UNIT 5 CONSUMER BEHAVIOUR: ORDINAL APPROACH

Structure

5.0 OBJECTIVES

After completion of this unit, you will be able to:

- state ordinal utility approach for measurement of utility;
- use Indifference curve analysis to explain consumer behaviour;
- identify shape of Indifference curve in case of perfect substitutes and complementary goods;
- explain the concept of Budget line;

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- identify the factors causing shift in Budget line;
- describe consumer equilibrium through Indifference curve approach;
- decompose price effect into income effect and substitution effect using Hicksian and Slutsky approach; and
- derive demand curve from Price Consumption curve (PCC).

5.1 INTRODUCTION

In Unit 4, we have learnt the concept of cardinal and ordinal utility in order to understand the concept of consumer preferences. We also examined consumer equilibrium through cardinal utility analysis. As discussed in previous unit, study of consumer behaviour has been a focus point for researchers as well as business houses. Consumer behaviour directly affects the sales and thus profits of the companies. In order to understand consumer's buying pattern, it is also important to understand how consumer equilibrium is attained. A rational consumer wants to maximise his satisfaction derived from consumption of various goods but is subject to his budget constraint. In this unit, we will examine the concept of consumer equilibrium using ordinal utility approach.

5.2 ORDINAL UTILITY APPROACH

Cardinal Utility approach was criticised for being restrictive in nature. English economist Edgeworth criticised cardinal approach for its Unrealistic assumptions. He was of opinion that measurement of utility in quantitative scale is neither possible nor necessary. This idea gave birth to ordinal approach. Edgeworth also believed that all consumer behaviour can be measured in terms of preferences and rankings and can be understood using Indifference curve approach. Though this approach was originally propounded by Edgeworth, it became popular because of Vilfred Pareto (1906), Slutsky (1915) and finally because of RGD Allen and J.R Hicks. However, this approach is also based on some assumptions.

Assumptions of Ordinal Utility Approach

1) **Rationality:** The basic assumption is that consumer is a rational being, i.e., he prefers more to less and tries to maximise his satisfaction.

2) Indifference curve analysis assumes that **utility is only ordinally expressible** i.e. utility derived from two goods can be compared, as more, less, or equal, but not how much more or less.

3) **Transitivity:** Consumer choices are assumed to be transitive. Transitivity of choices means that if a consumer prefers A to B and B to C, then he prefers A to C, or if she treats A>B and B>C, then she also treats A>C.

4) **Consistency:** Consistency of choice means that if a person prefers A over B in one period, he/she will not prefer B over A in another period.

5) **Non satiety:** This assumption means that a consumer prefers a larger quantity of all the goods over smaller quantities of the same.

6) **Diminishing Marginal Rate of Substitution (MRS):** MRS is that rate at which a consumer is willing to substitute one commodity (say X) for

another (say Y) while maintaining the same utility or level of satisfaction to the consumer. The concept of diminishing MRS will be discussed in greater detail in next section.

5.3 INDIFFERENCE CURVE ANALYSIS

J.R Hicks used the concept of Indifference curve to analyse consumer behaviour. A consumer facing choice between large number of bundles of two goods tries to maximise his satisfaction by choosing a combination which gives him maximum utility. In the course of decision making, consumer finds out that goods can be substituted for each other and identifies various combinations of commodities that give him equal level of satisfaction. When all these combinations are plotted graphically, it produces a curve called Indifference curve.

5.3.1 Indifference Schedule

An indifference schedule is a table which represents various combinations of two goods, which yield equal satisfaction to consumer. Since all the combinations give equal level of satisfaction, consumer is indifferent between them.

Table 5.1 presents an imaginary indifference schedule representing the various combinations of two goods X and Y.

Table 5.1: Indifference schedule of two commodities 'X' and 'Y'

Combinations	Units of 'X' Goods (Cup of Tea)	Units of 'Y' Goods (Biscuits)	Satisfaction
A	1 +	12	K
B	2+	8	K
C	3+	5	K
D	4+	3	K
E	5+	2	K

In above table, five different combinations of Tea and Biscuits are depicted. All these combinations give equal level of satisfaction i.e. K. The consumer is indifferent whether he buys 1 cup of tea and 12 biscuits or 2 cups of tea and 8 biscuits. Different schedules can be formed showing different levels of satisfaction.

5.3.2 Indifference Curve

The graphical presentation of Indifference schedule is known as Indifference curve. The indifference curve is locus of all the combinations of two commodities which give same level of satisfaction to the consumer.

Fig. 5.1 is graphical representation of Table 5.1. It shows all the combinations of good X and good Y i.e. A, B, C, D and E which yield equal level of satisfaction to the consumer. The curve is downward sloping, convex to the point of origin.

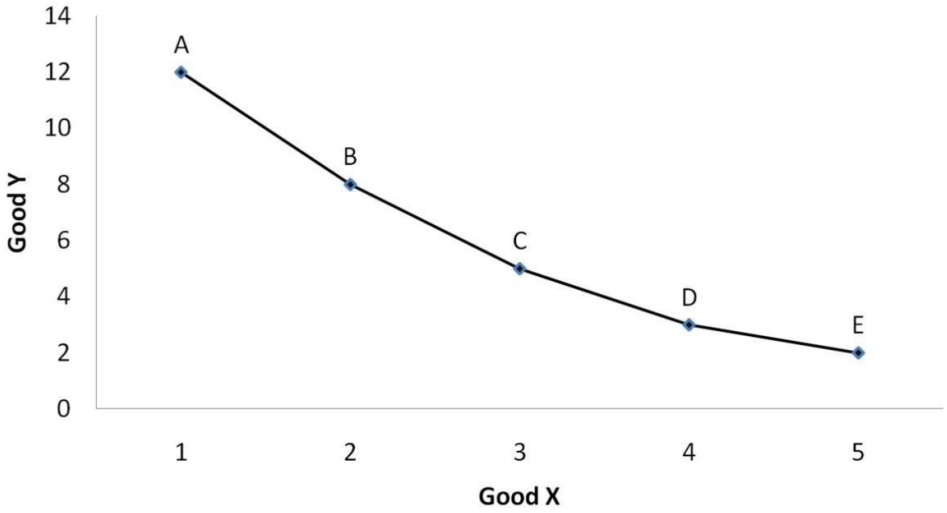

Fig. 5.1: Indifference curve

5.3.3 Indifference Map

The combinations of two commodities X and Y given in the Indifference schedule are not the only possible combinations for these commodities. The consumer may make any other combinations with less of one or both of the goods, each yielding the same level of satisfaction but less than the one shown in schedule. IC curve of this schedule will be above IC_1. Similarly, the consumer may make other combinations with more of one or both of the goods, each combination yielding the same satisfaction but greater than the satisfaction indicated.

A diagram showing different indifference curves corresponding to different indifference schedules of the consumer is indifference map. In other words, a set or family of indifference curves is an indifference map.

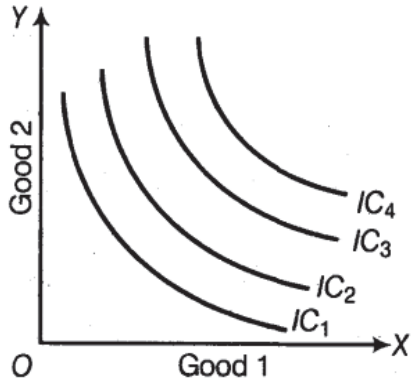

Fig. 5.2: Indifference map

Fig. 5.2 shows four indifference curves: IC_1, IC_2, IC_3 and IC_4. All the points on IC_2 will yield higher satisfaction than the points on IC_1 and all the points on IC_3 will yield lesser satisfaction than the points on IC_4.

5.3.4 Law of Diminishing Marginal Rate of Substitution

What is Marginal Rate of Substitution?

Marginal rate of substitution may be defined as the rate at which a consumer will exchange successive units of a commodity for another. In other words, Marginal rate of substitution is the rate at which, in order to get the additional units of a commodity, the consumer is willing to sacrifice or give up to get one additional unit of another commodity.

The Marginal Rate of Substitution can symbolically be represented as under:

$$MRS_{xy} = \Delta Y/\Delta X$$

Where MRS_{xy}= Marginal rate of substitution of X for Y

ΔY= Change in 'Y' commodity

ΔX= Change in 'X' commodity.

Diminishing Marginal rate of Substitution

One of the basic postulates of ordinal utility theory is that Marginal rate of substitution (MRS_{xy} or MRS_{yx}) decreases. It means that the quantity of a commodity that a consumer is willing to sacrifice for an additional unit of another commodity goes on decreasing. Law of diminishing Marginal rate of substitution is an extensive form of the law of diminishing Marginal Utility. As discussed in previous section, Law of diminishing marginal Utility states that as a consumer increases the consumption of a good, his marginal utility goes on diminishing. Similarly as consumer gets more and more unit of good X, he is willing to sacrifice less and less units of good Y for each extra unit of X. The significance of good X in terms of good Y goes on diminishing with each addition of good X. The law can be understood with the help of following Table 5.2.

Table 5.2: Marginal rate of Substitution

Units of 'X' Good	Units of 'Y' Good	MRS of 'X' for 'Y'
1	10	-
2	7	3:1
3	5	2:1
4	4	1:1

To have the second combination and yet to be at the same level of satisfaction, the consumer is ready to forgo 3 units of Y for obtaining an extra unit of X. The marginal rate of substitution of X for Y is 3:1. The rate of substitution is units of Y for which one unit of X is a substitute. As the consumer desires to have additional unit of X, he is willing to give away less and less units of Y so that the marginal rate of substitution falls from 3:1 to 1:1 in the fourth combination.

In Fig. 5.3 given below at point M on the Indifference curve I, the consumer is willing to give up 3 units of Y to get an additional unit of X. Hence, MRS_{xy} =3. As he moves along the curve from M to N, MRS_{xy}, = 2. When the consumer moves downwards along the indifference curve, he acquires more of X and less

of Y. The amount of Y he is prepared to give up to get additional units of X becomes smaller and smaller.

