive external market for the intermediate product. The two left-hand diagrams in Figure 14.12 are constructed in the same way as before. The right-hand diagram shows the producer's demand function and marginal revenue function in the external market, denoted D_3 and MR_3 respectively. The optimal transfer price of P_4 is the only value that satisfies the following conditions:

- At the producer's total output level of Q_5, the producer's marginal cost *equals* the transfer price, or $MC_1 = P_4$.

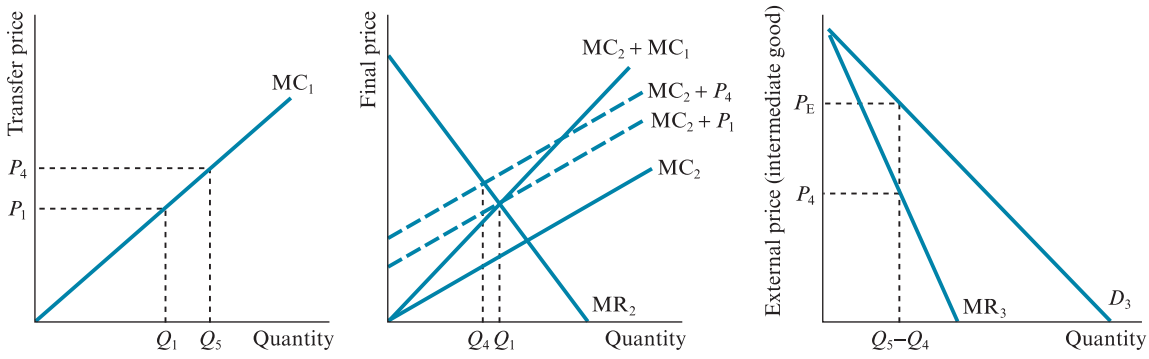

Figure 14.12 Transfer pricing: imperfectly competitive external market (price above P_1)

- At the transfer price of P_4, the distributor's total marginal cost *equals* the distributor's marginal revenue, or $MC_2 + P_4 = MR_2$, yielding an output level for the distributor of Q_4.
- When the surplus intermediate output of $Q_5 - Q_4$ is sold in the external market, the producer's marginal revenue in the external market *equals* the transfer price, or $MR_3 = P_4$. The producer's selling price in the external market is P_E, which is higher than the transfer price of P_4. Effectively, the producer practises third-degree price discrimination (see Section 14.3) by charging different prices in the segmented internal and external markets for the intermediate output.

Transfer pricing: some implications

The analysis in Section 14.5 has shown that the imputed profitability of each division is not the same as the contribution of each division to the profitability of the firm as a whole. There are several implications:

- The rewards and incentives for divisional managers should not be based solely on the imputed profitability of their own divisions, but should reflect the implications of their decisions for the profitability of the firm as a whole. If divisional managers seek to maximise the imputed profitability of their own divisions, in the case where there is no external market for the intermediate product a situation of bilateral monopoly exists. The distributor would prefer to use its monopsony power (as sole buyer) to reduce output and reduce the transfer price (see Figure 14.8), while the producer would prefer to use its monopoly power (as sole producer) to reduce output and increase the transfer price (see Figure 14.9). However, both of these outcomes reduce the profitability of the firm as a whole.
- Strategic decisions concerning the closure of (imputed) loss-making divisions or the expansion of profitable divisions should take account of the implications for the profitability of the firm as a whole. For example, the firm as a whole does not benefit from the closure of a loss-making production division if this decision reduces the profitability of the distribution division by more than the direct saving achieved by not producing the intermediate product in-house. If there are significant transaction costs associated with buying or selling on the external market, these should also be taken into account when assessing the viability of (imputed) loss-making divisions.
- Transfer pricing is a particularly controversial topic in the case of multinational firms. The fact that decisions concerning transfer prices have implications for the profits imputed to each division within the firm provides strong incentives for firms to set their transfer prices in such a way as to shift profits towards divisions located in countries with low rates of corporation tax (tax on company profits). A multinational firm may therefore declare artificially high or low transfer prices, so that its profits are declared in a way that minimises its overall corporation tax liability. The tax authorities may attempt to impose rules or controls on transfer pricing; for example, by insisting that transfer prices are comparable with prices at which the intermediate product

can be traded on the external market. However, often such controls are easily circumvented, especially in developing countries where the influence of the tax authorities over the accounting practices of large, foreign-owned multinationals may be weak.

