$$E p = \frac{\text{Percentage change in demand}}{\text{Percentage change in price}}$$

$$= \frac{\dfrac{\text{change in quantity demanded}}{\text{quantity demanded}}}{\dfrac{\text{change in price}}{\text{price}}}$$

$$= \frac{\Delta q}{q} \div \frac{\Delta p}{p}$$

$$= \frac{\Delta q}{q} \times \frac{\Delta p}{p}$$

$$e_p = \frac{\Delta q}{p} \cdot \frac{\Delta p}{q}$$

Where, e_p = price elasticity; Δq = change in quantity demanded; Δp = change in price; p = price; q = quantity.

Note: The elasticity of demand is always negative. This is because price and quantity are inversely related. But by convention, for the sake of simplicity, the minus sign is dropped in economics.

Arc Method

This is another important method to measure price elasticity of demand. In this method, we take the averages of original and new prices and quantities to measure elasticity. This method is used when there is a big change in price so that an arc is formed on the demand curve. It can be measured by using the formula shown below:

$$= \frac{\dfrac{\Delta q}{\dfrac{q' + q''}{2}}}{\dfrac{\Delta p}{\dfrac{p' + p''}{2}}}$$

$$= \frac{\Delta q}{q' + q''} \div \frac{\Delta p}{p' + p''}$$

$$e_p = \frac{\Delta q}{\Delta p} \cdot \frac{p' + p''}{q' + q''}$$

Where, p' = original price; p'' = new price; q' = original quantity; q'' = new quantity.

Point/Geometrical Method

This method measures elasticity using demand curve. It is, therefore, also called as geometrical method of measuring elasticity. The diagram below illustrates how to find different types of

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elasticity on a demand curve. DD is the straight line demand curve (constant slope). Elasticity is measured as under,

$$E = \frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$$

All five cases are shown in the Fig. 5.7 below. We find that elasticity of demand falls steadily as we move from D″ toward D.
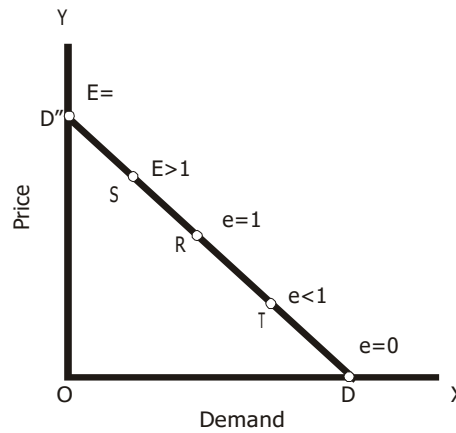

Fig. 5.7

For instance, let us find elasticity at point R using the above expression.

$$E = \frac{RD}{RD''} = 1$$

$$RD = RD''$$

Similarly, elasticity at different points is shown as under:

At D′: $\quad E = \dfrac{D''D}{0} = \infty$

At S: $\quad E = \dfrac{SD}{SD''} > 1$

At T: $\quad E = \dfrac{TD}{TD''} < 1$

At D: $\quad E = \dfrac{0}{DD''} = 0$

Revenue Method

Revenue is the amount that a firm earns by selling its products. It is measured by multiplying price with total quantity/units of product sold. Thus, $TR = \text{Quantity} \times \text{Price}$. Elasticity can be measured using the concepts of average and marginal revenue shown as under.

$$E = \frac{\text{Average revenue}}{\text{Average revenue} - \text{Marginal revenue}}$$

Income Elasticity of Demand

It is the ratio of the percentage change in the amount spent on the commodity to a percentage change in the consumer's income, price remaining constant. That is,

$$Ie = \frac{\text{Proportionate change in demand}}{\text{Proportionate change in income}}$$

Cross Elasticity of Demand

The responsiveness of demand to a change in the prices of related commodities (substitutes and complementary) is called cross elasticity of demand. It is responsiveness of demand for commodity X to a change in price of commodity Y and is represented as follows:

$$Cc = \frac{\text{Proportionate change in demand of X}}{\text{Proportionate change in price of good Y}}$$

DETERMINANTS OF PRICE ELASTICITY OF DEMAND

Elasticity of demand differs from commodity to commodity. The various factors upon which elasticity depends are the following:

1. **Substitute goods:** A commodity will have elastic demand if there are good substitutes for it. This is because when price of a good rises, a consumer will not buy the good but purchase its substitute.

2. **Nature of commodity:** All necessities like salt, rice etc that have no substitutes/or less substitutes will have an inelastic demand. People have to purchase such commodities for their sustenance. Therefore, there will be some demand despite the changes in price. Demand for luxury goods, on the other hand, will be elastic. If prices of such commodities rise even a little, consumers refrain to buy. At the same time a little lowering of price of such commodities attract a large number of consumers.

3. **Number of uses of commodity:** The larger the number of uses to which a commodity can be put, the higher will be its elasticity. Therefore the demand of such goods will have elastic demand. For example, milk can be used for various purposes such as for making curd, cake, sweets etc. When its price goes down, demand increases but a little rise in its price makes demand fall greatly.

4. **Possibility of postponement of consumption:** If there is a possibility of postponement of consumption of a commodity then demand will be elastic otherwise inelastic. Demand for certain goods can be postponed for sometime such as computers, printers, scanners etc. People may wait till they become cheaper. Therefore, their demand is elastic. But the demand for food or electricity cannot be postponed. As such their demand is inelastic.