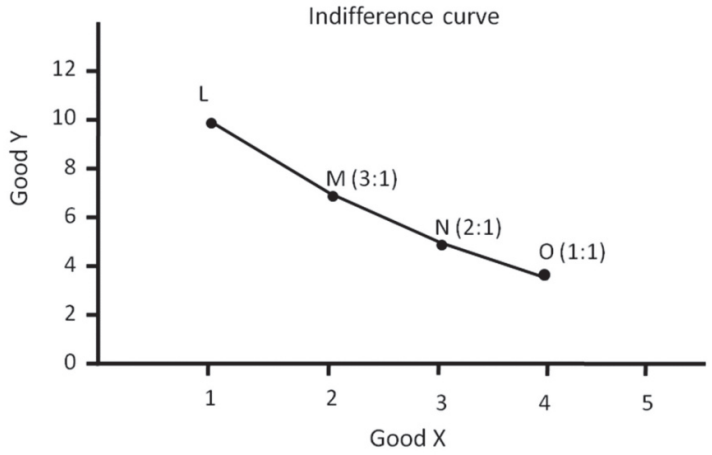

Fig. 5.3: Indifference curve and Marginal rate of Substitution

The marginal rate of substitution of X for Y (MRS_{xy}) is, in fact, the slope of the curve at a point on the indifference curve, such as points M, N or P in Fig. 5.3. Thus $MRS_{xy} = \Delta Y/\Delta X$

5.3.5 Properties of Indifference Curve

1) **Indifference curve slopes downwards from left to right:** It implies that Indifference curve has a negative slope. This attribute is based on the assumption that if a consumer uses more quantity of one good, he has to reduce the consumption of the other good in order to stay at the same level of satisfaction.

2) **Indifference curves are generally convex to the origin 'O':** This property is based on the principle of Diminishing Marginal Rate of Substitution. It means that as the units of 'X' are increased by equal amounts, the 'Y' diminishes by smaller and smaller amounts. This happens because as a consumer gets more and more units of 'X' good, he is willing to give up less and less units of good Y for each extra unit of X.

3) **Indifference curves cannot intersect each other:** This is because of the fact that each indifference curve represents different level of satisfaction. If two indifference curves intersect, it will lead to self-contradictory result. In Fig. 5.4, two Indifference curve IC_1 and IC_2 are shown intersecting each other at point C. But this is not possible.

Point 'A' and point 'C' on Indifference curve IC_1 represents combination yielding equal satisfaction. That is satisfaction from A combination = the satisfaction from C combination, therefore,

i) Pt. A = Pt. C (Because both lie on same IC curve IC_1)

ii) Pt. B = Pt. C (Because both lie on same IC curve IC_2)

Thus Pt. B = Pt. A in terms of satisfaction. But this is impossible because at combination 'B' quantities of both X and Y are more than in combination 'A', hence this is self-contradictory.

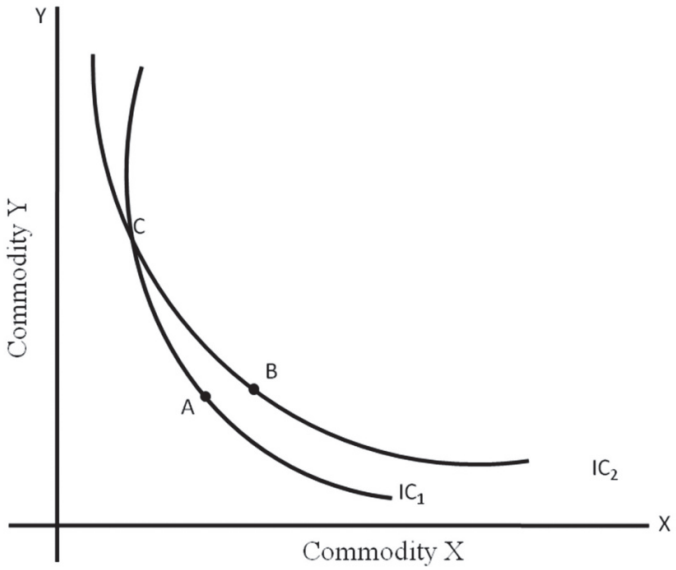

Fig. 5.4: Two Indifference curves cannot intersect

Thus, two Indifference curves cannot intersect with each other. The Indifference curves cannot be tangent to each other.

4) **Higher Indifference curve represents higher level of satisfaction:** In Fig. 5.5, the indifference curve IC_2 lies above and to the right of the IC_1. Point C on IC_2 represents more units of 'x' than point A on IC_1. Similarly, Point B on IC_2 represents more units of 'y' than point A on IC_1. It is thus evident that higher the indifference curve, the higher the satisfaction it represents because our consumer prefers more of a good to less of it. Also note that all the points between B and C on IC_2 show larger amounts of both X and Y compared to point A on IC_1.

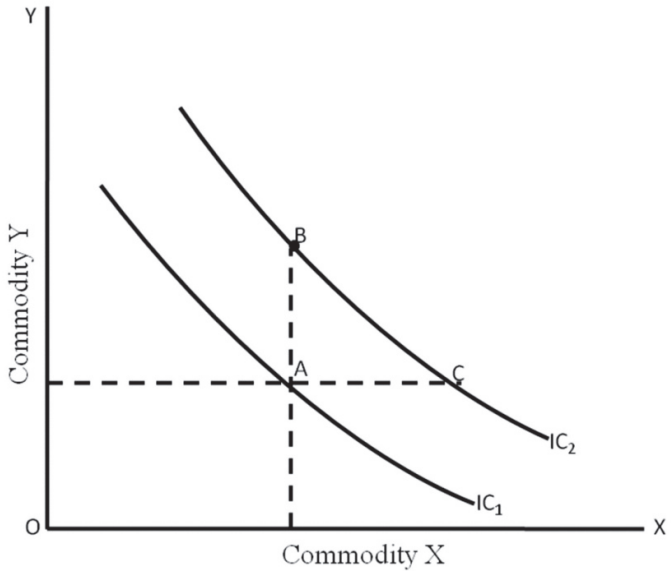

Fig. 5.5: Higher Indifference curve means higher level of satisfaction

5) Indifference curves do not touch either of the axes X or Y . This is because of the assumption that the consumer purchases combination of different commodities. In case, an indifference curve touches either axis, it means the consumer wants only one commodity and his demand for the second commodity is zero. Purchasing one commodity means

monomania, i.e. consumer's lack of interest in the other commodity. This is against the assumption of Indifference curve which is a two good model.

6) **No Indifference curve cuts either of axes:** If it were to happen, the consumer will be consuming negative quantity of that commodity which makes no sense.

5.4 SOME EXCEPTIONAL SHAPES OF INDIFFERENCE CURVE

Indifference curve may take a different shape in case of perfect substitutes and perfect complements. Some exceptional shapes of Indifference curve are discussed as follows:

Perfect Substitutes

We have examined the concept of perfect substitutes in previous units. Two goods are perfect substitutes if the utility consumers get from one good is the same as another.

When two goods are perfect substitutes of each other, their indifference curve will be a straight diagonal line sloping downwards from left to right. It is because of the fact that MRS in such cases is constant i.e. 1.

For example: Suppose good A and good B are perfect substitutes, consumer will be indifferent between them and will be ready to sacrifice equal quantity of good A to achieve good B. But, even here, the ICs will not cross the axes.

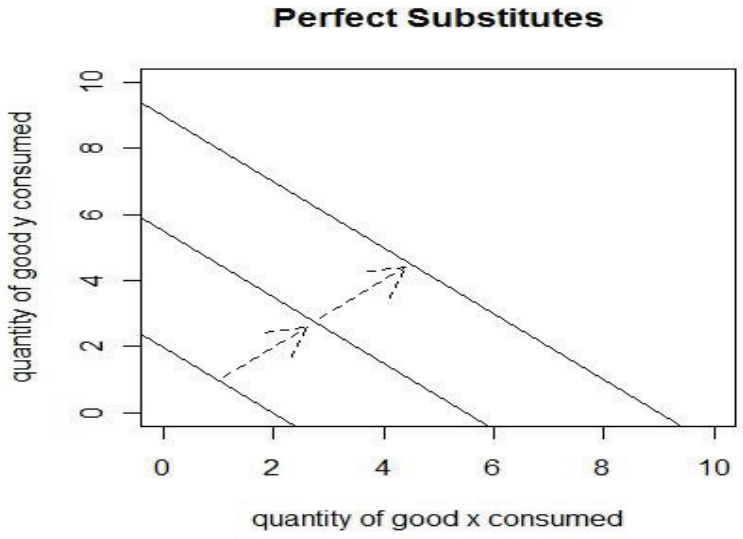

Fig. 5.6: Indifference curve in case of Perfect Substitutes

Perfect Complements

Two goods may be perfect complementary to each other. Just as left and right shoes, cups and saucers of a tea set etc. In such case, the indifference curve will be parallel to each other and bent at 90 degree angle or L shaped. Perfect complementary goods are those goods which are used in fixed ratio i.e. 1:1or 2:2. They cannot be substituted for each other, thus putting MRS as zero. This

case is shown in Fig. 5.7. It is clear that IC_1 and IC_2 are right angled curves, meaning thereby that the consumer buys piece of each right shoe. This will be useless. The consumer will be no better off and he will remain at point 'A' on IC_1. In case, he buys 2 pieces of left shoe and only one piece of right shoe, it will be useless, the consumer will be no better off and he will remain at point C of IC_1. It means that having one more pair of shoe will not add to his satisfaction. But if he buys one more shoe, his satisfaction will immensely increase and he will move to point B on higher Indifference curve IC_2.

