Block 2
Imperfect Competition-I

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UNIT 3 MONOPOLY

Structure

3.0 OBJECTIVES

After going through this unit, you will be able to:

- get an insight into the Monopolistic market structure;
- analyse profit maximisation and output choice under monopoly;
- compare Perfect competition with Monopoly;
- explain the relationship between Marginal Cost, Price and Elasticity of Demand under monopoly;
- discuss the practice of Price discrimination and specifically the three degrees of price discrimination adopted by a monopolist;
- explain the two-part tariff form of price discrimination and moreover determine the optimal tariff charged through various methods; and
- explain the conditions for the prevalence of a Natural monopolistic form of market structure and also identify the several pricing options possible under such form.

3.1 INTRODUCTION

Monopoly and perfect competition are two extreme or limiting market structures. Monopoly is a market structure involving a single seller of a commodity or service, which does not have a close substitute, for instance, our central bank, the Reserve Bank of India has a monopoly over printing currency notes. Similarly, Indian Railways can provide an example of monopoly to some extent. As in the case of currency notes the central bank has complete control over the supply of money. Though Indian railways has now close substitutes (air transport and improved road transport) it still has monopoly in affordable long-distance travel.

All of you must be wondering how some firms can have monopoly power? It is the prevalence of "barriers to entry" that makes it possible for a firm to maintain its monopoly power. In a perfectly competitive market, profits attract new companies into the industry which compete away the profits in the long-run allowing each firm to earn only normal profit; in a monopoly new companies cannot enter because of the barriers to entry which allows the monopolist to continue earning profits in the long-run.

3.1.1 Sources of Monopoly Power

How does a firm come to be the only one to serve the market? There are several factors which alone or in combination can enable a firm to become a monopolist. They are:

1) **Control over critical inputs:** If in an industry an input is critical in the production process and one firm controls the supply of inputs, then the firm can become a monopolist. Other firm cannot enter the industry because they do not have access to the critical inputs. For instance, for most of the twentieth century, De Beers group used to solely have control over most of the world supply of raw diamond, and therefore the group enjoyed monopoly power in the diamond industry.

2) **Economies of Scale and Scope:** The existence of economies of scale implies that the firm has a downward sloping average cost curve. So more the firm produces the lower is its unit cost of production. This creates a barrier to new firms in the industry as it is difficult for a new comer to compete with the incumbent low cost firm.

3) **Regulation:** In industries where economies of scale and scope are strong, the government through regulation may decide to allow only one (or a few firm) to operate in the market in order to achieve the lower average cost of production. By deliberately barring competition, the government hopes to avoid costly duplication. The government makes it illegal to enter such an industry without a government license.

4) **Intellectual Property Rights:** In order to encourage innovation, most countries give an innovator sole control over the use of an innovation

for a certain number of years. These are called Patents (In India it is granted for seven years). Patents create monopolies.

5) **Entry Lags:** In some industries like Steel, there is a huge gestation lag between the time the work starts on Plants and machinery and the time when production begins. These gestation lags prevents new firms from entering the industry.

A monopolist can set either price or quantity but not both. In this unit we will consider the situation where the monopolist sets the profit-maximising output level and the corresponding price is the market price.

3.2 PROFIT MAXIMISATION AND OUTPUT CHOICE

In case of a monopoly, the firm is not a price-taker. Rather it influences the price at which the good is sold; or it can dictate the profit maximising quantity for a given price. A monopolist faces a downward sloping demand function, given by say, $Q(P)$, that is, quantity (Q) as a function of price (P), which exhibits an inverse relation between the quantity demanded by consumers (for normal good) and price ($Q'(P) < 0 \; or \; \frac{dQ}{dP} < 0$). Correspondingly, an inverse demand function will be given by $P(Q)$, that is, price (P) as a function of quantity (Q). A monopolist takes demand or inverse demand function as given and aims at maximising profits (π) given by

$$\pi(Q) = TR(Q) - TC(Q) \qquad (1)$$

by choosing the optimal output production level (Q).

In Equation (1), $\pi(Q)$ stands for profit as a function of output Q.

TR stands for total revenue given by $P(Q) \times Q$, i.e., price × output.

TC stands for total cost given by $C(Q)$, *i.e.* cost as a function of output Q.

Thus, we have

$$\text{Maximise } \pi(Q) = P(Q) \times Q - C(Q) \qquad (2)$$

For profit maximisation, applying the first-order (or necessary) condition in Equation (1), we get,

$$\frac{d\pi(Q)}{dQ} = 0$$

$$\Longrightarrow \frac{dTR(Q)}{dQ} - \frac{dTC(Q)}{dQ} = 0$$

$$\Longrightarrow MR(Q) - MC(Q) = 0$$

$$\Longrightarrow MR(Q) = MC(Q) \qquad (3)$$

As we know, the first-order derivatives of total revenue (TR) and total cost (TC) with respect to output (Q) are marginal revenue (MR) and marginal cost (MC), respectively. Thus the first-order condition suggests that at the equilibrium level of output, MR is equal to MC.

The second-order (sufficient) condition for maximisation is that the second-order derivative of the profit function should be negative. That is,

$$\pi'' = TR''(Q) - TC''(Q) < 0$$

$$\Rightarrow \frac{dMR(Q)}{dQ} < \frac{dMC(Q)}{dQ} \quad (4)$$

Or, at the equilibrium point, the slope of MC curve should be steeper (greater) than that of the MR curve. In other words, MC should cut MR from below at the equilibrium. Given that MC rising ($\frac{dMC(Q)}{dQ} > 0$) and MR is falling ($\frac{dMR(Q)}{dQ} < 0$), the second-order condition will always be satisfied.

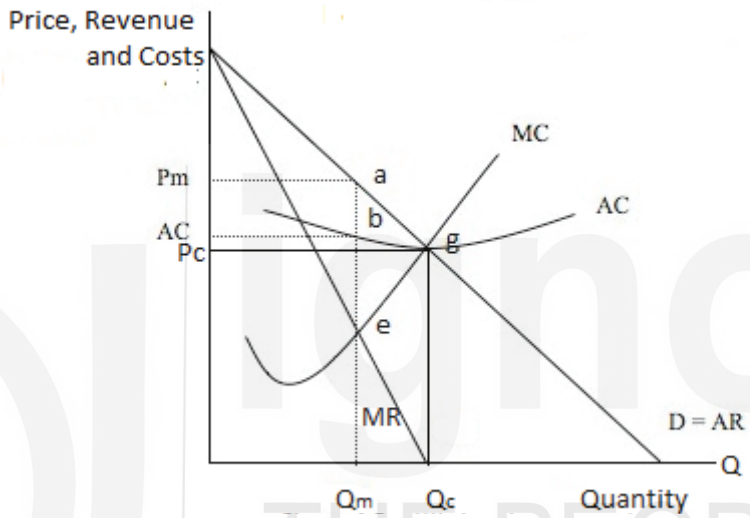

Fig. 3.1: Monopoly Equilibrium

In the above diagram, we have taken quantity on the horizontal axis and price, MR, MC and AR on the vertical axis. At the equilibrium point e, MR is equal to MC, i.e., the first-order condition of profit maximisation is satisfied. The intersection of these two curves determines monopoly quantity Q_m and the corresponding monopoly price P_m in equilibrium. The AR curve is also the market demand curve. Unlike in the case of perfect competition, the monopoly price is greater than both the MC and the MR because the demand curve (AR) is downward sloping and thus it has to be above the MR curve.

Example 1

Suppose a monopolist owns an amusement park and faces a linear market demand (Q) function for a fun ride given by, Q = 500 – 2P, where P is the market price. At equilibrium, how many fun rides monopolist would be providing and at what price, given the cost function he faces is C(Q) = 25Q?

Solution: The linear demand function Q(P) can be written as an inverse demand function P(Q), given by P = 250 – 0.5Q

Total Revenue (TR): $TR = Q \times P(Q)$

$$TR = 250Q - 0.5Q^2$$

Marginal Revenue (MR): $\frac{dTR(Q)}{dQ} \Longrightarrow$MR = 250 – *Q*

Marginal Cost (MC): $\frac{dTC(Q)}{dQ} \Longrightarrow$MC = 25

The first-order condition for equilibrium is MR = MC.

$$250 - Q = 25$$

Equilibrium quantity : *Q* = 225

On inserting *Q* = 225 in the demand function, we get the equilibrium price:

$$P = 137.5$$

As per second-order condition, at equilibrium,

$$\frac{d(MR)}{dQ} < \frac{d(MC)}{dQ}$$

Here, $\frac{d(MR)}{dQ}$ = –1 and $\frac{d(MC)}{dQ}$ = 0. Since –1 < 0, the second-order condition is fulfilled.

3.3 COMPARISON BETWEEN PERFECT COMPETITION AND MONOPOLY

On applying the first-order condition in Equation (2), we get

$$\frac{d\pi(Q)}{dQ} = 0$$

$$\Longrightarrow P(Q) + Q\frac{dP(Q)}{dQ} - \frac{\mathrm{dC}(Q)}{\partial Q} = 0$$

$$\Longrightarrow P(Q) + Q\frac{dP(Q)}{dQ} = \frac{dC(Q)}{dQ} \quad (5)$$

Here, $P(Q) + Q\frac{dP(Q)}{dQ}$ represent the marginal revenue (MR), and $\frac{dC(Q)}{dQ}$ the marginal cost (MC). Recall, in perfect competition, a firm maximises profits at the output level where marginal revenue equals marginal cost, and there marginal revenue equals the market-determined price. In case of monopoly also, the first-order profit maximising condition MR = MC remains the same, but here MR ≠ price (i.e. here MR < P(Q)). In case of Monopoly, along with price [*P*(*Q*)], MR has an additional term $Q\frac{dP(Q)}{dQ}$. This additional term represents the effect of change in quantity of output on price. A downward sloping demand curve facing a monopolist implies selling a unit more of output would require him to lower the price. This way price is lowered not only for the marginal unit but also on all other units sold, which is captured by this additional term $Q\frac{dP(Q)}{dQ}$. Thus, the two parts of the marginal revenue term are— the additional revenue due to selling one more unit, *i.e.*, P(Q), and the decrease in revenue due to the fact that the firm receives a lower price on all units it sells, *i.e.*,

$$Q\frac{dP(Q)}{dQ}.$$

An inverse relation between price and quantity would mean that the term $\frac{dP(Q)}{dQ}$ would bear a negative sign, and given that the quantity sold will be a positive number, the additional term $Q\frac{dP(Q)}{dQ}$ will be negative. Thus at the equilibrium the MR [$= P(Q) + Q\frac{dP(Q)}{dQ}$] < $P(Q)$; where the slope of the demand curve $\frac{dP(Q)}{dQ}$ is negative.

Thus, like a competitive firm, the monopolist produces the quantity at which marginal revenue equals marginal cost. The difference is that for the monopolist marginal revenue no longer equals price. The price that the monopolist charges is the price at which buyers are willing to buy the profit-maximising quantity (P_M in Fig. 3.2).

