2 CONSUMER'S EQUILIBRIUM

Learning Objectives

2.1 INTRODUCTION

The aim of this chapter is to make you understand "How does a consumer maximize his satisfaction from consumption of goods. As the resources are limited in relation to unlimited wants a consumer has to follow some principles and laws in order to attain the highest satisfaction level. The two main approaches to study consumer's behaviour and consumer's equilibrium are "Cardinal Utility Approach" and "Ordinal Utility Approach". We will study about them in detail. This chapter will also tell us about the concept of utility in which we will discuss about total utility, marginal utility and relationship between both of them.

2.2 THE CONCEPT OF UTILITY

Why does a consumer buy a commodity? What commodity does he purchase and what he does not? How should a consumer spend his income on different goods and services? Or, in short, what regulates the consumers behaviour in the market? To answer all such questions and for explaining consumer behaviour in the market, economists developed the notion of utility.

What do we mean by utility? We know that a consumer derives some sort of satisfaction from consuming a commodity. This power of satisfaction of a commodity is termed as utility. Thus, **utility is the want satisfying power of a commodity**. Now the question is: How is utility measured or what is the unit of measurement for utility? According to some economists, 'utils' can be taken as the unit of measurement for utility. On the other hand, some say that utility can directly be expressed in terms of money. There are two main forms of utility: marginal utility and total utility.

Marginal Utility (MU)

The marginal utility of a commodity is the change in total utility which results from a unit increase in consumption. In short, the increment to total utility is called marginal utility. Thus,

$$MU_n = TU_n - TU_{n-1} \quad Or \quad MU_n = \frac{\Delta \text{ in TU}}{\Delta \text{ in unit of commodity}}$$

Here,

MU = Marginal utility

TU_n = Total utility of n units of a commodity

TU_{n-1} = Total utility of $n - 1$ units of a commodity.

Suppose, the total utility from the consumption of 3 units of a commodity is equal to 20 and from 4 units we get 25 utils as the total utility, then the marginal utility is equal to 5 (25 – 20).

Total Utility (TU)

Total utility is defined as the **psychological satisfaction** a consumer obtains from consumi given amount of a particular good.

Total utility is the sum of the marginal utilities obtained from the consumption of diffe units of a commodity.

$$TU = \Sigma MU$$

$$TU = MU_1 + MU_2 + \ldots\ldots MU_n$$

TU = Total utility

ΣMU = Sum total of marginal utilities

Suppose, the marginal utilities of 3 units of a commodity are 6, 4 and 2 utils respectively. He TU will be equal to 12 utils (6 + 4 + 2).

Calculation of marginal utility and total utility has been explained in the following Table 2

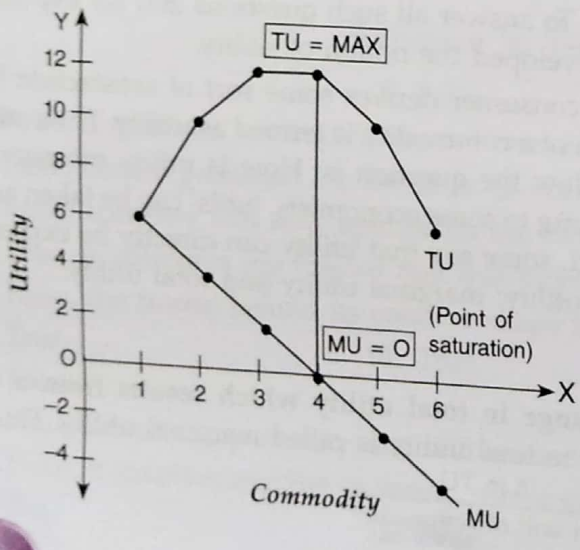
Table 2.1

Units of a Commodity	*MU (Utils)*	*TU (Utils)*
1	6	6
2	4	6+4 = 10
3	2	10+2 = 12
4	0	12+0 = 12
5	−2	12−2 = 10
6	−4	10−4 = 6

Units of Commodity	*TU (Utils)*	*MU (Utils)*
1	8	8 (= 8 – 0)
2	14	6 (= 14 – 8)
3	18	4 (= 18 – 14)
4	20	2 (= 20 – 18)
5	20	0 (= 20 – 20)
6	17	−(3) (= 17 – 20)

At 1st unit, MU is always equal to TU.

Relationship between MU and TU



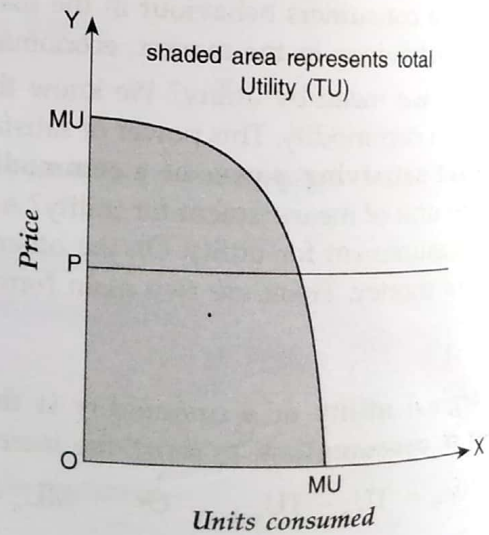


Fig. 2.1

The Table 2.1 and Fig. 2.1 show the relationship between MU and TU. Main points of this relationship are as follows:

(*i*) As long as the MU remains positive, TU goes on increasing at diminishing rate (till output 4).

(*ii*) When MU becomes zero, TU is maximum (at output 4).

(*iii*) When MU is negative, TU begins to fall (beyond output 4).

MU can be positive, zero or negative. But TU is always positive. In the beginning, TU increases then after reaching its maximum point, it starts to decline. Also, theoretically, if MU increases then TU increases at an increasing rate.

For Quick Revision

Marginal Utility (MU)	*Total Utility (TU)*
• When MU increases	• Then TU increases at increasing rate
• When MU falls but positive	• Then TU increases at diminishing rate
• When MU is zero	• Then TU reaches its maximum
• When MU is negative	• Then TU starts falling

2.3 LAW OF DIMINISHING MARGINAL UTILITY

Assumptions

1.Utility can be measured in quantity, i.e., utils.

2.It is assumed that consumption is a continuous process, i.e., there is no gap between consumption of two units.

3.No change in quality of commodity.

4.Consumer is rational, i.e., he aims at maximising total satisfation.

The law of diminishing marginal utility states that as the units of good consumed increase, the marginal utility of that good tends to diminish. What is the reason for this law? The diminishing marginal utility results from the fact that our enjoyment of the good declines as more and more of it is consumed. Suppose a consumer is hungry and starts to eat bananas. The first unit of banana gives him 8 utils of utility. Now marginal utility starts to diminish with the consumption of every successive unit of banana. Hence, the consumer gets 6, 4 and 2 of marginal utility from the consumption of second, third and fourth units of banana. When he consumes the fifth unit of banana, it does not give any additional utility to him because it is a **point of satiety** for him. Hence, the marginal utility of the 5th unit of banana becomes zero. If he goes on consuming bananas even after this point of satiety, it may create some trouble for him. It may have adverse effect on his stomach. Hence, the MU of the 6th unit becomes negative (as it is –2 in our example). This law of diminishing marginal utility is explained below with the help of Table 2.2 and Fig. 2.2.

Table 2.2

Units of a Commodity (Bananas)	*MU (Utils)*
1	8
2	6
3	4
4	2
5	0
6	–2

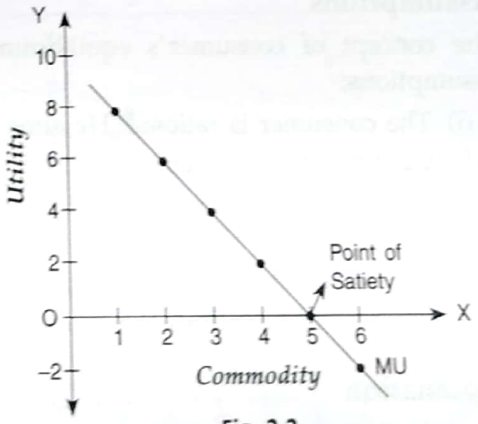


Fig. 2.2

Law of Diminishing Marginal Utility in terms of Total Utility

Law of diminishing marginal utility can also be explained with the help of total utility schedule. This total utility schedule is given below in Table 2.3.