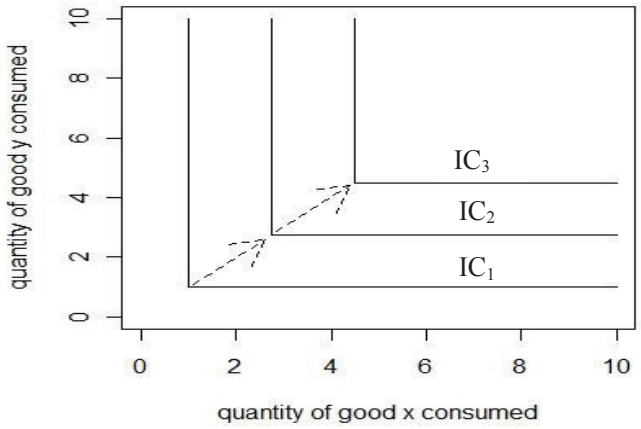

Fig. 5.7: Indifference curve in case of Perfect Complements

Check Your Progress 1

1) Suppose that goods A and B are perfect compliments. Draw a set of indifference curves for perfect compliments, and explain why the curves look the way they do. Do the same for perfect substitutes**?**

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2) Explain the concept of Marginal Rate of Substitution (MRS). What happens to MRS when consumer moves downward along the Indifference curve?

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3) Why is Indifference curve convex to origin?

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5.5 BUDGET LINE

As discussed above, a rational consumer always acts according to his budget constraint and tries to maximise his level of satisfaction. Thus, the knowledge of the concept of budget line or what is also called budget constraint is essential for understanding the theory of consumer's equilibrium.

A consumer in his attempt to maximise his satisfaction will try to reach the highest possible indifference curve. But in his pursuit of maximising satisfaction by buying more and more goods, he has to consider two constraints: first, he has to pay the prices for the goods and, secondly, he has a limited money income to purchase the goods. Thus, how much a person is capable to buy, depends upon the prices of the goods and the money income which he has at his disposal.

Price line or budget line represents all possible combinations of two goods that a consumer can purchase with his given income and the given prices of two goods. Let us try to understand the concept with the help of an example:

Suppose a consumer has an income of Rs. 100 to spend on Oranges and Apples which cost Rs. 10 each. He can either spend his limited income only on one good or both the goods. All the possible alternative combinations of two goods are presented in Table 5.3.

Table 5.3: Alternative consumption possibilities

Income	Apples (Rs. 10/piece)	Oranges (Rs. 10/piece)
Rs. 100	10	0
Rs. 100	9	1
Rs. 100	8	2
Rs. 100	7	3
Rs. 100	6	4
Rs. 100	5	5
Rs. 100	4	6
Rs. 100	3	7
Rs. 100	2	8
Rs. 100	1	9
Rs. 100	0	10

It can be observed from the above table that if the consumer spends his total income of Rs. 100 on Apples, he is able to buy 10 Apples. On the other hand, if he buys Oranges alone, he can get 10 Oranges by spending his total income. Further, a consumer can also buy both the goods in different combinations.

The budget line can be written algebraically as follows:

Algebraic Expression for Budget Set: The consumer can buy any bundle (A, B), such that:

$$M \geq (P_X * Q_X) + (P_Y * Q_Y)$$

Where P_X and P_Y denote prices of goods X and Y respectively and M stands for money income

We can rewrite the budget line as: $P_Y Q_Y = M - P_X Q_X$

dividing both sides by P_Y yields: $Q_Y = \frac{M}{P_Y} - \frac{P_X}{P_Y} Q_X$

This is the budget line plotted in Fig. 5.8.

SLOPE OF BUDGET LINE

As we know that the slope of a curve is calculated as a change in variable on the Y-axis divided by change in variable on the X-axis, slope of the budget line in given example will be number of units of Oranges, that the consumer is willing to sacrifice for an additional unit of Apple.

Slope of Budget Line = Units of Oranges (Y) willing to Sacrifice/ Units of Apples (X) willing to Gain = $\Delta Y/\Delta X$

In above example, 1 Apple need to be sacrificed each time to gain 1 Orange.

So, Slope of Budget Line = –1/1 = –1

This slope of budget line is equal to 'Price Ratio' of two goods.

Price Ratio = Price of X (P_X)/Price of Y (P_Y) = $-P_X/P_Y$

Budget line is presented in Fig. 5.8.

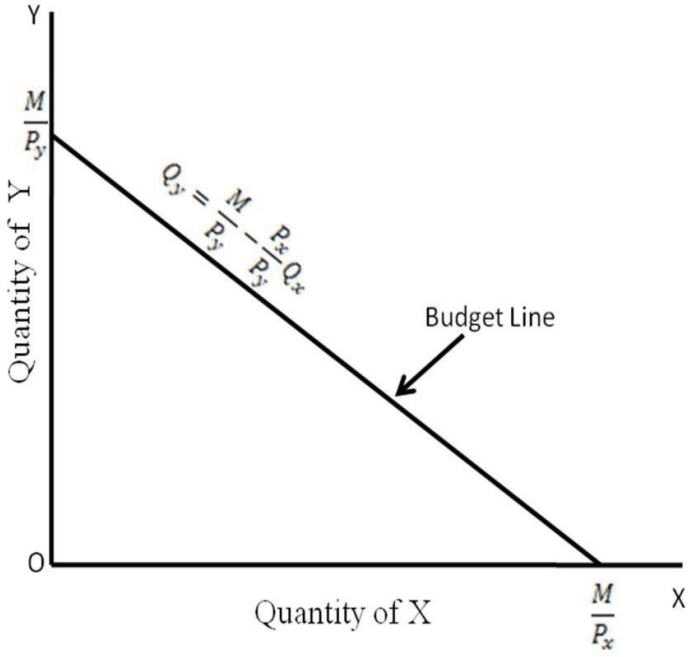

Fig. 5.8: Budget Line

5.6 SHIFT IN BUDGET LINE

Budget line is drawn on the basis of assumption of constant prices of the goods and constant income of the consumer. Thus, if there is any change in either of the two variables, budget line shifts.

Thus, there are two variables that causes shift in Budget Line:

1) Change in Income of the consumer

2) Change in equal proportion of Prices of both the goods.

Change in Income of the consumer

If income changes while the prices of goods remain the same, Budget line will shift rightwards or leftwards. Since the prices of two goods are constant, slope

of budget line will remain constant. The effect of changes in income on the budget line is shown in Fig. 5.9. If consumer's income increases while prices of both goods X and Y remain unaltered, the price line shifts upward and is parallel to the original budget line.

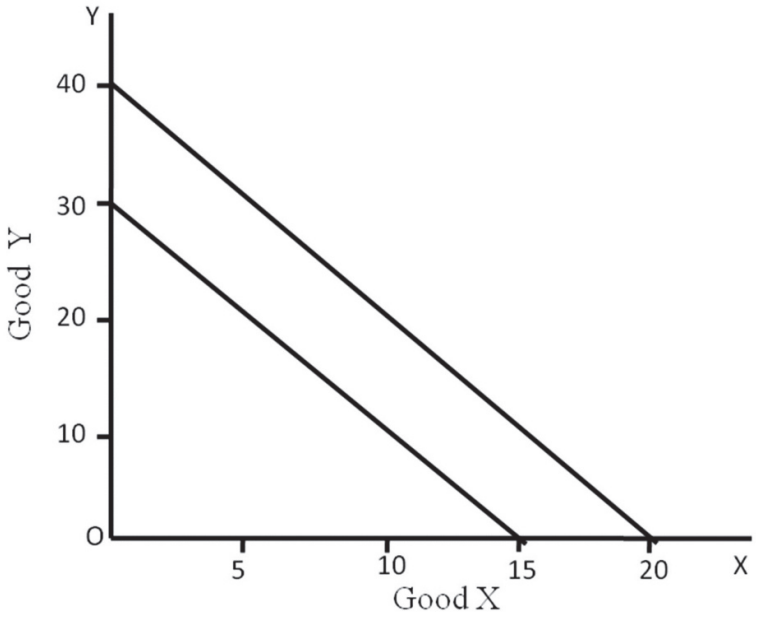

Fig. 5.9: Effect of change in Income on Budget Line

This is because with the increased income the consumer is able to purchase proportionately larger quantity of both goods than before.

On the other hand, if income of the consumer decreases, prices of both goods X and Y remaining unchanged, the budget line shifts downward but remains parallel to the original price line. This is because a lower income will leave the consumer in a position to buy proportionately smaller quantities of both goods.

Changes in Price of either of the two goods:

Budget Line also shifts when there is change in price of either of the two goods. Increase in price of any commodity reduces the purchasing power of the consumer, in turn reducing the quantity demanded. Shift of Budget line due to change in prices of either good x or good y is presented below:

Changes in Budget Line as a Result of Changes in Price of Good X

Suppose, price of good X rises, the price of good Y and income remaining unaltered. With higher price of good X, the consumer can purchase smaller quantity of X.

In Fig. 5.10, original price line is AB. With increase in Price of good X, budget line will shift to AB_2 i.e. consumer will be able to buy less quantity of good X, quantity of good Y remaining same. Similarly when there is fall in price of good X, keeping prices of good Y constant, budget line shifts from AB to AB_1 i.e. consumer will be able to buy more quantity of good X, quantity of good Y remaining same.

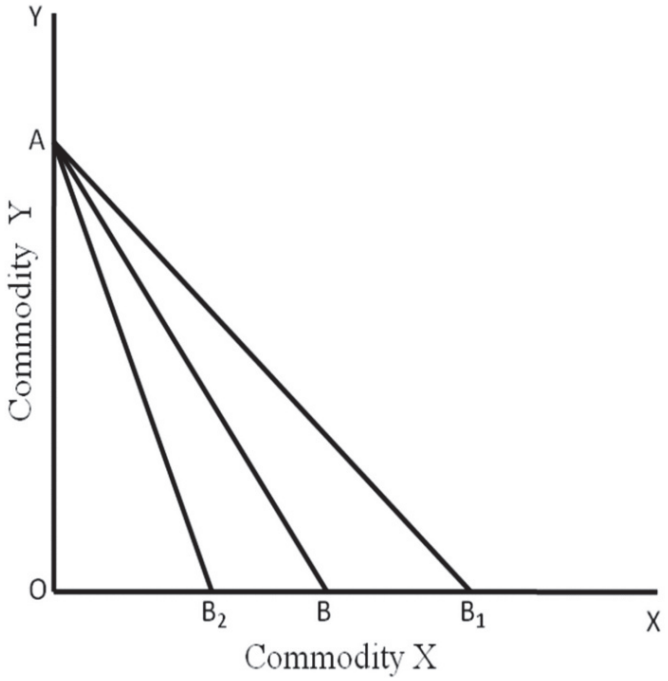

Fig. 5.10: Shift in Budget line due to change in price of good X

Change in Price of good Y

Fig. 5.11 shows the changes in the budget line when price of good Y falls or rises, with the price of X and income remaining the same. It can be observed from Fig. 5.11 that the initial budget line is AB. With fall in price of good Y, other things remaining unchanged, the consumer could buy more of Y with the given money income and therefore budget line will shift above to EB. Similarly, with the rise in price of Y, other things being constant, and the budget line will shift below to DB.

