Chapter 4

Indifference Curve Analysis and Consumer Demand

1. INTRODUCTION TO THE ANALYSIS

The classical economists including Marshall had adopted the cardinal utility approach to the theory of demand. Its main merit was its simplicity. But it was widely criticized because of the defective assumptions on which it was based. Taking these criticisms seriously some economists wanted to search for an alternative approach which could be free from criticisms. The most defective assumption and the most unrealistic assumption was that utility can be cardinally measured. Edgeworth, Fisher and Pareto had given some ideas about the possibility of building demand analysis on what was ordinal utility, that is, a measure of utility in which commodities or their combinations are ordered according to the preference of the consumer. In cardinal utility, the amount of utility in a commodity is measured absolutely and is given as so many units. In ordinal utility, commodities are ranked as first, second, third and so on according to the preference of the consumer.

Russian economist Slutsky is credited with the first statement of the law of demand with the help of ordinal utility in the year 1915. But a detailed study of the indifference curve analysis was given by Prof. Hicks and Allen in the year 1928 in a paper: 'A Reconsideration of the Theory of Value'. In this paper they strongly criticized cardinal utility theory and gave their own approach to consumer's demand, which they called 'Indifference Curve Approach'. J.R. Hicks wrote down the indifference curve theory in a much more detailed form in his book 'Value and Capital' published in 1939.

This analysis starts by rejecting the idea that utility can be cardinally measured. This is because utility is something subjective. According to Hicks and Allen cardinal utility measurement is not necessary for building a theory of demand. According to them, a consumer makes comparisons of the satisfaction obtainable from combinations of different commodities. Given two combinations of commodities, a consumer can easily tell us which of the two he prefers. But he cannot tell us how much he prefers one over the other. The consumer is able to

put the various combinations in order as first, second, third, as he views these combi... from the point of view of his satisfaction. Thus, Hicks and Allen claimed that their indif... curve analysis was merited on two grounds : (1) It had fewer assumptions and ... establish the law of demand. (2) It was more realistic because it could take into consid... combinations of commodities which were related with one another. The cardinal utility a... was unrealistic because it assumed the commodities to be independent and being bough... at a time.

2. ASSUMPTIONS OF INDIFFERENCE CURVE ANALYSIS

The indifference curve analysis of demand as given by Hicks and Allen is built o... following assumptions :

1. Rational behaviour of the consumer. It is assumed that the consumer behaves ratio... which means that he tries to obtain the maximum satisfaction from his expenditure on con... goods. As such the consumer is supposed to choose such a combination of his needed cons... goods as provides him with the maximum possible satisfaction.

2. Scale of Preference. Another assumption of the analysis is that the consumer is abl... arrange the available combinations of goods according to preference or indifference for th... Between two combinations he is assumed to be either indifferent or prefer one to the other... technical language, it is called 'Scale of Preference'. Stated simply it means that if there ar... number of combinations, the consumer is able to arrange them in an ascending or descend... order of his preference and is able to indicate the combinations among which he is indiffer... This assumption may be called the assumption of ordering ability.

3. Concept of ordinal utility. The indifference curve analysis is based on the concep... ordinal utility. Ordinal Utility implies that the consumer is in a position to rank the alterna... combinations available to him by a simple comparison of the satisfaction obtainable from ... given combinations. Ordinal utility does not require quantitative measurement of utilities... different combinations.

4. Diminishing marginal rate of substitution. Another assumption behind the indifferen... curve analysis is that of 'diminishing marginal rate of substitution'. This means that as ... amount of a commodity with the consumer goes on increasing he is prepared to exchan... lesser and lesser amounts of the other commodity for equal units of the commodity whos... amount is increasing.

5. Assumption of consistency. It is assumed that the consumer is consistent in h... behaviour. If he is indifferent between combination *A* and combination *B*, and is also indiffere... between combinations *B* and *C*, then he must be indifferent between combinations *A* and ... Stated negatively, this assumption requires that if the consumer prefers *A* to *B* and *B* to ... then he does not prefer *C* to *A* in any circumstances.

