for price OP_2. For a higher price OP_1 the amount demanded is reduced to OM_1. For a lower price OP_3 the amount demanded goes up to become OM_3. These movements along the demand curve are called extension and contraction in demand. The movement upwards to the left is contraction. The movement downward to the right is extension of demand.

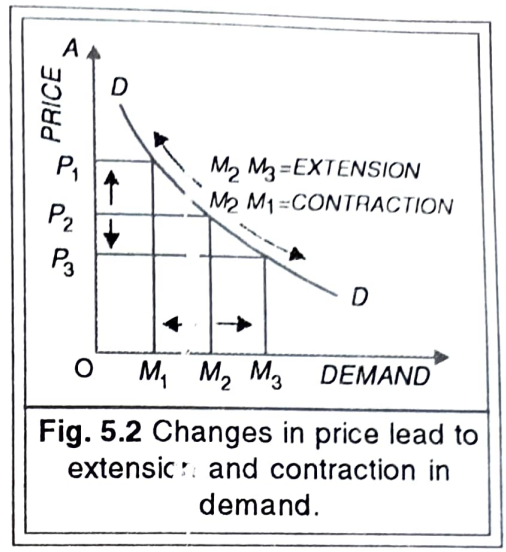
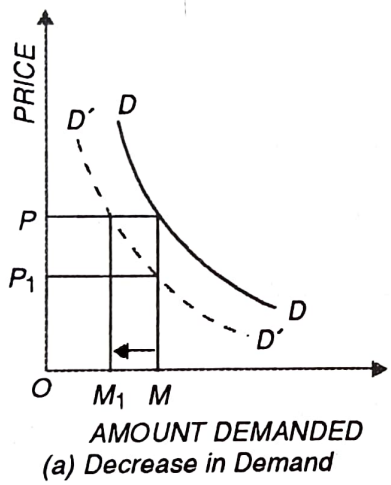


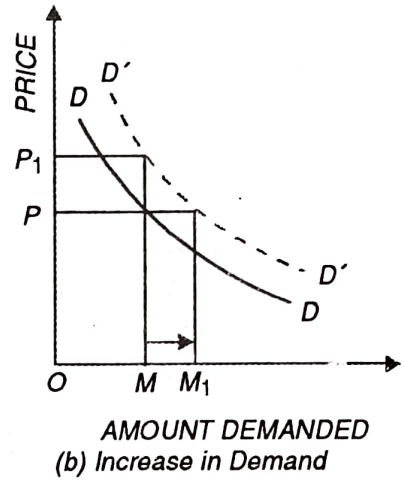
Fig. 5.2 Changes in price lead to extension and contraction in demand.

An increase in demand can be shown by a shift of demand curve to the right hand side, Graphically a decrease in demand is explained as follows. In Fig. 5.3(*a*) the decrease in demand is measured as MM_1. Here the price remains the same at OP. It is the amount demanded which falls.

Increase in demand is shown as a shift of the demand curve to the right hand side. This is shown in Fig. 5.3(*b*) by the shift of the demand curve DD to the position D′D′. Price remaining the same at OP, the amount demanded rises from OM to OM_1.



(a) Decrease in Demand



(b) Increase in Demand

Fig. 5.3.

In short, extension and contraction of demand follow a change in price. Increase and decrease in demand take place when price remains the same but other factors affecting demand are changed.

7. MEANING OF ELASTICITY OF DEMAND

Elasticity of demand is the measure of the degree of change in the amount demanded of commodity in response to a given change in price of the commodity, price of some related good or changes in consumers' income. This is the general definition of the term 'Elasticity of Demand'.

It should be clear from the above definition that elasticity of demand can be mainly of three types : (1) Price elasticity is responsiveness of demand to change in prices; (2) Income elasticity is the responsiveness of demand to changes in consumers income; (3) Cross elasticity is the responsiveness of demand for a commodity A to changes in the price of a related commodity B. We study these three types of elasticity of demand one by one.

8. PRICE ELASTICITY OF DEMAND

Price elasticity of demand is commonly called the elasticity of demand. This is because price is the most changeable factor influencing demand. Some popular definitions of the price elasticity of demand are :

"Elasticity of demand measures the responsiveness of demand to changes in price." Kenneth Boulding.

"The Elasticity (or responsiveness) of demand in a market is great or small according as the amount demanded increases much or little for a given fall in price and diminishes much or little for a given rise in price."-Alfred Marshall.

"The elasticity of demand for a commodity is the rate at which quantity bought changes as the price changes."-A.K. Cairncross.

$$\text{Elasticity of Demand} = \frac{\text{Proportionate change in Demand}}{\text{Proportionate change in Price}}$$

Writing in symbols, $E_p = \frac{\Delta Q}{\Delta p} \times \frac{p}{q}$

An example will illustrate the concept of price elasticity. Suppose, sugar is Rs. 5 per kg and its demand is 15 quintals in a small market. If the price falls to Rs. 4 per kg the amount demanded goes up to 30 quintals. Here change in demand is 15 quintals, the original demand was also 15 quintals. So the proportionate change in demand is 15/15 = 1. Now let us find out the pro portionate change in price. The absolute change in price is from Rs. 5 to Rs. 4; this means '–1'. The original price was Rs. 5. So the proportionate change in price is –1/5. Now, we can calculate the price elasticity of demand.

$$\text{Elasticity of Demand} = \frac{\text{Proportionate change in Demand}}{\text{Proportionate change in Price}}$$

$$= \frac{-1}{1/5} = 1 \times \frac{-5}{1} = -5$$

Thus, the demand for sugar is highly elastic. With 1 per cent change in its price, there is a 5 per cent change in its demand.