Case study 14.5

Light falls on Apple's tax deal with Ireland

FT

Corporate tax avoidance is usually portrayed as a game of cat and mouse, with leaden-footed governments chasing slippery companies for their missing taxes. In its forthright criticism of the dealings between Apple and the Irish government, the European Commission may have uncovered a new variation, in which the tax-avoiding mouse is receiving unfair help from the governmental cat.

This complicated affair shows where justifiable competitive behaviour may have strayed into closet protectionism. Michael Noonan, the Irish finance minister, this year denied that Ireland ever cut any special deals with individual companies. It is hard to read the commission's evidence, released yesterday, and draw the same conclusion.

At the heart of the matter is the murky business of transfer pricing, which can be used to shift profits between corporate subsidiaries. In Apple's case it has operations in Ireland that buy and sell gadgets around the world, using prices that cannot be confirmed in a market. Interview notes show representatives of Apple setting out in advance what profit it would be prepared to recognise in Ireland. What follows appears to be carefully engineered to achieve this agreed-upon profit. No strong reason is supplied for the cost-plus method that Apple is allowed to use, which included a change in the mark-up seemingly designed to encourage Apple to expand operations and employment in Ireland. The deal was allowed to stand for the unusually long period of 15 years. Taken together, the commission sees this as cause to believe that Ireland conferred a specific, negotiated advantage on Apple, which may well have undermined the single market.

It will be some time before the commission reaches its final verdict, and in the meantime both Apple and the Irish government appear likely to contest vigorously any implications of wrongdoing. But they should recognise that the tide is turning in the battle against corporate tax avoidance. Politicians everywhere are swapping their starry-eyed obsession with high-tech glamour for an unromantic lust for tax revenues. They are increasingly willing to co-operate to claw back some money. In this climate neither Apple nor Ireland should risk being caught out. They do not need to resort to questionable practices. Since 1990 when these tax affairs were first discussed Apple has transformed itself, becoming one of the most valuable companies on earth. From such a position it should care more for its reputation and resist the temptation to bully national treasuries into conceding lower tax rates.

Even without the red carpet treatment Ireland stands accused of rolling out for Apple, it has a highly competitive corporate tax rate. This has become as much a symbol of Irish identity as the Blarney Stone. Within an economic model based on free trade and

competitiveness, it helped to kick-start a long period of expansion and lure to Irish shores a constellation of multinational corporations. But it also inspires hostility in other European countries, notably France. Ireland has every right to craft its economic strategy, which includes setting its own tax rates. Its leaders will find it easier to defend this stance if they remove any impression of the sort of shady dealing suggested by the commission. The European Commission has shown why it was right to shine a light on these tax deals. Ireland claims to want to be part of the solution not the problem. If this is to mean anything, the government should demarcate the line between luring companies to Ireland and letting them craft bespoke tax policies.

Abridged

Source: FT View September 30, 2014

14.6 Price dispersion

In a competitive market in which an identical product or service is sold by many firms, and consumers have perfect information, firms should act as price-takers with the same price charged by all producers and retailers. If different prices are charged for the same product or service, this suggests some form of departure from the assumptions underlying the theoretical model of perfect competition. Therefore studying the extent of **price dispersion** across producers and retailers, and studying the degree to which price dispersion persists over time, may be informative as an indicator as to whether markets are competitive or uncompetitive (Pratt *et al.,* 1979; Lach, 2002).