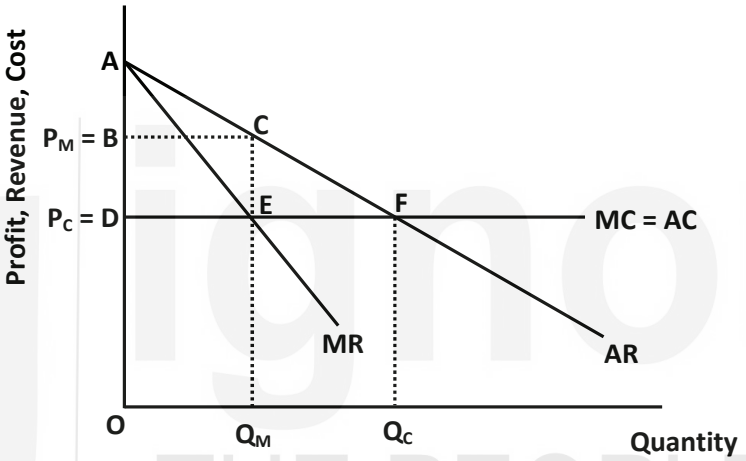

Fig. 3.2: Equilibrium under Monopoly and Perfect Competition

The profit-maximising output of a firm in perfect competition is at a point where MR = MC and here MR is given by the demand curve (AR curve) itself, that is, MR and AR are equal in the competitive market. In the above diagram, the competitive firm's output and price are Q_c and P_c respectively. The competitive output (Q_C) is greater than the monopolist's output (Q_M) and the competitive price (P_C) is lower than the monopolist's price (P_M).

Supply Curve of a Monopolist

Another difference between a perfectly competitive firm and a monopolist is that the latter does not have a unique supply curve. A supply curve indicates quantities of the commodity supplied by the firm corresponding to different prices. This concept makes sense when we are analysing competitive firms, which are price takers. But a monopoly firm is a price maker, hence it is not meaningful to ask what such a firm would produce at any given price. Indeed, the monopolist's decision about how much to supply depends upon the shape of the demand curve it faces, which in turn determines the shape of the marginal revenue curve. In a competitive market, the firm's supply curve is the portion of the MC curve above the minimum of the average variable cost curve. In this case, as the market demand curve shifts, we get another set of equilibrium price and quantity. On the other hand, in monopoly, as the market demand changes, so does the MR curve and we sometimes end up with a multiple equilibria situation.

3.4 DEADWEIGHT LOSS IN MONOPOLY

In Fig. 3.3, (Q_M, P_M) and (Q_C, P_C) are monopolist and competitive firm's quantity and price combination, respectively. The figure represents welfare loss in terms of changes in consumer and producer surplus when moving from competitive price (P_C) and quantity (Q_C), to a monopolist's price (P_M) and quantity (Q_M). In case of perfect competition, consumer and producer surplus is given by area ADF and HDF, respectively. While with monopoly, consumer surplus reduces to area ABC and producer surplus equals area HBCG. In movement from perfect competition to monopoly, consumer surplus falls by area BCFD, a part (area BCED) of which is producer's gain. Area CFG (shaded area) represents the deadweight loss or cost of monopoly to the society.

Economic surplus comprising consumer and producer surplus is at optimal level when output is generated to the point where P = MC. This involves generation of quantity Q_C, as results under perfect competition. But, a monopolist cut back on production to level Q_M and thus prevents mutually benefit trade by not selling to consumers who value the good more than the marginal cost of producing an additional unit, but less than the monopolist's price. This results in what is known as the deadweight loss measuring inefficiency of monopoly relative to the competitive outcome. As a result of the deadweight loss, the combined surplus (producer and consumer) under monopoly is less than that generated under a competitive market. This implies that monopoly is inefficient when compared to a competitive market.

Determining Deadweight Loss

Deadweight Loss (given that demand and MC functions are linear) = area Δ CFG

$$= \frac{1}{2} \times (Q_C - Q_M) \times [P_M - MC(Q_M)]$$

[where $MC(Q_M)$ represents length GI which we get on inserting value Q_M in the marginal cost function MC(Q)]

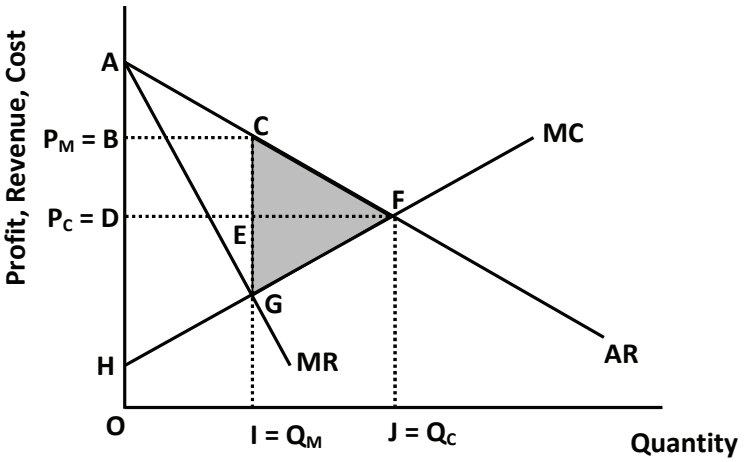

Fig. 3.3: Dead-weight loss under Monopoly

Example 2

Consider a monopolist facing an inverse demand function $P(Q) = 10 - Q$, and total cost function $2Q + Q^2$. Calculate the deadweight loss associated with this market condition.

Solution

The inverse demand function $P(Q)$ is given by $P(Q) = 10 - Q$

Total Revenue (TR): $TR = Q \times P(Q)$

$TR = 10Q - Q^2$

Marginal Revenue (MR): $\frac{dTR(Q)}{dQ} \Longrightarrow \text{MR} = 10 - 2Q$

Marginal Cost (MC): $\frac{dTC(Q)}{dQ} \Longrightarrow \text{MC} = 2 + 2Q$

The first-order condition for equilibrium is MR = MC.

$10 - 2Q = 2 + 2Q$

$Q_M = 2$

On inserting the equilibrium quantity $Q_M = 2$ in the demand function, we get the equilibrium price $P_M = 8$. One may also verify the second-order condition $\frac{d(MR)}{dQ} < \frac{d(MC)}{dQ}$.

To calculate the deadweight loss, we need quantity (Q_C) and price (P_C) under a perfect competitive market structure. The profit maximising condition under perfect competition is given by

$P(Q) = MC(Q)$

$10 - Q = 2 + 2Q$

Equilibrium quantity: $Q_C = \frac{8}{3}$

From the demand curve, we get the Equilibrium *price* $P_C = \frac{22}{3}$.

Deadweight loss $= \frac{1}{2} \times (Q_C - Q_M) \times [P_M - MC\ (Q_M)]$

$= \frac{1}{2} \times (\frac{8}{3} - 2) \times [8 - 6]$ $[\because MC(Q_M) = 2 + 2(2)]$

$= \frac{2}{3}$

3.5 THE RELATIONSHIP BETWEEN MC, PRICE AND ELASTICITY OF DEMAND

Price elasticity of demand (ε_d) plays an important role in determining by how much a monopolist can raise his price over marginal cost. This is given by the relationship between the marginal cost (MC), monopoly price P(Q) and elasticity of demand (ε_d) we present below.

Consider the equation of Marginal revenue we came across in Section 3.3.

$$\text{MR} = P(Q) + Q\frac{dP(Q)}{dQ}$$

Now, we rewrite the above equation by taking out P(Q) from the right-hand side

$$\text{MR} = P(Q)\left[1 + \frac{Q}{P(Q)}\frac{dP(Q)}{dQ}\right] \quad (6)$$

As we know, elasticity of demand (ε_d) is defined as the ratio between proportionate change in quantity demanded and proportionate change in price, that is,

$$\varepsilon_d = \frac{\frac{dQ}{Q}}{\frac{dP(Q)}{P(Q)}}$$

$$= \frac{dQ}{dP(Q)} \times \frac{P(Q)}{Q} \Rightarrow \frac{1}{\varepsilon_d} = \frac{Q}{P(Q)} \times \frac{dP(Q)}{dQ} \quad (7)$$

From Equation (6) and (7), we get

$$\text{MR} = P(Q)\left[1 + \frac{1}{\varepsilon_d}\right]$$

Since elasticity is a negative digit, we can also write

or $$\text{MR} = P(Q)\left[1 - \frac{1}{|\varepsilon_d|}\right] \quad (8)$$

From Equation (8), it becomes clear why a monopolist operates in the elastic portion of the demand curve (i.e. where$|\varepsilon_d| \geq 1$) and not on the inelastic portion (i.e. where $|\varepsilon_d| < 1$). When $|\varepsilon_d| < 1$, the term $\left[1 - \frac{1}{|\varepsilon_d|}\right]$becomes negative, and with P(Q) being a positive number MR turns out to be negative, and hence no firm will operate while losing money.

In equilibrium MR = MC$\Longrightarrow$ $P(Q)\left[1 - \frac{1}{|\varepsilon_d|}\right]$ = MC

Thus, we get $$P(Q) = \frac{MC}{\left[1 - \frac{1}{|\varepsilon_d|}\right]} \quad (9)$$

From the Equation (9) also, it is clear that monopolist would never choose to operate where the elasticity of demand ($|\varepsilon_d|$) is less than 1, i.e. where the demand is inelastic, since with $|\varepsilon_d| < 1$, the term $1 - \frac{1}{|\varepsilon_d|}$ will become less than 0, which in turn would mean the monopoly price $P(Q)$ reduces to a price of less than 0, which is not possible. Hence, the monopolist would always operate in the elastic portion of the demand curve.

Moreover, considering Equation 9 again

$$P(Q) = \frac{MC}{\left[1 - \frac{1}{|\varepsilon_d|}\right]}$$

$$P(Q)\left[1-\frac{1}{|\varepsilon_d|}\right]=MC$$

$$P(Q)-MC=\frac{P(Q)}{|\varepsilon_d|}$$

$$\frac{P(Q)-MC}{P(Q)}=\frac{1}{|\varepsilon_d|} \quad (10)$$

The left-hand side of Equation 10 is the "mark-up" of price P(Q) over marginal cost (MC), measured as a fraction of price. This quantity is known as the Lerner's index of market power, and is equal to the reciprocal of the price elasticity of demand (ε_d). It measures the monopoly power, as it gives how much a monopolist can exert the monopoly power in order to increase the price above marginal cost. The value of Lerner's Index ranges between 0 (for the competitive firm where $\varepsilon_d = \infty$) and 1 (for a monopolist facing a unit elastic demand with $\varepsilon_d = 1$). For instance, under perfect competition, firm is a price-taker, that is, the demand faced by a firm is perfectly elastic; $\varepsilon_d = \infty$. The RHS of Equation (10) becomes $\frac{1}{\varepsilon_d} = 0$

Equation 10 is now given by $\frac{P(Q)-MC}{P(Q)} = 0 \Longrightarrow P(Q) = MC$, which is the equilibrium condition under perfect competition. As elasticity of demand increases, the mark-up declines. For example, if $\varepsilon_d = -2$ then P = 2 MC and if $\varepsilon_d = -4$ then P = 1.33 MC. The practice of price discrimination is based on the basic premise of Equation 10, that is, when faced with two markets with varying price elasticities, monopolist would charge a higher price in the less elastic and lower price in the more elastic market.

Check Your Progress 1

1) A monopolist with constant marginal cost, *MC* = Rs 50, faces demand given by

$$Q = 100P^{-2}$$

What will be the monopolist's optimal price?

