Module 8

Pricing practices

Introduction

In previous modules, we saw that firms, in order to maximise profits, produce where marginal revenue (MR) equals marginal cost (MC) and then charge the price indicated on the demand curve they face. This is true under all types of market structures, except when firms in oligopolistic markets may pursue other objectives, such as sales revenue maximisation in the long run. Throughout our discussions, however, we employed a framework that assumed firms would (a) have perfect information about the buyers and sellers, and hence about demand and costs functions, or (b) sell in only one market, or (c) produce only one product. None of these assumptions, however, is generally true for most firms today. That is, most firms produce more than one product, sell products in more than one market, are organised (at least large corporations are) into a number of decentralised profit centres, and have only a general rather than a precise knowledge of the demand and cost curves they face. As a result, our discussion of the pricing decision presented in the previous module must be expanded to take into consideration actual pricing practices.

In this module, we examine the firm's pricing under imperfect knowledge, cost-plus pricing that approximates the MR = MC rule, price discrimination, price strategies that aim to capture consumer surplus such as bundling, two-part pricing (pricing of multiple products), and transfer pricing or the pricing of (intermediate) products transferred between the firm's divisions.

Upon completion of this module you will be able to:

Outcomes

- *explain* the objectives of pricing strategies.
- *explain* how an imperfectly competitive firm is able to apply various methods of pricing strategy.
- *explain* the conditions under which a firm may be able to successfully price discriminate.
- *analyse* the underlying strategy of the two-part pricing and the bundling.
- *discuss* the significance of transfer pricing.
- *explain* how the firm's transfer-pricing strategy changes with the underlying market conditions.

Terminology

Cost-plus pricing:	Price is determined by adding a fixed mark-up of some kind to the cost of producing or acquiring the product.
Market segmentation:	The carving up of a total market into subgroups from the standpoint of pricing.
Price discrimination:	Practice by a seller of charging different prices to the same buyer at different times or to different buyers for the same good or service at the same time.
Product bundling:	The practice of selling two or more products together as a package deal for a single price.

Cost-plus pricing

The most widely used method of pricing is known as *cost-plus pricing.* It is a procedure whereby the price is determined by adding a fixed mark-up of some kind to the cost of producing or acquiring the product. Thus development of a cost-plus price requires two basic steps: determination of the relevant cost and determination of what the 'plus' should be.

The formula for the mark-up percentage is

$$Markup = \frac{Price - Cost}{Cost} \qquad (1)$$

For example, if the cost (average variable cost = AVC) of a product that sells for $12 is $10, the mark-up on cost would be

$$= \frac{12-10}{10} = 0.2 = 20\%$$

Suppose the percentage of mark-up is denoted by X. Rearranging equation (1) yields

$$X = \frac{P - AVC}{AVC},$$
$$or$$
$$P - AVC = X.AVC$$
$$and \qquad (2)$$
$$P = AVC + X.AVC$$
$$or$$
$$P = AVC(1+X)$$

This mark-up, in dollar terms, is the per-unit contribution to overheads and profits, and hence choosing the size of the mark-up amounts to choosing the contribution margin. As a matter of practice, the mark-up should be large enough so that, at the actual level of sales volume, the total contributions to overheads and profits actually cover the overheads and allow a profit to be made.

The size of the mark-up is constrained, however, by the willingness of consumers to pay the higher prices associated with a higher mark-up. Even a firm that has a monopoly over a certain product must acknowledge that at higher prices consumers in aggregate will buy fewer units. Oligopolists must take into account the relative prices of competitors. An individual firm will lose sales to rivals if its price is significantly above the prices of its rivals and if consumers do not think the item is worth the extra money.

Mark-up pricing is often thought to be simply cost based, but it is evident that the amount by which price can be marked up is highly dependent on the demand conditions facing the firm. When asked what factors determine the size of the mark-up percentage, business people often respond that they choose the mark-up with an eye to 'what the market will bear'. These statements carry an implicit message about the price elasticity of demand facing the firms. Therefore, the size of the mark-up is both cost as well as demand based, contrary to the naive view that mark-up pricing depends on cost alone.

At this juncture, two questions arise:

1. Does the practice of mark-up pricing ignore the marginalist principles of pricing?
2. And if not, is there any way to determine if cost-plus pricing is maximising?

The answer to the first question is NO; it does not ignore marginalist principles. To the second question, the answer is YES, if we are able to determine the price elasticity of the product.

First, let us remember that

$$MR = P(1 - 1/EP) \qquad (3)$$

where EP is the absolute value of the price elasticity of demand. When profit is maximised, MR = MC. Therefore, we can substitute MC for MR in equation (3)

$$MC = P(1 - 1/EP) \qquad (4)$$

If, we assume, for simplicity, that the cost function is linear (AVC = MC), we will have

$$AVC = P\ (1 - 1/EP) = P(EP - 1)/EP]$$

Isolating P

$$P = AVC\ [EP/(EP - 1)]$$

or

$$P - AVC = AVC[(EP/(EP\text{-}1)] - AVC$$

and therefore,

$$\frac{P - AVC}{AVC} = \frac{1}{E_p - 1} \qquad (5)$$

Equation (5) indicates that the percentage of mark-up varies with the price elasticity of demand.

From this analysis we can draw the following conclusions:

1. Different products with different elasticity should have different percentages of mark-up even if they have the same marginal cost.
2. The more price-elastic the product, the smaller should be the rate of mark-up.
3. If the mark-up rate is chosen correctly, it will give exactly the profit-maximising price. For example, for a product that has a price elasticity of 3 (in absolute value), a mark-up of 50 per cent $\left(\frac{1}{3-1} = \frac{1}{2}\right)$ would be consistent with the marginalist principles. And for a product with a price elasticity of demand of 2, a mark-up of 100 per cent $\left(\frac{1}{2-1} = \frac{1}{1}\right)$ would be consistent with the profit-maximisation principle.

Demonstration problem

Suppose a retail sport store charges $30 for a jersey and the cost to the firm is $10. The firm has reasons to believe that the price elasticity of demand for its product at that price is 2 (in absolute value). Is this price optimal?

Answer:

The percentage of actual mark-up is

$$X = (30 – 10)/10 = 2 = 200\%$$

The optimal (profit maximizing) mark up, however, is

$$1/(Ep – 1) = 1/(2 – 1) = 100\%$$

Since the optimal mark-up rate of 100 per cent is less than the actual mark-up of 200 per cent, the actual (current) mark-up and the resulting price are too high.

