SEMESTER-II

ଓଡ଼ିଶା ରାଜ୍ୟ ମୁକ୍ତ ବିଶ୍ୱବିଦ୍ୟାଳୟ, ସମ୍ବଲପୁର
ODISHA STATE OPEN UNIVERSITY, SAMBALPUR

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Odisha State Open University
Sambalpur

MASTER OF ARTS
ECONOMICS
(MAEC)

MEC-202: WELFARE ECONOMICS

Credit: 4

Block-1, 2, 3 & 4

MEC-202: Welfare Economics

Brief Contents

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WELFARE ECONOMICS

Block 01

Welfare Economics and Economics of Information

Unit-1: Introduction to Welfare Economics

Structure:

1.0 Learning Objectives

After studying this module you shall be able to:

- Know the concept of welfare economics
- Learn about pareto-optimality

1.1 Introduction

Welfare economics studies the conditions under which the solution to a general equilibrium model can be said to be optimal. This requires among other things, an optimal allocation of factors among commodities and an optimal allocation of commodities (i.e distribution of income) among consumers. In welfare economics attempt is made to establish criteria or norms, with which to judge or evaluate alternative economic states and policies from the view point of the society's well- being. In the words of Oscar Lange, "welfare economics establishes norms of behavior which satisfy the requirements of social rationality of economic activity." The term "Social rationality" of economic activity is to be interpreted as that activity which ensures optimum allocation of resources and therefore guarantees maximum social welfare. In this context Oscar Lange says, “The norms of behavior established by welfare economics are supposed to guarantee the optimal allocation of economic resources of the society.”

The inter-relationship among various parts of the economy implies that certain specific change in one past of the economy affects resource allocation in all other parts of the economy. Thus, a central problem in welfare economics relates to whether a specific change in resource allocation will increase or decrease its social welfare.

1.2 Pareto-Optimality Criterion

Developed by the Italian economist, Vilfredo Pareto, the Pareto optimality criterion is the cornerstone of modern welfare economics. The criterion is used to determine whether the social welfare is higher in one economic situation than in another.

According to the Pareto optimality criterion, a distribution of inputs among commodities and of commodities among consumers is Pareto optimal or pare to efficient if, no reorganization of production or consumption is possible by which some individuals are made better off (in their own judgment) without making someone else worse off.

In other words, Pareto optimal is a situation in which it is impossible to make anyone better off without making someone else worse off. This situation is also called Pareto efficient. It follow that any change that improves the well- being of some individuals without reducing the well-being of others, clearly improves the welfare of society as a whole and should be undertaken. This will move the society from a Pareto non-optimal position to Pareto optimum. Once at Pareto optimum, no reorganization of production and exchange is possible that makes someone better off without, at the same time, making someone else worse off.

In a Pareto optimal state of an economy, it is impossible to make any one better off without making someone worse off by any of the following three means;

1. Re allocation of the already available goods among consumers.
2. Re allocation of inputs among producers (in order to increase the output of some goods without reducing the output of any other good.)

3. Changing the composition of output that is, producing more of some and less of others.

Let us examine each of these three situations.

1. Allocation of goods among consumers: Efficiency in Exchange

Pareto optimality (or efficiency) in exchange is achieved when allocation of commodities among the consumers is such that it is not possible to increase the satisfaction of any person without reducing the satisfaction of someone else Pareto optimality (or efficiency) in exchange can be achieved only when all consumers have the same marginal rate of substitution between the same pair of goods. This marginal condition, with reference to two commodity and two- consumer model, may be expressed as

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

In a situation, where this condition is not fulfilled, it is always possible to increase the total welfare by transferring some units of a commodity from a person who derives lower utility to the person who derives greater utility.

The Pareto optimum allocation of commodities among the consumers is illustrated by using Edgeworth Box diagram, as presented in Figure 1.1.

Pareto used ordinal utility functions to represent consumers preferences as well as welfare levels, using a two consumer economy A and B we can indicate their welfare levels by means of indifference curves mapping which satisfy the normal properties of consumers preference ordering. The indifference curves for consumer A, convex to origin OA, are given by A_1, A_2, A_3 and A_4. The indifference curves of consumer B, convex to origin OB, are given by B_1, B_2, B_3 and B_4. The dimensions of the box are given by the total amount of the two commodities owned by the two consumers together. Any point inside the box indicates how the total amount of the two commodities is distributed between the two consumers.

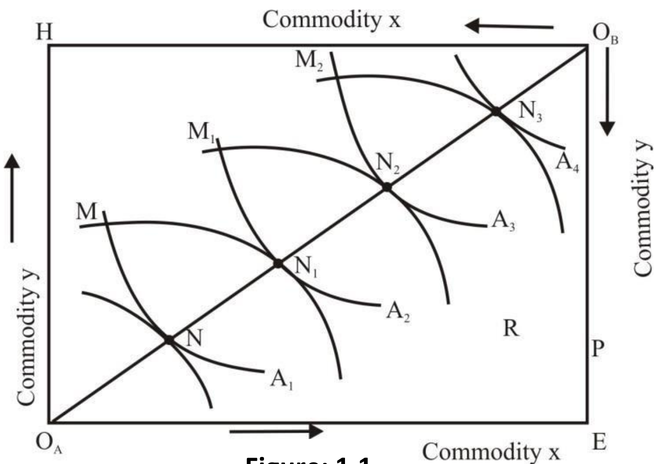


Figure: 1.1

Edgeworth Box Diagram; Efficiency in Exchange

In Figure 1.1 above, at points N, N_1, N_2 and N_3 the indifference curves of consumers A and B are tangential to each other. This would imply that MRS_A must equal MRS_B at each of these points. The marginal rates of substation between commodities x and y are the same for both the consumers, A and B. Since marginal rate of substitutions are equal no scope exists for improving the welfare of any one consumer unless the welfare of the other consumer is reduce. When marginal rate of substitutions are not equal as at points like M, M_1 and M_2, opportunities exist for improving the welfare of one consumer without reducing the welfare of any other consumer in the economy. Such points (or states of the economy) are called pareto in optimal points. It must be noted that Pareto optimality is often called pareto efficiency? While pareto in optimality is referred to as pareto in efficiency. The locus of the points of tangencies defines the contract curve O^N_A N_1 N_2 N_3 O_B. Once consumers A and B are on the contract curve, it is impossible to make either of them better off without making the other worse off. Thus, the contract curve shows the locus of pareto optimal or efficient allocation of commodities. As mentioned above, the marginal condition for a pareto optimal resource allocation requires that the MRS between two commodities be equal for both consumers, i.e,

$$MRS^A_{XY} = MRS^B_{XY}$$

It can be shown that the above argument can be extended for any number of commodities and any number of consumers. Therefore, we conclude that the marginal condition for a pareto optimal or efficient allocation of goods among consumers requires the equality of MRS between any number of commodities for all consumers.

2. Optimal allocation of factors; Efficiency in production. Like efficiency of exchange, we can also explore the efficiency in production. Efficiency in production or pareto optimality in allocation of resources requires that factors (L and K) are so allocated in the production of two commodities, x and y, that it is not possible to increase the output of one commodity, by reallocation factors, without causing a decrease in the production of the other. The marginal condition that must be fulfilled to achieve pareto optimality in resource allocation is that marginal rate of technical substitution (MRTS) between L and K is the same for both x and y produced by two firms. That is, for all producers of x and y,

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

Pareto optimality in the allocation of factors between the two products and also between the two firms has been diagrammatically shown in terms of Edgeworth Box diagram in Figure 1.2. The analysis is analogous to one developed to present the marginal condition of optimum allocation of goods between the consumers.

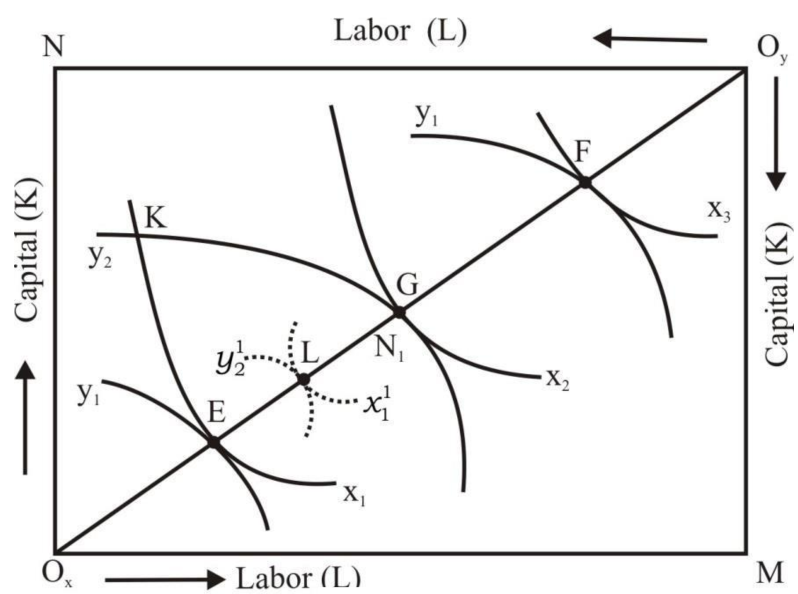


Figure: 1.2

Edgeworth Box Diagram; Efficiency in production

In Figure 1.2, the dimensions of the box are quantities of labour and capital which are available for production of commodities x and y. Isoquant map for x is given by x_1, x_2 and x_3 with origin O_X. Isoquants for y are given by y_1,y_2 and y_3, Isoquant map of y with origin as Oy , is inverted and superimposed on the map of x. The equilibrium is achieved where the isoquants of x and y are tangential to each other. The efficiency locus or contract curve of production Ox EG F Oy is obtained by joining these points. That is, the condition

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

is fulfilled along the efficiency locus. Since K is not on the contract curve of production, a reallocation of labour and capital in such a way as to move to a point on the contract curve will allow production of more of one or both commodities without reducing the output of other.

