faction to the consumer. But later on for the sake of simplicity and geometrical convenience, we may consider groups of only two commodities in the course of our analysis. We may, thus, take two goods say, apples and bananas into consideration for our hypothetical consumer. We assume that the following combinations of these goods yield equal level of satisfaction to him, hence an indifference schedule is composed accordingly (See Table 4.1)

Table 4.1

Combination	Apples (*X*)	Bananas (*Y*)
a.	1	12
b.	2	8
c.	3	5
d.	4	3
e.	5	2

Since, by definition, all these combinations give him the same level of satisfaction, the consumer is indifferent to any of these combinations whether he gets a, or b, or c, or d, or e. He will neither be better off nor worse off whichever combination he chooses.

It must be remembered that an indifference schedule represents a part of consumer's "scale of preference." The scale of preference about combination of goods will constitute different ranks of preferences of given combinations, whereas, at a given rank, there may be certain combinations that may be yielding equal satisfaction. An indifference scheduled represents only equal satisfaction combinations at a particular order of preference, while a scale preference represents all combinations yielding different as well as equal levels of satisfaction.

INDIFFERENCE CURVE

The Indifference curve is a geometrical device representing all such combinations of two goods yielding equal satisfaction of a particular level. While plotting an indifference curve, however, it is assumed that the consumer is able to give sufficient information and the goods are perfectly divisible, so that we have infinite number of combinations of given goods (apples and bananas in our illustration) yielding the same level of satisfaction. Thus, by graphically plotting all such combinations and joining their loci points we derive an indifference curve as illustrated in Fig 4.1.

In Fig. 4.1, apples and bananas are measured along the *x*-axis and the *y*-axis, respectively. *IC* is the indifference curve derived on the basis of indifference schedule (in Table 4.1). Thus, an indifference

curve is the curve representing the various combinations of two goods (in consideration) yielding equal satisfaction to the consumer. Obviously, different points (a, b, c, d, e) on the indifference curve indicate different combinations of the two goods, but all these combinations are of equal significance for the consumer. So he is indifferent to them as he will be neither better off nor worse off in choosing any of these points. Thus, the consumer is indifferent to any point on a given indifference curve. Again, an indifference curve represents a particular level of satisfaction, but all points on it represent the same level of satisfaction. Thus, if we move downward or upward from one point to another on the given indifference curve, the level of satisfaction remains unchanged, though combinations between the two goods change. Alternatively, therefore, an indifference curve may be described as *equal satisfaction curve* or *iso-utility curve*.

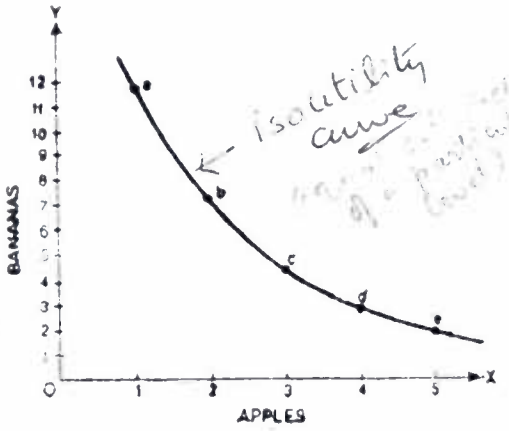


Fig. 4.1

Indifference Map

Following the above stated principal of equal satisfaction yielding combinations of two goods X and Y, we can form various indifference schedules of these goods with more and more quantities that can be purchased with higher levels of income, and set out a complete schedule or scale of preference by putting indifference schedules in order of their levels of significance. Accordingly, we can draw several indifference curves, each representing an indifference schedule. Hence, we can have a set or a group of such different indifference curves called *indifference map*. This has been illustrated in Table 4.2 and Fig. 4.2.

In Fig. 4.2, x-axis represents commodity X and y-axis represents commodity Y. The indifference curves IC_1, IC_2 and IC_3 are representing different level of satisfactions, namely U_1, U_2 and U_3 derived from the various combinations of two goods X and Y. Remember,

Table 4.2

Hypothetical Data for an Indifference Map

Combination of two goods (Units)					
I		II		III	
X	*Y*	*X*	*Y*	*X*	*Y*
1	10	2	15	3	20
2	6	4	10	5	14
3	3	6	6	7	10
4	1	8	3	9	7
Level of Significance U_1	(IC_1)	U_2	(IC_2)	U_3	(IC_3)
Third Order Preference		Second Order Preference		First Order Preference.	

U_1, U_2 and U_3 stand for the level of satisfaction which is comparable but not quantifiable. Thus, $U_3 > U_2 > U_1$. Evidently, a higher level of indifference curve represents a higher level of satisfaction. By definition, all points on any one curve must represent the same level of satisfaction. Thus, combinations of points *a* and *b* yield the same level of satisfaction (U_1) on the curve IC_1. However, point *c* and *d* yield equal satisfaction (U_2) at difference curve IC_2. the consumer is, therefore, indifferent to both *a* and *b*. He is also indifferent to both *c* and *d*. But, he is not indifferent between *a* and *c*. He would prefer *c* to *a*, because *c* yields him a higher level of satisfaction than *a*. ($\because U_2 > U_1$). As the consumer moves to the right from lower to the higher indifference curve, he derives more satisfaction because of the increased quantities of the two goods. It may be recalled here that, the level of satisfaction or ordinal utility is the increasing function of the quantities of the goods under consideration.

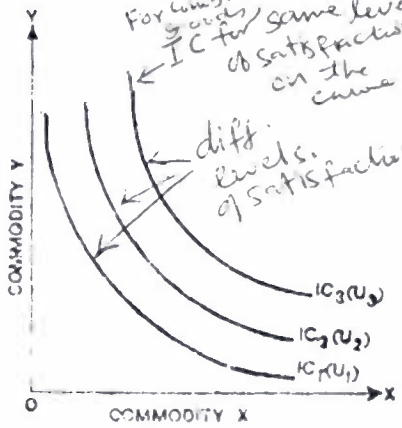


Fig. 4.2

PROPERTIES OF INDIFFERENCE CURVES

In order to use the indifference curves as a tool of analysis, it is essential to know their basic characteristics. Some basic properties of indifference curves are enlisted and discussed below :

1. Indifference curves slope downwards and to the right.
2. They are convex to the origin.
3. They can never intersect each other.
4. They need not be parallel.
5. They represent ordinal measurement of utility.

1. Downward Slope

By definition, every indifference curve must slope downwards from left to the right. That means, the indifference curve has a negative slope indicating that as the quantity of X increases in the set of combination of X and Y, the amount of Y decreases. This is very essential to substantiate the definition of an indifference curve that it represents an equal-satisfaction phenomenon at all points.

It may be recalled that in order to maintain $dU = O$, when dX represents an increase, dY must imply a decrease. This is possible only when the curve has a negative slope [See Fig. 4.3 (A)].

If, however, an indifference curve has no negative slope, it will have either zero slope or a positive slope. If it has no slope, then the indifference curve is a horizontal straight line as shown in Fig 4.3 (B).

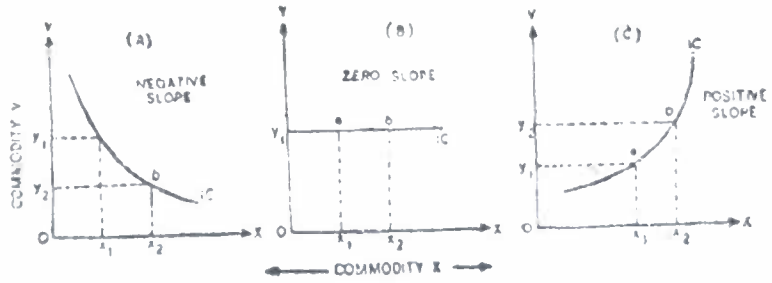


Fig. 4.3

This implies that the consumer would be actually satisfied with more of commodity X combined with a given quantity of Y. This is absurd. Actually, a combination which includes an increased quantity of one

good with no decrease in the amount of another good will yield a higher level of satisfaction as compared to a combination containing less of the one good and the unchanged amount of another good. Hence, the consumer cannot be indifferent to these combinations. In Fig. 4.3 (B) thus, combination *b* is preferred to *a*. Thus, the level of satisfaction does not remain constant, as we move from *a* to *b*. While, by definition, the indifference curve implies that the level of satisfaction remains constant throughout the curve. Thus, the indifference curve cannot be horizontal or parallel to *x*-axis. Similarly, it can be proved that an indifference curve to *y*-axis cannot run parallel, i.e., it cannot be vertical straight-line.

Likewise, it can be seen that an indifference curve cannot slope upward measuring a positive slope. For, this would mean that the consumer treats equal level of satisfaction in less as well as more quantities of the two goods. This is also absurd. In graphical terms, see Fig. 4.3 (C), when we compare combination of *X* and *Y* at point *a* with *b*, we find that the combination *b* includes large quantities of both *X* and *Y*. Obviously, then *b*, will be preferred to *a*, consumer cannot be indifferent to *a* and *b*. Hence, the positive slope of indifference curve is also ruled out as it does not correspond to definition of the indifference curve concept. We, therefore conclude that all indifference curve must slope downward towards the *x*- axis.

2. **Convexity**

All difference curves are convex to the origin of the axes, or they are concave upwards, so that they are relatively flatter towards the *x*-axis and steeper towards the *y*-axis, (See Fig. 4.4).

Convexity is an important characteristic of an indifference curve. because it implies the law of diminishing marginal rate of substitution.

The Marginal Rate of Substitution (MRS)

The marginal rate of substitution refers to the rate of substituting one commodity (on marginal basis) for the other, maintaining the same aggregate level of satisfaction as before. From an indifference curve we can find out the marginal rate of substitution between the two goods. Thus, the amount of *Y* the consumer is willing to give up in order to obtain an extra unit (the marginal unit) of *X*, with a view to remain on the same indifference curve, is technically called the marginal rate of substitution of *X* for *Y* — (MRS*xy*). In fact, the negative slope of an indifference curve implies that in order to

the same level of satisfaction, if the consumer gets an increase in the stock of one commodity, (say X) he must have a decrease in the stock of another commodity (say Y). This rate of relative change between these two goods is the marginal rate of substitution. The slope of the indifference curve measures the marginal rate of substitution. Thus :

$$MRS_{xy} = -\frac{\triangle y}{\triangle x}$$

where,

MRS_{xy} = the marginal rate of substitution of X for Y.

$\triangle y$ = a small change in the quantity of Y.

$\triangle x$ = a small change in the quantity of X.

