Notes

# 14

# CONSUMER'S EQUILIBRIUM

We buy many goods and services to satisfy our wants. Using up of goods and services to satisfy wants is called consumption and the economic agent who buys goods and services is called a consumer. When a consumer buys any good or service, his/her main objective is to get maximum satisfaction from the quantity of the commodities purchased by spending his/her income at the given market price. How does a consumer maximize his/her satisfaction from spending his/her income on various goods and services is the subject matter of this chapter.

## OBJECTIVES

After completing this lesson, you will be able to:

- understand the meaning of consumer's equilibrium;
- understand the meaning of utility, marginal utility and total utility;
- understand the relationship between total utility and marginal utility;
- explain the law of diminishing marginal utility;
- explain consumer's equilibrium, based on utility analysis;
- understand the meaning of indifference curve, indifference map, budget line, budget set and marginal rate of substitution; and
- derive consumer's equilibrium using indifference curve and budget line.

## 14.1 MEANING OF CONSUMER'S EQUILIBRIUM

Equilibrium means a state of rest from where there is no tendency to change. A consumer is said to be in equilibrium when he/she does not intend to change his/her level of consumption i.e., when he/she derives maximum satisfaction. Thus, **consumer's equilibrium refers to a situation where the consumer has achieved**

**maximum possible satisfaction from the quantity of the commodities purchased given his/her income and prices of the commodities in the market.** As the resources are scarce in relation to unlimited wants, a consumer has to follow some principles or laws in order to attain the highest level of satisfaction.

There are two main approaches to study consumer's equilibrium. They are as follows:

1. Cardinal utility approach (or Marshall's utility analysis)
2. Ordinal utility approach (or indifference curve analysis)

## 14.2 CARDINAL UTILITY APPROACH

The theory of consumers behaviour by using utility approach was first given by the noted economist Alfred Marshall.

Before discussing how a consumer attains equilibrium , we need to understand the concept of utility, marginal utility and total utility.

### (i) Utility

**Utility is defined as the power of a commodity to satisfy a human want.** Utility of a commodity is the total amount of psychological satisfaction that a person gets from consumption of a good or service, e.g. a thirsty person derives satisfaction from drinking a glass of water. So a glass of water has got utility for the thirsty person. Utility differs from person to person. Utility is subjective and cannot be measured quantitatively. Yet for the sake of convenience it is measured in 'utils'. Marshall suggested that the measurement of utility should also be done in monetary terms by converting 'util' into money by using the following formula Utility in Money = Utility in Util/Utility of a rupee. Utility of rupee can be assumed to be any number such as 1, 2, 3 ... . Let utility of a rupee is assumed to be 2 utils.

Then 10 utils = $\frac{10}{2}$ = ₹ 5.

### (ii) Marginal Utility (MU)

**Marginal utility is the addition to the total utility derived from the consumption of an additional unit of a commodity.** It can also be defined as the utility from the last unit of a commodity consumed. Let us explain the concept of marginal utility with the help of an example. Suppose, a consumer gets total utility of 10 utils from consumption of one orange and 18 utils from two oranges. He gets 8 utils from consumption of second orange. So, marginal utility of second orange is 8 utils. If total utility derived from three oranges is 24 utils then marginal utility of

three oranges is 6 utils (i.e. 24-18 utils). In this case third orange is the last orange. Thus marginal utility of 3 oranges is 6 utils. Marginal utility can be calculated by the following formula:

$$MU_n = TU_n - TU_{n-1}$$

or

$$MU = \frac{\Delta TU}{\Delta X}$$

Where $MU_n$ = Marginal utility of nth unit of the commodity

$TU_n$ = Total utility of n units

$TU_{n-1}$ = Total utility of n–1 units

$X_n$ = Quantity of nth unit of good X

$X_{n-1}$ = Quantity or (n–1)th unit of good X

"n" takes the values 1, 2, 3, ... .

### (iii) Total utility

**Total utility is the total satisfaction obtained from the consumption of all possible units of a commodity.** For example, if the first orange gives you a satisfaction of 10 utils, second one gives you 8 utils and third one gives you 6 utils, then total utility from three oranges = 10 + 8 + 6 = 24 utils. Total utility can be obtained by summing up marginal utilities from consumption of different units of a commodity. Thus, total utility can be calculated as:

$$TU_n = MU_1 + MU_Z + MU_3 + ..... MU_n$$

or

$$TU_n = \Sigma MU$$

where, $TU_n$ = Total utility from n units of a given commodity

$MU_1$, $MU_2$, $MU_3$, $MU_n$ = Marginal utilities from 1st, 2nd 3rd and nth unit of the commodity

## 14.3 RELATIONSHIP BETWEEN TOTAL UTILITY AND MARGINAL UTILITY

The relationship between total utility and marginal utility is explained with the help of following table 14.1 and Fig. 14.1.

**Table 14.1**

| Units of Oranges Consumed | Marginal Utility (Utils) | Total Utility (Utils) | |
|---|---|---|---|
| 0 | – | 0 | TU increases at diminishing rate (MU is positive) |
| 1 | 10 | 10 | |
| 2 | 8 | 18 | |
| 3 | 6 | 24 | |
| 4 | 2 | 26 | |
| 5 | 0 | 26 | TU is maximum when MU is zero |
| 6 | –2 | 24 | TU falls when MU is negative |

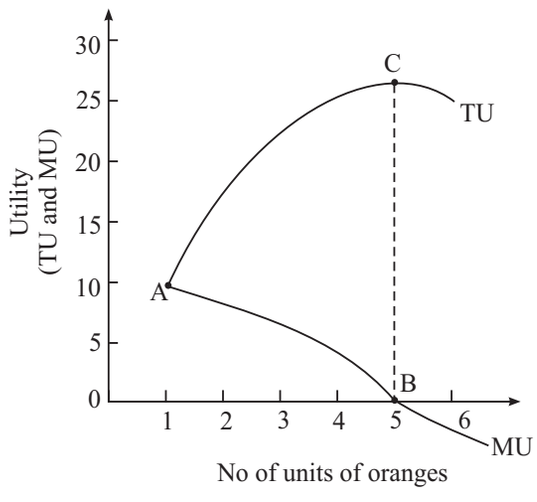


**Fig. 14.1**

1. MU is the rate of change of TU. It means that Total Utility increases as long as marginal utility is positive. In the table 14.1 marginal utility is declining between the range AB but is positive. So total utility is increasing at decreasing rate.
2. Total Utility is maximum when marginal utility is zero. At point B, MU = 0, and the corresponding point on TU is C where TU is maximum.
3. Total utility starts declining when marginal utility becomes negative (i.e., less than zero)

## 14.4 LAW OF DIMINISHING MARGINAL UTILITY

It is a matter of common observation that as we get more and more units of a commodity, the intensity of our desire for that commodity tends to diminish. The law of diminishing marginal utility also explains the same thing. It states that **'as more and more units of a commodity are consumed, marginal utility derived from each successive unit goes on diminishing.'**

The law can be explained with the help of an example. Suppose, a thirsty man drinks water. The first glass of water he drinks will give him maximum satisfaction (utility), say, 20 utils. Second glass of water will also fetch him utility but not as much as the first one because a part of his thirst is satisfied by drinking the first glass of water. Suppose he gets 10 utils from the second glass. It is just possible that he may get zero utility from the third glass because his thirst has now been satisfied. There will be negative utility from the fourth glass of water. Any rational consumer will not consume additional glass of water when it gives disutility or negative utility.

### 14.4.1 Assumption of Law of Diminishing Marginal Utility

The law of diminishing marginal utility operates under certain specific conditions. These are called assumptions of the law. Some important assumptions of the law are:.

1. It is assumed that utility can be measured and a consumer can express his satisfaction in quantitative terms like 1, 2, 3 etc. We have already said that unit of measurement of utility is 'util'. So utility is cardinal.
2. Quality of the commodity should not undergo any change. Take the above example of glass of water. From the quality point of view a consumer who drinks a glass of cold water must continue with the same. He or she cannot change its quality from cold to normal as normal water give different satisfaction.
3. Consumption should not proceed at intervals. It should be a continuous process. Continuing with the above example, second glass of water, if consumed two hours after the first glass of water was consumed, may give more, less or equal satisfaction.
4. Consumer should be a rational person. This means that he/she prefers more quantity to less quantity of a good.
5. Time period of consumption should not be too long. Consumer's tastes, habits, income etc. may change if the time gap is more.
6. The price of the substitute and complementary goods should not change. If these prices change, it may be difficult to predict about the utility derived from the commodity in question.

### 14.4.2 Exceptions to the Law of Diminishing Marginal Utility

Some of the important exceptions to the law are following:

(i) A miser is not a good subject for this law. His desire for more wealth may in fact increase with every successive increase in the accumulation of wealth.

(ii) A collector of rare articles like stamps, coins, paintings etc. may escape this law.

(iii) The law may not apply when it comes to a melody recital or a beautiful scenic view.

These are in fact the only real exceptions of the law and these too do not prove real hurdles to the application of the law. It is easy to visualize that a miser or stamp collector or a musician may find their marginal utilities increasing instead of decreasing as postulated by the law. But this tendency shall not last for long having reached a particular stage; the law must come into operation.

## INTEXT QUESTIONS 14.1

1. What is meant by consumer's equilibrium?
2. Define the following:
   (i) Utility (ii) Marginal Utility (iii) Total Utility
3. State the law of diminishing marginal utility.
4. What will be the total utility when marginal utility is zero?

## 14.5 CONSUMER'S EQUILIBRIUM IN CASE OF A SINGLE COMMODITY

Consumer's equilibrium in case of a single commodity can be explained on the basis of the law of diminishing marginal utility. How does a consumer decide as to how much to buy of a good? It will depend upon two factors.

(a) The price she pays for each unit which is given and

(b) The utility she gets

At the time of purchasing a unit of a commodity, a consumer compares the price of the given commodity with its utility. The consumer will be at equilibrium when marginal utility (in terms of money) equals the price paid for the commodity say 'X' i.e. $MUx = P_X$. (Note that marginal utility in terms of money is obtained by dividing marginal utility in utils by marginal utility of one rupee).

If $MU_X > P_x$, the consumer goes on buying the commodity because she is paying less for each additional amount of satisfaction. As she buys more, MU falls due to operation of law of diminishing marginal utility. When MU becomes equal to price, consumer gets maximum satisfaction and now she is at equilibrium. When $MU_X$

$< P_x$, the consumer will have to reduce consumption of the commodity to raise his total satisfaction till MU becomes equal to price. This is because she is paying more than the additional amount of satisfaction that she is getting.

Consumer's equilibrium (in case of single commodity) can be explained with the help of table 14.2. Suppose, the consumer wants to buy a good which is priced at ₹.10 per unit. Further, suppose, MU obtained from each successive unit is determined. Assumed that 1 util = Re. 1.

