ECO-03-5

Institute of Distance and Open Learning
Gauhati University

M.A./M.Sc. in Economics
Semester II

Paper V
Advanced Microeconomics

Contents:

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GAUHATI UNIVERSITY

COURSE STRUCTURE

A student shall do a total number of sixteen papers in the four Semesters. Each paper will carry 100 marks - 20 marks for internal evaluation during the semester and 80 marks for external evaluation through end semester examination. All the papers in the First, Second and Third Semesters will be compulsory. The paper XIII and XIV of the Fourth Semester will also be compulsory. The remaining two papers for the Fourth Semesters will be chosen by a student from the optional papers. The names and numbers assigned to the papers are as follows.

First Semester

I Microeconomics Theory
II Macroeconomics Theory - I
III Mathematical Methods for Economic Analysis-I
IV Statistical Methods for Economic Analysis

Second Semester

V Advanced Microeconomics
VI Macroeconomic Theory -II
VII Mathematical Methods for Economic Analysis-II
VIII Elementary Econometrics

Third Semester

IX Development Economics-I
X International Economics
XI Issues in Indian Economy
XII Public Finance-I

Fourth Semester

XIII Development Economics-II
XIV Public Finance-II

Papers XV and XVI are optional

A student has to choose any two of the following courses.

(a) Population and Human Resource Development
(b) Econometric Methods
(c) Environmental Economics
(d) Financial System

Detailed Contents of this Paper

Paper - V
ADVANCED MICROECONOMICS

Unit – 1: Analysis of Consumer's Choice

A Review of Indifference Curve and Revealed Preference Approach – Violation of the Premises of Indifference curve Approach: Satiation and Lexicographical Ordering.

Unit – 2: Inter-temporal Choice & Choice under Uncertainty

Discounting and Present Value – Inter-temporal Consumption Decision – Inter-temporal Production Decision – Evaluation of Investment Projects – Determination of the Rate of Interest; Attitude Towards Risk – Expected Utility – Measures of Risk Aversion – Certainty Equivalence and the Cost of Risk – Economics of Insurance. – Asymmetric Information and Adverse Selection – Moral Hazard

Unit –3: General Equilibrium

Partial Versus General Equilibrium Approaches – Meaning of General Equilibrium – Walrasian General Equilibrium System: Tatonnement; Existence, Stability and Uniqueness of the Equilibrium – Introductions to the Contributions of Arrow and Debreu – Critique of General Equilibrium Theory – Non–tatonnement Process.

Unit – 4: Welfare Economics

Pareto Optimality – The Fundamental Theorems of Welfare Economics – Market Failure: Externality and Public Good – Welfare Effects of Non-price Allocations and Price Control – Problem of Welfare Maximization: Compensation Principle, Social Welfare Function – Social Choice: Contributions of Arrow and Sen.

* * *

UNIT-1

Analysis of Consumers Choice

STRUCTURE:

1.0. Introduction

The indifference curse and Revealed Preference Approach are two very important approaches used in the theory of consumer demand. Again violation of the Premises of indifference curve approach leads to certain problems. In this unit we shall discuss violation of two assumptions under indifference curve analysis thus leading to lexicographic ordering and satiation.

1.1. Objectives

After going through this unit, you will be able to

- Get an overview of Indifference Curse and Revealed Preference approach
- Analyses the sturdy of lexicographic Ordering
- Examine the Process of satiation

1.2. A Review of Indifference Curve and Revealed Preference Approach

The indifference curve approach was based on the assumptions of rationality, ordinal utility, diminishing marginal rate of substitutions and consistency and transitivity of choice. An indifference curve is the locus of combinations of two goods, which yields the same satisfaction to the consumer.

The indifference curves analysis has been a major advance in the field of consumer's demand. The assumptions of this theory are less stringent than for the cardinal utility approach. The methodology of indifference curves has provided a framework for the measurement of the 'consumer's surplus', which is important in welfare economics and in designing Government Policies.

Although the advantages of the indifference curves approach are important, the theory has indeed its over severs limitations. The main weakness of this theory is its axiomatic assumption of the existence and convexity of the indifference curves. The theory does not establish either the existence or the shape of the indifference curves.

Also the preferences of the consumers change continuously under the influence of various factors, so that any ordering of these preferences, even if possible, should be considered as valid for the very short run. Another defect of the indifference curves approach is that does not analyses the effects of advertising, of past behaviors, of stocks, of the interdependence of the preferences of the consumers, which lead to behaviors that would be considered as irrational, and hence is ruled out by the theory.

The Revealed Preference Hypothesis

Samuelson introduced the term 'revealed preference' into economics in 1938, since then the literature in this field has proliferated.

The Revealed Preference hypothesis is considered as a major breakthrough in the theory of demand, because it has made possible the establishment of the 'law of demand' directly (an the basis of the revealed preference axiom) without the use of indifference curves and all their restrictive assumptions. This theory is based on the assumptions of rationality, consistency, transitivity and the revealed preference axiom.

We have already said that Samnelson's revealed preference theory is a major advancement to the theory of demand. It provides a direct way to the derivation of the demand curve, which does not require the use of the concept of utility. The theory can prove the existence and convexity of the indifference curves under weaker assumptions than the earlier theories. It has also provided the basis for the construction of index numbers of the cost of

living and their use for judging changes in consumer welfare in situations where prices change.

1.3. Violation of the Premises of Indifference curve Approach

The shapes of the indifference curves hold valid under the assumptions of nonsatiety, transivity and diminishing marginal rate of substitution. In reality, any or all of these conditions can be violated.

1.3.1 Lexicographic Ordering:

If a consumer orders bundles of commodities in a particular way, an indifference curve does not exist. If a person has a craving for cheese then he would prefer any bundle with more cheese (is his craving), regardless of the amount of the other commodity in the bundle. Again, if two bundles contained equal amounts of cheese, he prefers the bundle with more of the other commodity. In this case there is no indifference curve. This can be shown in the following diagram.

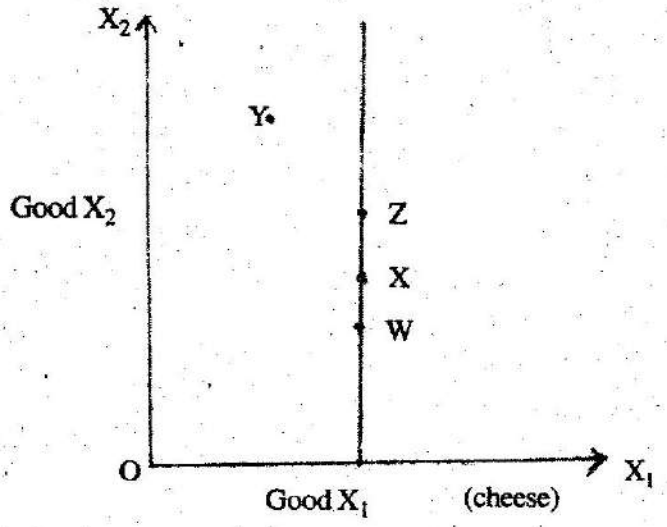

Figure 1.1

To the right of X, all bundles contain more cheese; hence all points to the right of X are preferred to X. Similarly, all points to the left of X are inferior to X. Bundles lying to the north of X are preferred to those to the scuba of X, Here again, point Y could have been indifferent to X but here it is inferior to X as it lies to its left (is it has less of cheese which is the craving) Points like Z and W are superior and inferior respectively. Thus,

there is no point other than X itself, which are indifferent to X. Thus there is no indifference curve.

This bind of ordering is called a lexicographic or lexical ordering. To establish an indifference curve we must rule out the possibility of lexicographic orderings.

Check your Progress:

Q. Write a short note on lexicographic ordering.

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1.3.2. Satiation:

If satiation exists with respect to all goods, the indifference map will be closed and takes the appearance of an orderly target

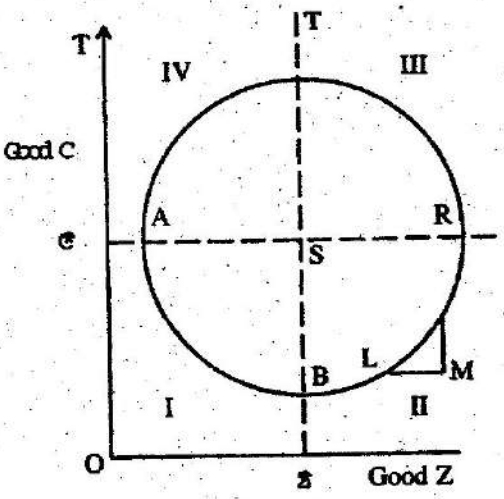

Figure 1.2

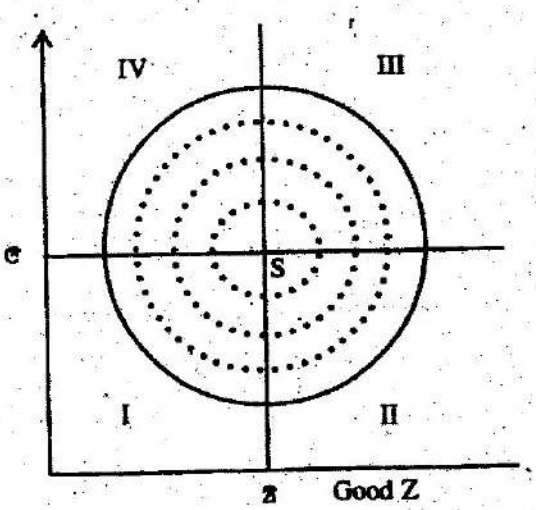

Figure 1.3

In the figure, supposes Z* is the minimal desired quantity of Z and C* is the minimal desired quantity of C. In figure 1.2, OZ*SC* is the region of non-satation. Any point in this region (region I) represents a combination of the two goods which leaves the consumer wanting more of either or both. Here one can see a normally shaped indifference curve AB. Again, at any point in

region II to the right of Z* but below C* (eq. Point L), the consumer still wants more of C but now he desires less of Z. Hence if he gets more of Z (from L to M) and yet remains indifferent, he must be compensated for the (repugnant) rise in quantity of Z by a desired rise in C. The indifference curve in this region must have a positive slope. The same argument holds for region IV. However, in region III, the consumer has more than he wants either item the indifference curve will acquire its negative slope. This is so because to compensate him for an addition in his unwanted holding of Z, he must be relieved of some of his unwanted C. A rise in Z must be accompanied by a full in C for him to he indifferent.

Figure 1.3 shows a set of several indifference curves. The optimal will exist at the saturation point, S (also called the 'bliss point'), at which the consumers possesses exactly the maximal amounts he wants of Z and C.

1.4. Summary

The indifference curve and revealed preference approach are two very important approaches in the field of consumer demand. Although the advantages of both the approaches are manifold yet these theories suffer from various limitations. Again violation of the assumptions of the indifference curve analysis leads to the existence of lexicographic and satiation.

1.5. Additional Readings

1. Baum ad, W.J., "economic Theory and Operations Research" Prentice Hall
2. Ryan and Pearce, 'Price Theory", Macmillan
3. Madalla and Miller, "Microeconomics", Tata McGraw Hill.
4. Henderson and Quanta, "Microeconomic Theory"
5. Kotsoyiannis, A, "Modern Microeconomics"

1.6. Self Assessment Test

1. Give a brief review of the Indifference curve and the revealed Preference Approach
2. Explain what do you mean by lexicographic ordering.
3. Describe the shape of an indifference curve when there is satiation.

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UNIT - 2

INTERTEMPORAL CHOICE AND CHOICE UNDER UNCERTAINTY

Structure :

2. 1. INTRODUCTION

Most often the decision/choices made by economic agents have Consequence over a period of time. Therefore in dealing with the Choices made by economic agents we must incorporate the time dimension into our analysis. This is What we are trying to explore in the intertemporal choice analysis of microeconomics.

Apart from that in real situations certainty for economic agents is rarely the case. Therefore in the choice under uncertainty section we are going to investigate how economic agents make their decisions under uncertainty.

2. 2. INTERTEMPORAL CHOICE :

Economic agents often make choices that have consequences over a period of time. For instance, consumers was to choose how much of his/her income is to

be spent now and how much to save for the future. Similarly, a producer has to decide by how much he should spend his resources to expand his plant Capacity in order to meet future demands. Thus the time factor is playing the most important role in making the choices. Therefore, the Choices involving time are called intertemporal Choice.

However, in real situations intertemporal choice may not be that easy as it appears to be since the future costs and returns of agent may not be certain.

But for our analytical purpose we take it for granted that we are certain about future cost and returns.

Before we analyses the problem of intertemporal choice we need to define two concepts which enable us to evaluate future costs and returns at the present time. These two concepts are discounting and present value.

2.2.1. DISCOUNTING AND PRESENT VALUE

Rupees 100 in hand of an economic agent today is not the same as Rs. 100 to be received one year later. One of the reasons for this is that Rs. 100 today can earn some interest in one year time. Hence, by next year the same will be workings Rs. 100 plus the interest on it. In other words, Rs. 100 today will be worth more than Rs. 100 next year (Assuming no inflation). By the same logic Rs. 100 next year worth less than Rs. 100 today. Thus in comparing present and future sums of money economic agents discount the future sums. Formally therefore we can define discounting as the process by which future sums are converted to their present equivalent worth. Now we are in a position to define present value.

The present Value of a future sum of money is the amount received today that would be equivalent in value to the future sum. Alternatively, the discounted value of the future sum is the present value. We use the process of discounting to find present value. Let the rate of interest be r. Now Rs.1 today will be equivalent to Rs. $1+r$ X Rs.1 i.e. Rs.1 $(1+r)$ in the next period. Conversely, Rs.1 $(1+r)$ next period is worth Rs. 1 today. In the same way Rs. 1 to be

received next period is worth $\frac{1}{(1+r)}$ today. We worked out the present value by dividing the future sum by the discounting factor (1+r). Here r is the discount rate which in this case is same as the rate of interest.

We are now in a position to generalise. If r is the rate of discount the present value of a sum R to be received next period is $\frac{R}{(1+r)}$. If the sum is to be received not next period by after two period the sum has to be discounted twice to be converted to its present value is, $\frac{R}{(1+r)^2}$. Thus if amounts R_1, R_2, R_3, ...etc. are to be received after one, two, three..... periods the present value of these future sums will be $\frac{R_1}{(1+r)}$, $\frac{R_2}{(1+r)^2}$, $\frac{R_3}{(1+r)^3}$ ..... and so on. The present value (pv) of the entire stream of sums will be

$$p.v = \frac{R_1}{(1+r)} + \frac{R_2}{(1+r)^2} + \frac{R_3}{(1+r)^3} + ...$$

The readers can intutively verify that higher the discount rate lower is the present value of future sum/stream of sums.

The use of present value is of practical importance while taking intertemporal decisions. Suppose an investor is considering a number of investment projects in which he can invest his money. In making a decision where to invest the investor will calculate present value of benefits and present value of costs for each project. He will chose that project where the difference between present value of benefits and present value of costs is maximum. The difference between present value of benefits and present value of costs is called Net Present Value (NPV). The project with highest NPV will be chosen first Clearly, a project is not viable unless NPV>0 (why ?)

The NPV Criteria is the most reliable Criteria to choose from alternative investment projects for it gives discounted net profit which the investor wants to maximize. The investor can also rank all the projects under his consideration according to the NPV project topping the list, next highest second and so on.

2.2.2. Intertemporal Consumption Decision :

In this subsection we analyse consumers choice between current and future consumption using a simple two period framework. We denote the present period by 0 and a future period by 1. The Consumers Current and future incomes are Y_0 and Y_1 respectively. The rate of interest for saving and borrowing is r. The consumers problems is to choose the utility maximizing combination of present and future Consumption expenditures C_0 and C_1 given Y_0, Y_1 and r. Now what will be the nature of the consumer's intertemporal budget line ? For an answer, let us first find the maximum possible present consumption of the consumer. The consumer can consume entire current income Y_0 and borrow a sum against the future income Y_1. Thus the maximum feasible current consumption is Y_0 plus the present value of Y_1 i.e. $\frac{Y_1}{(1+r)}$

If we denote maximum current consumption by W_0 then

$$W_0 = Y_0 + \frac{Y_1}{(1+r)}$$

In this way we have visualised one point on the consumers budget line namely current consumption of W_0 and future consumption being zero. To find the other extreme point of the intertemporal budget line, we need to work out the maximum feasible future consumption W_1.