$-\frac{\triangle y}{\triangle x}$ measures the slope of the indifference curve which is negative, suggesting that if X increases, Y decreases and vice versa. The measurement of MRS is illustrated in Table 4.3.

Table 4.3

Measurement of Marginal Rate of Substitution

Commodity X	Commodity Y	$MRS = \frac{\triangle Y}{\triangle X}$
10	25	—
11	20	$-\frac{5}{1} = -5$
12	16	$-\frac{4}{1} = -4$
13	13	$-\frac{3}{1} = -3$
14	11	$-\frac{2}{1} = -2$

As in Fig. 4.4, the downward slope of the indifference curve measures MRS. But, the indifference curve has convexity, which implies that the slope is not constant and it diminishes as we move downwards on the difference curve. This suggests that the marginal rate of substitution of X for Y is diminishing progressively. In the indifference curve concept, thus, Hicks replaces the law of diminishing marginal utility by introducing the principle of diminishing marginal rate of substitution. The reason behind diminishing MRS_{xy} is apparent.' As the consumer has an increase in the stock of commodity X, its margi-

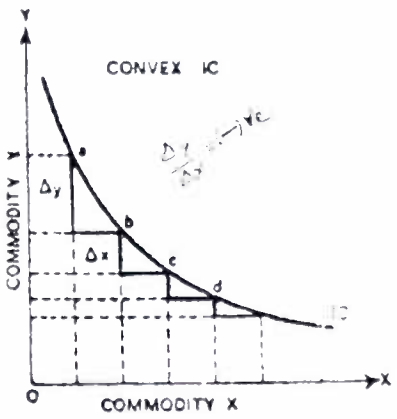


Fig. 4.4

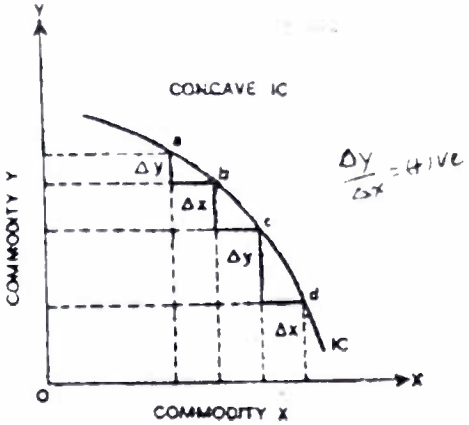


Fig. 4.5

nal significance in terms of commodity *Y* tends to diminish. That is, *X* tends to become relatively less attractive than before. While, the marginal significance of *Y* in terms of *X* tends to improve with the decrease in its stock so it becomes relatively beneficial. As such, the consumer, in order to remain on the same level of satisfaction, is required to sacrifice or part with lesser amount of *Y* for each additional unit of *X* acquired successively.

The principle of diminishing marginal rate of substitution is a definite improvement upon the Marshallian law of diminishing marginal utility. Unlike Marshall, Hicks does not assume the cardinal measurement of utility which is unrealistic and impracticable. The marginal rate of substitution is a measurable concept, at it is defined as the ratio of a small change in the quantity of one commodity (y) to a small change in the quantity of another one (x). Thus, *MRSxy* is measured in terms of physical units of the goods.

Indifference curves are convex and not concave to origin. Concavity implies that there is an increasing slope of an indifference curve which suggest an increasing mode of the marginal rate of substitution. It means that as the consumer has more of *X*, he finds *X* to be more and more beneficial, so he will go on substituting *X* for *Y* indefinitely (See Fig. 4.5). This is far from reality. So, the possibility of complete concavity of indifference curve is totally ruled out. However, there might be a typical indifference curve with bumps of concavity along with the range of convexity. It displays discontinuity in consumer's demand curve. But such discontinuity is a rare phenomenon. Hence,

it can be said that normally indifference curves are always convex to the origin of the axes.

3. No Intersection

Indifference curves do not interest or cross each other. That means that there cannot be a common point between the two indifference curves. This is true by definition, because each indifference curve represents a particular level of satisfaction. If two indifference curves cross each other, there will be a common point between them which will mean that one level of satisfaction is at the same time greater or less than as well as equal to the other. This involves absurdity. (See Fig. 4.6)

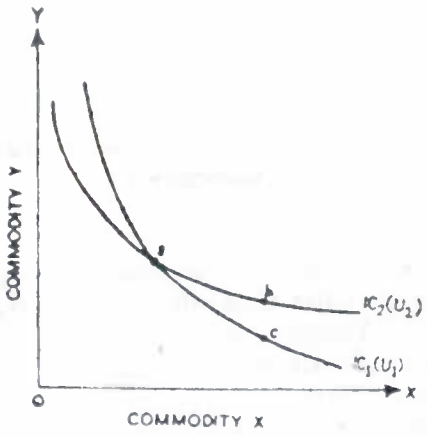


Fig. 4.6

In Fig. 4.6, IC_1 intersects IC_2 at point a. Now, from the indifference curves we may find out the following information :

(i) The consumer is indifferent between a and c because both points yield the same level of satisfaction U_1 corresponding to IC_1 Thus, $a = c$.

(ii) The consumer is indifferent between a and b because these points yield the same level of satisfaction U_2 corresponding to IC_2 thus $a = b$.

(iii) Since, $a = c$ and $a = b$, it follows that $b = c$. Again, the fact that 'a' is common to both the curve IC_1 and IC_2, proves that level of satisfaction $U_2 = U_1$. This is irrational and unacceptable.

Hence, we may conclude that, by definition, indifference curves can never intersect.

The above stated three properties are most significant.

4. Parallel

When a set of indifference curve is drawn, curves appear to be parallel. But, they need not be parallel. The economic significance of an indifference map does not vary whether curves are parallel or not.

Actually, there is no definite proportion between the range of different levels of satisfaction represented by different indifference curves. So they are not parallel. Economists quite often draw them as if they are parallel, but it is just for the sake of convenience and pictorial beauty.

5. Ordinal Utility

An indifference map represents the ordinal measurement of utility and the consumer's scale of preference. An indifference curve, away from the origin depicts a higher level of satisfaction. A higher indifference curve represents a high level of satisfaction because it corresponds to a larger quantity of two goods than what is in the case of a lower indifference curve. Thus, the height and place of indifference curves in a map indicate the rank of utility and the order of preference. A rational consumer always prefers a higher indifference curve to a lower one.

It follows, thus, that the indifference map represents the scale of preference of a consumer regarding various combinations of the given two goods. Since a higher indifference curve shows more satisfaction than a lower one, a consumer would prefer the higher one. Thus IC_3 is assigned the first order preference, IC_2 the second and IC_3 third order ones. Remember, the consumer assigns order of preference to different indifference curves, between any point he has equal preference, so he is indifferent. Thus, indifference map is just a pictograph of the consumer's devices and scale of preference.

THE PRICE LINE : THE BUDGET LINE

What a consumer can actually buy depends on the income at his disposal and the prices of goods he wants to buy. Thus, income and prices are the two objective factors which form the budgetary constraint of the consumer. To illustrate the point, let us assume that a consumer has an amount of Rs. 50 to be spent on two goods X and Y. The price of X is Rs. 5 per unit and the price of Y is Rs. 10 per unit. Then, his alternative spending possibilities can be assumed as under. (See Table 4.4)

It is clear that the consumer could spend his given income on any one of the alternative combination of two goods X and Y. If he spends all his amount of Rs. 50 on Y he has 5 units of Y and none of X. Alternatively, he can have 10 units of X and none of Y. Or, he can allocate his entire income on two goods in different proportions and can have a combination as illustrated in Table 4.4.

Table 4.4

Alternative Purchase Possibilities

	Units of Commodity Y	Units of Commodity X
A	5	0
	4	2
	3	4
	2	6
	1	8
B	0	10

ming that X and Y are prefectly divisible, we can have an infinite number of possible purchase combinations of X and Y as represented diagrammatically in Fig. 4.7.

In Fig. 4.7, point A denotes that if a consumer spends all his income on Y, he can buy OA of Y. (In our numerical illustration, 5 units of Y). Similarly, point B denotes that OB of X can be bought maximum by spending the entire given income on it. (i. e. 10 units of X in the illustration). By joining A and B, we derive the line AB, which is described as the *price line* or the *budget line*, representing various alternative purchase combinations. It exhausts all the opportunities of purchase in relation to a given income and prices of goods. So, it is called budget constraint. The consumer cannot have any point of combinations (like say, point z), which is beyond the region of the budget line. This is because his income could buy only limited quantities of the goods. He can only select any point (like a, b, c, etc.) and the relevant combination on the budget line, if he spends his entire income on these goods X and Y. The budget line is also referred to as *income line* because it represents the real income of the consumer. Any point (like point S) which is below the price line AB, indicates that the consumer does not spend his entire income on X and Y.

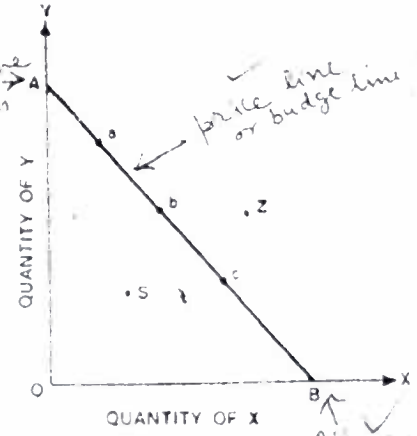


Fig. 4.7

Now, the slope of the price line is measured as : $\frac{OA}{OB}$

Thus, Slope of the Price Line $= \frac{Px}{Py}$

That is the slope of the price line or the budget line represents the ratio of prices of two goods under consideration.

Evidently, the slope and position of the price line depends on two factors : (i) The money income of the consumer, and (ii) Prices of the two goods he wants to buy.

It follows thus that, prices of the two goods (X and Y) remaining unchanged, so that $\frac{Px}{Py}$ is constant, if the money income of the consumer changes (increases or decreases) the price line or the income line will shift accordingly (Fig. 4.8).

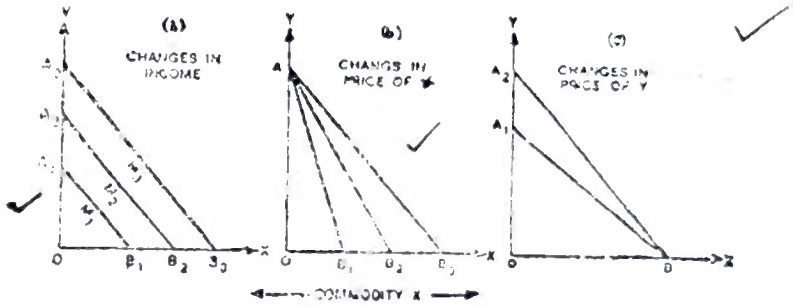


Fig. 4.8

In Fig. 4.8 (A), the income line shifts upward as A_1B_1, A_2B_2, A_3B_3 etc. as money income increases from M_1 to M_2 and M_3 etc. Since, $\frac{Py}{Px}$ is constant, the slope of income line does not change.