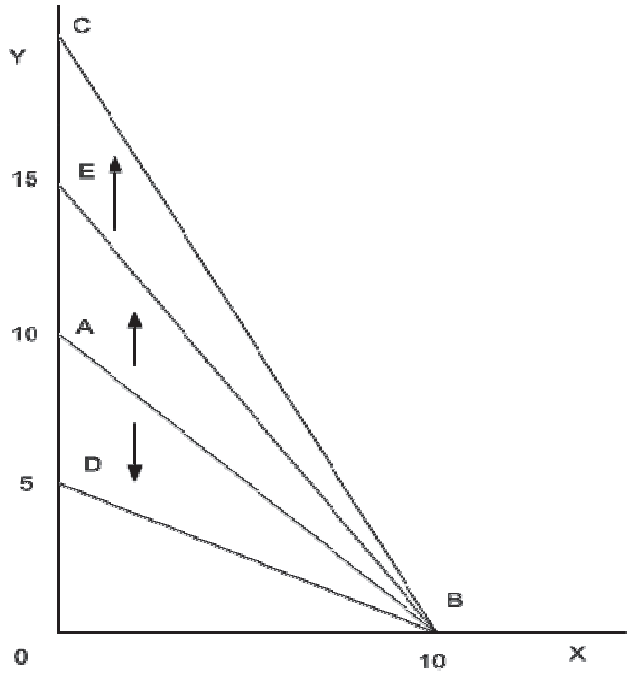

Fig. 5.11: Shift in Budget line due to change in price of good Y

Check Your Progress 2

1) What is budget line? Calculate slope of Budget line if prices of good X and good Y are 8 and 10 respectively?

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2) What will happen to budget line if:

Case A: Price of good X increases

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Case B: Price of good Y decreases

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Case C: Income of consumer increases

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5.7 CONSUMER EQUILIBRIUM THROUGH INDIFFERENCE CURVE ANALYSIS

Assumptions

As discussed above, consumer equilibrium is a point of maximum satisfaction for the consumer. It is a state of rest for the consumer. Study of Consumer equilibrium requires some assumptions to be made about the consumer behaviour. These are:

i) Rationality: The consumer is rational. He wants to obtain maximum satisfaction given his income and prices.

ii) Consumer has an indifference map, showing his scale of preference for various combinations of good x and y.

iii) Utility is ordinal: It is assumed that the consumer can rank his preference according to the satisfaction of each combination of goods.

iv) Consistency of choice: It is also assumed that the consumer is consistent in the choice of combination of goods.

v) Consumer has a given and fixed amount of money income to spend on the goods. Thus, consumer has to choose to spend his income on either of the two goods or a combination thereof.

vi) All the units of the goods are homogeneous.

vii) The goods are divisible i.e. they can be divided into small units.

viii) Total utility: The total utility of the consumer depends on the quantities of the good consumed.

Conditions of Consumer's Equilibrium

There are two fundamental conditions of consumer's equilibrium through Indifference curve approach:

1) The price line should be tangent to the Indifference curve. It means that at the point of equilibrium the slope of the indifference curve and of the price line should be same. The slope of Indifference curve indicates MRS_{xy} i.e. $-\Delta Y/\Delta X$. The slope of the price line indicates the ratio between price of two goods X and Y i.e. P_x/P_y.

2) Indifference curve should be convex to the point of origin: Marginal rate of substitution of X for Y (MRS_{xy} i.e. $\Delta y/\Delta x$) is equal to the slope of the price line that indicates the ratio between prices of two goods.

Condition 1: MRS_{XY} = Ratio of prices or P_X/P_Y

Let the two goods be X and Y. The first condition for consumer's equilibrium is that

$$MRS_{xy} = P_x/P_y$$

- If $MRS_{xy} > P_x/P_y$, it means that the consumer is willing to pay more for X than the price prevailing in the market. As a result, the consumer buys more of X. As a result, MRS falls till it becomes equal to the ratio of prices and the equilibrium is established.

- If $MRS_{xy} < P_x/P_y$, it means that the consumer is willing to pay less for X than the price prevailing in the market. It induces the consumer to buys less of X and more of Y. As a result, MRS rises till it becomes equal to the ratio of prices and the equilibrium is established.

Condition 2: MRS continuously falls

The second condition for consumer's equilibrium is that MRS must be diminishing at the point of equilibrium, i.e. the indifference curve must be convex to the origin at the point of equilibrium. Unless MRS continuously falls, the equilibrium cannot be established.

Thus, both the conditions need to be fulfilled for a consumer to be in equilibrium.

Let us now understand this with the help of a diagram:

In Fig. 5.12, IC_1, IC_2 and IC_3 are the three indifference curves and MM is the budget line. With the constraint of budget line, the highest indifference curve, which a consumer can reach, is IC_2. The budget line is tangent to indifference curve IC_2 at point 'P'. This is the point of consumer equilibrium.

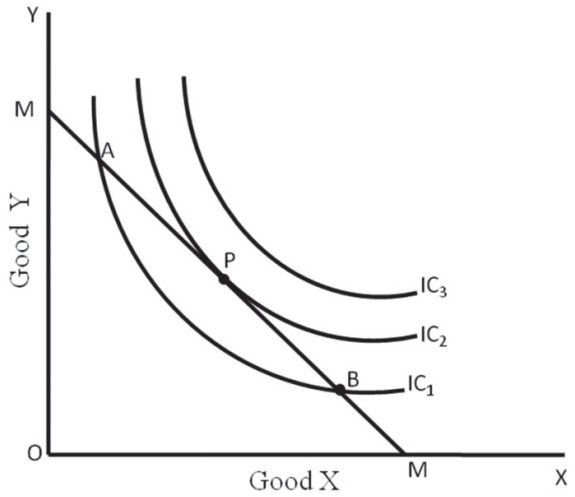

Fig. 5.12: Consumer equilibrium through indifference curve

All other points on the budget line to the left or right of point 'P' will lie on lower indifference curves and thus indicate a lower level of satisfaction. As budget line can be tangent to one and only one indifference curve, consumer maximises his satisfaction at point P, when both the conditions of consumer's equilibrium are satisfied:

i) MRS = Ratio of prices or P_X/P_Y:

At tangency point P, the absolute value of the slope of the indifference curve (MRS between X and Y) and that of the budget line (price ratio) are same. Equilibrium cannot be established at any other point such as $MRS_{XY} > P_X/P_Y$ at all points to the left of point P or $MRS_{XY} < P_X/P_Y$ at all points to the right of point P. So, equilibrium is established at point P, when $MRS_{XY} = P_X/P_Y$.

ii) MRS continuously falls:

The second condition is also satisfied at point P as MRS is diminishing at point P, i.e. IC_2 is convex to the origin at point P.

5.8 SOME EXCEPTIONAL SHAPES OF INDIFFERENCE CURVE AND CORNER EQUILIBRIUM

As hinted earlier, indifference curve may take different shape in exceptional cases like perfect complements, perfect substitutes. Also if an assumption of 'two goods' is dropped, indifference curve may touch X axis or Y axis also. In case of an exceptional shape of an indifference curve, equilibrium may be called as corner solution. This section deals with such cases.

Normally, an equilibrium is achieved at the point of tangency between the budget line and his indifference curve. At this point, consumer's preferences are such that he likes to consume some amount of both the goods. This equilibrium position at the point of tangency which lies within commodity space between the two axes is often called interior solution. Interior solution implies that consumers' pattern of consumption is diversified and they prefer basket or bundle of several different goods instead of spending their entire income on a single commodity.

However, this may not be true in real life scenario and a customer may prefer small number of goods and service rather than buying all goods and services available. There may be various reasons for such behaviour – price, taste and preference etc.

Corner solution when only Commodity Y is purchased

Fig. 5.13 presents a case where indifference map between two goods X and Y and budget line BL are such that the interior solution is not possible and consumer in its equilibrium position at point B will not consume any quantity of commodity X. The reason behind such indifference map is high price of commodity X. As we already know that the slope of budget line is ratio of price of two goods, high price of good X makes the budget curve is steeper than the indifference curves between the two commodities i.e. price or opportunity cost of commodity X in the market is greater than the marginal rate of substitution of X for Y which indicates willingness to pay for the commodity X ($P_x/P_y > MRS_{xy}$). The price of good X is so high that the consumer does not purchase even one unit of the commodity X. Thus the consumer maximises his satisfaction or is in equilibrium at the corner point B where he buys only commodity Y. Thus, consumer's equilibrium in this case is a corner solution.