Suppose the Consumer saves the entire current income, In that case future consumption can be the future income plus the compounded value of the present income. Thus, maximum feasible future consumption is $W_1 = Y_1 + Y_0(1+r)$

Incidentally $W_1 = W_0(1+r)$ (how ?)

Thus we have got two extreme points of the budget line as $(W_0, 0)$ and $(0, W_1)$ or $\{0, W_0(1+r)\}$. Joining these two points we get the intertemporal budget line of the consumer.

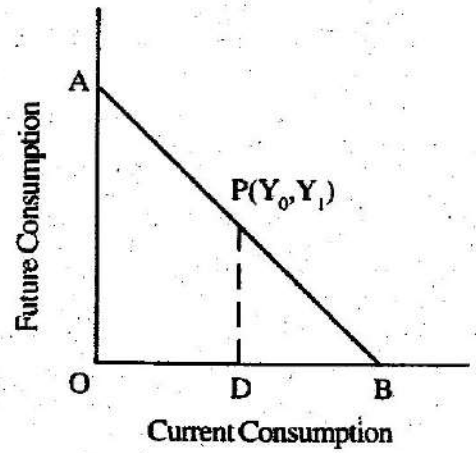

Fig. 2.1

In fig. 2.1. AB is the consumers intertemporal budget line. Thus

$$OB = W_0 = Y_0 + \frac{Y_1}{1+r}$$

and $$OA = W_1 = W_0(1+r)$$

Now slope of the budget line is given by

$$\frac{OA}{OB} = \frac{W_1}{W_0} = (1+r)$$

The budget line has negative slope indicating reduced future consumption as current consumption increases and vice versa.

In the fig 2.1. suppose the point P on the budget line AB represents current and future income i.e. OD of Y_0 and DP of Y_1. If the consumer consumes at P he/she neither saves nor borrows. In each period the consumption is equal to income. To the right of P i.e. on the PB portion of the budget line current consumption is more than current income Y_0. Thus a consumer consuming at any point in this portion is a borrower. Similarly, a consumer consuming at a point to the lift of P on the budget line is a saver.

Assuming consumers indifference curve between current and future consumption is downward sloping and convex to the origin, as usual (implying diminishing marginal rate if substitution between current and future consumption) we are in a position to locate the optimum combination of current and future consumption. The optimal combination of current and future consumption is given by that

point on the budget line at which an indifference curve is tangential to the intertemporal budget line. This is shown by point E in fig. 2.2.

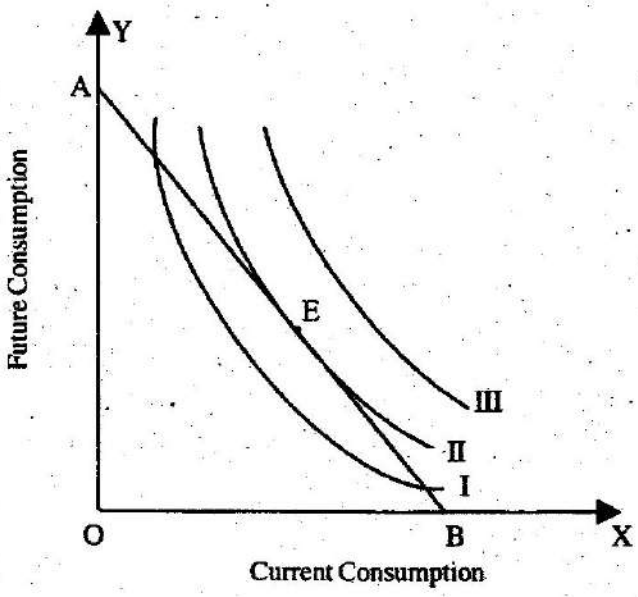

Fig. 2.2

$$\text{At E, } \frac{\text{Marginal utility of } C_0}{\text{Marginal utility of } C_1} = (1+r)$$

The Effect of Change In the Interest Rate

Suppose the consumer is neither a saver nor a borrower the change in the interest rate would not effect him. He/she will consume at a point in the budget line corresponding to current and future income i.e. consumption equals income in each period. In fig. 2.3. this point is represented by P.

But if the consumer is either a saver or a borrower, with a change in the rate of interest the slope of the budget line will change and it will rotate around point P. With a rise in r. The slope (1+r) will be higher and the new budget line will be steeper like A_1B_1 in fig 2.3.

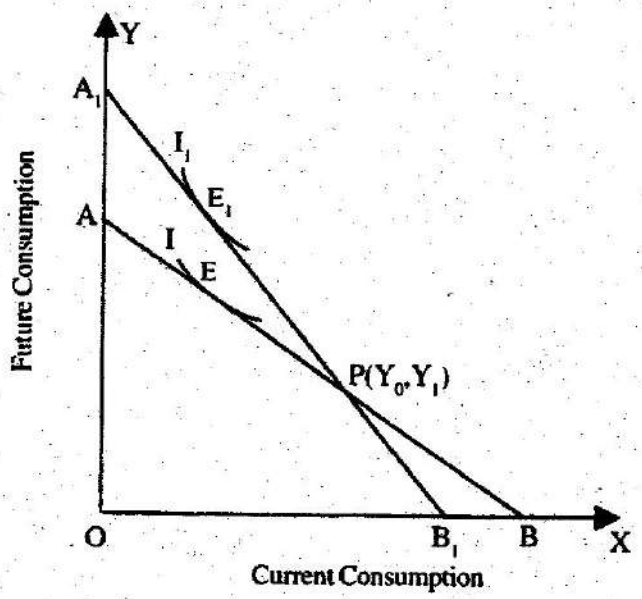

Fig. 2.3

Now, how is the consumer effected by the rise in r. The answer depends on whether the consumer is a saver or a borrower before rise in r. A saver (who was in equilibrium at AP portion of the budget line before rise in r) will gain from the rise in r. The result is intutively clear.

In fig 2.3. initially, with budget line AB, the consumer was in equilibrium at E on the indifference curve I. After the rise in r, as the budget line changes to A_1B_1 the consumer consumer consumes at E_1 which is on the higher indifference curve I_1 (Readers, may try the borrowers case as an exercise). Readers may also verify that a fall in the rate of interest will make savers worse off and borrowers better off.

Different Interest Rates For Savers and Borrowers.

In real situations borrowers often pay a higher interest rate than what the savers receive. In such a situation the budget line will have a kink at the point P indicating the combination of current and future income. Since borrowers pay a higher rate of interest the borrowers portion of the budget line (i.e. BP portion) will have a higher slope than the savers portion. The budget line will be like APB in fig. 2.4.

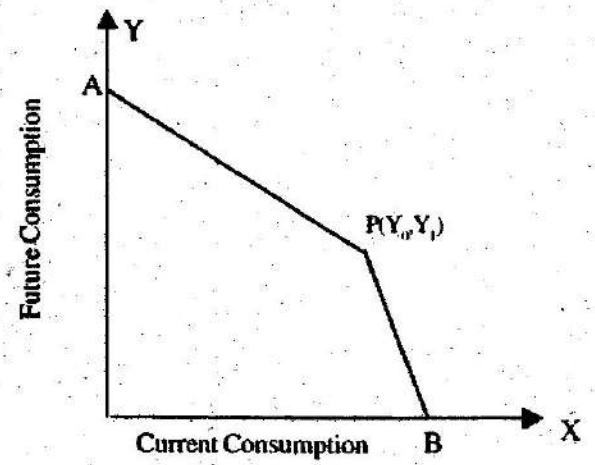

Fig. 2.4

By superimposing indifference curve consumers equilibrium can be found. Readers may verify how changes in borrowing/saving rate of interest changes the consumers equilibrium.

In the above analysis of intertemporal consumption decision the rate of growth of prices was not accounted for. Our analysis can be extended to express future consumption in real terms. Let P_0 and P_1 be the price level in current and future periods respectively. Suppose g is the rate of growth of prices then

$$P_1 = P_0(1+g)$$

Since W_0 saved now will become $W_0(1+r)$ in future period but will worth only

$$\frac{W_0(1+r)}{1+g}$$

therefore the relationship between current and future consumption becomes

$$W_1 = \frac{W_0(1+r)}{1+g}$$

The slope of the intertemporal budget line will be

$$\frac{W_1}{W_0} = \frac{(1+r)}{1+g}$$

What will happen if $r = g$?

2.2.3. Intertemporal Production Decision

Like a consumer a producer also often has to decide as to now much of the resources at disposal to be used up for current production and how much to be invested for future production. For an introductory analyses of intertemporal production decision by a firm we again fall back on a simple two period framework (with 0 indicating current period and 1 indicating future period).

For a given amount of productive resources at the disposal of a firm its options for present and future productions can be represented by transformation or production possibility curve. As in the multiproduct case, the production possibility curve of present and future production is assumed to be negatively sloped and concave to the origin.

The assumption implies that with given amount of resources more present production implies reduced future production and that the marginal rate of transformation increases with increase in current production. In fig 2.5. the production possibility is shown by the curve PP'.

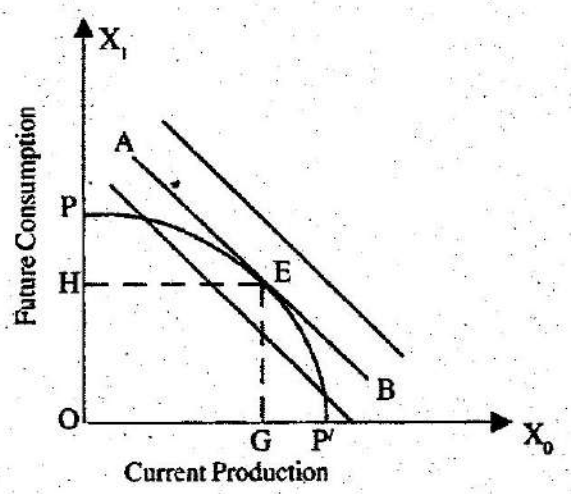

Fig. 2.5

Given the production possibility Frontier, the firms choice of optimal combination of present and future production will be guided by the consideration of maximizing the present value of the revenue stream, Which in the present case is the sum of current revenue and discovered value of future revenue. Thus we may write

$$R = P_0X_0 + \frac{1}{1+r}P_1X_1$$

Where r is the rate of interest P_i and X_i are prices and output in period i ($i=0,1$) and R is the present value of revenue stream. Assuming r, P_0 and P_1 to be given (i.e. ruling out uncertainty) and for a given value of R (say $\bar{R}$) the above relation can be represented by a negatively sloped straight line like AB on fig 7.5. The lines showing alternation (X_0X_1) combinations. Yielding the same present value of revenues, has a slope of the magnitude of

$$\frac{P_0}{\frac{P_1}{(1+r)}}$$

Which is nothing but the ratio of current prices to discovered future prices. When price remains constant over the two periods, the slope is reduced to just $(1+r)$.

Different present value of revenue streams can be represented by family of parallel lines, with the above mentioned slope. Higher lines will obviously represent higher present value. A firm aiming to maximize present value of revenue will thus opt for that point on the production possibility curve which is highest of these parallel lines. In fig. 7.5. the firms optimal combination of current and future production is shown by E, where the iso-present value of revenue line' is tangential to the production possibility frontier. Since tengency implies equality of slopes of the two functions thus the optimal combination of current and future production is achieved by the firm when marginal rate of transformation between present and future output is equal to the ratio of their discounted prices.

2.3. Choice Under Uncertainty

In a typical text book of economics the problem of choice of economic agents is usually analysed under the condition of certainty. It is often assumed that prices, costs, revenues etc. are known with certainty. For instance, for a firm making production decisions it is assumed that it knows with certainty the prices it will be paying for the inputs and prices it will receive while selling output. The Certainty assumptions is actually unrealistic. In most cases economic agents have to make their choices under uncertainty arising from various sources. In this section we introduce same basic ideas for a formal analysis of choice of economic agents under uncertain conditions.

In the following discussion the ideas of probability and expectation (or expected value) are unavoidable. Readers may recollect these from their earlier Course. The term probability is a number lying between 0 and 1, indicating the chance of occurrence of a particular outcome (result). Thus probability gives the numerical measure of uncertainty associated with uncertain events. Closer the probability to 1 better is the chance. The outcome occurs with certainty if probability is 1 and the outcome does not occur at all if the probability is 0.

The expected value of an uncertain event with a number of possible outcomes/ results is a weighted average of these possible values where the respective probabilities of alternative outcomes are used as weights. For example suppose an investor is investing in a risky venture Yielding Rs. 1000 crore with the probability of $\frac{3}{5}$ (i.e. in 60% of cases) and a loss of Rs. 500 crore with a probability of $\frac{2}{5}$ (i.e. in 40% of cases). The expected return of the investor would then be

$$E(\text{Return}) = \frac{3}{5} \times 1000 + \frac{2}{5}(-500)$$

$$= \frac{3}{5} \times 1000 - \frac{2}{5} \times 500$$

$$= \text{Rs. } 400 \text{ Crore.}$$

The expected value can be interpreted as the average value of the uncertain prospect which is obtained from a large number of repetitions.

2.3.1. Attitude Towards Risk

Economic agents are not uniform in their response to risk i.e. their attitude towards risk ate not the same. On the basis of attitude towards risk, economic agents are classified into risk averters and risk lovers. The formal classification is based on an agents response to what is called a fair gamble. Before defining a fair gamble it may be noted that since choice under uncertainty involves a question of making gains or suffering losses depending on the actual occurrence of one of the possible alternative outcomes, such situations are often referred to as a gamble or a lottery in the literature.

A fair gamble is one from which the net expected returns are zero Let us take a couple of examples to illustrate the concept.

Example 1 : Let us define a gamble on the basis of toss of a coin. The gamble is such that I receive Rs. 100 if the toss results in head and I pay Rs. 100 if toss results in tail. Since the probabilities of getting head and tail are both 0.5, the expected value of the gamble is gives by,

(probability of head $\times$ value of getting head + probability if tail $\times$ value of getting tail)

$$= 0.5 \times \text{Rs.}100 + 0.5 \times (-\text{Rs.}100) = 0$$

This implies that if the gamble is repeated a large number of times I shall gain in about 50% of times but also lose in about 50% of times. Thus the amount I gain will roughly balance the amount I lose and I can only expect to be left without gain or loss. Such a gamble is called a fair gamble (with no entry fee).

Example 2 : This is an example from a probable real life situation. Let there be a new Crop variety that gives higher yield than the traditional variety grown by the farmer. If the farmers grows the new variety he can get an income of Rs. 1500/-. If the rains are normal, but will get no income (i.e. gets Rs. 0) if rains are either excessive or deficient. On the other hand if he grows the traditional variety, he gets Rs. 900 irrespective of whether rains are normal, excessive or deficient. The former can now take two alternative course of action.

Course A : Grown traditional Variety and be satisfied with income of Rs. 900.

Course B : Grow the new variety and take the risk of either earning a higher income if Rs. 1500 or earning nothing. Now suppose that the probability of rains being normal is 0.6 and that of the other prospect is 0.4 (i.e. in 60% of cases rains are normal but in remaining 40% of cases they are either deficient or excessive). So if the farmer takes the gamble of growing the new variety, his expected income is—

0.6 x Rs. 1500 + 0.4 x Rs. 0 = Rs. 900 Which happens to be his certain income if he does not take the gamble. Thus the net expected gain from the gamble is 0. Thus by definition this is also a fair gamble.

Now the question is whether the farmer will take the gamble of growing the new variety. The answer depends on the farmer's attitude towards risk. If the farmer is risk averse he will not take the gamble and settle for the certain income of Rs. 900/- by continuing to grow the traditional variety. If he is a risk lover he will take the gamble of earning Rs. 1500/- by growing the new variety.

Based on an agents response to a fair gamble—

An economic agent is said to be risk averse if he/she is not willing to undertake a fair gamble. An economic agent is said to be risk loving if he/she is willing to undertake a fair gamble. The agent may be even prepared to pay a price to play the gamble. The dividing borderline is risk neutrality. A risk neutral agent is indifferent between accepting or rejecting a fair gamble i.e. he/she may take the gamble if there is no entry fee or ticket for the game.