Theory suggests that price dispersion may arise due to heterogeneity between buyers in respect of search costs, brand loyalty, frequency of repeat purchases and access to information; or heterogeneity between sellers in respect of production costs, product quality and technology (Stigler, 1961; Rothschild, 1973; Reinganum, 1979; Rosenthal, 1980; Varian, 1980; Narasimhan, 1988; Stahl, 1989; Spulber, 1995; Sorenson, 2000; Gerardi and Shapiro, 2009). If individual sellers pitch their prices at permanently low or high levels relative to their competitors, then consumer learning should lead to the elimination of high-price sellers from the market, and to the elimination of price dispersion. On the other hand, if sellers frequently vary their relative positions, then search costs may make it prohibitive for consumers to identify the lowest prices available at any particular time. It is likely that the advent of the internet had implications for the extent and persistence of price dispersion by reducing search costs. However, some evidence suggests that consumers often fail to choose the best price because they search too little, become confused comparing prices, are over-confident and/or show excessive inertia through too little switching away from past choices or default options (Grubb, 2015a,b,c).

In recent years, the development and rapid growth of online markets has made it easier for researchers to collect information on the prices charged by different

retailers, either by collecting data from the websites of individual producers or retailers or by using specialised price comparison websites. Price comparison websites enable retailers to display price information, information about the attributes of the products they supply, and information about the service the retailers themselves provide, in a format that can be easily accessed by consumers (Baye and Morgan, 2001). Price comparison websites may drastically reduce the search costs that consumers would otherwise incur. Therefore it might be expected that, in markets where price comparison websites are available, the level of price dispersion should be less than in markets where such tools are unavailable. Gorodnichenko and Talavera (2016) report empirical evidence to suggest that relative to prices in traditional outlets, prices in online markets are more flexible and adjust rapidly to changes in external economic conditions such as exchange rates and the degree of competition.

In the academic literature on price dispersion, it is often assumed that there are two types of consumers: the informed (sometimes known as shoppers) and the uninformed (sometimes known as loyals). Informed consumers search intensively to obtain the lowest available prices, while uninformed consumers either do not access price data, or have preferences for particular retailers that override price considerations. This suggests price dispersion is possible, even in equilibrium. This price dispersion is likely to be persistent, with the identity of firms offering the highest and lowest prices changing over time.

In an early empirical study, Brynjolsson and Smith (2000) compare the prices of books and CDs at 41 online and traditional retailers between 1998 and 1999. Contrary to expectations, prices and price dispersion were found to be higher in online markets than in traditional markets. Subsequent US and Italian studies for books and CDs by Clay *et al.* (2002) and Ancarani and Shankar (2004) report similar findings. These studies attribute their findings to a lack of maturity in the online market.

Early studies for other products also suggest price dispersion is higher in online markets. Using US data, Erevelles *et al.* (2001) find the price of vitamins is higher online than in drug stores, supermarkets and warehouse suppliers. Scholten and Smith (2002) compare price dispersion in traditional retail markets for products such as deodorants, hairspray, aspirin and cameras in 1976, with dispersion for the same products in 2000. Price dispersion was higher in 2000 than in 1976. However, Brown and Goolsbee (2002) find the price dispersion of life insurance policies declined over the period 1992–7 as customer use of the internet increased. A hedonic regression model is used to control for differences in the terms, conditions and coverage of the policies that are compared. Cavallo (2016) compares online with offline prices for 56 retailers across 10 countries. In 72 per cent of cases the prices of offline and online products are identical. Most similarity between online and offline prices are found for electronic products, while least similarity is found for pharmaceutical and office products.

Another facet of recent work is to examine whether price dispersion differs between pure play (specialist online retailers) and multi-channel retailers (bricks and mortar and non-specialist online retailers). Tang and Ting (2001) compare the levels and dispersion of prices between six online retailers and four multi-channel retailers for 51 DVD titles in Singapore. The online retailers tended to

charge lower prices, and there was less price dispersion, than the multichannel retailers. Using Italian data on the prices of books and CDs, Ancarani and Shankar (2004) find multichannel retailers charged higher prices and had greater price dispersion than pure play retailers.