The elasticity of demand with regard to price of the commodity is always having a minus sign. This shows that price and demand are inversely related. The negative sign is not ordinarily used in writing the value of price elasticity of demand. The sign is understood.

Degrees of Price Elasticity of Demand

Elasticity of Demand for different commodities is different. Some commodities have more elastic demand while others have relatively inelastic demand. Elasticity of demand may have a value from zero to infinity. We can graphically show some particular values of elasticity of demand.

1. *Completely inelastic demand* is shown by a straight line demand curve which is parallel to vertical axis showing price. This means that whatever the changes in price may be, the amount demanded remains the same. In the case, price elasticity of demand is equal to zero.

2. *Perfectly elastic demand* is one in which a small change in price will cause an infinitely large change in amount demanded. A small rise in price on the part of the seller reduces

the demand to zero. A small reduction in price leads to such a big expansion in demand that no seller is able to satisfy this demand at the reduced price. This case of infinite elasticity of demand is shown by a straight line demand curve parallel to the horizontal axis.

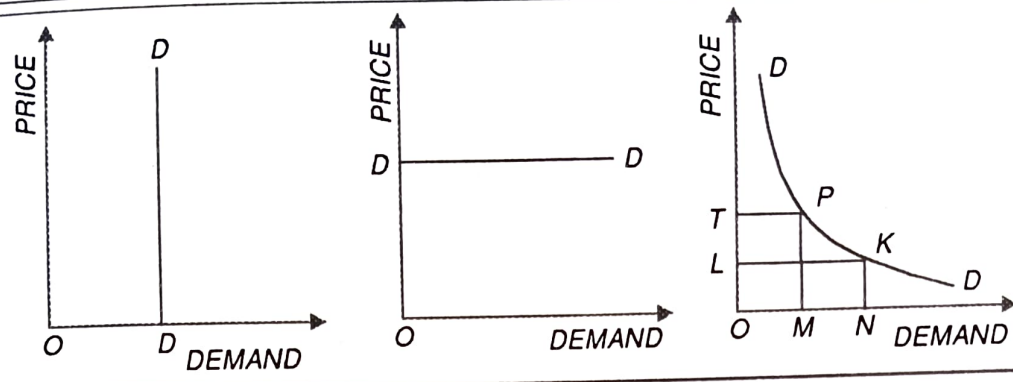


Fig. 5.4 Demand Curves with Different Elasticities.

3. *Unitary elasticity of demand.* This is a particular case of elasticity of demand in which a given percentage change in price leads to exactly the same percentage change in amount demanded. According to Marshall, a commodity has elasticity equal to one if the total expenditure of the consumers on the commodity remains the same even when the price changes. In practice, it is difficult to find such commodities as have a demand curve whose elasticity is equal to one throughout. Generally, a part of the curve may be having unitary elasticity.

In theory, a demand curve that subtends equal-area rectangles over the X and Y axis has unitary elasticity of demand. Such a demand curve is known in mathematics as a rectangular hyperbola. This curve is shown in panel C of the diagram 5.4. The two sides of the curve are such that they approach the two axes but never meet them. We can call this curve as a constant-total-outlay curve. This can be readily shown in the panel C of the diagram. Total expenditure is equal to the quantity demanded multiplied by price. In the diagram when the price is OT and the amount demanded OM, the total expenditure is $OT \times OM$ which is the area of the rectangle $OMPT$. At price OL, total expenditure is the area of the rectangle $ONKL$. Since the two rectangles are obtained by drawing perpendiculars from two points of a rectangular hyperbola to the X and Y axes, the rectangles have the same area even though their sides are different. According to Marshall when total expenditure remains the same with changes in price, elasticity of demand is equal to one. We can observe from the diagram that as we go up and down the demand curve, the points make rectangles with the two axes whose sides are longer and longer and breadth shorter. The total area of the rectangles is always equal. In general, we can say that whenever a part or whole of demand curve is of the shape of a rectangular hyperbola, its elasticity of demand on that part equals one.

4. *Relatively elastic and inelastic demand.* Those demand curves which have elasticity between zero and infinity are loosely classified as relatively inelastic and relatively elastic. We may say that demand elasticity between zero and one may be termed relatively inelastic. A higher value of elasticity than one may be called relatively elastic. On the basis of the sign and value of the price-elasticity of demand for a commodity, it is usually classified as a necessity, a comfort and a luxury. Necessities of life like wheat atta or rice have price-elasticities less than one. Comforts have slightly higher values of price elasticity. Luxuries have the highest values of price-elasticity. In all these cases the sign of price elasticity is minus. All these commodities obey the Law of Demand.