**Table 14.2: Consumer's Equilibrium (in case of a single commodity)**

| Consumption (Units of X) | Price (₹) ($P_X$) | $MU_X$ (Utils) | $MU_X$(₹) (1 Util = Re. 1) | Difference | Remarks |
|---|---|---|---|---|---|
| 1 | 10 | 20 | 20/1 = 20 | 10 | $MU_x > P_x$, consumer will |
| 2 | 10 | 16 | 16/1 = 16 | 6 | increase the consumption |
| 3 | 10 | 10 | 10/1 = 10 | 0 | $MU_x = P_x$, consumer's equilibrium |
| 4 | 10 | 4 | 4/1 = 4 | –6 | $MU_x < P_x$, consumer will |
| 5 | 10 | 0 | 0/1 = 0 | –10 | decrease the consumption |
| 6 | 10 | –2 | –2/1 = –2 | –12 | |

It is clear from the table 14.2 that the consumer will be at equilibrium when he buys 3 units of the commodity X. He will increase consumption beyond 2 units as MUx $> P_x$. He will not consume 4 units or more of the commodity X as $MU_x < P_x$.

## 14.6 CONSUMER'S EQUILIBRIUM IN CASE OF TWO OR MORE COMMODITIES

The law of diminishing marginal utility applies in case of one commodity only. But in real life a consumer normally consumes more than one commodity. In such a situation, law of equi-marginal utility helps in optimum allocation of his income. Law of equi-marginal utility is based on law of diminishing marginal utility. According to the law of equi-marginal utility a consumer will be in equilibrium when the ratio of marginal utility of a commodity to its price equals the ratio of marginal utility of other commodity to its price.

Let a consumer buys two goods X and Y. Then at equilibrium

$MU_x/P_x = MU_Y/P_Y$ = MU of last rupee spent on each good, or simply MU of Money.

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \frac{MU_Z}{P_Z} = MU_{Money} - MU_{Money}$$

Similarly if there are three goods X, Y, Z then the condition of equilibrium will be simply MU Money.

Thus, to be in equilibrium

1. Marginal utility of the last rupee of expenditure on each good is the same.
2. Marginal utility of a good falls as more of it is consumed.

To explain the consumer's equilibrium in case of two goods let us take an example. Suppose a consumer has ₹ 24 with him to spend on two goods X and Y. Further, suppose price of each unit of X is ₹ 2 and that of Y is ₹ 3 and his marginal utility schedule is given in table 14.3.

**Table 14.3: Consumer's Equilibrium (in case of two goods)**

| Units | $MU_X$ | $MU_X/P_x$ (A Rupee worth) of MU | $MU_Y$ | $MU_Y/P_Y$ (A Rupee worth) of MU |
|---|---|---|---|---|
| 1 | 20 | 20/2 = 10 | 24 | 24/3 = 8 |
| 2 | 18 | 18/2=9 | 21 | 21/3=7 |
| 3 | 16 | 16/2 = 8 | 18 | 18/3=6 |
| 4 | 14 | 14/2 = 7 | 15 | 15/3 = 5 |
| 5 | 12 | 12/2 = 6 | 12 | 12/3 = 4 |
| 6 | 10 | 10/2=5 | 9 | 9/3=3 |

For obtaining maximum satisfaction from spending his income of ₹ 24, the consumer will buy 6 units of X by spending ₹ 12 (₹ 12 = 2 × 6) and 4 units of Y by spending ₹ 12 (₹ 12 = 2 × 6). This combination of goods brings him maximum satisfaction (or state of equilibrium) because a rupee worth of MU in case of good X is 5 (MUx/Px = 10/2) and in case of good Y is also 5

($MU_Y/P_Y$ = 15/3)

(= MU of last rupee spent on each good)

It should be noted that, consumer's maximum satisfaction is subject to-budget constraints i.e. the amount of money to be spent by the consumer (₹ 24 in this example)

### What happens when the consumer is not in equilibrium?

Suppose, MUx/Px is greater than MUy/Py. This means that MU from last rupee spent on X is greater than the MU of the last rupee spent on Y. This induces the consumer to transfer his expenditure from Y to X. As a consequence, MUx falls and MU rises. The act of transfer of expenditure continues until MUx/Px becomes equal to MUy/Py.

## 14.7 LIMITATION OF UTILITY ANALYSIS

In the utility analysis, it is assumed that utility is cardinally measurable, i.e., it can be expressed in quantitative term. However, utility is a feeling of mind and there cannot be a standard measure of what a person feels. So, utility cannot be expressed in figures.

## INTEXT QUESTIONS 14.2

1. State the necessary condition for consumer's equilibrium in case of a single good.
2. What are necessary conditions for consumer's equilibrium in case of two goods?

## 14.8 ORDINAL UTILITY APPROACH (INDIFFERENCE CURVE ANALYSIS)

You have already studied the utility approach which was based on the assumption that utility is measurable numerically (like 1 util, 2 utils, 3 utils). This is called cardinal utility approach. **Prof. J.R.** Hicks criticized the utility approach as unrealistic because satisfaction (utility) is a subjective phenomenon and so it can never be measured precisely. He, therefore, presented an alternative technique known as indifference curve approach (also called ordinal utility approach). It is based on the assumption that every consumer has a scale of preference in the form of assigning ranks (like 1st 2nd, 3rd rank) to different combinations of two goods called bundle and can tell which bundle he likes most.

Before we proceed to discuss the consumer's equilibrium through indifference curve approach, let us understand some useful concepts related to indifference curve analysis.

### (i) Meaning of Indifference Curve

When a consumer consumes various goods and services, then there are some combinations (bundles) which give him same satisfaction. The graphical representation of such combinations is termed as indifference curve.

An indifference curve is a curve that shows all those combinations (bundles) of two goods which give equal satisfaction to the consumer.

Table 14.4 shows an indifference schedule showing all the combinations of good X and good Y giving 'equal satisfaction to the consumer.

**Table 14.4: Indifference Schedule**

| Combinations | Good X (Units) | Good Y (Units) | Marginal Rate of Substitution ($\Delta Y/\Delta X$) |
|---|---|---|---|
| A | 1 | 8 | – |
| B | 2 | 4 | 4Y: 1X |
| C | 3 | 2 | 2Y: 1X |
| D | 4 | 1 | 1Y : 1X |

Combinations A, B, C and D of good X and Y viz. (1X + 8Y), (2X + 4Y), (3X + 2Y) and (4X + 1Y) give the consumer equal satisfaction. In other words, consumer is indifferent between these combinations of good X and good Y. When these combinations are represented graphically, we get an indifference curve as shown in Fig. 14.2.

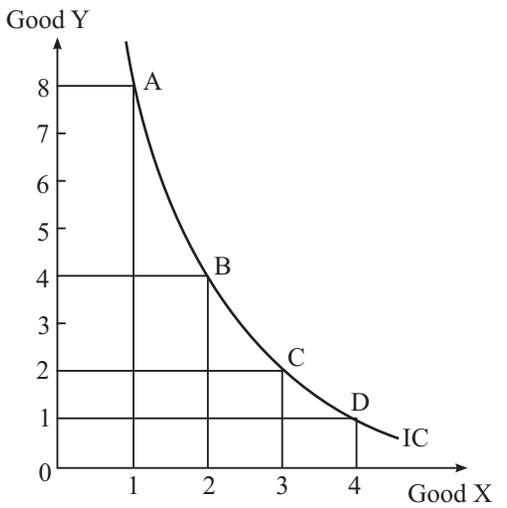


**Fig. 14.2**

### (ii) Monotonic Preferences

Consumer's preferences are called monotonic if and only if between two bundles, consumer prefers the bundle which has more of at least one of the good and no less of other good as compared to other bundles. For example, between the bundles

(2X + 2Y), (1X + 2Y), (2X + 1Y) and (1X + 1Y), the consumer will prefer only bundle (2X + 2Y) to all the three bundles, if his preferences are monotonic.

### (iii) Indifference Map

**An indifference map is a collection of indifference curves that represent different levels of satisfaction.** Higher indifference curves represent higher level of satisfaction because higher indifference curves represent more quantities of both the goods or same quantity of one good and more quantity of other good.

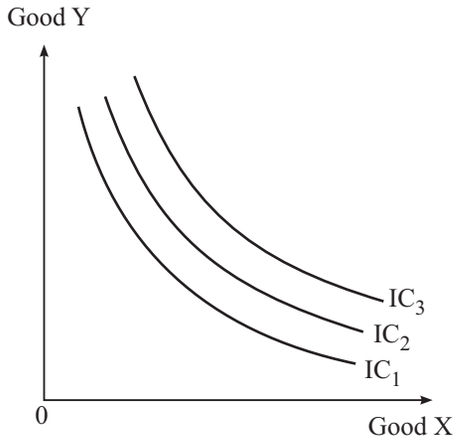


**Fig. 14.3** Indifference Map

An indifference map containing three indifference curves $IC_1$, $IC_2$ and $IC_3$, is drawn in Fig. 14.3. All the bundles on $IC_2$ give more satisfaction to the consumer in comparison to $IC_1$. Similarly, the bundles on $IC_3$ give more satisfaction to the consumer in comparison to $IC_1$ and $IC_2$. This is a result of monotonic preferences.

### (iv) Budget Line

A budget line graphically represents all possible combinations of two goods which a **consumer can buy with his entire income at the prevailing market prices.** Anywhere on the budget line consumer is spending his entire income either on single or both the goods. Suppose, the consumer wants to buy good X and good Y; price of each unit of X is P and that of Y is $P_2$; Then

Accordingly the expenditure on X will be equal to $P_1X$ and the same on Y will be equal to $P_2Y$.

Total expenditure on good X and Y will be $P_1X + P_2Y$. Let the money required to buy these goods is denoted as M. So we can write that

$$P_1X + P_2Y = M$$

This is called the equation for budget line.

This is shown in Fig. 14.4

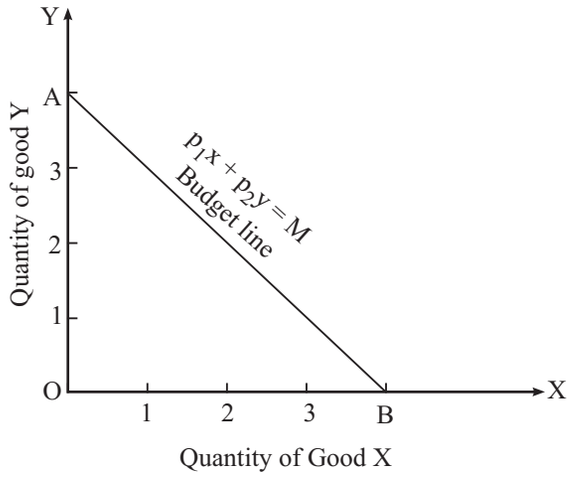


**Fig. 14.4**

In the Fig. 14.4, AB is the budget line. Point A is located by dividing the entire income over quantity of good Y only. Similarly point B is located by dividing the entire income over quantity of good X only. At any point on the line AB other than, A and B, the consumer can buy certain combination of X and Y by using her income.

A budget line changes when either the prices of the goods or income of the consumer or both changes. A budget line is negatively sloped because to buy more units of a good, consumer must buy less units of other good as consumer's income is fixed.

Slope of budget line = Quantity of other good sacrificed/ Quantity of good obtained = $\Delta Y/\Delta X$

Suppose, price of good X is ₹.2 and that of good Y is Re.1. So, he has to sacrifice 2 units of good Y to obtain one unit of good X. In this example,

Slope of budget line = $\Delta Y/\Delta X$

= 2/1

2/1 is nothing but the price ratio between good X and good Y. So the price ratio indicates the slope of budget line. Thus,

Slope of budget line = Px/Py. This is also called market rate of exchange (MRE) because the two goods can be exchanged at this rate, given their prices in the market.