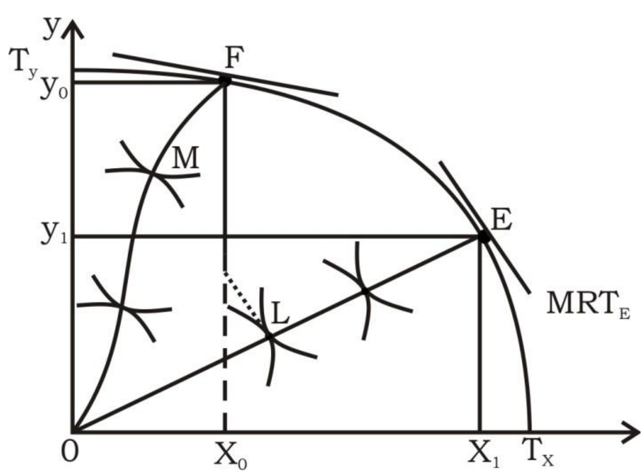
For instance, at point E, more y and the same amount of x are produced; while as L the output of both x and y are higher. Once we are on the contract curve, it is impossible to increase the output of either good without reducing the output of the other; thus, the allocation of resources among the producers of x and y is pareto optimal. It may be noted that there are several points on the contract curve of production and each of them represents the optimum allocation of labor and capital as between the two firms producing commodities x and y. But which one of them is best cannot be said on the basis of pareto criterion because movement along the contract curve in either direction represents such factor re-allocation which increases the output of one and reduces the output of another firm.

1.3 Optimal Composition of Output; Efficiency in product Mix

Given fixed quantities of commodities, the consumption efficiency ensures their efficient exchange between individuals. Likewise, the production efficiency condition ensures efficient use of resources, given fixed amount of resources, in producing different commodities. The third condition for pareto efficiency is product-mix efficiency. That is, the mix of commodities produced by the economy must reflect the preferences of those in the economy. The economy must produce along the production possibilities curve at a point that reflects the preferences of consumers. Intuitively this can be done by simply equating the rates of substitution between x and y on both production and consumption sides. Since MRT_{XY} shows the rate at which x and y are transformed in production and MRS_{XY} show the rate at which consumers are willing to exchange x and y the two ratios must be equal in the equilibrium. This gives the Pareto optimum condition for product- mix. That is, it requires equality between MRT in production and MRS in Consumption for every pair of commodities and for every individual. In the case of a very simple economy composed of only two commodities and two individual (A and B), pareto optimality in production and consumption requires that

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

The product-mix efficiency condition thus requires a simultaneous equilibrium in production and consumption as shown in Figure 1.3. For example, corresponding to point E on the production possibility curve, the total production OX_1 and OY_1 should be distributed between individuals A and B such that the slope of the tangent of point E (MRTxy) is the same as of the tangent at point L on the exchange efficiency locus ($MRS^{A}_{XY} = MRS^{B}_{XY}$). The same rules would apply for point F as well should this combination of OX_o and OY_o be chosen, given the resource endowments.



This means then product-mix being produced at points E and F on the production possibility curve is consistent with the preferences of the two consumers, under the different situations. Therefore, composition of production at point E and consumption pattern of individuals at point L would ensure maximum satisfaction and represent pareto optimal product mix. Likewise, same inference can be drawn with regard to point F on the production possibility curve which is consistent with the preferences of the two consumers at point M. This is because having attained equilibrium at these points, through any further re-allocation of resources and changing the product mix we cannot increase satisfaction of one without reducing the satisfaction of the other, or increase the satisfaction of both.

Role of value Judgments in welfare economics

Welfare economics examines the conditions for economic efficiency in the production of output and in the exchange of commodities, and equity in the distribution of income. The maximization of society's well-being requires the optimal allocation of inputs among commodities and the optimal allocation of commodities (i.e, distribution of income) among consumers. The conditions for the optimal allocation of inputs among commodities and exchange of commodities among consumers requires that

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

These are objective criteria devoid of ethical connotation or value judgments. On the other hand, it is impossible to objectively determine the optimal distribution of income. This necessarily requires inter-personal comparisons of utility and value judgments. For example, imposing a tax of Rs. 1000 on individual A and giving it as a subsidy to individual B will certainly make B better off and A worse off. But who is to say that the society composed of both individuals is better or worse off as a whole? Determining this involves comparing the utility gained by individual B (i.e, making interpersonal comparison of utility). And even if A has a high income and B has a low income to begin with, different people will have different opinions on whether this increases social welfare, reduces it or leaves it unchanged.

Therefore, no entirely objective or scientific rule can be defined. There is a great controversy regarding whether value judgments should have any role to play in welfare economics. Robbins and his followers have been asserting that the inclusion of value judgments would make our subject unscientific and therefore, according to them, economists should refrain from making value judgments. On the other hand, majority of modern economists are of the view that economists should not deliberately avoid making value judgments. If there is wide consensus about them among the community. Using his knowledge of economics together with these value judgements he should comment upon desirability or otherwise of certain policies and issues.

As regards the welfare of individual is concerned, it can be measured in ordinal terms by specifying preferences. For instance, if an individual chooses state a rather than state b, it shows that his welfare is grater in state a then in state b, Thus, choice by an individual is an objective test for knowing and comparing his welfare in different economic states. Therefore, what promotes individual welfare or not can be tested and verified. However, when welfare economics has to judge the social welfare, it encounters difficulties, because the measurement of social welfare is not an easy task and contains value judgements and interpersonal comparisons of utility. We cannot derive propositions of social welfare from choice of individuals comprising the society. Individual choices differ because various individuals have different tastes, preferences and ethical beliefs and therefore different value judgements. The vital issues in welfare economics are concerned with social welfare and devising certain criteria to judge the social welfare. Therefore, welfare economics cannot be purely objective or free from value judgements.

According to Vilfredo Pareto the social welfare depends upon the welfare of the individuals comprising the society and, according to his optimality criterion, if at least one individual is made better off by certain economic reorganization and no one being made worse off, the social welfare increases, that is, if an economic reorganization increases the welfare of one without reducing the welfare of any other, then the social welfare increases. When a certain economic state is reached, when through any reorganization it is not possible to make at least one individual better off with no other being worse off, this is called the state of maximum social welfare or Pareto optimum. Also, Nicholas kaldor and John Hicks propounded a compensation principle of welfare which is free from value judgements. According to this compensation principle, if a change in economic organization increases the welfare of some and reduces the welfare of others, and those who again in welfare are able to compensate the losers and still be better off than before, then he change in economic organization will increase the social welfare. Abraham Bergson has pursued a different line of approach to welfare economics. He has propounded the concept of social welfare function in which a set of value judgements is explicitly introduced and with this social welfare function, the economists can judge the desirability of certain economic reorganization or policy changes. These value judgements, according to Bergson, “must be determined by its compatibility with

the values prevailing in the community the welfare of which is being studied”. Followers of Abraham Bergson like Samuelsson and I.M.D. Little are of the view that welfare economics cannot be separated from value judgements, because any statement about increase or decrease of social welfare necessarily involves value judgements. Since welfare economics has been developed to make policy recommendations to promote social welfare, economists cannot escape from introducing ethical norms or value judgements.

1.4 Summary

- Welfare economics studies the conditions under which the solution to the general equilibrium model can be said to be optimal. It examine the conditions for economic efficiency in the production of output and in the exchange of commodities, and for equity in the distribution of income.
- Pareto was the first economist who provided a positive criterion for comparing alternative states of the economy the paretian criterion says that if it is possible to improve the standard of atleast one person in moving from state 1 to state 2 without decreasing the standard of standard of anybody else, then state 2 is ranked superior to state by society. In other words it is desirable to move from state 1 to state 2 and this movement is considered as pareto improvement. However, when it is not possible to improve the standard of someone else.
- The basic marginal conditions of pareto optimality may be summarized as follows:

  (a)Marginal condition of Exchange optimality: It means that the marginal rate of substitution (MRS) between any pair of goods must be the same for all the consumers.

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

  (b)Marginal condition for production optimality That is, the marginal rate of technical substitution (MRTS) between any pair of factors must be equal for all commodities and all firms.

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

  (c)Marginal condition in product Mix:

  It means that the marginal rate of transformation (MRT) between any pair of goods must be equal to the marginal rate of substitution for any pair of goods.

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

- The value of judgements are unavoidable in welfare economics as ‘welfare’ itself is an ethical term. Any theorems pertaining to choices among various situations to maximize welfare are also ethical and must rest on some obvious or hidden value judgements.
- Value judgements are open to argument, criticism and disagreement. As a result, welfare theory which depends on value judgements is bound to be normative in character

Unit- 02: New Welfare Economics

Structure:

2.0 Learning Objectives

After studying this module, you shall be able to

- Know about the theory of 'second best'
- Understand Arrow's Impossibility Theorem
- Understand Rawls' 'Theory of Justice'

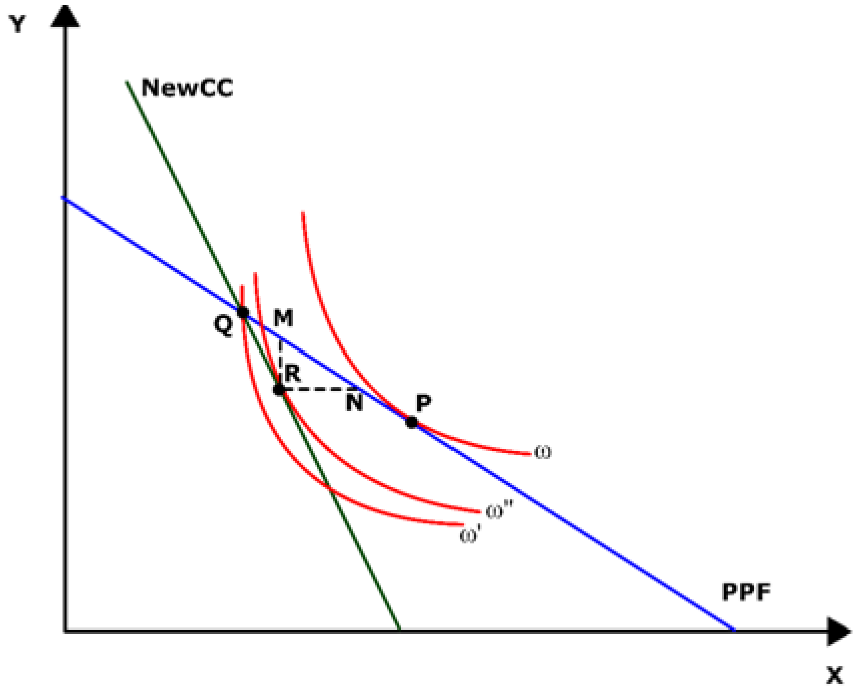
2.1 Introduction

The theory of second best concerns a situation when one or more optimality conditions cannot be satisfied. Arrow's Impossibility Theorem also says that any Social Welfare Function (SWF) cannot satisfy all the optimality conditions simultaneously. These optimality conditions include Non- Dicatatorship, Unrestricted domain, Weak Pareto criterion and Independence of Irrelevant Alternatives. Rawls' theory of justice builds on the social contract tradition to offer an alternative to utilitarianism. Rawls singles out justice – not maximum welfare or efficiency – as "the first virtue of social institutions".