It is helpful to point out a common mistake made about elasticity of demand. It is that we cannot talk of the elasticity of a demand *curve except* in the three special cases shown in the diagram 5.4. Some text books call demand curve as elastic or inelastic which is altogether wrong. Elasticity of demand is shown by a point on demand curve or at the most over a small range of the demand curve. Different points on a demand curve, therefore, have different elasticities. It is wrong to say that a demand curve is elastic or inelastic.

A second type of mistake commonly made is to judge elasticity from the slope of a demand curve. Without any thought about the definition of elasticity, steeply sloped demand curves are called inelastic and the demand curves with gentle slope are referred to as elastic. It should be remembered that the slope of a demand curve shows the ratio between two absolute changes in price and in amount demanded. Elasticity of demand refers to the relative (percentage or proportionate) change in prices and resulting changes in demand. These two ratios can never be the same. This view may be verified from the fact that a straight line demand curve has the same slope throughout. Yet the elasticity of demand differs from point to point on the straight line demand curve.

9. MEASUREMENT OF PRICE-ELASTICITY OF DEMAND

Elasticity of demand can be measured through three popular methods. These methods are given next page :

Total Expenditure Method

Elasticity of demand can be measured from the changes in the expenditure of the consumers on the commodity as its price changes. Known also as the outlay method, it was given by Marshall. He distinguished between three separate cases of changes in total outlay resulting from a change in the price of the commodity. These three cases can be shown with the help of a table and a diagram.

In the Table 5.2, the price of the commodity goes down from rupees ten to rupee one. Suppose the amount demanded increases from one kilogram to ten kilograms. We can easily calculate the resulting changes in total outlay. These changes can be easily classified into three parts as shown in the table given below:

In the table, three separate cases of price elasticity of demand are easily traced out.

(*i*) If with a (small) change in price of the commodity total expenditure by consumers on its purchase remains the same, then the elasticity of demand within that range of price change is equal to one.

(*ii*) If with a 'small' fall in the price of the commodity total expenditure on it also falls, the elasticity of demand in that range of price change is said to be less than one. That is, if total outlay and price move in the same direction elasticity of demand is taken to be less than one. For example, in the lowest part of the given table, this is the case.

(*iii*) If a 'small' fall in price results in an increase of total outlay on the commodity, the elasticity of demand in this range of price variation is said to be greater than one. In such cases total outlay and price move in opposite directions. This is the case in our table in the first part.

Table 5.2 Total Expenditure and Elasticity

Price	Amount demanded	Total expenditure	Elasticity of demand expenditure	Direction of Price	Direction of total
Rs.	Kilos	Rs.			
10	1	10			
9	2	18	Greater than Unity	Down	Increasing
8	3	24			
7	4	28			
6	5	30	Equal to Unity	Down	Constant
5	6	30			
4	7	28			
3	8	24	Less than Unity	Down	Decreasing
2	9	18			
1	10	10			

Graphic Method–Point Elasticity

The second popular method of measuring elasticity of demand was also given by Marshall. In this method we make use of a demand curve drawn on a graph. Therefore, it is called the graphic method or the Geometrical method. The method can be illustrated with the help of a diagram.

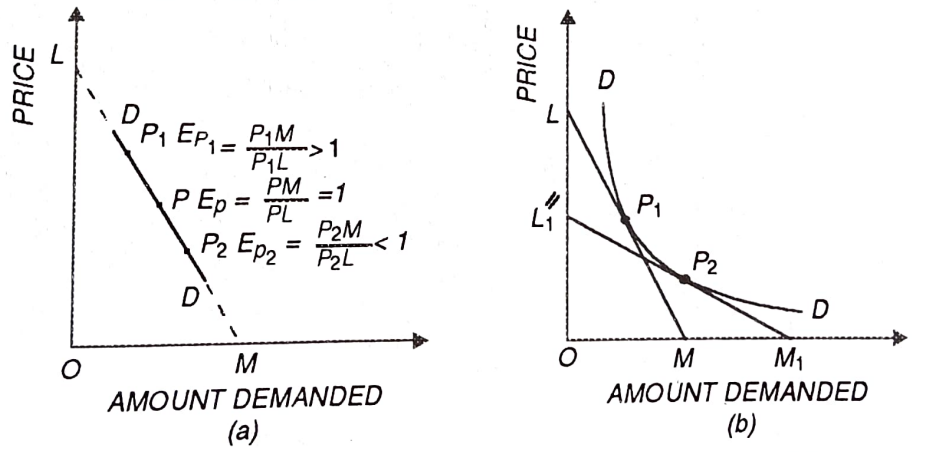


Fig. 5.5 Measuring Price Elasticity of Demand Geometrically.

In the figure 5.5, we have a straight line demand curve in the (*a*) portion of the diagram and a curve convex to the origin in the part (*b*) We can illustrate the method of finding out the price elasticity at any point of the demand curve.

Let us take the straight line demand curve *DD* in part (*a*). We join both sides of the straight line demand curve with the two axes at points *L* and *M*. Elasticity at any point *P* is equal to the ratio of the distance from the point *P* to the *X*-axis and the distance from *P* to the *Y*-axis. In the diagram the point *P* is half way between *M* and *L*.