[**Hint:** In case of demand curve given by $Q = AP^b$ where *Q* denotes quantity, *P* price, *A* any constant, then *b* represents the price elasticity of demand]

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2) A monopolist can produce any quantity at a constant average and marginal costs, AC = MC = 10. The market-demand curve faced by the firm is $Q = 40 - P$.

   a) Illustrate the problem with the help of a diagram.

   b) Calculate the profit-maximising output and price of the monopolist.

   c) Calculate the deadweight loss incurred by the society because of the monopoly.

   d) Suppose the cost function changes to

   $TC = Q^2 - 20Q + 100$

   What will be the equilibrium quantity and price for the monopolist?

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3) Differentiate between Perfect Competitive market structure with that of Monopoly.

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3.6 PRICE DISCRIMINATION

Price discrimination results when firm engages in non-uniform pricing by charging customers different prices for the same products, which may sometime depend upon the "separation" of the markets, on the "time" of purchase, or on the "quantity" purchased. A monopolist can increase his/her profit by engaging in non-uniform pricing. We call such a monopolist a discriminating monopolist if he/she can sell otherwise identical products at different prices. One can find innumerable examples of price discrimination in everyday life. Banks pay different interest rates on deposits to senior citizens and other depositors, restaurants charge different rates for meals at different times, wholesale price differs substantially from the retail price. All these are the examples of price discrimination.

Firm's ability to successfully price discriminate depends on three conditions, viz. (i) the firm must have some market power, (ii) the firm must have the ability to sort customers, and (iii) the firm must be able to prevent resale. Market power of the monopolist enables him to benefit from price

discrimination. Selling good at a price in excess of its marginal cost, and lowering the price to the marginal consumer only instead to all, in turn requires monopolist's ability to sort consumers. Also, if the monopolist is to sell at different prices to different consumers, he must have a way to prevent consumers who purchase at a discounted price from reselling to other consumers.

There exist three broad categories of price discrimination, viz. price discrimination of first degree, second degree and the third degree. Detailed exposition to these discriminating practices is presented in the following sub-sections.

3.6.1 Perfect Price Discrimination or First Degree Price Discrimination

Suppose a monopolist knows the preference of each and every consumer, that is, she/he knows the maximum price a consumer is willing to pay for each unit of the commodity rather than to go without it. Such a price is also known as the reservation price given by the demand curve corresponding to each unit of output. In that case, can you guess what would the monopolist do? Instead of charging a uniform price, the monopolist would charge a price exactly equal to consumer's willingness to pay for each unit such that the consumer's surplus reduces to zero (where consumer surplus equals willingness to pay minus actual price paid for each unit). $P(Q)$ (equation of the inverse demand curve) gives the Q^{th} consumer's willingness to pay for the good. If a monopolist is able to charge each consumer $P(Q)$ for the good, then monopolist's marginal revenue will be equal to $P(Q)$, and so for profit maximisation the monopolist sets quantity Q so that $P(Q) = MC$.

The first degree price discrimination is illustrated in Fig. 3.4, where the shaded area represents the producer's surplus. One interesting observation is that though the consumer surplus reduces to zero, there is no dead-weight loss in this case. Whatever would have been the consumer surplus in a uniform-price situation is appropriated by the producer as increased producer surplus.

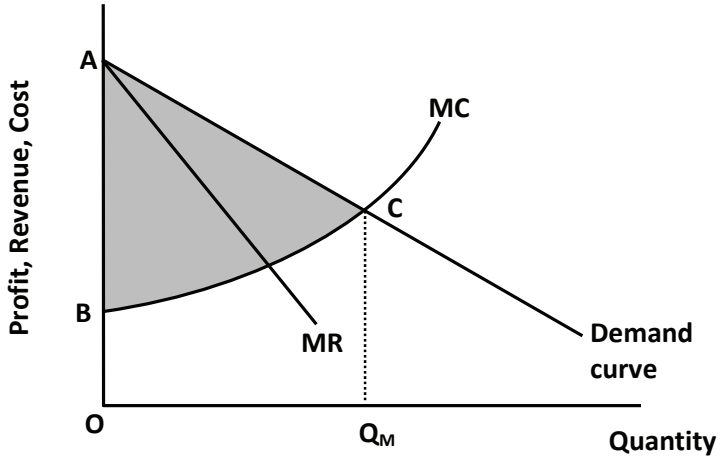

Fig. 3.4: First Degree Price Discrimination

3.6.2 Third Degree Price Discrimination

First degree price discrimination is the theoretical benchmark as it assumes that monopolist has full information concerning each consumer's preferences. But knowledge about the reservation price of every consumer is not practically possible; instead firm is better able to segment the market between different groups of buyers possessing some observable characteristic(s). This way, it becomes possible for the firm to charge a uniform price to all consumers in a particular group and charge different uniform prices to different groups. The pricing rule followed here is to charge high price from the consumers with low elasticity of demand and lower price from the consumers with high elasticity of demand.

For instance, consider Fig. 3.5, where we have two submarkets, A and B, with elasticity of submarket A to be less than that of submarket B. D_A and D_B represent market demand curves of market A and B respectively with corresponding marginal revenue curves represented by MR_A and MR_B. The marginal cost of production (MC) is uniform in both the markets. The aggregate demand curve, D_T, is derived by horizontally summing up the demand for the product in both the markets. For example, if at price = Rs. 5 per unit, market A demands Q_A =10 units and market B, Q_B =7 units of good X, then the aggregate demand will be Q_T =17 units of good X at price = Rs. 5 per unit. MR_T is the marginal revenue curve corresponding to aggregate demand curve. The industry which is also the monopolist in this case determines the total equilibrium output (Q_T) at the point of intersection of MC with MR_T. This total output is divided among the two sub-markets (Q_A and Q_B) as per the intersection of their respective marginal revenue curves with the MC at the industry equilibrium. The sub-markets corresponding to that equilibrium output determine the respective prices (P_A and P_B) in their markets. As regards profits, the dark and the light shaded regions represents profits earned by the monopolist without and with price discrimination, respectively. As one may easily make out, profit amount after discrimination rises.

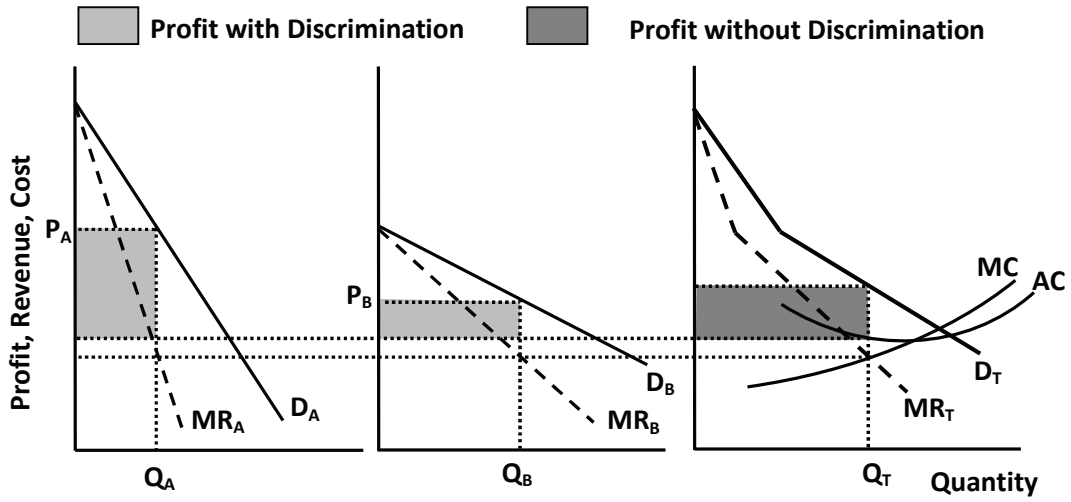

Fig. 3.5: Third Degree Price Discrimination

Relationship between Price and Price Elasticity of Demand of two sub-markets

Consider equation 9 from Section 3.5:

$$P(Q) = \frac{MC}{\left[1-\frac{1}{|\varepsilon_d|}\right]}$$

Let $P_A(Q)$ and $P_B(Q)$ be the equilibrium prices and $\mathcal{E}^A{}_d$ and $\mathcal{E}^B{}_d$ be the corresponding elasticities in the two sub-markets A and B respectively. Inserting these values in the above equation for the respective sub-market, we get

$$P_A(Q) = \frac{MC}{\left[1-\frac{1}{|\varepsilon^A{}_d|}\right]} \text{ and } P_B(Q) = \frac{MC}{\left[1-\frac{1}{|\varepsilon^B{}_d|}\right]}$$

$$\Rightarrow MC = P_A(Q)\left[1-\frac{1}{|\varepsilon^A{}_d|}\right] \text{ and } MC = P_B(Q)\left[1-\frac{1}{|\varepsilon^B{}_d|}\right]$$

Since the marginal cost is the same in both the markets, we get

$$\Rightarrow P_A(Q)\left[1-\frac{1}{|\varepsilon^A{}_d|}\right] = P_B(Q)\left[1-\frac{1}{|\varepsilon^B{}_d|}\right]$$

$$\Rightarrow \frac{P_A(Q)}{P_B(Q)} = \frac{\left[1-\frac{1}{|\varepsilon^B{}_d|}\right]}{\left[1-\frac{1}{|\varepsilon^A{}_d|}\right]}$$

If we assign some numbers to elasticities then we can easily verify that the price in a less elastic market would be greater than the price in a more elastic market. Suppose the price elasticities of demand in market A and market B are respectively −2 and − 4. The value of the right-hand side is $\frac{3}{2}$), which is greater than 1. In other words, $P_A(Q) > P_B(Q)$. Thus if, $\mathcal{E}^A{}_d < \mathcal{E}^B{}_d \Rightarrow \left[1-\frac{1}{|\varepsilon^A{}_d|}\right] < \left[1-\frac{1}{|\varepsilon^B{}_d|}\right] \Rightarrow P_A(Q) > P_B(Q)$. The above diagram also supports this statement. The monopolist will enter this third-degree price discrimination if profit with discrimination is greater than without it. Profit after discrimination is sum total of profit in submarket A and profit in sub-market in B.

3.6.3 Second-Degree Price Discrimination

In third-degree price discrimination it is assumed that the monopolist can identify the groups of individuals to charge each group as per its price elasticity of demand. Sometimes a monopolist cannot even classify consumers into groups, i.e., it knows there are different groups of consumers, but does not know who belongs in which group. In such a case the product may be designed and priced to cater different sub-groups of consumer. In other words, monopolist offers a menu of bundles to choose from, to allow consumers to self classify or self select themselves into the different price segments.

For instance, when firm offers quantity discounts, prices per unit differ depending on the number of units of the good bought, but not across consumers. That is, here consumers face the same price schedule with prices depending on the quantity, but they classify themselves by their choices for different menus. Another example is of airline pricing where the airline firm cannot distinguish between business travellers and tourists, but knows that the former value higher quality seats more. Hence the airline firm set higher prices for business-class than the economy-class seats so that consumers can "self-select". Thus, it can be said that the second-degree price discrimination is possible if and only if the firm can vary the quantity or quality across customers.

3.6.4 Two-part Tariffs

Price discrimination also occurs when consumers pay a fixed one-time fee to get the access to the commodity and a per-unit price for each unit of commodity they consume. Such a pricing scheme is called two-part tariff, first discussed by Walter Oi. He had discussed the case of amusement parks where we pay for the entry ticket and then pay for every ride. Such a kind of price discrimination is prevalent in our everyday lives. We pay a membership fee to a club and then over that we pay for every service that we avail from it. Another example of this is Dilli Haat where we first pay for the entry ticket and then pay for every additional service such as refreshments or handicrafts.