2.2 The Theory of Second Best

When one optimality condition in an economic model cannot be satisfied, then opting the next best solution involves changing other variables away from the values that would otherwise be optimal. In an economy with some un-correctable market failure in one sector, government intervention to correct market failures in another related sector with the intent of increasing overall economic efficiency may actually decrease overall economic efficiency. So, practically it is always better to let two market imperfections cancel each other out rather than making an effort to fix either one. Thus, it may be optimal for the government to intervene in the second market in a way that does not affect the first market. Therefore the theory advises that there is a need to study the details of the situation before jumping to the theory-based conclusion because an improvement in market perfection in one area may not necessarily imply a global improvement in efficiency. For Example: There exists a monopoly that created pollution as an outcome of its production process and this pollution causes harm to the river nearby affecting the outcome of the fishery industry in a negative way. Suppose in addition that there is nothing at all that can be done about the pollution without also reducing production. The government can however break up the monopoly of the firm creating pollution. But, if the government does this i.e. increasing competition in this market increases production and because pollution is an outcome of the production so, with increase in production, pollution also increases. Thus, it is not clear that eliminating the monopoly increases efficiency. Gains from trade in coal will increase, but externalities from pollution will increase as well, possibly outweighing the gains from trade.

This can be easily learned from the following diagram as well



Consider a typical optimization problem with a given production possibility frontier (PPF) considered as a boundary condition, indifference curves (green curves, in this case representing an individual welfare function, ω) and the optimum point is where the PPF is tangent to ω (point P). Since this points lies on both, the transformation line and an indifference curve, it defines the production and consumption optima.

When a new constraint condition (red curve) is drawn, it can be easily seen that point P is no longer attainable because we are now at a lower Indifference curve. Q could be a second best solution, since it lies both on PPF and New CC. However, as the definition points out, the second best point would be R, inside the transformation line. This is so because an improvement on welfare can only be attained by moving to point R i.e. movement to a higher Indifference curve, which means an increase in welfare. (ω''). The segment MN is technically more efficient than R, but since the points on this segment are not attainable, R is the second best solution.

2.3 Arrow's Impossibility Theorem

In social choice theory, Arrow's impossibility theorem states that, when voters have three or more distinct alternatives, no SWF can convert the ranked preferences of individuals into a complete and transitive preference ranking while also meeting the criterion of Unrestricted Domain(U), Weak Pareto Criterion(P), Independence of Irrelevant Alternatives(I) and Non Dictatorship(ND).

Social Choice Rule (SCR): A SCR is a rule to derive a Social Preference Relation from individual preference relations. Formally, a SCR is a functional relation specified by the function $f : Rn \rightarrow R$, such that, $(\forall(R1, ..., Rn) \in On)$ and $[f(R1, ..., Rn) = R]$, where $R \in R$, O is the set of orderings. That is, for any given profile of individual orderings $(R1, ..., Rn) \in On$, function f produces one and only preference relation R, called social preference relation. However all along we will assume that individual preferences are rational, i.e., the individual preference are orderings: for all i= 1,2,3…..n , Ri belongs to O.

A Collective Choice Rule is a functional relation f such that for any set of n individual orderings R1,…..Rn (one ordering for each individual), one and only one social preference relation R is determined, R = f(R1,…..,Rn) .

Arrows' use of the expression Social Welfare Function says that a collective choice rule that specifies orderings for the society is called a Social Welfare Function. It is a particular type of collective choice rule such that each social preference that is determined by an ordering, i.e. reflexive, complete and transitive

If the social preference relation generated by a SCR, f, is an ordering we say that f is a Social Welfare Function (SWF). Let $D \subset On$. A SCR, $f : D \rightarrow O$, is called a Social Welfare Function, if f such that: $(\forall(R1, ..., Rn) \in D)$ and $[f(R1, ..., Rn) \in O]$.

Condition O: A SCR, f, satisfies condition O if it is a SWF. That is, if the range of function f is the set O.

The four conditions that Arrow uses in his theorem are:

Condition U: Unrestricted Domain: A SCR f satisfies condition of 'unrestricted domain', if its domain is On, i.e., D = On. So, if a SCR f satisfies Condition U, f generates a social preference relation for every possible profile of rational individual preferences.

Condition P: Weak Pareto Criterion/Principle: A SCR f satisfies condition P, if $(\forall x, y \in X)$ $(\forall i \in N)$ $[xPiy \Rightarrow xPy]$. If everyone prefers x to y, then society must also prefer x to y.

Condition I: Independence of Irrelevant Alternatives : Take any $S \subset X$, and ANY two profiles of individual orderings, say (R1, ..., Rn) ∈ On and (R'1 , ..., R'n) ∈ On . Let f(R1,..., Rn) = R and f(R'1 ,..., R'n) = R' . A SCR f satisfies Condition I if the following holds:

$(\forall x, y \in S)(\forall i \in N)$ $[xRiy \Leftrightarrow xR'i\ y]$. Arrow requires that social choice over a set of alternatives must depend on the orderings of the individuals only over those alternatives, and not on anything else. Suppose the choice is between x and y, and the individual rankings of x and y remain same, but the rankings of x vis-à-vis some other alternative z changes or the rankings of z vis-à-vis some other alternative say w alters. What is required is that the social choice between x and y should still remain the same.

Condition ND: Non-Dictatorship: A SCR f satisfies condition ND, if there is no individual $i \in N$ such that $(\forall x, y \in X)((R1, ..., Rn) \in On)$ $[xPiy \Rightarrow xPy]$. This implies that in every context wherein the dictator has strict preference, his preference will prevail over the rest of the society. That is, there should be no individual such that whenever he prefers x to y, society must prefer x to y, irrespective of the preferences of everyone else.

Arrows' Impossibility Theorem therefore, says that there is no SWF that satisfies condition U, P, I, ND simultaneously. In order to prove this theorem if one tries to satisfy all the four conditions they will not get satisfied simultaneously. For example:

There exists a SWF $f: D \rightarrow O$ that satisfies conditions U, P, and ND, but does not satisfy condition I.

Then using the ‘Borda count’ method

X	Y	Z
Y	Z	X
Z	X	Y

In the above table each alternative is ranked 6 i.e. the first element in each row has rank 3, second one has rank 2 and last one has rank 3.

A	B	C
X	Y	Z
Y	Z	X
Z	X	Y

In the above table x gets a rank of 7, y gets 6 and z gets 5. So, z is independently irrelevant variable. So, Borda count violates condition I.

Another example: Consider 3 individuals 1, 2 and 3 and 3 alternatives x, y and z. Let individual 1 prefer x to y, and y to z, and individual 2 prefer y to z, and z to x, and individual 3 prefer z to x, and x to y. It can easily be checked that x can defeat y by two votes to oe, y can defeat z by the same margin, so by transitivity requires that x should defeat z in a vote too. But, in fact, z defeats x by two votes to one. Thus, the method of majority decisions leads to inconsistencies because conditions P, I and D are satisfied but condition U is violated.

Similarly, if U, P and I gets satisfied then ND will be violated or if U, P, ND are satisfied then I will be violated and vice versa. So, there is simply no possibility of getting a SWF such that the four conditions stated are satisfied simultaneously. This is also called Arrows’ Paradox.

2.4 Rawls' Theory of Justice

To illustrate Rawls' criterion of justice with a concrete example, we assume here that there are two people and only one good say wealth. Let x be a social state in which one persons' wealth is $1,000,000 and other persons' wealth is $0. Let y be a social state in which the wealth of both is $1000. Rawls' argues that the social choice between x and y. made from behind a veil of ignorance (without any prior knowledge) should be y. Not knowing whether he would be a millionaire or the pauper under x, each person ought to prefer y, because y is guaranteed to be a tolerable level of wealth. That is the Rawls' criterion is to opt for the state that maximises the utility of the person in the worst position, or to maximise the minimum utility. It is therefore called the maximum criterion.

Formally, let $x = (x_1, x_2, \ldots\ldots x_n)$ and $y = (y_1, y_2, \ldots. y_n)$ be distributions of one good among n people.

We say that x is Rawls' Superior to y, written xRy, if, $\min\{x_1, \ldots. x_n\} > \min\{y_1, \ldots., y_n\}$. For Instance: let,

x = (50, 100, 150) y = (90, 90, 90) z = (80, 250, 250)

Then the Rawls' criterion says that y is better than x, which is plausible; going from x to y sacrifices some total wealth (total wealth of x = 300 and total wealth of y =270) but gains lots of equality. However, the Rawls' criterion also says y is better than z, and in this case it sacrifices a great deal of total wealth (total wealth of z = 580) for the sake of some increase in equality. In fact, if real people named 1, 2 and 3 were choosing between y and z from behind the veil of ignorance, and if, like most real people, they were willing to take small risks for large potential gains, they would most likely choose z, in spite of Rawls' advice.

