Monopoly

DEFINITION

Monopoly is a market structure in which there is a single seller, there are no close substitutes for the commodity it produces and there are barriers to entry.

The main causes that lead to monopoly are the following.

Firstly, ownership of strategic raw materials, or exclusive knowledge of production techniques.

Secondly, patent rights for a product or for a production process.

Thirdly, government licensing or the imposition of foreign trade barriers to exclude foreign competitors.

Fourthly, the size of the market may be such as not to support more than one plant of optimal size. The technology may be such as to exhibit substantial economies of scale, which require only a single plant, if they are to be fully reaped. For example, in transport, electricity, communications, there are substantial economies which can be realized only at large scales of output. The size of the market may not allow the existence of more than a single large plant. In these conditions it is said that the market creates a `natural' monopoly, and it is usually the case that the government undertakes the production of the commodity or of the service so as to avoid exploitation of the consumers. This is the case of the public utilities.

Fifthly, the existing firm adopts a limit-pricing policy, that is. a pricing policy aiming at the prevention of new entry. Such a pricing policy may be combined with other policies such as heavy advertising or continuous product differentiation, which render entry unattractive. This is the case of monopoly established by creating barriers to new competition.

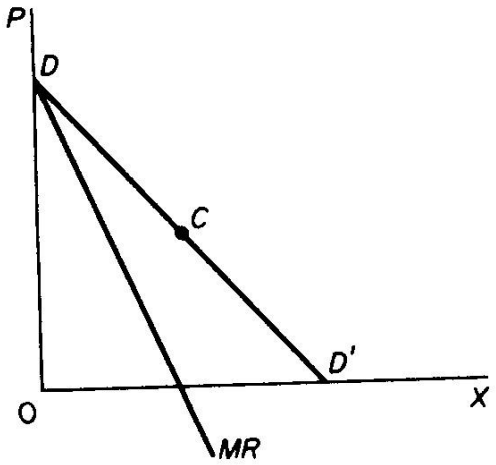
DEMAND AND REVENUE

Since there is a single firm in the industry, the firm's demand curve is the industry demand curve. This curve is assumed known and has a downward slope (figure 6.1). We will use a linear demand function for simplicity.

The demand equation, *ceteris paribus, is*

$$X = b_o - b_1 P$$

The clause *ceteris paribus* implies that all the other factors (such as income, tastes, other prices) which affect demand are assumed constant. Changes in these factors will shift the demand curve.



The slope of the demand curve is

$$\frac{dX}{dP} = -\,b_1$$

The price elasticity of demand is

$$e_p = \frac{dX}{dP} \cdot \frac{P}{X} = -\,b_1 \cdot \frac{P}{X}$$

That is, elasticity changes at any one point of the demand curve.
(a) At point D the elasticity approaches infinity

$$e_p = -\,b_1 \cdot \frac{P}{X} \to \infty$$

(b) At point D' the elasticity is zero

$$e_p = -\,b_1 \cdot \frac{P}{X} = -\,b_1 \cdot \frac{0}{X} = 0$$

(c) At the mid point C the price elasticity is unity

$$e_p = -\,1$$

The total revenue of the monopolist is

$R = P.X$

Solving the demand equation for P we may rewrite the price equation as

$P = b_o - b_1X$

Substituting into the revenue equation we find

$R = P.X = (b_o - b_1 X).\ X$

or $R = bo.X - b_1 X^2$

The average revenue is equal to the price:

$$AR = \frac{R}{X} = \frac{PX}{X} = P = b_o - b_1X$$

Thus the demand curve is also the A R curve of the monopolist.

The marginal revenue is:

$$MR = \frac{dR}{dX} = \frac{d(bo.X - b1\ X2}{dX} = b_0 - 2b_1X$$

That is the *M R* is a straight line with the same intercept as the demand curve, but twice as steep.

The general relation between P and *M R* is found as follows. Given

$R = P.X$

$$MR = \frac{dR}{dX} = P.\frac{dX}{dX} + X.\ \frac{dP}{dX}$$

$$\text{or,}\ \ MR = P + X.\ \frac{dP}{dX}$$

The marginal revenue is at all levels of output smaller than P, given that

$$P = MR - X.\ \frac{dP}{dX}$$

The relationship between MR and price elasticity e is

$$\mathbf{MR = P\ (\ 1 - \frac{1}{e}\ )}$$

Proof:

We know that

$$MR = \frac{dR}{dX} = P + X.\ \frac{dP}{dX}$$

The price elasticity of demand is defined as

$$e_p = - \frac{dX}{dP} . \frac{P}{X}$$

Inverting this relation we obtain

$$\frac{1}{e} = - \frac{dP}{dX} . \frac{X}{P}$$

Solving for dP/dX we find

$$\frac{dP}{dX} = - \frac{1}{e} . \frac{P}{X}$$

Substituting in the expression of the MR we get

$$MR = P + X\ (- \frac{1}{e} . \frac{P}{X})$$

$$\text{or } MR = P\ (\ 1 - \frac{1}{e}\ )$$

COSTS:

In the traditional theory of monopoly the shapes of the cost curves are the same as in the theory of pure competition. The *A VC, MC* and ATC are U-shaped, while the AFC is a rectangular hyperbola. However, the particular shape of the cost curves does not make any difference to the determination of the equilibrium of the firm, provided that the slope of the *MC* is greater than the slope of the *MR* curve (see below).