The two-part tariff function looks like

$$T(Q) = S + PQ \qquad (11)$$

Where $T(Q)$ represents total amount paid on consumption of Q units of commodity, S is the fixed one-time access fee, P denotes per unit price of the commodity and Q is the quantity of the commodity consumed. The monopolist's objective is to choose that value of S and P which maximises the profit (π) given by

$$\pi = \text{Total Revenue (TR)} - \text{Total Cost (TC)}$$
$$= T(Q) - MC \times Q$$
$$= S + PQ - MC \times Q$$

3.6.4.1 The Optimal Tariff

Oi's suggestion was to first set the per unit price (P) equal to the marginal cost (MC) and then choose S which is the consumer surplus of the least interested buyer. For this, consumers are arranged on the basis of their willingness to pay and S becomes the consumer surplus of the least keen buyer. The alternative method is to choose the profit maximising price and then at that price calculate consumer's surplus of the least eager consumer which becomes the S. The following example will clarify both the methodologies.

Suppose there are two sets of consumers, set A and set B. The monopolist faces a constant marginal cost equal to Rs. 2. The demand functions for both sets of the consumers are as follows:

$$Q_A = 20 - P_A \quad \text{and} \quad Q_B = 20 - 2P_B$$

For the sake of convenience let us consider linear demand functions. Here Q_i and P_i denote demand and price of the i^{th} set, where $i = A$ and B. Total output (Q) equals $Q_A + Q_B$

Oi's Solution

$$\text{Set } P_A = P_B = \text{MC} \Rightarrow P_A = P_B = 2 \text{ (given MC = 2)}$$

Inserting value of $P_A = P_B = 2$ in respective demand equations, we get $Q_A = 18$ and $Q_B = 16$. This implies that consumers from set B have the lower willingness to pay for the commodity.

Now refer Fig. 3.6 where the shaded area represents the consumer surplus of this least interested consumer set. D_A and D_B are the demand curves for the consumer set A and B respectively, and MC = 2 represent the marginal cost curve.

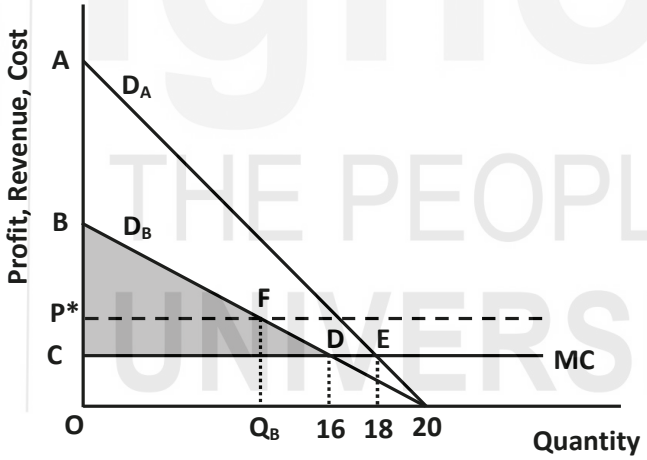

Fig. 3.6: Two-part Tariffs

Consumer surplus for set B (the shaded area) will be given by $= \frac{1}{2} \times CD \times BC$

$$= \frac{1}{2} \times 16 \times (10 - 2) = 64$$

Thus, the fixed one-time fee (S) = Rs 64. The tariff function is

$$T(Q_i) = S + PQ_i$$

The total profit (π) in this case will be π = Total Revenue (TR) – Total Cost (TC)

$$= T(Q_A) + T(Q_B) - MC\,(Q_A + Q_B)$$

$$= (S + PQ_A) + (S + PQ_B) - 2Q$$

$$= 2 \times S + P(Q_A + Q_B) - 2Q$$

$= 2 \times 64 + 2Q - 2Q$ ($\because$ P = 2 and $Q_A + Q_B = Q$)

$= 128$

The Alternate Solution

In this case the monopolist chooses the profit-maximising unit price (P*) and at that price calculates the consumers' surplus of the least eager consumer. The quantity for each set is the quantity corresponding to the profit-maximising price. The total profit in this case is given by:

π = Total Revenue (TR) – Total Cost (TC)

$= T(Q_A) + T(Q_B) - MC\ (Q_A + Q_B)$

$= (S + P^*Q_A) + (S + P^*Q_B) - MC \times Q$

$= 2 \times S + P^* \times Q - MC \times Q$

$\pi = 2S + (P^* - MC)Q$ (12)

Now, we know $Q = Q_A + Q_B$

$= 20 - P_A + 20 - 2P_B$

$= 20 - P^* + 20 - 2P^*$

[where $P_A = P_B = P^*$ (the profit maximising unit price)]

$= 40 - 3\ P^*$

S equals the consumer surplus of the least interested buyer set (here set B), given by the area of the shaded triangle BP*F in Fig. 3.6.

Thus, $S = \frac{1}{2} \times P^*F \times BP^*$

$= \frac{1}{2} \times Q_B \times (10 - P^*)$

Substituting the values of S and Q in Equation (12) we get

$\pi = 2 \times \frac{1}{2} \times Q_B \times (10 - P^*) + (P^* - 2)(40 - 3\ P^*)$ ($\because$ MC = 2)

Substituting for $Q_B = 20 - 2P_B$ with P_B as P^* and rewriting the equation, we get $\pi = 120 + 6P - (P^*)^2$

The first-order condition for profit maximisation requires $\frac{\partial \pi}{\partial P} = 0$

$6 - 2P^* = 0$

Or $P^* = 3$

As one may notice here, the profit maximising unit price of the commodity is greater than the marginal cost, i.e. $P^* >$ MC. From the given demand equations and the value of $P_A = P_B = 3$, the corresponding values of Q_A and Q_B are 17 and 14, respectively.

Using the value of P =3 to ascertain the fixed one-time fee (S)

$$S = \frac{1}{2} \times Q_B \times (10 - P^*)$$

$$S = \frac{1}{2} \times (20 - 2P_B) \times (10 - P^*)$$

$$S = \frac{1}{2} \times [20 - 2(3)] \times (10 - 3) = \text{Rs } 49$$

The tariff function becomes, $T(Q_i) = 49 + 3Q_i$

Both the methods try to extract the entire consumer's surplus of the least interested buyer. They differ in terms of their fixed one-time fee (S) and per-unit price (P). In Oi's solution the monopolist first keeps the per-unit price equal to the marginal cost of production. The fixed one-time fee is the least interested consumer's consumer surplus. On the other hand in the alternate case the profit maximising price is the per-unit price that maximises total profits and the corresponding consumer surplus of the least interested consumer is the access fee.

Check Your Progress 2

1) Suppose a monopolist sells his product in two geographically well separated sub-markets with different elasticities of demand. Show that the monopolist can charge different prices and sell different quantities in both the markets. He/she can charge a higher price in a less elastic demand market and a lower price in a more elastic demand market.

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2) An amusement park owner opts for two-part tariff. He/she charges for an entry ticket and then for every ride. Suppose AC = MC = 6. The market-demand curves for the two separable markets are: $Q_1 = 60 - P_1$ and $Q_2 = 60 - 2P_2$

   i) The firm can follow a two-part tariff. What will be the fixed one-time fee provided by

      a) Oi's solution and

      b) Alternate method using the Profit maximising unit price.

   ii) Calculate the monopolist's profit in both the situations.

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3) Suppose a monopolist practices third-degree price discrimination. Two markets are separable and the transportation cost from one market to the other is very high. If ratio between elasticity in market one and

elasticity in market two is less than one, what will be the relationship between the prices in the two markets?

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3.7 NATURAL MONOPOLY

Natural Monopoly is a market structure created and sustained by economies of scale over the relevant range of output of the industry. Presence of significant economies of scale ensures that minimum efficient scale is not reached until output is produced at a large extent in relation to the total size of the market. That is, it is the substantial amount of economies of scale that makes production of a good or service to be more efficient if it is carried by a single firm rather than divided among several firms. The economies of scale could result when production requires incurring very high fixed costs so that expansion by a single firm can serve the market demand at a lower cost than two or more firms can. This effectively blocks the entry of the new firms and the firm enjoys natural monopoly. Natural monopolies are common in markets for 'essential services' that require an expensive infrastructure and distribution network to deliver the good or service, such as in the cases of water supply, electricity, railways, and other industries known as public utilities.

Refer Fig. 3.7 where the situation of a natural monopoly is represented by the falling average total cost (ATC) resulting from presence of significant economies of scale. Falling ATC ensures that marginal cost (MC) remains below ATC over the range of output with economies of scale.

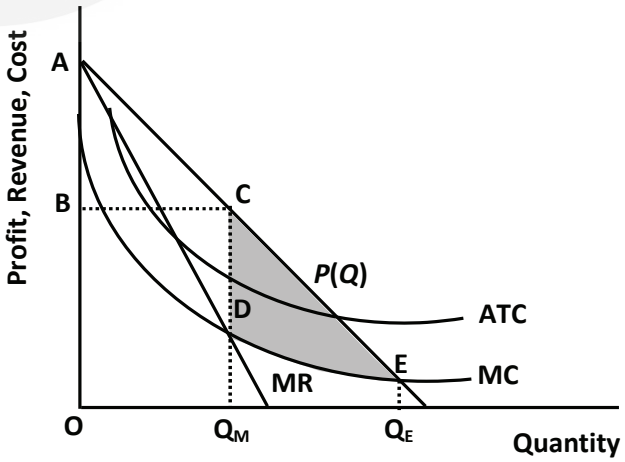

Fig. 3.7: Natural Monopoly

The condition of natural monopoly is:

$$C(Q) < C(q_1) + C(q_2) + \ldots + C(q_n)$$; where, $Q = q_1 + q_2 + \ldots + q_n$

Q is the total output produced, while q_1, q_2, ..., q_n represents output produced by firm 1, firm 2,…firm *n*, respectively. Suppose that the total cost function is given by $C = 50 + 10Q$. If output per day is 25, one firm can produce this amount at an average cost of Rs. 12 and at the total cost of Rs. 300. On the other hand, if there are two firms with one producing 12 units while the other producing 13 units, the total cost of production will become 170 + 180 = Rs 350, which is greater than the cost of production of a single firm. In this case, goal of minimisation of per unit cost dictates that only one firm should be serving the market.

3.7.1 Pricing under Natural Monopoly

3.7.1.1 Unregulated Natural Monopoly

An unregulated natural monopoly would attempt to maximise profits by producing the quantity of output where marginal revenue (MR) equals marginal cost (MC). This is represented by quantity Q_M in Fig. 3.7. Is this efficient from society's point of view? As one can easily make out, producing the profit-maximising quantity of output like Q_M causes a huge welfare loss (the shaded area CDE in Fig. 3.7) with respect to the efficient quantity Q_E obtained when MC crosses the demand curve *P*(*Q*). The welfare loss is given by the difference between the value lost for unfulfilled demand between Q_E and Q_M as given by the area below the inverse demand *P*(*Q*) between Q_E and Q_M, and the cost saved by the monopolist for not producing up to Q_E, given by the area below the MC curve between Q_E and Q_M. Thus there arises a need for Government regulation to deal with the welfare loss resulting from profit maximising output decision by an unregulated Natural monopoly.