Extracting Consumer Surplus

Price discrimination

Price discrimination describes in general a method that can be used by some sellers to tailor their prices to the specific purchasing situations or circumstances of their buyers. Specifically, it is defined as the practice by a seller of charging different prices to the same buyer at different times or to different buyers for the same good or service at the same time, without corresponding differences in cost. For analytical purposes, it is convenient to distinguish among three degrees of differential pricing.

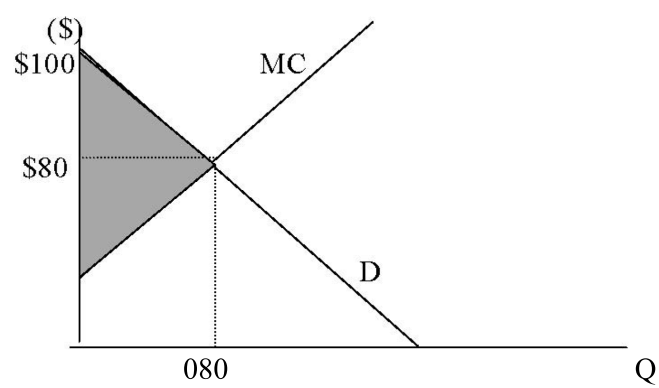
First-degree price discrimination

In differential pricing of the first degree, the seller charges the same buyer a different price for each unit bought, thereby extracting the consumer's maximum willingness to pay the *reservation price*. By shading the price down to the buyer for each additional unit purchased, the seller obtains larger total revenue than if the same price per unit were charged for all units bought. Unfortunately for managers, first-degree price discrimination (also called perfect price discrimination) is extremely difficult to implement because it requires the firm to know precisely the maximum price each consumer is willing and able to pay for alternative quantities of the firm's product.

Nonetheless, some service-related businesses, including car dealers, mechanics and lawyers, successfully practice a form of first-degree price discrimination. For example, when a firm sells a product at an auction, it is attempting to get consumers to bid up the price so that the consumer with the highest reservation price purchases the good. Also, most car dealers post sticker prices on cars that are well above the dealer's actual marginal cost, but offer 'discounts' to customers on a case-by-case basis. The best salespersons are able to size up customers to determine the minimum discount necessary to get them to drive away with the car. In this way they are able to charge different prices to different consumers depending on each consumer's willingness and ability to pay. This practice permits them to sell more cars and to earn higher profits than they would if they charged the same price to all consumers. Similarly, most professionals also charge rates for their services that vary, depending on their assessment of customers' willingness and ability to pay.

Figure 8-1 shows how first-degree price discrimination works. Each point on the market demand curve reflects the maximum price that consumers would be willing to pay for each incremental unit of the output, that is, reservation price. Consumers start out with 0 units of the good, and the firm can sell the first incremental unit for \$100. Since the demand curve slopes downward, the maximum price the firm can charge for each additional unit declines, ultimately to \$80 at an output of 80 units. The first unit goes to the customer with the highest reservation price, \$100. The firm would sell the first unit for \$100 and captures all of the consumer surplus. The second unit is sold to the person with the second highest reservation price of \$99, and similarly, the third unit goes for \$98, etc. This way, the seller charges each customer his or her highest reservation price for that unit, which is the height of the demand curve. The difference between each point on the demand curve and the firm's marginal cost represents the profits earned on each incremental unit sold. Thus, the shaded area between the demand curve and the firm's marginal cost curve reflects the firm's total profit when it charges each consumer the maximum price he or she will pay for small increments of output between 100 and 80 units. This strategy allows the firm to earn the maximum possible profits. Notice that consumers receive no consumer surplus on the five units they purchase: the firm extracts all surpluses under first-degree price discrimination. This practice is also referred to as *perfect price* discrimination.

Figure 8-1



Demonstration problem

Suppose a perfectly discriminating monopolist faces the following demand curve, P = 30 – Q. The monopolist's marginal cost is MC = 10, and there are no fixed costs.

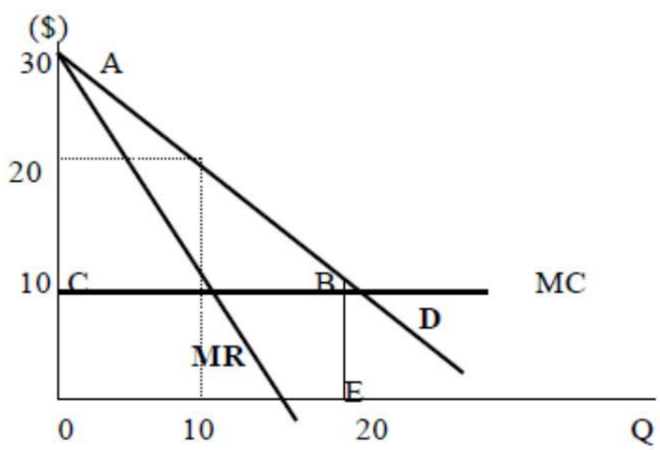
a. What are the profit maximising price and quantity under first-degree (perfect) price discrimination? What is the gain to the monopolist?

b. What would be the price-maximising price and quantity under simple (non-discriminating) solution?

Answer:

a. A first-degree price discriminating monopolist maximises profit by setting P = MC, 30 – Q = 10, hence producing Q = 20, and charging the marginal price (price of the last unit) of $10. At this point, the firm's total revenue is represented by the area ABC in Figure 8-2:

Figure 8-2



The numerical value of this area is $200. The producer receives the area of the triangle ABC ($200) plus the area of the rectangle OCBE (P x Q = 20 x 10 = $200), equal to $400, of which the cost of production is the rectangle OCBE. The net profit is, therefore, $200.