2.2. Expected Utility

Expected utility of an uncertain event is defined as the sum of utilities of alternative prospects of the event multiplied by their respective probabilities. In other words, it is the weighted average of utilities of different prospects weighted by the respective probabilities. Thus if an uncertain event has two possible outcomes (prospects) X and Y with respective probabilities P_X and P_Y ($=1-P_X$) the expected utility of the event is

$$P_X \times U(X) + P_Y \times U(Y)$$

where, U(x) and U(y) are Utilities from the prospects X and Y respectively.

According to the Expected Utility Hypothesis formulated by Von Neuman and Morgenstern, individuals try to maximize expected utility while taking decisions under uncertainty. In making a choice under uncertainty an individual compares the expected utility of the alternative decisions. He then opts for that decision which has a higher expected utility compared to the other options.

This hypothesis is useful for inferring about the nature of utility functions of risk averse, risk loving and risk neutral individuals.

2.3.3. Utility Function

Let us go back to the example of the farmer facing the choice between the traditional and the new variety. We mentioned that the risk averse former will opt for A (i.e. grow traditional variety and reap the certain income of Rs. 900) rather than B (grow the new variety and take the gamble of Rs. 1500 with probability 0.6 and Rs. 0 with probability 0.4). By expected utility hypothesis he does so because his expected utility from A is greater than that from B. The expected utility from B is

$$0.6 \times U(1500) + 0.4 \times U(0)$$

On the other hand expected utility from A is

$$1 \times U(900) = U(900) = U(\text{expectation of B})$$

Since 900 happens to be the expected value of growing the new variety. Thus for the risk averse farmer utility of expected value of B is greater than the expected certibility of B. In general we may now state that for a risk averse person the utility of the expected value of a fair gamble is greater than the expected utility of the gamble. In the context of the uncertain event of alternative prospects X and Y with respective probabilities P_X and P_Y, we may recall that the expected value of the event is

$$P_X \times X + P_Y \times Y$$

Expected utility is

$$P_X \times U(X) + P_Y \times U(Y)$$

Thus for a risk averse person

$$U\{P_X \times X + P_Y \times Y\} > \{P_X \times U(X) + P_Y \times U(Y)\}$$

By contrast for a risk loving person

$$U\{P_X \times X + P_Y \times Y\} < \{P_X \times U(X) + P_Y \times U(Y)\}$$

and for risk neutral person

$$U\{P_X \times X + P_Y \times Y\} = \{P_X \times U(X) + P_Y \times U(Y)\}$$

Having obtained this result we now take the help of a diagram to infer about the nature of utility function of a risk averse person.

In fig. 2.6. income (I) is represented along the horizontal axis and utility U along the vertical axis. Let OA and OB be incomes X and Y and AA′ and BB′ be utilities from X and Y respectively. thus—

$X = OA, \quad U(X) = AA' \quad$ and $\quad Y = OB, \quad U(Y) = BB'$

Now, expected value of the event with alternation prospects X and Y is

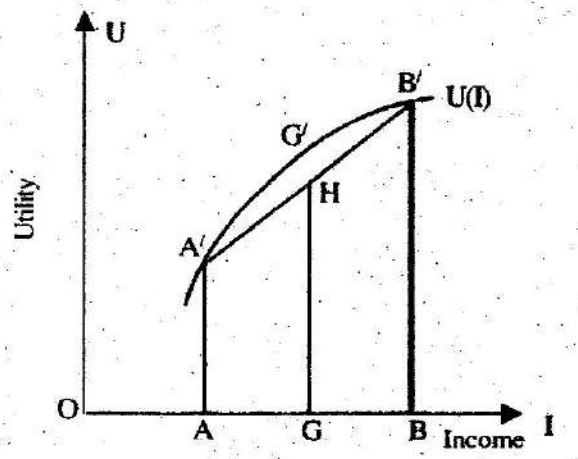

Fig. 2. 6

$$P_X \times X + P_Y \times Y$$

$$\text{or} \quad P_X \times X + (1 - P_X) \times Y$$

which will lie between OA and OB.

Let the expected value be OG. (The exact position of G will depend on the value of P_X and P_Y (= 1–P_X). For higher value of P_X, G will be closer to A. When $P_X = P_X = 0.5$, G will bisect the line segment AB). Now expected utility of the event being $P_X \times U(X) + P_Y \times U(Y)$ is equal to $P_X \times AA' + P_Y \times BB'$. This is geometrically equal to the length GH. (Note that H lies vertically above G on the line joining A′ and B′). Since for a risk averse person utility of expected value is greater than expected utility, utility of OG amount of income will be greater than

GH, the expected utility. So the utility of OG will be given by same line like GG/ which is longer than GH. The utility function of the person is now formed by point like A/ G/ B/. The line forming the utility function of the risk averse person therefore has to lie above the straight line A/B/ and well be concave to the income axis.

It is now not difficult to argue that the utility functions of a risk lover will be covex to the income axis (like RST in fig. 2.7.)

The function is linear for a risk neutral person. It should be noted that for all categories of people, the utility function is upward rising and positively sloped. From the above discussion it is clear that the utility functions of the risk lover and risk averters are going to be fundamentally different. The change is marginal utility of income for the risk averse individual is

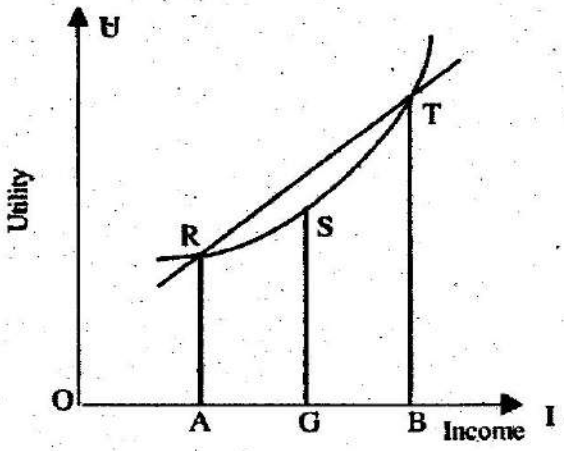

Fig. 2. 7

negative $(\text{i.e. } U'' < 0)$ and the same is positive for the risk living individual $(\text{i.e. } U'' > 0)$ though all if them have positive marginal utility $(\text{i.e. } U' > 0)$. For a risk averse individual the prospect of gain in total utility is less than the prospect of loss in it; when he/she come across a fair gamble. The reverse is the case for risk loving people. This is why their attitude to a fair gamble is fundamentally different.

2.3.4. Measure of Risk Aversion

Most people in the world are risk averse But even risk averse persons differ from one another on the degree of risk aversion i.e. some people are more risk averse than others. Thus a measure of risk aversion can be of some use.

Since the utility function of a risk averse person is concave, the degree of concavity can be used as a measure of risk aversion. The degree of concavity is indicated by the magnitude of the second order derivative of the utility function U''. Since the second order derivative of such a function is always negative, the magnitude is given by $-U''$ which will be positive. The measure of risk aversion based on the second order derivative of the utility function has been formally defined as—

$$RA = -\frac{U''}{U'}$$

This measure is known as Arrow-Pratt measure of absolute risk aversion. The measure is free from the unit of measurement.

2.3.5. Certainty Equivalence

Certainty equivalence or certainty equivalence income is that certain income which gives the same utility as the expected utility of the uncertain prospect. To explain the concept let us refer to Fig 2.8. which is basically a repetition of Fig. 2.6. As in the case of fig. 2.6. let the uncertain prospect be incomes of OA with probability P and OB with probability 1–P. From the utility function we can see that AA' is the utility of income OA and BB' is the utility of income OB.

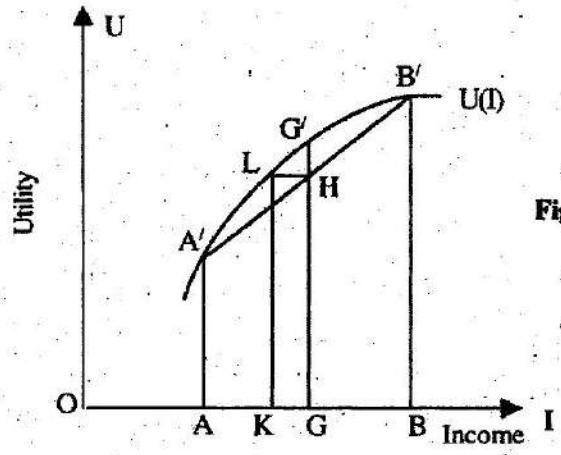

Fig. 2. 8

Let OG be the expected value of the uncertain prospect, i.e.

$OG = P \times OA + (1-P) \times OB$. Accordingly the expected utility of the prospect is $GH = P \times AA' + (1-P) \times BB'$. Now from the figure it is clear that the certain income which will give the same utility as the expected utility GH of the uncertain prospect is OK. (utility of income OK is KL which is equal to GH). Thus OK is the certainty equivalence income of the uncertain prospect that gives OA with probability P and OB with Probability (1–P).

The difference between the expected value of an uncertain prospect and its certainty equivalent value is called Risk Premium or cost of Risk. In our example this is OG - OK=GK. The risk premium is the amount an individual facing the uncertain prospect will be prepared to pay to insurer for a guarantee of the certainty equivalent income.

The risk premium or cost of risk depend on two things. They are

(i) Degree of risk aversion and

(ii) Variance of income with uncertainty.

In the first case cost of risk for a more risk averse individual is greater than that of a less risk averse individual. Since the degree of concavity can be used as a measure of risk aversion, the following fig. 2.9. explains the point.

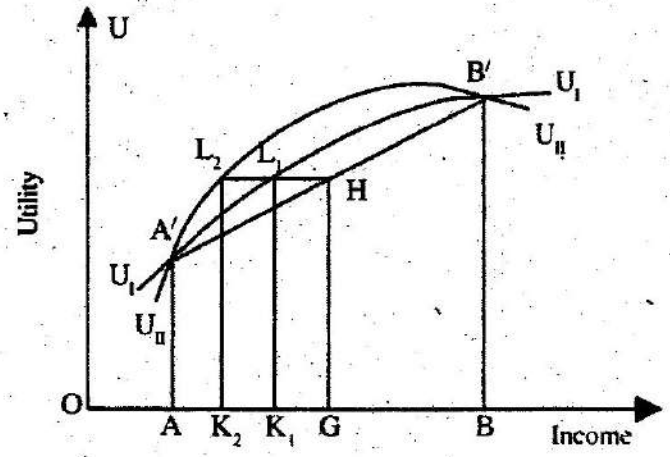

Fig. 2. 9

In fig. 2.9. U_I is the utility function of the first Individual who is less risk averse than the second individual whose utility function is shown as U_{II}.

In the fig. 2.9. both of them have the same expected income (OG). The certainty equivalence for the first Individual is OK_1 since OK_1 gives him the same utility (K_1L_1) as the expected utility — of the uncertain prospect (K_1L_1 =GH). Thus the cost of risk for individual I is

$$OG–OK_1 = GK_1$$

For individual II the certainty equivalence is OK_2 since utility from OK_2 is equal to expected utility (GH). In the fig. 2.9. utility from OK_2 is K_2L_2 which is equal to GH. Therefore cost of risk for Individual II is

$$OG–OK_2 = GK_2$$

Since $GK_2 > GK_1$, it is clear that people with high degree of risk aversion would be prepared to pay high risk premium to have certainty.

In the second case cost of risk will increase with variation in income. Let us go back to our two individual case. Suppose the first Individual faces low variability in income prospects while the second individual faces high variability in the same. Given that the risk aversion and expected income remains the same for both cost of risk will be higher for the second individual as he has high variability in income prospects. This is shown diagrammatically

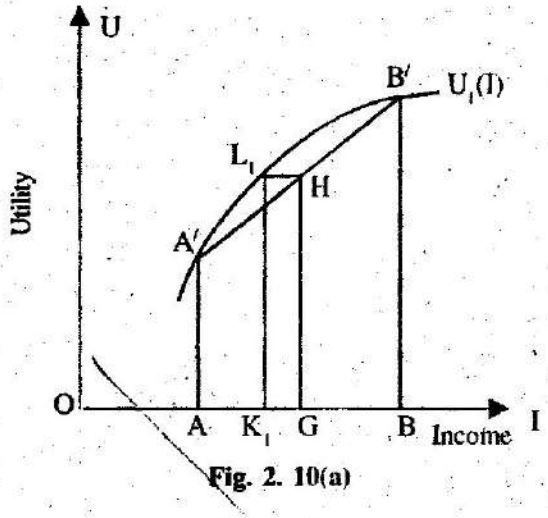

Fig. 2. 10(a)

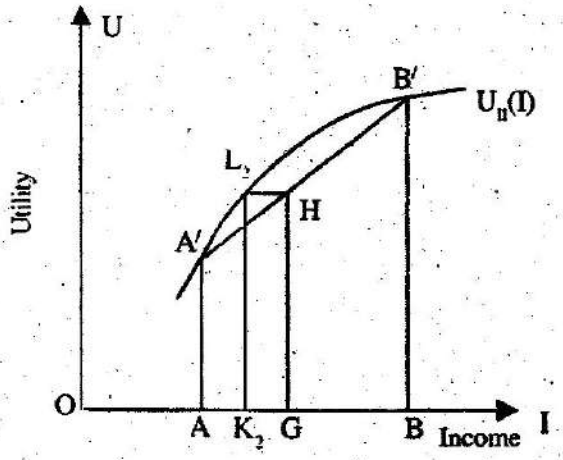

Fig. 2. 10(b)

In fig. 2.10. both individuals have same expected income but with different variability of income prospects. Individual I with expected income OG has the certainty equivalence income OK_1 since OK_1, gives utility K_1L_1 which is equal to the expected utility GH. Thus the cost of risk for the first individual is

$$OG-OK_1 = GK_1 \qquad \text{(fig. 2.10(a))}$$

Now for the second individual the certainty equivalence income is OK_2 [fig. 2.10. b] since OK_2 gives utility K_2L_2 which is equal to expected utility GH. Therefore the cost of risk for individual II is $OG-OK_2 = GK_2$. Now Comparing cost of risk of both $GK_2 > GK_1$ hence it is evident that cost of risk varies depending on the variability of income with uncertainty. In this case the second individual will be prepared to pay more to avoid uncertainty.

2.3.6. The Economics of Insurance

Introspection and observed behaviour Suggest that most people are risk averse in most of their dealings. In the preceding section we saw that a risk averse person facing an uncertain prospect will be prepared to pay premium for a guarantee of certainty equivalence income. These two facts are indeed the basis of insurance business. Insurance companies sale policies offering compensation against loss of income or property arising from unforeseen contingencies. The insurance business thrives on the fact that while many people run such risks and therefore buy policies, in reality only a handful of them actually suffer the loss and

therefore need to be compensated.

The preceding paragraph gives an insight to the nature of insurance. In insurance there are two parties the insured party (i.e. the buyer of insurance) and the insurance provider (i.e. the supplier of insurance) Insurance is a kind of contract between the two parties such thaf the insurance provider compensate for the loss or damage to insured party arising from the adverse state of nature. While under favourable state of nature the insurance provider pockets the premium.

Demand for Insurance :

Now a question arises in our mind i.e. why does the demand for insurance arise?

The obvious answer is that most people are risk averse in most of their dealings. Therefore, a risk averse person facing an uncertain prospect will be prepared to pay premium for a guarantee of certainty equivalence income.

Another very important factor determining the demand for insurance is the cost of risk or the risk premium. This concept has already been explained in section 7.3.5. since this amount of income is in excess of certainty equivalence income the risk averse individual will denote this amount for the purpose of buying insurance against adverse state of nature.

There is a theorem concerning the demand for insurance. The theorem runs as follows. If fair insurance is available a risk averse person would insure fully i.e. the person would go for full coverage of his risk. A fair insurance is insurance at a premium which leaves the insurance provider with zero expected profit. Where the expected profit (EP).

= (Collection of Premium) — (the expected amount of Compensation to be period)

For a formal proof of the theorem we assume that there are two state of nature namely the favourable state of nature (f) and the adverse state of nature (a) Now without insurance let the income of a risk averse individual in the favourable state of nature (X_f) be X_0. Suppose the state of nature is adverse in such a situation his/her income (X_a) is $X_0 - L$. Where L is the amount of loss/damage

which is fixed. Thus without insurance.

$$X_f = X_0 \qquad X_a = X_0 - L.$$

$$P_f = 1-q \qquad P_a = q.$$

Where q is the probability of the adverse state of nature (P_a) and 1-q is the probability of favourable state of nature (P_f)

Now with Insurance

$$X_f = X_0 - pC \text{ .....(i)} \qquad X_a = X_0 - pC - L + C \text{ .....(ii).}$$

$$P_f = 1-q \qquad P_a = q.$$

Where P is the premium per unit of coverage and C is the coverage

The expected utility of the risk averse individual would then be

$$EU = (1-q)\,U(X_f) + q\,U(X_a) \qquad \text{(iii)}$$

As per the expected utility hypothesis while choosing C the risk averse individual will maximize expected utility. Thus to find optimum C, expected utility (EU) should be maximised with respect to C.