Table 2.3: Total Utility Schedule

Units of a Commodity	MU (Utils)	TU (Utils)
1	8	8
2	6	14
3	4	18
4	2	20
5	0	20
6	–2	18

From the above schedule, it becomes clear that when a consumer consumes more and more units of a commodity, its marginal utility declines. But here, as we observe, total utility increases with a diminishing rate. This happens up to 4th unit of the commodity in the schedule. When a consumer consumes the 5th unit, MU becomes zero and TU is the maximum. After it, when consumer consumes the 6th unit, MU becomes negative and TU declines. Thus, in short, in the case of **law of diminishing marginal utility, first TU increases with a diminishing rate and after reaching its maximum level starts to decline.**

2.4 MEANING OF CONSUMER'S EQUILIBRIUM

How should a consumer spend his money income on different commodities? How much quantity of different commodities should be purchased by the consumer? Or how should a consumer allocate his given money income among different commodities? Or what is the guiding principle for the consumer in the purchase of various commodities? To answer all these questions, the economists have developed the concept of consumer's equilibrium. What is meant by consumer's equilibrium?

Consumer's equilibrium refers to a situation wherein a consumer gets maximum satisfaction from the purchase of the commodity with his given income and he has no tendency to make any change in his existing purchase. In short, consumer's equilibrium represents the state of maximum satisfaction to the consumer from a given money-income.

There are two approaches to explain the consumer's equilibrium: Utility Approach (cardinal) and Indifference Curve Approach (ordinal). These are discussed below.

2.5 UTILITY APPROACH [CARDINAL ANALYSIS]

Assumptions

The concept of consumer's equilibrium through utility approach is based on the following assumptions:

(*i*) The consumer is rational. He aims at the maximization of his utility or satisfaction.
(*ii*) Cardinal measurement of utility is possible, *i.e.*, it can be measured in units.
(*iii*) Utility can also be measured in terms of money. And marginal utility of money remains constant.
(*iv*) The law of diminishing marginal utility operates.
(*v*) Prices of commodities are given and remain constant.

Explanation

Now we shall explain consumer's equilibrium in two different situations.

A. Single commodity model

Let us suppose that a consumer wants to purchase only one commodity with his income. Now the question is: How much quantity should he purchase to reach the level of equilibrium? In this situation, the consumer should purchase that quantity of the commodity where the **marginal utility of the commodity in terms of money becomes equal to the price of the commodity**. How can we find out marginal utility of a commodity in terms of money? If we divide marginal utility of a commodity (in terms of utils) by the marginal utility of a rupee, we get marginal utility of a commodity in terms of money. Hence,

$$MU_x \text{ in terms of money } (MU_M) = \frac{MU_x \text{ in terms of utils}}{MU \text{ of a rupee } (MU_R)}$$

What is marginal utility of a rupee? It is the worth of a rupee to a consumer in terms of other goods. In other words, the marginal utility of a rupee is the extra utility that a consumer gets from the expenditure of one additional rupee on **other available goods**.

Now we can understand MU of a commodity in terms of money with the help of an example. Suppose, the marginal utility of x is 40 utils and the marginal utility of a rupee is 5 utils, then the marginal utility of x in terms of money will be equal to ₹ 8 (40/5).

Hence, the condition for consumer's equilibrium in one commodity model will be as follows:

MU in terms of Money (MU_M) = Price of commodity (P_x).

$$\text{i.e., } \frac{MU \text{ of product } (MU_x)}{MU \text{ of a rupee } (MU_R)} = P_x$$

Or

$MU_x = P_x$ {when $MU_R = 1$}

Let us illustrate the equilibrium with an example.

Let price of good x (P_x) = ₹ 3

₹ 1 = 2 units

i.e., $MU_R = 2$

Table 2.4

Units	MU_x	MU_M	P_x
1	10	5	3 } Consumer surplus
2	8	4	3 } Consumer surplus
3	**6**	**3**	**3 Consumer equilibrium**
4	4	2	3 } Loss
5	2	1	3 } Loss
6	0	0	3 } Loss

Here consumer will be in equilibrium at 3 units because at this levels $MU_M = P_x$.

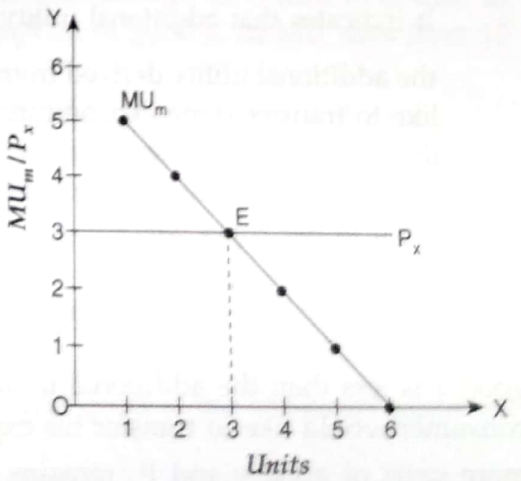


Fig. 2.3 (a)

Now

Why $MU_M = P_x$ is equilibrium condition? Let's see:

Using the given diagram.

(*i*) Before point E, $MU_m > P_x$ which signifies that satisfaction obtained from each additional unit of good x is greater than what a consumer pays for that commodity so he will increase the consumption of good x. As a result MU_m will fall till it become equal to P_x.

(*ii*) After point E, $MU_m < P_x$ which signifies that consumer is willing to pay less than what he actually pays so he will reduce the consumption of good x. As a result MU_m will rise till it become equal to P_x.

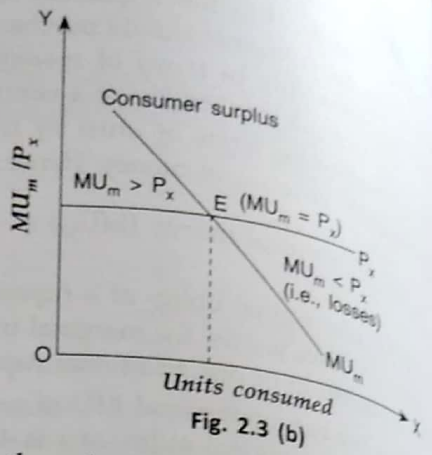


Fig. 2.3 (b)

(*iii*) **Conclusion**: From the above two points we conclude that equilibrium is struck at point E, where the price consumer is willing to pay is equal to price he actually pays.

B. Two commodities

Suppose a consumer wants to purchase more than one commodity or many commodities from his given income. In order to keep our analysis simple, we assume that the consumer wants to purchase two commodities. The fundamental condition of consumer's equilibrium is the principle of equi-marginal utility. The **law of equi-marginal utility** states that a consumer gets maximum satisfaction when the ratio of marginal utilities of all commodities and their prices is equal. In other words, the principle of equi-marginal utility implies that the consumer should incur expenditure on different commodities in such a manner that the marginal utility of the last rupee spent on each one of them is equal. The **conditions of consumer's equilibrium** are given below:

(*i*) $$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \text{MU of a rupee spent on a good}$$

where,

MU_x = Marginal utility of x

MU_y = Marginal utility of y

P_x = Price of x

P_y = Price of y

(*ii*) Law of Diminishing Marginal Utility must prevail i.e. MU_x must diminish.

Now let us see what happens if the above conditions are not satisfied. Suppose the ratio related to x commodity is greater than the ratio related to y commodity, *i.e.*, $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$. It indicates that additional utility derived from spending last rupee on good x is more than the additional utility derived from spending last rupee on good y. Hence, the consumer would like to transfer some expenditure from y to x. When the consumer buys more units of x and the P_x remains the same, the per rupee MU_x will go down. On the other hand, buying less units of y will raise the per rupee MU_y. This process continues till per rupee MU_x becomes equal to per rupee MU_y.