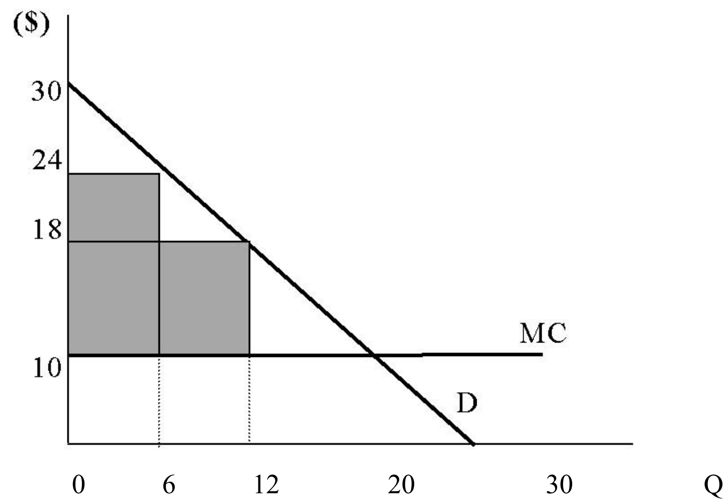
b. If the firm cannot price discriminate and instead charges a single price for all units sold, it will produce where MR = MC. MR = 30 – 2Q = MC =10, and Q = 10. Total revenue, in this case, equals $200 (10 x $20) and total cost equals $100 (10 x $10). Therefore, the profit is $100.

Second-degree price discrimination

More practical and common is second-degree price discrimination. Differential pricing of the second degree, more commonly known as volume discounting or quantity discounting, involves the same underlying principle as first-degree differential pricing, except that the seller charges different prices for groups of units instead of for individual units. By doing so, the firm will extract part, but not all, of the consumer's surplus. By charging a higher price for smaller quantities, the seller receives higher total revenue than if a single price were charged. This practice is very common in the electric utility industry, where firms typically charge a higher rate on the first hundred kilowatt hours of electricity used than on subsequent units. Thus, the firm charges different prices to different consumers, but does not need to know specific characteristics of individual consumers.

For example, suppose that the firm of Figure 8-2 sets the price of $24 per unit on the first six units of the product and the price of $18 per unit on the next batch or group of six units of the product, Figure 8-3.

Figure 8-3



The total revenue of the firm would then be *$144* ($24 x 6) from the first batch of six units of the product and *$108* ($18 x 6) from the second batch or group of six units, for the overall total revenue of *$252 and profit of $132* (TR – TC = $252 – $10 x 12), as compared to *$160* with first-degree price discrimination and *$100* without any price discrimination. Thus consumers end up with some consumer surplus, which means that second-degree price discrimination yields lower profits for the firm than it would have earned if it were able to perfectly price discriminate. Nonetheless, profits are still higher than they would have been if the firm had used the simple strategy of charging the same price for all units sold. In effect, consumers purchasing small quantities (or alternatively, those having higher marginal valuations) pay higher prices than those who purchase in bulk.

Third-degree price discrimination

The final type of price discrimination is commonly practiced by firms that recognise that the demand for their product differs systematically across consumers in different demographic groups. In these instances firms can profit by charging different groups of consumers different prices for the same product, a strategy referred to as *third-degree price discrimination.*

Differential pricing of the third degree occurs when the seller segregates buyers according to income, geographic location, individual tastes, kinds of uses for the product, or other criteria, and charges different prices to each group or market despite equivalent costs in serving them. Thus, as long as the demand elasticity among different buyers are unequal, it will be profitable to the seller to group the buyers into separate classes according to elasticity, and charge each class a separate price. This is what is referred to, more generally, as *market segmentation*, that is, the carving up of a total market into subgroups from the standpoint of pricing.

There are many examples of third-degree price discrimination. One of these is provided by electrical power companies, which usually charge higher rates to residential than to commercial users of electricity. The reason is that the price elasticity of demand for electricity is higher for the latter than for the former because the latter could generate their own electricity if its price rose above the cost of building and running their own power plants. This choice is generally not available to households. Other examples of third-degree price discrimination are the higher air fares charged to airlines to business travellers than to vacationers, the higher price charged by telephone companies during business hours than at other times, and the higher prices charged for many services to all customers, except children and the aged.

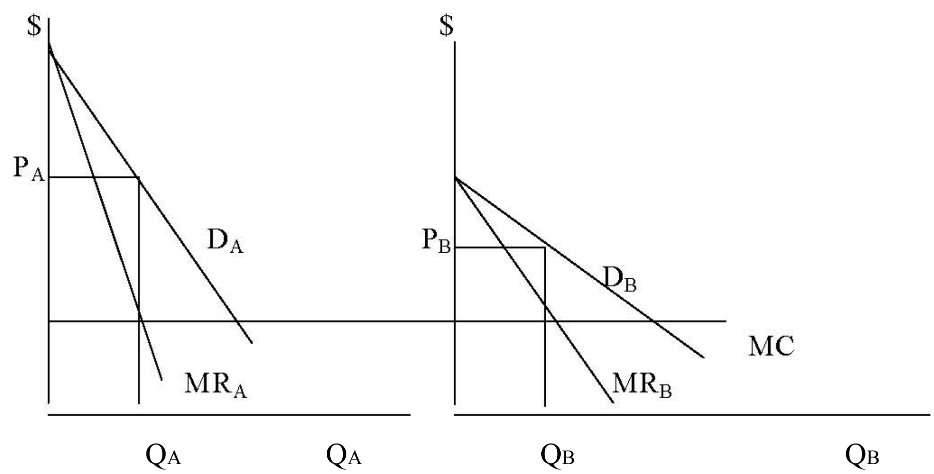
To practice price discrimination effectively, two conditions must be satisfied:

1. *Market segmentation*. The seller must be able to partition (segment) the total market by segregating buyers into groups or submarkets according to elasticity. Profits can be enhanced by charging a different price in each submarket.
2. *Market sealing*. The seller must be able to prevent – or natural circumstances must exist that will prevent – any significant resale of goods from a lower-priced submarket to a higher one. Any resale (leakage) by buyers between submarkets tends to neutralise the effect of different prices and narrow the effective price structure toward a single price to all buyers.

To see how the third-degree price discrimination enhances profits, we will consider a firm with market power that can charge two different prices to two groups of consumers and the marginal revenues of selling to group A and group B are MRA and MRB, respectively. The basic profit-maximising rule is to produce output such that marginal revenue is equal to marginal cost. This principle is still valid, but the presence of two marginal revenue functions introduces some ambiguity. The condition for maximum profit using price discrimination is that the marginal revenue be the same in all markets and equal to marginal cost. That is, the additional revenue gained from selling one more unit in market A shall be equal to the additional revenue obtained by selling one more unit in market B. If the MRs are not equal, the firm can increase its revenue and profit by selling more to the market with the higher MR. The concept is illustrated in Figure 8-4.