So, in a world with many goods and in which individuals tastes differ, the Rawls' criterion may be impossible to apply.

2.5 Summary

Thus Arrows' Impossibility Theorem is basically an example of the Theory of Second Best because in Arrows' paradox also, all the optimality conditions (U, P, I, ND) cannot be satisfied simultaneously. The most discussed case of such inconsistency is the so called paradox of voting. Rawls' theory of Justice on the other hand, offers a model of fair choice situation, it tries to establish justice by the means of fairness and equality. But the Rawls' criterion just like the fairness criterion, doesn't mesh well with the usual economic criterion

.Just as the Fairness criterion contradicts the more fundamental Pareto criterion, the Rawls' criterion can contradict some other well criterions of welfare economics such as Kaldor, Scitovsky and Samuelson criterion. But, one thing that is common to all the three models is that all three are set in accordance to the General Equilibrium analysis, but, can be extended to the Partial equilibrium case as well.

Unit- 03: Social Welfare Function

Structure:

3.0 Learning Objectives

After studying this module, you shall be able to

- Know the concept of social welfare function
- Understand the different social welfare functions such as: classical utilitarian social function, Weighted – sum – of – utilities welfare function, Rawlsian or minimax Social welfare function, Bergson – Samuelson welfare function.
- Learn how welfare is maximized in a society.

3.1 Introduction

SOCIAL WELFARE FUNCTION

Economists explain the concept of social welfare through social utility or social welfare function (SWF). A SWF is same kind of aggregation of individual utilities. It gives a way to rank different allocations that depends only on the individual preferences, and it is an increasing function of each individual's utility. A social welfare function is just some function of the individual utility functions: W (U, (x), u_2 (x)),…..u_n (x)),. Some of the few functional forms that a SWF can take are;

(1) Classical utilitarian or Benthamite welfare function.

(2) Weighted – sum – of – utilities welfare function

(3) Rawlsian or minimax Social welfare function.

(4) Bergson – samuelson welfare function

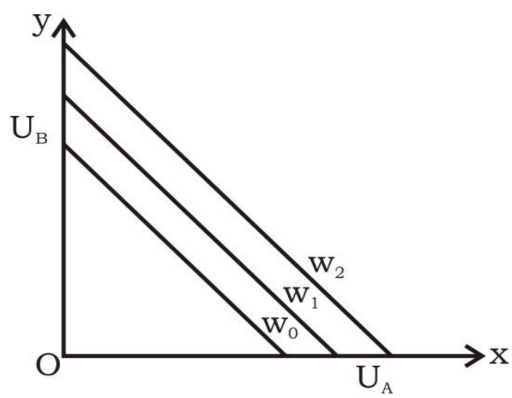
3.2 Classical utilitarian or Bentha-mite Social Welfare function

In this approach, individual's derive utility from consumption or income. Utility is a cardinal concept and can be compared across individuals. The utility functions of individual are additive and separable. The social welfare function W (u_1, u_2,...u_n) = $\sum_{i=1}^{n} u_i$ W = sum of individual utility or welfare function If an economy consists of two individuals A and B, U_A and U_B are their total utility functions then Social welfare function is

$W = U_A + U_B$

Graphically a social welfare function can be represented by social indifference curves or social welfare contours. A social difference curve is defined as the locus of utility combination of the two individuals which produce the same social welfare. If one individual's utility increases and another individual's utility decreases the effect on social welfare will be the same. In other words in the utilitarian approach the social value of an in cerement of utility is the same irrespective of to whom it accrues. The effect on social welfare of an additional unit of utility to individual A is the same had individual B received the same increment of utility. The distribution of utility is not important. It does not matter to whom the additional unit of utility accrues. That is every individual is treated similarly in the utilitarian approach. The social indifference curves are downward scoping straight lines with a slope of minus are. The social indifference curve in an indifference mapping are parallel to each other as shown in Figure1.

Figure1



3.3 Weighted sum of utilities welfare function

The weighted – sum – of – utilities welfare function is given below:

$$W = (u_1, u_2, \ldots u_n) = \sum_{i=1}^{n} a_i u_i$$

Where the weight $a_1, a_2, \ldots, a_n$ are supposed to be numbers indicating how important each agent's utility is to the overall social welfare. It is natural to rake each ai as being positive. If an economy consists of two individuals A and B, U_A and U_B are their total utility functions then social Welfare function is $W = a_1U_A + a_2U_B$

In this case also the social indifference curves are downward sloping straight lines.

3.4 Rawlsian Social welfare Function

Another important social welfare function has been proposed by John Rawe. According to John Rawe, for maximizing social welfare the poorest individual's welfare must be maximized. He is concerned with the welfare of the least well-off members of a society. His social welfare function is also known as minimax social welfare function and can be written as

$$W = (u_1, u_2, \ldots u_n) = \min\{u_1, u_2, \ldots u_n\}$$

This welfare function says that the social welfare of an allocation depends only on the welfare of the worst off individual, that is, the person with the minimal utility

This function can be graphically represented by a map of 150-welfare or social indifference cures as shown in Figure 2.

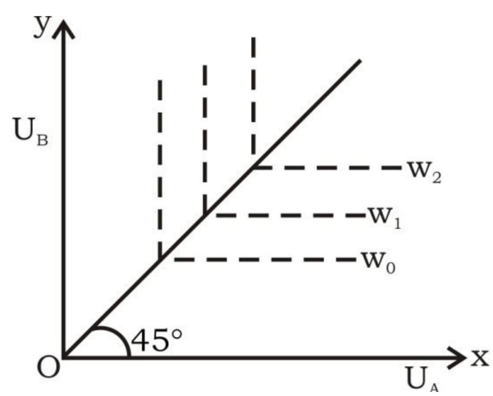


Figure 2

3.5 Bergson – Samuelson welfare function

The Bergson – Samuelson welfare function represents the utility levels of all individuals in the society. Bergson suggested the use of an explicit set of value judgments in the form of a social welfare function. If an economy consists of two individuals, this welfare function can be written as:

$$W = W\left[U_A\left(X_A, Y_A \ldots\right),\ U_B\left(X_B Y_B \ldots\right)\right]$$

Where

U_A (X_A, Y_A) is the utility of individual A
U_B (X_B, Y_B) is the utility of individual B

X ,Y are the two commodities

A,B are two individuals.

The above welfare function is directly a function of an individual's utility levels and indirectly that is why it is also known as individualistic welfare function. The advantage of such a function is that if each individual's utility depends only upon his own consumption, then standard economic efficiency rules apply and pare to efficient allocations and welfare maximisation are intimately related.

This function can be graphically represented by a map of 150-welfare or social indifference curves as sham in Figure 3.

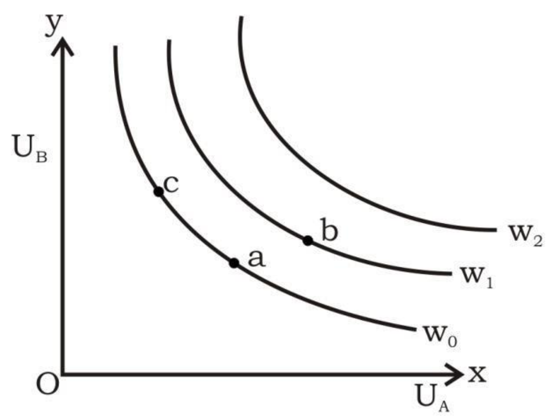


Figure 3

Three important characteristics of 150-welfare curves are given below:

Firstly, as regards the society's and the individual's indifference maps, the farmer is with respect to the utilities of all individuals and the letter is with respect to the commodities in the consumers basket. As shown in Figure 24.3, The utility of individual A increases while that of individual B remains constant, resulting in an increase of social welfare form the level W_0 and W_1. Hence a movement form point a to point b is a pare to improvement. Here some one's standard is improved with and decreasing another person's standard; and this very concept is khan as pareto principle. Secondly, given the level of social welfare, say wo, if the standard of individual B is improved by moving from a to c, Then the standard of individual A would automatically be worsened. That means the social indifference curves or welfare contours have a negative slope. Thirdly, the ease of a tradeoff between utilities of individuals A and B becomes difficult, given the constant welfare level, say wo, as society moves along the social welfare contour; this ensures the convexity to origin property of social indifference curves. Bergson- Samuelson welfare function is based on following assumptions;

(1) The distribution of income is assumed to be constant.

(2) All individuals are assumed to wave identical marginal utility of income.

(3) All person count equally interns of welfare

(4) Individual utility functions, U_A and U_B are independent of each other.

Grand utility possibility Frontier:

Utility possibility frontier shows the various combinations of utilities received by individuals A and B (i.e U_A and U_B) when the economy composed of individuals A and B is in general equilibrium or pareto optimum in exchange. It is derived from consumption contract curve. For one specific set of endowments, along utility possibility frontier, one point is pareto optimal. Further, different utility possibility frontier can be derived for each feasible point defined by the production possibility frontier. As production aggregates change, the dimension of the Edgeworth consumption box also change. Therefore by taking different points an the transformation curve, we can construct different Edgeworth Box diagram and consumption contract curve. From this we can derive all possible utility possibility frontier and different points of pareto optimum in production and exchange. By then joining the resulting points of pareto optimum in production and exchange, we get the Grand utility possibility frontier as shown in Figure 4.