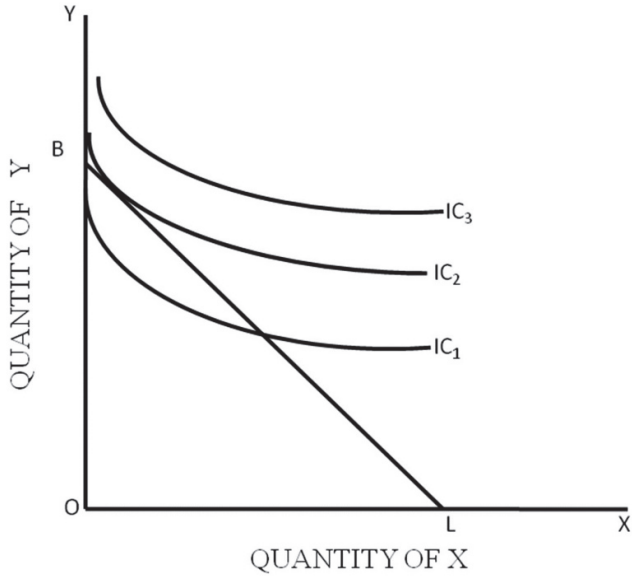

Fig. 5.13: Corner solution when only Commodity Y is bought

Corner solution when only Commodity X is purchased

On the other hand, when the indifference map between the two goods is such that the budget line BL is less steep than the indifference curves between the two goods so that the $MRS_{xy} > P_x/P_y$ for all levels of consumption along the budget line BL. Therefore, he maximises his satisfaction at the corner point L where he buys only commodity X and none of Y. In this case price of commodity Y and willingness to pay (i.e. MRS) for it are low that he does not consider it worthwhile to purchase even one unit of it. Fig. 5.14 presents the corner solution when only commodity X is purchased.

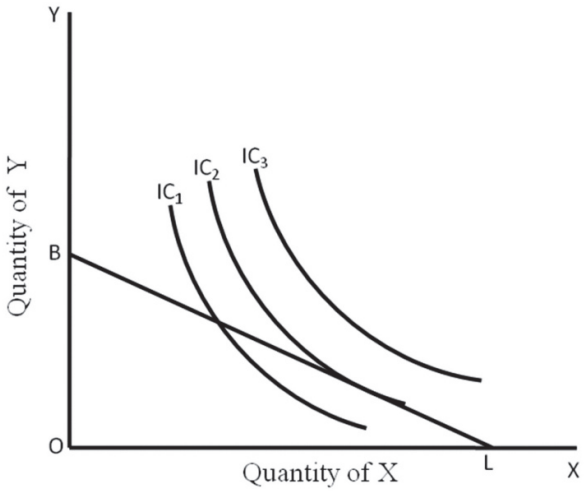

Fig. 5.14: Corner solution when only Commodity X is purchased

Corner Equilibrium and Concave Indifference Curves:

The indifference curves are usually convex to the origin. Convexity of indifference curves is due to the reason that marginal rate of substitution of X for Y falls as more of X is substituted for Y. However, indifference curves are concave to the origin in some exceptional cases. Concavity of the indifference curves implies that the marginal rate of substitution of X for Y increases when more of X is substituted for Y. Thus, in case of concave indifference curve, consumer will choose or buy only one good. It implies that the customer prefers to buy only one good and does not prefer diversification in his buying pattern.

In case of concave indifference curves, the consumer will not be in equilibrium at the point of tangency between budget line and indifference curve, that is, in this case interior solution will not exist. Instead, we would have corner solution for consumer's equilibrium. Corner solution in case of concave indifference curve is presented in Fig. 5.15.

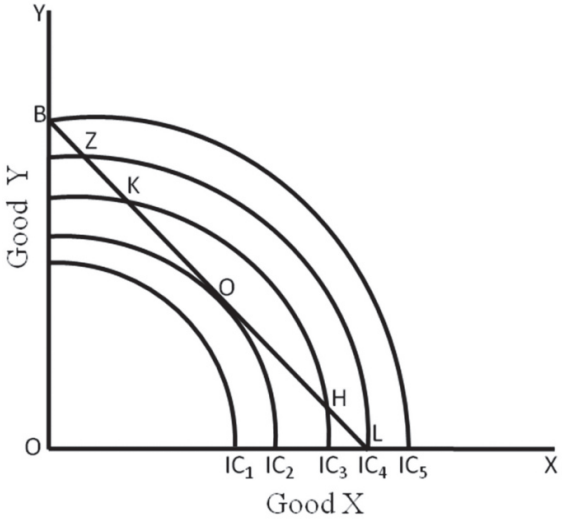

Fig. 5.15: Consumer equilibrium in case of concave indifference curves

It can be observed from Fig. 5.15 that the given budget line BL is tangent to the indifference curve IC_2 at point Q. However, consumer cannot be in equilibrium at Q since by moving along the given budget line BL he can get on

to higher indifference curves and obtain greater satisfaction than at Q. Thus, by moving on higher indifference curve he will reach at extreme point B or point L. In Fig. 5.15, point B is on higher indifference curve. Thus, consumer will be satisfied at point B where he will buy OB units of commodity Y. It should be noted that at B the budget line is not tangent to the indifference curve IC_5, even though the consumer is here in equilibrium. It is clear that when a consumer has concave indifference curves, he will consume only one good.

Corner solution in case of Perfect Substitutes and Perfect Complements:

Another case of corner solution to the consumer's equilibrium occurs in case of perfect substitutes. As seen above, indifference curves for perfect substitutes are linear. In their case tangency or interior solution for consumer's equilibrium is not possible since the budget line cannot be tangent to a point of the straight-line indifference curve of substitutes.

In this case budget line would cut the straight-line indifference curves. Fig. 5.16A presents a case where slope of the budget line BL is greater than the slope of indifference curves. If the slope of the budget line is greater than the slope of indifference curves, B would lie on a higher indifference curve than L and the consumer will buy only Y.

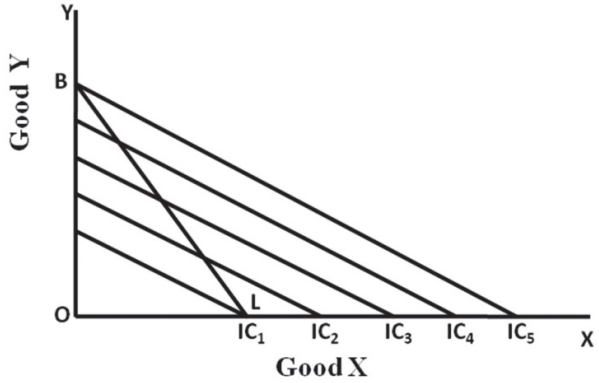

Fig. 5.16 A: Corner equilibrium in case of Perfect Substitutes

Fig. 5.16 B presents a case the slope of the budget line can be less than the slope of indifference curve. If the slope of the budget line is less than the slope of indifference curves, L would lie on a higher indifference curve than B and the consumer will buy only X.

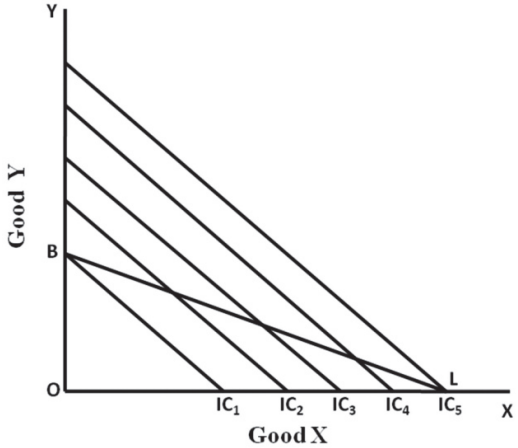

Fig. 5.16 B: Corner equilibrium in case of Perfect Substitutes

Perfect complements

Another exceptional case of perfect complementary goods is presented in Fig. 5.17. Indifference curves of perfect complementary goods have a right-angled

shape. In such a case the equilibrium of the consumer will be determined at the corner of indifference curve which just touches the budget line. It can be noted from Fig. 5.17 that in case of perfect complements equilibrium point will be point C and will be consuming OM of X and ON of Y.

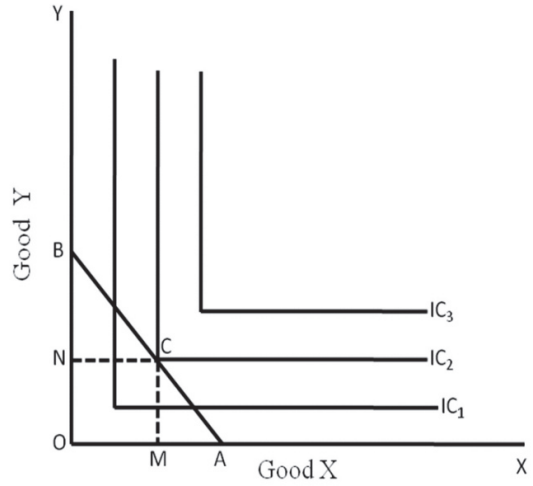

Fig. 5.17: Corner solution in case of Perfect Complements

5.9 PRICE EFFECT AS COMBINATION OF INCOME EFFECT AND SUBSTITUTION EFFECT

As discussed above, a consumer's equilibrium position is affected by the changes in his income, prices of substitute and changes in the price of goods consumed. These effects are known as:

1) Income effect,

2) Substitution effect, and

3) Price effect

5.9.1 Income Effect

In the analysis of the consumer's equilibrium it is assumed that the income of the consumer remains constant, and the prices of the goods X and Y are given. Thus, given the tastes and preferences of the consumer and the prices of the two goods, if the income of the consumer changes, the effect it will have on his purchases is known as the Income effect.

The Income effect may be defined as the effect on the purchases of consumer caused by the changes in income, if the prices of goods remain constant. If the income of the consumer increases his budget line will shift upward to the right, parallel to the original budget line. On the contrary, a fall in his income will shift the budget line inward to the left. The budget lines are parallel to each other because relative prices remain unchanged.

Assumptions of Income Effect

1) The prices of both the commodities X and Y remain constant

2) Taste and preferences remain constant

3) There is no change in fashion and market condition

Kinds of Income Effect

Income effect may be of three types:

1) Positive Income effect
2) Negative Income effect
3) Zero Income effect

1) **Positive Income effect:** When an increase in income leads to an increase in demand for a commodity or for both the commodities the income effect is positive. In case of Normal goods, income effect is positive and Income consumption curve slopes upwards to the right.
2) **Negative Income effect:** Income effect is negative, when with the increase in his income, the consumer reduces his consumption of the good. Income effect is negative in case of inferior goods.
3) **Zero Income effect:** If with the change in income, there is no change in the quantity purchased of a commodity, than the income effect is said to be zero. Zero income effect is in case of goods like medicines, necessities like salt etc.