Figure 8-4 illustrates that the customers are willing to pay a higher price than those in market B, perhaps because there is less competition in market A. Less competition implies higher mark-up. In contrast, in market B the lower price represents lower mark-up, which is the symptom of a weaker market power, which in turn can be a function of a greater competition in that market.

Figure 8-4



Demonstration problem

Suppose an airline company faces two different groups of clients, business people and vacationers. The demand equation representing each group is given as follows:

Business passengers: $P_A = 20 - 0.2Q_A$

Vacationers : $P_B = 10 - 0.05Q_B$

Also assume that this firm faces a cost function represented by:

$TC(Q) = 4Q_T$, where $Q_T = Q_A + Q_B$

a. Show how this airline company can increase its profit by engaging in a third-degree price discrimination. What price will the airline company charge and what output will it produce in each market?

b. If for some reason the airline company is unable to practice price discrimination and, therefore, it charges a single price, what will be the price and output?

Answer:

a. First we should find the MRs and MC. MRA = 20 – 0.4Q_A, and MR_B = 10 – 0.1Q_B, and MC = 4. Next, we set MR_A = MC, and MR_B = MC to obtain Q_A and Q_B as follows:

20 – 0.4Q_A = 4, yielding Q_A = 40

10 – 0.1Q_B =4, yieldingQ_B = 6, for the total of Q_T = Q_A + Q_B = 100

Plugging for Q_A and Q_B in their own respective demand equations, we have: P_A = \$12, and P_B = \$7. Profit equals TRA + TRB – TC = \$12 x 40 + \$7 x 60 – 4 x 70 = \$620.

In absence of price discrimination, the firm will sell its tickets at the same price in both markets (P = P_A = P_B). The total market demand faced by the airline company is: Q_T = Q_A + Q_B. We, therefore, need to invert the demand equations first and then add them:

Q_A = 100 – 5P_A, Q_B = 200 – 20P_B

Hence QT = 300 – 25P, so that P = 12 – 0.04Q_T.
Setting MR = MC

12 – 0.08 Q_T = 4

yields Q_T = 100, P = \$8. Profit equals = TR – TC = 100 x \$8 – (100 x \$4) = \$400, which is less than that earned under price discrimination practice.

In the example of the airline company, above, we noticed that the airfare in the business travellers market was set higher (full fare) than that in the vacationers market (excursion fare). This is so, because business travellers' willingness to pay is typically greater than that of the vacation travellers, due to the fact that the time and the duration of their business trips are less flexible. There are simply not as many good alternatives available to business travellers in regard to the mode of transport and the time of their trips as there are to excursion travellers. The availability of substitutes, however, is reflected in the price elasticity of demand.

Recall the relationship between MR and P. Applying this to both markets, we have:

$MR_A = P_A (1 – 1/E_{PA})$

$MR_B = P_B (1 – 1/E_{PB})$

Since in equilibrium, $MR_A = MR_B$

$$P_A\ (1 - 1/E_{PA}) = P_B\ (1 - 1/E_{PB})$$

Hence

$$\frac{P_A}{P_B} = \frac{(1-1/E_{PB}}{(1-1/E_{PA}} \qquad (6)$$

Based on equation (6), one can see that the airline company tends to charge full fare in market A, where the price elasticity is lower (more inelastic), and charge an excursion (lower) price in market B, where the elasticity is greater.

Demonstration problem

Suppose that the airline company, above, faces the following price elasticity of demand: E_{PA} = 1.2 and E_{PB} = 2. What is the ratio of the airfare (full fare) in market A to the fare (excursion fare) in market B?

Answer:

$$\frac{P_A}{P_B} = \frac{(1-1/2)}{(1-1/1.2)} = 3$$

Two-part tariffs

Another form of pricing strategy, which is a variation of second-degree price discrimination, is two-part tariffs (pricing).

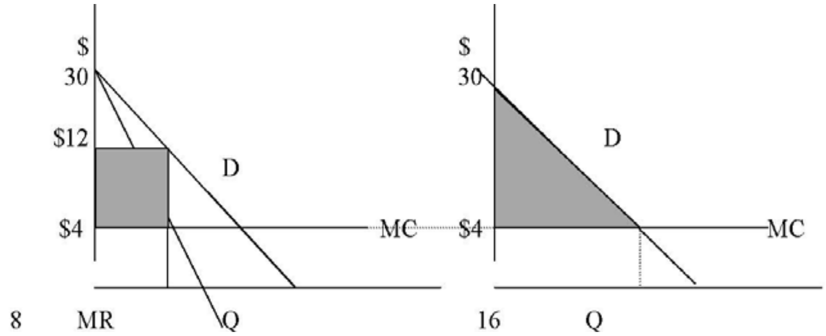
With a two-part tariff, the firm charges a consumer a fixed fee (the first tariff) plus a per-unit charge (the second tariff) for the right to buy as many units of the good as the consumer wants.

This strategy is usually used by car rental companies to enhance profits. They typically charge a per-day fee and a price per kilometre driven. Fairs usually charge an entrance fee and a price for each ride.

To profit from two-part tariffs, a firm must have market power, know how demand differs across customers or with the quantity that a single customer buys, and successfully prevent re-sales.

We now examine how a firm uses a two-part tariff to extract consumer surplus. Suppose that a monopoly has a constant marginal and average cost of \$4 and no fixed cost, and consumers are represented by the demand curve equation P = 20 – Q, Figure 9-5. If the monopolist adopts a policy of charging a single price to all customers, its profit maximising-price and quantity would be found by setting its MR = MC. That yields a price of \$12 per unit and output of eight units, respectively.

Figure 8-5



In this case, the profit equals to TR ($12 x 8) – TC ($4 x 8) = $64. If on the other hand, the monopolist engages in a two-part pricing, the outcome would be very much like the first-degree price discrimination, which allows a firm to extract all consumer surpluses from consumers. Accordingly, the monopolist would charge a price equal to its MC = $4 and would sell 16 units that will allow it to break even on each unit sold. However, in doing so, it can also charge a lump-sum fee of up to $208, which is the potential consumer surplus, the shaded triangle under the demand curve and above the price line.