6. Scale of preferences is independent of the market prices. It is further assumed th... the consumer is not influenced in his preference or indifference between combinations by th... market prices of different goods. In other words, he is supposed not to regard a higher-price... commodity as superior and lower priced commodity as inferior.

7. Weak ordering. Indifference curve analysis is based on the weak ordering form ... preference hypothesis. According to J.R. Hicks, weak ordering implies that there is a possibili... of the consumer being indifferent between any two combinations along with the possibility ...

preferring one combination to the other. The consumer may prefer A to B or B to A, or he may be indifferent between two combinations. As against weak ordering, strong ordering means that the consumer is allowed to indicate his preference only. The possibility of indifference between two combinations is ruled out in strong ordering.

8. Assumption of transitivity. Another assumption underlying indifference curve analysis is that consumer's preference or indifference relations do not contradict the consumer's position of indifference between combinations taken as whole, and taken separately. It means that if the consumer prefers A to B, B to C and C to D, then, he also prefers A to D. Likewise, if he declares his indifference between pairs of combinations separately, then he is indifferent between all of them. His indifference lies all over his choice field.

9. Assumption of continuity. The indifference curve analysis given by Hicks and Allen was based on the assumption of continuity. Continuity means that the consumer is in a position to rank all conceivable combinations of the needed goods according to his preference or indifference. This means further that the consumer is never tired of ordering the combinations available to him, howsoever small the difference in satisfactions may be between the combinations. The consumer is assumed to make minute comparisons so that different sets of indifference curves are available from him. Prof. Hicks gave up this assumption in his 'Revision of Demand Theory'.

3. BASIC CONCEPTS OF THE INDIFFERENCE CURVE ANALYSIS

The indifference curve analysis is in many ways similar to the cardinal utility analysis but it has important differences with that analysis also. It has its own concepts. Before we take up the analysis of indifference curves, these concepts must be made very clear.

Definition of Indifference curve

According to Hicks, a consumer can tell whether the various combinations of any two commodities which he wants to purchase give him equal satisfaction so that he is indifferent between them. If we show these combinations on a graph showing one commodity on the horizontal axis and the other on the vertical axis, then the combinations bearing consumer's indifference can be shown as points on the graph. If we join these points to form a curve, it will be known as an indifference curve. Thus, *an indifference curve is the locus of all those points representing various combinations of two commodities giving the same satisfaction to the consumer.*

"An indifference schedule (curve) may be defined as a schedule of various combinations of goods which will be equally satisfactory to the consumer concerned." *A.L. Meyers*

"A single indifference curve shows the different combinations of *X* and *Y* that yield equal satisfaction to the consumer." *Prof. Leftwitch*

Indifference schedule

An indifference schedule is a table representing the various combinations of goods which give equal satisfaction to the consumer.

"An indifference schedule may be defined as a schedule of various combinations of goods that will be equally satisfactory to the individual concerned." *A.L. Meyers*

The following table shows the indifference schedule of combinations of biscuits and cups of tea for a consumer.

Table 4.1 An Indifference Schedule

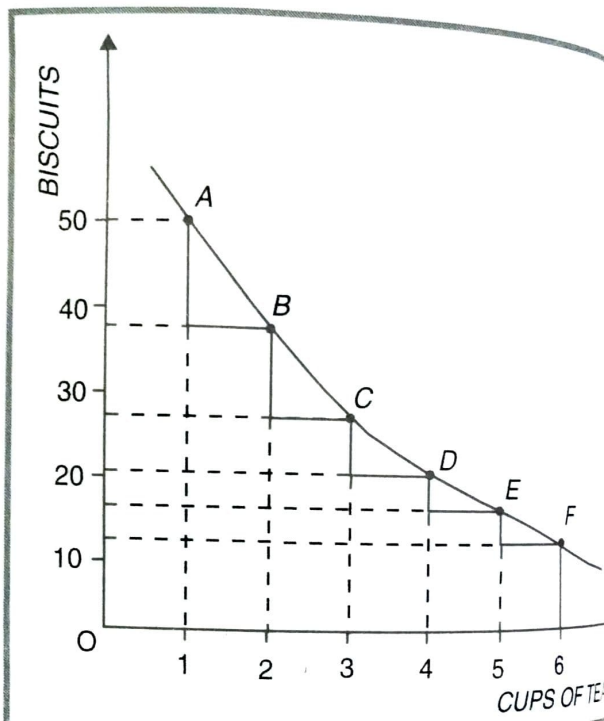
Combinations	Cups of Tea	+	Biscuits
A	1	+	50
B	2	+	38
C	3	+	28
D	4	+	21
E	5	+	17
F	6	+	15