There is, thus, a parallel shift away from the origin. Similarly, when money income decreases, income line will tend to shift towards origin.

If, however, price of the goods change, but the money income remains unchanged, then also the real income of the consumer will change, so the budget line will change. But, in this case, the slope of

the budget line or the price line will also change. See Fig. 4.8 (b) and (c).

As in Fig 4.8 (b), when the price of X falls, the price ratio $\frac{(Px)}{(Py)}$ will tend to diminish, therefore the slope of the price line will tend to be more flat. Thus, the price line changes as AB_1 to AB_2, AB_3 etc. with the fall in price of X. Conversely, when the price of X tends to rise, $\frac{(Px)}{(Py)}$ rises; so the slope of the price line will become more and more steeper, as the line moves from AB_3 to AB_2, AB_1 etc.

Likewise, Fig. 4.8 (c), depicts the movement of the price line when price of Y changes—(price of X remaining unchanged). With the fall in price of Y, the price line tends to move as OA_1 to OA_2 etc. We can find out the rise in price of Y, by viewing the move of the price line as OA_2 to OA_1 etc.

EQUILIBRIUM OF THE CONSUMER

A rational consumer attains an equilibrium position when his motive of maximising satisfaction is realised. Marshall has given the 'proportionality rule' ($MUx/Px = MUy/Py$... etc.) in his marginal utility analysis of the consumer's equilibrium. But based on the cardinal measurement of utility, his approach was very much criticised. Hence, Hicks came forward with an alternative approach in terms of the 'ordinal preference' or indifference curves. Under that approach, the assumption that the consumer tries to maximise satisfaction is retained but maximising satisfaction no longer means achieving the maximum total utility but rather reaching the highest level of satisfaction.

In the indifference curve approach, the equilibrium position of a consumer is examined under the following assumptions :

1. The consumer has a fixed amount of money income to spend. (To express symbolically let it be Mo.)
2. He intends to buy a combination of two goods X and Y.
3. The price of X and Y are given and are constant. Thus, the ratio $\frac{Px}{Py}$ is fixed. So, the budget line or the price line has a constant slope.
4. Each of the goods X and Y is homogeneous (i. e., all its units have identical characteristics) and divisible, so that various combinations of these goods can be had.

5. The consumer has definite tastes and preferences. So, he has a given scale of preference expressed through an indifference map. This scale of preference remains the same throughout the analysis.

6. The consumer is rational. This rationality assumption implies that the consumer seeks maximisation of his satisfaction. Thus, in terms of indifference curve, the consumer acts to reach to the highest possible indifference curve—i.e. the highest level of satisfaction.

In order to find out the equilibrium purchases, of the consumer, thus, we should consider the scale of preference i.e. indifference map and the price line simultaneously. The price line represents the budgetary constraint relating to the opportunities of combining the two goods, based on the objective consideration of market prices of these goods and the consumer's income. The indifference map represents the subjective scale of preference of the consumer based on his taste, habit and liking. Hence, it should be noted that the indifference map and the price line are quite independent of one another. That is to say, the consumer has a scale of preference which does not depend on prices or income. But, it is also a fact that the consumer cannot purchase beyond the budget line (or the price line).

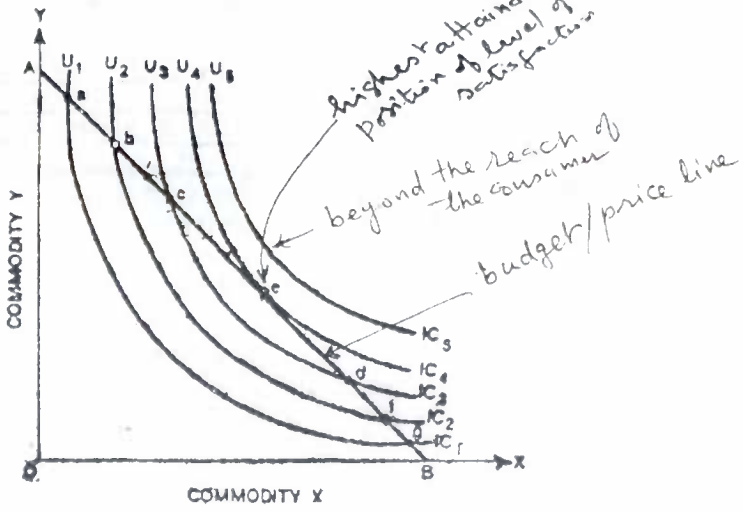


Fig. 4.9

Hence, in the graphical technique, to obtain the equilibrium position of the consumer, we have to superimpose the budget line upon the consumer's indifference map, as shown in Fig. 4.9.

Evidently, all indifference curves (such as IC_5), which are above the region of the budget line AB, in Fig. 4.9, are beyond the reach of the consumer. So, they are irrelevant for equilibrium consideration. A consumer can choose any point on the budget line. His interest, however, lies in the maximisation of satisfaction. So, he will try to attain the highest possible indifference curve within his reach. Suppose, the consumer starts at the point a on the budget line AB. Here, he derives U_1 level of satisfaction (represented by the indifference curve IC_1) relating to a relevant combination of two goods X and Y which he could buy. If, however, he moves from point a to b on the budget line, he is placed on the higher indifference curve IC_2 representing U_2 level of satisfaction. By so doing, he has reallocated his total expenditure in favour of X. That is, he has substituted some quantity of X for Y in the combination. He, thus, prefers point b to a because the level of satisfaction U_2 derived at point b on IC_2 is greater than U_1 level of satisfaction realised on point a on IC_1. Similarly, as he moves ahead on point c, he moves to a still preferred position of the indifference curve IC_3. The consumer will continue this process of moving downward on the budget line till he reaches point e. Point e places the consumer on IC_4, which the highest attainable position of the level of satisfaction under the given constraints of income and prices. If he moves further down on the budget line to points d, f and g, he will again be placed to a lower and lower indifference curve. As such, after, once attaining point e, the consumer would not like to move further. Apparently, if the consumer begins from point g, as he moves up to point f, d and e, he will be placed to a higher and higher indifference curve. (Here, he tends to substitute Y for X in the combination). Anyway, point e is the position most preferred by the consumer, as at that point only, he attains the highest order of indifference curve.

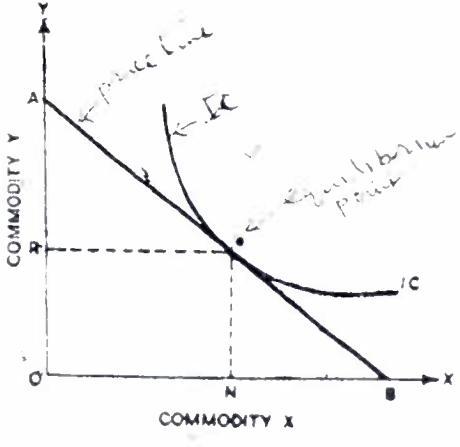


Fig. 4.10

Viewing Fig. 4.10, it may be observed that, in technical sense, at this most preferred position—point

—the equilibrium point, the price line is tangent to the indifference curve IC_4. We may, thus, conclude :

Maximum satisfaction is yielded and the consumer reaches equilibrium at the point of tangency between an indifference curve and the price line. There can be only one such indifference curve tangent to the price line. And, this indifference curve is of the highest order in the consumer's scale of preference within his reach.

It follows, thus, that the consumer cannot be in equilibrium at the point of intersection or cross between any indifference curve and the price-line.

This geometrical tangency of the consumer's equilibrium implies that the slope of the price line is exactly equal to the slope of the indifference curve. This leads to the following observations and conclusions :

$$\text{Slope of Indifference curve} = -\frac{\triangle Y}{\triangle X} = MRSxy$$

$$\text{Slope of price line} = \frac{Px}{Py}$$

$\longrightarrow$ At equilibrium point,

Slope of Indifference curve = Slope of price line

$$\therefore \quad MRSxy = \frac{Px}{Py}$$

Thus in economic sense, it may be restated that :

Satisfaction is maximised when the marginal rate of substitution of X for Y is just equal to the ratio of the price of X to the price of Y.

Now, it is easy to see why the consumer cannot be in equilibrium at the point of intersection between the indifference curve and the price line. See Fig. 4.11.

In Fig. 4.11, a is the point of intersection between the indifference curve IC_1 and the price line AB. Tangent t_1 is drawn at point a to measure the slope of the indifference curve. Tangent t_1 is steeper as compared to the slope of line AB. It, thus, implies that $MRSxy > \frac{Px}{Py}$ at point a ($\because \frac{\triangle Y}{\triangle X} > \frac{Px}{Py}$). Thus, obviously, does not satisfy the equilibrium condition ($MRSxy = \frac{Px}{Py}$) so that satisfaction is maximised. The consumer will not stick to point a because he finds

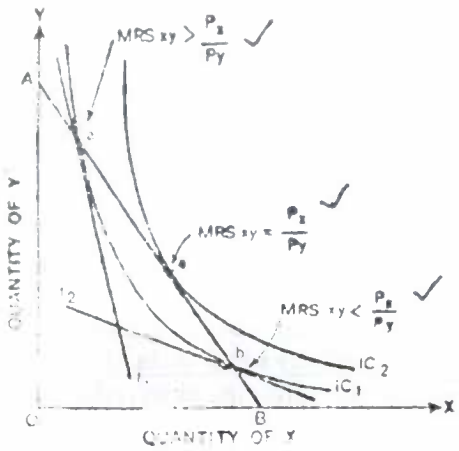


Fig. 4.11

greater significance of X measured in terms of Y than the price of X. Hence, he will prefer to acquire more X at the detriment of Y. So, he will tend to move downward on the budget line. The process will continue till he reaches point e.

Similarly, at point b also, there is a cross between the indifference curve and the price line. Tangent t_2 is drawn at that point which measures the slope of the indifference curve which is flatter than that of the price line. This suggests, $MRSxy < \frac{Px}{Py}$. (∵ the slope of the indifference curve is less than the slope of the price line). As such, the consumer will prefer Y to X, so he will tend to substitute some amount of Y for X and thereby will experience a rise in his level of satisfaction derived from the changed combination. Thus the consumer will not be at equilibrium. The process of substitution and the reallocation of income spending in favour of Y will be continued till he reaches point e, where the $MRSxy$ becomes just equal to the ratio $\frac{Px}{Py}$.