The first order condition for maximizing expected utility with respect to C requires

$$\frac{\partial(EU)}{\partial C} = 0$$

Now partially differentiating (iii) with respect to C, we have

$$\frac{\partial(EU)}{\partial C} = 0 \Rightarrow (1-\theta)\frac{\partial U(X_f)}{\partial C} + \theta\frac{\partial U(X_a)}{\partial C} = 0$$

$$\Rightarrow (1-\theta)U'(X_f)\frac{\partial X_f}{\partial C} + \theta U'(X_a)\frac{\partial X_a}{\partial C} = 0$$

$$\Rightarrow -p(1-\theta)U'(X_f) + \theta U'(X_a)(1-p) = 0$$

since $\frac{\partial X_f}{\partial C} = -p$ and $\frac{\partial X_a}{\partial C} = (1-p)$ [Readers may varify it by partially differentiating (i) and (ii) with respect to C]

Transfering terms we have

$$\theta U'(X_a)(1-p) = p(1-\theta)U'(X_f)$$

or $$\frac{U'(X_a)}{U'(X_f)} = \frac{p(1-\theta)}{\theta(1-p)} \qquad \text{.....(iv)}$$

Since under fair insurance expected profit is zero i.e.

$$pC - \theta C = 0$$

or $$(p-\theta)C = 0$$

since $C \neq 0$, $p - \theta = 0$ hence $p = \theta$

Thus (iv) becomes

$$\frac{U'(X_a)}{U'(X_f)} = 1$$

or $$U'(X_a) = U'(X_f)$$

hence $X_a = X_f$

Now using (i) and (ii)

$$X_0 - pC - L + C = X_0 - pC$$

or $L = C$

[i.e. loss is equal to Coverage]

Therefore if fair insurance is available a risk averse person will go for full coverage of his risk.

For a risk averse person the second order condition for maximizing expetted utility follows automatically from the concavity of the utility function

i.e. $$\frac{\partial^2(EU)}{\partial C^2} < 0$$

However, it should be noted that in reality fair insurance is not possible because of many imperfections in the insurance market.

Supply of Insurance :

Since there are demands for insurance for the market to exist there must be a simply side to it. Readers may perhaps know that insurance is not provided for

all kinds of risks to which people are exposed. For supply of insurance to be available the following two conditions must be met.

a) Risk pulling is possible

b) It is possible for the insurer to share the risk.

Supply of insurance will be available if risk pulling is possible. People expose to the risk join hands and collect their risks so as to avoid unforeseen contingencies in future dates. It must be noted that for risk pulling to be successful risks must be repeated to which many agents are exposed. In addition risk must be independent i.e. people who have pulled their risk should not fall into the adverse state of nature at the same time. Otherwise risk pulling will fail and so insurance will not be available.

In empirical fields this type of situation arises. For instance, crop insurance is not available in most of the cases since the risks are not independent.

For large, lumphy, is alerted projects (e.g. launching of a Sattelite, cricket match and so on) insurance is available if it is possible for the insurer to reinsure with other insurance companies This is the case of sharing the risk in which risk is being shared effectively. The sharing of risk lead to risk pulling amount insurance companies.

Now it is evident that insurance is a desirable thing which reduces risk and raises economic activities. A lot of economic projects would have been less viable without insurance.

Problems associated with Insurance Market :

There are two well known problems associated with the economics of insurance.

a. adverse selection arising form assymetric information and

b. Moral Hazard.

The first of these problems arise because usually the insurer (say the insurance company) has less information about the risk than the insured (the person who buys the insurance policy). For instance in case of medical insurance the insured

has better idea than about his/her health conditions and therefore about the amount of risk than the insurance company which offers the insurance policy. The amount of such risks obviously varies from person to person and it is not practicable for the insurance company to assess the risk for each possible customer and fix premium accordingly. Hence the premium is fixed on the basis of a notion of average risk run by different individuals. However such a policy premium fixation may lead to the problem of adverse selection. The people whose risks are higher than the average risk will find the premium attractive and therefore insure themselves. However people facing less than average risk will find the premium too high and therefore may not insure. Thus the insurance company will be left out with only high risk clients and the persons with low risk will have insufficient insurance cover. Clearly this is an unsatisfactory and inefficient solution.

To overcome adverse selection arising from assymetric information the insurer need to invest for getting more information and design alternative policies for different groups of individuals. The complete solution to this Problem is difficult to achieve. The insurer can at best discriminate between high and low risk customers to cope with adverse selection.

Moral Hazand arises When the customer of an insurance company can effect the liability of the company without the company knowing it. Whether a person meets with a particular contingency (say, car accident, sickness, theft of property) and suffer loss; depends in part on the persons own action and not entirely on the state of nature. After having an insurance policy covering damage from such events, the insured person may take less come to avoid such contingency. A number of examples can be cited. After buying a policy covering theft, a person may become less careful about precautions, as compensation of loss from theft is now assured. Similarly a person having a medical insurance may cut down spending on preventive care and even seek excessive medical care, as the costs will be compensated by the insurer.

Though no complete solutions have yet been found for such problems related to insurance business, companies try to come round such problems by various measures including suitable modifications in policy designs. For instance, to overcome moral hazards insurance companies often practise 'Co-Insurance' whereby the insured party also has to bear a part of the loss. Another common

practice is 'deduction' in which case insured party is paid only on the excess of loss over some fixed amount. This is intended to discourage frivolous claims.

2.4. Key Words

Intertemporal Choice : The choice involving time is called intertemporal choice

Discounting : Discounting is a process by which future sums of money are converted to their present equivalent worth.

Present Value : The discounted value of future sum is the present value.

Net Present Value : Net Present value is the difference between the present value of benefits/returns and the present value of costs.

Expected Value : Expected Value is the average value of a random variable.

Fair Gamble : Fair gamble is a gamble with zero net expected return.

Expected Utility : Weighted average of utilities of different prospects of an uncertain event.

Certainty Equivalence : the certain income which yields the same utility as the expected utility associated with uncertain prospect

Costs of Risk : The difference between expected income and certainty equivalence income.

State of Nature : One Particular, Outcome of an uncertain. event.

Premium : Price per unit of coverage.

Fair Insurance : Insurance which yield zero expected profit to the exposer.

Assymetric Information : A case where one party has better information about the probability of an outcome.

Adverse Selection : The case where only individuals with greater risk purchase insurance.

Moral Hazard : The case where individuals bevaviour is altered after buying insurance.

Co-Insurance : The case whereby the insured party also has to bear a part of the loss.

2.5. Terminal Questions :

1. Why discounting is essential in dealing with intertemporal Choice ? Illustrate with example.
2. Analyse the intertemporal equilibrium of a consumer. How is the consumer effected by a change in the rate of interest ?
3. What will be the nature of a consumers intertemporal budget line when interest rate on borrowing is higher than that of saving ?
4. What do you mean by discounting and present value ? Explain how does a producer determine the optimal combination of present and future Production.
5. How would you distinguish between risk averter and risk lover ?
6. What does the expected utility hypothesis state ? Using the expected utility hypothesis derive the utility function of a risk averse individual.
7. Consider the following utility function $U = \ln(Y)$ where U is utility and Y is income show that risk aversion decreases with increase in income.
8. What do you mean by Certainty equivalence ? Using the concept show that risk averters will be prepared to avoid uncertainty.
9. What is cost of risk? Show that Cost of risk Varies directly with the degree of risk aversion.
10. Why does demand for insurance arise ? Give on outline of the nature of insurance ?

11. What is fair insurance ?

12. Under what conditions the supply of insurance be available ? Does the mutual reinsurance amount to risk pulling by the insurers ?

13. What do you mean by assymetric information ? Why is it a problem for insurance market ?

14. What are the Problems with the economics of insurance ? How can they be overcomed ?

15. Why does moral hazard a problem for insurance market ? How can insurance & deduction overcome it ?

2.6. Additional Readings

Maddala and Miller, "Microeconomics" McGraw Hill

Pindyck and Rubinfeld "Microeconomics" prantice Hall of India.

Chapter 5

D. Wade Hands "Introduction to Mathematical Economics" Oxford University Press

Chapter 4.3.

●●●

UNIT—3

General Equilibrium

Structure :

3.0. Introduction :

We always talk about equilibrium, specially in microeconomic theories. For example, equilibrium of a consumer, firm, industry and so on. Thus equilibrium analysis occupies an important place in economic theories. 'Equilibrium' generally implies a position of rest where no one has a tendency to move. If a change in the equilibrium position brings about the original equilibrium automatically, it is called stable equilibrium and if not it is called unstable equilibrium. Equilibrium can be of two types -Partial equilibrium and general equilibrium. This unit starts with a distinction between the two. It deals with some of the major issues of general equilibrium.

3.1 Objectives :

When you study this unit, you will be able to know–

- Distinction between partial equilibrium and general equilibrium approach.
- Meaning of general equilibrium.
- Walrasian general equilibrium system with a simple example.
- Tatonnement and non-tatonnement mechanisms.
- The issues of existence, stability and uniqueness of general equilibrium.
- Contribution of Debreu and Arrow to general equilibrium analysis.

3.2. Partial Equilibrium Versus General Equilibrium Approach:

In partial equilibrium analysis the behaviour of an economic agent or the operation of a market is examined in isolation from the rest of the economy. By making suitable assumptions the economic agent or the market under study is shielded from the influence of whatever happens in the rest of the economy. The response of the agent or the market to the given situation in then analysed. The approach is useful for gathering insights into behaviour of economic agents and working of markets. The analysis however remains partial or incomplete as it ignores the interdependence between the constituents of an economic system which is bound to affect the individual choices of economic agents and equilibrium values of the different markets.

In partial equilibrium analysis of consumer's choice, income of the consumer and the prices of goods are assumed to be given. We then look for the optimal consumption bundle i.e., the combination of goods at which the consumer will be in equilibrium. The approach is useful for deducing the conditions for consumer's equilibrium in a restricted situation. The analysis can take into account the effect of prices and income on determination of consumer's choice but ignores the fact that consumer's choice itself has some influence on demand for consumption of goods and supply of productive services and hence on the prices themselves. The analysis, therefore, remains partial and unrealistic. Similarly in partial equilibrium analysis of a market, the price determination of a good is examined assuming given demand and supply curves. But once we recognise that markets for different goods (both products

and factors) are interdependent, the positions of the demand and supply curves cannot be assumed to remain unchanged in the process of price determination. Partial equilibrium approach is not equipped to handle such complications arising from interdependence of different constituents of an economic system.

In contrast such interdependences are emphasised in the general equilibrium approach. Thus in general equilibrium approach behaviour of interrelated economic agents and operations of interrelated markets are analysed simultaneously.

Notwithstanding their differences, the two approaches are indeed complementary in nature. Partial equilibrium analysis, though incomplete in nature, provides a useful preliminary idea of behaviour of economic agents and operations of markets. In doing so it provides the building blocks for more complete and complicated general equilibrium model of an entire economic system in which the mutual interdependence of the constituents of the system are explicitly taken into account.

Check your progress:

Distinguish between partial equilibrium analysis and general equilibrium analysis

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3.3 Meaning of General Equilibrium :

An economic system is comprised of numerous economic agents. The agent may be an individual buying consumption goods and selling productive services. Or it may be a firm procuring productive services to produce goods to be sold in the market. Each agent operates (rather is assumed to operate) independently guided by its self interest. (The individual may be seeking his/ her own maximum utility and the firm is likely to be guided by its own profit

considerations.) Now the questions is whether such self interest guided actions of economic agents can lead to a situation in which everyone attains equilibrium simultaneously. If such a situation exists, that indeed is the state of general equilibrium of the economic system. Formally, therefore, *general equilibrium may be defined as a situation in which all markets are cleared without excess demand or supply at positive prices with all economic agents being simultaneously at equilibrium having optimised their respective goals.*

The first task of general equilibrium theory is to deal with the existence question, i.e. whether general equilibrium exists under reasonable conditions. Equilibrium without stability is useless as the economy will not tend to it unless it is stable. Besides stability, uniqueness of the equilibrium is also desirable. In the event of existence of multiple equilibria, the economy may experience shifts between different equilibrium positions resulting in wide disturbing swings from time to time. Thus the three basic issues that concerns general equilibrium theorists are existence, stability and uniqueness of general equilibrium.

Check your progress:

1. What do you mean by general equilibrium ?

.....

.....

.....

2. What are the three basic issues of general equilibrium ?

.....

.....

.....

3.4 Walrasian General Equilibrium System :

In the Walrasian system, at the beginning of each period the economy has an initial endowment of resources distributed in the hands of the different economic agents. The economic process begins from the meeting in the

market of these various economic agents. The agents are present in the market as consumers or/and suppliers of productive survices or/and a entrepreneurs. As consumers they try to determine the way in which their consumable income is to be shared out in the buying of various goods so as to obtain the maximum utility. As suppliers of productive services agents try to obtain the best balance between the income received in payment for these services and the sacrifice involved in their supply. The entrepreneurs try to maximise profit from their own activity by attempting to maximise the difference between the value of the goods produced and the costs sustained in producing them. The central problem of Walrasian theory is to show how the voluntary exchanges among individuals who are well informed (each is perfectly aware of the terms of his own choice), self interested (each think of himself/herself) and rational (each try to optimise own goal) will lead to systametic organisation of production and distribution of income which is efficient and mutually beneficial.

In the market the actions of the different economic agents are coordinated by the prices. The prices are the parameters on the basis of which individual agents make their choices. However, the prices themselves are not independent of the choices. Individual choices, through their impact in market demand and supply, affect the prices. An economy is in Walrasian general equilibrium when there is a set of prices such that (a) in each market demand is equal to supply and (b) each agent is able to buy and sell the quantities that optimise his/her goals.

3.4.1 Tatonnement :

The model of price formation underlying Walrasian theory is one of competitive bargaining. He conceptualised markets as auctions. At the beginning of the bargaining the auctioneer calls out the prices and leaves the agents to formulate their buying and selling proposals. If in these prices the supply and demand are equal for each good, the bargaining is closed and the agents carry out the exchanges. If this does not happen, the auctioneer will adjust the prices by increasing the prices of goods in excess demand and

decreasing the prices of goods in excess supply. This trial and error process, which Walras calls tatonnement, will continue until all excesses of demand and supply have been eliminated. The prices tried in the adjustment process are virtual prices in the sense that no transaction takes place during the adjustment process. The exchanges actually take place only in the equilibrium prices.

3.4.2 The Existence Question :

To capture the interdependence between choices of individual agents and prices in the different markets, Walras constructed a system of simultaneous equations. The equations of the system are derived from optimisation processes of economic agents. Optimisation process of an individual yields the individual demand functions for consumption goods and supply functions of productive services. The optimisation of firms yields demand functions for productive services and inputs, and supply functions for products. Thus for each market (i.e. for each good) three sets of equations are obtained—

(a) demand functions (b) supply functions and

(c) the 'clearing the market',equation which stipulates the equilibrium condition that for each good sum of demands by different agents must be equal to sum of its supplies by the different agents. The variables to be determind by this system of simulataneous equations are the prices of the different goods exchanged, quantities demanded of the different goods by the different agents, and quantities supplied of the different goods by the different agents. If this system of equations yield economically sensible solution value for all these unknown variables, general equlibrium is said to exist.

A necessary condition for such a system of equations to have a solution is that the number of unknowns is equal to the number of equations. Though Walrasian system usually satisfies this condition, one of the equations in the system is functionally dependent on the others. (When 'clearing the market' equations in all but one market is satisfied, the equation for the remaining market will be automatically satisfied. Thus if there are N markets, only (N-1) 'clearing the market' equations will be independent. As illustrated in the next section, this follows from the budget constraints of economic agents.) As

a result, absolute levels of all the prices cannot be determined. A way out of the problem is to take one of the prices as a numeraire or unit of measurement and express the other prices in terms of the numeraire.