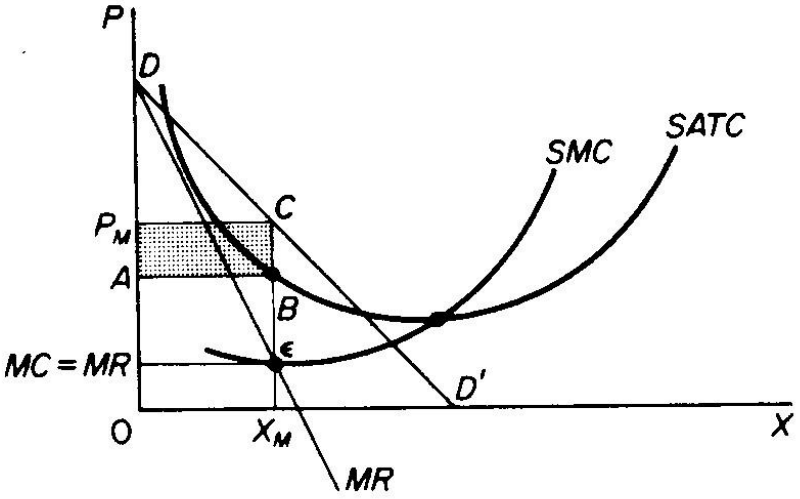
EQUILIBRIUM OF THE MONOPOLIST

SHORT-RUN EQUILIBRIUM

The monopolist maximizes his short-run profits if the following two conditions are fulfilled:

Firstly, the *MC* is equal to the *MR.*

Secondly, the slope of *MC* is greater than the slope of the *MR* at the point of intersection.



In figure 6.2 the equilibrium of the monopolist is defined by point E, at which the *MC* intersects the *MR* curve from below. Thus both conditions for equilibrium are fulfilled. Price is P_M and the quantity is X_M. The monopolist realises excess profits equal to the shaded area AP_MCB. Note that the price is higher than the *MR.*

In pure competition the firm is a price-taker, so that its only decision is output determination. The monopolist is faced by two decisions: setting his price and his output. However, given the downward-sloping demand curve, the two decisions are interdependent. The monopolist will either set his price and sell the amount that the market will take at it, or he will produce the output defined by the intersection of *MC* and *MR,* which will be sold at the corresponding price, P. The monopolist cannot decide independently both the quantity and the price at which he wants to sell it. The crucial condition for the maximisation of the monopolist's profit is the equality of his *MC* and the *MR,* provided that the *MC* cuts the *MR* from below.

A numerical example

Given the demand curve of the monopolist

$$X = 50 - 0.5P$$

which may be solved for P

$$P = 100 - 2X$$

Given the cost function of the monopolist

$$C = 50 + 40X$$

The goal of the monopolist is to maximise profit

$$\pi = R - C$$

(i) We first find the *MR*

$$R = XP = X(100 - 2X)$$

$$R = 100X - 2X^2$$

$$MR = \frac{dR}{dX} = 100 - 4X$$

(ii) We next find the *MC*

$$C = 50 + 40X$$

$$MC = \frac{dC}{dX} = 40$$

(iii) We equate MR and MC

$$MR = MC$$

$$or, 100-4X=40$$

$$or, X=15$$

(iv) The monopolist's price is found by substituting $X = 15$ into the demand price equation

$$P=100-2X=70$$

(v) The profit is

$$\pi = R - C = 1050 - 650 = 400$$

This profit is the maximum possible, since the second-order condition is satisfied:

(a) From

$$\frac{dC}{dX} = 40$$

we have

$$d^2C/ dX^2 = 0$$

(b) From

$$\frac{dR}{dX} = 100 – 4X$$

We have

$$d^2R/ dX^2 = -4$$

Clearly $-4 < 0$

There is no unique supply curve for the monopolist derived from his *MC*.

One point should be stressed here. The *MC* curve is not the supply curve of the monopolist, as is the case in pure competition. In monopoly there is no unique relationship between price and the quantity supplied. Now re-examine the statement that **there is no unique supply curve for the monopolist derived from his *MC*.** Given his *MC,* the same quantity may be offered at different prices depending on the price elasticity of demand. Graphically this is shown in figure 6.3 The quantity X will be sold at price P, if demand is D, while the same quantity X will be sold at price P_2 if demand is D_2. Thus there is no unique relationship between price and quantity.