### (v) Budget Set

**Budget set is the set of all possible combinations of two goods which a consumer can afford, given his income and market prices of the two goods.** So, a budget set includes all the bundles of two goods which consumer can afford even if her entire income is not spent.

### (vi) Marginal rate of substitution (MRS)

**Marginal rate of substitution refers to the rate at which consumer is willing to give up amount of other good to obtain one extra unit of the good in question without affecting total satisfaction.** So, the rate of substitution of one commodity for another is called marginal rate of substitution. It is expressed as MRSxy of good X for good Y. Symbolically, MRSxy = Loss of good Y/ Gain of good X = $\Delta Y/\Delta X$

$MRS_{xy}$ can be explained with the help of Fig. 14.5.

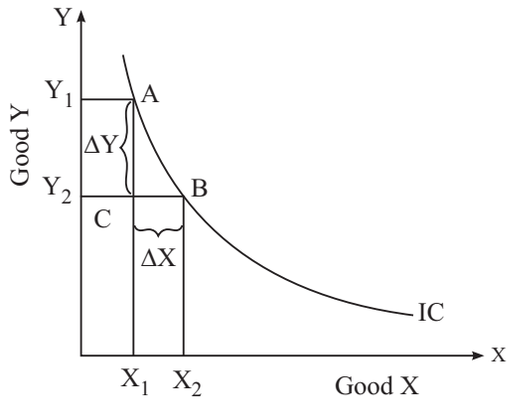


**Fig. 14.5**

$MRS_{XY} = \Delta Y/\Delta X = AC/CB$

AC/CB is the slope off indifference curve, i.e. slope of indifference curve = $MRS_{XY}$. As the consumer gets more and more units of good X, marginal utility of good X goes on falling with every increase in units of good X. Simultaneously, the consumer is left with lesser units of good Y. So, marginal utility of Y rises. Therefore, he is willing to give up lesser quantity of good Y for obtaining additional units of good X. Hence MRS diminishes along an indifference curve when we move from upwards to downward.

## 14.9 PROPERTIES OF INDIFFERENCE CURVES

### (i) Indifference Curves are always convex to the origin

Indifference curves are always convex to the origin because of diminishing marginal rate of substitution. As the consumer consumes more and more of one

good, his marginal utility of this good keeps on declining and he is willing to give up less of other good. Therefore, indifference curves are convex to the origin.

### (ii) Indifference Curves slope downwards

It implies that as a consumer consumes more of one good, he must consume less quantity of the other good so that the total utility remains the same.

### (iii) Higher Indifference Curves represent Higher level of satisfaction

Consider Fig. 14.6

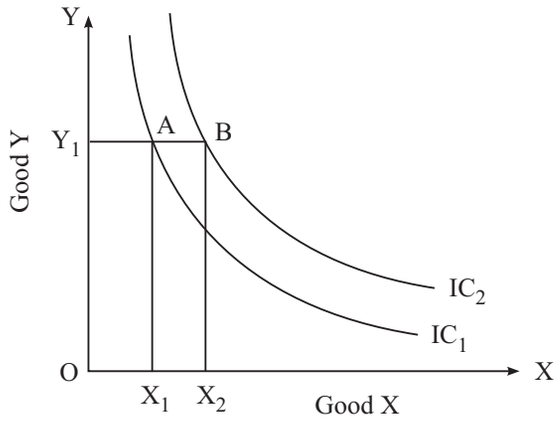


**Fig. 14.6**

Bundle A on indifference curve $IC_1$, contains $OY_1$ quantity of good Y and OX, quantity of good X. Bundle B on indifference curve $IC_2$ has same quantity i.e. $OY_1$ of good Y but more quantity i.e. $OX_2$ of good X. Since, the consumer's preferences are monotonic, he will prefer bundle B to bundle A. It means, higher indifference curves represent higher level of satisfaction.

### (iv) Indifference Curves can never Intersect

To analyze this, let us consider Fig. 14.7

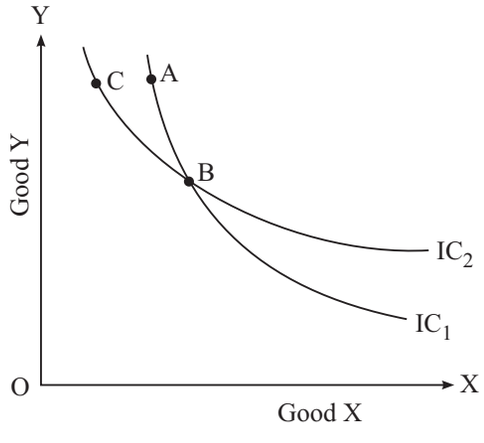


**Fig. 14.7**



We have two indifference curves that intersect at point B. The consumer is indifferent between bundles A and B as they lie on the same indifference curve $IC_1$. Similarly, the consumer is indifferent between bundles C and B as they lie on the same indifference curve $IC_2$. This implies that bundles A and C give the consumer the same level of satisfaction. However, this is not possible as higher indifference curve represents higher level of satisfaction.

## 14.10 ASSUMPTIONS OF INDIFFERENCE CURVES

Indifference curve analysis is based upon the following assumptions:

(i) It is assumed that the consumer has fixed amount of money whole of which is to be spent on two goods, given the market prices of goods.

(ii) It is assumed that the consumer has not reached the point of satiety. He always prefers more of both the commodities.

(iii) Consumer can rank his preferences on the basis of the satisfaction from each bundle of goods.

(iv) It is assumed that marginal rate of substitution is diminishing.

(v) Consumer is a rational person i.e. he always aims to maximize his satisfaction.

## 14.11 CONSUMER'S EQUILIBRIUM BY INDIFFERENCE CURVE ANALYSIS

As stated earlier, consumer's equilibrium refers to a situation when he gets maximum satisfaction and he feels no need to change his position, subject to his income and market prices of two goods.

### Condition of Consumer's Equilibrium

According to indifference curve approach, a consumer will be at equilibrium when:

(i) Budget line is tangent to the indifference curve.

i.e. slope of budget line = slope of indifference curve

Or, $MRS_{XY} = P_x/P_Y$

Suppose, two goods consumed are X and Y. Further suppose the consumer wants to increase consumption of good X in place of good Y. MRS is the rate/at which consumer is willing to sacrifice amount of Y to get one more unit of X. Market rate of exchange (MRE) is the rate at which consumer has to sacrifice amount of Y to get one more unit of X.

When MRS>MRE, it implies that in order to obtain one unit of X, the consumer is willing to sacrifice more units of Y than the market allows. This will lead to increase in consumption of X but decrease in consumption of Y. MRS starts falling. He continues to consume more of X till MRS becomes equal to MRE.

When MRS<MRE, it implies that inorder to get one more unit of X, the consumer is willing to sacrifice less units of Y than the market requires. He will reduce the consumption of X and increase consumption of Y. MRS Starts rising. He continues reducing consumption of X till MRS becomes equal to MRE.

To study consumer's equilibrium, let us study the Fig. 14.8

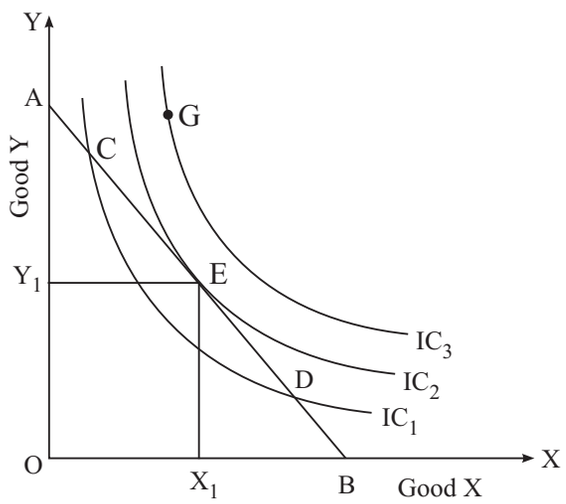


**Fig. 14.8**

Given the indifference map and the budget line, the consumer is at equilibrium at point E. The consumer obtains maximum satisfaction when, he consumes bundle E containing $OX_1$ quantity of good X and $OY_1$ quantity of good Y. At E point budget line is tangent to the indifference curve $IC_2$, i.e. MRS = MRE= Px/PY Note that the consumer can buy bundles C and D because they also lie on his budget line but these bundles lie on lower indifference curve which represents lower level of satisfaction. He will like to consume bundle G lying on indifference curve $IC_3$ which represents highest level of satisfaction but it is beyond his budget. So the consumer's equilibrium bundle is $X_1$, $Y_1$ at point E where the budget line is tangent to indifference curve.

## INTEXT QUESTIONS 14.3

1. What is an indifference curve?
2. Define marginal rate of substitution.
3. What do you mean by monotonic preferences? Give example.
4. State the conditions of consumer's equilibrium in indifference curve approach.

## WHAT YOU HAVE LEARNT

- Consumer's equilibrium refers to a situation when he/she spends his/her money income on purchase of a commodity/bundle in such a way that yields him/her maximum satisfaction and he/she feels no urge to change.
- Utility is the power of a commodity to satisfy a want.
- Marginal utility is the addition to the total utility derived from the consumption of an additional unit of a commodity, say good X.

$$\mathbf{MU_X} = \frac{\Delta TU}{\Delta X}$$

- Total utility (TU) is the total satisfaction obtained from the consumption of all possible units of a commodity.

  $TU_n = MU_1 + MU_2 + MU_3 + ..... MU_n$

- (i) TU increases when MU is positive

  (ii) TU is maximum when MU is zero

  (iii) TU falls when MU is negative

- Law of diminishing marginal utility states that 'as more and more units of a commodity are consumed, marginal utility derived from each successive unit goes on diminishing.'
- In case of a single commodity a consumer will be at equilibrium when marginal utility (in terms of money) equals the price paid for the commodity.

  i.e., $MU_X = P_X$, where X is the commodity.

- In case of two goods, a consumer will be in equilibrium when (i) the ratio of MU of a good to its price equals the ratio of MU of another good to its price, i.e. $MU_X/P_X = MU_Y/P_Y$ = MU of last rupee spent on each good. This is called law of equimarginal utility.
- An indifference curve is a curve that shows all those combinations of two goods which give equal satisfaction to the consumer

- An indifference map is a collection of indifference curves that represent different levels of satisfaction.-
- A budget line graphically represents all possible combinations of two goods which a consumer can buy with his entire income at the prevailing market prices.
- Budget set is the set of all possible combinations of two goods which a consumer can afford, given his income and market prices of the two goods.
- Marginal rate of substitution refers to the rate at which consumer is willing to give up amount of other good to obtain one extra unit of the good in question without affecting total satisfaction.
- Consumer's preferences are called monotonic if and only if between two bundles, consumer prefers the bundle which has more of at least one of the good and no less of the other good as compared to the other bundles.
- Properties of indifference curves are:
  - (i) Indifference curves are always convex to the origin;
  - (ii) Indifference curves always slope downwards;
  - (iii) Indifference curves never intersect;
  - (iv) Higher Indifference curves represent higher level of satisfaction.
- According to indifference curve approach a consumer will be in equilibrium when,
  - (i) Budget line is tangent to the indifference curve

    or $MRS = P_X/P_Y$

    or $MRS = MIRE$

## TERMINAL EXERCISE

1. What is meant by consumer's equilibrium? Explain the condition of consumer's equilibrium in case of a single commodity using utility approach.
2. Explain the condition determining how many units of a good the consumer will buy at a given price.
3. Explain the relationship between total utility and marginal utility.
4. Explain the law of diminishing marginal utility with the help of a schedule.
5. A consumer buys two goods X and Y. Explain the conditions of his equilibrium using utility approach.