Pricing product bundles

Product bundling is the practice of selling two or more products together as a package deal for a single price. Firms that sell two or more goods may use bundling to raise profits. Bundling allows firms that cannot directly price discriminate to charge customers different prices.

A series of examples will indicate how widespread product bundling is. Computers are often bundled with monitors and with software and sold as a package deal. Restaurants offer fixed menus which include soup, main course, dessert and coffee for a single price. Cars offer luxury or sports packages that must be sold in conjunction with the basic vehicle. Professional sports teams and symphony orchestras offer season tickets that bundle together a variety of events for a single price. And cable television companies bundle channels and sell them as a package rather than selling them individually.

Put simply, the firm has a profit incentive to bundle products together when doing so allows the extraction of a greater degree of consumer surplus from the potential customers. In general, it may be optimal to offer the products both separately and in the bundle, since some consumers will only want one of the products and would not be willing to pay the bundle price. Offering both the bundle and the separate products is known as ‘mixed’ bundling, as opposed to ‘pure’ bundling, where the products are only available as a package deal.

In practice, the seller will be unable to determine each buyer’s reservation price and will simply assume that buyers have a range of reservation prices, such that there is a negatively sloping demand curve for both the products separately and collectively (the bundle). The seller will typically increase profit (over that available from pricing the products separately) by raising the prices of each product *if sold separately* and offering the bundle as a package deal at a price which is less than the sum of the prices of the components of the bundle. Thus buyers who only want one or some subset of the products in the bundle must pay more than they otherwise would have, and other buyers who would not have purchased all the products separately end up buying the bundle because it is the cheapest way to get the products that they do want. Raising the price of individual products will cause the firm to lose some sales, but the gain in sales resulting from the availability of the bundle typically outweighs that loss, such that the overall sales and profit are higher than if the products were priced separately.

An application of bundling is *quantity discounts.* The theory of bundling explains why some firms offer a given product in several different sizes (such as small, medium, large, and jumbo bottles of Coke), and why some consumers buy only the small size and others pay more to buy larger sizes (but at a reduced price per unit, such as per ounce). The larger sizes can be viewed as bundles, or multiples, of the smallest size of the same product and the buyer is given a discount for purchasing in quantity. Similarly, when a product is priced at, say, $3 each, or two for $5, the buyer is essentially getting a discount on the second unit of the product if he or she chooses to buy that additional unit. Why are some people induced to buy in quantity while others are not? A person will demand the extra units of the product bundled together in the larger size if the incremental cost to the consumer is less than the consumer's reservation price for those extra units.

Demonstration problem

A consumer might be willing to pay a maximum of $1 for a 250ml can of cola, if she is very thirsty. The store price is, let us say, 80 cents. Since the asking price is less than the buyer's reservation price, the seller will make the sale. But suppose the seller also has a 500ml can of the same cola for $1.20. Will the consumer buy that one instead?

Answer:

Suppose that the consumer's reservation price on the 500ml size is $1.50, indicating she expects 50 cents worth of extra utility (consumer surplus) from the additional 250ml. Since the additional 250ml will cost her only 40 cents more, she will buy the larger size. Now, suppose the store also has a 750ml size, priced at $1.80. The consumer's reservation price for the 750ml size is, say, $1.75, indicating her willingness to pay only another 25 cents for the additional 250mls. Since the additional quantity would cost her 60 cents, however, she chooses the 500ml size. The seller collects $1.20 from this customer, compared to only 80 cents that would have been collected if the cola had been priced uniformly per millilitre (ml) regardless of bottle size. Assuming that the seller's marginal cost of the extra 250ml is always less than the price premium attached to the larger sizes, the seller will have increased both sales and profit. Of course, more thirsty customers, or someone buying the family groceries, are likely to buy the 750ml size, because their reservation prices are more likely to exceed the price asked.

A more elaborate discussion of bundling can be made by working through the following illustration.

Suppose a tour company in the hotel and hospitality business identifies three groups of customers for an exclusive destination:

Group 1: 1/3 of the customers will use a package of hotel and airfare

Group 2: 1/3 of the customers will use only airfare

Group 3: 1/3 of customers will use only hotels.

The marginal cost of the airfare is $400 and the marginal cost of the hotel is $250. The maximum price each type of consumer will pay is:

Table 8-1

Commodity bundling	Reservation price (maximum willingness to pay)	
	Airfare	Hotel
Group 1	$800	$500
Group 2	$800	$400
Group 3	$500	$600

First let us see how much profit the firm can earn if it does not bundle the fare and the hotel.

Optimal price of airfare: What price should the tour company set for the airfare?

If it sets the airfare at $500, all three groups of customers will buy and the firm's profit will be (TR) – (TC) = (3 x $500) – (3 x $400) = $300. At the price of $800, the firm will sell airfare only to Group 1 and 2, and will earn (2 x $800) – (2 x $400) = $800. Therefore it should set the price of airfare at $800.

Optimal price of hotel: What price should the tour company set for the hotel?

If it sets the hotel at $400, all three groups of customers will buy and the firm's profit will be (TR) – (TC) = (3 x $400) – (3 x $250) = $450. At the price of $500, the firm will sell hotel only to Group 1 and 3, and will earn (2 x $500) – (2 x $250) = $500. At the price of $600, the firm will sell hotel only Group 3, and will earn (1 x $600) – (1 x $250) = $350 Therefore, the tour company should set the price of hotel at $500.

The best the firm can do without bundling is to set the price of airfare at $800 and the price of hotel at $500. It will then earn a total profit of $1,300.

Now consider the option to bundle the airfare and the hotel, selling two components in a single package.

Optimal price of package: What price should the tour company set for the package?

In order to answer this, we first need to summarise the customers' reservation price for the package. Building on the information in Table 8-1:

Table 8-2

Commodity bundling	Reservation price (maximum willingness to pay)		
	Airfare	Hotel	Value of bundle
Group 1	$800	$500	$1,300
Group 2	$800	$400	$1,200
Group 3	$500	$600	$1,100

If the bundle is sold at $1,100, all three groups would buy the package and the firm will earn (3 x $1,100 – 3 x $650) = $1,350. If the bundle is sold at $1,200, only Group 1 and 2 will buy the package and the profit will be (2 x $1,200 – 2 x $650) = $1,100. And if the tour company sets the price at $1,300, its profit from the sale of the package to only Group 1, will be $650. Therefore, the optimal bundle price is $1,100. Note that the bundling has increased profits from $1,300 without bundling to $1,350 with bundling.