All the three effects are explained diagrammatically.

In Fig. 5.18, when the budget line is B_1, the equilibrium point is X* where it touches the indifference curve I_1. If now the income of the consumer increases, B_1 will move to the right as the budget line B_2, I_1, and the new equilibrium point is X_1 where it touches the indifference curve I_2. As income increases further, B_3 becomes the budget line with X_2 as its equilibrium point.

The locus of these equilibrium points X*, X_1 and X_2 traces out a curve which is called the income-consumption curve (ICC). The ICC curve shows the income effect of changes in consumer's income on the purchases of the two goods, given their relative prices.

Normally, when the income of the consumer increases, he purchases larger quantities of two goods. Usually, the income consumption curve slopes upwards to the right as shown in Fig. 5.18. Here the income effect is also positive and both X and Y are normal goods.

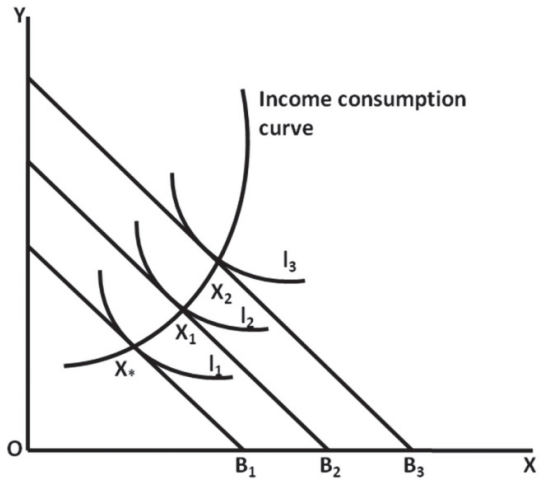

Fig. 5.18: Income Consumption curve-Normal goods

But an Income-consumption curve can have any shape provided it does not intersect an Indifference curve more than once.

The second type of ICC curve may have a positive slope in the beginning but become and stay horizontal beyond a certain point when the income of the consumer continues to increase. In case where X is a superior good and Y is a necessity, shape of ICC curve will be as shown in Fig. 5.19.

In Fig. 5.19, the ICC curve slopes upwards with the increase in income up to the equilibrium point R at the budget line P_1Q_1 on the indifference cure I_2. Beyond this point it becomes horizontal which means that the consumer has reached the saturation point regarding consumption of good Y. He buys the same amount of Y (RA) as before despite further increases in his income. It often happens in the case of a necessity (like salt) whose demand remains the same even when the income of the consumer continues to increase further. Here Y is a necessity.

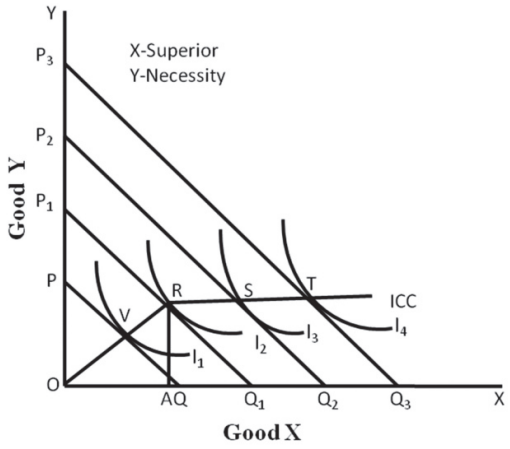

Fig. 5.19: Income Consumption curve (X is a superior good and Y is a necessity)

Further, the demand of inferior goods falls, when the income of the consumer increases beyond a certain level, and he replaces them by superior substitutes. For example, he may replace coarse grains by wheat or rice, and coarse cloth by a fine variety. In Fig. 5.20, good X is inferior and Y is a normal good.

It can be observed from the Fig. 5.20, that up to point R the ICC curve has a positive slope and beyond that it is negatively inclined. The consumer's purchases of X fall with the increase in his income.

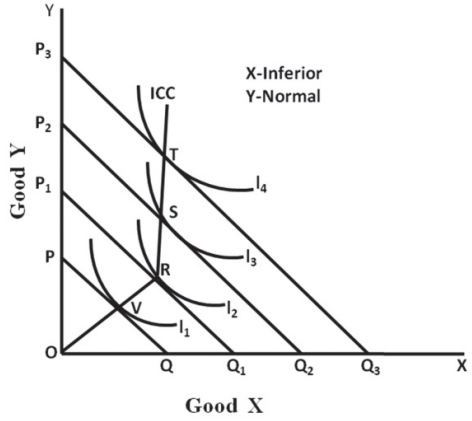

Fig. 5.20: Income Consumption curve (Y is normal good and X is inferior)

The different types of income-consumption curves are also shown in Fig. 5.21 where: (1) ICC_1, has a positive slope and relates to normal goods; (2) ICC_2 is horizontal from point A, X is a normal good while Y is a necessity of which the consumer does not want to have more than the usual quantity as his income increases further: (3) ICC_3 is vertical from A, y is a normal good here and X is satiated necessity; (4) ICC_4 is negatively inclined downwards, Y becomes an inferior good form A onwards and X is a superior good; and (5) ICC_5 shows X as an inferior good.

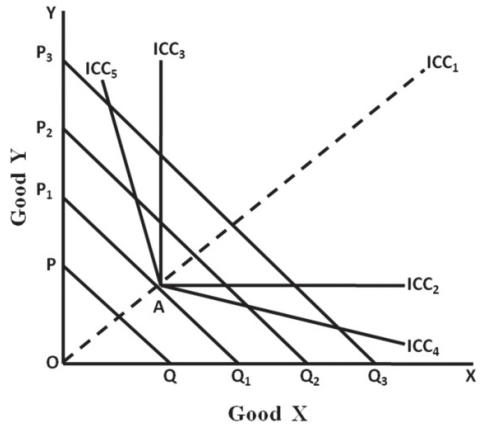

Fig. 5.21: Possible shapes of Income Consumption curve (ICC)

5.9.2 Substitution Effect

The substitution effect relates to the change in the quantity demanded resulting from a change in the price of one good it prompts the substitution of relatively cheaper good for a dearer one, while keeping the price of the other good, real income and tastes of the consumer as constant. Prof. Hicks has explained the substitution effect independent of the income effect through compensating variation in income. "The substitution effect is the increase in the quantity bought as the price of a commodity falls, after adjusting income so as to keep the real purchasing power of the consumer the same as before. This adjustment in income is called compensating variations and is shown graphically by a parallel shift of the new budget line until it become tangent to the initial indifference curve."

Thus, on the basis of the methods of compensating variation, the substitution effect measures the effect of change in the relative price of a good. The increase in the real income of the consumer as a result of fall in the price of, say good X, is so withdrawn that he is neither better off nor worse off than before.

The substitution effect is explained in Fig. 5.22 where the original budget line is PQ with equilibrium at point R on the indifference curve I_1. At R, the consumer is buying OB of X and BR of Y. Suppose the price of X falls so that his new budget line is PQ_1. With the fall in the price of X, the real income of the consumer increases. To make the compensating variation in income or to keep the consumer's real income constant, take away the increase in his income equal to PM of good Y or Q_1N of good X so that his budget line PQ_1 shifts to the left as MN and is parallel to it so that new budget line tangent to I_1 at point H.

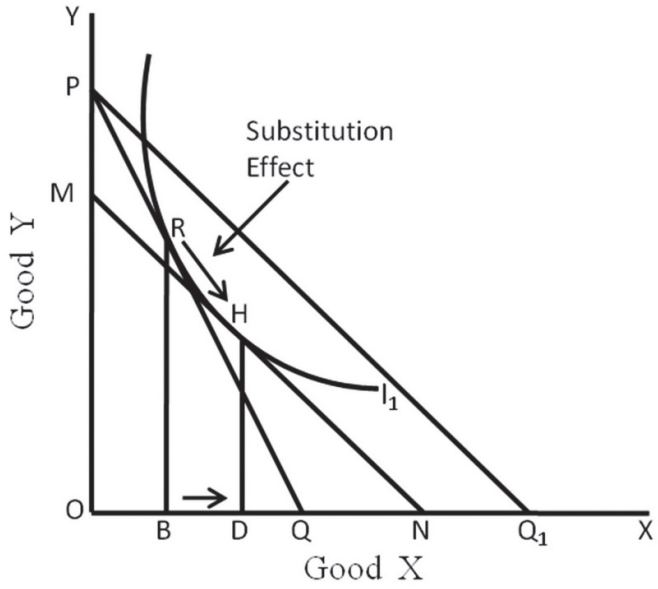

Fig. 5.22: Substitution effect (Hicksian Analysis)

As MN is tangent to the original indifference curve I_1, at point H, the consumer buys OD of X and DH of Y. Thus PM of Y or Q_1N of X represents the compensating variation in income, as shown by the line MN being tangent to the curve I_1 at point H. Now the consumer substitutes X for Y and moves from point R to H or the horizontal distance from B to D. This movement is called the substitution effect. The substitution affect is always negative because when the price of a good falls (or rises), more (or less) of it would be purchased, the real income of the consumer and price of the other good remaining constant. In other words, the relation between price and quantity demanded being inverse, the substitution effect is negative.

5.9.3 Price Effect

The price effect indicates the way the consumer's purchases of good X change, when its price changes, given his income, tastes and preferences and the price of good Y. This is shown in Fig. 5.23. Suppose the price of X falls. The budget line PQ will extend further out to the right as PQ_1, showing that the consumer will buy more X than before as X has become cheaper. The budget line PQ_2 shows a further fall in the price of X. Any rise in the price of X will be represented by the budget line being drawn inward to the left of the original budget line towards the origin.

