BUSINESS ECONOMICS
B.COM 1st YEAR

TOPIC :The Average Revenue, Marginal Revenue and Price Elasticity of Demand!

There is a very useful relationship between elasticity of demand, average revenue and marginal revenue at any level of output. We will make use of this relation extensively when we come to the study of price determination under different market conditions. Let us study what this relation is.

We have stressed above that the average revenue curve of a firm is really the same thing as the demand curve of consumers for the firm's product. Therefore, elasticity of demand at any point on a consumer's demand curve-is the same thing as the elasticity of demand on the given point on the firm's

We know that elasticity of demand at point R on the average revenue curve DD in Fig. RD'/RD. With this measure of point elasticity of demand we can study the relationship between average revenue, marginal revenue and price elasticity at any level of output.

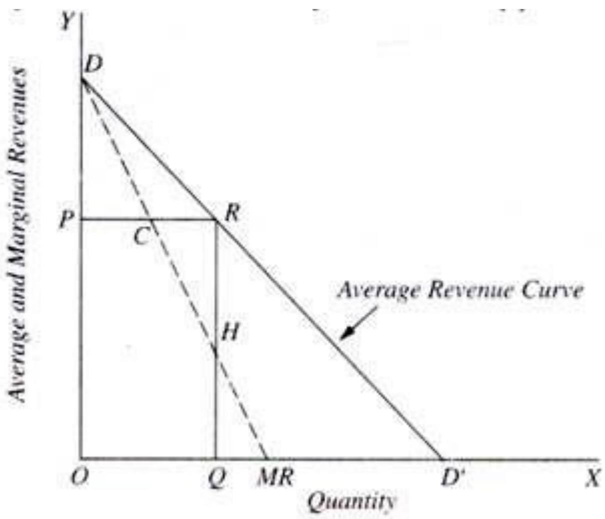

Fig. 21.6. *Relationship between AR, MR and Price Elasticity of Demand*

In Fig. AR and MR are respectively the straight lines average and marginal revenue curves of a firm.

Elasticity of demand at point R on the average revenue curve:

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e_P = RD'/RD

Now, in triangles PDR and QRD’

<DPR = <RQD’ (right angles)

<DRP = <RD’ Q (corresponding angles)

Third <PDR = <QRD’

Therefore, triangles PDR and QRD’ are equiangular RD’ RQ

Hence = RD’/RD = RQ/PD ……(i)

In the triangles

PC = RC

< PCD = < RCH (vertically opposite angles)

< DPC = < CRH (right angles)

Therefore, triangles PDC and CRH are congruent (i.e., equal in all respects).

Hence PD = RH ….(ii)

From (i) and (ii), we get

Price elasticity at R = RD’/RD = RQ/PD = RQ/RH

Now, it is seen from Fig.that

RQ/RH = RQ/RQ-HQ

Hence, price elasticity at point R = RQ/RQ-HQ

It will be seen from Fig. that RQ is the average revenue (AR) and HQ is the marginal revenue (MR) at the level of output OQ corresponding to point R on the demand or average revenue curve DD’. Therefore,

Average Revenue, Marginal Revenue and Price Elasticity of Demand.

then, $$e = \frac{A}{A-M}$$

$$eA - eM = A$$
$$eA - A = eM$$
$$A(e-1) = eM$$
$$A = \frac{eM}{e-1}$$

Hence, $$A = M\left(\frac{e}{e-1}\right)$$

And also, $$M = A\left(\frac{e-1}{e}\right)$$

Or, $$M = A\left(1-\frac{1}{e}\right)$$

Since price (P) equals average revenue (A) we have

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

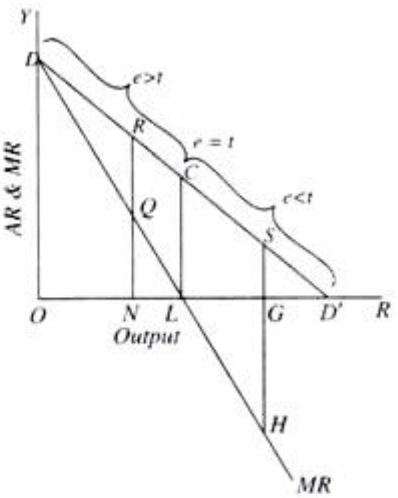

Fig. 21.7. *Average Revenue, Marginal Revenue and Price Elasticity of Demand*

Where e stands for price elasticity of demand at a given point on the average revenue curve.

With the help of the above formulae we can find out marginal revenue at any level of output from average revenue at the same output provided we know the point price elasticity of demand on the average revenue curve. If the price elasticity of a firm's average revenue curve at a given level of output is equal to one marginal revenue equals zero.

This can be proved as under:

M = A (1-1/e)

= A (1-1/1)

= A × 0 = 0

It will be seen from Figure 21.7 that corresponding to the middle point C on the average revenue curve DD' where elasticity of demand equals unity, the marginal revenue is zero.

By applying the above formula it can be shown that at a point on the average revenue curve where elasticity of demand is greater than one, marginal revenue will be positive though less than the average revenue. Thus when demand elasticity on a firm's average revenue curve is 2, the marginal revenue will be positive and will equal half the average revenue. This is

M = A (1 – 1/e)

= (1 – 1/2)

= 1/2A

If price elasticity of demand at a point on the average revenue curve equals 2, then the relevant point on the average revenue curve DD' in Figure is R corresponding to output ON such that RD' = 2RD. This is because elasticity at point R = RD'/RD = 2. Now, with elasticity of demand being equal to 2 at point R on the average revenue curve the marginal revenue NQ will be found half of the average revenue NR.