3.7.1.2 Marginal Cost Pricing

One way to address the welfare loss is to make the natural monopolist adopt MC pricing which involves setting price equal to the marginal cost (P = MC), that is, producing the quantity where price equals marginal cost (given by Q_E in Fig. 3.8). Though this will eliminate the deadweight loss, but since the price set is below the average cost of production, the firm would incur losses (given by shaded area BDCE in Fig. 3.8). Hence, the efficient level of output Q_E will not be affordable for the firm, and the monopolist would prefer to go out of business. In order to keep the firm operating the government may opt to pay a lump-sum subsidy to the firm to cover for the economic loss.

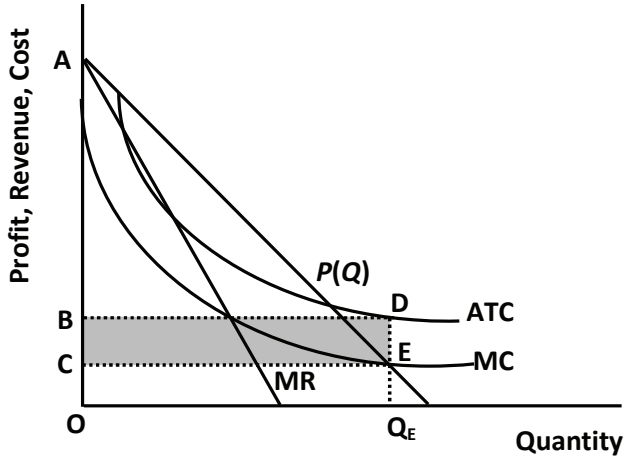

Fig. 3.8: Marginal Cost Pricing

3.7.1.3 Average Cost Pricing

To avoid the need for a subsidy, natural monopolies are often regulated to adopt AC pricing which involves firms to charge a price where demand curve and the average cost curve intersect, resulting in firm producing quantity Q_{AC} and earning zero economic profit (Refer Fig. 3.9). This way price remains lower than it would be if the government left the industry unregulated and the deadweight loss (shaded area CDE) is smaller and moreover, the government would not have to subsidise the company for the economic loss resulting from the MC pricing. However such a pricing rule often acts as a disincentive for the firm to keep cost low.

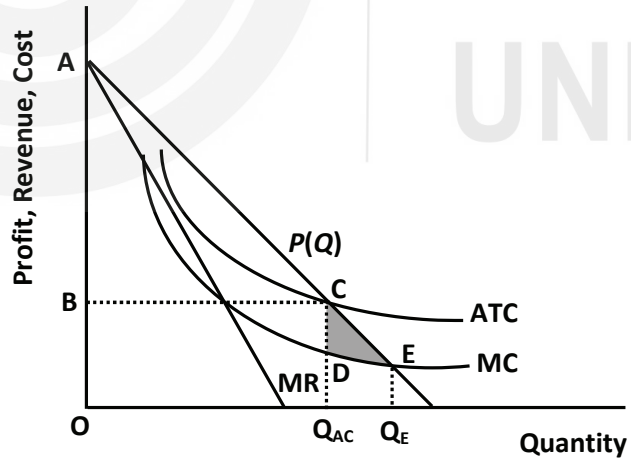

Fig. 3.9: Average Cost Pricing

3.8 LET US SUM UP

To summarise, in this unit we discussed monopolistic market structure— a market with a single supplier of a commodity, which does not have a close substitute. A monopolist can retain his/her control over the market because of any of the factors such as legal sanction, substantially high initial investment or ownership over some key inputs. By the virtue of a sole

supplier the monopolist can optimise either in terms of output or price. This should not be interpreted that monopolist can charge any price for his/her product. The elasticity of demand plays a crucial role in checking the monopoly power. In the monopolist market structure there is no one to one correspondence between price and quantity demanded and as a result this market structure does not have a supply curve.

A monopolist can charge different prices for the same product from different consumers at the same time or at different times. This phenomenon is known as price discrimination. Price discrimination also occurs in the two-part tariff form where consumers pay a fixed one-time fee to get the access to the commodity and a per-unit price for each unit of commodity they consume. Following Walter Oi, we have discussed the solution for optimal tariff along with an alternative way of determination of equilibrium profit. Towards the end, the case of Natural Monopoly is explained, which concludes with a discussion about the various pricing options available under such a market form, viz. that of unregulated natural monopoly, MC pricing and AC pricing.

3.9 SOME USEFUL REFERENCES

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- Pindyck R. S and Rubinfeld D. L, *Microeconomics*, Pearson India, 2009
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3.10 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) $P_M = 100$

Hint: Profit maximisation requires

MR = MC $\Rightarrow = \frac{MC}{\left[1-\frac{1}{|\varepsilon_d|}\right]}$. We have $\mathcal{E}_d = -2$ and MC = 50

2) a) Refer Section 3.2 and draw.

b) $Q_M = 15$ and $P_M = 25$

c) Deadweight loss = 112.5

d) $Q_M = 15$ and $P_M = 25$

3) Refer Sections 3.3 and answer.

Check Your Progress 2

1) Let the two markets be A and B. We know in equilibrium,

MC = $P_A\left[1 - \frac{1}{|\varepsilon_A|}\right]$ and MC = $P_B\left[1 - \frac{1}{|\varepsilon_B|}\right]$, where MC represents the marginal cost and ε_A and ε_B the price elasticities of demand in respective markets A and B.

Since MC is same in both the equations, for equilibrium, the following must satisfy

$P_A\left[1 - \frac{1}{|\varepsilon_A|}\right] = P_B\left[1 - \frac{1}{|\varepsilon_B|}\right]$

If $\varepsilon_A > \varepsilon_B$ then $\frac{1}{|\varepsilon_A|} < \frac{1}{|\varepsilon_B|}$

That is, $\left[1 - \frac{1}{|\varepsilon_A|}\right] > \left[1 - \frac{1}{|\varepsilon_B|}\right]$, for optimisation condition to hold $P_A < P_B$ suggesting that the price of the commodity would be lower in the more elastic market than the less elastic one.

2) i) a) Oi's solution: S (fixed one-time fee) = 1296

b) Alternate method using the Profit maximising unit price: S = 351

ii) Monopolist's profit with Oi's solution: 2592, and with alternate method using the Profit maximising unit price: 1557

3) Refer Sub-section 3.6.2 and answer.

UNIT 4 MONOPOLISTIC COMPETITION

Structure

4.0 OBJECTIVES

After going through the unit, you will be able to explain:

- characteristic features of monopolistic competition;
- short-run and long-run equilibrium condition for a firm in monopolistic competition;
- social cost associated with monopolistic competition as compared to perfect competition and monopoly; and
- non-price competition under monopolistic market structure.

4.1 INTRODUCTION

An economy is composed of various market structures with varying characteristics. We have already covered two such structures, viz. Perfect competition in Intermediate Microeconomics-I of Semester 3 (Units 7 and 8) and Monopoly (Unit 3) in Intermediate Microeconomics-II of the present semester. Both these market structures have defining features which differentiate these structures and place them at two extremes. For instance, in perfect competition we have many buyers and sellers, with each firm being a price taker; in contrast to this, in monopoly there is a single seller who acts as a price-maker. In perfect competition, demand curve faced by a single firm is infinitely elastic (horizontal), whereas in monopoly the market demand curve faced by the monopolist is downward sloping. We also came across the equilibrium outcomes in terms of equilibrium quantity and price for each of these market structures. In equilibrium, monopolist charges more than the price charged by a perfect competitive firm, consequently it

supplies lower quantity of output than that is supplied by a firm in perfect competition.

These two extreme market structures with such extreme assumptions hardly exist in reality. For instance, one may rarely find perfect substitutes or identical products. Instead products available in the market are most of the times similar but not identical. Such products are in fact deliberately differentiated by their supplier in their attempt to have some pricing power (though limited). In the late 1920's economists became increasingly dissatisfied with the use of extreme market structures (perfect competition and monopoly) as analytical models of economic behaviour. Sraffa, Chamberlin and Joan Robinson worked individually to get closer to the market structure that fit into the real world. In his revolutionary book Chamberlin introduced a new market structure with the flavours of both perfect competition and monopoly. He called this new market structure monopolistic competition. This particular market structure neither qualifies for monopoly nor for perfect competition, that is, it has features of both the extreme cases. The present unit is an attempt to discuss this form of market structure.

4.2 MONOPOLISTIC COMPETITION MARKET

Imperfect competition market structure is the one which falls between the perfect competitive and the monopolistic market structure. Under imperfect competition comes the Monopolistic competition and Oligopoly (which will be discussed in the next unit). The monopolistic competitive market was first discussed in 1933 by Prof. Chamberlin in his book titled *The Theory of Monopolistic Competition*. A monopolistic competitive market can be defined as a market where many sellers compete by selling differentiated products which are close substitutes but are not perfect substitutes. In other words, products sold by different sellers are similar but not identical having positive and high cross price elasticity. As the name itself suggests, this market has some features of monopoly and some features of perfect competition. Product differentiation gives monopolistic competition its monopolistic aspect. Each firm produces a product that is slightly different from that of others. This way firm retains some monopoly power to determine good's price rather than being a price-taker, that is, each firm faces a downward-sloping demand curve. Like a monopoly, a monopolistic competitive firm faces a downward sloping demand curve. Like a perfect competition market structure, under monopolistic competition, there are many firms competing for the same group of customers. There are no barriers to enter and exit the market. This limits the long-run economic profit to zero for all the firms. In order to create the market for their product, firms resort to both price and non-price competition. They spend aggressively on advertisements, brand creation and promotion of their product. The selling cost is quite substantial in this market. Since all the firms do not sell identical products, they are collectively called a product

group rather than an industry. There are many buyers and sellers in this market. Since the products are unique in some way, each producer has some control on the determination of price of its product. We know that the monopolistic control over price (also known as mark-up, the relative difference between price and marginal cost) depends on the price elasticity of demand. The higher the elasticity, lower the mark-up and vice versa. This condition is widely known as Lerner's index in economics. In the market under discussion the elasticity of demand is relatively higher than that under monopoly, hence the mark-up is small.

Check Your Progress 1

1) What are the main characteristics of a monopolistic competitive market structure?

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2) Do you think that firms in a monopolistic competition can independently determine price? Explain.

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3) A monopolistic competitive market has characteristics of both perfect competition and monopoly. Explain.

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4.3 EQUILIBRIUM UNDER MONOPOLISTIC COMPETITION

As we are aware, a firm under monopolistic competition produces a differentiated good with close substitutes. Accordingly, these firms have limited monopoly power over price determination. Monopolistic competitive market is not enough to ensure a profit as high as in monopoly.

The free entry and exit from the product group ensures that firms make only normal profit or in other words, zero economic profit in the long-run.