The number of independent equations being equal to the number of unknowns is however merely a necessary but not a sufficient condition for existence of a solution to a system of equations. The existence of general equilibrium for a competitive economy was proved not by Walras himself but by other economists in the subsequent period, specially by Arrow and Debreu. But before taking up their contribution, we have a simple illustrative model of competitive general equlibrium to explain the questions of existence, stability and uniqueness of the equilibrium.

3.4.3 : A Simple Example of Walrasian General Equilibrium, the General Equilibrium of Exchange, i.e., the case of consumption without production :

Suppose that in an economy there are only two consumers A and B who receive a regular endowment of two goods X and Y. The endowment is represented by the point E in the Edgeworth Box (Fig.1) (A's position is measured from the origin O_A and B's from O_B)

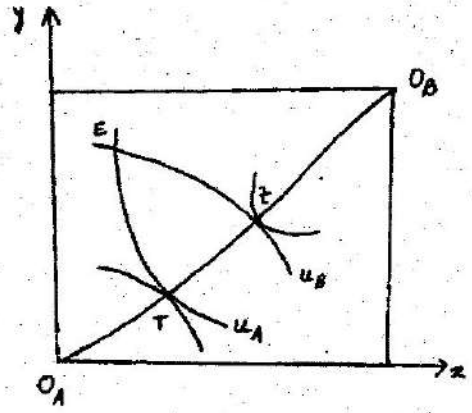

Fig.1

At E, A's indifference curve U_A has a greater slope than B's. i.e. At E the MRS_{XY} of A is greater than that of B. ($MRS^A_{XY} > MRS^B_{XY}$). This means that at E, A values X in terms of Y more highly than B does. Hence a scope for fruitful exchange exists. A can trade Y for X's with B and both can be on

higher indifference curves by moving to some point in the area bounded by U_A and U_B. Once the exchange process starts, the consumers will finally settle down at some point on the Tt portion of the contract curve. Because until they reach the contract curve, the scope for further fruitful exchange will exist and so further exchanges will take place. The exact equilibrium point on Tt is yet indeterminate— the present case being that of a bilateral monopoly. Let us now discuss what happens if the markets are perfectly competitive.

Under perfect competition both consumers will behave as price takers. The price ratio $p = (P_X / P_Y)$ will define the slope of their budget line which will pass through the endowment point E. The budget constraints stipulate that the value of the consumption bundle choosen by a consumer must be equal to the value of the endowment i.e. For A.

$$P_X X_A + P_Y Y_A = P_X \overline{X}_A + P_Y \overline{Y}_A \quad .....(1)$$

Where X_A and Y_A are demands for X and Y by A and $\overline{X}_A$ and $\overline{Y}_A$ are endowments of X and Y with A. Re-organising (1) we have

$$P_X(X_A - \overline{X}_A) + P_Y(Y_A - \overline{Y}_A) = 0$$

or $$P_X ED_X^A + P_Y ED_Y^A = 0 \quad .....(2)$$

where ED_X^A and ED_Y^A are respectively the excess demands of A for X and Y.

Similarly for B also we have—

$$P_X\ ED_X^B + P_Y ED_Y^B = 0 \text{ ---------- } (3)$$

Adding up (2) and (3) we get

$$P_X(ED_X^A + ED_X^B) + P_Y(ED_Y^A + ED_Y^B) = 0$$

or $$P_X ED_X + P_Y ED_Y = 0 \qquad \text{------- } (4)$$

Where ED_X and ED_Y are market excess demands for X and Y.

The equation (4) represents the famous Walras law which states that **price weighted excess demands in all markets must sum to zero.**

By corollary—

(a) if one market has positive excess demand, another must have negative excess demand (i.e. excess supply) and

(b) if all but one markets are in balance (i.e. ED = 0), the last one must

also be in balance.

The Walras law considerably simplifies the analysis in the present case of only two markets, when the market for X is cleared, by Walras law the market for Y must also be in balance. Thus we can now talk of general equilibrium merely by focussing on the equilibrium in the market for X.

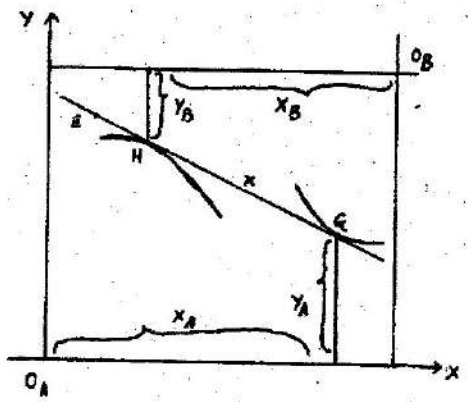

Fig.2

Let initially the price ratio be as represented by the slope of the budget line Et (**Fig.-2**). At this price ratio (say p_1), A would like to consume at G and B at H. Clearly there is no equilibrium as demand for X ($=X_A+X_B$) exceeds the total endowment of X given by the length of the edgeworth box. There is positive excess demand for X (and negative excess demand for Y). In a Walrasian world no transaction takes place at such prices. Instead the system tries out other prices and exchanges take place only when the market clearing prices are found.

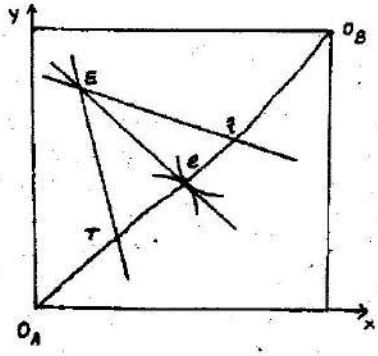

Fig.3

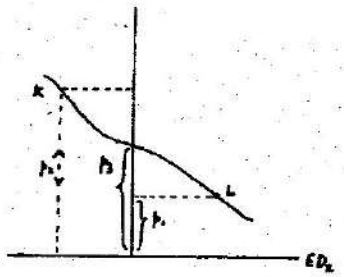

Fig.4

Let us next consider a higher relative price of X_1, say p_2, represented by the scope of the line ET. **(Fig. 3)**. This time there will be negative excess demand for X (and positive access demand for Y.) The two situations are represented by the points L and K in **Fig. 4.** L shows positive excess demand for X at low relative price p_1 and K shows negative excess demand for X a high relative price p_2. If the excess demand function is continuous between L and K, then there must be at least one relative price like p_3 at which $ED_x = 0$, i.e. market for X is cleared and so market for Y is also cleared and we have a general equilibrium. In **Fig.-3** this is represented by the point e on the line Ee.

At e both A and B are in equilibrium, their indifference curves being tangential to their budget line Ee at e. Indeed the two indifference curves are tangential to each other at e. Thus the equilibrium lies on the contract curve and therefore is Pareto optimal.

A question now arises as to how the economy is to find the equilibrium. In a Walrasian set up, the equilibrium prices are found through the process of 'tatonnement' or grouping, i.e. through a process of trial and error with alternative sets of prices.

The convergence to the market clearing price set will take place if the economy responds to positive excess demand by raising the relative price and to negative excess demand by lowering the relative price. Indeed competitive markets are known to respond in this manner.

3.4.4 The Question of Stability :

The stability of the equilibrium requires that it is automatically restored after temporary disturbance. This requires excess demand to be negative at relative prices higher than the equilibrium level (so that downward pressure is generated to bring the relative price to the equilibrium level). Similarly at below equilibrium relative prices, excess demand should be positive (so that upward pressure is generated to bring the relative price to the equilibrium level).

In other words stability of the equilibrium requires that the excess demand function is negatively sloped in the neighbourhood of the equilibrium relative price (i.e. the relative price at which excess demand is zero), i.e. at the equilibrium point, the excess demand function must cut the relative price axis from above.

3.4.5 The Question of Uniqueness :

When the ED_X function is negatively sloped through out (as in **Fig.-4**), it can cut the relative price axis only once. Thus there will be a unique stable equilibrium. For multiple equilibrium to occur, the ED_X must cut the relative price axis more than once (as in **Fig.-5**) :

For this the ED_X function must change direction and should be positively sloped for some range of the relative price. Let us take up the possibility of the ED_X function being positively sloped.

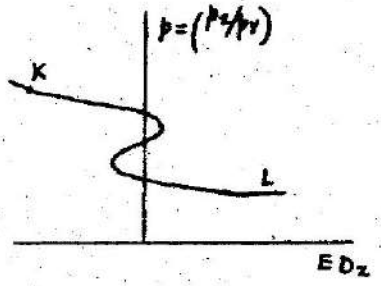

Fig.5

When the relative price P_X / P_Y goes up, the substitution effects of both A and B will reduce the demand for X. But the income effects of A and B will be dissimilar. A, who has a relatively poor endowment of X, experiences income loss. But B, being richly endowed with X, has income gains. Assuming X to be a normal good to both A and B, A's income effect will lower demand for X but B's will raise the demand for X. Now for the ED_X to be positively sloped, (i.e. for ED_X to increase with the increase in P_X / P_Y), B's income effect must be greater in magnitude than the sum of the two substitution effects and A's income effect. The possibility cannot be theroretically ruled out, but will occur only under some extreme conditions.

Thus multiple equilibrium cannot be ruled out. But a unique stable equilibrium is more likely.

Check your progress:

1. When an economy is said to be in Walrasian general equilibrium ?

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2. Write a note on tatonnement mechanism.

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3. What do you mean by stable equilibrium ?

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4. State the Walras law ?

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5. In a Walrasian set up, how the equilibrium prices are obtained ?

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3.5 Introduction to the Contribution of Debreu and Arrow:

The idea of general equilibrium had developed since the time of Adam Smith, mostly through the pioneering works of Walras, Von Neumann, Wald, Hicks and Samuelson. But it was left to Arrow and Debreu to spell out precise microeconomic assumptions at the level of microeconomic agents that could be

used to show that the model was consistent. Thus the principal achievement of Arrow-Debreu model was to lay out explicitly the conditions under which it was possible to claim that a properly chosen price system must always exist that can guide diverse and independent agents to make mutually compatible choices. The model can be outlined as follows.

The model assumes that the following information is known.

1. There are 'l' commodities, denoted by k (where k = 1,2,.....,l)
2. There are 'm' consumers, denoted by i (where i = 1,2,.....,m)
3. There are 'n' producers, denoted by j (where j = 1,2,.....,n)
4. Technological constraints to production.
5. Psychological characteristics of each consumer, including tastes.
6. Initial endowment of resources of each consumer.
7. The share of profit of each producer which belongs to each consumer.

The commodities are a set of goods and services specified in terms of their physical characteristics and place and time. Each commodity is given a price. The price vector is $p = (p_1, p_2,.....,p_l)$.

Producer j faces a technological constraint which is denoted by Y_j. It contains all the combinations of inputs and outputs which are technically feasible to the producer. A production plan is one of these combinations and is expressed by the vector $y_j = (y_{j1}, y_{j2}.....y_{jl})$. In each production plan inputs are represented by negative elements and output by positive ones. The producer will choose a production plan so as to maximize profit $\pi_j = p_{yj}$

Consumer 'i' has a consumption set which is denoted by X_i. It contains the various consumption plans comprising of all the combinations of commodities which the consumer can buy and sell. A consumption plan for consumer i is a vector $x_i = (x_{i1}, x_{i2}.....,x_{il})$ whose negative elements are the goods sold and positive elements are the goods bought. For some goods there are physical constraints. For example, it is impossible to sell more than a certain number of working hours per day. Again, a preference ordering which expresses his tastes is defined for each consumer. Finally, given the resource endowment of consumer

'i' denoted by $\sigma_i = (\sigma_{i1}, \sigma_{i2}, \ldots, \sigma_{il})$ and his profit shares, $\theta_i = (\theta_{i1}, \theta_{i2}, \ldots, \theta_{il})$ his total wealth is defined as $w_i = p\sigma_i + \theta_i\pi$ where $\pi = (\pi_1, \pi_2, \ldots, \pi_n)$. The consumer will choose x_i within X_i with the objective of maximising his own satisfaction under the budget constraints $px_i \leq w_i$.

Thus the economy is an (m + n)-ple,

$$(x, y) = (x_1, x_2, \ldots, x_m, y_1, y_2, \ldots, y_n)$$

which includes all the plans of actions of all the consumers and producers. Each element of the (m+n)-ple is a vector of 'l' elements. In such a state of economy the net total demand is $Z = x - y - \sigma$. An equilibrium is an (m+n+1)-ple,

$$(x^*, y^*, p^*) = (x_1^*, x_2^*, \ldots, x_m^*, y_1^*, y_2^*, \ldots, y_n^*, p^*)$$

such that x^* maximises satisfaction of all the consumers; y* maximises profit of all the producers; all and only available resources are used, i.e. $x^* - y^* = \sigma$. The vector of equilibrium price is p*.

Using Kakutanis fixed point theorem Arrow and Debreu proved the existence of this equilibrium in a competitive economy under more general conditions than their predecessors. The conditions are–

1. Each consumption set must be convex so that if two consumption plans are in one set, this will also include all their linear and convex combinations.
2. The consumer must be insatiable in the sense that for every chosen consumption plan there will always be another which is preferred.
3. Total production set must be convex. Thus it excludes the possibility of increasing returns to sale. However, Arrow and Halm extended this existence problem with limited amount of increasing returns to scale.
4. There is no externality.

This model was extended to incorporate uncertainty situation. A further specification, i.e. state of nature was attributed to the goods. In this context Debreu introduced the concept of contingent commodity. It is assumed that there are contingent markets for each possible states of nature. Arrow also

introduced another instrument known as 'Arrows' security to indicate all the contingent markets. Thus the element of uncertainty was incorporated in the general equilibrium analysis.

3.6 Non Tatonnement Processes :

The tatonmerment process does not seem to be a good description of the price mechanism. In this process transactions are supposed to take place only when the equilibrium prices have been found. Any exchange between economic agents is ruled out during the search for the equilibrium prices. This is highly implausible. Moreover the tatonnement process conceptualised by Walras is highly centralised, while the competetive price mechanism is generally thought to be a completely decentralized process.

For these reasons economists have come up with non-tatonnement processes. One such process has been formulated by Halm. In his scheme at an initial set of non-Walrasion prices economic agents carry out transactions. But not all agents can realise the trade they desire and excess demands and supplies appear in markets. These excesses generate price adjustments. At the new prices agents can again trade and again excesses will come out generating yet another round of price adjustments. Hence during the process not only prices change, but also the quantities in the hands of the agents. These quantities are however assumed to change only through trade and not by consumption or production. Production and consumption are assumed to take place only when the equilibrium prices have been established, i.e., when all excesses have disappeared. The prices and allocations emerging from the process in general will be different from those generated by Walrasian tatonnement. Nonetheless the final allocation has been shown to be Pareto optimal.

Check your progress:

1. What do you mean by non-tatonnement process ?

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3.7 Summary:-

The partial equilibrium analysis is concerned with the behaviour of an economic agent or operation of a market in isolation of the rest of the economy. On the other hand, the general equilibrium analysis is concerned with the behaviour or equilibrium of all the economic agents and all the markets simultaneously. The general equilibrium analysis assumes interdependence among all the economic agents and all the markets.

An economic system is comprised of numerous economic agents. Every economic agent tries to maximize satisfaction as a consumer or maximize profit as a producer. When such self interest guided actions of economic agents leads to situation where everyone attains equilibrium simultaneously it is called a general equilibrium.

Leon Walras has an important contribution to the general equilibrium analysis. The central problem of Walrasian theory is to show how the voluntary exchanges among individuals who are well informed, self interested and rational will lead to a systematic organization of production and distribution of income which is efficient and mutually beneficial. An economy is said to be in Walrasian general equilibrium when there is a set of prices such that in each market demand is equal to supply and each agent is able to buy and sell the quantities that optimize his/her goals.

The tatonnement mechanism has an important place in Walrasian theory of general equilibrium. Walras conceptualised market as auctions. At the beginning of the bargaining the auctioneer calls out the prices for the goods and services to be traded. If in these prices the supply and demand are equal to each good, the bargaining is closed and the agents carry out transactions. If demand is not equal to supply the auctioneer will adjust prices of the good by increasing prices of the good in excess demand and decreasing the prices of the good in excess supply. This trial and error process will continue until all excess of demand and supply have been eliminated.

The first issue of general equilibrium theory is to deal with the existence question, i.e., whether general equilibrium exists under reasonable conditions. The second issue of general equilibrium is stability. Equilibrium without stability is useless as the economy will not tend to it unless it is stable. Besides stability, uniqueness of the equilibrium is also desirable.