In short, when $MRSxy > \frac{Px}{Py}$ the consumer will not be at equilibrium as he feels that by substituting X for Y to some extent he can improve his level of satisfaction. If $MRSxy < \frac{Px}{Py}$, then also he will not be at equilibrium, as he finds the scope of moving to the higher level of satisfaction by substituting Y for X to some extent. However, when $MRSxy = \frac{Px}{Py}$ he experiences highest possible level of satisfaction under the given conditions of his scale of preference and his income and the price of goods (X and Y) in consideration.

Thus, it may be recalled that according to the Hicksian ordinal preference approach the consumer's equilibrium is represented by the tangency between the price line and an indifference curve. At the point of tangency only, the ratio of consumer's marginal significance of X in terms of Y (or the $MRSxy$) is equal to the ratio of the price of X to the price of Y (i.e. $\frac{Px}{Py}$).

It must be noted that while equation : $MRSxy = \frac{Px}{Py}$ is a necessary condition for maximising satisfaction i.e. the point of tangency between the price line and an indifference curve, it is not a sufficient condition. Because, the point of tangency does not necessarily imply the position of maximum satisfaction realised by the consumer. If, for example, the indifference curve at the point of tangency is concave to the origin, it would imply minimum level of satisfaction rather than maximum one. (See Fig. 4.12). Concavity implies that the $MRSxy$ is increasing, so the consumer will be inclined to substitute X for Y to the extent that he would like to replace Y completely by spending all of his income on X. Then, point a in Fig. 4.12 cannot be the equilibrium point. But, when he moves further to point e, he attains stable equilibrium. It will be noticed that at that point, the indifference curve is convex to the origin. It follows thus that to ensure maximum level of satisfaction, the indifference curve must be convex to the origin at the point of tangency. This second order condition that the indifference curve is convex to the origin must be satisfied by the equilibrium point. It is the sufficient condition, which assures a stable equilibrium.

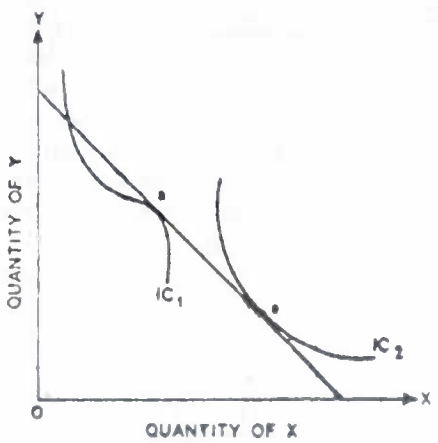


Fig. 4.12

Convexity of the indifference curve means that the slope of the curve is diminishing. This implies that the marginal rate of substitution between X and Y is diminishing. Thus, when the $MRSxy$ is diminishing at the equilibrium point, the consumer finds no benefit in

further substituting X for Y but it would lead him to a lower level of satisfaction.

We may conclude thus that there are two essential conditions for the consumer's equilibrium.

1. First order condition : The price line is tangent to the highest attainable indifference curve, i.e. $MRSxy = \frac{Px}{Py}$.

2. Second order condition : The indifference curve is convex to the origin, i.e. the $MRSxy$ is diminishing.

It may be commented that, the condition of consumers' equilibrium laid down by Hicks is strickingly resembling to the condition laid down by the Marshallian utility approach.

According to Marshall, total utility will be maximised when :

$$\frac{MUx}{Px} = \frac{MUy}{Py} \text{ for the goods } X \text{ and } Y.$$

By slight manipulation, it can be stated as : $\frac{MUx}{MUy} = \frac{Px}{Py}$.

According to Hicks, however, the satisfaction maximised when :

$$MRSxy = \frac{Px}{Py}.$$

Thus Hicks, in the ordinal utility approch has substituted the term 'marginal rate of substitution between goods' in place of the 'ratio of marginal utilities of the two goods.'

Some critics, thus, observe that actually $MRSxy = \frac{MUx}{MUy}$, as the rate of substitution is measured in terms of the marginal significance of X in terms of Y and vice versa. Even though this is true, the concept of $MRSxy$ is better than that of marginal utility because the former is based on more tenable assumptions than those assumed by the latter. Again $MRSxy$ is a measurable term in physical quantities while $\frac{MUx}{MUy}$ is immeasurable when the assumption of cardinality is ruled out.

ANALYSIS OF ECONOMIC EFFECTS ON THE CONSUMER'S EQUILIBRIUM

The consumer's equilibrium may change when income of the consumer's changes or when the price of the commodity changes.

The Income Effect : The Income Consumption Curve (ICC)

The income effect may be defined as the effect of changes in the money income of the consumer on his equilibrium position in the purchases of goods or combination of goods, prices of which and his taste remaining constant.

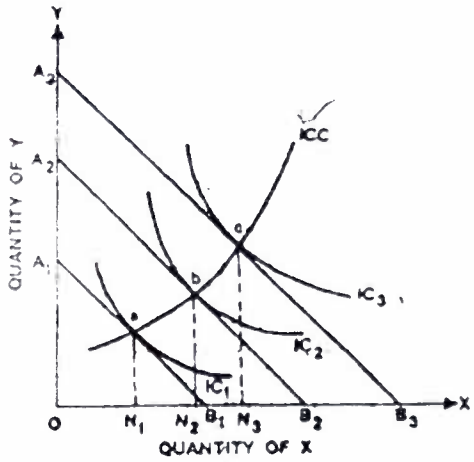


Fig. 4.13

In terms of indifference curve techniques, changes in income can be interpreted through shifts in the budget line. When the income rises, the budget line shifts towards its right, away from the origin. Similarly, when income falls the budget line shifts to its left, towards the origin. As the prices of goods X and Y are constant, the shift remains parallel. See Fig. 4.13.

In Fig. 4.13 budget lines $A_1B_1 \parallel A_2B_2 \parallel A_3B_3$.

Their slopes are identical :

$$\frac{OA_1}{OB_1} = \frac{OA_2}{OB_2} = \frac{OA_3}{OB_3}.$$

Indeed, for each level of income, the consumer will have an equilibrium position. Thus, when these income lines are superimposed on the consumer's scale of preference, for each level of income there will be an indifference curve which is tangent to the relevant price line or budget line. Thus, in Fig. 4.13, we have tangency points, a, b, c, as the equilibrium points. Joining loci of all such points—assuming an indefinitely large number of possible equilibrium positions like a, b, c, etc,—we may derive a curve called 'income-consumption curve' (*ICC*). The income-consumption curve shows how equilibrium positions and the combinations of two goods (X and Y) change as income changes, under the conditions of a given scale of preference and the fixed relative prices of goods. Thus, the income-consumption curve measures the income effect.

Geometrically, an upward movement on the income-consumption curve, places the consumer on a higher and higher indifference curve, and a downward movement places him on a lower and lower indifference curve. Thus, through income effect, the consumer moves from one level of satisfaction to the other.

Normally, the income-consumption curve has an upward slope as in Fig. 4.13. This implies a positive income effect for both the commodities, X and Y, i.e. the positive income effect induces the consumer to buy more of both the goods.

In certain cases, however, there may be a negative income effect. A negative income effect implies that the consumer will tend to buy less of a commodity when his income increases above a certain level. This happens in the case of inferior goods. Inferior goods refer to goods of relatively cheap quality. In the Indian economy, inferior goods are numerous. For instance, plantains, guaves, vegetable ghee, pacca rice, *totapyri* mangoes, maize, coarse cloth etc. are comparatively inferior goods. These goods are common consumption items of the poor. As income rises, it may be reasonably assumed that, people can afford to buy a greater and better variety of consumption goods, and less and less of these types of inferior goods will be demanded.

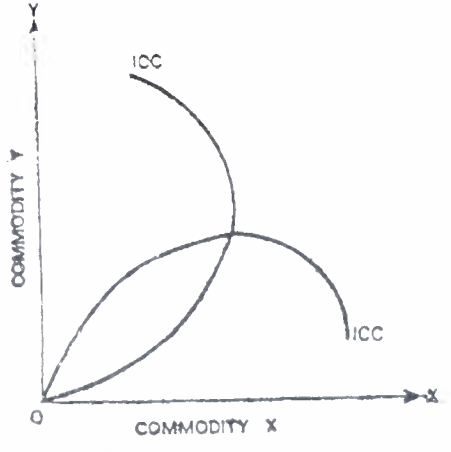


Fig. 4.14

In the case of a negative income effect, the income consumption curve will have either a backward slope or downward one. See Fig. 4.14 (a).

Of the two goods X and Y, if X is inferior and Y is relatively superior, then the income effect, after a point will be negative in case of X, so that less of X will be demanded with the rise in income. In that case, the income - consumption curve has a backward slope. See Fig. 4.14 (b), ICC_4.

If, however, the incomeconsumption curve has a downward slope, (See Fig. 4.15 (b), ICC_5) it implies a negative income effect on the

purchase of commodity *Y* which is inferior as compared to *X*, which is relatively superior.

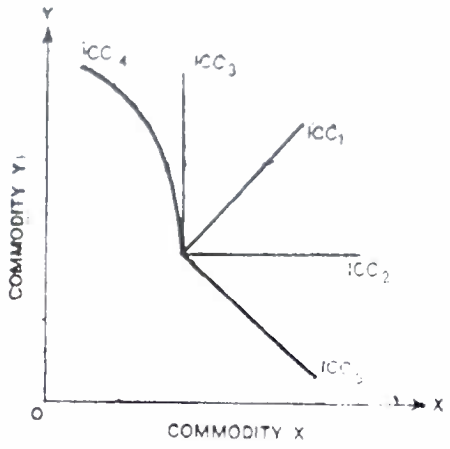


Fig. 4.15

If, however, the *ICC* is a horizontal straight line (as in Fig. 4.15 (b)-ICC_2) then *X* will be superior, and *Y* is neutral having zero income effect. Likewise, vertical slope of *ICC* (in Fig. 4.15, ICC_3), suggests that *X* is a neutral commodity having zero income effect and *Y* is superior one with positive income effect.

The Substitution Effect

Whenever there is a change in the relative prices of goods, a rational consumer will be induced to substitute a relatively cheaper commodity for the dearer one. Such effect of the change in relative prices of goods is, thus, described as the substitution effect. Under substitution effect, the consumer will tend to buy more of a good, the price of which has fallen and less of the good, the price of which has remained unchanged or has increased as he would reallocate his expenditure in favour of the relatively cheaper good and substitute it for the dearer one.