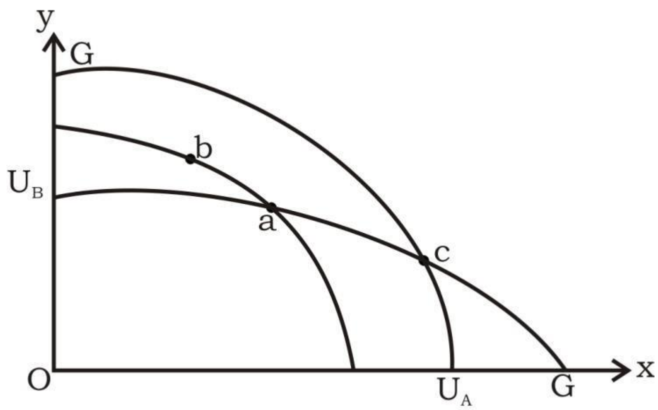


Figure 4

Grand utility possibility frontier (G-G-) is the envelope cover to the utility possibility frontiers at pareto optimum points of production and exchange. The grand utility possibility frontier indicates that no reorganization of the production-exchange process is possible that makes someone better off without, at the same time, marking someone else worse off. To determine the pareto optimum point in production and exchange at which social welfare is maximum, we need a social welfare function.

3.6 Maximisation of welfare

Now, let us superimpose grand utility passivity frontier on the social indifference curves representing social welfare function to find a unique optimum position of social welfare.

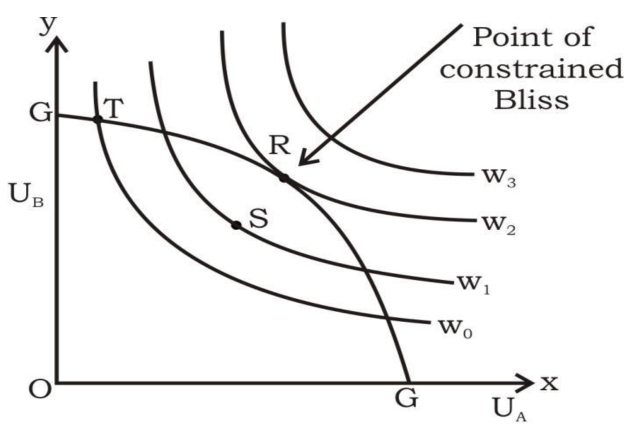


Figure 5

In figure 5 the grand utility possibility frontier (GG) is combined with the social welfare function shown by the set of social indifference contours w_0, w_1, w_2 and w_3. Social indifference curve w_2 is tangent to the grand utility possibility curve (GG) at point R.

Thus, point R represents the maximum possible social welfare given the factor endowments, state of technology and preference scales of the individuals. This point is called the point of bliss given the constraints regarding factor endowments and the state of technology. It may be noted that social welfare represented by social indifference curve w_3 is higher this social indifference curve w_2, but it is not possible to attain it, given the technology and factor endowment. Thus, from among a large number of pareto optimum points on the grand utility possibility curve, we have a unique optimum point R at which the social welfare is the maximum. Social welfare is maximized as the point of tangency of the grand utility possibility frontier with the highest possible social indifference curve. This point R in our Figure 24.5 represents economic efficiency as it lies on the grand utility possibility curve (GG). Besides economic efficiency, the optimum cant R reveals equitable distribution in the society as judges by the ethical judgment made by the society, and also represents the unique pattern of production of goods, unique distribution of goods between the individuals and unique combination of factors employed to produce the goods. It can be seen from Figure 24.5 that the point T. lying on the grand utility possibility frontier is the position of economic efficiency and, on the other hand, position S (below the grand utility frontier) is economically in efficient, But point S lies on a higher social indifference curve w1 then point T lying on a lower social indifference curve w_0. This means economically less efficient position S yields higher level of social welfare then the position T of economic efficiency. It is so because as judged by the society position S represents more equitable distribution then position T.

It is now clear that the bliss point is uniquely associated with the maximum social welfare and is pareto-efficient. It should, however, be noted that pareto-efficiency is a necessary, but not sufficient condition, for social welfare maximization. That is, the marginal efficient conditions only give pare to efficiency requirements; but they alone do not guarantee a welfare maximum.

3.7 Summary

A Social Welfare Function is a kind of aggregation of individual utilities. It gives a way to rank different allocations that depends only on the individual preferences, and it is an increasing function of each individual's utility.

In Classical utilitarian or Benthamite Social Welfare function approach, individuals derive utility from consumption or income. Utility is a cardinal concept and can be compared across, i.e.;

The weighted – sum – of – utilities welfare function is given below:

Where the weight are supposed to be numbers indicating how important each agent's utility is to the overall social welfare. It is natural to take each ai as being positive.

John Rawe proposed another important social welfare function for maximizing social welfare the poorest individual's welfare must be maximized. This is known as the Rawlsian Social welfare function and is represented by: $W = (u_1, u_2,\dots u_n) = \min\{u_1, u_2,\dots u_n\}$.

Grand utility possibility Frontier Utility possibility frontier shows the various combinations of utilities received by individuals A and B (i.e and) when the economy composed of individuals A and B is in general equilibrium or pareto optimum in exchange.

The highest point on the grand utility possibility frontier represents the maximum possible social welfare given the factor endowments, state of technology and preference scales of the individuals. This point is called the point of bliss given the constraints regarding factor endowments and the state of technology.

The bliss point is uniquely associated with the maximum social welfare and is pareto- efficient. It should, however, be noted that pareto-efficiency is a necessary, but not sufficient condition, for social welfare maximization. That is, the marginal efficient conditions only give pare to efficiency requirements; but it alone do not guarantee a welfare maximum.

Unit- 04: Economics of Information

Structure:

4.0 Learning Objectives

After studying this module, you will be able to

- Know the notion of asymmetry in information
- Learn about the different outcomes of asymmetric information
- Analyze the problem of adverse selection in various markets
- Identify the various market responses in the form of signaling and screening, to cope with the problem of adverse selection

4.1 Introduction

Asymmetric Information

Till now, it has been assumed that consumers and producers have complete information about the economic variables that are relevant for the choices they face. In this module, we will examine a situation where the characteristic of ‘perfect information’ does not exist. In such a case, one some parties have more information about the transaction than the others. This is a situation of asymmetric information.

The asymmetry in information can arise from two types of information—first, about the characteristic, wherein one side knows some characteristic which the other side would like to know; and second, about an action that one side can take and the other side cannot directly observe. The former is referred to as a situation of hidden characteristic and the latter is referred to as a situation of hidden action. In such situations, the markets perform differently, leading to inefficiencies and undesirable outcomes.

The present module focuses on hidden characteristics and the subsequent module discusses hidden action.

4.2 Hidden Characteristic: Adverse Selection

One of the outcomes of asymmetric information is adverse selection. Adverse selection is a hidden characteristic problem. It refers to the situations where one side of the market is unable in observing the ‘type’ or quality of the goods that other type of market is using. In other words, the seller knows more about the attributes of the good being sold than the buyer does. In such a situation, the buyer runs the risk of being sold a good of low quality. That is, the ‘selection’ of goods sold may be ‘adverse’ from the standpoint of the uninformed buyer.

The classic example of adverse selection is the market for used cars. Sellers of used cars know their vehicles’ defects while buyers often do not. The owners of the worst cars are more likely to offer them at a price higher than their actual marginal cost because of the advantageous information asymmetry.

Another example of adverse selection occurs in the labour market. The workers, who vary in their abilities, may know their own abilities better than do the firms that hire them. When a firm cuts the wage it pays, the more talented workers are more likely to quit, knowing they are better able to find other employment.

4.2.1 Market for Lemons

Let us look at the standard example of a market for second hand used cars to illustrate the implications of the problem of adverse selection.

Consider a market with 100 people who want to sell their used cars and 100 people who want to buy a used car. Everyone knows that 50 of the cars are good cars and 50 are 'lemons' (bad cars). The quality of each car is known to the current owner, but the prospective purchasers have no idea whether any given car is a good car or a lemon. The owner of a lemon is willing to give it for Rs.60, 000 and the owner of a good car is willing to give it up for Rs.1, 50,000. The buyers of the car are willing to pay Rs.2, 00,000 for a good car and Rs.90, 000 for a lemon. If it is easy to verify the quality of the cars there will be no problems in this market. The lemons will sell at some price between Rs.60, 000 and Rs.90, 000 and the good cars will sell at some price between Rs.1, 50,000 and Rs.2, 00,000. But if the buyers are unable to observe the quality of the car, then in that case the worth of the car will be guessed by the buyer.

Let us assume that if a car is equally likely to be a good car as a lemon, then a typical buyer would be willing to pay the expected value of the car. Using the numbers described above this means that the buyer would be willing to pay [½ (90,000) + ½(2, 00,000)] = Rs.1, 45,000.

At this price, the owners of the lemons would certainly be willing to sell their car, but the owners of the good cars wouldn't be willing to sell their cars—by assumption they need at least Rs.1, 50,000 to part with their cars. The price that the buyers are willing to pay for an "average" car is less than the price that the sellers of the good cars want in order to part with their cars. At a price of Rs.1, 45,000 only lemons would be offered for sale. But if the buyer was certain that he would get a lemon, then he wouldn't be willing to pay Rs.1, 45,000 for it! In fact, the equilibrium price in this market would have to be somewhere between Rs.60, 000 and Rs.90, 000. For a price in this range only owners of lemons would offer their cars for sale, and buyers would therefore (correctly) expect to get a lemon. In this market, none of the good cars ever get sold! Even though the price at which buyers are willing to buy good cars exceeds the price at which sellers are willing to sell them, no such transactions will take place.

It is worth contemplating the source of this market failure. The problem is that there is an externality between the sellers of good cars and bad cars; when an individual decides to try to sell a bad car, he affects the purchasers' perceptions of the quality of the average car on the market. This lowers the price that they are willing to pay for the average car, and thus hurts the people who are trying to sell good cars. It is this externality that creates the market failure. The cars that are most likely to be offered for sale are the ones that people want most to get rid of. The very act of offering to sell something sends a signal to the prospective buyer about its quality. If too many low-quality items are offered for sale it makes it difficult for the owners of high-quality items to sell their products.

4.2.2 Quality Choice

In the lemons model there were a fixed number of cars of each quality. Now let us consider a variation on that model where quality may be determined by the producers. We will show how the equilibrium quality is determined in this simple market.