3.8. Glossary:

Partial equilibrium : An equilibrium of an economic agent or a firm or a market determined independently of other agents or firms or market.

General Equilibrium : A situation where all the economic agents, firms and markets attain equilibrium simultaneously.

Tatonnement : The bargaining process by which equilibrium is reached in the Walrasian market. In this process a set of prices is first called by the auctioneer which is then adjusted upward or downward according to excess demand or excess supply situation and a new set of prices is called. The process continues until an equilibrium set of prices is reached where demand is equal to supply or there is no excess demand or excess supply.

Stable equilibrium : An equilibrium position where if there is any deviation from the equilibrium position, automatic forces will bring back the original equilibrium position.

3.9 Self Assessment Test :

1. What do you mean by general equilibrium ? Explain how equilibrium is reached in Walrasian general equilibrium system.
2. Explain the existence, stability and uniqueness problems of general equilibrium with an example.
3. Explain the contribution of Arrow and Debreu to general equilibrium.

3.10 Suggested Readings :

1. Maddala, G. S. and Ellen Miller (2004), "Microeconomics– Theory and Application", Tata McGrow Hill Publishing Company Limited, New Delhi.
2. Koutsoyiannis, A (1979), Modern Microeconomics, Mcmillom Press, London.
3. Baumol, W.J. (1982), Economic Theory and Operation Analysis", Prentice Halls of India, New Delhi.
4. Screpanti and Zamagri (1993), "An Outline of the History of Economic Thought," Clarendon Press, oxford .Page -340-344.

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UNIT-4:

WELFARE ECONOMICS

Structure :

4.0 INTRODUCTION

Welfare economics is an important branch of economics. It is mainly concerned with the allocation of resources in such a way so as to bring about maximum possible welfare in the society. As we all know that the basic of economics is that our wants are unlimited, but the resources or means to satisfy them are very limited. Therefore, the efficient allocation of resources is very much essential so that the maximum possible well-being is attained in the society. Welfare economics has positive as well as normative aspects. The positive science explains things

as they are. On the other hand, the normative science involves 'value judgements' in the sense that it explains what should be done. The two basic issues of welfare economics are efficiency and distributional equity. These two aspects will be discussed later on.

4.1 OBJECTIVES

When you study this unit you will be able to know–

- Pareto optimality and conditions of it.
- Externality and public goods as two important causes of market failure.
- Effects of price control on social welfare.
- Compensation principles of Kaldor, Hicks and Scitovsky.
- Social welfare function and Arrow's criticism.
- Arrow's impossibility theorem.

4.2 PARETO OPTIMALITY AND THE NECESSARY CONDITIONS TO ATTAIN THEM

As mentioned earlier the two important issues of welfare economics are efficiency and distributional equity. Here efficiency is used in the sense of Pareto Optimality. Pareto Optimality or efficiency is defined as a situation where it is not possible to make someone better off without making someone else worse off. Pareto Optimality requires satisfaction of three conditions----a) efficiency in consumption or exchange, b) efficiency in production and c) efficiency in product mix. Each of these three conditions can be explained as follows.

a) Efficiency in consumption or exchange: -

Pareto Optimality in consumption or exchange refers to a situation where it is impossible, by any redistribution of the products, to increase satisfaction of one person without reducing the satisfaction of any other person. This requires that the marginal rate of substitution (MRS) between two commodities must be equal for each consumer. MRS between two commodities is defined as the

rate at which one good can be substituted for another while the consumer remains at the same level of satisfaction. The condition of efficiency in consumption is shown in Fig-4.1

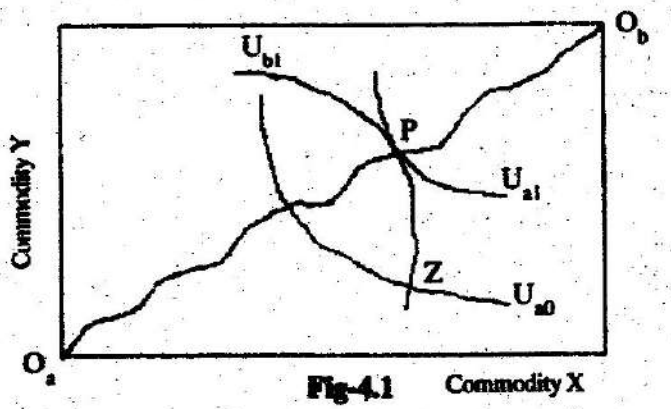

Fig-4.1

The efficiency in consumption is shown with the help of Edgeworth box diagram in Fig-4.1. Let us take two consumers A and B consuming two commodities X and Y. The consumption pattern of A is measured from the lower left hand corner upwards and the consumption pattern of B is measured from the upward right hand corner downward. The various indifference curves represent various utility levels of the two individuals. To begin with let us assume that the utility level of B is given by indifference curve U_{b1}. Given the utility level of B by U_{b1}, A's utility will be maximized at point P subject to U_{b1}. At P, the slope of U_{b1} and U_{a1} are equal. The slope of an indifference curve at any point is nothing but the marginal rate of substitution (MRS) between two commodities. Thus, slope of U_{a1} is the MRS of X for Y for consumer A whereas slope of U_{b1} is the MRS of X for Y for consumer B.

Hence at P, $MRS^{A}_{XY}=MRS^{B}_{XY}$

Thus P is a point of efficiency in consumption.

Similarly we can represent a number of indifference curves for both individual A and B (this is not shown in Fig-4.1). If we join the tangency points between the indifference curves of A and B (like point P in Fig-4.1) we will get a curve like OaOb, which is known as Edgeworth contract curve. All the points on the

contract curve OaOb satisfy the Pareto Optimality condition of efficiency in consumption since any point on OaOb satisfy the condition of

$$MRS^{A}_{XY}=MRS^{B}_{XY}.$$

Any point within the box diagram represents a particular pattern of distribution of the two commodities X and Y between A and B. A point off the contract curve is inefficient in the sense that it is possible to increase the satisfaction of A or B or both through a redistribution of these two commodities without reducing the satisfaction of the other. Let us take a point off the contract curve, say point Z. Point Z represents a particular pattern of distribution of commodities X and Y between A and B. Corresponding to Z, A is on indifference curve U_{a0} whereas B is on the indifference curve U_{b1}, both receiving a particular level of satisfaction. Now if we move from point Z to point P, then A will be on a higher indifference curve U_{a1} whereas B will be on the same indifference curve U_{b1}. It means that A's satisfaction increases while B's satisfaction remains the same. Similarly we can show that a movement from Z can increase the level of satisfaction of B or of both without reducing the satisfaction of the other.

Thus the marginal condition for Pareto Optimality or efficiency in consumption requires that the MRS between two commodities should be equal for all the consumers.

b) Efficiency in production:-

Pareto Optimality of efficiency in production is a situation where different factors of production are so allocated between various lines of production that it is impossible to increase output of any one product without reducing output of any other product through a reallocation of the resources. For this we require that the Marginal Rate of Technical Substitution (MRTS) between factors should be equal for each product. The MRTS between two factors can be defined as the rate at which one factor can be substituted for the other while level of output remains the same.

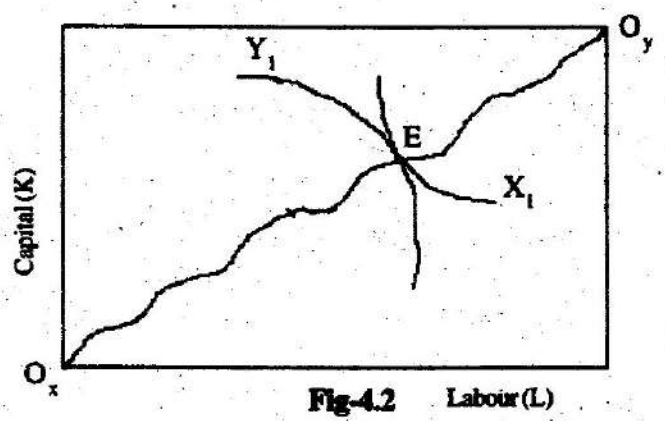

Fig-4.2

The efficiency in production is shown with the help of Edgeworth box diagram in Fig-4.2. Let us take two commodities X and Y, which are produced with the help of two factors labour (L) and capital (K). The production levels of commodity X is measured from the lower left hand corner upward and the production levels of commodity Y is measured from the upward right hand corner downward. The various isoquants represent various levels of production for the two commodities. To begin with let us assume that the production level of Y is given by the isoquant Y1. This Y1 represents a particular pattern of allocation of factors L and K. Now we have to maximize the production of X subject to the given level of production of Y1. This is attained at point E where isoquant Y1 is tangent to the isoquant X1. At E, the slope of Y1 and X1 are equal. The slope of an isoquant at any point is nothing but the marginal rate of technical substitution (MRTS) between two factors. Thus, slope of X1 is the MRTS of L for K for commodity X whereas slope of Y1 is the MRTS of L for K for commodity.

Hence at E, $\mathbf{MRTS^{X}_{LK} = MRTS^{Y}_{LK}}$

Thus E is a point of efficiency in production. This is due to the fact that the marginal rate of technical substitution between the factors is equal for each product at E.

Similarly we can represent a number of isoquants for both commodity X and Y (this is not shown in Fig-4.2). If we join the tangency points between the isoquants of X and Y (like point E in Fig-4.2) we will get a curve like OxOy, which is known as Edgeworth contract curve. All the points on the contract curve OxOy

satisfy the Pareto Optimality condition of efficiency in production. In other words, each point on the contract curve is efficient in the sense of Pareto Optimality, where

$$MRTS^{X}_{LK} = MRTS^{Y}_{LK}$$

Thus the marginal condition for Pareto Optimality or efficiency in production requires that the MRTS between two factors should be equal for all the products.

c) Efficiency in product mix:-

The third condition for Pareto Optimality is the efficiency in product-mix. This implies that the combination of output for both consumers and producers must be consistent. For attaining efficiency in product-mix the marginal rate of substitution (MRS) between any two products must be equal to the marginal rate of transformation (MRT) between them. Taking the earlier example of two products X and Y, it means

$$MRS_{XY} = MRT_{XY}$$

Since the amount of resources is limited, to increase the output of one product we have to transfer resources from other products, i.e., we have to reduce the output of the other product (in other words, we transforming one product into another). The rate at which a good can be transformed into another is known as marginal rate of (product) transformation. Thus, marginal rate of transformation of X for Y (MRTXY) shows the amount of Y that must be sacrificed in order to obtain an additional unit of X.

Thus MRT shows the rate at which a good can be transformed into another (on the production side) whereas MRS shows the rate at which consumers are willing to substitute or exchange a good for another. For a Pareto Optimal situation these two rates should be equal. Let us take a numerical example and see what happens if these two rates are not equal.

Let us suppose that $MRS_{XY} = 2Y/1X$; $MRT_{XY} = 1Y/1X$.

The $MRS_{XY} = 2Y/1X$ implies that the consumer is willing to exchange or sacrifice two units of Y for one unit of X, i.e., the consumer values X more in terms of Y. If we can increase the production of X then the welfare of the consumer will increase. On the other hand, the $MRT_{XY} = 1Y/1X$ means that if we reduce the output of Y by one unit we can get one more unit of X. In terms of value this one additional unit of X will be equivalent to two units of Y for the consumer (since $MRS_{XY} = 2Y/1X$). Therefore if we increase the production of X by reducing the production of Y it will increase welfare. *Thus, if $MRS_{XY} > MRT_{XY}$ then welfare can be increased by increasing the production of X at the cost of production of Y.*

On the other hand, let us suppose that

$$MRT_{XY} = 2Y/1X \quad ; \quad MRS_{XY} = 1Y/1X.$$

Here, $MRT_{XY} = 2Y/1X$ means the economy can produce two more units of Y by sacrificing only one unit of X. Thus the production cost of X is more in terms of Y. On the other hand, $MRS_{XY} = 1Y/1X$ means that the consumers are willing to exchange one unit of Y for one unit of X, i.e., they value these two goods equally. So, by reducing one unit of X we can produce two more units of Y, whereas the consumer is ready to sacrifice one unit of X for one unit of Y only. *Thus, if $MRT_{XY} > MRS_{XY}$ then welfare can be increased by increasing the production of Y at the cost of production of X.*

Check your progress:

Q. No.1. What do you mean by Pareto Optimality?

Q.No.2. What are the marginal conditions of Pareto Optimality?

Q.No.3. What do you mean by marginal rate of substitution, marginal rate of technical substitution and marginal rate of transformation?

4.3. EXTERNALITY AND PUBLIC GOODS

A perfectly competitive equilibrium is said to be Pareto Optimal provided there is no market failure. Market failure refers to a situation where the market forces fail to achieve an efficient allocation of resources. There are several factors responsible for the market failure. An important factor responsible for market failure is the externalities. We have already discussed the conditions for efficiency in production, efficiency in consumption and overall economic efficiency (i.e., efficiency in product-mix).These conditions are based on the assumption that production costs are borne by only the producer of the product and that the utility derived from consumption is enjoyed only by the purchaser/consumer. However this is not always true. There are certain products production or consumption of which involve external effects or externalities.

4.3.1 EXTERNALITIES :

Externalities are the external effects of production or consumption by one agent (or decision making unit like producer or consumer) on the production or consumption of another agent. Externalities exist when production or consumption decision of one agent affects the production or consumption opportunities open to another agent directly rather than through prices he or

she faces. Externalities may be positive or negative. If production or consumption by one person renders benefits for others it is called positive externality. On the other hand if production or consumption decision by one person causes cost for others it is called negative externality. Externalities can be classified into following four groups---

a) Positive externality in consumption: Let us take the example of vaccination. When one person is vaccinated it helps not only the person who is vaccinated but also his entire neighbourhood by preventing the spread of the infectious diseases. Thus taking vaccines by one person renders positive (external) benefits for the entire neighbourhood.

b) Negative externality in consumption: Let us suppose that one of your neighbour is playing music in full volume. Also suppose that you have examination the next day. So it will create disturbance for you. This is an example of negative externality in consumption.

c) Positive externality in production: Let us take the example of honey production. Suppose a farmer is producing mustard and the field is completely yellow with flowers of mustard. Let us again suppose that there is one beekeeper nearby. Thus the nectar from the plants increases the production of honey. Thus the production of mustard positively affects the production of honey.

d) Negative externality in production: Let us take the example of a paper mill. The paper mill produces paper and the waste is dumped into the river. Thus the riverside residents and the fishermen will be adversely affected by this.

A.C. Pigou was the first economist to deal with externalities in a systematic way. Pigou argued that in the presence of externalities even if we have perfect competition we cannot achieve a situation of Pareto Optimality. Let us take the following notations.

MPC = marginal private cost.

MEC = marginal external cost.(This is also called marginal damage)

MSC = marginal social cost.

MSC = MPC+ MEC.

i.e., marginal social cost is a combination of marginal private cost and marginal external cost (since social benefit or cost is the sum of private and external benefit or cost).

Again,

MPB = marginal private benefit.

MEB = marginal external benefit.

MSB = marginal social benefit.

MSB = MPB+MEB.

i.e., marginal social benefit is the sum of marginal private benefit and marginal external benefit.

The overall economic efficiency requires that **MSC = MSB** for each product. This is due to the fact that if MSB>MSC, production should be expanded because the additional benefits exceed the additional cost. On the other hand, if MSB<MSC, it implies that the additional or marginal cost is more than the additional benefit. Hence production should be reduced. So there should be equality between MSB and MSC. For economic efficiency consumers and producers must take into account the full social benefits and costs of consumption and production, i.e., they have to take into account both the private and external portion of benefits and costs. One way to make the producers and consumers to weigh social benefits and costs is to impose taxes and provide subsidies which bring private benefits and costs into line with social benefits and costs.

We will discuss here two cases of externalities with diagram----- negative externality in production and positive externality in consumption.

4.3.1.1 Negative Externality in Production:-

The negative externality in production is shown in Fig-4.3. Since there is no externality in consumption the demand curve DD shows the marginal private benefit as well as marginal social benefits, i.e., MPB = MSB (since there is no externality in consumption, MEB = 0). Since there is negative externality in production MEC will be positive and consequently MSC curve will lie above the MPC curve.