6. A consumer buys two goods X and Y. Explain the conditions of his equilibrium using indifference curve approach.
7. Explain the properties of indifference curves.

## ANSWERS TO INTEXT QUESTIONS

### 14.1

1. Read section 14.1
2. (i) Read section 14.2(i)
   (ii) Read section 14.2(ii)
   (iii) Read section 14.2(iii)
3. Read section 14.3 (Maximum)

### 14.2

1. Read section 14.5
2. Read section 14.6

### 14.3

1. Read section 14.8(i)
2. Read section 14.8(vi)
3. Read section 14.8(ii)
4. Read section 14.11

Notes

# 15

# DEMAND

You have already studied in the previous lessons that goods and services have the power to satisfy our wants. We have unlimited wants. Most of them can be satisfied by goods and services. Therefore, we purchase goods and services from the market. Now a days the market is flooded with various types of goods. We cannot purchase all these goods since we have limited money. So, we have to make a choice between what to purchase and what not to purchase. We decide to purchase a good or a combination of goods depending on the amount of money we have and the price we have to pay. All these things are related with the study of **Demand**.

## OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of demand;
- differentiate between desire, want and demand;
- differentiate between individual demand and market demand;
- explain the factors that affect individual demand and market demand for a commodity;
- explain the Law of Demand;
- identify the reasons of law of demand as well as exception to law of deamand;
- prepare a hypothetical individual demand schedule and draw an individual demand curve;
- prepare a market demand schedule and draw a market demand curve; and
- Differentiate between movement along the demand curve and shift in the demand curve.

## 15.1 MEANING OF DEMAND

It is commonly observed that people alternatively use the terms desire, want and demand. In economics, they are not same. Desire means merely a wish to have a commodity. It is simply craving for a commodity. So any body can desire anything, irrespective of whether that thing is really available or not. On the otherhand, want is the desire which is backed by ability and willingness to pay. So every desire is not a want. Desire becomes a want only when the person is in a position to satisfy it.

By demand for a commodity we **mean** the desire for the commodity backed by purchasing power and the willingness to spend. When a consumer wishes to consume a commodity and has also the necessary purchasing power i.e. income along with willingness to spend, he is said to have demand for the commodity.

**Demand for a commodity refers to the quantity of a commodity that a consumer is willing to buy at a given price during a given period of time.**

The definition of demand highlights three essential elements of demand:

(i) price of the commodity

(ii) quantity of the commodity

(iii) period of time: the time period may be a day, a week, a month, a year or any other period.

Let us consider the following statements:

(i) Mr. Akshay purchased 2kgs. apples last week.

(ii) Mr. Akshay purchased 2Kgs. apples when the price of apples was ₹ 60 per kg.

(iii) Mr. Akshay purchased 2Kgs. apples last week when the price of apples was ₹ 60 per Kg.

The first two statements are incomplete in context of demand. In the first statement the price of apples is not stated. In the second statement period of time is not stated. The third statement is complete as it states the quantity of the apples, the price of apples and the time period during which the said quantity is demanded.

## 15.2 INDIVIDUAL DEMAND AND MARKET DEMAND

**Individual demand** for a commodity refers to the quantity of the commodity that an individual buyer is willing to buy at a given price during a given period of time. In the example given in the beginning of the lesson Akshay's demand for apple is the individual demand for apple.

But Akshay is not the only buyer of apple in the market. There may be other persons who may demand apples in the market. Let us assume that besides Akshay there are three more buyers of apples in the market Rohit, Ritik and Ajai. Market demand for apples will be the sum of demand of all the buyers of apples at a given price during a given period of time. Suppose, when price of apples is ₹ 60 per Kg., Akshay buys 2 Kgs. , Rohit buys 3 Kgs. , Ritik buys 2.5 Kgs. and Ajai buys 1.5 Kgs. of apples during a week then market demand for apples will be 2 + 3 + 2.5 + 1.5 = 9 kgs. at price ₹ 60 per kg.

Thus, **market demand** for a good means the total quantity of a commodity that all the buyers of the good are willing to buy at a given price over a given time period.

## INTEXT QUESTIONS 15.1

1. What is meant by demand for a commodity?
2. What are the three essential elements of demand?
3. How does a desire differ from demand?
4. Distinguish between individual demand and market demand?

## 15.3 FACTORS AFFECTING INDIVIDUAL DEMAND FOR A COMMODITY

The factors that influence a consumer's decision to purchase a commodity are also known as determinants of demand. The following factors affect the individual demand for a commodity:

1. price of the commodity
2. price of related goods
3. income of buyer of the commodity
4. tastes and preferences of the buyer

### 1. Price of the Commodity

You must have observed that when price of a commodity falls, you tend to buy more of it and when its price rises, you tend to buy less of it, when all other factors remain constant ('other things remaining the same'). In other words, **other things remaining the same, there is an inverse relationship between the price of a commodity and its quantity demanded by its buyers.** This statement is in accordance with law of demand which you will study in the later part of this lesson.

Price of a commodity and its quantity demanded by its buyers are inversely related only when 'other things remain the same'. So, 'other things remaining the same' is an assumption when we study the effect of changes in the price of a commodity on its quantity demanded.

## 2. Price of Related goods

A consumer may demand a particular good. But while buying that good he/she also asks the price of its related goods.

Related goods can be of two types-

(i) Substitute goods

(ii) Complementary goods

While purchasing a good, prices of its substitutes and complements do affect its quantity purchased.

**(i) Price of Substitute Goods: Substitute goods are those goods which can easily be used in place of one another for satisfaction of a particular want,** like tea and coffee. An increase in price of substitute good leads to an increase in demand for the given commodity and a decrease in price of substitute good leads to a decrease in demand for the given commodity. It means demand for a given commodity is directly affected by change in price of substitute goods. For example, if price of coffee increases, the demand for tea will rise as tea will become relatively cheaper in comparison to coffee.

**(ii) Price of Complementary goods: Complementary goods are those goods which are used together to satisfy a particular want** like car and petrol**.** An increase in the price of complementary goods leads to a decrease in demand for the given commodity and a decrease in the price of complementary goods leads to an increase in demand for the given commodity. For example, if price of petrol falls then the demand for cars will increase as it will be relatively cheaper to use both the goods together. So, demand for a given commodity is inversely affected by change in price of complementary goods.

## 3. Income of the Buyer of Commodity

Demand for a commodity is also affected by income of its buyer. However, the effect of change in income on demand depends on the nature of the commodity under consideration.

In case of some goods like full cream milk, fine quality of rice (Basmati rice) etc, demand for these commodities increases when income of the buyer increases and demand for these commodities decreases when income of the buyer decreases. Such goods, whose demand increases with the increase in income of the buyer, are called **normal goods.** But there are some goods like coarse rice, toned milk etc.

whose demand decreases when income of buyer increases and their demand increases when income of the buyer decreases. Such goods, whose demand decreases with the increase in income of the buyer, are called **inferior goods**. Suppose, a consumer buys 10 Kgs. of rice whose price is ₹ 25 per Kg. He cannot afford to buy better quality of rice because the price of such rice is ₹ 50 per Kg. The consumer is spending ₹ 250 per month on the purchase of rice. Now, if income of the consumer increases and he can afford ₹ 350 on purchase of 10 Kg. of rice. Now he can afford to buy some quantity of rice, say 6 Kgs., whose price is ₹ 25 per Kg. and may buy 4 Kgs. of rice whose price is ₹ 50 per Kg. Thus he will buy 10 Kgs. of rice by spending ₹ 350 per month.

Therefore, we may conclude that demand for normal goods is directly related to the income of the buyer but demand for inferior goods is inversely related to the income of the buyer.

### 4. Tastes and Preferences of the Buyer

The demand for a commodity is also affected by the tastes and preferences of the buyers. They include change in fashion, customs, habits etc. Those commodities are preferred by the consumers which are in fashion. So, demand for those commodities rises which are in fashion. On the other hand, if a commodity goes out of the fashion, its demand falls because no consumer will like to buy it.

## 15.4 FACTORS AFFECTING MARKET DEMAND FOR A COMMODITY

As stated earlier market demand is the total quantity of a commodity that all its buyers taken together are willing to buy at a given price during a given period of time. In addition to the factors affecting individual demand for a commodity, market demand is also influenced by the following factors:

### (i) Number of Buyers in the Market(Population)

Increase in population raises the market demand, whereas decrease in population reduces the market demand for a commodity. Not only the size of population but its composition like age (ratio of males, females, children and old people in population) also affects the demand for a commodity. It is because of needs of children, young, old, male and female population differ.

### (ii) Distribution of Income and Wealth

If the distribution of income and wealth is more in favour of the rich, demand for the commodities preferred by the rich such as comforts and luxuries is likely to be higher. On the other hand, if the distribution of income and wealth is more in favour of poor, demand for commodities preferred by the poor such as necessities will be more.

### (iii) Season and Weather Conditions

This is generally observed that the demand for woolens increases during winter whereas, demand for ice creams and cold drinks increases during summer. Similarly, market demand for umbrellas, rain coats increases during rainy season.

## INTEXT QUESTIONS 15.2

1. What are substitute goods? Give one example of substitute goods.
2. What are inferior goods? Give one example of inferior goods.
3. What are normal goods? Give one example of normal goods.

## 15.5 LAW OF DEMAND

We have already studied about the effect of change in price on demand for a commodity. The law of demand explains the relationship of price of a commodity and its quantity demanded, when all other factors affecting demand remain constant.

The law of demand states that **other things remaining same, quantity demanded of a commodity is inversely related to its price.** In other words, demand for a commodity rises when its price falls and its demand falls when price rises provided other factors remain unchanged.

The law of demand can better be explained with the help of table 15.1 and figure 15.1

**Table 15.1**

| Price (In ₹) | Quantity Demanded (In Units) |
|---|---|
| 1 | 10 |
| 2 | 8 |
| 3 | 6 |
| 4 | 4 |
| 5 | 2 |

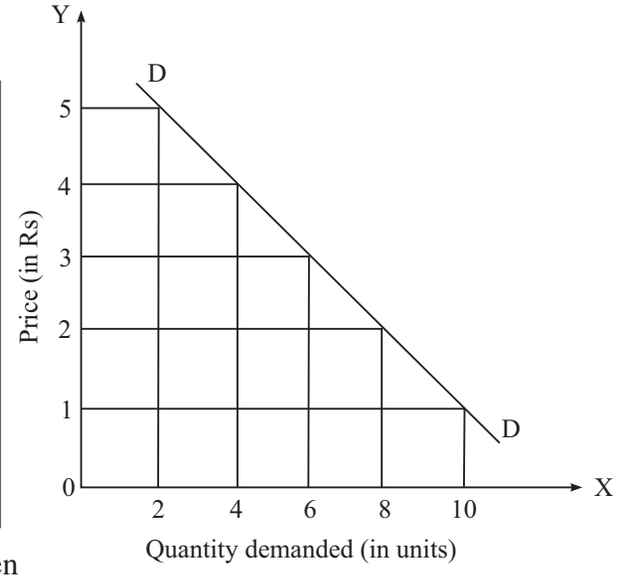


**Fig. 15.1**

As you see in table 15.1 when price of the commodity rises, quantity demanded decreases.