If we regard PQ_2, as the original budget line, a two time rise in the price of X will lead to the shifting of the budget line to PQ_1, and PQ_2 – PQ. Each of the budget lines fanning out from P is a tangent to an indifference curve I_1, I_2, and I_3 at R, S and T respectively. The curve PCC connecting the locus of these equilibrium points is called the price-consumption curve (PCC). The price-consumption curve indicates the price effect of a change in the price of X on the consumer's purchases of the two goods X and Y, given his income, tastes, preferences and the price of good Y.

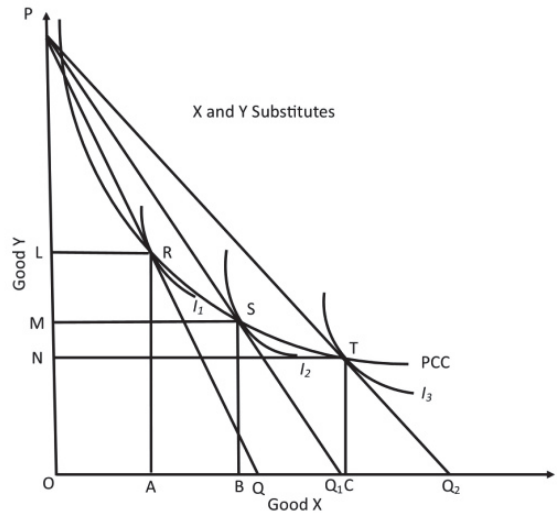

Fig. 5.23: Price effect through Indifference curve analysis

Check Your Progress 3

1) Differentiate between Income effect, price effect and substitution effect.

.....

.....

.....

2) What will be the shape of Income consumption curve (ICC):

Case A: X is an inferior good, Y is superior good

.....

.....

Case B: Y is an inferior good, X is superior good

.....

.....

5.10 MEASURING INCOME AND SUBSTITUTION EFFECTS OF PRICE CHANGE

As noted above, the change in consumption basket due to change in the prices of consumer goods is called price effect. Price effects combines two effects: Income effect and substitution effect. Income effect is the result of increase in real income due to decrease in price of a commodity. Substitution effect arises due to substitution of costly good by cheaper good. This section presents the decomposition of Income and substitution effect from the price effect. There are two approaches for the decomposition: a) Hicksian approach, and b) Slutsky approach.

Hicksian approach uses two methods of splitting the price effect, namely

i) Compensating variation in income

ii) Equivalent variation in income.

Slutsky uses cost-difference method to decompose price effect into its two component parts.

Hicksian or Compensating Variation approach

In this method of decomposition of price effect into income and substitution effects by compensating variation, income of the consumer is adjusted so as to offset the change in satisfaction and bring the consumer back to his original indifference curve, that is, his initial level of satisfaction before the change in price.

For instance, with the fall in price of a commodity, a consumer moves to a new equilibrium position at a higher indifference curve i.e. at a higher level of satisfaction. To offset this increase in satisfaction resulting from a fall in price of the good, one part of income is taken back to force him to come back at his original indifference curve. This requires reduction in income (say, through levying a lump sum tax) to cancel out the gain in satisfaction or welfare on account of by reduction in price of a good. It is called compensating variation in income.

The effect is called compensating variation in income because it compensates (in a negative way) for the gain in satisfaction resulting from a price reduction of the commodity. Process of decomposition of price effect into substitution effect and income effect through the method of compensating variation in income is presented in Fig. 5.24.

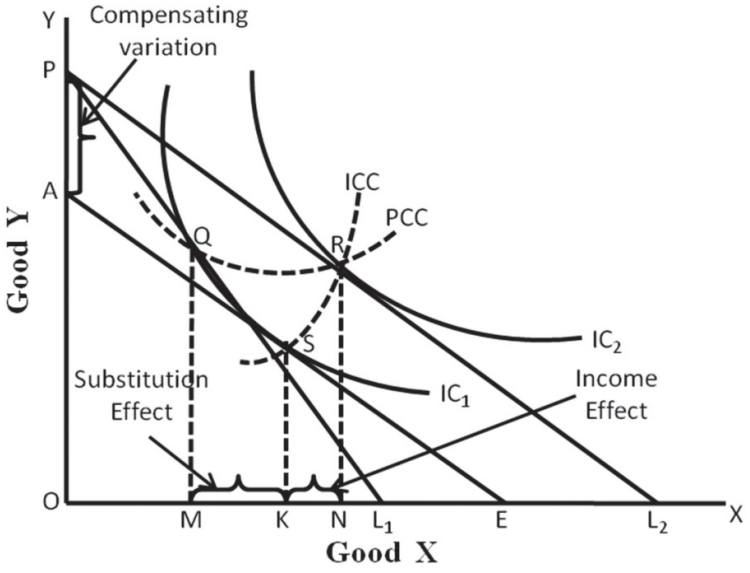

Fig. 5.24: Decomposition of price effect into income effect and substitution effect through Compensating variation in Income

It can be observed from Fig. 5.24, that when price of good X falls, budget line shifts to PL_2 i.e. real income of the consumer i.e. he can buy more of both the goods with his increased income. With the new budget line PL_2, consumer is in equilibrium at point R on a higher indifference curve IC_2 and enjoy increased satisfaction as a result of fall in price of good X.

Suppose, money income of the consumer is reduced by the compensating variation in income so that he is forced to come back to the original indifference curve IC_1 he would buy more of X since X has now become

relatively cheaper than before. In Fig. 5.24, with the reduction in income by compensating variation, budget line will shift to AB which has been drawn parallel to PL_2 so that it just touches the indifference curve IC_1 on which he was before the fall in price of X.

Since the price line AB has got the same slope as PL_2, it represents the changed relative prices with X being relatively cheaper than before. Now, X being relatively cheaper than before, the consumer, in order to maximise his satisfaction, in the new price income situation substitutes X for Y.

Thus, when the consumer's money income is reduced by the compensating variation in income (which is equal to PA in terms of Y or L_2B in terms of X), the consumer moves along the same indifference curve IC_1 and substitutes X for Y. At price line AB, consumer is in equilibrium at S at indifference curve IC_1 and is buying MK more of X in place of Y. This movement from Q to S on the same indifference curve IC_1 represents the substitution effect since it occurs due to the change in relative prices alone, real income remaining constant.

If the amount of money income which was taken away from him is now given back to him, he would move from S at indifference curve IC_1 to R on a higher indifference curve IC_2. The movement from S at lower indifference curve to R on a higher in difference curve is the result of income effect. Thus the movement from Q to R due to price effect can be regarded as having taken place into two steps first from Q to S as a result of substitution effect and second from S to R as a result of income effect. Thus, price effect is the combined result of a substitution effect and an income effect.

In Fig. 5.24 the various effects on the purchases of good X are:

- Price effect = MN
- Substitution effect = MK
- Income effect = KN
- MN = MK+KN or

Price effect = Substitution effect + Income effect

Slusky's Cost difference approach

In Slutsky's approach, when the price of good changes and consumer's real income or purchasing power increases, the income of the consumer is changed by the amount equal to the change in its purchasing power which occurs as a result of the price change. His purchasing power changes by the amount equal to the change in the price multiplied by the number of units of the good which the individual used to buy at the old price.

In other words, in Slutsky's approach, income is reduced or increased (as the case may be), by the amount which leaves the consumer to be just able to purchase the same combination of goods, if he so desires, which he was having at the old price.

That is, the income is changed by the difference between the cost of the amount of good X purchased at the old price and the cost of purchasing the same quantity of X at the new price. Income is then said to be changed by the cost difference. Thus, in Slutsky substitution effect, income is reduced or

increased not by compensating variation as in case of the Hicksian substitution effect, but, by the cost difference.

Slutsky substitution effect is explained in Fig. 5.25.

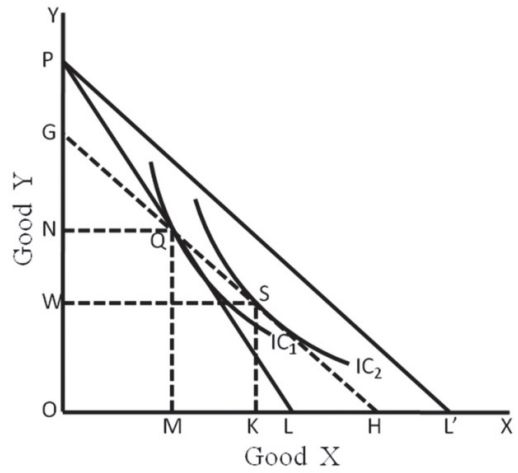

Fig. 5.25: Slutsky's Substitution Effect (For a Fall in Price)

Initially, with a given money income and the given prices of two goods as represented by the price line PL, the consumer is in equilibrium at point Q on the indifference curve IC_1 where consumer is buying OM units of good X and ON units of good Y. Suppose that price of X falls, price of Y and money income of the consumer remaining constant. As a result of this fall in price of X, the price line will shift to PL' and the real income or the purchasing power of the consumer will increase.

In order to identify Slutsky's substitution effect, consumer's money income must be reduced by the cost difference or, in other words, by the amount which will leave him to be just able to purchase the old combination Q, if he so desires.

For this, a price line GH parallel to PL' has been drawn which passes through the point Q. It means that income equal to PG in terms of Y or LH in terms of X has been taken away from the consumer and as a result he can buy the combination Q, if he so desires, since Q also lies on the price line GH.

Consumer will not now buy the combination Q since X has now become relatively cheaper and Y has become relatively dearer than before. The change in relative prices will induce the consumer to rearrange his purchases of X and Y. He will substitute X for Y. But in this Slutsky substitution effect, he will not move along the same indifference curve IC_1, since the price line GH, on which the consumer has to remain due to the new price-income circumstances is nowhere tangent to the indifference curve IC_1.

The price line GH is tangent to the indifference curve IC_2 at point S. Therefore, the consumer will now be in equilibrium at a point S on a higher indifference curve IC_2. This movement from Q to S represents Slutsky substitution effect according to which the consumer moves not on the same indifference curve, but from one indifference curve to another.

It is important to note that movement from Q to S as a result of Slutsky substitution effect is due to the change in relative prices alone, since the effect

due to the gain in the purchasing power has been eliminated by making a reduction in money income equal to the cost-difference.