A pure substitution effect, however, may be defined as the rearrangement in the purchases made by the consumer, caused by the change in the relative prices of goods, his real income remaining constant, so that his level of satisfaction remains as before. Hence, in our model of consumer behaviour, with a given money income and two goods *X* and *Y*, when the price of *X* falls and the price of *Y* remaining unchanged, to measure pure substitution effect first we will have to eliminate the change in the real income. It is obvious that as a result of fall in the price of *X* buy there is a rise in the real income of the consumer, as his given money income could now buy more than before. To eliminate this income effect, the consumer's money income must be altered appropriately, so that his real income (the pur-

chasing power in terms of X) remains at the original level. Thus, we have to take away his surplus money income realised due to fall in price of X. When this is done, he will be neither better nor worse off than he was before. This is called compensating variation in income. Thus, the compensating variation in income may be defined as an appropriate change in the consumer's income which would just compensate for a change in the relative prices of goods, so that the consumer is neither better nor worse off than he was before. In the indifference curve analysis, the compensating variation in income implies such adjustment in the income line which keeps the consumer on the same original indifference curve despite a change in the relative prices of two goods, X and Y. Thus, the substitution effect can be defined as the change in the combination of the goods bought due to the change in their relative prices, despite compensating variation in income. This means, if the consumer increases his purchase of commodity X, when its price falls, by reallocating his income spending, inspite of compensating variation in income, then his behaviour is attributed to the pure substitution effect. This is diagrammatically illustrated in Fig. 4.16.

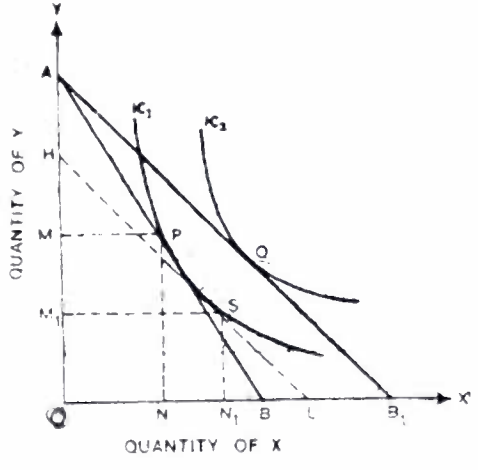


Fig. 4.16

In Fig. 4.16, the initial equilibrium position of the consumer is at point P, where the price line AB is tangent to IC_1. He buys OM of Y and ON of X. When the price of X falls, while the price of Y remains unchanged, the price-line will shift as AB_1. Because of the change in his real income, thus, the consumer would attain an equilibrium point on IC^2. To measure pure substitution effect, however, we have to resort to compensating variation in income. For this, a hypothetical income line HL is drawn, which is parallel to the new price line AB_1 and tangential to the original IC_1, so that the consumer is placed back on the original level of satisfaction, maintaining

the same real income as before. However, with respect to *HL* price line, though the consumer is brought back on the same indifference curve IC_1, his equilibrium position has changed from *P* to *S*. This means that now the consumer has rearranged his purchases due to the change in the relative prices of goods, after the compensating variation in income. The point *S* denotes that the consumer buys ON_1 of *X* and OM_1 of *Y*. He has substituted NN_1 of *X* for MM_1 of *Y*. This is pure substitution effect. Graphically, thus. *the substitution effect is measured by movement from one point to another point on the same indifference curve*. Again, the substitution effect may be small or large, but it will always be positive. That is, a substitution effect always induces the consumer to buy more of the goods when its price falls.

The Price Effect : Price Consumption Curve

The consumer's reaction to a change in the price of a commodity, other things (that is, his money income, tastes and prices of other goods) remaining constant, is called the price effect. As per the law of demand, when the price of a commodity falls, more of it is demanded. In the Indifference curve technique, the price effect is measured along the price-consumption curve, as shown in Fig. 4.17.

To draw the price-consumption curve in Fig. 4.17, we assume a successive fall in the price of commodity *P*, the price of *Y* remaining constant. Thus, there are changes in the ratio $\frac{Px}{Py}$. The ratio is decreasing. As such the slope of the price line becomes progressively flatter. Hence, with every assumed, fall in the price of *X* the price line tends to shift as AB_1 to AB_2 and AB_3 etc. Assuming, unchanged scale of preference and the given money income, it follows that now the consumer's equilibrium point will shift to P_1, P_2 and P_3 etc. where each new price line is becoming tangent to a higher indifference curve. At *P* equilibrium point the consumer buys *ON* of *X*, at P_2 he buys N_1N_2 more of *X* and at P_3 he buys N_2N_3, denote the price effect on the purchase of *X* which has become cheaper.

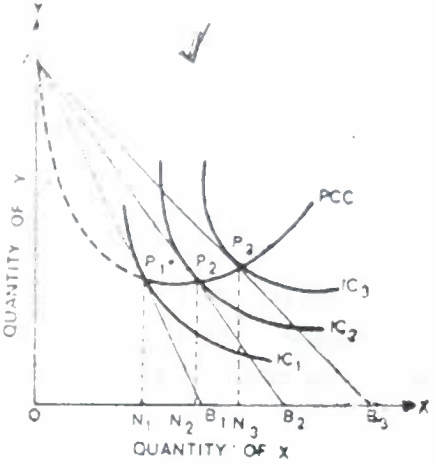


Fig. 4.17

By joining the *loci* of all such subsequent points of equilibrium like P_1, P_2 and P_3 etc. (considering an indifinitely large number of possible equilibrium position), we derive a curve called the price-consumption curve (*PCC*). The price-consumption curve depicts the price effect. In Fig. 4.17 it shows the way in which the demand for *X* changes when its price changes. The movements on the *PCC* from P_1 to P_2, P_3 indicates that when price of *X* falls more of *X* is purchased. Similarly, a reverse movement on the *PCC*, from P_3 to P_2, P_1 implies a rise in the price of *X* and condition in its demand.

In the same way we can draw a price-consumption curve, showing the effect of a progressive fall in the price of *Y*, price of *X* held constant. See Fig 4.18.

As in Fig. 4.18, the price-consumption curve may have an upward slope. This indicates that when the price of *X* falls, consumer's real income increases. This enables him to buy more of both the goods, *X* and *Y*.

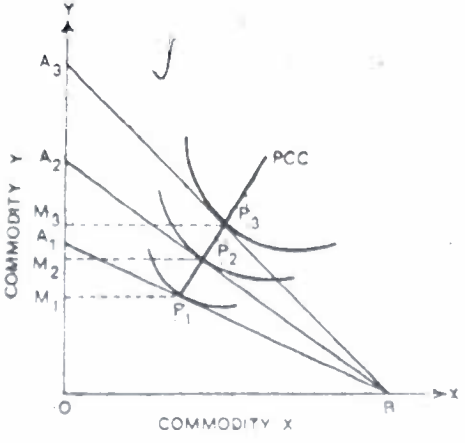


Fig. 4.18

Like the income-consumption curve, the price-consumption curve also determines its slope on the basis of the nature of two goods *X* and *Y*, as to whether both are superior or one of them is inferior.

Thus, when the *PCC* slopes downward to the right as in Fig. 4.19, it suggests that with the fall in the price of *X* is bought but less of *Y* is bought to attain a higher level of satisfaction when the real income

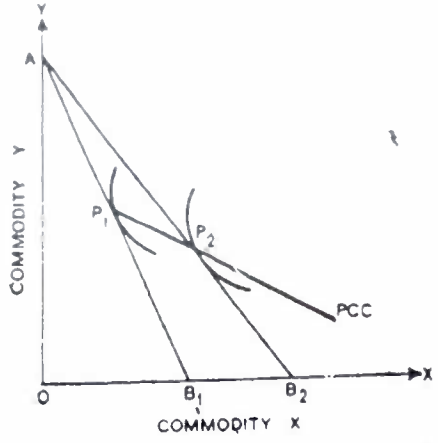


Fig. 4.19

rises. This means, that *X* is a superior commodity having a positive price effect, and *Y* is an inferior one having a negative price effect. The goods having negative price effect is described as Giffen goods. Simi-

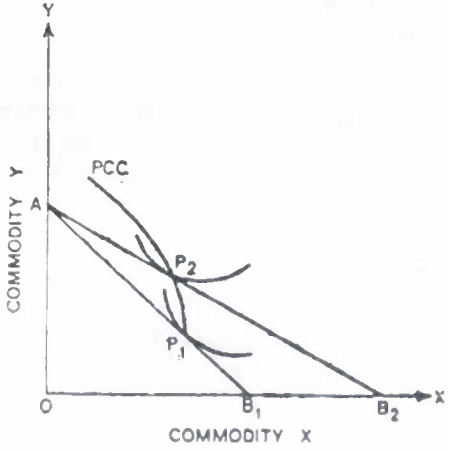


Fig. 4.20

larly, the *PCC* may slope backward as in Fig. 4.20. This implies that *X* is a Giffen good having negative price effect and *Y* is a superior commodity having positive price effect.

Again, *PCC* will be a horizontal straight line when *Y* is neutral and *X* is a superior product. (See Fig. 4.21). Similarly, when *X* is neutral

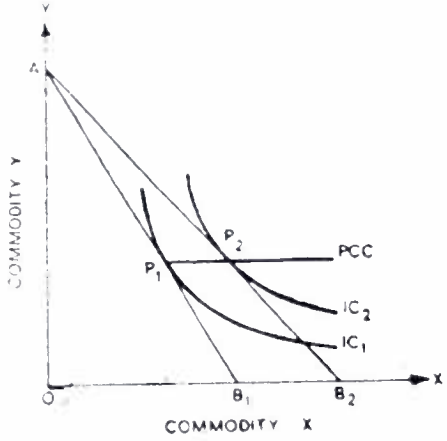


Fig. 4.21

and *Y* is a superior product, *PCC* will be a vertical straight line. (See Fig. 4.22)

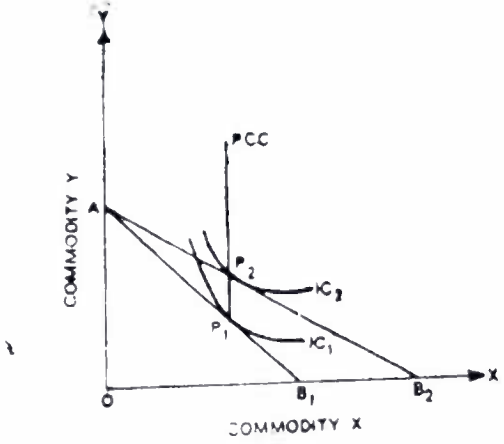


Fig. 4.22

Separation of Price Effect into Income Effect and Substitution Effect

When the price of a commodity changes, the money income of consumer held constant, two separate and different forces are simultaneously altered to affect his demand behaviour :

1. *The income effect* : The change in the real income or the purchasing power consumer's money income either makes him better off or worse off.