That is why the demand curve slopes downwards from left to right as shown in Fig. 15.1. Downward slope of demand curve shows the inverse relationship of price and quantity demanded of a commodity.

## 15.6 ASSUMPTIONS OF LAW OF DEMAND

In law of demand all other factors except price of the commodity are assumed to be constant. Therefore, we use the phrase 'other things remaining same'. This phrase is used to cover the following assumptions on which the law is based:

1. Prices of substitute goods do not change.
2. Prices of complementary goods do not change.
3. Income of the buyer remains the same.
4. There is no change in tastes and preferences of the buyer.

## 15.7 REASONS FOR OPERATION OF LAW OF DEMAND

Now we will try to explain why does a consumer purchase more quantity of a commodity at a lower price and less of it at a higher price or why does the law of demand operate i.e. why does the demand curve slope downwards from left to right. The main reasons for operation of law of demand are:

### 1. Law of Diminishing Marginal Utility

As you have studied earlier, law of diminishing marginal utility states that as we consume more and more units of a commodity, the utility derived from each successive unit goes on decreasing. The consumer will be ready to pay more for those units which provide him more utility and less for those which provide him less utility. It implies that he will purchase more only when the price of the commodity falls.

### 2. Income Effect

When price of a commodity falls, purchasing power or real income of the consumer increases which enables him to purchase more quantity of the commodity with the same money income. Let us take an example. Suppose you buy 4 ice creams when price of each ice cream is ₹ 25. If price of ice creams falls to ₹ 20, then with same money income you can buy 5 ice creams now.

### 3. Substitution Effect

When price of a commodity falls, it becomes comparatively cheaper as compared to its substitutes (although price of substitutes has not been changed). This will lead to rise in demand for the given commodity. For example, if coke and Pepsi

both are sold at ₹ 10 each and price of coke falls. Now coke has become relatively cheaper and will be substituted for Pepsi. It will lead to rise in demand for coke.

### 4. Change in Number of Buyers

When price of a commodity falls, some old buyers may demand more of the commodity at the reduced price and some new buyers may also start buying this commodity who were not in a position to buy it earlier due to higher price. This will lead to increase in number of buyers when price of the commodity falls. As a result demand for the commodity rises when its price falls.

### 5. Diverse Uses of a Commodity

Some commodities have diverse uses, like milk. It can be used for drinking, for sweet preparation, for ice cream preparation etc. If price of milk rises, its use may be restricted to important purpose only. This will lead to reduction in demand for other less important uses. When price of milk falls, it can be put to other uses also leading to rise n demand for it.

## 15.8 EXCEPTIONS TO THE LAW OF DEMAND

You have studied in law of demand that a buyer is willing to buy more quantity of a commodity at a lower price and less of it at a higher price. But in certain circumstances, a rise in price may lead to rise in demand. These circumstances are called Exceptions to the Law of Demand. Some important exceptions are:

### 1. Giffen Goods

Giffen goods are special type of inferior goods in which negative income effect is stronger than negative substitution effect. Giffen goods do not follow law of demand as their demand rises when their price rises. Examples of Giffen goods are jowar and bajra etc.

### 2. Status Symbol Goods

Some goods are used by rich people as status symbols, e.g. diamonds, gold jewellary etc. The higher the price, the higher will be the demand for these goods. When price of such goods falls, these goods are no longer looked at as status symbol goods and, tehrefore, therir demand falls.

### 3. Necessities

Commodities such as medicines, salt, wheat etc. do not follow law of demand because we have to purchase them in minimum required quantity, whatever their price may be.

### 4. Goods Expected to be Scarce

When the buyers expect a scarcity of a particular good in near future, they start buying more and more of that good even if their prices are rising. For example, during war, famines etc. people tend to buy more of some goods even at higher prices due to fear of their scarcity in near future.

## INTEXT QUESTIONS 15.3

1. State the law of demand.
2. State any two assumptions of law of demand.
3. State any two exceptions of law of demand.

## 15.9 INDIVIDUAL DEMAND SCHEDULE

In law of demand you have studied that other things remaining same, quantity demanded of a commodity is inversely related to its price. This inverse relationship of price and quantity demanded by an individual buyer can also be explained with the help of a schedule. **Individual demand schedule shows different quantities of a commodity demanded by an individual buyer at different prices. Such a schedule is given in table 15.2.**

**Table 15.2 Individual Demand for Apples**

| Price of Apples Per kg. (₹) | Quantity Demanded of Apples (per week) (In kgs.) |
|---|---|
| 90 | 1 |
| 80 | 2 |
| 70 | 3 |
| 60 | 4 |
| 50 | 5 |

The above schedule shows that when price of apples is ₹ 90 per Kg. quantity demanded is 1 Kg. per week. But when price falls to ₹ 80, ₹ 70, ₹ 60 and ₹ 50 per Kg. quantity demanded increases to 2 Kgs., 3 Kgs., 4 Kgs. and 5 Kgs. per week respectively. **So, the demand schedule is a tabular statement of law of demand. Demand schedule shows different quantities of a commodity demanded at different prices in tabular form.**

## 15.10 INDIVIDUAL DEMAND CURVE

Demand curve is a diagrammatic presentation of law of demand. If we plot the individual demand schedule on the graph paper, we will get a curve which is called as individual demand curve. Individual demand curve is shown in Fig. 15.2.

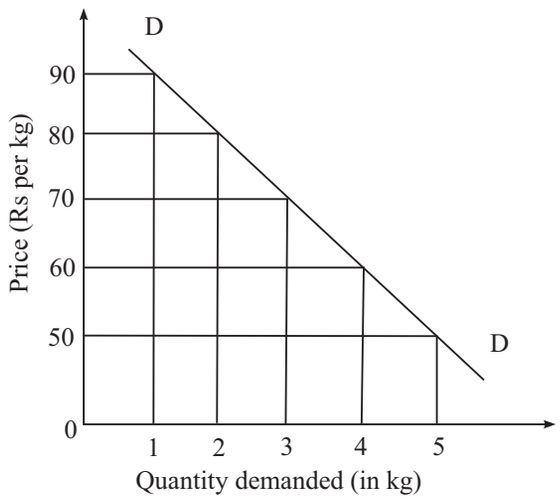


**Fig. 15.2:** Individual demand curve

As seen in the diagram, price is taken on Y-axis and quantity demanded on X-axis. Points A, B, C, E and F represent five combinations of price and quantity demanded of apples given in table 15.2. Point A shows that at the price of ₹ 90 per Kg. the quantity demanded of apples is 1 Kg. per week, Point B shows the quantity demanded is 2 Kgs. per week when the price is ₹ 80 per Kg. Similarly, the other combinations of price and quantities demanded of apples as given in table 15.2 are shown as points C, E and F. By joining these points individual demand curve for apples has been derived.

## 15.11 MARKET DEMAND SCHEDULE

As explained earlier, market demand is the total quantity of a commodity that all its buyers taken together are willing to buy at a given price during a given period of time. From the individual demand schedules of a commodity, we can prepare the market demand schedule of that commodity. We assume that there are only three buyers A, B and C of apples in the market. The demand schedules of these buyers are given in table 15.3.

**Table 15.3: Market Demand for Apples**

| Price of Apples | Quantity Demanded of Apples per week (In kgs.) | | | Market Demand of Apples per week (In kgs.) |
|---|---|---|---|---|
| | A | B | C | M.D. = A + B + C |
| 90 | 1 | 3 | 2 | 1 + 3 + 2 = 6 |
| 80 | 2 | 5 | 3 | 2 + 5 + 3 = 10 |
| 70 | 3 | 7 | 4 | 3 + 7 + 4 = 14 |
| 60 | 4 | 9 | 5 | 4 + 9 + 5 = 18 |
| 50 | 5 | 11 | 6 | 5 + 11 + 6 = 22 |

When price of apples is ₹ 90 per Kg. A demands 1 Kg. of apples, B demands 3 Kgs. of apples and C demands 2 Kgs. of apples. Thus market demand for apples at a price of ₹ 90 per Kg. is 1 + 3 + 2 = 6 Kgs. per week. Likewise, market demand for apples can be obtained at other prices also as shown in table 15.3.

## 15.12 MARKET DEMAND CURVE

Just as we plotted the individual demand curve on a graph paper, if we now plot the market demand schedule given in table 15.3, we will get the following figure 15.3.

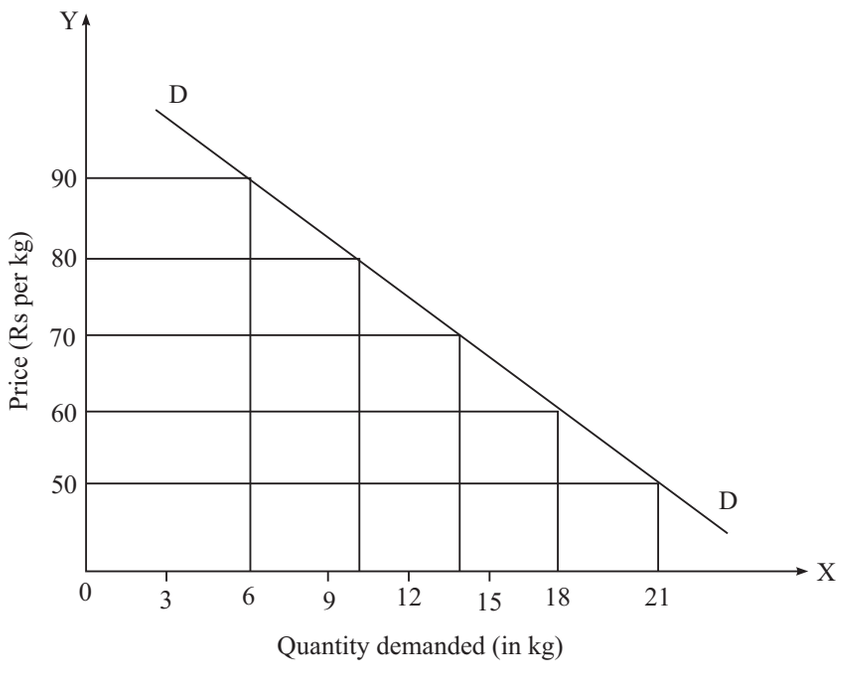


**Fig. 15.3**

In Figure 15.3 points F, G, H, I and J show the quantity demanded of apples per week in the market at each of the price given in schedule 15.3. Point F shows that the market demand per week of apples is 6 Kgs when the price of apples is ₹ 90 per Kg. Similarly, the other combinations of price and quantity demanded of apples as given in table 15.3 are shown as points G, H, I and J. By joining these points market demand curve for apples can be obtained. Thus, market demand curve is a horizontal summation of individual demand curves.

## 15.13 MOVEMENT ALONG THE DEMAND CURVE (CHANGE IN QUANTITY DEMANDED)

In law of demand you have already studied the inverse relationship between price and quantity demanded. When quantity demanded of a commodity changes due to change in its price, keeping other factors constant, it is called change in quantity demanded. It is graphically expressed as a **movement along the same demand curve**.