Suppose that each consumer wants to buy a single umbrella and that there are two different qualities available. Consumers value high-quality umbrellas at Rs.240 and low-quality umbrellas at Rs.100. It is impossible to tell the quality of the umbrellas in the store; this can only be determined after a few rainstorms.

Suppose that some manufacturers produce high-quality umbrellas and some produce low- quality umbrellas. Suppose further that both high quality and low-quality umbrellas cost Rs.180 to manufacture and that the industry is perfectly competitive. In such a situation what would be the equilibrium quality of umbrellas produced.

Now suppose that consumers judge the quality of the umbrellas available in the market by the average quality sold, just as in the case of the lemons market. If the fraction of high-quality umbrellas is q, then the consumer would be willing to pay $p = 240q + 100(1 - q)$ for an umbrella. There are three cases to consider.

Only low-quality manufacturers' produce- In this case then the consumers would be willing to pay only Rs.100 for an average umbrella. But it costs Rs.180 to produce an umbrella, so none would be sold.

Only high-quality manufacturers produce- In this case the producers would compete the price of an umbrella down to marginal cost, Rs.180. The consumers are willing to pay Rs.240 for an umbrella, so they would get some consumers' surplus.

Both qualities are produced- In this case competition ensures that the price will be Rs.180. The average quality available must therefore have a value to the consumer of at least Rs.180. This means that we must have $240q + 100(1 - q) \geq 180$.

The lowest value of q that satisfies this inequality is $q = 4/7$. This means that if 4/7 of the suppliers are high-quality the consumers are just willing to pay Rs.180 for an umbrella.

The determination of the equilibrium ratio of high-quality producers is depicted in Figure.1. The horizontal axis measures q, the fraction of high-quality producers. The vertical axis measures the consumers' willingness to pay for an umbrella if the fraction of high-quality umbrellas offered is q. Producers are willing to supply either quality of umbrella at a price of $180, so the supply conditions are summarized by the bold coloured horizontal line at Rs.180.

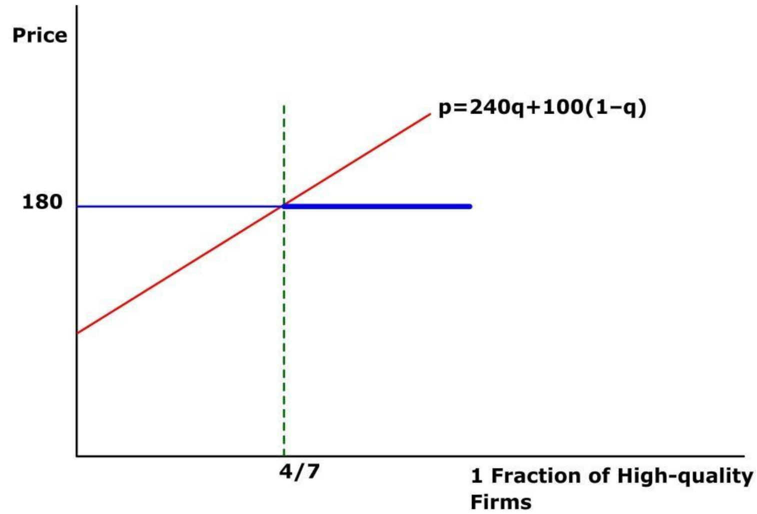


Figure 1: Equilibrium Quality

The slanted line represents the demand conditions: consumers are willing to pay more if the average quality is higher. Consumers are willing to purchase umbrellas only if $240q + 100(1 - q) \geq 180$; the boundary of this region is illustrated by the dashed line. The equilibrium value of q is between 4/7 and 1.

In this market the equilibrium price is Rs.180, but the value of the average umbrella to a consumer can be anywhere between Rs.180 and Rs.240, depending on the fraction of high-quality producers. Any value of q between 1 and 4/7 is equilibrium. However, all of these equilibria are not equivalent from the social point of view. The producers get zero producer surpluses in all the equilibria, due to the assumption of pure competition and constant marginal cost. Here it is easy to see that the higher the average quality, the better off the consumers is. The best equilibrium from the viewpoint of the consumers is the one in which only the high-quality goods are produced.

Now let us change the model a bit. Suppose that each producer can choose the quality of umbrella that he produces and that it costs Rs.180 to produce a high-quality umbrella and Rs.170 to produce a low-quality umbrella.

Suppose that the fraction of producers who choose high-quality umbrellas is q, where $0 < q < 1$. Consider one of these producers. If it behaves competitively and believes that it has only a negligible effect on the market price and quality, then it would always want to produce only low-quality umbrellas. Since this producer is by assumption only a small part of the market, it neglects its influence on the market price and therefore chooses to produce the more profitable product.

But every producer will reason the same way and only low-quality umbrellas will be produced. But consumers are only willing to pay Rs.100 for a low-quality umbrella, so there is no equilibrium. Or the only equilibrium involves zero production of either quality of umbrella! The possibility of low-quality production has destroyed the market for both qualities of the good!

4.3 Market Responses to Adverse Selection

From the above discussion, it is evident that asymmetric information can sometimes lead to a lemons problem: Because sellers know more about the quality of a good than buyers do, buyers may assume that quality is low, causing price to fall and only low-quality goods to be sold. Markets respond to the problems of asymmetric information in many ways. One of them is signaling, which refers to activities taken by an informed party for the sole purpose of credibly revealing his private information. The other is screening, wherein an uninformed party takes actions to induce the informed party to reveal private information.

4.3.1 Market Signaling

In the case of market for lemons, the owners of the good cars have an incentive to try to convey the fact that they have a good car to the potential purchasers. They would like to choose actions that signal the quality of their car to those who might buy it. One sensible signal in this context would be for the owner of a good used car to offer a warranty. This would be a promise to pay the purchaser some agreed upon amount if the car turned out to be a lemon. Owners of the good used cars can afford to offer such a warranty while the owners of the lemons can’t afford this. This is a way for the owners of the good used cars to signal that they have good cars. In this case, signalling helps to make the market perform better. By offering the warranty—the signal—the sellers of the good cars can distinguish themselves from the sellers of the bad used cars.

Let us consider a simple model of the education market to examine how signalling works. Suppose that we have two types of workers, able and unable, in a competitive market. The able workers have a marginal product of a2, and the unable workers have a marginal product of a_1, where $a_2 > a_1$. Suppose that a fraction b of the workers are able and 1 − b of them are unable. For simplicity we assume a linear production function so that the total output produced by L_2 able workers and L_1 unable workers is a_1L_1+a2L_2.

If worker quality is easily observable, then firms would just offer a wage of $w_2 = a_2$ to the able workers and of $w_1 = a_1$ to the unable workers. That is, each worker would be paid his marginal product and there would be an efficient equilibrium.

But if a firm can't observe the marginal products and distinguish the types of workers, then the best that it can do is to offer the average wage, which is $w = (1-b)a_1+ba_2$. As long as the good and the bad workers both agree to work at this wage there is no problem with adverse selection. And, given the assumption about the production function, the firm produces just as much output and makes just as much profit as it would if it could perfectly observe the type of the worker.

However, suppose now that there is some signal that the workers can acquire that will distinguish the two types. For example, suppose that the workers can acquire education. Let e_1 be the amount of education attained by the type 1 workers and e_2 the amount attained by the type 2 workers. Suppose that the workers have different costs of acquiring education, so that the total cost of education for the able workers is c_2e_2 and the total cost of education for the unable workers is c_1e_1. These costs are meant to include not only the rupee costs of attending school, but also the opportunity costs, the costs of the effort required, and so on.

Now there are two decisions to consider. The workers have to decide how much education to acquire and the firms have to decide how much to pay workers with different amounts of education. Let us make the extreme assumption that the education doesn't affect worker productivity at all. It turns out that the nature of the equilibrium in this model depends crucially on the cost of acquiring education.

Suppose that $c_2 < c_1$. This says that the marginal cost of acquiring education is less for the able workers than the unable workers. Let $e*$ be an education level that satisfies the following inequalities:

$$[(a_2 - a_1) / c_1] < e* < [(a_2 - a_1) / c_2]$$

Given the assumption that $a_2 > a_1$ and that $c_2 < c_1$ there must be such an $e*$.

Now consider the following set of choices: the able workers all acquire education level $e*$ and the unable workers all acquire education level 0, and the firm pays workers with education level $e*$ a wage of a_2 and workers with less education than this a wage of a_1. Note that the choice of the education level of a worker perfectly signals his type.

Now the question is whether the workers are behaving rationally given the wage schedule they face. Would it be in the interest of an unable worker to purchase education level $e*$? The benefit to the worker would be the increase in wages $a_2 - a_1$. The cost to the unable worker would be $c_1 e*$. The benefits are less than the costs if

$$a_2 - a_1 < c_1 e*.$$

But this condition holds by the choice of $e*$. Hence the unable workers find it optimal to choose a zero educational level.

Is it actually in the interest of the able workers to acquire the level of education $e*$? The condition for the benefits to exceed the costs is

$$a_2 - a_1 > c_2 e*,$$

and this condition also holds due to the choice of $e*$.

Hence this pattern of wages is indeed equilibrium: if each able worker chooses education level $e*$ and each unable worker chooses a zero educational level, then no worker has any reason to change his behaviour. Due to the assumption about the cost differences, the education level of a worker can, in equilibrium, serve as a signal of the different productivities.

However, this equilibrium is inefficient from a social point of view. Each able worker finds it in his interest to pay for acquiring the signal, even though it doesn't change his productivity at all. The able workers want to acquire the signal not because it makes them any more productive, but just because it distinguishes them from the unable workers. Exactly the same amount of output is produced in the signalling equilibrium as would be if there was no signalling at all. In this model the acquisition of the signal is a total waste from the social point of view.