A significant difference between this form of market structure with that of monopoly is that any firm i's inverse demand curve depends not only on the output q_i but also on the total number of firms in the market (n). Let $p_i(q_i, n)$ be the inverse demand curve for firm i in a monopolistic competitive industry. Similar to monopoly market structure, as q_i rises, $p_i(q_i, n)$ falls and when q_i falls, $p_i(q_i, n)$ rises. Further we also assume as n, that is, the number of firms rises in this monopolistic competitive industry, firm loses its market share and hence the market power over price determination. That is, as n rises, $p_i(q_i, n)$ falls and as n falls, $p_i(q_i, n)$ rises. This means to sell a given level of output firm i must charge a lower price if the number of competing firms increases. Firm i's problem is to choose its output q_i to maximise its profit $\pi_i(q_i, n)$. However it cannot control the entry and exit of the number of firms (only drastic step it can take is to leave the market itself). So the ith firm's profit is given by:

$$\pi_i(q_i, n) = R_i(q_i, n) - C_i(q_i) = p_i(q_i, n)q_i - C_i(q_i)$$

where $R_i(q_i, n)$ represents the total revenue earned by firm i, given by $p_i(q_i, n)q_i$ and $C_i(q_i)$ is the cost function faced by this firm. First-order condition for profit maximisation is given by:

$$\frac{d\pi_i(q_i, n)}{dq_i} = 0 \implies MC_i(q_i, n) = MR_i(q_i, n)$$

$\Longrightarrow$Marginal cost of firm i is equal to the Marginal revenue of firm i.

So far this is exactly similar to the equilibrium condition of the monopoly. We need to solve for the equilibrium number of firms in this market. Since there is free entry into the monopolistic competition market structure, no firm can enjoy supernormal profit, for they will attract new entries driving down the price and output of the incumbent firms till supernormal profit falls to zero in the equilibrium. This results in the situation where every ith firm charges a price equal to its average costs. That is, $p_i(q_i, n) = AC_i(q_i)$. However this condition is subject to the long-run equilibrium. In the short-run firms enjoys supernormal profits. We will now illustrate the short run and long run equilibrium graphically.

4.3.1 Short-run Equilibrium

In the short-run, a firm can earn positive profits or it may incur losses. Positive profit in the short-run attracts competition from other firms. Each new entry results in the introduction of a new competing brand in the product group and such entries continue till positive profit is wiped out. Fig. 4.1 illustrates the short-run equilibrium of a monopolistic competitive firm where firm is earning positive economic profit. The demand curve (which is also the average revenue curve) of a monopolistic competitive firm is a downward sloping curve with the corresponding marginal revenue (MR)

curve also sloping downwards (Refer Fig. 4.1). MC and ATC are marginal cost and average total cost curves, respectively. The demand curve of a monopolistic competitive firm is relatively flatter, that is, the curve is more elastic than the demand curve under the monopolistic market structure. This results from the fact that the power of price determination in a monopolistic competitive market is limited because of the availability of close substitutes. At point *E* both conditions of profit maximisation are satisfied, that is, at *E,* MR is equal to MC and MC intersects MR from below. Accordingly, point *E* provides profit maximising output and price. The short-run equilibrium quantity and price are *Q**and *P**respectively. We can easily check that at this equilibrium price, ATC is less than the per-unit price and the difference between the price and ATC is the per-unit profit. Total profit is the product of the per unit profit and the total quantity. In this case, firm is making positive profit (shown by the shaded region) which equals area of rectangle ABCD.

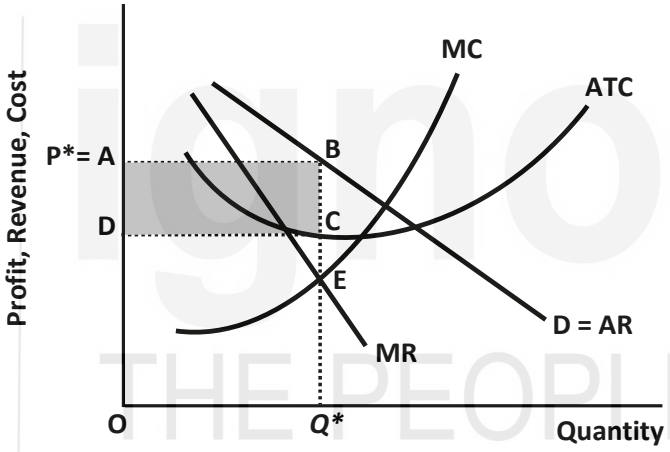

Fig. 4.1: Short-run Equilibrium under Monopolistic Competition

If a monopolistic competitor earns positive profit in the short-run, this attracts new entrants to compete away the positive profits by producing close substitutes. The entry of new firms causes two types of externalities. First, the entry of new firms in the product group will introduce more differentiated products in the market, because of which consumers will have a wider choice. At the same time, due to more suppliers supplying close substitutes of the commodity than before, the price of the commodity will fall. This is definitely a positive externality for the consumers. Consumers can now choose from a larger commodity bundle and at a lower price. Second, some of the incumbent (already existing) firms would find it difficult to operate in this market situation because of a reduced price and a smaller market share as new firms capture a portion of the existing market. This may force some of the existing firms to leave the market. This is a case of negative externality for the incumbent firms in the product group.

Fig. 4.2 illustrates the impact of new entrants on the demand and profit conditions of an incumbent firm. The demand curve (D_1) and the corresponding marginal revenue curve (MR_1) will shift to left to D_2 and MR_2

respectively, reflecting the decreased demand and market share of the incumbent firm. Increased competition will cause price to fall and with cost remaining the same (as shown by the ATC curve), the positive economic profit or the above normal profit will fall. Entry of new firms producing differentiated product will continue as long as above-normal profit exists for the existing firms. When the demand curve of an existing monopolistic competitor just touches the ATC curve with the profit reducing to the normal level (or zero economic profit level) is when the entry by new entrants ceases. Fig. 4.2, illustrates the long-run equilibrium position (*E*) where the firm in the monopolistic competition earns a normal profit.

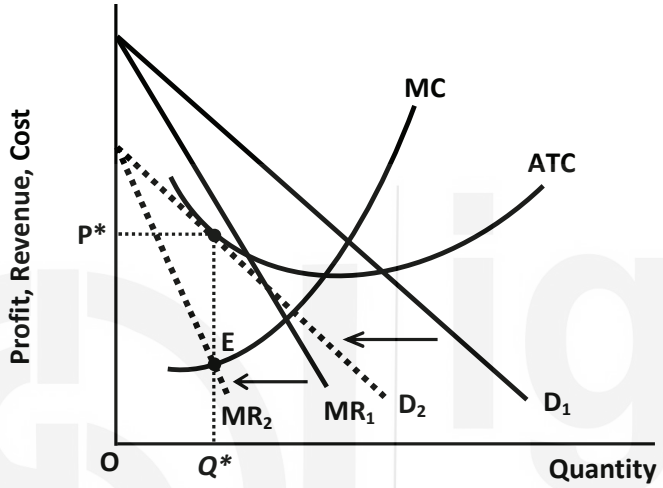

Fig. 4.2: Long-run Equilibrium under Monopolistic Competition

In the short-run an incumbent firm may also incur loss. This result when at the equilibrium point like E in Fig. 4.3 ATC is greater than the equilibrium price given by the demand curve. At point *E*, MR equals MC and the slope of MC is greater than that of MR. The per-unit loss is *AD* and the total loss is the area of the rectangle ABCD (given by the shaded region in Fig. 4.3).

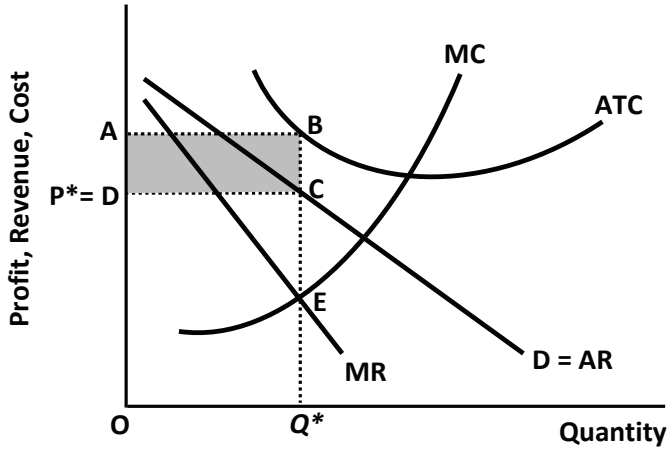

Fig. 4.3: Short-run Equilibrium under Monopolistic Competition

Short-run losses will encourage firms to exit the market. This exit will reduce the number of differentiated product choices offered to the consumers. This in turn will increase the demand and hence the market share of the remaining firms— as is captured by the rightward shift of the demand and the corresponding marginal revenue curve of a monopolistic competitor firm in Fig. 4.4. Lower product choices will increase market price. With cost remaining the same as is given by the ATC curve, a rightward shift in the demand curve will cause a fall in individual firm's losses to the level where they break-even or in other words earn a normal or zero economic profit. At this moment, the exit from the product group ceases with the remaining firms earning normal profit. Fig. 4.4, illustrates the long-run equilibrium position (*E*) where the firm in the monopolistic competition earns a normal profit.

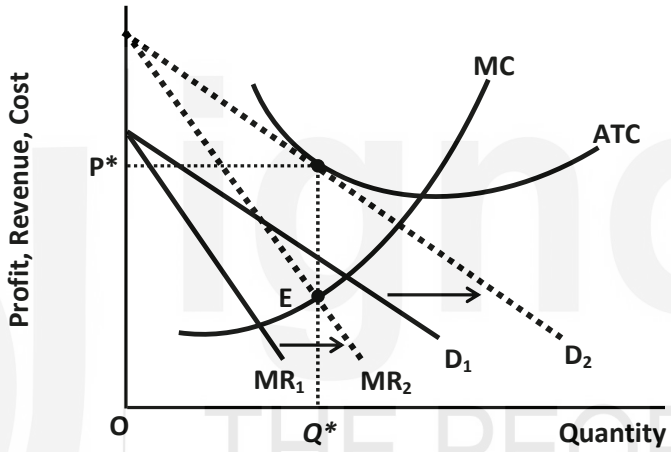

Fig. 4.4: Equilibrium under Monopolistic Competition

4.3.2 Long-run Equilibrium

Fig. 4.5 depicts the long-run equilibrium. At point *A*, ATC is tangent to the demand curve. In long-run equilibrium (as given by point *E*), price P* equals average total cost which means that the firm is earning only normal profit which are in turn enough to stay in the product group. Thus in the long-run there is no tendency to enter or exit the product group. One interesting fact about monopolistic competition is that though firms earn only normal profit, they manage to sell the additional unit at a price higher than the cost of production of the additional unit. This is evident from Fig. 4.5 which illustrates long-run equilibrium (as is given by point E) of a firm in monopolistic competition. Here, in equilibrium, cost of production of the marginal unit, that is, the marginal cost equals OB, whereas the price at which that additional unit is sold equals OP* with OP* > OB. In contrast, in perfect competition, at the point of equilibrium the cost of production of an additional unit is the same as the price of the commodity. We will talk about this phenomenon later when we will discuss the case of excess capacity.

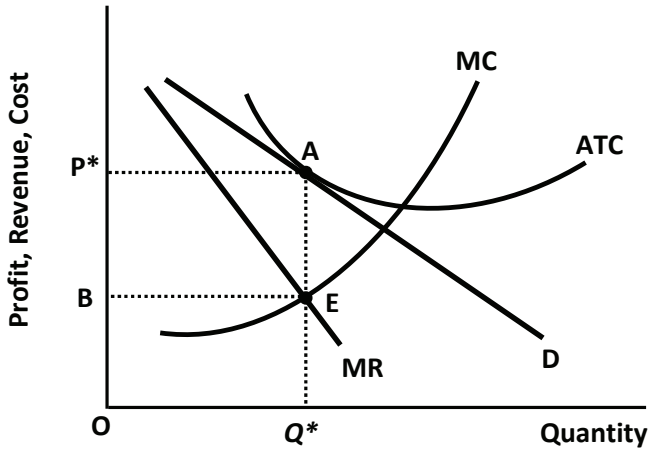

Fig. 4.5: Long-run Equilibrium under Monopolistic Competition

Check Your Progress 2

1) What happens to the demand curve of an incumbent firm when new firms enter with differentiated products as a close substitute under monopolistic competition?