There can be either a downward movement or an upward movement along the same demand curve. Upward movement along the same demand curve is called **contraction of demand or decrease in quantity demanded** and downward movement along the same demand curve is known as **expansion of demand or increase in quantity demanded.** These can better be explained with the help of Fig. 15.4.

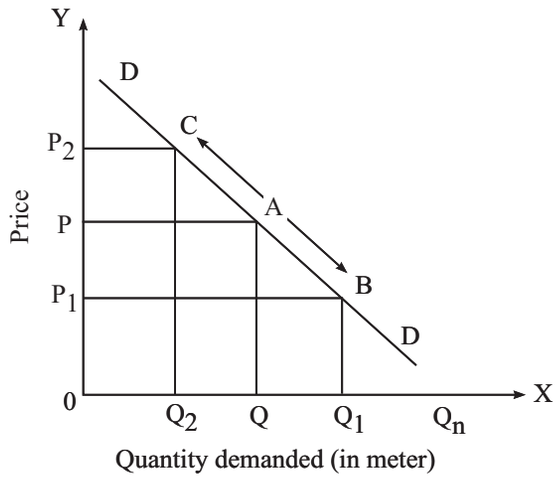


**Fig. 15.4:** Movement along the demand curve

A fall in price from OP to $OP_1$ leads to increase in quantity demanded from OQ to $OQ_1$ (expansion of demand) resulting in a downward movement from point A to point B along the same demand curve DD.

When Price rises from OP to $OP_2$, quantity demanded falls from OQ to $OQ_2$ (contraction of demand) leading to an upward movement from point A to point C along the same demand curve DD.

Expansion of demand and contraction of demand can also be explained through a demand schedule.

See the following demand schedules of apples in table 15.4 and 15.5:

**Table 15.4 Expansion of Demand**

| Price of apples (₹ Per kg.) | Quantity Demanded of apples per week (In kg.) |
|---|---|
| 70 | 3 |
| 60 | 4 |
| 50 | 5 |

As seen in table 15.4, as price of apples falls, quantity demanded of apples increases, showing expansion of demand. This is also called increase in quantity demanded.

**Table 15.5 Contraction of Demand**

| Price of apples (₹ Per kg.) | Quantity Demanded of apples per week (In kg.) |
|---|---|
| 70 | 3 |
| 80 | 2 |
| 90 | 1 |

You can see in table 15.5 when price of apples rises, quantity demanded falls showing contraction of demand. This is also called decrease in quantity demanded.

## 15.14 SHIFT IN DEMAND CURVE (CHANGE IN DEMAND)

In law of demand all factors other than price of the commodity are assumed to be constant. But what happens when other factors determining demand change but price remains constant? When the demand of a commodity changes at the same price, it means the change is due to change in anyone or more of the other factors that affect demand. **When the demand for a commodity changes due to change in any factor other than the price of the commodity, it is known as change n demand.** It is graphically expressed as **shift in demand curve.**

Demand curve of a commodity may shift due to change in price of substitute good, change in price of complementary goods, change in income of the buyer, change in tastes and preferences, change in population, change in distribution of income, change in season and weather etc.

The shift in demand curve can be explained with the help of Fig. 15.5:

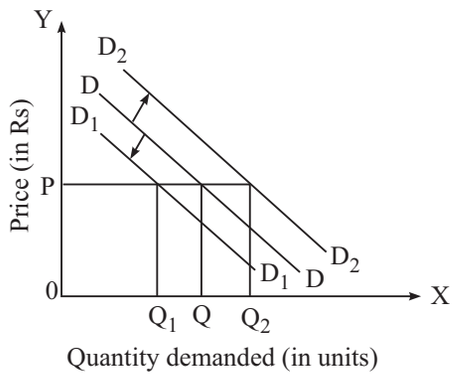


**Fig. 15.5:** Shift in demand curve

You can see in fig. 15.5 that quantity demanded decreases from OQ to $OQ_1$ at the same price OP. This decrease is due to unfavourable change in factors other than price of the commodity. This is called **decrease in demand.** When there is decrease in demand, the demand curve shifts towards left.

When quantity demanded increases from OQ to $OQ_2$ at same price OP, this is called **increase in demand.** Increase in demand is due to favourable change in factors other than price of the commodity. In case of increase in demand, the demand curve shifts towards right.

Increase in demand and decrease in demand can also be explained with the help of demand schedules. Table 15.6 explains increase in demand:

**Table 15.6 Increase in Demand**

| Price of Apples (₹ Per Kg.) (1) | Quantity Demanded of Apples (In kgs.) (2) | Quantity Demanded of Apples (In kgs.) (3) |
|---|---|---|
| 90 | 1 | 2 |
| 80 | 2 | 3 |
| 70 | 3 | 4 |

If you study table 15.6, you will find that at a price of ₹ 90per Kg. quantity demanded of apples rises from 1 Kg. to 2 Kg. Similarly at all other prices the quantity demanded of apples is more in column 3. This rise in demand is due to change in factors other than price of the commodity.

In the same way, we can prepare a demand schedule for decrease in demand. Table 15.7 explains decrease in demand:

**Table 15.7 Decrease in Demand**

| Price of Apples (₹ Per kg.) (1) | Quantity Demanded of Apples (In kgs.) (2) | Quantity Demanded of Apples (In kgs.) (3) |
|---|---|---|
| 70 | 3 | 2 |
| 60 | 4 | 3 |
| 50 | 5 | 4 |

Quantities of apples shown in column (3) of the table show the fall in demand at the same price. This fall in demand is due to unfavorable change in factors other than price of the commodity.

## INTEXT QUESTIONS 15.4

1. What is a demand schedule?
2. Complete the following table:

| Price (₹ Per Unit) | Quantity Household | Demanded Household | (Units) Household | Market Demand (Units) |
|---|---|---|---|---|
| | A | B | C | |
| 1 | 15 | 20 | 16 | – |
| 2 | 12 | 18 | 13 | – |
| 3 | 9 | 16 | 10 | – |
| 4 | 6 | 14 | 7 | – |
| 5 | 3 | 12 | 4 | – |

3. What is meant by expansion of demand of a commodity?
4. State any two factors which may lead to increase in demand for a commodity?

## WHAT YOU HAVE LEARNT

- Demand for a commodity is the quantity of a commodity that a consumer is willing to buy at a given price during a given period of time.
- Desire means a mere wish to have a commodity. Want is that desire which is backed by the ability and willingness to satisfy it. Demand is the want of a commodity at a given price during a given period of time.
- The main determinants of individual demand are: (i) Price of the commodity (ii) Price of related goods (iii) Income of the buyer and (iv) Tastes and preferences of the buyer.
- In addition to the factors affecting individual demand, market demand for a commodity is also affected by (i) Number of buyers in the market (ii) Distribution of income and wealth and (iii) Season and weather etc.
- The law of demand states that other things remaining same, quantity demanded of a commodity is inversely related to its price.
- The demand curve slopes downwards from left to right due to (i) Law of diminishing marginal utility (ii) Income effect (iii) Substitution effect (iv) Change in number of buyers and (v) Diverse uses of a commodity.
- Exceptions to the law of demand are: (i) Giffen goods (ii) Status symbol goods (iii) Necessities (iv) Goods expected to be scarce.
- Demand schedule is a tabular statement of different quantities of a commodity demanded at different prices.
- Individual demand schedule shows different quantities of a commodity demanded by an individual buyer and market demand schedule is an aggregate of all individual demand schedules in the market.
- Demand curve is a diagrammatic representation of law of demand.
- Individual demand curve shows different quantities of a commodity demanded by an individual buyer in a diagrammatic form. Market demand curve is a sum of horizontal slopes of all individual demand curves.
- When the quantity demanded of a commodity rises due to fall in price of a commodity, it is called expansion of demand or increase in quantity demanded.
- When the quantity demanded of a commodity falls due to rise in its price of a commodity, it is called contraction of demand or decrease in quantity demanded.
- In case of expansion of demand, there is a downward movement along the same demand curve and in case of contraction of demand, there is an upward movement along the same demand curve.

- When the quantity demanded of a commodity rises due to change in factors other than price of the commodity, it is called increase in demand.
- When the quantity demanded of a commodity falls due to change in factors other than price of the commodity, it is called decrease in demand.
- In case of increase in demand, the demand curve shifts towards right. In case of decrease in demand, the demand curve shifts towards left.

## TERMINAL EXERCISE

1. What is meant by the term 'demand'?
2. Distinguish between 'desire', want and 'demand' with suitable example.
3. Explain the factors affecting individual demand for a commodity.
4. How is demand for a commodity affected by increase in income of its buyer?
5. Distinguish between (i) Substitute goods and complementary goods (ii) Normal goods and inferior goods
6. State and explain the law of demand.
7. What are the reasons of law of demand?
8. Explain any three conditions in which law of demand does not operate.
9. Distinguish between expansion of demand and increase in demand.
10. Distinguish between contraction of demand and decrease in demand.

## ANSWERS TO INTEXT QUESTIONS

### 15.1

1. Read section 15.1
2. Read section 15.1
3. Read section 15.2
4. Read section 15.3

### 15.2

1. Read section 15.4
2. Read section 15.4
3. Read section 15.4

Notes

### 15.3

1. Read section 15.6
2. Read section 15.7
3. Read section 15.9

### 15.4

1. Read section 15.10
2. 51, 43, 35, 27, 19
3. Read section 15.14
4. Read section 15.15

Notes

# 16

# PRICE ELASTICITY OF DEMAND

You learnt that the law of demand which explains the inverse relationship between price and quantity demanded of a commodity. The law of demand explains only direction of change in quantity demanded but does not tell us by how much amount the quantity demanded changes due to change in the price. The response of quantity demanded to change in price of the commodity differs in different cases. This forms the subject matter of the study of price elasticity of demand.

## OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of elasticity of demand;
- explain the meaning of price elasticity of demand, income elasticity of demand and cross elasticity of demand;
- explain various degrees (types) of price elasticity of demand;
- explain methods of calculating price elasticity of demand;
- solve practical problems based on price elasticity of demand; and
- identify factors affecting price elasticity of demand.

## 16.1 MEANING OF ELASTICITY OF DEMAND

Demand for a commodity is affected by many factors such as its price, price of related goods, income of its buyer, tastes and preferences etc. Elasticity means degree of response. Elasticity of demand means degree of responsiveness of demand. Demand for a commodity responds to change in price, price of related goods, income etc. So, we have three dimensions of elasticity of demand:

**(i) Price elasticity of demand:** Price elasticity of demand means degree of responsiveness of demand for a commodity to the change in its price. For example, if demand for a commodity rises by 10% due to 5% fall in its price,

Price elasticity of demand ($e_p$)

$$= \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$= \frac{10}{(-)5} = (-)2$$

Note that $e_p$ will always be negative due to inverse relationship of price and quantity demanded.