The optimal condition as attained at point R corresponding to which **MSB = MSC**. Thus the optimal output and price are OQ and OP respectively. The competitive market, if left alone, will produce OQ_1 with price OP_1 because the producers will try to equate MPB with MPC. Hence there is a tendency to overproduce by the producers. At the optimal quantity of output OQ, the price would be OP but the MPC would be OC. Thus corresponding to the optimal output level OQ the producers will be receiving a price higher than the MPC by the amount PC. Therefore, the government could levy a per unit tax of PC on the firm which will raise MPC by PC (to MSC) and reduce output from OQ_1 to OQ. The consumers would pay OP of price which covers the entire amount of MSC of production. The tax revenue so collected could be used to pay for the external damages from production of the product concerned. The net gain to the society is given by the shaded area which is the excess of costs over benefits for the units of output which are eliminated by the tax.

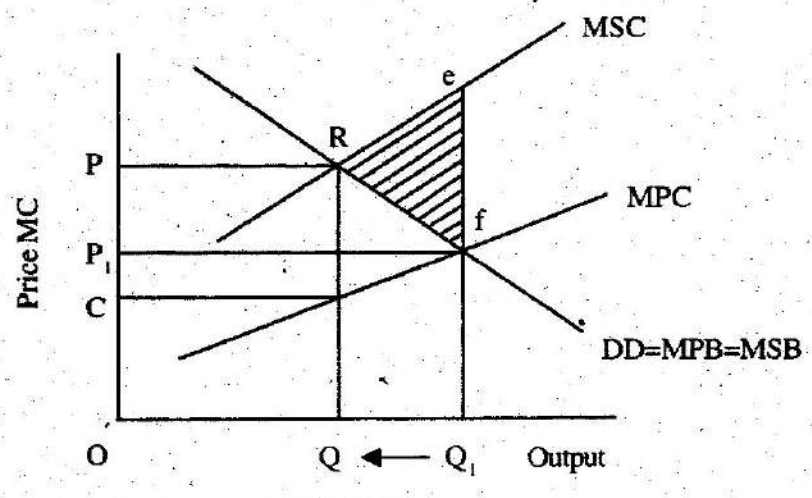

Fig. 4.3

4.3.1.2 Positive Externality in Consumption:-

Let us assume that there is positive externality in consumption and no externality in production. Since there is no externality in production, MEC = 0 and hence the competitive supply curve represents MSC = MPC. The demand curve reflects MPB. Since there is positive externality in consumption the MEB will be positive, consequently MSB will be higher than the MPB and MSB curve will lie above the MPB curve (or demand curve). This is explained with Fig-4.4.

In Fig-4.4 the optimal condition as attained at point R corresponding to which **MSB = MSC**. Thus the socially optimal quantity of output is OQ and price is OP. The competitive market, if left alone, will produce OQ_1 with price OP_1 because the producers will try to equate MPB with MPC. Hence there is underproduction as compared to the socially optimal level. At the optimal output level OQ, the marginal cost of production (OC) will be higher than the market price (OP). Therefore to encourage production from OQ_1 to OQ the consumers need to be given a subsidy of PC. Thus as a result of payment of subsidy the consumers will pay OP as market price whereas the producers will receive OC (i.e., market price + subsidy). The net benefit to the society from subsidy is given by the shaded portion which is the excess of social benefit over social cost for the output range QQ_1.

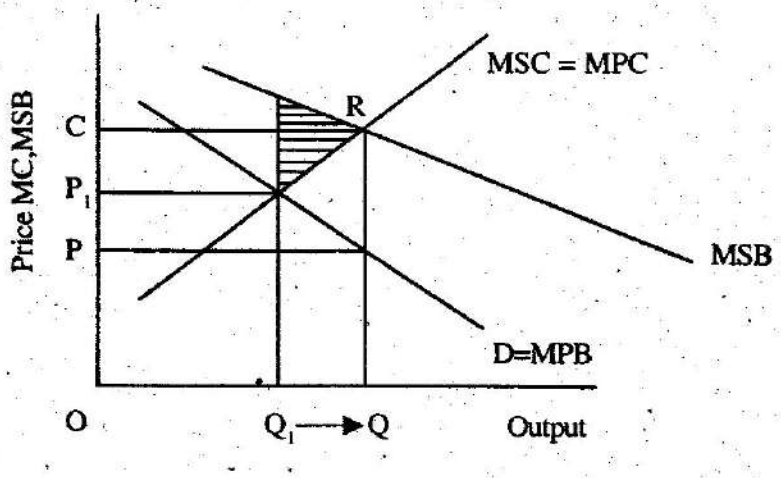

Fig-4.4

Thus from the above discussion it is clear that in the presence of externalities even if there is perfect competition we will not have a Pareto Optimality or efficient allocation of resources. *To bring about an optimal situation the government can use the tax and subsidy programs.* It is also possible to use both tax and subsidy if there are externalities in both production and consumption.

4.3.1.3 Coase Theorem:-

An important concept related to externalities is Coase Theorem. According to Ronald Coase, the problem of externalities arises due to the failures of institutions to clearly specify the property rights. The Coase Theorem states that if the rights are defined clearly or unambiguously and costless negotiations are possible then the negotiations between parties will lead to the attainment of socially optimum level of output through an efficient allocation of resources. The Coase Theorem can be explained with the help of Fig-4.5.

Let us take the earlier example of negative externality in production. The paper mill produces paper and the waste is dumped into the river. Thus the fishermen are adversely affected by this. In Fig-4.5 OQ is the socially optimal output level but the competitive market produces OQ_1. If the paper mill reduces output from OQ_1 to OQ, the net loss in producer's surplus and consumer's surplus is ACE; but the gain to the fisher man is given by the area ABCE. The gain to the fisher man or ABCE is the excess of MSC over MPC, i.e., the MEC for the output range QQ_1. Since the gain to the fisher man is greater than the loss to the producers and consumers (i.e., ABCE>ACE), it should be possible for the fisher man to bribe the producers and consumers to cut down production from OQ_1 to OQ. In other words, if the paper mill were to be assigned the property rights to the river and, thus, had the right to dump waste in it, and then the fisher man could bribe the paper mill not to dump waste. The amount of bribe would be the difference of MSC and MPC. When the paper mill calculated its costs, it would have to add to MPC this amount of bribe. Thus the cost curve of the firm would be looking like the MSC curve. Thus externalities have been internalized.

However, if the property rights to the river were assigned to the fisher man, then the paper mill would have to pay fisher man the compensation for dumping waste in the river. This compensation would be equal to the difference between MSC and MPC for each unit of output. The paper mill would have to take into account the compensations while calculating its costs. Thus when the compensation is taken as a part of cost the marginal private cost would be no longer the MPC but now would be the MSC. Thus the externalities have again been internalized. The output level of the firm would be at the socially optimal level OQ.

Thus, even without government intervention in the form of tax or subsidy the socially optimal level of output can be achieved provided the property rights are well defined and costless negotiations are possible. However the Coase theorem has certain limitations. If there are a large number of polluters and large number of victims then it may be impossible to assign property rights to anyone. It may also be impossible for the private parties to come together and reach an agreement.

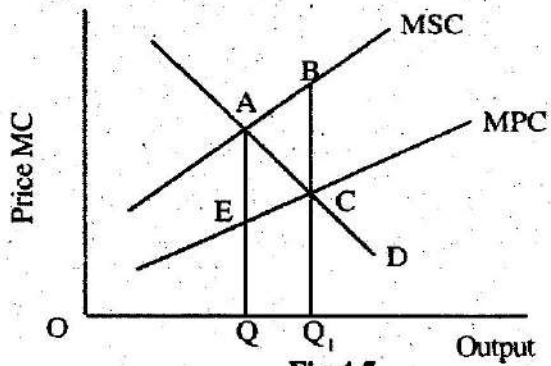

Fig-4.5

4.3.2 PUBLIC GOODS

Another important source of market failure is the existence of public goods. Public goods are those use or consumption of which by one person does not make it less available to others. A pure public good is one that provides non-excludable and non-rival benefits to all people in a given society. Non-excludability means it is technically impossible or extremely costly to exclude

any individual from the benefits of the good concerned. Non-rivalry means that there is no rivalry among the consumers because the enjoyment of the good by any one person does not reduce its availability for others. An example of a pure public good is the national defense.

There is no market for pure public good. Since no one can be excluded from the consumption of the good there is no way to charge a price for the good from a consumer. Therefore there is no incentive for the private entrepreneurs to produce and sell public goods. Even if people could be selectively excluded from consuming the good, the non-rivalry in consumption means that it is inefficient to exclude anyone. Consumption of a public good by one person does not make it less available for others. It means it costs nothing to provide the good to each additional consumer after the first. As this is the fact, social welfare is maximized by giving away the good free. Thus, it is difficult and sometimes impossible to fix a right price for a public good. Due to the failure of the market to deal efficiently with the provision of public goods the government has to come forward and intervene for the efficient allocation of public goods. The determination of the optimal output of a public good can be shown with the help of Fig-4.6.

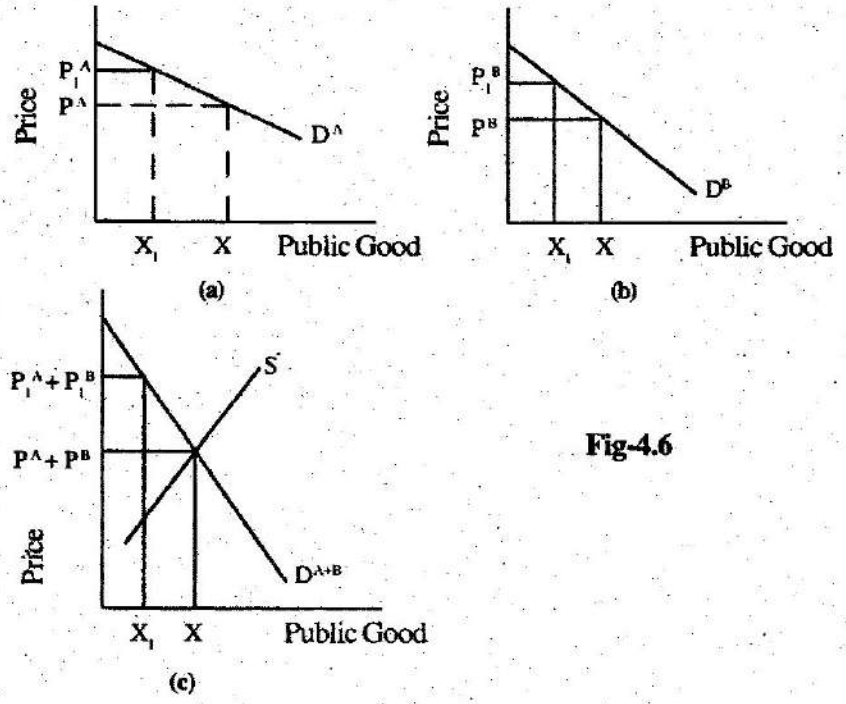

Fig-4.6

A pure public good has the special characterisation of non-excludability and non-rivalry. Suppose there are two individuals A and B in the society and one public good X. It is impossible to exclude either individuals from consuming the public good X. In figure 4.6(a), A's consumption of the public good is measured on the horizontzl axis and price per unit of the good is measured on the vertical axis. A's demand curve for the public good is D^A. Similarly, B's demand curve for the good is D^B as shown in the figure 4.6(b). Given the demand curve of A and B how to find ouut the total demand curve for the public good.

In case of a private good, different individuals consume different quantities in the same price. Therefore to find the market or total demand curve of a private good we horizontally sum the individual demand curves. But, for public goods this is not the case. A public good must be consumed in equal amount by all. If A consumes 10 units of public good, then B must also consume 10 units of the good concerned. In simple language, each individual derive benefits from each unit of the public good. However, the point to be noted is that although different individuals consume the same public good in equal amounts they derive different amount of utility. Therefore they are willing to pay different prices for the same amount of public good. So, to derive the market demand curve for public goods we vertically sum the individual demand curve. In other words, we add the prices that each individual would would be willing to pay for each unit of the good. In figure 4.6(c), the market demand curve is obtained through vertical summation of D^A and D^B. The supply curve is given by S. The equilibrium amount of public good is obtained through the intersection of demand and supply. Thus, the equilibrium amount of public good is OX with price $P^A + P^B$.

Let us assume that there are two consumers— A and B. The consumers consume two goods— one is public good X and the other is private good Y. The marginal rate of substitution of X for Y by individual A, i.e., MRS^A_{XY}, shows the rate at which A is willing to substitute X for Y. In other words, MRS^A_{XY} represents the valuation of X in terms of Y by individual A. Similarly MRS^B_{XY} represents the valuation of X in terms of Y by individual B. In other words, MRS^A_{XY} and MRS^B_{XY} show the marginal benefit (or valuation) of the public good X for A and B respectively. The social benefit is the sum total of A's benefits and B's benefits.

The marginal benefit from the public good X for the society as a whole or marginal social benefit is the sum of A's marginal benefit (i.e., MRS^{A}_{XY}) and B's marginal benefit (i.e., MRS^{B}_{XY}) and it is represented by the marginal rate of substitution, MRS_{XY}.

$$\mathbf{MRS_{XY} = MRS^{A}_{XY} + MRS^{B}_{XY} = MSB.}$$

All individuals derive benefits simultaneously from each unit of the public good. Therefore the marginal social benefit curve is derived through the vertical summation of individual marginal benefits curves. (The marginal social benefit curve is equivalent to the market demand curve and individual marginal benefit curve is equivalent to the individual demand curve. In case of private goods, the market demand curve is derived by horizontal summation of the individual demand curves. This is due to the fact that different consumers have demand for or derive benefits from different units of the private good.) Therefore the MRS_{XY} is derived through vertical summation of MRS^{A}_{XY} and MRS^{B}_{XY}.

The MC curve of the public good X represents its marginal social cost which, in turn, equals the marginal rate of transformation of X for Y.

That is, $\mathbf{MC = MSC = MRT_{XY}}$.

The condition for optimal output of a public good is,

$$\mathbf{MSB = MSC.}$$

Or, $\mathbf{MRS_{XY} = MRT_{XY}}$.

Thus, the optimal output of public good X in Fig-4.6 is OQ. However, in actual practice it is very difficult to find out an optimum solution since there is no market for public good as mentioned earlier. There is the problem as to how to obtain the marginal benefits or valuations of individuals. In case of public goods people may not reveal their actual preference or willingness to pay for the good. This problem arises because it is impossible to exclude anyone from consuming the good. While enjoying the benefit of the good an individual may think that others will bear the cost of the good. The tendency to let other people pay the cost of

public good while one enjoys the benefit is known as free rider problem. The market fails to deal efficiently with the provision of public good. There is every possibility that the market will fall short of providing the efficient amount of public good.

Due to the failure of the market to deal efficiently with the provision of public goods the government has to come forward and intervene for the efficient allocation of public goods.

Check your progress:

Q. No.1. What do you mean by externalities?

Q.No.2. Distinguish between positive and negative externalities.

Q. No.3. State the various forms of externalities with example.

Q.No.4. What do you mean by internalization of externalities?

Q.No.5. Define public goods with an example.

Q.No.6. 'There is no market for pure public goods'. How?

Q.No.7. In case of public good agg. demand curve is derived through vertical shown of individual demand curves. Why ?

Q.No.8. How the agg. demand curve is derived in case of public goods?

4.4. THE THEORY OF SECOND BEST

Pareto Optimality is considered to be the best from the point of view of social welfare and hence it is highly desirable. However, it is very possible that one or more of the Pareto Optimality conditions cannot be satisfied because of institutional constraints, market imperfections or some other reason. Thus, a

best welfare position is unattainable in this case. Therefore it is relevant to enquire whether a 'second best' position can be attained by satisfying the remaining Pareto conditions. In this connection the theory of second best states that it is not necessary that satisfaction of the remaining conditions will improve social welfare. The theory of second best states ---- "*If one or more of the first order conditions for Pareto Optimality cannot be satisfied because of institutional constraints, in general it is neither necessary nor desirable to satisfy the remaining Pareto conditions.*" The theory of second best has been used to question the desirability of policies to attain the Pareto conditions on a piecemeal basis. By piecemeal we mean treating markets in isolation and thus elimination of market imperfections or welfare impediments-one by one but not all of them at a time. For example, elimination of monopoly and oligopoly from certain markets but leaving monopolistic competition in some other markets would not improve social welfare, according to the theory of second best.