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2) a) Explain how a monopolistically competitive firm maximises profit in the short run?

b) Suppose a monopolistic competitive firm is earning positive economic profits in the short run, analyse the long run equilibrium situation of this firm.

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3) a) How is long run equilibrium under monopolistic competition different from that of monopoly?

b) Why is a monopolistic competitor's demand curve flatter than the market demand curve in monopolistic competition?

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4) Consider the following statements and answer whether they are True or False.

a) A monopolistic competitive firm does not have complete control over the price of the commodity.

b) Even in the short run, a monopolist competitive firm cannot earn a positive profit.

c) A monopolist firm does not face the entry of other firms in the product group.

d) At the point of equilibrium the marginal cost is equal to the price in both perfect competition and monopolistic competition.

e) There is no difference between the demand curve of a monopolist and a monopolistic competitive firm.

f) The average revenue and marginal revenue curves are the same in a monopolistic competitive market as in the case of perfect competition.

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4.4 SOCIAL COSTS OF MONOPOLISTIC COMPETITION

Now let us analytically discuss the social cost associated with the monopolistic competition in terms of welfare loss.

4.4.1 Monopolistic Competition versus Perfect Competition

Let us start with comparing long-run equilibrium of a monopolistic competitive firm with that of a perfect competitive firm. Both the monopolistic competitor and perfect competitor make zero economic profit in the long run, yet their impact on the total welfare (that is, a sum of consumers' surplus and the producers' surplus) varies. The perfect competitive firm produces at the point where the price line or the horizontal demand (also the MR) curve intersects the MC curve. In the long-run, this intersection happens at the minimum efficient scale or in other words at the level of output (Q_{PC}) where average total cost is minimised (point E_{PC} in Fig. 4.6). This results in maximum overall social welfare (i.e., sum of consumer and producer surplus).

A monopolistic competitive firm also produces where MR = MC, but here the difference arises due to the downward sloping demand curve. In the long run equilibrium, in contrast to the perfect competition where price equals marginal cost, under monopolistic competition, price is marked up over marginal cost. This results due to the different slopes of the demand curve faced by the firms in each market forms, which in turn results in allocative inefficiency (where allocative efficiency reached when P = MC) under monopolistic competition. Moreover, in contrast to the perfect competitive firm, under monopolistic competition, in the long run, each firm produces at the falling portion of the average total cost curve and not at its minimum. This is what is referred to as the productive inefficiency, with firm

operating at higher costs and not at the minimum average cost, as attained under perfect competition.

In the long run equilibrium under monopolistic competition (point E_{MC}) the equilibrium output (Q_{MC}) is less than that produced by a perfect competitive firm (Q_{PC}) and the equilibrium price (P_{MC}) is more than that charged under perfect competition (P_{PC}) and hence the social welfare is not maximised. There is a resulting deadweight loss as is represented by the shaded area ACE_{MC} in Fig. 4.6. Moreover, area $P_{MC}ABP_{Pc}$ which was part of the consumer's surplus in perfect competition became part of the producer's surplus in monopolistic competition. Flatter (or more elastic) the demand curve, smaller is the area of deadweight loss. In other words, flatter the demand curve, closer is the market structure towards perfect competition. The consumers in a monopolistic competitive market, while foregoing a part of consumers' surplus, enjoy a wider choice set due to the differentiated products. The tradeoff between the consumers' surplus and availability of variety of choice is something Chamberlin himself defended by saying it as "*consumers' love for variety*". The net effect although depends on whether the positive effects of diversified choice are greater or smaller than the negative effect of loss of the consumer's surplus.

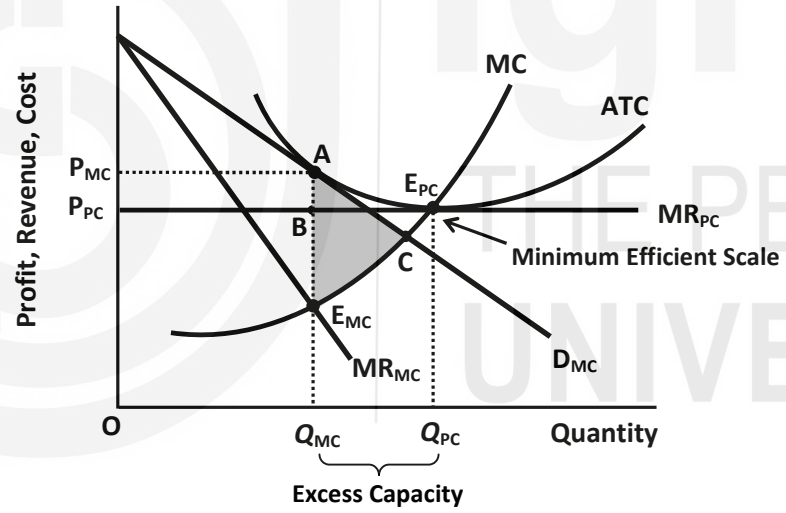

Fig. 4.6: Equilibrium under Perfect Competition and Monopolistic Competition

Excess Capacity

In the long run equilibrium, free entry results in competitive firms producing at the point where average total cost is minimised, which is the efficient scale of the firm. On the other hand, a monopolistic competitor produces in the falling portion of the average cost curve, point A in Fig. 4.6. There is no excess capacity under perfect competition in the long run. The efficient scale of production reached by the perfectly competitive firm in the long run (at the point $E_{PC,}$ with output Q_{PC}, as shown in the Fig. 4.6) implies that no further decrease in the average cost of production is possible by increasing the scale of production. On the other hand, monopolistic competitor at the long run equilibrium point E_{Mc} produces Q_{MC} level of output which is less than the efficient level of production (Q_{PC}). Here, there is a possibility of

lowering down the average cost of production by increasing the output supply to output level Q_{PC}. Thus, there exists excess capacity in monopolistic competition in the long run. In other words, a monopolistic competitor under-utilises the existing capacity; and steeper the demand curve, the more is the underutilisation of the installed capacity.

4.4.2 Monopolistic Competition versus Monopoly

Both the monopolistic competitor and monopolist face a downward sloping demand curve. Also firms in both the market structures possess market power to set market price. However, market power with a monopolistic competitor is limited as it faces competition from the differentiated products which are close substitutes to its products. Moreover free entry and availability of close substitutes result in a relatively elastic demand curve faced by a monopolistic competitor (D_{MC} in Fig. 4.7) than that faced by a monopolist (D_M in Fig. 4.7). In the long run, like in monopoly (P_M), firms in a monopolistic competition are able to charge a price (P_{MC}) marked up over marginal cost, which in turn results in a deadweight loss. The magnitude of the mark-up (relative difference between price and marginal cost) depends on the price elasticity of demand of the commodity. Higher the elasticity, smaller the mark-up, hence lower the deadweight loss and vice versa. In the case of perfect competition the price elasticity of demand is infinity and hence the mark-up and the deadweight loss is zero.While in case of monopolistic competition due to relatively elastic demand curve than that faced by a monopolist, deadweight loss (shaded area ABC) is relatively lower than that resulting in monopoly (shaded area DEF).

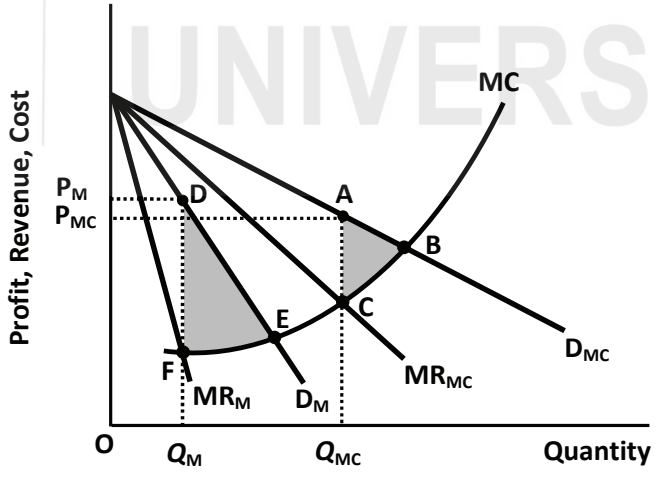

Fig. 4.7:Equilibrium under Monopoly and Monopolistic Competition

The regulatory implication of the monopolistic competition is not clear. When a firm i enjoys a market power (earning supernormal profit), forcing it to act competitive (i.e., producing at a point where price equals to its marginal costs) makes sense. However when firm i is a monopolistic competitive firm, there is not much scope for the government to do

anything, as it is already earning zero super normal profits in the long-run. However consumer should be alert that some of the firms in the market might want to force other firms out, to reduce competition, or that some of the firms in the market might want to create barriers to prevent other potential competitors from coming in.

Example1: The demand curve of a monopolistic competitive firm is as follows:

$$P = 185 - 15q$$

Where p and q are price and output, respectively. Assuming marginal cost is constant and given by, MC = 5. Find the deadweight loss of the monopolistic competitive firm.

Solution

Given, Demand curve, $P = 185 - 15q$

Total Revenue $= P \times q = 185q - 15q^2$

From TR, we calculate MR $= \frac{dTR}{dq} = 185 - 30q$

Now, monopolistic equilibrium condition is MR = MC

$\Rightarrow 185 - 30q = 5$ ($\because$ MC = *5*, given)

From this, we get equilibrium quantity $q^* = 6$.

Inserting q^* in demand function, we get equilibrium price $p^* = 95$

Now deadweight loss equals area of the shaded triangle (in Fig. 4.8) which is given by $\frac{1}{2}\times$ Base × Height

where base is $12 - 6 = 6$ and height equals $95 - 5 = 90$. The resultant area is then

$$\frac{1}{2}\times 6\times 90 = 270.$$

Note: '12' represents the output quantity under perfect competition, which is given by the relation P = MC $\Rightarrow 185 - 15q = 5 \Rightarrow q = 12$.

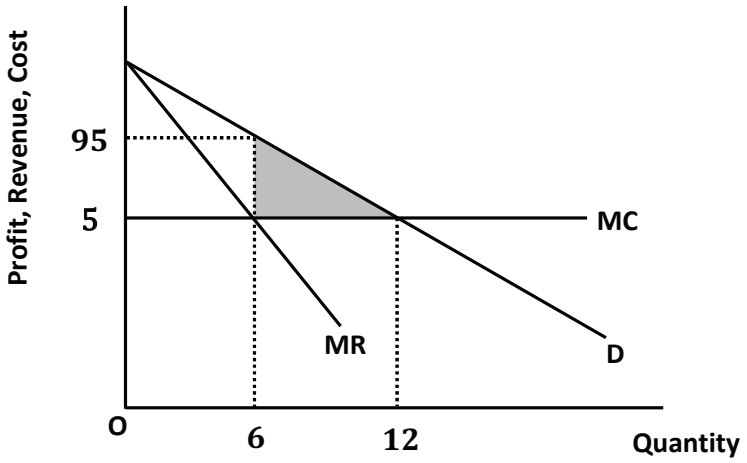

Fig. 4.8: Equilibrium under Monopolistic Competition

Example 2: In monopolistic competition, a firm produces 5 unit of output. The total cost (*TC*) function of the firm is given by:

$TC = 256 + 4q^2 + 150q$

Where q is the output of the firm.

a) what is the efficient level of output of the firm?

b) Do you think that the firm is producing at the efficient point?