Elasticity of Demand = $E_p = \frac{PM}{PL}$ (because *PM* is equal to *PL*) = 1.

Similarly, at the point P_1, elasticity of demand is equal to P_1M/P_1L. Here elasticity is greater than one because the point P_1 is higher than the mid-point P. By the same logic, Elasticity at the point P_2 is given as $P_2 M_1 /P_2L$, which is less than one.

In part (*b*) of the diagram we have the convex demand curve DD. Suppose we want to find out price elasticity at the point P_1. For this we draw a tangent LM at the point P_1. The elasticity is found easily as P_1M/P_1L. Similarly, for finding out elasticity at the point P_2 we draw a tangent at this point to the demand curve. The elasticity at this point is given by the ratio of the distance along the tangent to the X-axis divided by the distance to the Y-axis.

It should be remembered that the method of measuring price elasticity given above is designed to measure it around a point for small changes in price. Therefore, this measure is also called the point elasticity measure.

Mathematical Method

In this method, price elasticity is estimated by dividing the percentage change in amount demanded by the percentage change in price of the commodity. If the proportionate (percentage) change in amount demanded is higher than the percentage change in price, elasticity will be greater than one. In a mathematical form we can write :

$$E_p = \text{Price elasticity of Demand}$$

$$= \frac{\text{Proportionate change in Demand}}{\text{Proportionate change in Price}} = \frac{\text{Change in Demand}}{\text{Original Demand}} \div \frac{\text{Change in Price}}{\text{Original Price}}$$

The formula for price elasticity of demand given above suggests three different ways of finding out the proportionate change in demand and the proportionate change in price.

The first commonly adopted procedure is what Marshall called the point elasticity measure. If the difference between the original price and the new price is very small, then we get point elasticity measure through the above formula.

The formula given above tells us that price elasticity of demand is not simply a co-efficient or the slope of a curve of demand for the commodity. It is a ratio of the proportionate change in demand divided by the proportionate change in price. If we write q for the original demand and p for the original price, then Δp and Δq denote the absolute changes in demand and price respectively. And elasticity of demand is the ratio :

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

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

$$= \frac{\text{Original Price}}{\text{Original Demand}} \times \frac{\text{Change in Demand}}{\text{Change in Price}}$$

This shows that $\frac{\Delta q}{\Delta p}$ represents the slope of the demand curve which has to be multiplied with the ratio of price to quantity so as to get the estimate of price elasticity. *Thus, it should be clear that we cannot judge elasticity from the slope of a demand curve alone.*

Some writers such as Schnider and Bilas have suggested that we must not just take the original price or original demand in finding out price elasticity. It will be better *if* we take the lower value of the changed price and of the original price and the lower value of demand instead

of the original demand. Taking lower values of Q and P will ensure a realistic value of the price elasticity. It will avoid unnecessary over-estimation of price elasticity. An example shall make the point clear.

Suppose the price of mangos is Rs. 6 per kg and the amount demanded is 5 kilos. When price is reduced to Rs. 5, the amount demanded rises to 6 kilos. According to the total expenditure method the elasticity of demand shall be calculated as one, because the total expenditure remains the same at Rs. 30.

However, applying the mathematical method we have the following values:

$$p = 6,\ \Delta q = -1, \quad q = 5, \quad \Delta q = +1$$

$$E_p = \frac{p}{q} \times \frac{\Delta q}{\Delta p} = \frac{6}{5} \times \frac{-1}{1} = \frac{-6}{5} = -1.2$$

Now apply the formula using the lower quantity and the price. The relevant values for the formula are :

$p = 6$ but $p_1 = 5$, $\quad q = 5$ and q_1 is 6 kgs.

If we take the lower values of p and q,

$$E_p = \frac{p_1}{q_1} = \frac{5}{5} \times \frac{-1}{1} = -1.$$

Thus, we see that by taking the lower values of demand and price rather than the original values, we obtain a price elasticity measure which is consistent with the aggregate expenditure method.

10. CHOICE AMONG THE THREE METHODS

Which one of the three methods of measuring price elasticity of demand is the best ? The answer is that it all depends upon the objective of measuring we have before us and nature of price-demand data at our disposal. If we want an accurate measure of elasticity, the mathematical method using the average price and quantity may be the most desirable method. If our aim is simply to know whether price elasticity is greater than or less than one, we may use the total expenditure method. However, if we are dealing with a demand curve and the data is plotted on a graph, the graphic method is the only one to be used. However, use of graphic method is only for theoretical purposes. Its practical use is nil.

11. FACTORS AFFECTING PRICE ELASTICITY OF DEMAND

Price elasticity of demand depends upon a number of factors. The main factors are as follows :

1. Availability of Substitutes. If a commodity has close substitutes available at reasonable prices, then the demand for the commodity will be quite price elastic. The demand for Campa-Cola is elastic because a substitute Thumbs-up is easily available at a competitive price.

2. Nature of the Commodity. Price elasticity for necessaries of life is low while that for luxuries is quite high. The amount of demand in case of foodgrains does not change much because it is a necessity. The demand for butter and eggs is quite price-elastic because these are luxuries for the poor common man.