Several price dispersion studies use data from internet price comparison sites, where information may be updated on a weekly, daily or even hourly basis (Baye and Morgan, 2001; Baye *et al.,* 2007). For example, Baye *et al.* (2004) examine 4 million daily price observations for 1,000 consumer electronic products posted on the shopper.com website between August 2000 and March 2001, in order to determine whether price dispersion decreased as consumer usage of this website increased over the eight-month period of the study. A reduction in price dispersion over time would suggest that dispersion is a temporary, disequilibrium phenomenon. Alternatively, if there was no reduction, this would suggest that price dispersion is an equilibrium phenomenon, reflecting structural characteristics of the markets concerned. Three measures of price dispersion are used: the average percentage difference in price; the average difference between the two lowest prices; and the average coefficient of variation. There is little evidence to support the view that price dispersion was a temporary phenomenon; instead, price dispersion was persistent over time, and was dependent on structural indicators such as the number of firms listing prices for a given product. The degree of price dispersion was greater when there were fewer firms.

Pan *et al.* (2004) examine the determinants of price dispersion in online retailing, using 2000 and 2001 US data from a price comparison website on several hundred identical products. The factors that may be relevant in explaining the degree of price dispersion in the online markets for different products and services include shopping, retailer, market and product characteristics. Shopping characteristics include shopping convenience (ease of finding and evaluating products through search tools), reliability of delivery and customer service, depth of online product information, quality of shipping service and returns policy. Retailer characteristics include the timing of the retailer's market entry, degree of consumer trust and retailer branding, and consumer awareness. Market and product characteristics include the number of competing sellers, whether the product is cheap or expensive, homogeneity or heterogeneity of product characteristics and the popularity of the product among consumers. In general, variability of shopping characteristics is found to be important in explaining price dispersion, but retailer characteristics are found to be less important. Liu (2016) uses price information for a large sample of identical products sold by a large clothing company (Zara) across 74 countries in one week in 2013. There is evidence of price dispersion, particularly for lower-priced products. Income differences between countries account for much of the variation in prices.

14.7 Summary

One of the earliest challenges to the neoclassical theory of the firm questioned whether in practice firms have sufficient information to apply the profit-maximizing rule marginal revenue *equals* marginal cost when setting their prices.

Cost plus pricing is an alternative pricing rule, whereby price is determined by adding a percentage markup to average variable cost. The markup includes a contribution towards fixed costs, and a profit margin. Under some conditions, cost plus pricing may be simpler and less demanding in terms of its informational requirements than profit-maximizing pricing. However, the advantages of cost plus pricing are only likely to materialise if the firm's costs are stable, and if average variable cost is constant over the relevant range of output levels. If the cost plus pricing firm always selects approximately the same profit margin as a profit-maximizing firm would achieve, cost plus pricing and profit maximisation are equivalent. If so, the margin must be an inverse function of the firm's price elasticity of demand. Although the use of cost plus pricing is widely reported, cost plus could just be a convenient rule-of-thumb for firms that are really profit maximisers, even if profit maximization is not explicitly acknowledged.

Firms with a degree of market power need not always set uniform prices that are identical for all consumers, and identical no matter how many units of the product each consumer buys. With a policy of price discrimination, the firm might sell at different prices to different consumers, or make the price per unit each consumer pays dependent on the number of units purchased. For price discrimination to be possible, the firm must have market power, and the market must be divisible into submarkets with different demand conditions, so that secondary trade or resale between consumers in different submarkets is not possible.

There are three types of price discrimination:

- First-degree price discrimination makes the price per unit of output dependent on the identity of the purchaser and on the number of units purchased. The monopolist exploits differences in consumers' willingness to pay, by charging each consumer his or her own reservation price for each individual unit purchased. First-degree price discrimination yields a higher abnormal profit than the standard case of profit maximization with a uniform price in monopoly, because the consumer surplus in the standard case is converted into producer surplus, and deadweight loss is eliminated. The outcome under first-degree price discrimination is allocatively efficient, because price *equals* marginal cost for the most marginal unit produced and sold.
- Second-degree price discrimination makes the price per unit of output dependent on the number of units purchased. The price does not depend on the identity of the purchaser. The monopolist designs a menu of prices and quantities such that each consumer chooses a price–quantity combination that allows the monopolist to discriminate profitably between consumers. A two-part tariff, requiring the payment of a fixed fee if the consumer wishes to make any purchases at all, plus an additional uniform price per unit purchased, is a form of second-degree price discrimination.
- Third-degree price discrimination involves making the price per unit depend on the identity of the purchaser. The price does not depend on the number of units purchased. However, the monopolist is able to segment the market by offering different prices to different consumers. The monopolist charges a relatively high price to consumers whose demand is price inelastic, and a relatively low price to consumers whose demand is price elastic.