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5. **Percentage of income spent:** The elasticity of demand is also influenced by the percentage of income spent on the purchase of a commodity. If the percentage is very less then the demand will be inelastic. For instance, we spend a very less amount of our total money income on things like agarbatties (incense sticks), matches, pens, pencils etc. If prices of such commodities rise also, our demand is not reduced. Thus, demand of such goods is inelastic.

6. **Fashion:** Commodities, which are in fashion, will have inelastic demand. Fashion minded people do not compromise with price. Even if price is high, some people will demand more just because goods are in fashion.

7. **Change in taste:** A habitual commodity or a commodity for which consumers have developed a taste will have inelastic demand. A chain smoker always requires a cigarette, whatever the price may be. Likewise, a habitual paan (betel nut) chewer cannot leave his habit, in spite of rise in price. In such cases, therefore, demand is elastic.

8. **Price of the commodity:** Very high priced or very low priced goods have low elasticity whereas moderately priced commodities are quite high-elastic. If a good is very expensive, demand will not increase much even if there is little fall in its price. And demand will not increase even at very low prices, because people have already purchased their requirement at low prices.

Questions for Review

1. What is the shape of the perfectly inelastic demand curve?
2. What is the shape of the unitary elastic demand curve?
3. What is the shape of the perfectly elastic demand curve?
4. Define price elasticity of demand for a commodity and state its importance.
5. When is demand said to be inelastic?
6. How would you measure price elasticity of demand by the total outlay method? Explain.
7. Define price elasticity of demand. How can it be measured?
8. What will be the shape of demand curve when the demand is unitary elastic?

6 THEORY OF PRODUCTION

So far we have made an analysis of how a consumer behaves and his demand for a commodity. Now we shall see concepts related to production, which are very useful for a producer in his decision making.

MEANING OF PRODUCTION

Production in economics generally refers to the transformation of inputs into outputs. Inputs are the raw materials or other productive resources used to produce final products i.e., output. In technical terms, production means the creation of utility or creation of want-satisfying goods and services. Any good become useful for us or satisfies our want when it is worth consumption. Thus, a good can be made useful by adding utility. For instance, we cannot consume wheat flour raw when we are hungry (want), unless it is turned into bread (output). This conversion of wheat flour into bread is the process of creating utility. Utilities can be created in three ways. These are the following:

1. *By changing form or shape and size of a good.* The powdery wheat flour has been changed to slices of bread. Thus form of the good has been changed. Likewise, a carpenter giving shape of a chair to a piece of wood or a chef turning a lump of dough into delicious pizzas, are the examples of changing shape or size of a good/s and thereby creating utility.

2. Using the scarce goods and services in proper time when they are most required. Government maintains a buffer stock so that during the time of crisis, it releases food grains in the market to meet the demand.

3. By transferring a good from one place to another where its use is worthwhile. Sand transferred from river side to construction site increases its utility.

Thus, production is the process of adding utility to a good through form utility, place utility and time utility.

MEANING OF PRODUCTION FUNCTION

Production function is defined as the functional relationship between physical inputs and physical outputs. According to Stigler, "*the production function is name given to the relationship*

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between the rates of input of productive services and the rate of output of product. It is the economist's summary of technological knowledge." Production function can be expressed as follows:

$$Q = f(a, b, c, d\ldots)$$

Where, Q stands for output, *a*, *b*, *c*, *d*…. are the productive resources or inputs that help producing Q output; *f* refers to function. Thus Q is the function of *a*, *b*, *c*, *d*….., which means Q depends upon *a*, *b*, *c*, *d*…..

Thus a production function shows the maximum amount of output that can be produced from a given set of inputs in the existing state of technology.

RETURNS TO A FACTOR AND RETURNS TO SCALE

There are generally two types of production functions mostly used in economics. First, the production function when the quantities of some inputs are kept fixed and the quantity of one or few input/s are changed. This kind of production functions are studied under law of variable proportions. These are also called short-run production function. The short-run is a period during which one or more factors of production are fixed in amount. There is no time to change plants or equipments of an enterprise.

Secondly, the production functions in which all inputs are changed. This forms the subject matter of the law of returns to scale. These are also called long-run production function. The long run is a period during which all factors become variable. A new plant can be constructed in place of an old one.

Law of Variable Proportions/Law of Diminishing Returns

Law of variable proportions occupies an important place in the economic theory. It examines the production function with one factor variable, keeping the quantities of other factors constant. This law tells us how the total output or marginal output is affected by a change in the proportion of the factors used. The law states that when one factor is increased keeping others fixed, the marginal and average product eventually declines. According to Stigler, *"As equal increments of one input are added; the inputs of other productive services being held constant, beyond a certain point the resulting increments of product will decrease, i.e., the marginal products will diminish."* Thus, an increase in the quantities of a variable factor to a fixed factor results in increase in output to a point beyond which it eventually declines.

Assumptions of the law

The law assumes the following:

1. The state of technology is assumed to be constant.
2. There must be some inputs whose quantity is kept fixed.
3. The law is based upon the possibility of varying the proportions in which the various factors can be combined to produce a product. It cannot be applied to the cases where the factors must be used in fixed proportions to yield a product.