3. Number of Uses of a Commodity. The greater the number of uses to which a commodity is put, the higher is the elasticity of demand. For example, coal is used for many purposes. If its price rises, the less important users will not purchase coal and the amount demanded will fall appreciably. Contrary to this, ordinary women's jewellery has no other use and, therefore, its demand is relatively inelastic.

4. Possibility of Postponing the Purchase of a Commodity. Price elasticity is also affected by the possibility or otherwise of the postponement of the purchase of a commodity. for example, if woolen clothes become costlier, the middle class people try to get their old suits repaired and postpone the purchase of new woollen clothes. As a result, price elasticity will be high in this case.

5. Level of Income of the Consumers of the Commodity. Price elasticity of demand for a commodity also depends upon the income of the consumers of the commodity. Price elasticity of demand from the high income class for high quality mangoes is low because the expenditure on mangoes for this class forms only a minor part of the total expenditure. On the other hand, price elasticity for high quality mangoes from the poorer classes is very high.

6. Habitual Necessities. Those commodities whose consumption is a habit with consumers have low price elasticity. For example, the prices of cigarettes and liquor are rising but their demand has not diminished. It is price-inelastic.

7. Place of the Commodity in the Consumer's Budget. The demand for a commodity is less elastic, lesser is the proportion of expenditure on the commodity by the consumer such items as shoe-polish, newspaper, tooth paste and tooth powder have inelastic demand. If their prices rise, the consumer is not worried about his budget and, therefore, does not seek substitutes. On the other hand, demand for durable commodities claiming a good deal of income of the consumer is quite elastic. Examples are television, steel-almirahs, etc.

8. Prevailing Price Level of the Commodity. Price elasticity of demand also depends upon whether the price prevailing in the market is relatively high or low from the viewpoint of common consumers. Highly priced commodities such as diamonds, and low-priced commodities such as salt have low price elasticity because a change in their price has very little effect on their consumers. But commodities having price in the middle range are quite price-elastic because their consumers are quite conscious of their price; examples are radios, transistors, etc.

9. Time Period Under Consideration. Price elasticity in the short period is low while in the long period it will be relatively higher. This is because it is possible for consumers to change their consumption habits in favour of cheaper substitutes and against the expensive commodities. Therefore, in the long period, elasticity is generally higher for all the commodities.

10. Joint Demand. Price elasticity for a commodity is also dependent upon the nature of price elasticity of jointly-demanded commodities. If the demand for cars is inelastic the demand for petrol will also be inelastic. The elasticity of demand for ink depends directly on the nature of elasticity of demand for pens.

12. IMPORTANCE OF PRICE ELASTICITY OF DEMAND

Price elasticity of demand is a very useful concept for producers, farmers. workers and the Government. Lord Keynes considered price elasticity to be the most important contribution of Marshall. The practical importance of this concept should be clear from the following applications.

1. Determination of Price and Output. Every producer has to decide his volume of output and the price at which he has to sell it. In these decisions, elasticity of demand is one of the very relevant informations. If the demand is less elastic price will be higher. If the demand is elastic, a lower price is fixed.

2. Price Discrimination. A monopolist adopts a price discriminatory policy only when the elasticity of demand from different consumers or sub-markets is different. Those consumers whose demand is inelastic can be charged a higher price than those with more elastic demand.

3. Price Determination in Cases of Joint Supply. Jointly supplied goods are those which are the products of the same production process; for example, wood and mutton. The price determination of these joint products becomes a little difficult due to joint costs of production. In such cases, the concept of price elasticity of demand comes to our help. If the demand for wool is inelastic as compared to the demand for mutton, a higher price for wool is chargedand a lower price for mutton.

4. Explanation of the Paradox of Poverty of Farmers. The incomes of farmers are lower in a year of exceptionally-good harvest because of the sudden drop in the price of their produce as compared to the incomes in a year when the harvest is rather poor. This is called the paradox of poverty. It is commonly said that a good harvest brings poverty to the farmer. This paradox is easily explained by the inelastic nature of demand for most agricultural products. Since the demand is inelastic, prices of agricultural products are lower when their supply is high. The phenomenon is easily explained with the help of the diagram (Fig. 5.6) given here.

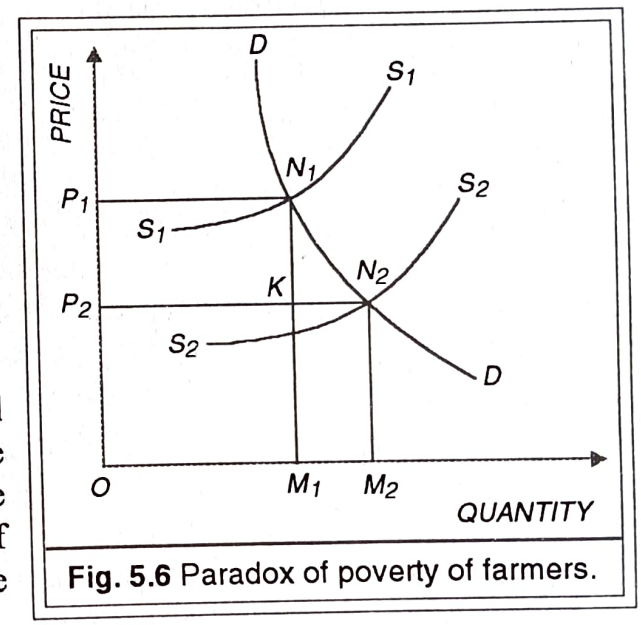


Fig. 5.6 Paradox of poverty of farmers.