Check your progress:

Q.No.1. If one of the Pareto Optimality conditions cannot be satisfied, is it possible to improve social welfare through satisfying the remaining Pareto Optimality conditions? Why?

4.5. WELFARE EFFE CTS OF NON-PRICE ALLOCATIONS AND PRICE CONTROL

Non-price allocation and price control of products have a very significant impact on the welfare of the society. A perfectly competitive equilibrium is in conformity with Pareto Optimality. Therefore any move to interfere in the functioning of the

market mechanism through non-price allocation or price control is bound to reduce social welfare. This is explained with the help of Fig-4.7.

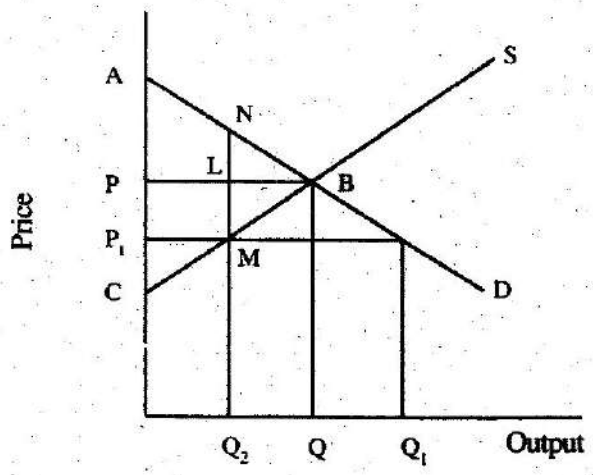

Fig-4.7

As shown in Fig-4.7 the competitive equilibrium price and output as determined through the interaction of demand and supply condition are OP and OQ respectively. Corresponding to this consumers' surplus is ABP and producers' surplus is PBC. Social welfare can be measured by the totality of these two surpluses, i.e., ABC.

Now let us assume that the government controls price at P_1. This results in a reduction of producers' surplus P_1MC. This also reduces output to OQ_2. But the consumers' surplus is still indeterminate since OQ_2 output is randomly distributed among the consumers who were earlier consuming OQ.

Let us suppose that those who constitute OQ_2 portion of demand get to buy it. Here consumers' surplus is $ANMP_1$ which is the maximum possible consumers' surplus. Thus total surplus declines from ABC to ANMC. Hence the loss in total surplus is NBM which implies a deadweight loss in social welfare.

Again there is a redistribution or transfer of surplus from the producers to the consumers by $PLMP_1$ as a result of price control. There is some loss of consumer's surplus also. This is because of the fact that the best possible consumers' surplus will not be realized. OQ_2 output will be randomly distributed among the potential buyers. In may not be necessarily distributed in favour of those who value.

Thus under perfect competition non-price allocation and price control reduce social welfare.

Check your progress:

Q.No.1. How does price control affect the welfare position of an economy?

4.6. PROBLEM OF WELFARE MAXIMISATION

Pareto Optimality is the best from the point of view of maximizing social welfare and hence most desirable. However it is not attainable due to non-fulfillment of one or more of the Pareto Optimality conditions. Therefore we should try to find out ways of increasing social welfare to the maximum extent possible. Different economists have put forward different views regarding how to maximize social welfare. Those are explained below.

4.7 COMPENSATION PRINCIPLES

The compensation principles have been formulated by Kaldor, Hicks and Scitovosky. Kaldor first advocated a compensation principle which implies that a change is an improvement if the gainers are able to compensate the losers and are still better off than before. In othr words, a move from state A to state B increases social welfare, if people who gain from the change could fully compensate for the losers and still be better off. For example, any reorganization of production will increase social welfare if it is possible for the state to give full compensation in the form of subsidies to the losers to the extent of their losses

out of the funds raised by taxing the gainers and still be left over with surplus.

Hicks' compensation criterion is slightly different from that of Kaldor, which looks into the situation from the losers point of view. According to Hicks' compensation criterion, a change is an improvement if the people who lose from the change are unable to bribe the gainers from not making the change. That means the gainers must have a greater amount of gains than the amount of loss of the losers so that it is not possible for the losers to persuade the gainers not to make the change.

Scitovsky found a logical contradiction in the compensation tests suggested by Kaldor and Hicks. According to him, it is possible that state A of the economy is better than state B in terms of Kaldor or Hicks criterion, but once a society moves from B to A, the same test may support the return from state A to state B on the ground of welfare. Hence Scitovsky has attempted to remove this contradiction by putting forward his own test known as 'Scitovsky double criterion' which can be stated as ----a state A of the economy is considered socially preferable to state B if those who gain from A could compensate (i.e., bribe) the losers into accepting the change from B to A, but simultaneously the losers could not bribe the gainers into not making the change. In other words, there is no possibility of reversibility to the old state once a change is accepted by the society.

However the compensation principles have certain limitations. It considers the 'efficiency' aspect only, but not distribution. It is essentially concerned with potential welfare rather than actual welfare since it does not require that compensation should actually be paid. It is argued that whether and in what manner compensation should take place, if it should take place at all, is a moral issue. Another problem is that the compensation principle allows comparisons between a few alternatives but does not tell us the state that achieves the maximum possible welfare. However, these principles are not entirely useless. These are very much useful particularly in cost-benefit analysis.

Check your progress:

Q. No. 1. State the Kaldor-Hicks criterion of compensation test.

Q. No. 2. State Scitovsky's compensation principle.

4.8 SOCIAL WELFARE FUNCTION

The concept of social welfare function was first introduced by Bergson to represent social preferences of various alternative situations. Social welfare function is an ordinal index of society's welfare and is defined as a function of utilities of all the individuals in the society. It is a function which establishes a functional relationship between social welfare and all possible variables which affect welfare of the individuals.

Thus, $W=W(U_1, U_2,\ldots,U_n)$

Where, W stands for social welfare and U_i $(i = 1,2,\ldots,n)$ is the level of utility for the ith individual, and 'n' is the total number of persons in the society. For simplicity, let us assume that the society consists of two individuals (consuming two commodities) whose utility functions are as follows:-

$$U_1 = U_1 (q_{11}, q_{12}, L_1)$$

$$U_2 = U_2 (q_{21}, q_{22}, L_2)$$

where, q_{ij} is the amount of the jth commodity consumed by the ith individual, L_1 and L_2 are leisure available to them.

The social welfare function is a sort of social indifference curve which shows the various combinations of utilities of different individuals that result in the same level of social welfare as shown in fig 4.8

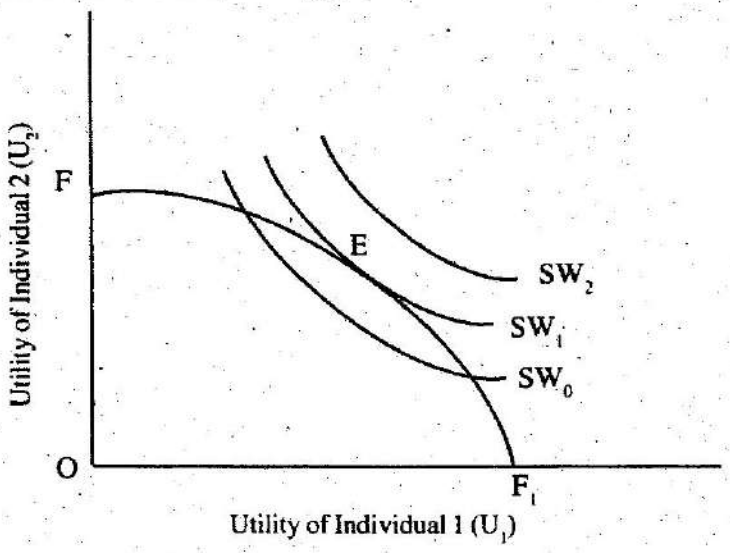

Fig-4.8

SW_0, SW_1 and SW_2 represent progressively higher and higher levels of social welfare. FF_1 is the utility possibility curve which shows various possible combinations of utilities received by the two individuals with the given resources and technology of the economy. The maximum social welfare is attained at point E where the social welfare function SW_1 is tangent to the utility possibility curve FF_1.

However, it is difficult to construct a social welfare function from individual utilities. The form of social welfare function depends on value judgment. But the question arises whether the value judgment should be made by the dictator or by tastes of the society in a democratic way. Arrow has demonstrated that in a democracy it is impossible to obtain the social welfare function even if individual preferences are consistent.

Check your progress:

Q. No.1. What is a social welfare function?

4.9 ARROW'S IMPOSSIBILITY THEOREM

Social preferences may be formed from individual preferences in a number of ways. Social preferences might be determined by a dictator or they might be determined by a majority vote of the individual members of the society. All the ways of translating individual preferences into social preference may not be equally desirable or acceptable. In this regard Arrow has suggested five conditions which the social preference must satisfy to be minimally acceptable. These conditions are as follows.

a) Social preferences must be consistent and transitive. There should be complete ordering of social preferences.

b) Social choices must not be dictated by anyone outside the community or any individual in the community.

c) Social preferences must not be imposed independently of individual preferences.

d) Social choices must be independent of the irrelevant alternatives. Let us assume that when alternatives A, B and C are available, the society prefers A to B and B to C. If C were no longer available it must not be true that the society then prefers B to A.

e) Social choices must not change in the opposite direction from the choice of the members of the society.

All these conditions reflect value judgment. Arrow's impossibility theorem states that, in general, it is not possible to construct social preferences from individual preferences without violating at least one of these conditions. In other words, social choice is inconsistent and undemocratic since no voting system allows these five conditions to be satisfied.

Let us suppose that there are three persons ---- A, B and C with three choices---- X, Y and Z. Their choice pattern is as follows.

Individuals	**Choice Pattern**	**By Majority Rule**
A	X>Y>Z	X>Y (choice of A and C)
B	Y>Z>X	Y>Z(choice of A and B)
C	Z>X>Y	Z>X (choice of B and C)

Thus two individuals A and C prefer X to Y, A and B prefer Y to Z while B and C prefer Z to X. Hence the majority prefers X to Y and Y to Z. But the majority also prefers Z to X. Thus social preference is inconsistent with individual preferences. This is the paradox of majority rule. Thus Arrow demonstrated that it is impossible to construct social preferences or social welfare function from individual preferences in a democratic state.

However, Amartya Sen has criticized Arrow's impossibility theorem. The theorem suffers from poverty of information. It is based on the assumption of ordinal measurement of utility and that there is no interpersonal comparison of utilities. The theory is concerned with merely preferences of individuals. But the intensity of individual preferences is a very important factor which must be taken into account while drawing social preferences from individual preferences. That is, how strongly the individuals prefer the various alternatives. For this, cardinal measurement and interpersonal comparison of utilities have to be allowed. Moreover, majority rule may not be just in judging conflict of interest, though it

may be accepted for resolving conflict of judgment.

Check your progress:

Q. No.1. State Arrow's impossibility theorem.

4.10 EQUITY-EFFICIENCY TRADE OFF

Equity implies a state of fairness or where something is equitable. There is a trade off between equity and efficiency which can be observed in many cases. Keeping in view the present state of income inequality, the term 'equity' may sometimes suggest a redistribution of income from the rich in favour of the poor by way of imposition of direct taxes such as income tax. However this will affect investment in the economy because the rich, generally, have a higher propensity to invest relative to the poor. Similarly when a good is scarce in supply, efficiency suggests its price should rise to direct the available supplies to the uses in which the highest valuation is put on them, or those who are able to pay a higher price will get it. This will hurt the poorer consumers the most and is often held to be to unfair or inequitable. Likewise efficiency suggests that it is not rational to tax other consumer goods and exempt food from it; while equity suggests exemption of food from tax because the poor spend relatively more of their income on it. There are many other cases which can be cited as examples of equity-efficiency trade off.

Check your progress:

Q. No.1. Write a note on equity-efficiency trade off.

4.11 SUMMARY

The concept of Pareto optimality occupies the central position in welfare economics. Pareto optimality is considered to be the best from the point of view of social welfare. However, if one or more of the conditions of Pareto optimality cannot be satisfied, it is not possible to improve social welfare by satisfying the remaining conditions, according to the theory of second best.

In many occasions the market may fail to attain an efficient allocation of resources. Two very important factors causing market failure are externality and public goods. According to Ronald Coase, the whole externalities arise due to failures of the institutions to clearly specify property rights. The Coase theorem states that if property rights are defined unambiguously and costless negotiations are possible then negotiations between parties will lead to the attainment of socially optimum level of output through and efficient allocation of resources.

Since public goods are no-rival and non-excludable in nature, the market mechanism fails to provide them. Therefore the government has to come forward to make provision of such goods.

The compensation principle was first put forward by Kaldor and later on Hicks and Scitovsky to show whether a change in the allocation of resources improves

social welfare. Kaldor's principle and Hicks' principle are the same in essence. Kaldor's principle looks into social welfare from the gainer's point of view whereas Hicks' principle looks into social welfare from the loser's point of view. Scitovsky combined these two principles and developed his own principle, which is also known as 'Scitovsky's double criterion'.

Bergson first introduced social welfare function to represent social preference of various alternative situations. However, according to Arrow, it is not possible to derive social preference from individual preferences in a democratic society. This is popularly known as Arrow's impossibility theorem.

4.12 GLOSSARY

Pareto optimality: A situation where nobody can be made better off without making someone else worse off through a reallocation of resources.

Pareto efficiency in production:

A situation where the resources are so allocated between various lines of production that it is impossible to increase output of one product without reducing the output of another product.

Pareto efficiency in consumption:

A situation where it is impossible to increase the satisfaction of one person without reducing the satisfaction of another person by any redistribution of products among the people in a society.

Marginal Rate of Substitution (MRS):

The MRS between two goods is the rate at which one good can be substituted for another good keeping the satisfaction of the consumer at the same level. For example, MRS of good X for good Y refers to the amount of Y that has to be surrendered to have an additional unit of X.

Marginal Rate of Technical Substitution (MRTS):

The MRTS between two factors of production is the rate at which one factor can be substituted for another. For example, MRTS of labour for capital refers to the amount of capital that has to be sacrificed to have an additional unit of labour in the production process keeping the output level constant.

Pareto efficiency in product mix:

A situation where the marginal rate of substitution between any two products is equal to the marginal rate of transformation between them.

Marginal Rate of Transformation (MRT):

The rate at which one good can be transformed into another. Since the resources are very limited, to produce an additional unit of one product the production of another product has to be reduced. For example, the MRT between X and Y refers to the amount of Y that has to be reduced (or surrendered) to produce an additional unit of X.

Externality:

The external effects of production or consumption by one agent on the production or consumption opportunities open to others. Externalities are said to exist when the production or consumption activity by one economic agent affects the production or consumption open to another economic agent directly rather than through prices which he or she faces.

Coase theorem:

The Coase theorem states that if property rights are well defined and if transaction costs are zero, then negotiation between parties will lead to an efficient allocation of resources.

Public good:

A public good is one which is non-rival and non-excludable in nature. Non-rival means that consumption of the good by one person does not reduce its availability

for others. Non-excludable means that it is impossible or highly costly to exclude anybody from the consumption of the good.

Theory of second best:

The theory of second best states that if one or more of the Pareto optimality conditions cannot be satisfied then it is not possible to improve social welfare by satisfying the remaining Pareto optimality conditions.

Social welfare function:

An ordinal index of society's welfare and is defined as a function of utilities of all individuals in the society.

Arrow's impossibility theorem:

It states that it is impossible to derive social preference from individual preferences in democratic set-up.

4.13 SELF-ASSESSMENT TEST

1. What do you mean by Pareto optimality? Explain the three conditions of Pareto optimality.
2. What do you mean by externalities? Explain two cases (one taxation and one subsidies) how government intervention can internalize externalities.
3. Examine critically Coase theorem on property rights.
4. Explain the provision of public goods.
5. State and explain Kaldor, Hicks and Scitovsky's compensation principles.
6. Show the problem of maximization of social welfare with the help of social welfare function.
7. "It is not possible to construct social preference from individual preferences in a democratic set-up". Examine Arrow's impossibility theorem in this context.

4.14 SUGGESTED READINGS

1. Maddala, G.S. and E. Miller (2004), "Microeconomics — Theory and Applications", Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Koutsoyiannis, A. (1979), "Modern Microeconomics", Macmillan Press, London.
3. Henderson, J.M. and R.E. Quandt (1980), "Microeconomic Theory: A Mathematical Approach", McGraw Hill, New Delhi.
4. Sen, A.K., "Collective Choice and Social Welfare".

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