At S, the consumer is buying OK of X and OW of Y; MK of X has been substituted for NW of Y. Therefore, Slutsky substitution effect on X is the increase in its quantity purchased by MK and Slutsky substitution effect on Y is the decrease in its quantity purchased by NW.

5.11 DERIVATION OF DEMAND CURVE FROM INDIFFERENCE CURVES

A demand curve shows quantity of a good purchased or demanded at various prices, assuming that tastes and preferences of a consumer, his income, and prices of all related goods remain constant. Demand curve showing relationship between price and quantity demanded can be derived from price consumption curve (PCC) of indifference curve analysis.

In Marshallian utility analysis, demand curve was derived on the assumptions that utility was cardinally measurable and marginal utility of money remained constant with the change in price of the good. In the indifference curve analysis, demand curve is derived without making such assumptions.

Let us suppose that a consumer has got income of Rs. 300 to spend on goods. In Fig. 5.26 money is measured on the Y-axis, while the quantity of the good X whose demand curve is to be derived is measured on the X-axis. An indifference map of a consumer is drawn along with the various budget lines showing different prices of the good X. Budget line PL_1 shows that price of the good X is Rs. 15 per unit.

As price of good X falls from Rs. 15 to Rs. 10, the budget line shifts to PL_2. Budget line PL_2 shows that price of good X is Rs. 10. With a further fall in price to Rs. 7.5 the budget line takes the position PL_3. Thus PL_3 shows that price of good X is Rs. 7.5. When price of good X falls to Rs. 6, PL_4 is the relevant budget line.

Tangency points between the various budget lines and indifference curves, which when joined together by a line constitute the price consumption curve shows the amounts of good X purchased or demanded at various prices. With the budget line PL_1 the consumer is in equilibrium at point Q_1 on the price consumption curve (PCC) at which the budget line PL_1 is tangent to indifference curve IC_1. In his equilibrium position at Q_1 the consumer is buying OA units of the good X. In other words, it means that the consumer demands OA units of good X at price Rs. 15. When price falls to Rs. 10 and thereby the budget line shifts to PL_2, the consumer comes to be in equilibrium at point Q_2 the price-consumption curve PCC where the budget line PL_2 is tangent to indifference curve IC_2. At Q_2, the consumer is buying OB units of good X.

In other words, the consumer demands OB units of the good X at price Rs. 10. Likewise, with budget lines PL_3 and PL_4, the consumer is in equilibrium at points Q_3 and Q_4 of price consumption curve and is demanding OC units and OD units of good X at price Rs. 7.5 and Rs. 6 respectively. Thus, price consumption curve shows the quantity demanded of the good X against various prices.

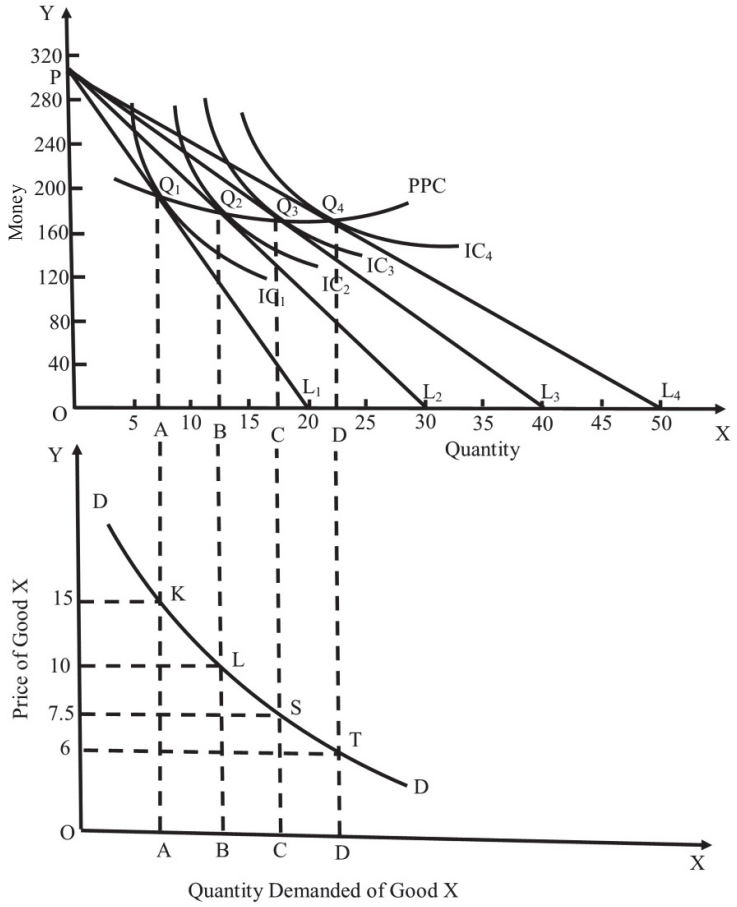

Fig. 5.26: Derivation of demand curve from indifference curve

In most cases, the demand curve of individuals will slope downward to the right, because as the price of a good falls both the substitution effect and income effect pull together in increasing the quantity demanded of the good. Even when the income effect is negative, the demanded curve will slope downward to the right if the substitution effect is strong enough to overcome the negative income effect. Only when the negative income effect is powerful enough to outweigh the substitution effect can the demand curve slope upward to the right instead of sloping downward to the left.

Deriving Demand Curve for a Giffen Good:

Giffen good is a good where higher price causes an increase in demand (reversing the usual law of demand). The increase in demand is due to the income effect of the higher price outweighing the substitution effect. In this section we will derive the demand curve of a Giffen good.

In Fig. 5.26, demand curve DD in case of a normal good is downward sloping. There are two reasons behind downward slope: a) income effect b) substitution effect.

Both the income effect and substitution effect usually work towards increasing the quantity demanded of the good when its price falls and this makes the demand curve slope downward. But in case of Giffen good, the demand curve slopes upward from left to right. This is because in case of a Giffen good, income effect, which is negative and works in opposite direction to the substitution effect, outweighs the substitution effect. This results in the fall in

quantity demanded of the Giffen good when its price falls and therefore the demand curve of a Giffen good slopes upward from left to right. Fig. 5.27 presents the Indifference curves of a Giffen good along with the various budget lines showing various prices of the good. Price consumption curve of a Giffen good slopes backward.

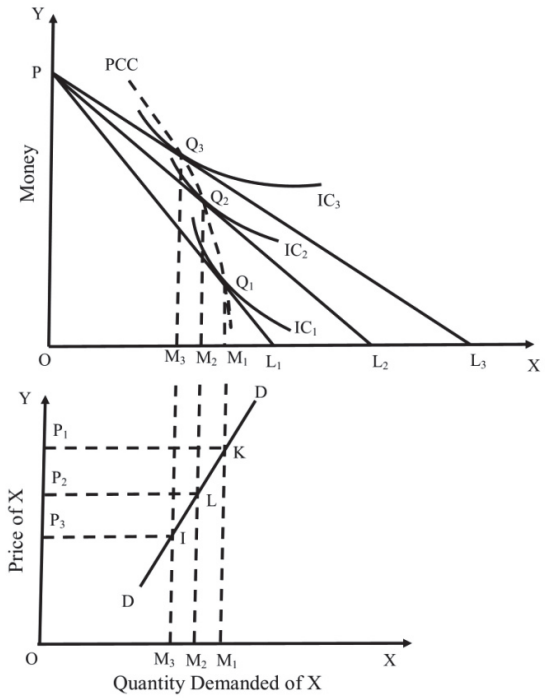

Fig. 5.27: Upward Sloping Demand Curve for a Giffen Good

It is evident from Fig. 5.27 (the upper portion) that with budget line PL_1 (or price P_1) the consumer is in equilibrium at Q_1 on the price consumption curve PCC and is purchasing OM) amount of the good. With the fall in price from P_1 to P_2 and shifting of budget line from PL_1 to PL_2, the consumer goes to the equilibrium position Q_3 at which he buys OM_2 amount of the good. OM_2 is less than OM_1.

Thus, with the fall in price from P_1 to P_2 the quantity demanded of the good falls. Likewise, the consumer is in equilibrium at Q_3 with price line PL_3 and is purchasing OM at price P_3. With this information we can draw the demand curve, as is done in the lower portion of Fig. 5.26. It can be seen from Fig. 5.27 (lower part) that the demand curve of a Giffen good slopes upward to the right indicating that the quantity demanded varies directly with the changes in price. With the rise in price, quantity demanded increases and with the fall in price quantity demanded decreases.

Check Your Progress 4

1) Differentiate between Hicksian or Compensating Variation approach and Slutsky Cost difference approach.

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2) How can demand curve be derived from Indifference curve?

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5.12 LET US SUM UP

In this unit, we have learnt consumer equilibrium through Indifference curve analysis. Consumer equilibrium is a situation, in which a consumer derives maximum satisfaction, with no intention to change it and subject to given prices and his given income. In indifference curve analysis, the point of maximum satisfaction is achieved by studying indifference map and budget line together. We have discussed the concept of budget line to identify consumer equilibrium. Price line or budget line represents all possible combinations of two goods that a consumer can purchase with his given income and the given prices of two goods. Budget line may shift due to change in income or change in prices of either of the two commodities. We further examined the two conditions of consumer equilibrium i.e. MRS_{XY} = Ratio of prices or P_X/P_Y and continuous fall of MRS. We have also learnt how is Price effect combination of income effect and substitution effect using Hicksian and Slutsky's analysis. Demand curve has been derived from price consumption curve.

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5.14 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Study Section 5.4 and answer

2) Study Sub-section 5.3.4 and answer

3) Indifference curve is convex to origin because of diminishing marginal rate of substitution.

Check Your Progress 2

1) Study Section 5.5 and answer

2) Study Section 5.6 and answer

Check Your Progress 3

1) Study Section 5.9 and answer

2) Study Section 5.9 and answer

Check Your Progress 4

1) Study Section 5.10 and answer

2) Study Section 5.11 and answer