2. *The substitution effect* : When price falls, the commodity becomes relatively cheaper, so the consumer is induced to buy more of it. And when the price rises, the commodity becomes relatively dearer, so the consumer tends to buy less of it, as he will replace it by buying more of other cheaper goods.

Evidently, the price effect can be interpreted as the sum of income effect plus substitution effect. Thus :

Price Effect (Pe) = *Income Effect* (Ie) + *Substitution Effect* (Se).

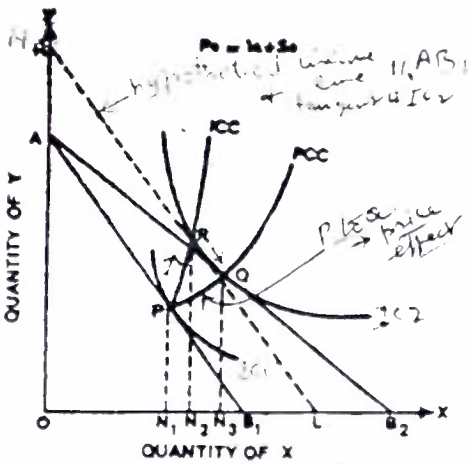


Fig. 4.23

The technique of indifference curves, enables us to have analytical bifurcation and exact measurement of income effect and substitution effect resulting into price effect. Graphically, the income effect is measured along the income-consumption curve, which implies a movement from one indifference curve to the other. While, the substitution effect is measured by a movement from one point to the another on the same indifference curve. Thus, in Fig. 4.23 the income, substitution and price effect of a fall in the price of commodity X is depicted.

→ In Fig. 4.23, AB_1 is the initial price line. Point P is the initial equilibrium point. The consumer thus buys ON_1 units of X and derives the level of satisfaction indicated by the indifference curve IC_1. However, when the price of X falls, and the price of Y remains constant the new price line is AB_2. As such the consumer attains a new equilibrium point Q placed on a higher indifference curve IC_2. He, thus, moves from P to Q on the price consumption curve PCC. The movement from P to Q measures the price effect. At point Q, the

consumer buys ON_3 of X, thus the price effect is N_1N_3. However, the movement from P to Q *i.e.* price effect is not straight. Actually, at first the consumer experiences income effect. With the fall in the price of X, his real income rises. This is shown by drawing a hypothetical line (HL) parallel to the original price line AB, and tangential to the new indifference curve, IC_2. (HL/AB, because we express change in real income measured in terms of constant $\frac{PX}{PY}$). Point R is thus obtained at the point of tangency and by joining point R, income consumption curve is derived

Thus, on account of income effect at first, the consumer moves from P to R on the income consumption curve ICC. He thus buys N_1N_2 more of X. This is measured as income effect.

The point R is, however not a stable equilibrium point. The substitution effect induces the consumer to move further from R to Q. Thus, the consumer moves downward on the same higher attended indifference curve. Since X has become relatively cheaper, the consumer feels that the marginal significance of X in terms of Y is now greater than its price in terms of Y. Hence, the consumer is induced to substitute X for Y until the marginal significance of X in terms of Y, ultimately equals the price of X in terms of Y. As such, he moves along the new higher difference curve (IC_2) from R to X and buys N_2N_3 more of X.

In short, when the price of X falls, the consumer first moves from P to R along the ICC. The substitution effect induces him to move further from R to Q. The total effect is thus measured as P to Q on the PCC.

Our graphical measurement of the price effect being the sum total of income effect and substitution effect may be summarised as under :

$$Pe = Ie + Se \therefore N_1N_3 = N_1N_2 + N_2N_3.$$

That is, N_1N_2 increase in the demand for X is due to income effect to this N_2N_3 demand is added by the substitution effect, so that the total price effect implies demand for X to expand by N_1N_3.

It may also be observed that the price-consumption curve (PCC) reflects the combined influence of the income and substitution effects of the price change. Again, the price-consumption curve lies between the income-consumption curve and the indifference curve of the original equilibrium position. Its economic significance is that analytically we first measure income effect and then consider substitution effect.

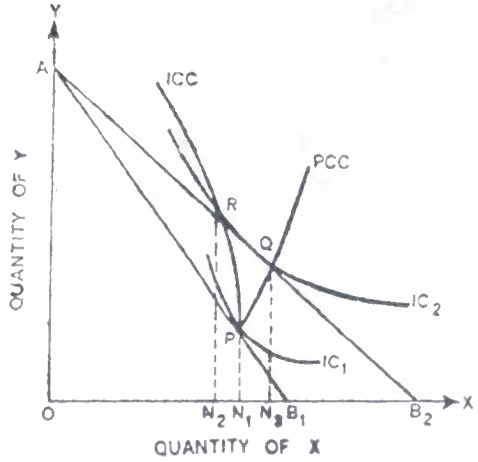
Price Effect in case of 'Inferior' Goods

Income effect tends to be negative in case of inferior goods. Thus, when the real income of the consumer rises as the result of fall in the price of a commodity, the negative income effect will induce him to buy less of this cheaper inferior good as he will prefer to buy a superior good instead which he can now afford. But, the price effect is the net effect of income and substitution effects combined together. The substitution effect is always positive whether the good is superior or inferior. If the positive substitution effect is more powerful than the negative income effect which is weak, the resulting net price effect will be positive as the negative income effect is more than counterbalanced by the strong substitution effect. To express in symbolic terms :

When, $+ve\ Se > -ve\ Ie \quad \therefore\ Pe = Se + (-Ie) = +ve$ net effect. This has been illustrated in Fig. 4.24.

In the Fig. 4.24, AB_1, is the initial price line. P is the initial equilibrium point, indicating that ON_1 of X is bought. X being an inferior commodity, when its price falls, the real income of the consumer rises, but it carries a negative effect, so the consumer first moves from P to R, on the income-consumption curve which is backward sloping. The P to R movement implies that he would buy less of X by $N_1 N_2$. But, there is a stronger substitution effect which forces the consumer to move again from R to Q. The substitution effect causes the consumer to buy N_2N_3 of X. Thus :

$$\text{Net } Pe = Ie + Se$$
$$N_1N_3 = (-N_1N_2) + (N_2N_3)$$
$$N_1N_3 \text{ is } + ve \therefore (+N_2N_3) > (-N_1N_2)$$



Thus, is case of inferior goods, the net price effect turns out to be positive when income effect is negative but weak and the substitution effect is positive and strong. Graphically, therefore, the *ICC* curve has a backward slope, while the *PCC* one has a positive slope.

Giffen Paradox

However, there are a few goods called *Giffen goods* for which the negative income effect caused by a fall in their prices stronger and predominant while the substitution effect is positive but weak in force, so that the overall price effect tends to be negative. Thus, in case of such typical inferior goods called *Giffen goods* the consumer tends to buy less of them, after a point, even if their prices fall. This is paradoxical to the law of demand which states that more is bought, when price falls. Hence, Giffen goods are exception to the law of demand. The demand behaviour of the consumer in these typical inferior products is referred to as *Giffen's paradox*. In the nineteenth century, it was Sir Robert Giffen, who pointed out the cases of typical inferior goods where demand contracts even with fall in the price. Sir Giffen explained the paradoxical tendencies by citing an example of demand for bread—the cheapest need of the poorer class in England, and observed that when the price of bread was high, people consumer more of it as it is the cheapest food as compared to their expensive food items like meat, cake etc. But when its price falls they would buy less of it, for they would like to spend the rise in their real income on better and more varied diet. Thus, to honour Sir Giffen, such typical inferior commodities having a predominant negative income effect are named as *Giffen goods*.

The price effect in case of *Giffen good* can be graphically illustrated as in Fig. 4.25.

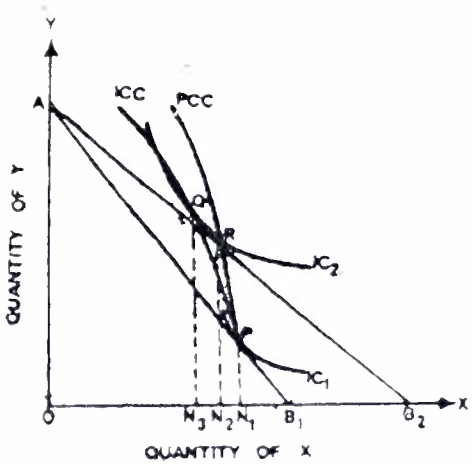


Fig. 4.25

In Fig. 4.25 commodity X represented on x-axis is a Giffen product. When the price of X falls, the income effect forces the consumer to move along ICC curve. The backward sloping ICC implies negative income effect. The consumer's equilibrium position changes from P to R.

This means that he tends to reduce his purchase of commodity X N_1 to N_3. However, the substitution effect, which is positive,

leads consumer to move further from point R to Q. Thus, he is induced to buy more of X by $N_3 N_2$ on account of substitution effect. But, $N_3 N_2$ being lesser than $N_1 N_3$, so the net price effect turns out to be negative *i.e.*, $-N_1 N_2$. The observation may be summarised as under :

$Pe = Ie + Se$

$\therefore (-N_1N_3) = (-N_2N_3) + (N_2N_3)$

$\therefore (-N_1N_3) > (N_2N_3)$, so N_1N_2 is negative.

Thus, it follows that in case of Giffen goods, strong negative income effect outweighs the positive substitution effect, so that net price effect is also negative. Graphically, therefore, both the income-consumption curve (*ICC*) as well as the price-consumption curve (*PCC*) slope backward when the good is a Giffen good. This suggest that a consumer would buy less of such goods when its price falls. Of course, such Giffen goods are rare and are occassional exceptions to the law of demand.

THE DERIVATION OF DEMAND CURVE THROUGH INDIFFERENCE CURVE TECHNIQUE

The demand curve is a graphical representation of the functional relationship between the price of and the demand for a commodity. It slopes downwards to the right, indicating that the consumer purchases more of a commodity when its price falls and *vice versa*.

In the Marshallian Utility analysis, the demand curve is drawn on the assumptions of utility being cardinally measurable and the marginal utility of money remaining constant.