**(ii) Income elasticity of demand:** Income elasticity of demand refers to the degree of responsiveness of demand for a commodity to the change in income of its buyer. Suppose, income of buyer rises by 10% and his demand for a commodity rises by 20%, then,

Income elasticity of demand ($e_y$)

$$= \frac{\text{\% change in quantity demanded}}{\text{\% change in price of the commodity}}$$

$$= \frac{20}{10} = 2$$

**(iii) Cross Elasticity of demand:** Cross elasticity of demand means the degree of responsiveness of demand for a commodity to the change in price of its related goods (substitute goods or complementary goods). Suppose, demand for a commodity rises by 10% due to 5% rise in price of its substitute good, then

Cross elasticity of demand ($e_c$)

$$= \frac{\text{\% change in quantity demanded}}{\text{\% change in price of related good}}$$

$$= \frac{10}{5} = 2$$

(Tastes and preferences cannot be expressed numerically. So elasticity of demand cannot be numerically expressed.)

## 16.2 DEGREES (TYPES) OF PRICE ELASTICITY OF DEMAND

You must have noticed that when price of salt rises, we go on consuming the same quantity of salt. In other words, quantity demanded of salt does not respond to the change in its price. But what happens when price of apples rises? We start purchasing less quantity of apples at higher price i.e. demand for apples responds when their price changes. So, degree of responsiveness of quantity demanded to a change in price may differ i.e. elasticity of demand could also differ. In this context, the price elasticity of demand is generally classified into following five categories:

**(i) Perfectly inelastic demand ($e_d = 0$) :** The demand for a commodity is called perfectly inelastic when quantity demanded does not change at all in response to change in its prices (See table 16.1). Graphically, the demand curve in parallel to y-axis as shown in Fig. 16.1.

**Table 16.1**

| Price (₹ Per kg.) | Quantity demanded (In kgs.) |
|---|---|
| 10 | 2 |
| 15 | 2 |
| 20 | 2 |

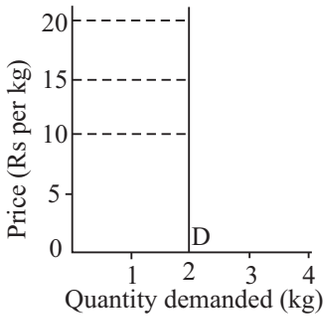


**Fig. 16.1**

**(ii) Less than unit elastic demand ($e_d < 1$) :** The demand for a commodity is called less than unit elastic or relatively inelastic when the percentage change in quantity demanded is less than the percentage change in price of the commodity (See table 16.2). Graphically, demand curve is steeper as shown in Fig. 16.2. The demand for necessary goods like medicines and food items etc. is less than unit elastic.

**Table 16.2**

| Price (₹ Per kg.) | Quantity demanded (In kgs.) |
|---|---|
| 10 | 4 |
| 20 | 3 |

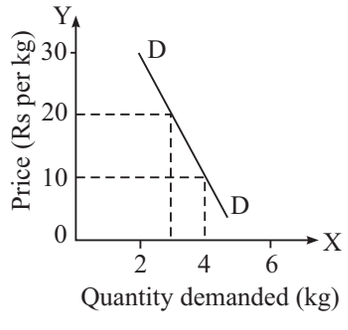


**Fig. 16.2**

You can see in table 16.2 that fall in quantity demanded is 75% in response to rise in price by 100%.

**(iii) Unit elastic demand ($e_d = 1$):** When percentage change in quantity demanded of a commodity equals percentage change in its price, the demand for the commodity is called unit elastic (See table 16.3). Graphically, demand curve is rectangular hyperbola as shown in fig. 16.3

(Rectangular hyperbola is a curve on which all the rectangles formed on the curve have same area).

**Table 16.3**

| Price (₹ Per meter) | Quantity demanded (In meters) |
|---|---|
| 20 | 40 |
| 30 | 20 |

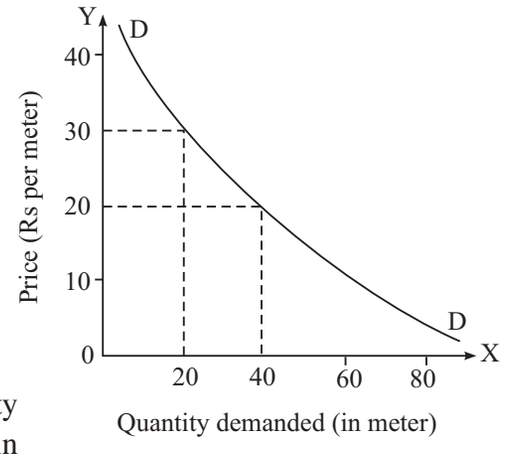


**Fig. 16.3**

You can see in table 16.3 that fall in quantity demanded is 50% in response to rise in price by 50%.

**(iv) More than unit elastic demand ($e_d > 1$):** When the percentage change in quantity demanded of a commodity is more than the percentage change in its price, the demand for the commodity is called more than unit elastic or highly elastic (see table 16.4). Graphically, the demand curve is flatter as shown in fig. 16.4. The demand for luxury goods is more than unit elastic.

**Table 16.4**

| Price (₹ Per unit) | Quantity demanded (In units) |
|---|---|
| 100 | 400 |
| 150 | 100 |

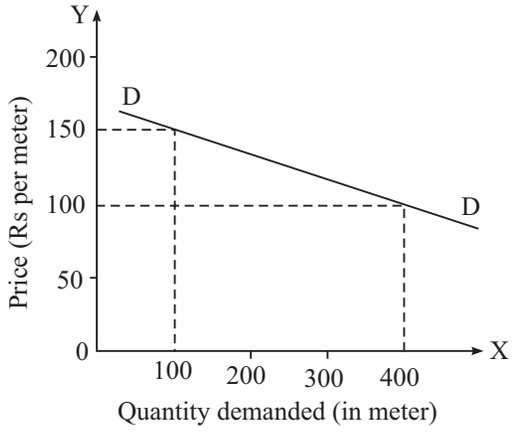


**Fig. 16.4**

In table 16.4 the quantity demanded has fallen by 75% in response to 50% rise in the price of the commodity.

**(v) Perfectly elastic demand ($e_d = \infty$):** The demand for the commodity is called perfectly elastic when its demand expands or contracts to any extent without

or very little change in its price (see table 16.5). Graphically, the demand curve is parallel to X-axis as shown in Fig. 16.5.

**Table 16.5**

| Price (₹ Per unit) | Quantity demanded (In units) |
|---|---|
| 20 | 2 |
| 20 | 4 |

In table 16.5 the quantity demanded of the commodity rises by 100% without change in its price.

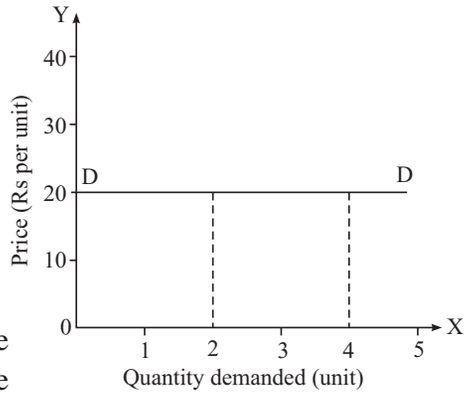


**Fig. 16.5**

## INTEXT QUESTIONS 16.1

1. Define the following:
   (i) Price elasticity of demand
   (ii) Income elasticity of demand
   (iii) Cross elasticity of demand
2. When the demand for a commodity is called elastic?
3. What is the likely shape of the demand curve when the demand for a commodity is unitary elastic?

## 16.3 METHODS OF MEASUREMENT OF PRICE ELASTICITY OF DEMAND

There are following two methods of measurement of price elasticity of demand:

(i) Percentage change method

(ii) Geometric method

In addition to the above mentioned two methods, we will also explain the measurement of price elasticity of demand on the basis of change in total expenditure incurred on the commodity.

### 16.3.1 Percentage Change Method

This method is also called **'proportionate method'** or flux method. According to this method price elasticity of demand is measured as a ratio of percentage change

in quantity demanded to the percentage change in price of the commodity.

Price elasticity of demand ($e_d$)

$$= \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

Percentage change in quantity demanded

$$= \frac{\text{Change in quantity } (\Delta Q)}{\text{Initial quantity } (Q)} \times 100$$

$$\text{Percentage change in price} = \frac{\text{Change in price } (\Delta P)}{\text{Initial price } (P)} \times 100$$

Therefore,

$$e_d = \frac{\frac{\Delta Q}{Q} \times 100}{\frac{\Delta P}{P} \times 100}$$

Where $\Delta Q$ = Change in quantity demanded

$Q$ = Initial quantity demanded

$\Delta P$ = Change in price

$P$ = Initial price

### Illustration 1

Calculate price elasticity of demand if quantity demanded of a commodity rises by 20% due to 8% fall in its price.

### Solution:

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$= \frac{20}{(-)8} = (-)\ 2.5$$

[This is to be noted that price elasticity of demand is always a negative number because of inverse relationship between price and quantity demanded. However, minus sign is often ignored while writing the value of elasticity.]

### Illustration 2

When price of a commodity is ₹ 10 per unit, its demand is 100 units. When the price falls to ₹ 8 per unit, demand expands to 150 units. Calculate price elasticity of demand.

### Solution:

$$e_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price of the commodity}}$$

$$\text{Percentage change in quantity demanded} = \frac{(150-100)}{100} \times 100 = 50\%$$

$$\text{Percentage change in price} = \frac{(-)2}{10} \times 100 = (-)20\%$$

So, $$e_d = \frac{50}{(-)20} = (-)2.5$$

We can also use the simplified formula for percentage change method.

$$e_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{150-100}{(8-10)} \times \frac{10}{100}$$

$$= \frac{50}{(-)2} \times \frac{10}{100}$$

$$= (-)\ 2.5$$

### Illustration 3

Price elasticity of demand of a commodity is (–) 2. A consumer demands 50 units of this commodity when its price is ₹ 10 per unit. At what price he will demand 40 units of this commodity?

### Solution:

$$e_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$\Rightarrow \quad (-)2 = \frac{40-50}{\Delta P} \times \frac{10}{50}$$

$$\Rightarrow \quad -2 = \frac{(-)10}{\Delta P} \times \frac{10}{50}$$

$$\Rightarrow \quad \Delta P = \text{Re 1 per unit}$$

$$\text{New price} = 10 + 1$$

$$= ₹\ 11 \text{ per unit}$$

### 16.3.2 Geometric Method

This method is also known as 'point method'. Geometric method is used to measure the elasticity at a point on the straight line demand curve. Elasticity of demand is different at different points on the same straight line demand curve.

According to the geometric method, elasticity of demand at any point of a straight line demand curve is measured as a ratio of lower segment of the demand curve and upper segment of the demand curve

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

Let us consider a straight line demand curve AB at which elasticity of demand is to be measured at point C, D, M, N, and P (Fig. 16.5).

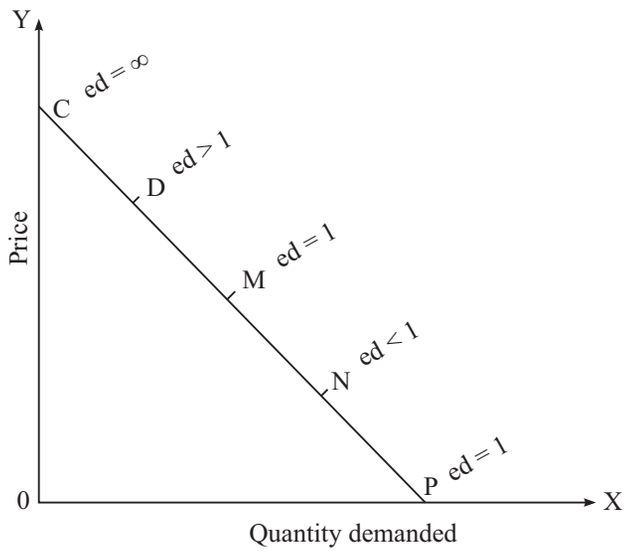


Fig. 16.6

M is the mid- point of the demand curve AB.