In the figure 5.6, the quantity of supply and demand for an agricultural crop is shown on the horizontal axis and price on the vertical axis. The demand curve DD shows the inelastic nature of demand for the farmers' produce. The supply curve SS is shown to be quite price-elastic.

At price OP_1, the amount demanded of the produce and the amount supplied are equal to OM_1. The income of farmers is given by the area $OP_1 N_1 M_1$. This is the income when the farmers have a poor harvest, may be due to delayed, scanty monsoons. Now, in another year of good, timely monsoons when the farmers have a bumper harvest leading to a shift in their supply curve from $S_1 S_1$ to S_2S_2 , the farmers' income is given by the area of the rectangle $OP_2 N_2 M_2$. A good harvest must ordinarily have given to the farmers the hope of increased incomes. But actually their incomes are less than those in the year of bad harvest. If we compare the rectangles $OP_1 N_1 M_1$ and $OP_2 N_2 M_2$, we find that the gain in area due to the better harvest is equal to $M_1 KN_2 M_2$ while the loss in area is equal to $P_1 N_1 KP_2$. The loss in area (income) is much bigger than the gain in area resulting from a good harvest. It should be clear that higher agricultural production than what consumers ordinarily demand leads to a fall in farmers' income due to inelastic nature of demand for farm products. This is the paradox of poverty of farmers.

5. Determination of Sale Policy for Super Markets. Super markets are a combined set of shops run by a single organisation. These markets are supposed to sell commodities

at lower prices than are charged by shopkeepers in the bazar. The costs of marketing have also to be covered. Therefore, the policy adopted in the super forgaars is to charge a slightly lower price for goods whose demand is quite elastic. As a result of the greater sales, the costs are easily covered.

6. Effect of use of Machines on Labour Employment. The concept of price elasticity is useful in knowing the effect of introduction of machinery in factories. Workers often oppose the use of machines fearing unemployment. With the help of the concept of price elasticity of demand we can say that machines do not always reduce the demand for labour. It all depends on the price elasticity of demand for their manufacture. In some cases where machines reduce costs and prices of the products with elastic demand, the amount demanded of the same may go up. As a result, production may have to be increased and more workers employed. On the opposite, if the demand for production is inelastic, machines will replace workers.and create unemployment.

7. Use of the concept in factor pricing. The idea of price elasticity is helpful in explaining the relative shares of factors of production in the production process. The factors having price-inelastic demand for the goods they produce can obtain a higher price than those with elastic demand. For example, workers producing petro-products having inelastic demand can easily get their wages raised.

8. Use in International Trade. Elasticity of demand concept has importance in many aspects of international trade. For example, (1) a country benefits from such exports as have price-inelastic demand for a rise in price and elastic demand for a fall in price. For imports the opposite holds. That is, the demand for imports should be inelastic for a fall in price and elastic for a rise. These two qualities of imports and exports shall reduce the balance of payment problems. Secondly, the benefits of devaluation are obtained only when the demand for exports is price-elastic.

9. Importance in Taxation policy. The finance minister often taxes those commodities whose demand is price-inelastic. This increases total expenditure on the commodity and taxation revenue. Similarly in levying indirect taxes, the finance minister taxes those commodities which are having inelastic demand from the rich class. That way, the burden of taxation falls on the richer class.

10. Pricing Policy for Public Utilities. Such enterprises as provide services of mass consumption like water, electricity, elasticity postal services, railways and communication are known as public utilities. A suitable price policy for these enterprises is to charge consumers according to their elasticity of demand for the public utility. Household consumers are charged a higher rate of electricity than industrial consumers because the demand for electricity from households is less elastic compared to that from industrial consumers.

13. INCOME ELASTICITY OF DEMAND

Definition

The ratio of the percentage change in amount demanded as a result of a given percentage change in income of a consumer is called Income Elasticity of demand. According to Watson, "Income elasticity of demand means the ratio of the percentage change in the quantity demanded to the percentage change in income. Income elasticity measures the responsiveness of demand to

change in income. It gives us an idea of the sensitivity of demand for a commodity as consumer's income changes,

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

$$= \frac{\Delta q}{q} \div \frac{\Delta y}{y} = \frac{y}{q} \times \frac{\Delta q}{\Delta y}$$

where E_y is income elasticity of demand, Δq is the change in demand, q is original demand, y original income and Δy the change in income.

Suppose a consumer's income is Rs.100, and he purchases 10 kilos of sugar. If his income goes up to Rs. 110, he is prepared to purchase 12 kilos of sugar. We can find the income elasticity of demand here as

$$\frac{y}{q} \times \frac{\Delta q}{\Delta y} = \frac{100}{10} \times \frac{2}{10} = 2$$

Thus, the income elasticity of demand for sugar is 2 which means that the demand is quite income-elastic.