Under the indifference curve analysis, utility is measured in ordinal sense, and the consumer's demand behaviour is reflected through price-consumption curve.

There are, however, notable differences between the demand curve and the price-consumption curve and the latter appears to be superior to the former in certain respect :

1. In case of demand curve, only one commodity is considered. In the price consumption curve, two goods are represented. Thus, demand curve does not reveal anything about complementarity and substitutability characteristics of goods, which is clearly exposed by the price consumption curve. Thus, from the analytical viewpoint, price-consumption curve is superior to the conventional demand curve.

2. The demand curve represents quantified marginal utility. The price-consumption curve signifies the rank order of the level of satisfaction.

3. The demand curve assumes constant marginal utility of money. The price-consumption is free from any such assumption.

4 The demand curve represents consumer's average expenditure curve. The price-consumption curve represents the total outlay curve.

5 Marshallian demand curve does not reveal the size of consumers' given income. It also does not show the income left after spending on the given commodity X. The price-consumption curve, on the other hand, represents consumers' given money income in real terms through budget line and also depicts what will be left after spending X, if we plot money income on Y-axis. Thus, the PCC curve provides better and clearer results.

6. The price-consumption curve, in fact, incorporates the conventional demand curve in it.

It is possible to derive to conventional demand curve from a given price-consumption curve. The process of derivation is illustrated in Fig. 4.26.

In Fig. 4.26, we take money as a commodity on the y-axis and commodity X on the x-axis. This is just to be in line of demand curve information that on y-axis price in terms on money is measured and on x-axis demand for the commodity is expressed.

With respective price lines AB_1, AB_2, AB_3, etc. the price-consumption curve (PCC) is drawn. Equilibrium points P_1, P_2, P_3 show that the consumer buys ON_1, ON_2 and ON_3 units of X respectively. The consumer's total outlay in each case is AM_1, AM_2, and AM_3 respectively. Thus, the price per unit of X can be measured as : $\frac{AM_1}{ON_1}$, $\frac{AM_2}{ON_2}$ and $\frac{AM_3}{ON_3}$ respectively as it is clear that the price of X falls progressively as we move from P_1 to P_3 on the price-consumption curve (PCC). These prices are, represented by the slopes of price-line AB_1, AB_2 and AB_3. From the y-axis, we can read that the consumer has a given money income of Rs. *e.g.* OA. At equilibrium point P_1 he parts with AM_1 to buy X and retains OM_1 with him. At point P_2, he spends AM_2 and keeps OM_2 with him and so on. In short, the price-con-

sumption curve represents total outlay for X at different relative prices. Thus, the price of X per unit can be measured by dividing total out-

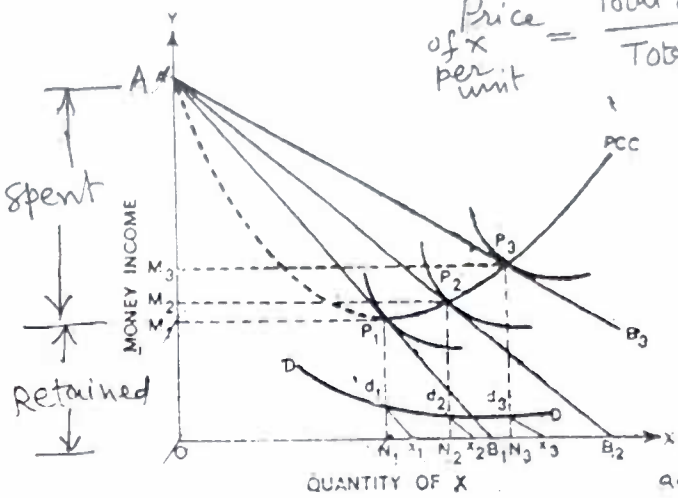


Fig. 4.26

lay by total quantity bought. With regard to the price-line AB_1, we find that ON_1 of X is bought at the per unit price $\frac{AM_1}{ON_1} = \frac{OA}{OB_1}$. But it is difficult to plot this ratio graphically. Hence, a simple process to measure the per unit price of X, take, N_1X_1, as one additional unit of X at the price $\frac{OA}{OB^1}$. Line $x_1 d_1$ is drawn parallel to AB_1. Since the slope of $x_1 d_1$ is identical to the slope of AB_1 both represents the same unit price of X. The distance $N_1 d_1$ represents the price of X for one unit ($N_1 x_1$), when ON_1 of X is purchased. Point d_1 is thus, a point relating to price-quantity relation expressed on the demand curve. It reveals the amount of X demanded when the price of X is $N_1 d_1 \left(= \frac{OA}{ON_1} \right)$. Similarly, $N_2 X_2$ is marked off to measure one unit of X in relation to the price line AB_2 and $N_2 d_2$ is drawn parallel to AB_2. Point d_2 is another point on the demand curve denoting $N_2 d_2$ price and ON_2 demand. Likewise $N_3 X_3$ is marked off and $N_3 d_3$

is drawn parallel to AB_3. Point d_4 is another point on demand curve representing $N_3 e_3$ price and ON_3 demand for X. Joining the points d_1, d_2, d_3 etc. the demand curve (DD) is derived. It is a downward sloping curve expressing inverse functional relationship between the price of and the demand for X.

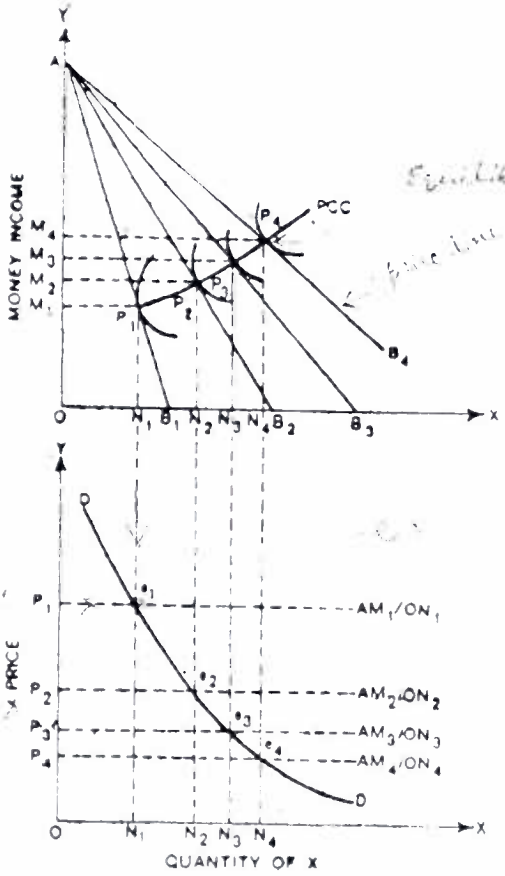


Fig 4.27

Alternative Method of Derivation

There is another method of deriving the demand curve from a given price-consumption curve. This has been illustrated in Fig. 4.27.

In Fig.4.27, AB_1, AB_2, AB_3 and AB_4 represents the price line when the price of X falls from P_1 to P_2, P_3 and P_4 alternatively. PCC

is the price-consumption curve. When the consumer is at the equilibrium point, he buys ON_1 of X by incurring total outlay of AM_1.

Thus, unit price of X, $P_1 = \frac{AM_1}{ON_1}$. Likewise,

$$P_4 = \frac{AM_2}{ON_2}, \quad P_3 = \frac{AM_3}{ON_3} \text{ and } P_4 = \frac{AM_4}{ON_4}.$$

This has been represented in Part II of the diagram. As we know that at P_1, the consumer buys OM_1 of X_1 at P_2 he buys ON_2 of X and so on, the points of respective quantities of Part I in the diagram can be extended to Part II of the diagram by drawing perpendiculars. We, thus, get points e_1, e_2, e_3 and e_4. Joining these points, the demand curve DD is drawn. It is a downward sloping curve expressing inverse functional relationship between price and demand.

SUPERIORITY OF INDIFFERENCE CURVE APPROACH

The indifference curve approach is considered superior to the Marshallian utility analysis of consumer demand in the following respects :

1. Marshall assumes cardinal measurement of utility, which is unrealistic. The indifference curve technique, on the other hand, realistically makes an ordinal comparison of utility—the level of satisfaction.

2. The concept of utility is replaced by the concept of scale of preference in the indifference curve technique. The scale of preference is laid down on the basis of consumer's tastes and likings, independent of his income.

Again, unlike Marshall, Hicksian scale of preference needs no information as to how much satisfaction is gained but it aims only at knowing whether a consumer's satisfaction level is greater than, less than or equal, between various combinations of two goods.

3. The Marshallian analysis assumes that to the consumer the marginal utility of money remains constant. In the indifference curve analysis, such assumption is not needed.

4. Marshallian demand theory deals with a single commodity taken exclusively. Hick's ordinal approach, however, consider at least two goods in combination. Thus complementarity and substitutability aspects of goods are being explicitly considered in the Hicksian analysis.

5. The utility approach is based on the law of diminishing marginal utility. On the other hand, the indifference curve approach rests on the principle of diminishing marginal rate of substitution. The concept of marginal rate of substitution is superior to that of marginal utility because it considers two goods together and also because it is a ratio expressed in physical units of the two goods and as such practically measurable.

6. In Marshall's analysis, the consumer equilibrium condition is :

$$\frac{MUx}{Px} = \frac{MUy}{Py}.$$

The utility cannot be measured numerically, this condition is impracticable.

In Hicksian analysis, the equilibrium condition is expressed as :

$$MRSxy = \frac{Px}{Py}.$$

This is a measurable phenomenon. Again, it is more comprehensive as it recognises the fact that equilibrium in purchasing one commodity depends on the price of other goods and their stocks as well.

7. The Marshallian demand curve has no means to dichotomise the price effect into income and substitution effects. In the indifference curve analysis, the price-consumption curve enables us to have the bifurcation of price effect into income and substitution effect.

8. Marshall views the Giffen paradox as an exception to the law of demand. Whereas the case of Giffen good is incorporated in the price-consumption curve to examine the consumer's typical behaviour caused by negative income effect. Thus, the unsolved riddle about Giffen good in the utility analysis is solved in the indifference curve analysis. It represents the law of demand in a broader and more precise way.