Also, if $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$, it implies that additional utility derived from spending last rupee on good x is less than the additional utility derived from spending last rupee on good y. Hence, the consumer would like to transfer his expenditure from good x to good y. When the consumer buys more units of good y and P_y remains the same, the per rupee MU_y will go down. On the other

hand, buying less units of good x will raise the per rupee MU_x. This process continues till per rupee MU_x becomes equal to per rupee MU_y *i.e.*, $\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$.

Consumer's Reaction in Different Situations

We know that in case of two commodities, a consumer will be in equilibrium when the ratio of marginal utility to price in regard to both the commodities is equal. It means for consumer's equilibrium following condition should be fulfilled:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

Now let us see what happens when this condition is disturbed? Or what will be the reaction (or behaviour) of the consumer when this condition is not fulfilled?

Lets take the following example:

Say, MU_x = 10 utils

P_x = ₹ 2

MU_y = 15 utils

P_y = ₹ 3

According to above information, equilibrium condition is met, *i.e.*

$$\frac{MU_x}{P_x} = \frac{10}{2} = \frac{MU_y}{P_y} = \frac{15}{3} = 5$$

Now say Price of good × falls from ₹ 2 to ₹ 1, then see what happens:

$$\frac{MU_x}{P_x} = \frac{10}{1} = 10$$

and $\frac{MU_y}{P_y}$ is still 5.

So, now the following situation will occur:

$$\frac{MU_x}{P_x}, \text{ i.e., } \left(\frac{10}{1}\right) > \frac{MU_y}{P_y}, \text{ i.e., } \left(\frac{15}{3}\right)$$

Here consumer will do **two** things:

1. Increase the consumption of good x so that MU_x keeps on falling as per law of diminishing marginal utility.
2. Decrease the consumption of good y so that MU_y keeps on rising as per the law of diminishing marginal utility.

Lets say, with increase in consumption of good x, its MU falls from 10 to 9, then to 8, then to 7, then to 6 and on the other hand with decrease in consumption of good y, its MU rises from 15 to 16, then to 17 and then to 18.

Now, after the above change in MUs of good x and good y, following positon will occur:

$$\frac{MU_x}{P_x} = \frac{6}{1} = 6$$

and $\frac{MU_y}{P_y} = \frac{18}{3} = 6$

So, ultimately with the change in combination of good x and good y, the consumer again will attain the equilibrium position as:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = 6$$

For quick revision

Situation	Implication	Consumer's reaction
1. P_x falls	$\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$	• Increase good x • Decrease good y
2. P_x rises	$\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$	• Decrease good x • Increase good y
3. P_y falls	$\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$	• Decrease good x • Increase good y
4. P_y rises	$\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$	• Increase good x • Decrease good y

2.6 INDIFFERENCE CURVE APPROACH (ORDINAL UTILITY)

Indifference curve analysis is based on the concept of **ordinal measurement of utility**. It is a comm experience that a consumer cannot measure utilities of different commodities in quantitative ter It is because of this reason that the indifference curve analysis was developed on the basis of ordi measurement of utility. The concept of ordinal measurement of utility implies that a consumer c state definitely whether the utility derived from a commodity is greater, less or equal to the util derived from another commodity.

Distinction between Cardinal Utility and Ordinal Utility

Cardinal utility refers to the analysis in which we can measure utilities of different commodities quantitative terms. For example, the marginal utility of 1st and 2nd unit of banana is equal to 5 and 4 uti respectively or when a consumer consumes 1 unit of apple, he gets 10 utils utility from it. On the oth hand, ordinal utility implies that a consumer can state that the utility derived from a commodity (or combination of goods) is greater, less or equal to the utility derived from another commodity (or anoth combination of goods). Thus, in case of ordinal utility, a consumer expresses his order of preferen regarding different combinations of two goods. For example, here consumer says that he prefe $3x + 4y$ than $3x + 3y$.

Basis	Cardinal Utility Analysis	Ordinal Utility Analysis
1. Concept	1. Utility is measurable and quantifiable concept.	1. Utility is a psychological concept.
2. Expressed in	2. Utility is expressed numerically in utils.	2. Utility is expressed in terms of ranking, i.e., consumer gives his preference.
3. Propounded by	3. Given by Prof. Alfred Marshall.	3. Given by Prof. J.R. Hicks.

2.7 BUDGET LINE

A consumer cannot purchase every combination of the two goods (or bundles) that he wishes purchase. It is because of **two reasons:** First, he has fixed amount of money-income to spend the goods. Secondly, prices of the two goods are given in the market and hence, they also pos limitations on his purchase. Thus, the bundles that the consumer can actually purchase depe upon his money-income and the prices of two goods. Suppose, the income of the consumer is

and the prices of good 1 and good 2 are P_1 and P_2, respectively. Now x_1 units of good 1 can be purchased by P_1x_1 amount of money and x_2 units of good 2 by P_2x_2 amount of money. It means for the purchase of a bundle having x_1, x_2 good, a consumer has to spend $P_1x_1 + P_2x_2$ amount of money. If the consumer possesses amount of money-income at least equivalent to $P_1x_1 + P_2x_2$ only then he can purchase x_1, x_2 bundle of goods. It means that given the prices of two goods and money-income, a consumer can purchase any bundle which costs less than or equal to his money-income. This can be expressed as follows:

$$P_1x_1 + P_2x_2 \leq M$$

Here,

$P_1x_1 + P_2x_2$ = Money required to purchase a bundle (x_1, x_2) of goods

M = Consumer's money-income

If consumer's money-income is less than the money required to purchase the bundle of goods, then it is called **consumer's budget constraint**. There can be a number of bundles of the two goods that the consumer can afford to purchase. All such bundles, which are available to the consumer, form the budget set for the consumer. Thus, **the budget set refers to all those bundles that the consumer can purchase with his money-income at the given prices of the goods.**

Budget set depends upon two factors:

(*i*) Consumer's money-income (*ii*) Price of the two goods

Budget set can better be explained with the help of following example:

Suppose,

(*i*) Consumer's income (M) = ₹ 20

(*ii*) Price of good 1 (P_1) = ₹ 4 per unit

(*iii*) Price of good 2 (P_2) = ₹ 2 per unit

On the basis of this information, we can find out those combinations of good 1 and good 2 that the consumer can afford to purchase. This is shown in Table 2.5.

Table 2.5

Good 1 (Units)	Good 2 (Units)	Total Expenditure (₹)	Bundles
0	0	0 + 0 = 0	(0, 0)
0	1	0 + 1 × 2 = 2	(0, 1)
0	2	0 + 2 × 2 = 4	(0, 2)
0	3	0 + 3 × 2 = 6	(0, 3)
0	4	0 + 4 × 2 = 8	(0, 4)
0	5	0 + 5 × 2 = 10	(0, 5)
0	6	0 + 6 × 2 = 12	(0, 6)
0	7	0 + 7 × 2 = 14	(0, 7)
0	8	0 + 8 × 2 = 16	(0, 8)
0	9	0 + 9 × 2 = 18	(0, 9)
0	10	0 + 10 × 2 = **20**	(0, 10)
1	0	1 × 4 + 0 = 4	(1, 0)
1	1	1 × 4 + 1 × 2 = 6	(1, 1)
1	2	1 × 4 + 2 × 2 = 8	(1, 2)
1	3	1 × 4 + 3 × 2 = 10	(1, 3)
1	4	1 × 4 + 4 × 2 = 12	(1, 4)
1	5	1 × 4 + 5 × 2 = 14	(1, 5)
1	6	1 × 4 + 6 × 2 = 16	(1, 6)
1	7	1 × 4 + 7 × 2 = 18	(1, 7)
1	8	1 × 4 + 8 × 2 = **20**	(1, 8)
2	0	2 × 4 + 0 = 8	(2, 0)
2	1	2 × 4 + 1 × 2 = 10	(2, 1)
2	2	2 × 4 + 2 × 2 = 12	(2, 2)
2	3	2 × 4 + 3 × 2 = 14	(2, 3)
2	4	2 × 4 + 4 × 2 = 16	(2, 4)
2	5	2 × 4 + 5 × 2 = 18	(2, 5)
2	6	2 × 4 + 6 × 2 = **20**	(2, 6)
3	0	3 × 4 + 0 = 12	(3, 0)
3	1	3 × 4 + 1 × 2 = 14	(3, 1)
3	2	3 × 4 + 2 × 2 = 16	(3, 2)
3	3	3 × 4 + 3 × 2 = 18	(3, 3)
3	4	3 × 4 + 4 × 2 = **20**	(3, 4)
4	0	4 × 4 + 0 = 16	(4, 0)
4	1	4 × 4 + 1 × 2 = 18	(4, 1)
4	2	4 × 4 + 2 × 2 = **20**	(4, 2)
5	0	5 × 4 + 0 = **20**	(5, 0)