This inefficiency arises because of an externality. If both able and unable workers were paid their average product, the wage of the able workers would be depressed because of the presence of the unable workers. Thus they would have an incentive to invest in signals that will distinguish them from the less able. This investment offers a private benefit but no social benefit. Signalling doesn't always lead to inefficiencies. Some types of signals, such as the used-car warranties described above, help to facilitate trade. In that case the equilibrium with signals is preferred to the equilibrium without signals. So signalling can make things better or worse; each case has to be examined on its own merits.

4.3.2 Screening

When an uninformed party takes an action to induce the informed party to reveal private information, the phenomenon is called screening.

A person buying a used car may ask that it be checked by an auto mechanic before the sale. A seller who refuses this request reveals his private information that the car is a lemon. The buyer may decide to offer a lower price or to look for another car.

In the insurance market, insurance companies have come up with a good number of screening devices. One of the most commonly used screening mechanisms is the medical examination, which screens an individual and categorizes him as healthy or sick. While such an examination prevents adverse selection, which is desirable from the company's point of view, socially, the test does not add value. If anything, it imposes a cost on the individuals and deprives a section of the society of the benefits of insurance (because insurance policies are priced very steeply for sick individuals).

4.4 Summary

- In many economic transactions, information is asymmetric, i.e., a situation where some people are better informed than others.
- Asymmetric information causes significant problems with the efficient functioning of a market.
- The asymmetry in information can arise from hidden characteristics, wherein one side knows some characteristics which the other side would like to know, but does not know.
- Hidden characteristics lead to situations where the type of the agents is not observable so that one side of the market has to guess the type or quality of a product based on the behavior of the other side of the market. This leads to the problem of adverse selection.
- In markets involving adverse selection too little trade may take place. A buyer of a car gets to trade with sellers of bad cars only; a health insurance company gets to trade with only unwell people.
- In situations of adverse selection, the informed party looks for indicators of hidden characteristics called signals, and often use a screening device to sort out customers according to their willingness to pay.

Block 02

Market Failure

Unit-05: Market Failure: Presence of Market Imperfection

Structure:

5.0 Learning Objectives

After going through this unit the learners will be able to understand

- Market Imperfection
- How Market imperfection leads to Market failure
- Market Failure
- factors responsible for Market Failure

5.1 Introduction to Market Imperfection

Market imperfection occurs when any economic market fails to meet the required standard of the hypothetical perfect or pure competition. Pure or perfect competition is an abstract, theoretical market structure that requires to meet a series of criteria. Since all real markets exist outside of the spectrum of the perfect competitive market framework, they can be classified as imperfect markets.

In fact, the individual buyers and sellers can influence prices and production under imperfect competition. The other related features of imperfect competitions includeabsence of full disclosure of information about products and prices, and high barriers to entry or exit in the market. Imperfect Market structure can broadly be categorized as monopolies, oligopolies, monopolistic competition, monopsonies, and oligopsonies.

The range of market imperfections is as wide as the range of all real-world markets-some are much or less efficient than others.

Some economists argue that any deviation from perfect competition models justifies government intervention, in order to promote increased efficiency in production or distribution. Other economists argue that government intervention may not always be necessary to correct imperfect markets. This is because government policy is also imperfect, and government actors may not possess the right incentives or information to interfere correctly. Finally, many economists argue government intervention is rarely, if ever, justified in markets.

5.1.1 Types of Imperfect Markets

When at least one condition of a perfect market is not met, it can lead to an imperfect market. Every industry has some form of imperfection. Imperfect competition can be found in the following structures:

Monopoly

This is a structure in which there is only one (dominant) seller. Products offered by this entity have no substitutes. These markets have high barriers to entry and a single seller who sets the prices on goods and services. Prices can change without notice to consumers.

Oligopoly

This structure has many buyers but few sellers. These few players in the market may bar others from entering. They may set prices together or, in the case of a cartel, only one takes the lead to determine the price for goods and services while the others follow.

Monopolistic Competition

In monopolistic competition, there are many sellers who offer similar products that can't be substituted. Businesses compete with one another and are price makers, but their individual decisions do not affect the other.

Monopsony and Oligopsony

These structures have many sellers, but few buyers. In both cases, the buyer is the one who manipulates market prices by playing firms against one another.

5.1.2 Market Imperfection and Market Failure

In reality, no market can ever have an unlimited number of buyers and sellers. Economic goods in every market are heterogeneous, not homogeneous, as long as more than one producer exists. A diverse range of goods and tastes are preferred in an imperfect market.Thus often the nature of market imperfection due to information asymmetry in various spheres and in different ways leads to market failure

As in an imperfect market, individual buyers and sellers can influence prices and production, there is no full disclosure of information about products and prices, and there are high barriers to entry or exit in the market, it leads to market failure as because a market failure occurs when there is an inefficient distribution of goods and services which leads to a lack of equilibrium in a free market.

5.2 Market Failure- Concept

It occurs when market operating without government, fail to deliver an efficient or optimal allocation of resources--- therefore economic and social welfare may not be maximized—leading to loss of allocative and productive efficiency (i.e. welfare losses for society). In other words, market failure refers to those situations in which the condition necessary to achieve the efficient solution in the market fail to exist or one contravened in one or other way or another.

Market failure is an extremely important feature of the observed markets which can be interpreted in three ways:-i) Over-Production, ii) Under-Production and iii) no-existence or no production of certain essential commodities.

In the real world, there is non-attainment of Pareto optimality due to a number of constraints in the working of perfect competition. It reflects failure of government policy in removing market distortions created by price controls and subsidies.

5.3 Factors Responsible for Market Failure

The factors responsible for failure of the market to achieve efficient solution are mainly due to

i) Incomplete markets
ii) Indivisibilities
iii) Common Property Resources
iv) Imperfect Markets
v) Incomplete Information (Information Asymmetry)
vi) Externalities
vii) Public Goods and Public Bads
viii) Natural Monopoly.

51.3.1 Incomplete markets:

Markets for certain things are incomplete or missing under perfect competition. The absence of markets for such things as public goods and common property resources is a cause of market failure. There is no way to equate their social and private benefits and costs either in the present or in the future because their markets are incomplete or missing.

5.3.2 Indivisibilities:

The Paretian optimality is based on the assumption of complete divisibility of products and factors used in consumption and production. In reality, goods and factors are not infinitely divisible.

Rather, they are indivisible. The problem of divisibility arises in the production of those goods and services that are used jointly by more than one person.

An important example is of road in a locality. It is used by a number of persons in the locality. But the problem is how to share the costs of repairs and maintenance of the road. In fact, very few persons will be interested in its maintenance. Thus marginal social costs and marginal social benefits will diverge from each other and Pareto optimality will not be achieved.

5.3.3 Common Property Resources:

Another cause of market failure is a common property resource. Common ownership when coupled with open access, would also lead to wasteful exploitation in which a user ignores the effects of his action on others. Open access to the commonly owned resources is a crucial ingredient of waste and inefficiency.

Its most common example is fish in a lake. Anyone can catch and eat it but no one has an exclusive property right over it. It means that a common property resource is non-excludable (anyone can use it) and non-rival (no one has an exclusive right over it). The lake is a common property for all fishermen.

When a fisherman catches more fish, he reduces the catch of other fishermen. But he does count this as a cost, yet it is a cost to society. Because the lake is a common property resource where there is no mechanism to restrict entry and to catch fish. The fisherman who catches more fish imposes a negative externality on other fishermen so that the lake is overexploited.

This is called the tragedy of the commons which leads to the elimination of social gains due to the overuse of common property. Thus when property rights are common, indefinite or non-existent, social costs will be more than private costs and there will not be Pareto Optimality.

5.3.4 Imperfect Markets:

Pareto efficiency increases under perfect competition. But it declines under market distortions or imperfections. Let us consider a case of monopoly. Initially, monopoly equilibrium is at point E where the private marginal cost curve, PMC, cuts the marginal revenue curve, MR, from below.

The monopolist produces OQ_1 output at OP_1 price. But the production process generates smoke in the air. Therefore, the pollution board levies a tax equal to TE on the monopoly firm. The imposition of a pollution tax is, in fact, a fixed cost to the monopoly firm. Now the social marginal cost curve cuts the marginal revenue curve at point e.

The monopolist increases the price of his product from OP_1 to OP_2 and restricts output to OQ_2 and thereby reduces consumers' surplus to $Q_2 MLQ_1$ ($= OQ_1 LP_1 – OQ_2 MP_2$). In fact, $Q_2 MLQ_1$ is the social cost of OQ_2 output. But the net loss to society is $Q_2 MLQ_1 – TE= eMLT$, the shaded area in the figure.

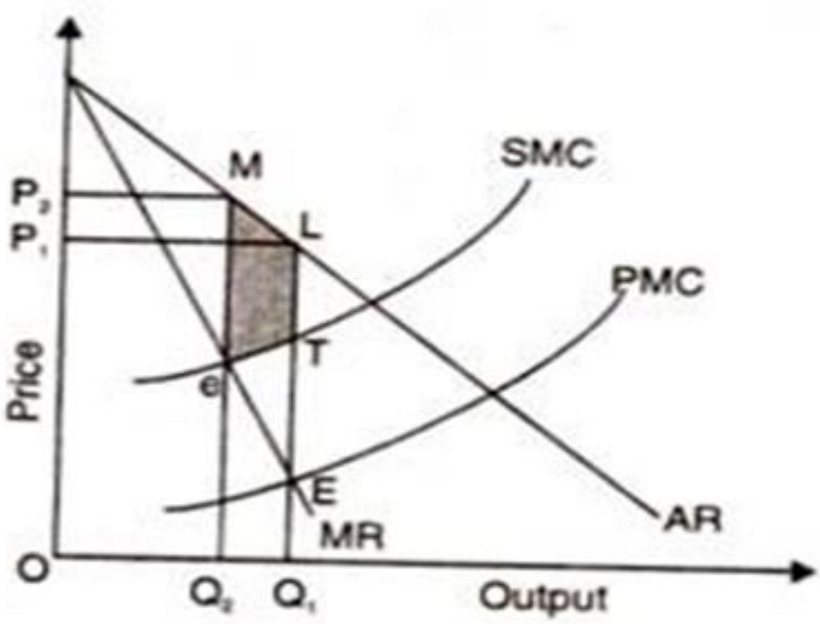


Fig.5.3.4 Imperfect Markets

5.3.5. Asymmetric Information:

Pareto optimality assumes that producers and consumers have perfect information regarding market behaviour. But according to Joseph Stiglitz, "In the real world, there is asymmetric (incomplete) information due to ignorance and uncertainty on the part of buyers and sellers. Thus they are unable to equate social and private benefits and costs."