Decentralisation and transfer pricing

Many large firms are organised into divisions or profit centres to facilitate the efficient operation of the firm. The decentralisation of decision-making in this way is considered to have a beneficial impact on the firm's overall efficiency and profitability, since each division manager is judged by the profit performance of his or her division or profit centre. A problem can arise, however, when one division or profit centre supplies a component product (or intermediate product) to another division or profit centre that uses this intermediate product as the basis for the firm's finished product, which is sold to consumers. This transaction is essentially internal to the firm and does not take place in the market for that intermediate product, if indeed there is a market for it. Since the transfer of such products involves a transaction between autonomous units within the firm, it becomes necessary to establish a *transfer price* at which the product may be sold by one division and purchased by the other.

If the transfer price is set at a relatively high level, the supplying division will make more profits and the buying division less, presuming there is competition of some sort in the market for the finished product. If the transfer price is set at a relatively low level, the opposite will prevail. The firm as a whole will wish to set the transfer price at a level which serves to maximise the profit of the firm as a whole, rather than at some arbitrary or negotiated level that may not best serve the firm's objective.

We shall analyse the transfer pricing problem under three scenarios, first considering the case where there is no external market for the intermediate product, then considering the existence of a perfectly competitive external market for the intermediate product, and finally considering the existence of an imperfectly competitive market for the intermediate product.

Transfer pricing with no external market for the intermediate product

The marginalist rule, that marginal cost equals marginal revenue, determines the profit-maximising output and price level for the firm as a whole. But if the firm has two divisions, for example, its overall marginal cost at any output level will be the sum of the marginal costs in its two divisions. Suppose a firm has two divisions: P (production) and M (marketing). The intermediate product is produced in Division P, and then packaged and marketed by Division M. We suppose that each division has an upward-sloping marginal cost curve, as shown in Figure 8-6, where

MC_P = Division P's marginal cost of producing components for Division M,

MC_M = Division M's marginal cost of completing the firm's product,

MC_F = The firm's marginal cost, which is the vertical summation of MCP+ MCM,

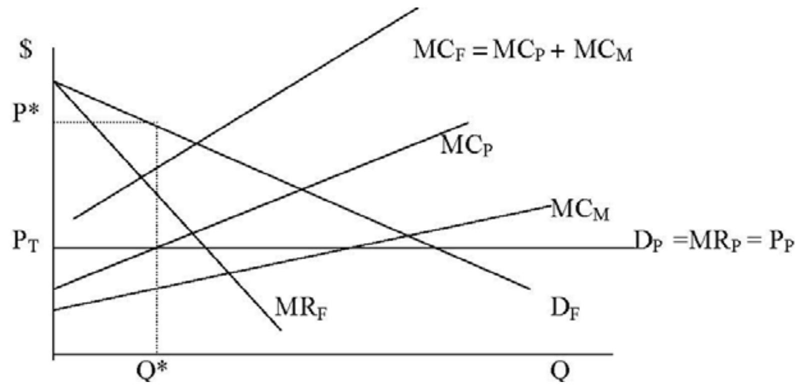
D_F = Demand for the firm's product,

MR_F = The firm's marginal revenue,

P_T = The transfer price.

Since there is no external market for Division P's product, its only customer is Division M. On the other hand, Division M's only source of the product is Division P. Hence, the production by Division P precisely equals to the demand by Division M. Therefore, given this information, the firm maximising price, output, and the transfer price are P* level Q*, and P_T, respectively.

Figure 8-6



What transfer price should be established to induce Division P to produce exactly the profit-maximising output of the intermediate product? Similarly, what transfer price will induce Division M to set the market price at the level P***** such that the firm's profits are maximised? In Figure 8-6, we show the optimal transfer price as P_T, chosen to equate Division P's marginal cost at output level Q*. As a result, Division P faces a horizontal demand curve (D_A) at the transfer price – it can sell as much as it wants to at that price.

However, it will only want to produce Q* units, since its marginal cost MCP equals its marginal revenue ($P_A = MR_A$) at that output level. Thus setting the transfer price at the level P_T induces Division P to produce and supply exactly the optimal amount.

From the viewpoint of division M also, the market price P***** and output/sales level Q* are consistent with profit-maximisation. At any other price and output combination in the market for the finished product, Division M's net additional revenue (net marginal revenue) would either exceed or fall short of the transfer price (its effective marginal cost of the intermediate product), and its divisional profit would not be maximised.

Thus establishing the transfer price at the level P_T provides the appropriate incentives for both divisions to produce and sell at the firm's profit-maximising output level Q*. Each division maximises its profits by producing Q* units and the overall firm's profits are also maximised. Any other transfer price may have higher profits for either Division P or M, but would have lower profit for the firm as a whole, not to mention a shortage or surplus of the intermediate product.

Demonstration problem

Suppose a vertically integrated firm has two divisions. The P (production) Division manufactures a patented product that S Division uses in a customised finished product that it assembles and installs. Demand and cost functions have been estimated as follows:

Demand for the firm's product is: $P_F = 500 - 0.01P_F$. Marginal cost in P Division: $MC_P = 10 + 0.001Q_P$, and marginal cost in S Division: $MC_S = 100 + 0.005Q_S$.

a. What are the firm's profit maximising price and output?

b. What is the transfer price and what is the level of output produced by Division P? How many units of the customised finished product will be produced?

Answer:

a. Optimality requires that the firm set $MR_F = MC_F$. From the demand curve we obtain $MR_F = 500 - 0.02QF$, then we obtain MC_F by adding the two (divisional) marginal costs curves vertically

$MC_F = MP_F + MCs = (10 + 0.001Q_P) + (100 + 0.005Qs)$. Since $Q_P = Qs = Q_F$ at the profit-maximising level of output, $MC_F = 110 + 0.006Q_F$. At the point of optimality,

$MR_F = MC_F$

$500 - 0.02Q_F = 110 + 0.006\ Q_F$,

$0.026Q, = 390$

$Q_F = 15,000$, and $P_F = \$350$.

The transfer price is the Production Division's marginal cost at a production level of 15,000 units:

$MC_P = 10 + 0.001Q_P = 10 + 0.001\ (15,000) = \$25$ per unit.