Out of these bundles (0, 10), (1, 8), (2, 6), (3, 4), (4, 2) and (5, 0) cost exactly ₹ 20 and the bundles cost less than ₹ 20. Apart from these, there can be some other bundles like (0, 11), (1, 9), (2, 7), (3, 5), (4, 3) and (5, 1) that cost more than ₹ 20, hence the consumer cannot afford to purchase them. Such bundles do not form the part of budget set or these bundles are not available to the consumer because of budget constraint.

All the bundles given in the Table 2.5 form the budget set because a consumer can afford to purchase all these bundles with his given money-income at the given prices of the two goods. A graphic representation of all those bundles, which cost the amount just equal to the consumer's money-income, gives us the budget line. Thus, **a budget line represents the different combinations of two goods (or bundles) that the consumer can purchase by spending all his money-income given the prices of the goods.** This can be explained with the help of our previous example.

Consumer's income = ₹ 20

P_1 (Price of good 1) = ₹ 4 per unit

P_2 (Price of good 2) = ₹ 2 per unit

On the basis of this information, we can find out those bundles (combinations) of good 1 and good 2, which form the budget line. These are given in Table 2.6.

Table 2.6

Good 1 (units)	Good 2 (units)	Total Expenditure (₹)
0	10	0 × 4 + 10 × 2 = 20
1	8	1 × 4 + 8 × 2 = 20
2	6	2 × 4 + 6 × 2 = 20
3	4	3 × 4 + 4 × 2 = 20
4	2	4 × 4 + 2 × 2 = 20
5	0	5 × 4 + 0 × 2 = 20

From Table 2.6, we learn that if the consumer spends all his income on good 2, he can purchase 10 units of good 2 and if he spends all his income on good 1, he can purchase 5 units of good 1. Thus, he can either purchase the combination of (0, 10) or the combination of (5, 0). In between these two limits, he can also purchase some other combinations of good 1 and good 2 which are shown in the Table 2.6. These attainable combinations (or bundles) of the two goods are shown on the budget line in the Fig. 2.4.

In the Fig. 2.4, good 1 is measured on the *x*-axis and good 2 is measured on the *y*-axis. We have already said that the consumer can purchase either 10 units of good 2 or 5 units of good 1 with his entire income. By joining points indicating 10 units of good 2 and 5 units of good 1 in the Fig. 2.4, we have drawn a line MN. It is the budget line.

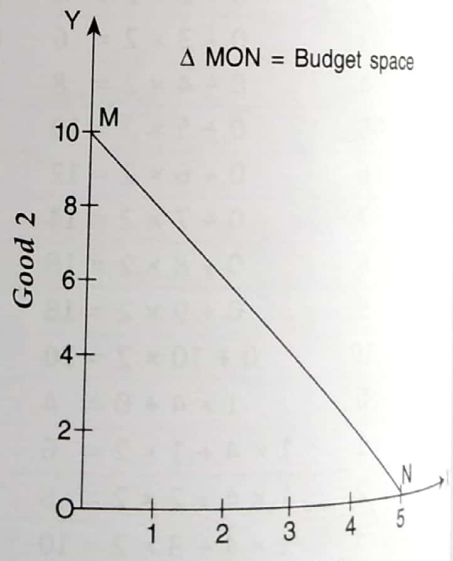


Fig. 2.4

Every point on this budget line indicates those bundles of good 1 and good 2 which the consumer can purchase by spending his whole income of ₹ 20 at the given prices of goods. The **equation of the budget line** can be written as follows:

$$P_1X_1 + P_2X_2 = M$$

All points on or below the budget line indicate the budget set. All points on the budget line indicate those bundles of two goods which cost exactly equal to M. On the other hand, points below the budget line indicate bundles which cost less than M.

Features of Budget Line

1. The shape of the budget line depends on consumer's income and the prices of two goods.
2. It is a straight line.
3. The horizontal intercept (M/P_1) indicates the bundle that the consumer can buy if he spends his entire income on good 1. On the other hand, the vertical intercept (M/P_2) indicates the bundle that the consumer can buy if he spends his entire income on good 2.
4. It slopes downwards from left to right or it is a negatively-sloped line.
5. The slope of the budget line is equal to the price ratio of the two goods.

$$\text{Slope of the budget line} = -\frac{P_1}{P_2} = \text{MRE (i.e., Market rate of exchange)}$$

The slope of the budget line measures the amount of change in good 2 required for per unit change in good 1 along the budget line.

Price Ratio and Slope of the Budget Line

Now let us understand **what does the slope of the budget line or price ratio indicate?** A point on the budget line indicates a bundle which the consumer can purchase by spending his entire income. If the consumer wants to have one extra unit of good 1, he has to give up some amount of good 2. Now the question is, how much amount of good 2 does the consumer have to give up in order to get one extra unit of good 1. It depends on the prices of two goods. We know that the cost of one unit of good 1 is P_1. Therefore, the consumer will have to reduce his expenditure on good 2 by P_1 amount. With P_1 amount, he can purchase $\frac{P_1}{P_2}$ units of good 2. Hence, if the consumer wants to purchase an extra unit of good 1, he will have to give up $\frac{P_1}{P_2}$ units of good 2. It means the consumer can substitute good 1 for good 2 at the rate of $\frac{P_1}{P_2}$. Thus, **the absolute value of the slope of the budget line is the rate at which the consumer can substitute good 1 for good 2 at the prevailing market prices by spending his entire income and is known as Market Rate of Exchange (MRE).**

Points Below the Budget Line and Points on the Budget Line

Let us understand the meaning and difference between points below the budget line and points on the budget line. Now take the case of a point below the budget line. We know that a point below the budget line indicates a bundle which costs less than the consumer's income. It implies that if a consumer purchases this bundle, he will have some money left over. He can spend this extra money on either of the two goods. If he does so, he can buy a bundle which consists of more quantity of, at least, one of the goods and the same quantity of the other as compared to the bundle lying below the budget line. This bundle will lie on the budget line. Thus, a bundle on the budget line indicates a bundle which costs exactly equal to the consumer's income. It also indicates that there is always some bundle on the budget line which contains more quantity of at least one of the goods and no less of the other compared to a point below the budget line. This we can understand with the help of the Fig. 2.5.

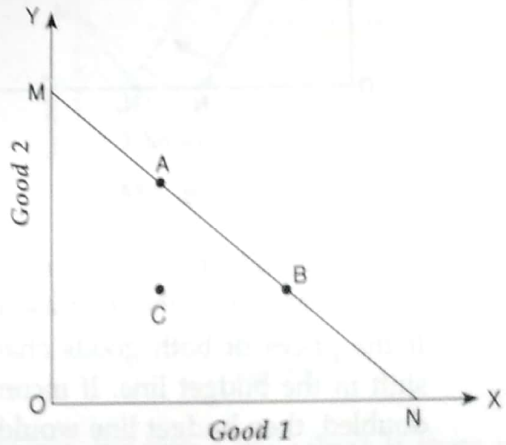


Fig. 2.5

In Fig. 2.5, the point C lies below the budget line while points A and B are on the budget line. Now it is clear from the Fig. 2.5 that point A contains more quantity of good 2 and the same quantity of good 1 as compared to point C. On the other hand, point B contains more quantity of good 1 and the same quantity of good 2 as compared to point C.