In the table 4.1 the consumer is assumed to be purchasing combinations of cups and biscuits. He tells us that he is indifferent between the six combinations given Combination *A* shows that the consumer has one cup of tea and 50 biscuits. While combi *B* shows that the consumer gets two cups of tea and 38 biscuits. The consumer is indi between these combinations since they give him the same level of satisfaction. Similar case with the other combinations *i.e. C, D, E* and *F*. The consumer is indifferent among combinations. In other words, he prefers none of these combinations.

An Indifference curve

When we show these combinations on a graph showing cups of tea on the *X*-axis and biscuits on *Y*-axis we obtain a curve as is shown in the diagram 4.1. It is called an Indifference Curve because it joins the points of indifference on the graph.

In the diagram 4.1, *IC* is an indifference curve. The different points on it show the various combinations of Tea and Biscuits. The consumer likes all of them equally. Therefore, he is indifferent among them. By joining these points we obtain the Indifference curve *IC*. Although in the successive combinations the amount of biscuits goes on diminishing as we move from the left side of the indifference curve to the right side, the increase in the quantity of



commodities A and B in the diagram (Fig. 4.2). The Indifference Map is a geometrical expression of a number of indifference schedules on the assumption that the commodities constituting the combinations of each schedule are finitely divisible.

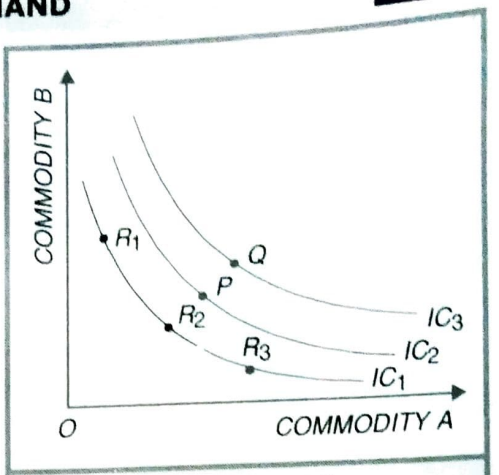


Fig. 4.2 An Indifference Map.

In the diagram (Fig. 4.2) there are three combinations of commodity A and commodity B. These are R_1, R_2, R_3 among which the consumer is indifferent. Therefore, these may be taken to give an equal level of satisfaction to the consumer. Hence, these combinations lie on the same indifference curve IC_1. However, combinations P and Q are in the north-east of these combinations. They show greater amounts of both the commodities. Combinations P and Q are lying on higher indifference curves and show greater amounts of both the commodities. Therefore, combinations P and Q are preferred to those on the IC_1. We may, therefore, say that the higher an indifference curve is, the greater the level of satisfaction it represents.

The Marginal rate of substitution (MRS)

A study of the Indifference curve shows that as the consumer gets one more unit of the commodity on the horizontal axis, his total satisfaction is increased. If he wants to maintain his satisfaction at the same level, he has to sacrifice some units of the commodity on the vertical axis. If by obtaining one unit of a commodity A, he is prepared to give up five units of the commodity B and maintain his satisfaction at the same level, then five units of commodity B is the marginal rate of substitution for one unit of the commodity A.