CRITICISMS OF INDIFFERENCE CURVE ANALYSIS

Following are the major criticisms levelled against the indifference curve analysis :

1. D. H. Robertson opines that the indifference curve analysis conveys nothing new about the theory of demand. It is just 'old wine in new bottle.' It merely substitutes new concepts and equations in the old logic. For instance in place of the concept of 'utility', it has introduced the term 'preference'. Again, in place of cardinal number

system it gives just ordinal number system to denote the scale of preference. Moreover, the concept of marginal utility is replaced by the marginal rate of substitution. All these ultimately amount to the same thing as what Marshall wanted to convey in his exposition of the law of demand. Above all, the concept of scale of preference introduced by Hicks is as subjective and unrealistic as the concept of utility itself. Thus the indifference curve analysis has remained only an exercise of abstract thinking.

2. Again, the Hicksian principle of diminishing marginal rate of substitution is, in essence, based on the law of diminishing utility. That means the law of diminishing marginal rate of substitution is as much determinate or indeterminate as the much criticised law of diminishing marginal utility. Thus, strangely enough Hicks has himself utilised Marshall's assumption even after severely criticising them.

3. The indifference curve analysis assumes that the consumer has perfect knowledge and capability 'of forming his scale of preference which is translated in terms of indifference map. In actual practice, this is hardly possible. In fact, the consumer would make choices in particular situations, but he would not contemplate making choices and lay down scale of preference in an indefinitely large number of situations and determine indifferent positions.

4. Professor Armstrong points out that in drawing the indifference curve, Hicks assumes transitivity and continuity. Actually, indifference curves are non-transitive. An indifference curve is transitive if we see that the utility difference at difference point of indifference curve is not preceptible to the consumer. This may be true with very close points on an indifference curve. Thus, in Fig. 4.28 (a), $a=b$, $b=c$, $\therefore$ $a=c$ is visualised on the transitivity assumption. But, when the difference of utility is perceptible a may not be equal to c. Thus, if we remove the assumption of transitivity, indifference curves will be discontinuous as shown in Fig. 4.28 (b). With discontinuous indifference curves, it is very difficult to carry out the whole demand analysis as has been seen in the previous sections.

5. The indifference curve analysis has basic limitations of geometrical dimensions. Thus, it cannot be easily extended to more than two goods.

6. The indifference curve analysis being introspective, has no empirical test. Again the functions involved are incapable of statistical verification.

7. Indifference curve analysis may look absurd in case of bulky goods which are not divisible, yet we think of 1/3 of T. V. set combined with 1 1/2 of Refrigerator and so on. Similarly, absurdity is also involved in considering cases like combination of sarees and blouses. It is ridiculous to say that a women consumer is indifferent between 1 saree and 10 blouses and 4 sarees plus 2 blouses, as she derives the

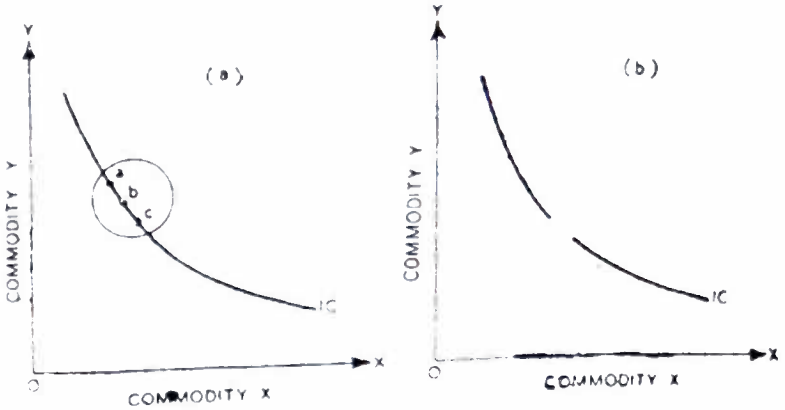


Fig. 4.28

same satisfaction from both the combination. Moreover, is it not absurd to say that 2 1/2 sarees are combined with 7 3/4 blouses to get the same indifference curve ?

Despite these shortcomings of the indifference curve analysis, however, the fact remains that technique of indifference curves has wide applications in economic analysis. It is widely used in modern welfare economics.

SUMMARY

1. Hicks popularised the technique of indifference curves as an alternative approach to the Marshallian utility theory of consumer demand.

2. Hicks discarded Marshall's claim to the cardinal measurement of utility and suggested its ordinal measurement.

3. The scale of preference shows ordinal utility preference. It refers to the ordering of combinations of goods in terms of the level of satisfaction visualised in their specific stocks.

4. There may be an infinite number of combinations of two goods assumed to yield the same level of satisfaction at a given order of preference, so that the consumer is indifferent to any of such combinations.

5. An indifference curve represents all such combinations of two goods which equally satisfy the consumer.

6. The indifference curve implies that $dU = 0$. That is, when we move along an indifference curve, the level of satisfaction remains unchanged. Thus, the consumer will be indifferent to all the points covered by an indifference curve. However, he prefers a point on a higher indifference curve to a point on the lower one.

7. Important properties of indifference curves are:

(a) They slope downward and to the right.
(b) They are convex to the origin of the axis; they are concave upwards.
(c) They can never intersect each other.
(d) They need not be parallel, and
(e) They represent the ordinal measurement of utility.

8. The indifference map is a pictograph or like a cardio-gram of consumer's scale of preference.

9. The marginal rate of substitution of X for Y ($MRSxy$) is defined as the quantity of Y the consumer must give up in order to get an additional unit of X, maintaining the level of satisfaction intact.

10. The budget line (price line) indicates the buying possibilities. A consumer cannot go beyond the budget line constraint determined in relation to his given money income and the relative prices of the two goods he wants to buy.

11. Hicks, uses ordinal measurement of utility, to state that a rational consumer seeks to reach to the highest attainable level of satisfaction (or the indifference curve) within a given budgetary constraint.

12. The consumer attains an equilibrium point at which an indifference curve is tangent to the price line. In the economic sense this means:

$$MRSxy = \frac{P_x}{P_y}$$

is the condition of maximising the satisfaction.

13. The tangency between the price line and the highest attainable indifference curve is a necessary condition of equilibrium. The sufficient condition requires that the indifference curve must be convex at the point of equilibrium. Thus, two essential conditions of equilibrium are:

(i) $MRSxy = \frac{P_x}{P_y}$ (first order condition)

(ii) $MRSxy$ diminishes (second order condition)

14. The income consumption curve (ICC) denotes the income effect. An upward movement along ICC places the consumer on a higher and higher indifference curve.

15. Pure substitution effect can be measured through technique of compensating variation in income. A movement along an indifference curve shows the substitution effect.

16. The price-consumption curve represents the price effect of a change in the price of a commodity on its demand.

17. In case of normal goods, the price consumption curve slopes upward. In case of Giffen goods, it may slope backward or upward as the case may be.

18. Price effect = Income effect + Substitution effect.

19. In normal goods, both income and substitution effects are positive. So aggregate price effect is also positive.

20. In case of inferior goods, income effect is negative but weak, while substitution effect is strong and positive, so the net price effect is positive.

21. In case of Giffen goods, the income effect is negative and predominant, while the substitution effect is though positive but insignificant as such net price effect is negative. Thus, less is bought of a Giffen product when its price falls. This is called Giffen paradox, which is a contradiction to the law of demand.

22. The Conventional demand curve can be easily derived from a given price-consumption curve.

23. Indifference curve analysis is superior to utility analysis on the following counts:

(i) It adopts ordinal measurement of utility in a more realistic way.

(ii) It introduces the concept of marginal rate of substitution which is measurable in physical terms as:

$$\frac{\triangle y}{\triangle x}$$

(iii) It considers two goods simultaneously and their combination, so their complementarity and substitutability aspects are easily dealt with.

(iv) It enables to have a precise measurement of income and substitution effect comprised in the price effect.

(v) It adequately deals with the case of Giffen goods and thus, presents a more generalised and clearer form of the law of demand.

24. Main shortcomings of the indifference curve analysis are:

(i) It has a restricted scope because of limitations of geometry.
(ii) If transitivity assumption is removed, the analysis becomes unworkable.
(iii) It is incapable of empirical test.
(iv) It involves absurdity in the case of bulky goods by assuming their fractional combinations on an indifference curve.

EXERCISES

3.1 (a) Differentiate between the cardinal and the ordinal measurement of utility.

(b) Distinguish between the terms 'marginal utility' and 'marginal rate of substitution'.

3.2 (a) What is a scale of preference?
(b) What is an indifference curve?
(c) What is an indifference map?

3.3 (a) What are the characteristics of indifference curves?
(b) What is a budget line?

3.4 State, giving reasons, whether the following statements are true or false:

(i) Indifference curves are concave upwards.
(ii) Two indifference curves can intersect each other.
(iii) Indifference curves are based on the cardinal measurement of utility.

(iv) Indifference curves slope downwards to the right.

(v) The law of diminishng marginal rate of substitution is better than the law of diminishing marginal utility.

3.5 Points *a*, *b*, *c*, *d* and *e* on an indifference curve represent the following combinations between two goods X and Y:—

	a	*b*	*c*	*d*	*e*
Units of X:	30	32	34	36	38
Units of X:	20	15	12	10	9

Measure the marginal rate of substitution of X for *Y* and comment upon the result.

3.6 State giving reasons, whether the following statements are true or false:

(i) The Income-consumption curve measures the price effect.

(ii) The Giffen paradox is a rare phenomenon.

(iii) The law of diminishing marginal rate of substitution is superior to the law of diminishing marginal utility.

(iv) Indifference curve analysis has no empirical foundation.

3.7 Distinguish between:

(a) Income effect and substitution effect.

(b) Demand curve and price-consumption curve.

(c) Cardinal and ordinal approach to consumer's equilibrium.

3.8 Answer the following:

(a) In what way the indifference curve analysis is superior to the utility analysis?

(b) What are the shortcomings of the indifference curve approach?

(c) How would you measure pure substitution effect?

(d) Show the derivation of demand curve from a price-consumption curve.

(e) What are the characteristics of an indifference curve?

3.9 "Tangency between the price-line and an indifference curve is in terms of indifference curves the expression of the proportionality between marginal utilities and prices." Explain.

3.10 "The price effect is the net result of income effect and substitution effect." Discuss.

3.11 Explain why a consumer is not in equilibrium at the points of intersection of the price line and an indifference curve. What way will he move?

3.12 Examine the consumer's reaction to a price change in case of (i) inferior good, and (ii) Giffen good.

3.13 Starting from a position of consumer equilibrium (a) separate the substitution effect from the income effect of a price reduction for a normal goods, (b) measure the income effect in case of an inferior good when the money income of the consumer increases.

3.14 (a) What is the basic difference between the utility approach and the indifference curve approach to consumer demand theory?

(b) Which of these two approaches will you prefer? why ?