So, $$e_d \text{ at point M} = \frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$$

$$= \frac{MP}{MC} = 1$$

(Because MP= MC)

$$e_d \text{ at point N} = \frac{NP}{NC}$$

Point N is below point M so NP is less than NC and elasticity will be less than one.

$$e_d \text{ at point P} = \frac{0}{PC} = 0$$

(Here lower segment is 0)

$$e_d \text{ at point D} = \frac{DP}{DC}$$

Point D is above point M. So, DP is more than DC. Elasticity at this point will be more than one.

$$e_d \text{ at point C} = \frac{CP}{0} = \infty$$

(Upper segment is 0)

So, we can conclude that elasticity at mid- point of a straight line demand curve will be 1, elasticity at every point below the mid- point will be less than one and elasticity at every point above the mid- point will be greater than one.

## 16.4 RELATIONSHIP BETWEEN TOTAL EXPENDITURE AND PRICE ELASTICITY OF DEMAND

We have studied that price of a good and its quantity demanded are inversely related. So, responsiveness of demand in relation to change in price i.e. price elasticity of demand determines the change in expenditure. We can consider the following cases:

**(i) Elasticity is less than one ($e_d$ <1):** When the demand for a commodity is less than unit elastic, a fall in price leads to fall in total expenditure and a rise in price leads to rise in total expenditure on the commodity. (Price of the commodity and total expenditure move in same direction).See table 16.6.

**Table 16.6**

| Price (₹ Per unit) | Quantity Demanded (In Units) | Total Expenditure (In ₹) |
|---|---|---|
| 12 | 10 | 120 |
| 10 | 11 | 110 |
| 8 | 12 | 96 |

**(ii) Elasticity is more than unit elastic ($e_d$ >1):** When the demand for a commodity is more than unit elastic, a fall in price leads to rise in total expenditure and a rise in price leads to a fall in total expenditure on the commodity. (Price of the commodity and total expenditure move in opposite direction).See table 16.7.

**Table 16.7**

| Price (₹ Per unit) | Quantity Demanded (In Units) | Total Expenditure (In ₹) |
|---|---|---|
| 12 | 10 | 120 |
| 10 | 14 | 140 |
| 8 | 20 | 160 |

**(iii) Elasticity is equal to one ($e_d$ = 1):** When the demand for a commodity is unit elastic, total expenditure incurred on the commodity does not change with the change in its price. See table 16.8.

**Table 16.8**

| Price (₹ Per unit) | Quantity Demanded (In Units) | Total Expenditure (In ₹) |
|---|---|---|
| 12 | 10 | 120 |
| 10 | 12 | 120 |
| 8 | 15 | 120 |

All the three cases discussed above are shown diagrammatically in Fig. 16.7

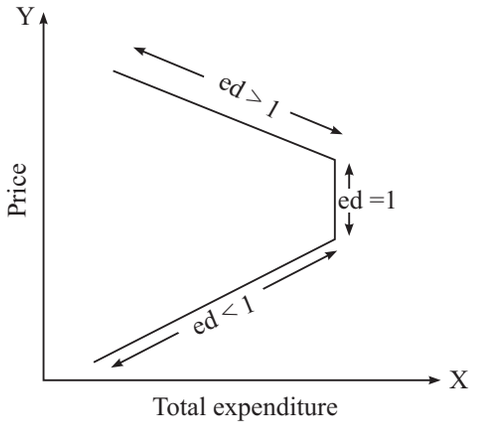


**Fig. 16.7**

### Illustration 1:

Due to 2% fall in price of good X total expenditure on good X rises by 3%. A 10 % rise in price of good Y leads to 20 % rise in total expenditure on good Y. Using total expenditure method, compare price elasticity of demand of good X and good Y.

### Solution:

Demand for good X is more than unit elastic because price of the commodity and total expenditure on the commodity move in opposite direction.

Demand for good Y is less than unit elastic because price of the commodity and total expenditure on the commodity move in same direction.

### Illustration 2:

When the price of a good changes to ₹ 11 per unit, the consumer's demand falls from 11 units to 7 units. The price elasticity of demand is (–) 1. What was the price before change? Use expenditure approach of price elasticity of demand to answer this question.

### Solution:

| Price (₹ Per unit) | Quantity Demanded (In Units) | Total Expenditure (In ₹) |
|---|---|---|
| ? | 11 | ? |
| 11 | 7 | 77 |

As the price elasticity of demand is (–) 1 i.e. unit elastic, so, total expenditure will remain unchanged at ₹ 77. Therefore, price before change was 77/11 = ₹ 7 per unit

**Illustration 3:**

When price of a good falls from ₹ 10 per unit to ₹ 9 per unit, its demand rises from 9 units to 10 units. Compare expenditures on the good to find price elasticity of demand.

| Price (₹ Per unit) | Quantity Demanded (In Units) | Total Expenditure (In ₹) |
|---|---|---|
| 10 | 9 | 90 |
| 9 | 10 | 90 |

The demand for the good is unit elastic as the total expenditure remains unchanged at ₹ 90 when its price falls.

## 16.5 FACTORS AFFECTING PRICE ELASTICITY OF DEMAND

As discussed earlier, in case of some goods responsiveness of quantity demanded to the change in price is more than some other goods. For example, a very small change in price of luxury goods may affect their demand to a considerable extent but a large change in price of salt may not affect its demand. This means, price elasticity of demand is different for different goods. Following factors may affect the price elasticity of demand for a good:

(i) **Availability of close substitutes:** Demand for a commodity which has large number of substitutes, is usually more elastic than those commodities which have no substitutes. For example, coke, Pepsi, limca etc. are good substitutes. Even a small rise in price of coke will induce the buyers to go for its substitutes. On the other hand demand for electricity will be less elastic because it has no close substitutes.

(ii) **Nature of the Commodity:** Demand for necessities like medicines, food grains is less elastic because we have to consume them in minimum required quantity, whatever their price may be. But demand for comforts and luxuries like refrigerators, air conditioners etc. is more elastic because their consumption may be postponed for future if their price rises.

(iii) **Share in Total Expenditure:** Greater the proportion of income spent on the commodity, more is the elasticity of demand for it. Demand for a commodity is inelastic if proportion of income spent on that commodity is very small.

(iv) **Level of Price:** Demand for a commodity at higher level of price (like air conditioners, cars etc.) is generally more elastic than for a commodity at lower level of price (like match box, pencils etc.)

(v) **Level of Income:** Demand for a commodity is generally less elastic for higher income level groups in comparison to people with low incomes. For example,

if price of a good rises, a rich consumer is not likely to reduce his demand but a poor consumer can reduce his demand for that commodity.

(vi) **Habits:** Habits of consumers also determine price elasticity of demand of commodities. For example, a chain smoker will not restrict his smoking even when the price of cigarettes rise.

## INTEXT QUESTIONS 16.2

1. Due to 5% fall in price of a commodity its demand rises by 7.5%. Calculate and state coefficient of price elasticity of demand. Whether the demand is elastic or inelastic? Give reason.
2. Write formula for measuring price elasticity of demand at a point on a straight line demand curve.
3. The total expenditure on a commodity falls when its price rises. Comment on the price elasticity of demand of the commodity.
4. State any two factors which may affect price elasticity of demand of a commodity.
5. Why is the demand for water inelastic?

## WHAT YOU HAVE LEARNT

- Price elasticity of demand is the degree of responsiveness of demand for a commodity to the change in its price.
- When quantity demanded of a commodity does not change at all in response to change in its price, the demand for the commodity is called perfectly inelastic.
- The demand for a commodity is called less than unit elastic when the percentage change in quantity demanded is less than the percentage change in its price.
- The demand for a commodity is called unit elastic when the percentage change in quantity demanded equals the percentage change in its price.
- The demand for a commodity will be more than unit elastic if the percentage change in quantity demanded is more than the percentage change in its price.
- When the demand for a commodity expands or contracts to any extent without or very little change in its price, its demand is called perfectly elastic.

- By percentage method, price elasticity of demand can be ascertained by the formula:

$$e_d = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price of the commodity}}$$

$$= \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

- Price elasticity of demand at mid- point of a straight line demand curve will be 1, elasticity at every point below the mid- point will be less than 1 and elasticity at every point above mid- point will be greater than 1.
- When the demand for a commodity is less than unit elastic, price of the commodity and total expenditure on the commodity move in same direction.
- When the demand for a commodity is more than unit elastic, price of the commodity and total expenditure on the commodity move in opposite direction.
- When the demand for a commodity is unit elastic, total expenditure incurred on the commodity does not change with the change in its price.
- Price elasticity of demand of a commodity is influenced by (i) availability of close substitutes, (ii) nature of the commodity, (iii) share in total expenditure, (iv) level of price, (v) level of income and, (vi) habits etc.

## TERMINAL EXERCISE

1. Draw diagrams for:
   (i) Perfectly elastic demand
   (ii) Perfectly inelastic demand
   (iii) Unit elastic demand
2. Prepare a schedule for:
   (i) More than unit elastic demand
   (ii) Less than unit elastic demand
3. Explain 'percentage change' method of measuring price elasticity of demand.
4. Explain the relationship between total expenditure incurred on a commodity and its price elasticity of demand.
5. How is price elasticity of demand of a commodity affected by availability of its close substitutes? Explain.

6. A household purchases 40 units of a good when its price is Re. 1 per unit. At what price he would purchase 36 units of it if coefficient of price elasticity of demand is unitary.
7. What quantity of a commodity would a household purchase at a price of ₹ 12 per unit, if he purchases 40 units of it at ₹ 10 per unit? Price elasticity of demand is (-) 1.5.
8. A household spends ₹ 120 on purchase of a commodity when its price is ₹ 6 per unit. When price rises to ₹ 10 per unit, his total expenditure on this commodity becomes ₹ 180. Calculate price elasticity of demand by percentage change method.
9. When price of a commodity falls from ₹ 20 per unit to ₹ 16 per unit, its quantity demanded increases by 20%. Calculate coefficient of price elasticity of demand.
10. A consumer buys 15 units of a good at a price of ₹ 10 per unit. At price ₹ 15 per unit he buys 10 units. What is price elasticity of demand? Use expenditure approach. Comment on the likely shape of demand curve on the basis of this measure of elasticity.

## ANSWER TO INTEXT QUESTIONS

### 16.1

1. Read section 16.1
2. Read section 16.2(iv)
3. Rectangular hyperbola

### 16.2

1. $e_d$ = 1.5, Demand is more than unit elastic because percentage change in quantity demanded is more than the percentage change in price of the commodity.
2. $e_d = \dfrac{\text{lower segment of demand curve}}{\text{Upper segment of demand curve}}$
3. Demand for the commodity is more than unit elastic because price and total expenditure move in opposite direction.
4. (i) Nature of the commodity (ii) Availability of close substitutes
5. Demand for water is inelastic because water is a necessity.