"The marginal rate of substitution of *X* for *Y* is defined as the amount of *Y* the consumer is just willing to give up to get one more unit of *X* and maintain the same level of satisfaction."
Prof. Bilas

The marginal rate of substitution between two commodities is shown by the slope of the indifference curve showing their combinations. If the two commodities are X and Y, the marginal rate of substitution between them is written as $MRS_{yx} = \Delta X/\Delta Y$. It is the rate at which the consumer is willing to substitute Y for X. The main characteristic of the MRS is that it diminishes as one commodity is increased and the other commodity is decreased in the consumer's indifference schedule. As a result the indifference curve slopes from left down to the right. It means a negative and diminishing rate of substitution of one commodity for the other.

Prof. J.R. Hicks has built up the *principle of diminishing marginal rate of substitution*. This principle is similar to the law of diminishing marginal utility and is yet different. According to Hibdon, "The law of Diminishing Marginal Rate of Substitution states that the consumer will be willing to forgo smaller and smaller units of Y in order to have successive additional units of X." We can explain the law much better with the help of the indifference schedule which we have given earlier. We reproduce the same schedule here and calculate the MRS of cups of tea for biscuits.

In Table 4.2, all the combinations give the same satisfaction to the consumer. If he chooses combination A he gets one cup of tea and fifty biscuits. In the combination B, he get one more cup of tea and is prepared to give twelve biscuits for it. The MRS here is therefore 1 : 12. In the

combination C, he is willing to sacrifice only ten biscuits for another cup of tea. The MRS to become 1 : 10. In the successive combinations D, E and F, the MRS continues to fall. It illustrates the diminishing marginal rate of substitution.

Table 4.2. Marginal Rate of Substitution

Combination	Cups of Tea	Biscuits	MRS of tea for Biscuits
A	1	50	—
B	2	38	1 : 12
C	3	28	1 : 10
D	4	21	1 : 7
E	5	17	1 : 4
F	6	15	1 : 2

MRS of X for Y is the ratio of the change in the quantity of Y which would keep the consumer on the same indifference curve for a change in the marginal quantity of X.

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

Since MRS is denoted as the slope of an indifference curve, it is commonly negative and falling. The convex indifference curve falling from left down to the right shows the Law of Diminishing Marginal Rate of Substitution.

Prof. Hicks has given his justification for assuming a diminishing MRS. There are two reasons for this. In the first place, each particular want is satiable. Therefore, as a consumer obtains more and more of one commodity, his intensity of the need for it goes on diminishing. As a result, the consumer will be prepared to sacrifice less amount of the other commodity in order to obtain more and more of this commodity.

Secondly, goods are imperfect substitutes for one another. Normally, a commodity is not completely substitutable for another. If it were, then the two commodities would be the same. There is no need to distinguish between the two. But goods are imperfect substitutes just as tea and coffee are. Commodities are to some extent complementary also. Therefore, the MRS of one for the other must diminish. In his opinion if it does not diminish then consumer's equilibrium is rendered unstable. Since in practice we see consumer's passing from one point of equilibrium to another with change in prices without any instability of behaviour, we can safely assume that *the MRS is always diminishing around the point of consumer's equilibrium.*

There are limitations to this law also. But these are in the nature of rare exceptions. The first is the case of perfect complementarity. For example, the left foot and right foot shoes have no rate of substitution. Secondly, there is the case of perfect substitutes wherein MRS becomes infinite. An example is the products of two firms in perfect competition. Consumer's indifference curves in this situation would be straight lines.

These are, however, extreme cases not commonly found in consumer's choice. The diminishing MRS must not be confused with the diminishing marginal utility of the cardinal utility analysis. The two concepts are entirely different. The main differences are as follows :

1. *MRS denotes the rate of commodity substitution.* It has no subjective element in it. It just tells us as to how much amount of one commodity the consumer is willing to forgo to get a small amount of another and yet remain on the same indifference curve. It is an objective thing.
2. *It does not need the assumption of independent commodities in the combinations.* It allows complementarity and substitution. As such MRS is a wider concept than diminishing marginal utility.