Moreover, any point on the segment 'AB' indicates a bundle which has more of both the goods compared to point C.

Thus, when we compare a point below the budget line with a point on the budget line, following three possibilities may emerge:

(*a*) A point on the budget line may have more of good 1 and the same amount of good 2 compared to a point below the budget line.

(*b*) A point on the budget line may have more of good 2 and the same amount of good 1 compared to a point below the budget line.

(*c*) A point on the budget line may have more of both the goods (*i.e.*, good 1 and good 2) compared to a point below the budget line.

In short, a point on the budget line may have more quantity of at least, one of the goods or more quantity of both the goods compared to a point below the budget line.

Changes (or Shifts) in the Budget Line (or Budget Set)

With the changes in consumer's income and the prices of two goods, budget line also undergoes a change (or the set of available bundles is also likely to change). Changes in budget line in different situations are discussed below.

(*i*) **Change in income or prices of both goods:** Now let us see what happens to the budget line if income changes, while the prices of the two goods remain unchanged. Change in income can take two directions: there may be increase in income or decrease in income. If there is increase in income, the vertical intercept increases and the budget line shifts outward parallel to the original budget line. It is shown in the Fig. 2.6A. Now consumer can buy larger quantity of both goods at the given prices of the goods. On the other hand, if there is decrease in income then the vertical intercept decreases and the budget line shifts inward parallel to the original budget line. Now consumer can purchase smaller quantity of both goods at the given market prices. It is shown in the Fig. 2.6B. Shifts in budget line due to changes in income are shown in the Fig. 2.7.

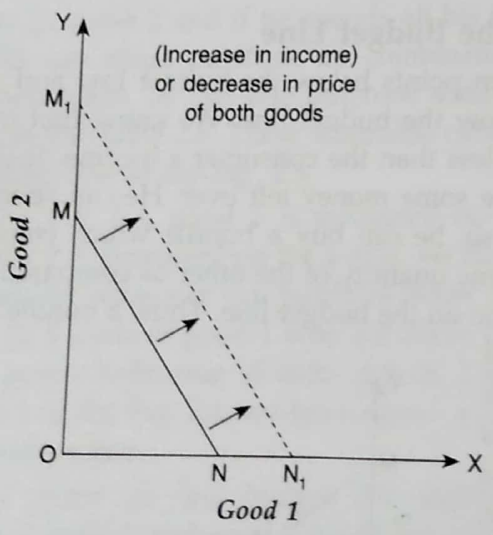


Fig. 2.6A

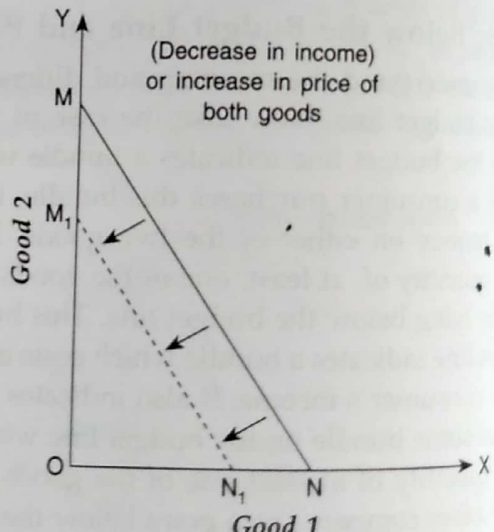


Fig. 2.6B

Thus, the budget line shifts outward (or rightward) with the increase in income and inward (or leftward) with the decrease in income. This is shown in the Fig. 2.7.

If the prices of both goods change in the same proportion then also there will be parallel shift in the budget line. If income remains unchanged, but the prices of both the goods are doubled, then budget line would shift leftward and if the prices become half then budget line

would shift rightward. If both the prices as well as the consumer's income doubles then the budget line would remain unchanged because even now consumer can have the same bundles of goods.

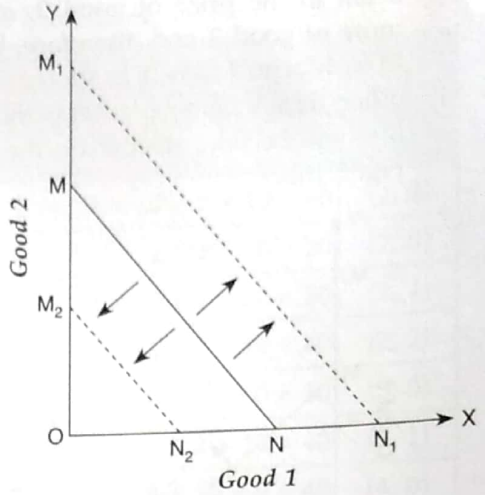


Fig. 2.7

(*ii*) **Change in the price of good 1 and the budget line:** What happens to the budget line when consumer's income and the price of good 2 remains unchanged but the price of good 1 changes. Suppose the price of good 1 falls then the absolute value of the slope of the budget line decreases. Hence, the budget line becomes flatter on the *x*-axis. It is shown in the Fig. 2.8A that budget line shifts outward from MN to MN_1. Now with the lower price of good 1, the consumer will be able to purchase more quantity of good 1 than before with his given income. On the other hand, if the price of good 1 rises then the absolute value of the slope of the budget line increases and hence, the budget line becomes steeper on the *x*-axis. With higher prices of good 1, the consumer will be able to purchase the smaller quantity of good 1 than before. This is shown in the Fig. 2.8B that the budget line shifts inward from MN to MN_2.

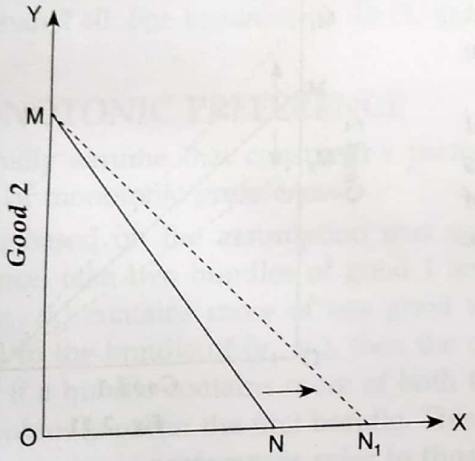


Fig. 2.8A

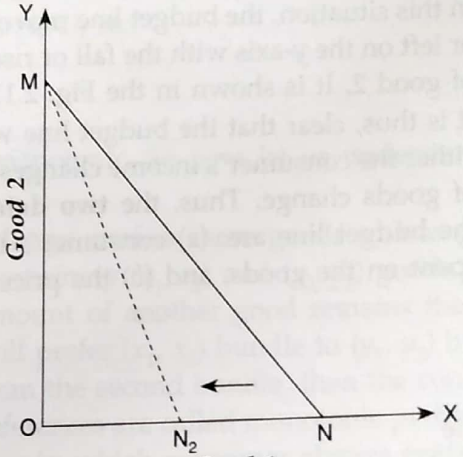


Fig. 2.8B

Here one thing should be kept in mind that, the vertical intercept of the new budget line remains the same with the change in the price of good 1.

Thus, in short, when consumer's income and the price of good 2 remains unchanged but the price of good 1 changes, the budget line also undergoes a change. In this situation, the budget line moves to the right or left on the *x*-axis with the fall or rise in the price of good 1. It is shown in the Fig. 2.9.

