

6. Monopoly

I. 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 realised 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.¹

II. 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. We have examined the properties of this form of demand in Chapter 2. They may be summarised as follows:

1. The demand equation, *ceteris paribus*, is

$$X = b_0^* - b_1^*P$$

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.

¹ See also Chapter 13.

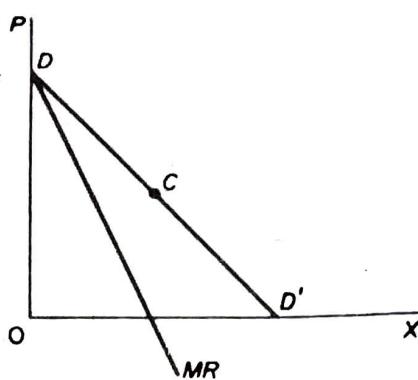


Figure 6.1

2. The slope of the demand curve is

$$\frac{dX}{dP} = -b_1^*$$

3. 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

$$e_P = -b_1^* \cdot \frac{P}{X} \rightarrow \infty$$

(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

$$e_P = -1$$

4. The total revenue of the monopolist is

$$R = P \cdot X$$

Solving the demand equation for P we find

$$P = \frac{b_0^*}{b_1^*} - \frac{1}{b_1^*} X^\infty$$

Setting $(b_0^*/b_1^*) = b_0$ and $(1/b_1^*) = b_1$ we may rewrite the price equation as

$$P = b_0 - b_1 X$$

Substituting into the revenue equation we find

$$R = PX = (b_0 - b_1 X)X$$

or

$$R = b_0 X - b_1 X^2$$

5. The average revenue is equal to the price:

$$AR = \frac{R}{X} = \frac{PX}{X} = P = b_0 - b_1 X$$

Thus the demand curve is also the AR curve of the monopolist

6. The marginal revenue is:

$$\frac{dR}{dX} = \frac{d(b_0 X - b_1 X^2)}{dX} = b_0 - 2b_1 X$$

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

The general relation between P and MR is found as follows. Given

$$R = PX$$

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

or

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

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

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

$\frac{dP}{dX} < 0 \rightarrow$ slope of dd curve

and the term $(X(dP/dX))$ is positive (since the slope of the demand curve $(dP/dX) < 0$). Hence $P > MR$.

Intuitively, since demand is negatively sloping, the firm must lower its price if it is to sell an additional unit. The net change in total revenue, the MR , is the new (lower) price from selling the additional n th unit minus the loss the firm realises from selling all previous units $(n - 1)$ at the lower price:

$$MR_2 = P_2 - (n - 1)(P_1 - P_2)$$

Thus $MR_2 < P_2$, given $(n - 1) > 0$ and $(P_1 - P_2) > 0$

7. The relationship between MR and price elasticity e is

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

Proof

We established that

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

The price elasticity of demand is defined as

$$e_P = \frac{\frac{dX}{dP}}{\frac{P}{X}}$$

Inverting this relation we obtain

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

Solving for dP/dX we find

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

Substituting in the expression of the MR we get

$$MR = P + X \left(-\frac{1}{e} \cdot \frac{P}{X} \right)$$

or

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

Q.E.D

III. COSTS

In the traditional theory of monopoly the shapes of the cost curves are the same as in the theory of pure competition. The AVC , 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).

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 (see below, p. 177).

IV. EQUILIBRIUM OF THE MONOPOLIST

A. SHORT-RUN EQUILIBRIUM

The monopolist maximises 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.

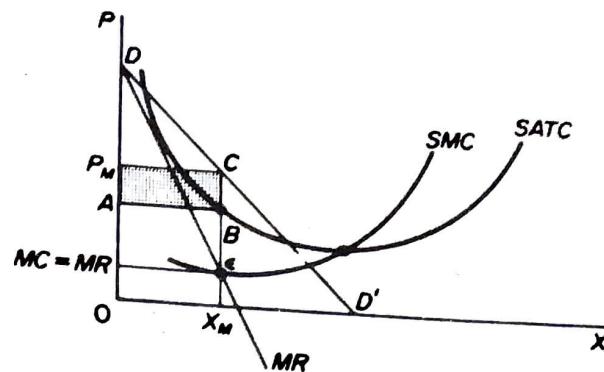


Figure 6.2

Formal derivation of the equilibrium of the monopolist

Given the demand function

$$X = g(P)$$

which may be solved for P

$$P = f_1(X)$$

and given the cost function

$$C = f_2(X)$$

The monopolist aims at the maximisation of his profit

$$\Pi = R - C$$

(a) *The first-order condition for maximum profit Π*

$$\frac{\partial \Pi}{\partial X} = 0$$

$$\frac{\partial \Pi}{\partial X} = \frac{\partial R}{\partial X} - \frac{\partial C}{\partial X} = 0$$

or

$$\frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$$

that is $MR = MC$

(b) *The second-order condition for maximum profit Π*

$$\frac{\partial^2 \Pi}{\partial X^2} < 0$$

$$\frac{\partial^2 \Pi}{\partial X^2} = \frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2} < 0$$

or

$$\frac{\partial^2 R}{\partial X^2} < \frac{\partial^2 C}{\partial X^2}$$