Transfer pricing with a perfectly competitive external market

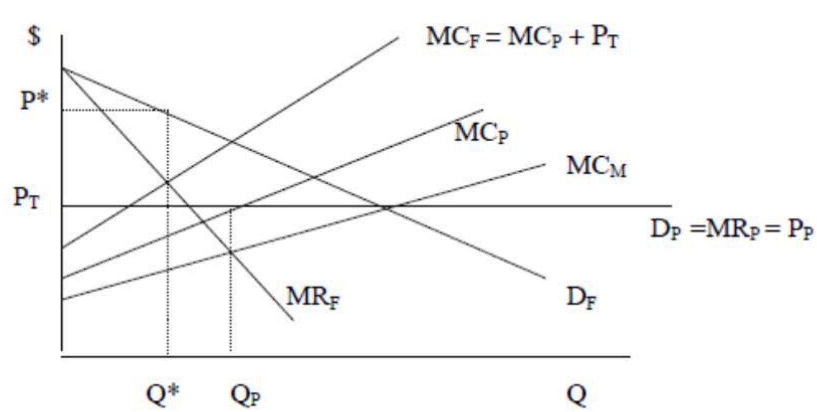
Now suppose that the intermediate product is available from other suppliers as well as Division P. Moreover, Division P's product is identical to that of other suppliers. There will be a market price for the intermediate product determined by the forces of supply and demand in that external market. In this case the transfer price must be set equal to the market price for the intermediate product. If it is set higher, Division M will prefer to buy from the external market rather than from Division P. If the transfer price is set below the external market price, Division P will prefer to sell to the external market rather than to Division M. If, at the transfer price (equal to the market price), division P wants to produce more than Division M wishes to purchase, it can sell the balance in the external market. Conversely, if Division M wants to purchase more than Division P wishes to produce, it can buy the remainder in the external market.

For the case of perfectly competitive external market, we shall illustrate the derivation of a transfer price with the aid of Figure 8-7. The Figure conveys the following information:

> D_F = Demand curve for the firm's product, which is assembled and sold by Division M,
>
> D_P = Demand curve for Division P's product. Since the product is sold in a perfectly competitive external market, D_P is a horizontal line,
>
> MC_P = The marginal cost of selling Division P's product,
>
> MC_M = Marginal cost to Division M of assembling and marketing the firm's product, excluding the purchases from Division P or the external market,
>
> MC_F = Marginal cost of producing the firm's product, including purchases from Division P or the external market, i.e., $MC_F = MC_P + P_T$. Since Division P will establish production at a level where $MR_P = MC_P$, then $MC_T = MC_M + MC_P$.

As illustrated in Figure 8-7, the transfer price, P_T, is the external market price, since the external market is perfectly competitive. Note that Division P will operate at its profit-maximizing level of production, QP, such that $MC_P = MR_P$. It will, however, sell Q* units to Division M, and, thus, it will sell the remainder, shown by the distance QP – Q*, in the external market for the intermediate product. Had the competitive external market price been lower, such that QP < Q*, Division M would have purchased some from Division P and the remainder from the external market. Clearly, Division M's profit maximizing output is found by setting $MR_F = MC_T$. This is the quantity of Division P's product that Division M will buy.

Figure 8-7



Demonstration problem

Suppose that demand, and cost curves for a vertically integrated firm with two divisions P and M are given as follows**:**

$P_F = 18 - 0.1Q_F$

$MC_P = 1 + 0.1Q_P$

$MC_M = 1 + 0.1Q_M$

Also assume the perfectly competitive external price for the intermediate product that Division P produces is \$6. Determine the best level of output of the intermediate product for Division P. How much of this will be sold to the Marketing Division and how much to external buyers? What is the transfer price? What is the optimal level of price and output from the perspective of the firm?

Answer:

The profit-maximising level of price and output for the production division:

$MC_P = 1 + 0.1Q_P = \$6 = P_T$ and hence $Q_P = 50$

The profit-maximising level of price and output for the Marketing Division:

$MC_F = MC_M + P_T = 0.1Q_M + 6$

Then MC_F $(= 0.1Q_M + 6) = MR_F$ $(= 18 - 0.2Q_M)$

Hence, $Q_M = 40$, and $P_M = \$14$.

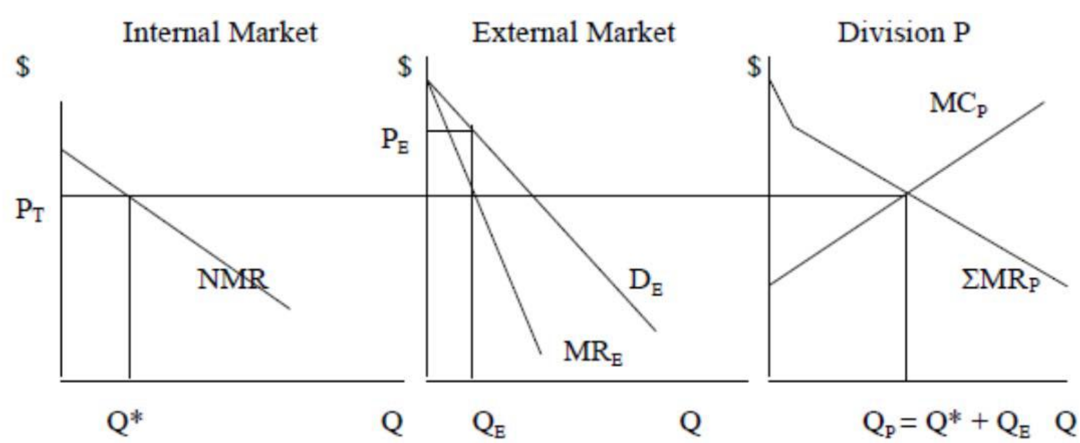
Therefore, the Production Division produces 50 units, selling 40 units to Division M, and the rest, 10 units, in the external market.

Transfer pricing with an imperfectly competitive external market

Now we suppose that the intermediate products are not identical across firms, and thus each supplier to the external market faces a downward-sloping demand curve in that market. In the left-hand panel of Figure 8-8, we show the net marginal revenue, NMR, curve for (the marketing) Division M of the firm. In the Division M market, the relevant marginal revenue is the net marginal revenue derived by subtracting the cost of the component purchased from Division P from the marginal revenue derived from demand for Division M's product (which is the firm's product as assembled and marketed by Division M). That is, $NMR_M = MR_F - MC_P$. The cost of the component purchased from Division P is just Division P's marginal cost. In the middle panel, we show the demand curve, D_E, and the marginal revenue curve, MR_E, of the imperfect external market for Division P's intermediate product.