Forms of price discrimination used in practice include the following:

- Intertemporal price discrimination, whereby the supplier segments the market by the point in time at which the product is purchased.
- Branding, whereby different prices are charged for similar or identical goods differentiated solely by a brand label.
- Loyalty discounts for regular customers, operated by airlines, supermarkets and other retailers.
- Coupons providing price discounts that discriminate between consumers on the basis of willingness to make the effort to claim the discount.
- Stock clearance sales involving successive price reductions which are a form of intertemporal price discrimination.
- Metering, involving pricing for a low profit margin on a primary product (such as film tickets) and a high profit margin on a tied secondary product (such as popcorn).
- Free-on-board pricing, involving the producer or distributor absorbing transport costs, and representing a form of price discrimination favouring buyers in locations where transport costs are higher.

In markets where demand varies at different times of the day or on different days of the year, but the supplier is unable to adjust capacity to meet the higher level of demand in peak periods (or reduce capacity in off-peak periods) the supplier faces a peak-load problem. If the levels of demand and costs are such that it is efficient to operate at full capacity in both periods, the social welfare maximizing price for each period is the marginal cost of installing an extra unit of capacity *plus* the marginal production cost in both periods *minus* the price charged in the other period. If it is efficient to operate at full capacity during the peak period, the willingness of the off-peak consumers to pay becomes irrelevant in determining the optimal capacity, because the system only operates at capacity during the peak period.

In multidivisional organizations, the choice of transfer prices at which intermediate products are traded internally between divisions affects the imputed profitability of the divisions involved. Decisions taken at divisional level with a view to the maximization of divisional profits do not necessarily ensure the maximization of the total profit of the firm as a whole. In this chapter, profit-maximizing models of transfer pricing have been developed for the cases where there is no external market for the intermediate product, and where the intermediate product can be traded on an external market that is either perfectly competitive or imperfectly competitive. The analysis suggests that incentives for divisional managers should not be based solely on imputed divisional profitability, but should reflect the profitability of the entire organization. Strategic decisions concerning the closure of (imputed) loss-making divisions should also take account of the implications for the profitability of the firm as a whole, including any additional transaction costs associated with trade on the external market that are not considered when calculating imputed divisional profits. The

transfer pricing practices of multinational firms can raise particularly difficult policy issues in cases where firms use transfer pricing to minimise their corporation tax liabilities.

In a competitive market with perfect information and product homogeneity, economists would expect all producers or retailers to charge the same price. If there is price dispersion, this suggests some form of failure of the assumptions underlying the theoretical model of perfect competition. In recent years, the growth of online markets has allowed consumers to compare prices more easily, either from the websites of individual producers or retailers, or by using specialised price comparison websites. Product characteristics, and structural characteristics of online markets including the number of retailers, their reputation and the quality of service they offer, appear to be influential in determining the extent of price dispersion. Advances in the collection, handling and storage of price data offer significant opportunities for new and innovative research on price dispersion (Cavallo and Rigobon, 2016).

Discussion questions

1. For what reasons might a firm depart from a policy of pricing for profit maximization and adopt a cost plus pricing formula instead? Under what conditions do these two pricing methods produce identical outcomes?
2. What conditions must be satisfied for a producer to be able to implement a policy of price discrimination?
3. Explain carefully the distinction between the three degrees of price discrimination.
4. In the case of a monopolist, why might a policy of first-degree price discrimination produce an outcome that is preferred on social welfare criteria over a policy of setting a uniform price to maximise profit?
5. Consider two medium-sized English Premier League football clubs, one of which has a small stadium, which is regularly filled to capacity, while the other has a larger stadium in which often there are many empty seats. In what ways might you expect the ticket price structures of these two clubs to differ? Your answer should refer to Case Study 14.1.
6. With reference to Case Study 14.2, what factors should be considered by a cinema chain in setting its ticket prices, and the prices that are charged inside the cinema for food and drinks?
7. Explain why economists have interpreted supermarket (or other retailer) loyalty cards as a form of second-degree price discrimination.
8. The demand for gas and electricity varies between different times of the day and between different months of the year. What factors should be considered by a utility company when deciding how much capacity to install, and what prices to charge during peak and off-peak periods?
9. With reference to Case Study 14.3, examine the extent to which industry structure determines gender-based pricing.