Types of Income Elasticity and Classification of Goods

An income demand curve shows the changes in amount demanded in response to changes in income. Figure 5.7 (*a*) shows the income-curve for a normal commodity. This curve shows positive income elasticity. The response of demand to income changes may be classified to be of three types: it is positive, negative and zero.

1. *Positive income elasticity of demand.* When the amount demanded of a commodity increases with increase in income and vice-versa, the income demand curve will be shown as positively-sloping from left upwards to the right. In this case the commodity is shown on the horizontal axis and income on vertical axis. The commodity is normal because the proportionate change in demand in response to a given change in income is strictly positive. It has a positive income-elasticity as shown in part (*a*) of the diagram given below.

2. *Zero income elasticity.* When the demand for a commodity does not respond to changes in income, it is said to be completely income inelastic. Examples are salt, kerosene oil and post cards. In these cases, the income demand curve is shown as a straight line parallel to

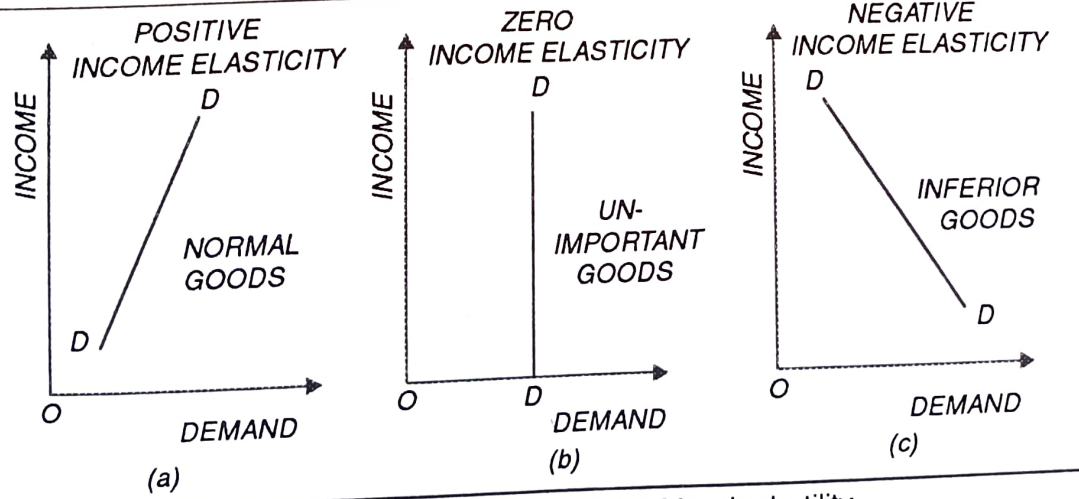


Fig. 5.7 The Law of Diminishing Marginal utility.

the vertical axis, as shown in part (*b*) of the diagram. Whatever the level of income, the demand remains at *OD*.

3. *Negative income elasticity.* When the amount demanded of a commodity diminishes with an increase in income of the consumer, the commodity is said to be an inferior one. In this case, the income demand curve will be shown as sloping from left downwards to the right as shown in part (*c*) of the diagram. The coarse foodgrains such as Jowar and Bajra are inferior goods.

Importance of Income Elasticity of Demand

The concept of income elasticity of demand is of theoretical and practical importance.

1. *Use in Capitalist Economies.* Income elasticity concept occupies an important place among the analytical tools applied for business research. In the U.S.A. the department of commerce has evolved another concept intimately related to income elasticity. This concept is of income sensitivity of consumption expenditure. The main point of difference between the two concepts is that while income elasticity concerns *physical units* of the commodity purchased, income sensitivity tells us about changes in *dollar expenditures*. Income sensitivity has a coefficient which measures the percentage increase in dollar expenditure associated with a one percentage change in disposable income in the same period. The income sensitivity estimates are of great use in business forecasting. It has been found that telephone service, automobiles, air-transportation, television repair and foreign travel have high income sensitivities (co-efficients equal to 1.5 or more) while shoes, clothing, local bus-transportation and dental care have a low income sensitivity (co-efficient less than 0.5).

2. *Importance in developing economies.* In less developed countries like India as level of living rises, demand for some commodities is expected to go up much faster than the demand for others. In the earlier stages income elasticity of demand for food tends to be high. Generally as income rises there is a shortage of food, which when not satisfied leads to inflation. Similarly, in urban areas the demand for comforts like superior foot-wears, auto-cycles and scooters, movies, readymade garments and medical care rises fast. As such these commodities have high income elasticities of demand which work to create an acute shortage of these goods and services. Rural areas in a developing economy tend to reduce the marketable surplus of food articles while putting a pressure on the demand for manufactures. The differing income elasticities and supply elasticities create problems of inter-sectoral in balance. If the planners know the income elasticities of demand of at least the goods and services of general use, steps can be taken to balance demand and supplies by introducing special controls. Thereby, the tendency of prices to rise due to high income-elasticities can be contained.

Income Elasticity and Decision Making

The income-elasticity for a firm's product is an important determinant of the firm's success at different stages of the business cycle. During periods of expansion, incomes are rising and firms selling luxury items such as gourmet foods and exotic vacations will find that the demand for their products will increase at a rate faster than the rate of income growth. However, during a recession, demand may decrease rapidly. Conversely, sellers of necessities such as fuel and basic food items will not benefit as much during periods of economic prosperity, but will also find that their markets are somewhat recession-proof. That is, the change in demand will be less than that in the economy in general.