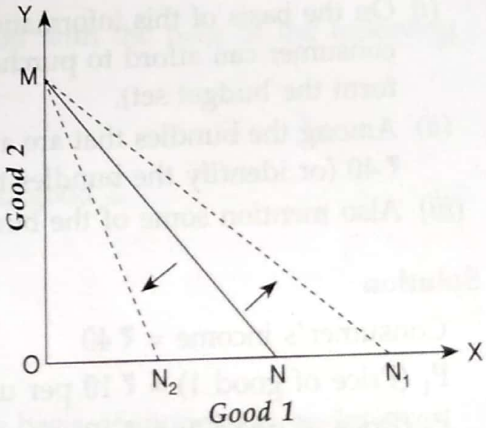


Fig. 2.9

(*iii*) **Change in price of good 2 and the budget line:** What happens to the budget line when the price of good 2 changes, with the price of good 1 and income remaining the same? If there is

a fall in the price of good 2, other things remaining unchanged, the consumer could buy more of good 2 and, therefore, budget line will become flatter on the y-axis and it will shift from MN to M_1N. It is shown in the Fig. 2.10A. Similarly, with the rise in price of good 2, other things being constant, the consumer could buy less of good 2 and therefore, budget line will become steeper on the y-axis and it will shift from MN to M_2N. It is shown in Fig. 2.10B.

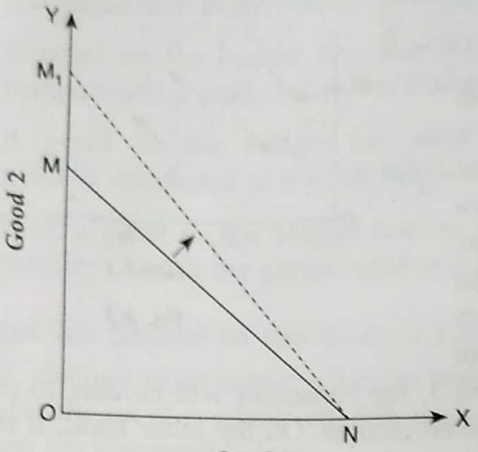


Fig. 2.10A

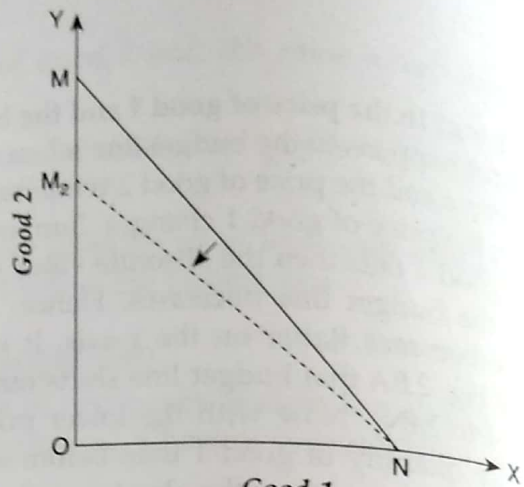


Fig. 2.10B

When consumer's income and the price of good 1 remain unchanged but the price of good 2 changes, the budget line also undergoes a change. In this situation, the budget line moves to the right or left on the y-axis with the fall or rise in the price of good 2. It is shown in the Fig. 2.11.

It is thus, clear that the budget line will change if either the consumer's income changes or the prices of goods change. Thus, the **two determinants** of the budget line are: (*a*) consumer's income to be spent on the goods, and (*b*) the prices of goods.

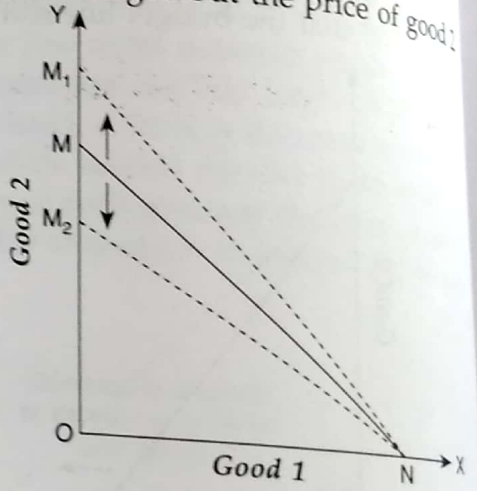


Fig. 2.11

Example

Suppose a consumer's money-income is ₹ 40. Price of good 1 (P_1) and price of good 2 (P_2) is the same: ₹ 10 per unit.

(*i*) On the basis of this information, find out those combinations of good 1 and good 2 that the consumer can afford to purchase (or the bundles that are available to the consumer or those form the budget set).

(*ii*) Among the bundles that are available to the consumer, identify those which cost him exactly ₹ 40 (or identify the bundles that form the budget line).

(*iii*) Also mention some of the bundles that the consumer cannot afford to purchase.

Solution

Consumer's income = ₹ 40

P_1 (Price of good 1) = ₹ 10 per unit

P_2 (Price of good 2) = ₹ 10 per unit

Table 2.7: Bundles Available to the Consumer

Good 1 (Units)	Good 2 (Units)	Total Expenditure (₹)	Bundles or Budget Set
0	0	0 + 0 = 0	(0, 0)
0	1	0 + 1 × 10 = 10	(0, 1)
0	2	0 + 2 × 10 = 20	(0, 2)
0	3	0 + 3 × 10 = 30	(0, 3)
0	4	0 + 4 × 10 = 40	(0, 4)
1	0	1 × 10 + 0 = 10	(1, 0)
1	1	1 × 10 + 1 × 10 = 20	(1, 1)
1	2	1 × 10 + 2 × 10 = 30	(1, 2)
1	3	1 × 10 + 3 × 10 = 40	(1, 3)
2	0	2 × 10 + 0 = 20	(2, 0)
2	1	2 × 10 + 1 × 10 = 30	(2, 1)
2	2	2 × 10 + 2 × 10 = 40	(2, 2)
3	0	3 × 10 + 0 = 30	(3, 0)
3	1	3 × 10 + 1 × 10 = 40	(3, 1)
4	0	4 × 10 + 0 = 40	(4, 0)

From the above Table 2.7, we learn:

(*i*) Bundles that are available to the consumer or that form the budget set are: (0, 0); (0, 1); (0, 2); (0, 3); (0, 4); (1, 0); (1, 1); (1, 2); (1, 3); (2, 0); (2, 1); (2, 2); (3, 0); (3, 1); (4, 0).

(*ii*) Bundles that cost exactly ₹ 40 or that form the budget line are: (0, 4); (1, 3); (2, 2); (3, 1); (4, 0).

(*iii*) Bundles that the consumer cannot afford to purchase will be those bundles which cost more than ₹ 40. For instance: (0, 5); (1, 4); (3, 2); (2, 3); (4, 1), *etc.*

2.8 MONOTONIC PREFERENCE

We normally assume that consumer's preferences are monotonic. So now let us understand the meaning of monotonic preferences.

This is based on the assumption that a consumer always prefers more goods to less goods. For instance, take two bundles of good 1 and good 2 containing (x_1, x_2) and (y_1, y_2) goods. If the bundle (x_1, x_2) contains more of one good while the amount of another good remains the same compared to the bundle of (y_1, y_2), then the consumer will prefer (x_1, x_2) bundle to (y_1, y_2) bundle. Similarly, if a bundle contains more of both the goods than the second bundle, then the consumer will undoubtedly prefer the first bundle. This kind of preferences are called monotonic preferences. In short, **monotonic preferences refer to those preferences in which consumer always prefers the bundle having either more of both goods or more of at least one good and no less of the other good compared to another bundle.**

This kind of monotonic preferences can better be understood with the help of the following example.

Example

Suppose there are following four bundles containing good 1 and good 2.

Bundle A (7, 7)
B (5, 5)
C (7, 6)
D (6, 7)

State which bundle will be preferred by the consumer on the basis of monotonic preferences.

Solution: The consumer will prefer the bundle (7, 7) compared to bundle (5, 5) because the former has more of both the goods.

Similarly, the consumer will prefer bundle (7, 7) compared to bundle (7, 6) because the former has equal amount of good 1 but more of good 2 and also compared to bundle (6, 7) here it has equal amount of good 2 but more of good 1. Thus, the consumer will prefer the bundle (7, 7) compared to all the three bundles if he has monotonic preferences.