Division P again has two markets for its output – it can sell to either Division M or it can sell to the external market, E. However, since the elasticity of demand are different in these two markets this case, Division P will find it profitable to practice price discrimination between the two markets. As shown in the right panel, Division P's marginal revenue is the horizontal summation of the total division's marginal revenue in both markets, i.e., $\Sigma MR_P = MR_E + NMR_M$, where Σ (the Greek letter sigma) stands for the sum. The intersection of ΣMR_P and MC_p determines Division P's optimal output level is Q_P units, which must be allocated between the internal and external market. The optimal transfer price is $P_T = MC_P$.

Figure 8-8



At the transfer price of P_T dollars, Division M will purchase Q_p units of Division P's product. In the external market, the optimum sales level is Q_E units, which will clear the market at a price of P_E dollars, which is more than the transfer price, P_T. Setting the transfer price equal to Division P's marginal cost insures that Division M will demand from Division P a quantity that will maximise profit for the firm as a whole.

Module summary

Summary

A firm with market power can influence the price in the market. Firms with market power can use many strategies to increase their profits. One common practice is price discrimination, by which the firm charges different prices to different consumers at the same time or to the consumers at different times, for reasons not associated with costs. To be able to implement this successfully, however, the firm requires information about its customers and their willingness to pay. Bundling is another strategy by which firms may be able to enhance their profit. This is a form of tie-in sales that requires customers to purchase goods in a package. Bundling increases profits when customers have different demands and tastes. Transfer pricing refers to the determination of the price of the intermediate products sold by one semiautonomous division of a firm to another semiautonomous division of the same enterprise. Appropriate transfer pricing is essential in determining the optimal output of each division and the firm as a whole.

Assignment

Assignment

1. A monopolist uses 'block-pricing' strategy to extract all consumer surpluses. If the inverse demand function faced by the firm is P = 10 – 0.5Q then what bundle should the firm offer to consumers? (Assume that the firm produces at constant marginal cost of $4.00). How much surplus is extracted in this situation?

2. The local telephone company has monopoly power over the market. A researcher who has been employed by the firm submitted a report that shows significant difference in demand for international calls in the night compared to the number of calls in the day time. How should the company decide on the price for international calls to maximise profit?

Assessment

Assessment

1. Why is transfer pricing important? Explain the transfer price formula given that a firm has one upstream and one downstream division. If the cost function of these two divisions are $Cu(Q) = 5Q + 10Q^2$ and $Cd(Q) = 50Q$ respectively, then find the profit maximising level of output and profit for the firm. Assume that the inverse demand function is $P = 100 – 2Q$.
2. Explain the relevance of the following pricing strategies for a monopolist:
   a. first degree price discrimination
   b. second degree price discrimination
   c. third degree price discrimination.
3. A monopolist faces an inverse demand function of $P = 10 – 0.2Q$. The marginal cost of the firm is \$6.00. If the firm uses standard monopoly pricing policy find the equilibrium price, output and profit. With a ‘two-part’ pricing strategy what should the firm do with regard to price setting?

Assessment answers

1. Transfer pricing is important since large firms with different divisions producing parts of products at different places consider these divisions as independent cost centres. Therefore, costs need to be optimised for all divisions, otherwise this could result in a loss for the firm. The rule is to equate net marginal cost of downstream with upstream MC to find an optimal level of output.

   Marginal Cost of Upstream = MC_u = 5+20Q

   Marginal Cost of Downstream = MC_d = 50

   Revenue function of Downstream = PQ = $100Q - 2Q^2$

   Marginal Revenue of Downstream = MR_d =100 – 4Q

   Net Marginal Revenue of Downstream = $MR_d - MC_d$ = 50 – 4Q

   Setting Net Marginal Revenue of Downstream = MC_u, we get

   5 + 20Q = 50 – 4Q or Q = 45/24 = 1.875 units.

2. A monopolist, by virtue of being the only seller has market power to set prices. Market power allows the monopolist to charge arbitrary prices for profit maximisation. First-, second-, and third-degree price discriminations are various strategies to extract whole or part of the consumer surplus over and above the producer surplus that the monopolist would generate by following the profit-maximising rule only.

   a. First-Degree Price Discrimination: This strategy is applicable only if the monopolist can differentiate the consumers individually, and is fully aware of the demand function. The monopolist extracts the entire consumer surplus in this way.

   b. Second-Degree Price Discrimination: The monopolist puts consumers in different price brackets. Prices are usually declining with higher level of purchase. For example, if the monopolist charges one price for 0-10 units, another price for 11-20 units, another price for 21-30 units and so on, then the firm is able to extract some consumer surplus without having to know about all consumers individually.

   c. Third-Degree Price Discrimination: This strategy is relevant when there are markets that are not overlapping. The firm sets prices according to individual market demand curves, setting marginal cost equal to the marginal revenue from that particular market.

3. $P = 10 - 0.2Q$ [if $Q = 0$ then $P = 10$]

Revenue $R = 10Q - 0.2Q^2$

Marginal Revenue $MR = 10 - 0.4Q$

Setting MR = MC

$10 - 0.4Q = 6$

$Q = 10$

$P = 8$

Profit = (10 x 8) – (8 x 6) = 32

Consumer Surplus = 0.5 (10 – 8) x 8 = 8

Two part pricing, buy 10 for [32 + (10 x 8)] = 112

Profit = 112 – 48 = 64

References

References

Baye, M. (2002). *Managerial Economics and Business Strategy*, Irwin: McGraw Hill.

Besanko, D., & Braeutigam, R. (2002). *Microeconomics: An Integrated Approach*. New York: Wiley & Sons.

Douglas, J. E. (1992). *Managerial Economics: Analysis and Strategy*. Upper Saddle River, NJ: Prentice Hall.

Pindyck, R. S., & Rubinfeld, D. (2001). *Microeconomics, 5th Edition*. Upper Saddle River, NJ: Prentice Hall.

Salvatore, D. (1993). *Managerial Economics in a Global Economy*. Irwin: McGraw Hill.