Knowledge of income-elasticities can be useful in targeting marketing efforts. Consider a firm specialising in expensive men's footwears. Because such goods are luxuries, those in high income groups would be expected to be the prime customers. Thus the firm should concentrate its marketing efforts on media that reach the more wealthy segments of the population. For example, advertising rupees should be spent on the suitable space in the *Reader's Digest* and in *India Today*.

14. CROSS ELASTICITY OF DEMAND

When the demand for a commodity changes with a change in the price of another related commodity, the case is of related demand or Cross Demand. Cross Elasticity of demand measures the responsiveness of demand for a commodity, say tea, when the price of another related commodity, say coffee, changes by a small amount.

In the words of Liebhafsky, "The cross elasticity of demand is a measure of the responsiveness of purchases of Y to change in the price of X." Speaking out more exactly, Prof. Ferguson observes, "The cross elasticity of demand is the proportional change in the quantity of X demanded resulting from a given relative change in the price of the relative good Y."

Measurement of Cross Elasticity of Demand

$$E_{xy} = \frac{\text{Proportionate change in demand of } X}{\text{Proportionate change in the price of } Y}$$

Writing in symbols

$$E_{xy} = \frac{\Delta q_x}{q_x} \div \frac{\Delta P_y}{P_y} = \frac{\Delta q_x}{q_x} \times \frac{P_y}{\Delta P_y} = \frac{\Delta q_x}{\Delta p_y} \times \frac{P_y}{q_x}$$

where p and q have their usual meanings of price and quantity and Δ is the small change in it.

A numerical example will explain the concept of cross elasticity further. Suppose the price of coffee rises from Rs.10 per tin of 250 gms to Rs.12 per tin. As a result, consumers' demand for tea, an immediate substitute, rises from 70 kilos to 100 kilos. Then, the cross elasticity of demand of tea for coffee can be calculated as follows:

Δq_x = 100 – 70 = 30 kilos.

q_y = 70 kilos.

Δp_y = Rs. 12 – Rs. 10 = Rs. 2

p_y = Rs. 10

$$\text{Cross elasticity of demand} = E_{xy} = \frac{\Delta q_x}{\Delta p_y} \times \frac{P_y}{q_x} = \frac{30}{2} \times \frac{10}{70} = 2.14$$

Classification of Commodities through Cross Elasticity

Cross elasticity of demand can be used to classify goods into three types :

1. *Substitute goods.* Examples of substitute goods are tea and coffee. The cross elasticity of demand for these goods is positive, because a rise in the price of tea will raise the demand for coffee. The rise in demand for coffee as a result of the rise in the price of tea will give a positive coefficient of cross elasticity.

2. *Independent goods.* Such goods as eggs and diesel engines have no price relationship with one another. If eggs go cheaper, the demand for diesel engines remains unaffected. The value of cross elasticity in such cases is zero; these are, therefore, called 'independent goods'.

3. *Complementary goods.* Milk and sugar are examples of complementary goods. When the price of milk rises, its demand falls. Since sugar is used along with milk, demand for sugar will also fall. The value of cross elasticity in this case will be negative because the price of milk and the demand for sugar move in opposite directions.

Cross Elasticity and Decision Making

Many large limited companies produce several related products. Gillette makes both razors and razor blades. Ford sells several competing brands of automobiles. When a company's products are related, the pricing of one good can influence the demand for other products. Gillette will probably sell more razor blades if it lowers the price of its razors. In contrast, if the price of Maruti Esteem is reduced, sales of Maruti Zen may decline. Information regarding cross elasticities can help decision-makers in assessing such impacts.

Cross elasticities are also useful in establishing boundaries between industries. Sometimes, it is difficult to determine which products should be included in an industry. For example, should the manufacturing of cars and trucks be considered one industry or two ? One way of answering such questions is to specify industries based on cross elasticities. This approach defines an industry as including firms whose products exhibit a high positive cross elasticity. Goods and services with negative or small cross-elasticities are considered to belong to different industries. This definition of industry might seem to be an unimportant matter, but the choice can have important implications. For example, the outcomes of anti-monopoly cases alleging illegal monopolies are sometimes determined primarily by the industry definition used by the judges assigned to the case.

15. DERIVATION OF THE POINT ELASTICITY MEASURE IN THE GRAPHICAL METHOD

Proof of the point elasticity formula given by Marshall is simple to understand. We use the following figure to help us in the proof.

RT is the straight line demand curve on which points A and C are taken to show a very small change in price from OP to OP_1. As a result of this change in price from OP to OP_1, amount demanded rises from OQ to OQ_1 .

$$\text{Thus, Price-elasticity of Demand} = \frac{\text{Proportionate change in Demand}}{\text{Proportionate change in Price}}$$

Change in Demand = QQ_1

Change in Price = PP_1

$$E_p = \frac{\dfrac{\text{Absolute change in Demand}}{\text{Original Demand}}}{\dfrac{\text{Absolute change in Price}}{\text{Original Price}}}$$