2.9 INDIFFERENCE SCHEDULE AND INDIFFERENCE CURVE

Bundles indicating equal level of satisfaction form the basis of indifference curve analysis. An **indifference schedule may be defined as a schedule of various bundles of goods that give equal level of satisfaction to the consumer.** Hence, a consumer becomes indifferent between them. An example of indifference schedule is given below in the Table 2.8.

Table 2.8: Indifference Schedule

Bundles	*Good 1 (Units)*	*Good 2 (Units)*
A	1	12
B	2	8
C	3	5
D	4	3
E	5	2

The Table 2.8 shows five different bundles—A, B, C, D and E of good 1 and good 2. These different bundles give the same level of satisfaction to the consumer. It means whatever satisfaction a consumer derives from the bundle of 1 unit of good 1 and 12 units of good 2 (bundle A), the same satisfaction he derives from the bundle of 2 units of good 1 and 8 units of good 2 (bundle B) and also from 3 units of good 1 and 5 units of good 2 (bundle C), and so on. Thus, he likes all these bundles equally and remains indifferent between them. That is why, we call this schedule as an indifference schedule.

The graphical representation of indifference schedule becomes the indifference curve. Hence, **an indifference curve is one where different points on it show those bundles of goods which give equal satisfaction to the consumer**. On the basis of indifference schedule given above, an indifference curve is constructed in the Fig. 2.12.

In the Fig. 2.12, X-axis measures good 1 while Y-axis measures good 2. A curve is drawn by joining different bundles—A, B, C, D and E of good 1 and good 2 and it forms the IC curve. The different bundles on this curve give equal satisfaction to the consumer.

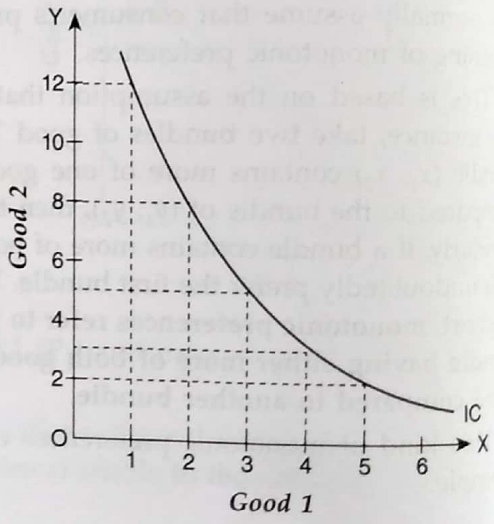


Fig. 2.12

Points above and Points below the Indifference Curve

Now let us understand the meaning and implication of points above, points below and points on the indifference curve. This can be explained with the help of an indifference curve as shown in Fig. 2.13.

In the Fig. 2.13, the points A and B lie on the indifference curve while point C lies above the indifference curve. It is clear from the Fig. 2.13 that the point C contains more of good 1 and the same amount of good 2 as compared to point A. Similarly, point C contains more of good 2 and the same amount of good 1 as compared to point B. And compared to any other point on the segment AB (say point E), the point C contains more of both the goods. Thus, if consumer's preferences

are monotonic, the bundle represented by point C would be preferred to bundles represented by points on the segment AB and as well as to all bundles on the indifference curve. Hence, a very important implication of monotonicity of preferences is that any point above the indifference curve represents a bundle which is preferred to the bundles represented by points on the indifference curve. Similarly, in the Fig. 2.13, point D lies below the indifference curve. It indicates that the bundle represented by point D is less preferred or inferior to the bundles represented by points on the indifference curve. Thus, compared to the points on an indifference curve, the points above the indifference curve represent the preferred bundles, whereas the points below the indifference curve represent the inferior bundles.

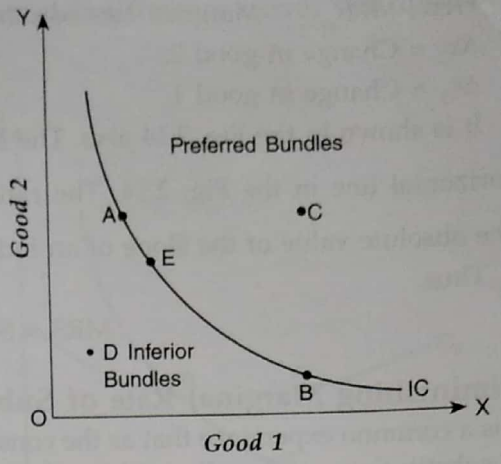


Fig. 2.13

2.10 MARGINAL RATE OF SUBSTITUTION

When a consumer increases the quantity of a commodity, he has to sacrifice some quantity of another commodity so that the level of satisfaction should remain the same. Here one commodity is substituted in place of the other. But the question is how much of good 2 the consumer is willing to sacrifice in order to get an extra unit of good 1. It depends on the marginal rate of substitution. **The marginal rate of substitution (MRS) of good 1 for good 2 is the number of units of good 2 that the consumer is willing to give up for an additional unit of good 1, so as to maintain the same level of satisfaction.**

$$\text{MRS} = \frac{\Delta \text{ goods lost}}{\Delta \text{ goods gained}}$$

The marginal rate of substitution is explained with the help of the following Table 2.9 and Fig. 2.14.

Table 2.9: Example for Marginal Rate of Substitution

Bundles	*Good 1 (Units)*	*Good 2 (Units)*	*MRS = $\frac{\Delta \text{ goods lost}}{\Delta \text{ goods gained}}$*
A	1	12	–
B	2	8	4:1
C	3	5	3:1
D	4	3	2:1
E	5	2	1:1

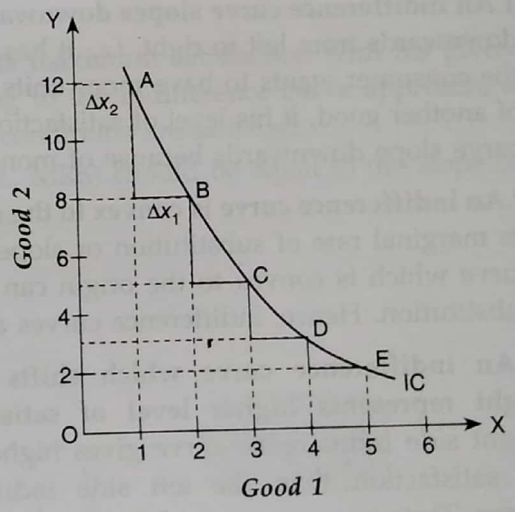


Fig. 2.14

The example shows the different combinations of good 1 and good 2 which give equal satisfaction to the consumer. In the beginning, consumer has 1 unit of good 1 + 12 units of good 2 (bundle A). Now in order to get an additional unit of good 1, he is prepared to give up 4 units of good 2 (bundle B), hence MRS will be 4:1. It implies that the consumer gets the same satisfaction from 2 units of good 1 + 8 units of good 2 as he gets from 1 unit of good 1 + 12 units of good 2. Thus, the marginal rate of substitution between two goods can be estimated with the help of following formula:

$$\text{MRS}_{x_1x_2} = \frac{\Delta x_2}{\Delta x_2} \left(= \frac{\Delta \text{ good 2}}{\Delta \text{ good 1}} \right)$$

Here, MRS_{12} = Marginal rate of substitution of x_1 for x_2.

Δx_2 = Change in good 2.

Δx_1 = Change in good 1.

It is shown in the Fig. 2.14 also. The MRS is equal to the deep vertical line divided by the deep horizontal line in the Fig. 2.14. The ratio of $\frac{\Delta \text{good } 2}{\Delta \text{good } 1}$ shows the slope of the indifference curve. The absolute value of the slope of an indifference curve indicates the marginal rate of substitution. Thus,

$$MRS = \text{Slope of the indifference curve}$$

Diminishing Marginal Rate of Substitution

It is a common experience that as the consumer increases the quantity of one good, the marginal rate of substitution goes on diminishing. It means the law of diminishing marginal rate of substitution operates. **The law of diminishing marginal rate of substitution states that as good 1 is substituted for good 2, the marginal rate of substitution of good 1 for good 2 goes on diminishing.** It is clear from above example, and Fig. 2.14 also. According to the example, the consumer has 1 unit of good 1 + 12 units of good 2, then in order to get one additional unit of good 1, he is prepared to give up 4 units of good 2. But to get third unit of good 1, he is prepared to give up only 3 units of good 2. Similarly, to get fourth and fifth units of good 1, he is prepared to give up only 2 and 1 unit of good 2 respectively. Thus, in order to get every successive unit of good 1, the consumer is prepared to give up less and less units of good 2. This shows the diminishing marginal rate of substitution and it can be shown by an indifference curve which is convex to the origin as shown in the Fig. 2.14.