Solution

a) Given TC = $256 + 4q^2 + 150q$, we need to find ATC (Average total cost) from it.

$$\text{ATC} = \frac{TC}{q} \Rightarrow \text{ATC} = \frac{256}{q} + 4q + 150.$$

Efficient output is attained when ATC is minimised. First order condition for minimising ATC is given by

$$\frac{dATC}{dq} = 0 \Rightarrow -\frac{256}{q^2} + 4 = 0$$

$$\Rightarrow q = 8$$

Hence, the efficient level of output is 8.

b) No, firm is not producing at the efficient point with 5 units of output production. At this level, there is presence of excess capacity which equals efficient output level minus level of production of the firm ⇒ 8 – 5 = 3 units.

Check Your Progress 3

1) Compare the efficiency of monopolistic competition with that of perfect competition.

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2) Differentiate welfare loss of a monopolistic competition with that resulting in case of a monopoly.

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3) Consider the following statements and answer whether they are True or False.

   a) A monopolistic competitive firm produces at the minimum average unit cost.

   b) Deadweight loss in monopoly is more than that in the monopolistic competitive market.

   c) The minimum point of average cost curve is the efficient production point.

   d) A perfectly competitive market has the highest deadweight loss.

4) Suppose the demand curve of a firm in a monopolistic competitive market is as follows.

   $P = a - bq$

   Where p and q are respectively price and output of the firm. The constant marginal cost of the firm is c. Find the deadweight loss. Also draw the diagram.

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5) The equilibrium output of a monopolistic competitive firm is 25 units. The total cost of production is as given below:

   $TC = 0.25q^2 - 10q + 400$

   Where q is the output of the firm. We assume that the cost of producing a differentiated product is included in the fixed cost. Do you think that the firm's equilibrium output is efficient? Justify your answer. What is the firm's efficient output level? Also find the excess capacity of the firm in terms of the lost output.

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4.5 NON-PRICE COMPETITION: ADVERTISEMENT

Under monopolistic competition, firms resort to both, price and non-price competition in their attempt to create and retain their brand loyalty. Non-price competition involves firms adopting various measures like providing after-sales services, extended warranty, onsite service, 24×7 helpline, home delivery, etc. These measures are adopted to create and increase demand

for the differentiated products. The cost incurred in such measures is also known as the selling cost. It is interesting to note that a perfect competitive firm will never provide for the selling cost as the given competitive market price does not provide enough cushion to incur such enhanced cost of production. Any increase in the cost of production would be translated into increased price for the firm in discussion. Further, any increment in the price of a specific firm would wipe out its total demand in this market structure. Similarly, a monopolist need not incur selling cost in its attempt to maintain its market share which is itself maintained by the barriers to entry.

For a monopolistic competitive firm, increasing the market share is of the utmost importance and at the same time its price is greater than the marginal cost, thus firms resort to various sales promotion schemes. Advertisement accounts for a substantial part of the total cost of production under monopolistic competition. When firms sell differentiated products and charge prices above marginal cost, each firm has an incentive to advertise in order to attract and retain more buyers to its particular brand of product. Some advertisements are informative, telling consumers about the characteristics of the commodity such as the unique quality of the product or about its uses. Advertisement, besides disseminating information about the product, also generates demand for products with insufficient demand. Such kind of advertisement is persuasive and is often aimed at manipulating people's tastes. Sometimes firms while promoting their product attempt to downgrade their rivals' commodities. Such negative campaigns are not allowed in our country. By portraying that products are way too different than they truly are, advertisements are often criticised for impeding competition. This in turn is defended with the argument that advertisements by offering a greater variety of products increase competition. Sometimes willingness of a firm to spend on advertising acts as a signal to consumers about the quality of the product. A product that is highly advertised is usually considered as the product with high quality. Also, firm which establishes a brand name using advertisements makes the consumers brand conscious and make them to believe differences that do really exist, and moreover ensure that the product they are buying is of high quality.This sometimes acts as an incentive for the firm to maintain high quality. Sometimes consumers are also loyal to a particular brand. The loyalty of consumers to a particular brand is conditional on the price of rival products. Consumers remain loyal only up to a certain level of price difference between their choice of a particular brand and the similar product of some other brand. If the price difference is greater than their range then they would shift to other competing brands.

The primary objective of advertising is to create loyalty for the similar but not-identical products of the firms in monopolistic competition. This shifts the demand curve facing a monopolistic competitive firm towards right and moreover makes it relatively inelastic. Advertising also increases the cost of production shifting the average total cost curve up.

Check Your Progress 4

1) Selling cost is an important component of the total cost in a monopolistic competitive market. Explain.

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2) Give some examples of non-price competition among monopolistic competitive firms.

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4.6 LET US SUM UP

In this unit we discussed the monopolistic competitive market structure. The special features of this market include a large number of buyers and sellers of a differentiated product with close substitutes in the market. There is no restriction on firms as regards to entry and exit in the market. This structure has attributes of both monopoly and perfect competition. Like monopoly, it also faces a downward sloping demand curve and given the same profit-maximisation condition (i.e., MR=MC and MC cuts MR from below), the market price is greater than the marginal cost. The latter condition is a trait of the long-run equilibrium as well. Like monopoly such a market causes deadweight loss to the society. In other words, monopolistic competitive firms underutilise their existing production capacity. Like a perfect competitive market structure, in monopolistic competition there are no barriers to entry or exit from the industry, which in turn drives down the long run profits to normal levels. We also came across the social cost of the monopolistic competition market structure in terms of both, allocative as well as productive inefficiency. A monopolistic competitor is allocatively inefficient, as price in the equilibrium is above the marginal cost. The firm is productively inefficient due to the fact that it does not produce at the minimum unit cost of production. Firms under monopolistic competition try to compete with both price and non-price competition. Advertisements play a very crucial role in creation and increasing the demand for the differentiated products of the firms in the monopolistic competition. Consumers are generally loyal to a particular brand. The determining factor of this loyalty is the price difference among the rival brands. The selling

costs incurred on advertising the product may result in shifting the demand for the product of a monopolistic competitor towards right and even make it relatively more inelastic.

4.7 SOME USEFUL REFERENCES

- Kutsoyiannis, A. (2005), *Modern Microeconomics*, 2nd edition, International edition, (Macmillan Press Ltd. London), pp. 202-214.
- Browning and Browning (1994), *Microeconomic Theory and Applications*, (New Delhi, Kalyani Publishers, 2nd edition), pp.399-407.
- Pindyck and Rubinfeld, *Microeconomics*, (New York, Macmillan Publishing Company, 1989), pp. 421-426.
- Mankiw, N. G. (2012), *Principles of Economics*, (New Delhi, CengageLearning), pp. 329-348.

4.8 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Refer Section 4.2 and answer

2) No, the availability of close substitutes and free entry checks the monopolistic power of the firm to mark up price over marginal cost.

3) Refer Section 4.2 and answer.

Check Your Progress 2

1) Demand curve of an incumbent firm will shift left.

2) a) A monopolistically competitive firm maximises profits at the level of output where MR = MC, with MC intersecting MR from below.

   b) If a monopolistically competitive firm is earning economic profits in the short run, entry of new firms will eliminate those profits in the long run. Refer Sub-section 4.3.2 to answer with the help of a diagram.

3) a) In the long run equilibrium under monopolistic competition, due to free entry and exit into the industry, a firm earns normal or zero economic profits, while a monopolist, whose market share stays intact as a result of barriers to entry, may earn supernormal or positive economic profits. Also, a monopolistic competitor faces a relatively elastic demand curve than that faced by the monopolist. As a result of this, the equilibrium price of monopolistic competitor is lower than that charged under monopoly, and the resultant equilibrium quantity supplied by the monopolistic competitor is more than that supplied by the monopolist.

b) Due to presence of differentiated products which act like close substitutes and that there is free entry and exit into the industry.

4) (a) True; (b) False, (c) False, (d) False, (e) False, (f) False

Check Your Progress 3

1) Refer Sub-section 4.4.1 and answer.

2) Refer Sub-section 4.4.2 and answer.

3) (a) False,(b)True, (c) True, (d) False

4) DWL = $\frac{(a-c)^2}{8b}$

Solution: Given, Demand curve, $P = a - bq$.

Total Revenue = P × q = $aq - bq^2$, from this we calculate MR = $\frac{dTR}{dq} = a - 2bq$

Now, monopolistic equilibrium condition is MR = MC $\Rightarrow a - 2bq = c$ ($\because$ MC = c, given)

From this, we get equilibrium quantity $q^* = \frac{a-c}{2b}$. Inserting q^* in demand function, we get equilibrium price $p^* = \frac{a+c}{2}$. Now deadweight loss equals area of the shaded triangle (in Figure 4.9) which is given by $\frac{1}{2}$× Base × Height, where base is $\frac{a-c}{b} - \frac{a-c}{2b} = \frac{a-c}{2b}$ and height equals $\frac{a+c}{2} - c = \frac{a-c}{2}$. The resultant area is then $\frac{1}{2} \times \frac{a-c}{2b} \times \frac{a-c}{2} = \frac{(a-c)^2}{8b}$

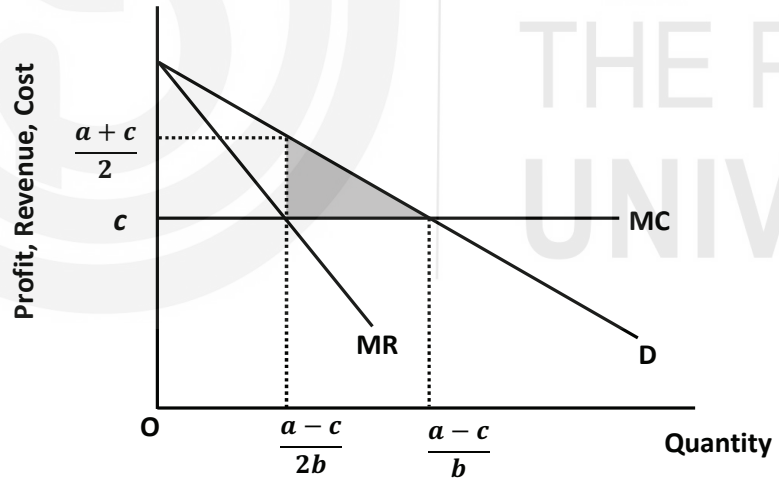

Fig. 4.9

5) No the firm's equilibrium output is not efficient. Efficient output = 40 units, Excess capacity = 15 units

Solution: Given TC = $0.25q^2 - 10q + 400$, we need to find ATC (Average total cost) from it.

ATC = $\frac{TC}{q} \Rightarrow$ ATC = $0.25q - 10 + \frac{400}{q}$. Efficient output is attained when ATC is minimised.

First order condition for minimising ATC is given by $\frac{dATC}{dq} = 0 \Rightarrow$ $0.25 - \frac{400}{q^2} = 0 \Rightarrow q = 40$

Excess capacity = Efficient output level – equilibrium output level of the firm = 40 – 25 = 15

Check Your Progress 4

1) Refer Section 4.5 and answer

2) Refer Section 4.5 and answer