10. With reference to Case Study 14.4, explain 'geo-blocking' and discuss the likely impact on competition.
11. To maximise the aggregate profits of a multidivisional firm, it is not sufficient to ask each division to attempt to maximise its own profit. Explain why not and discuss the implications for corporate governance.
12. Explain how a multidivisional firm should set its transfer price when there is an imperfectly competitive external market for the intermediate product.
13. With reference to Case Study 14.5, explain how Apple, with the help of the Irish government, used transfer pricing to reduce its tax exposure. Using your own research, update this case study.
14. Explain how study of the phenomenon of price dispersion can provide insights into the competitive structure of traditional and online retail markets.
15. After reading Cavallo and Rigobon (2016), explain how 'big data' can improve our understanding of price dispersion.

Computational questions

A monopoly supplier of music downloads sells to two distinct types of consumer, with the following monthly demand functions:

Type 1: $q_1 = 200 - 2p_1$

Type 2: $q_2 = 400 - 5p_2$

There are 20 Type 1 consumers and 10 Type 2 consumers. The supplier's marginal cost of production is 40 pence per download, and there are no fixed costs.

1. Suppose the supplier cannot distinguish between the two types of consumer, and must sell to everyone at a uniform price. Let $Q = 20q_1 + 10q_2$ denote the total quantity produced and sold, and let p denote the uniform price.
   a. Write down an expression for the supplier's total demand function, in the form of an equation for Q in terms of p.
   b. Derive expressions for the supplier's total revenue and profit functions, in the form of equations for TR and π in terms of Q.
   c. Calculate the supplier's profit-maximizing value of Q, and the corresponding profit-maximizing value of p.
   d. Calculate the total consumer surplus and total producer surplus (monopoly profit) at this profit-maximizing solution.
2. Suppose the supplier can distinguish between the two types of consumer, and is permitted by law to sell to different consumers at different prices. Let $Q_1 = 20q_1$ and $Q_2 = 10q_2$ denote the total quantities produced and sold to Type 1 and Type 2 consumers, respectively.

a. Write down expressions for the supplier's total demand functions for each type of consumer, in the form of expressions for Q_1 in terms of p_1, and Q_2 in terms of p_2.

b. Derive expressions for the supplier's total revenue and profit functions for each type of consumer, in the form of equations for TR_1 and π_1 in terms of Q_1 and for TR_2 and π_2 in terms of Q_2

c. Calculate the supplier's profit-maximizing values of Q_1 and Q_2 and the corresponding profit-maximizing values of p_1, and p_2.

d. Calculate the total consumer surplus and total producer surplus (monopoly profit) at this profit-maximizing solution.

3. Suppose the supplier is prohibited by law from selling to different consumers at different prices, but is permitted to offer different two-part tariffs provided each tariff is made available to every consumer. Suppose the supplier offers two alternative subscription packages, as follows:

Package A: £10 per month fixed charge, plus 65 pence per download

Package B: £35 per month fixed charge, plus 42 pence per download.

a. Show that Type 1 consumers would be attracted to subscribe to Package A, but would not consider subscribing to Package B; and that Type 2 consumers would be attracted to subscribe to Package B, but would not consider subscribing to Package A.

b. Calculate the total consumer surplus and total producer surplus (monopoly profit) at this profit-maximizing solution.

c. Compare the total welfare, and the surpluses achieved by each party (supplier, Type 1 consumers, Type 2 consumers) under uniform pricing (Q1), third-degree price discrimination (Q2) and second-degree price discrimination (Q3).

Further reading

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