It is important to understand that at a point on the average revenue curve at which elasticity of demand is less than unity, the marginal revenue will be negative. For instance, suppose elasticity at a point on the average revenue curve is 1/4. Then,

$$M = A\frac{\frac{1}{4}-1}{\frac{1}{4}} = A\left(-\frac{3}{4}\right)\times 4$$
$$= -3A$$

It will be seen from Figure that corresponding to point S which lies below the middle point on the demand or average revenue curve DD' and therefore at which elasticity is less than unity, the marginal revenue is negative and is equal to GH (note that beyond output OL, the MR curve goes below the X-axis). Further, it will be noticed

from Figure that point S lies at such a position on the average revenue curve DD' so that SD = 1/4 SD and, therefore, e_p = SD'/SD = 1/4.
Thus on measurement it will be found that corresponding to point S at which elasticity is equal to 1/4 the marginal revenue GH is three times the average revenue GS.

To sum up, marginal revenue is always positive at any point or output where the elasticity of the average revenue curve is greater than one and marginal revenue is always negative where the elasticity of average revenue curve is less than one and marginal revenue is zero corresponding to unit elasticity at the average revenue curve.

Three Types of Revenue (AR, MR, TR) and Price Elasticity (E):

We are now in a position to describe the relationship between three types of revenue, namely, AR, MR, and TR on the one side and price elasticity of demand on the other. From the formula MR = AR (e – 1/e) we can know what would be the marginal revenue, if elasticity and AR are given to us. When the elasticity is equal to one, it follows from the above formula that marginal revenue will be equal to zero.

Thus,

MR = AR (e – 1/e)

MR = AR (1 – 1/1)

MR =AR x 0=0

Likewise, it can be proved that,

If e > I, MR is positive, and

If e < 1, MR is negative

In a straight-line demand curve we know that the elasticity at the middle point is equal to one. It follows that marginal revenue corresponding to the middle point of the demand curve (or AR curve) will be equal to zero.

Consider Fig. C is the middle point of the average revenue or demand curve DD At point C price elasticity is equal to one. Corresponding to C on the AR curve, marginal revenue will be zero. Thus MR curve is shown cutting the X-axis at point N which corresponds to point C on the AR curve.

At a quantity greater than ON price elasticity on the demand curve, curve is less than one and the marginal revenue is negative. Marginal revenue being negative beyond ON means that total revenue will diminish if a quantity greater than ON is sold.

Total revenue will be increasing up to ON output, since up to this marginal revenue remains positive. It follows therefore that total revenue will be maximum where elasticity is equal to one. Thus TR curve drawn in the bottom panel of Fig. 21.8 is shown to be at its highest level corresponding to the point C on AR curve or ON output where marginal revenue is zero and elasticity is equal to one.

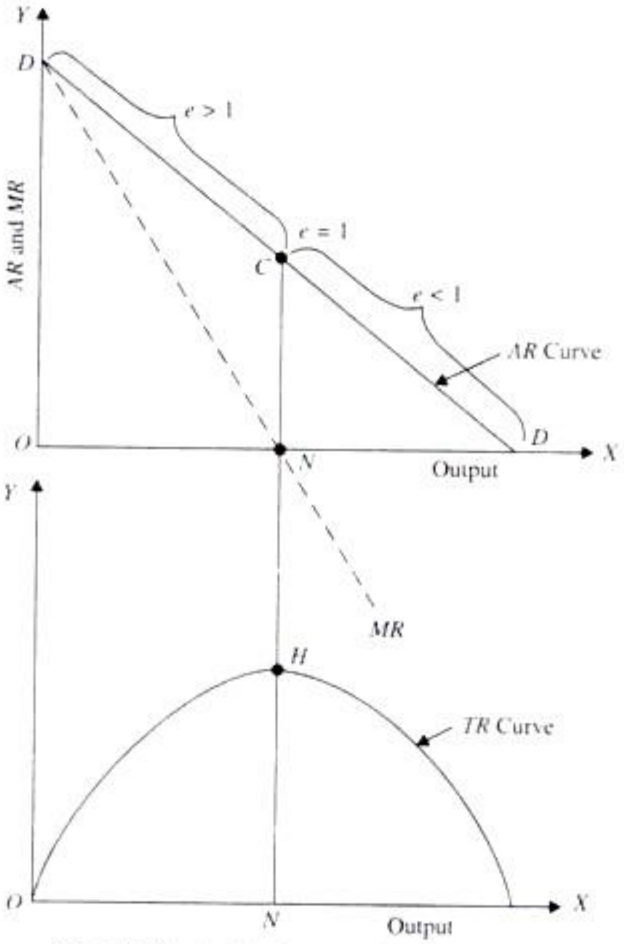

Fig. 21.8. *Relationship between AR, MR, TR and Price Elasticity*

We can also prove that total revenue is maximum corresponding to the unit elasticity point on the AR curve even without bringing in the marginal revenue. We know from the relationship between elasticity and total outlay (or total revenue) that the total revenue increases when elasticity is greater than one and total revenue diminishes when elasticity is less than one.

Thus, in Fig. beginning from point D on the average revenue or the demand curve DD' and coming down to the middle point C, elasticity remains greater than one and therefore the total revenue will go on increasing as we descend from point D to point C on the demand curve.

Below point C on the demand or AR curve, elasticity is less than one therefore the total revenue will start diminishing as we descend from point C downward. It, therefore, follows that corresponding to the middle point C on the demand curve where elasticity is equal to one the total revenue will be maximum.

It will be seen from Fig. that total revenue curve starts from O and goes on rising till it reaches its peak at point H. Then it starts declining till it meets point D' on the X-axis. It means that at output OD' total revenue is zero. This is because at output OD' average revenue or price is zero.