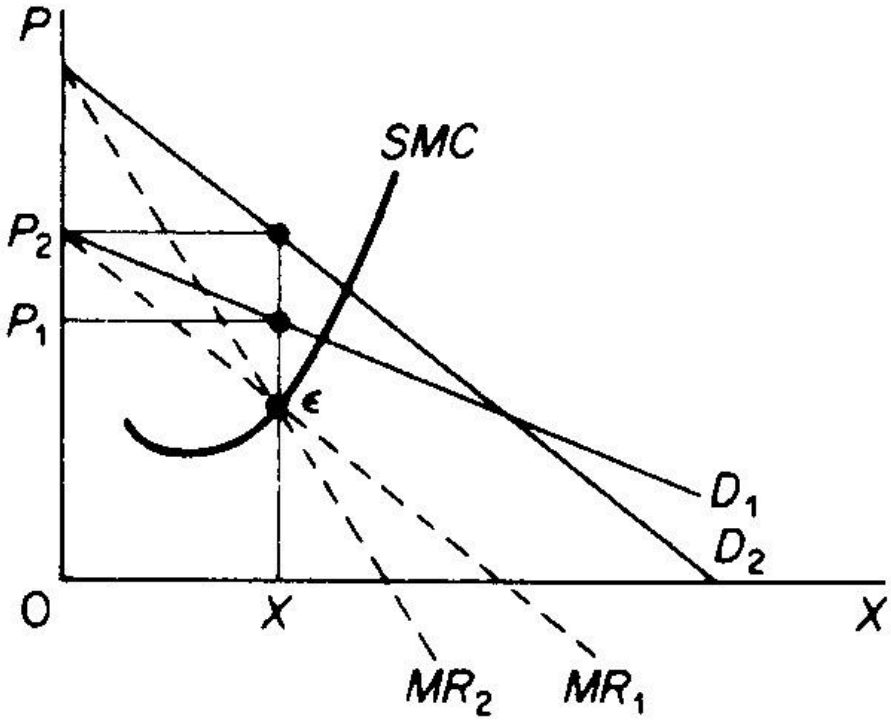


Figure 6.3

Similarly, given the MC of the monopolist, various quantities may be supplied at any one price, depending on the market demand and the corresponding *MR* curve. In figure 6.4 we depict such a situation. The cost conditions are represented by the MC curve. Given the costs of the monopolist, he would supply OX_1 if the market demand is D_1, while at the same price, P, he would supply only OX2, if the market demand is D_2.

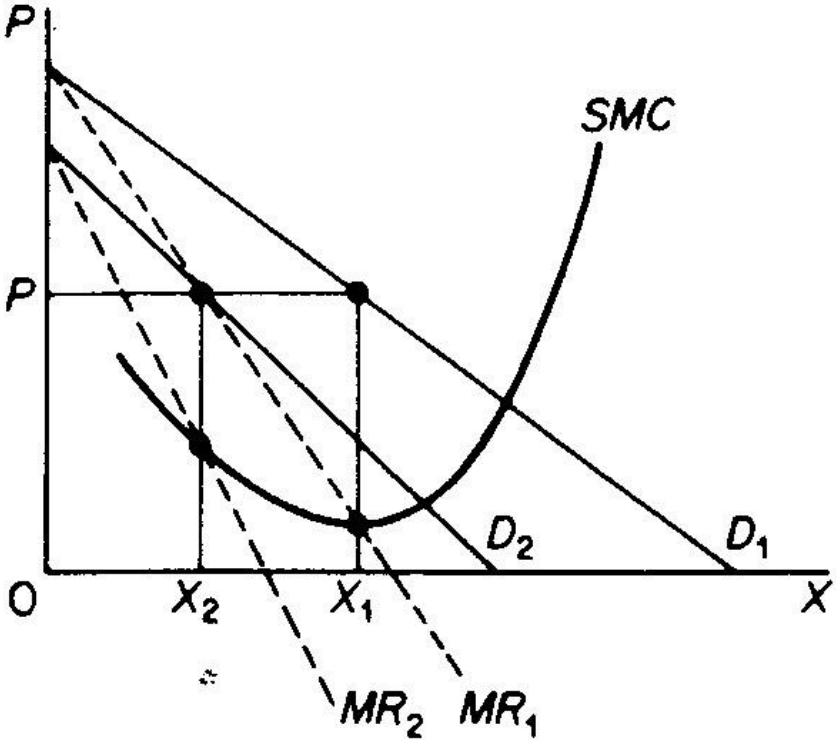


Figure 6.4