2.11 PROPERTIES OF INDIFFERENCE CURVE

1. **An indifference curve slopes downwards from left to right:** An indifference curve always slopes downwards from left to right, *i.e.*, it has a negative slope. It is because of the simple reason that if the consumer wants to have more units of one good, he will have to reduce the number of units of another good, if his level of satisfaction is to remain unchanged. In other words, an indifference curve slope downwards because of monotonic preferences.

2. **An indifference curve is convex to the origin:** We know that as the quantity of one good increases, its marginal rate of substitution or slope of the indifference curve goes on diminishing. Only the curve which is convex to the origin can indicate declining slope or diminishing marginal rate of substitution. Hence, indifference curves are always convex to the origin.

3. **An indifference curve which shifts to the right represents higher level of satisfaction:** Right side indifference curve gives higher level of satisfaction than the left side indifference curve. Thus, as we move to the right, the level of satisfaction also rises. Let us understand this with the help of the given diagram, (A, B_1) implies the consumption bundle "P" on indifference curve IC_1 and (A, B_2) implies the consumption bundle "Q" on indifference curve IC_2. At the same level of "A" the consumer is getting more of good X at bundle Q and since his preferences are monotonic, he will select the bundle that has more of at least one good with no less of other good. Therefore, we can say that higher

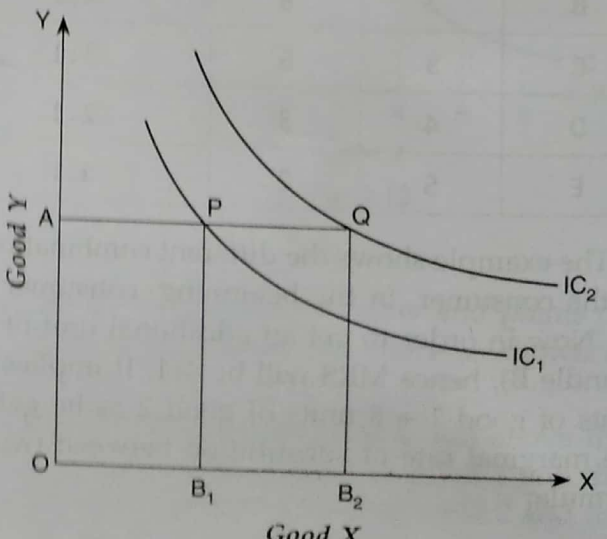


Fig. 2.15

the indifference curve, higher will be the satisfaction. **A set of indifference curves that indicate different levels of satisfaction is called indifference map.**

4. **Two indifference curves never intersect each other:**

(i) Satisfaction from bundle A = satisfaction from bundle B because they both lie on same IC, i.e., IC_2.

(ii) Satisfaction from bundle B = satisfation from bundle C because they both lie on same IC, i.e., IC_1.

(iii) Equating both equations, satisfaction from bundle A should be equal to satisfaction from bundle C but this is not possible, since they both lie on different indifferene curves.

Hence, we can say that two IC can never intersect each other.

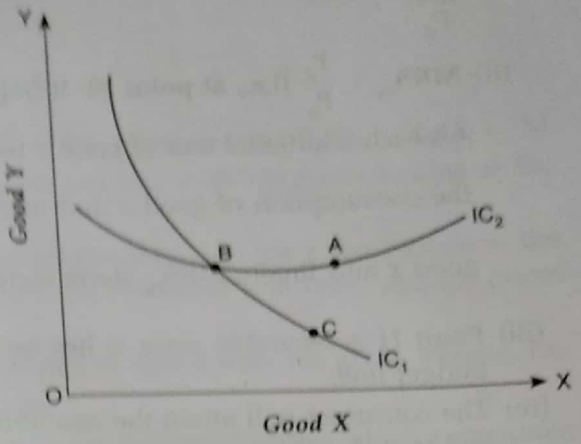


Fig. 2.16

2.12 ASSUMPTIONS AND EQUILIBRIUM CONDITIONS UNDER INDIFFERENCE CURVE APPROACH

(i) Consumer is rational.
(ii) Utility is ordinal.
(iii) Consumer has monotonic preference.
(iv) Price of the goods and income of the consumer is fixed.
(v) Consumption of atleast two goods must be there.

Consumer's Equilibrium Conditions

Consumer's equilibrium is a point where a consumer gets maximum satisfaction with his given income and he has no urge to change his state. According to the indifference curve approach, a consumer will be at equilibrium when the following two conditions are satisfied:

(i) **MRS = MRE:** The slope of an indifference curve (*i.e.*, MRS) should be equal to the slope of a budget line (*i.e.*, MRE). According to this condition,

$$MRS_{xy} = \frac{P_x}{P_y}$$

(ii) MRS is diminishing, *i.e.*, the indifference curve should be convex to the origin – Unless the IC is convex, equilibrium cannot be established. The given diagram shows the equilibrium: A consumer will attain equilibrium at point E where the budget line is tangent to IC_2.

Now let us discuss the equilibrium in detail:

(i) **$MRS_{xy} > \frac{P_x}{P_y}$ (i.e., at point A):** It implies that the consumer is willing to sacrifice more of good y for each additional unit of good x than what market requires,

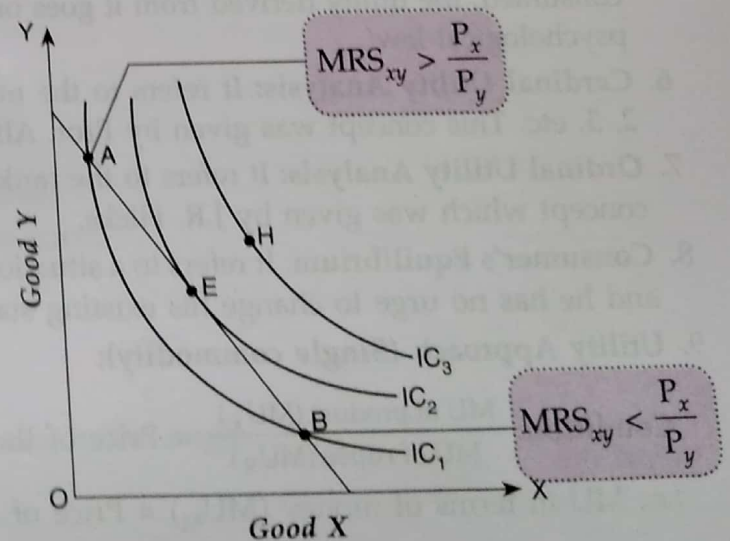


Fig. 2.17

due to which he will increase the consumption of good x and reduce that of good y. This leads to fall in the utility of good x, and finally MRS_{xy} starts falling till the time $MRS_{xy} = \frac{P_x}{P_y}$

(ii) **$MRS_{xy} < \frac{P_x}{P_y}$ (i.e., at point B):** It implies that consumer is willing to sacrifice less of good y for each additional unit of good x than what market requires due to which he will decrease the consumption of good x and increase that of good y. This leads to rise in the utility of good x and finally MRS_{xy} starts increasing till the time $MRS_{xy} = \frac{P_x}{P_y}$

(iii) Point H is desirable since it lies on IC_3 but it is not attainable because it is beyond the budget line.

(iv) The consumer will attain the equilibrium at point E where budget line is tangent to the IC and it is the only combination which the consumer is willing and is able to buy.