Suppose a producer introduces a new antipollution device in the market. But it is very difficult for him to predict the current demand of his product. On the other hand, consumers may be ignorant about quality and utility of this anti-pollution device. In some cases, information about market behaviour in the future may be available but that may be insufficient or incomplete. Thus market asymmetries, fail to allocate efficiently.

5.3.6. Externalities:

The presence of externalities in consumption and production also lead to market failure. Externalities are market imperfections where the market offers no price for service or disservice. These externalities lead to malallocation of resources and cause consumption or production to fall short of Pareto optimality.

Externalities, lead to the divergence of social costs from private costs, and of social benefits from private benefits. When social and private costs and social and private benefits diverge, perfect competition will not achieve Pareto optimality.Because under perfect competition private marginal cost (PMC) is equated to private marginal benefit (i.e. the price of the product).

5.3.6.1 Positive Externalities of Production:

According to Pigou, when some firm renders a benefit or cost of a service to other firms without appropriating to itself all the benefits or costs of his service, it is an external economy of production. External economies of production accrue to one or more firms in the form of reduced average costs as a result of the activities of another firm.

In other words, these economies accrue to other firms in the industry with the expansion of a firm. They may be the result of reduced input costs which lead to pecuniary external economies. Whenever external economies exist, social marginal benefit will exceed private marginal benefit and private marginal cost will exceed social marginal cost.

This is illustrated in Figure 5.5.6.1 where PMC is the private marginal cost curve or supply curve of firms. The demand curve D intersects the PMC curve at point E and determines the competitive market price OP and output OQ.

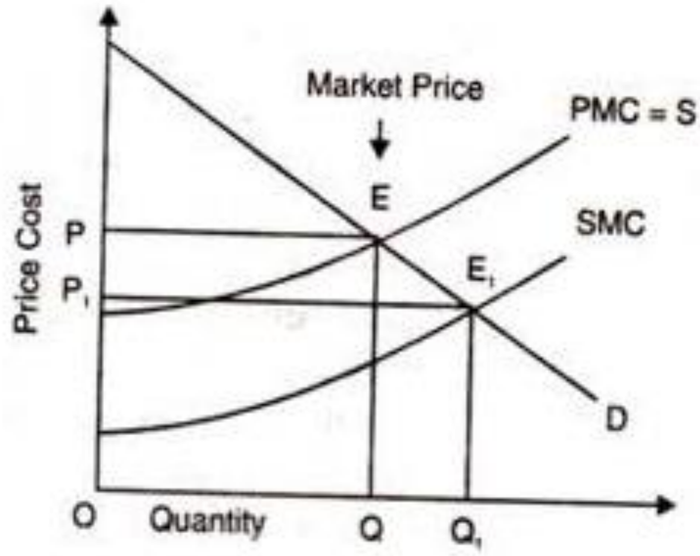


Fig. 5.5.6.1 Positive Externalities of Production

SMC is the social marginal cost curve which intersects the demand curve D at point E_1 and determines the social optimum output level OQ_1 at price OP_1. Since for every unit of output between OQ and OQ_1 social marginal cost (OP_1) is less than the competitive market price OP, its production involves a net social gain equal to QQ_1.

5.3.6.2 Negative Externalities of Production:

When the production of a commodity or service by a firm affects adversely other firms in the industry, social marginal cost is higher than social marginal benefit. Suppose, a factory situated in a residential area emits smoke which affects adversely health and household articles of the residents.

In this case, the factory benefits at the expense of residents who have to incur extra expenses to keep themselves healthy and their households clean. These are social marginal costs because of harmful externalities which are higher than private marginal cost and also social marginal benefit.

This is illustrated in Fig. 18.3 where the PMC curve which intersects the D curve at point E and determines the competitive price OP and output OQ. But the socially optimum output is OQ_1 and price is OP_1, as determined by the intersection of SMC and D curve at point E_1.
Thus the firms are producing Q_1 Q more than the social optimal output OQ_1. In this case, for every unit between Q_1 and Q, social marginal cost (SMC) is more than the competitive market price OP. Thus its production involves a social loss i.e.. $OQ - OQ_1 - QQ_1$.

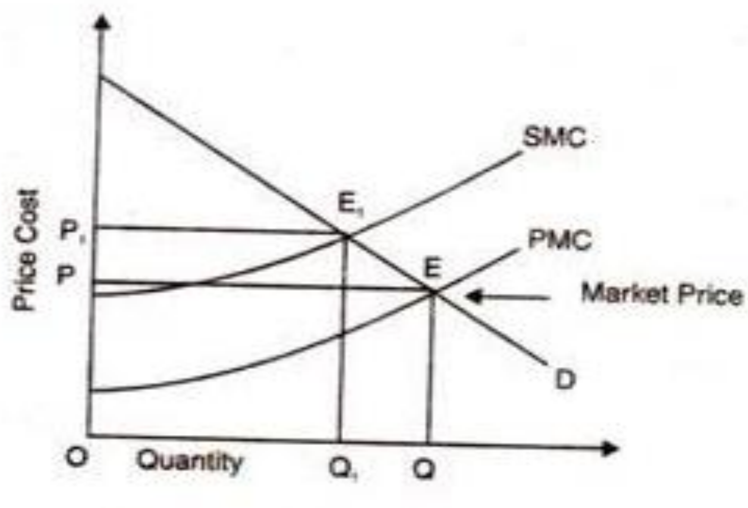


Fig. 5.3.6.2 Negative Externalities of Production

5.3.6.3 Positive and Negative Externalities in Consumption:

Positive Externalities in Consumption:

Externalities in Consumption lead to non-attainment of Pareto optimality. External economies of consumption arise from non-market interdependences of the satisfactions enjoyed by different consumers. An increase in the consumption of a good or service which affects favourably the consumption patterns and desires of other consumers is an external economy of consumption.

When an individual installs a TV set, the satisfaction of his neighbours increases because they can watch TV programmes free at his place. Here social benefit is larger and social cost is lower than the private benefit and cost. But the TV owner is likely to use his TV set to a smaller extent than the interests of society require because of the inconvenience and nuisance caused by his neighbours to him.

Negative Externalities in Consumption:

Negative externalities in consumption arise when the consumption of a good or service by one consumer leads to reduced utility (dissatisfaction or loss of welfare) of other consumers. Negative externalities in consumption arise in the case of fashions and articles of conspicuous consumption which reduce their utility to some consumers. For example, smokers cause disutility to non-smokers, and noise nuisance from stereo systems to neighbours etc. Such diseconomies of consumption prevent the attainment of Pareto optimality.

Suppose there are two room-mates A and B. Individual A likes to smoke while individual B likes clean air. Further, B's utility of consuming clean air is affected by individual A's smoking. This is explained in terms of Figure 5.5.6.3 (A) & (B). Initially, individual A's utility from smoking gives him 50 utilis at point A while individual B's consumption of clean air gives him 80 utilis at point B. When there are no externalities in consumption, the tangent at point A and point B are parallel to each other.

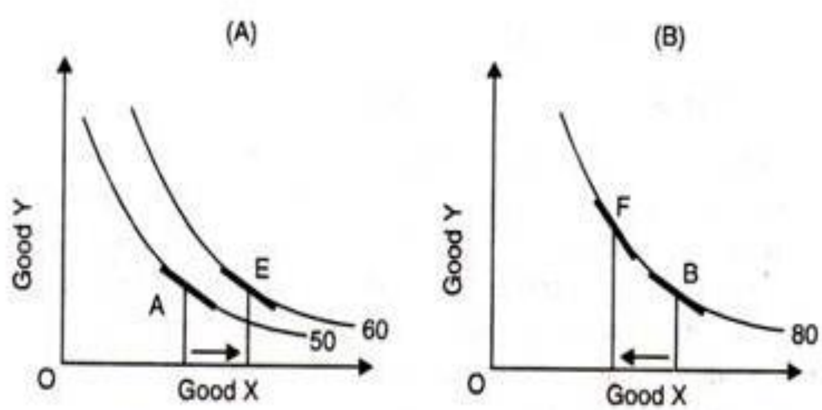


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Fig. 5.5.6.3

If individual A smokes at his leisure then his utility increases to 60 utilis and he moves to point E. The effect of individual A's smoking reduces the utility of clean air to individual B who moves from point B to point F on the same utility curve.

Individual A has moved on a higher utility curve from 50 to utility curve 60, but the non-smoker is on the same utility curve 80. Thus Pareto optimality is not attained because the utility of one consumer (smoker) A has increased whereas the utility level of the other consumer (non-smoker) B has been reduced.

5.3.7. Public Goods and Public Bads

Another cause of market failure is the existence of public goods. A public good is one whose consumption or use by one individual does not reduce the amount available for others. An example of a public good is water which is available to one person and is also available to others without any additional cost. Its consumption is always joint and equal.

It is non-excludable if it can be consumed by anyone. It is non-rival if no one has an exclusive rights over its consumption. Its benefits can be provided to an additional consumer at zero marginal cost. Thus public goods are both non-excludable and non-rival. Moreover, environmental quality is generally considered as a public good and when it is valued at market price, it leads to market failure.

The Paretian condition for a public good is that its marginal social benefit (MSB) should equal its marginal social cost (MSC). But the characteristics of a public good are such that the economy will not reach a point of Pareto optimality in a perfectly competitive market. Public goods create externalities.

The externality starts when the marginal cost of consuming or producing an additional unit of a public good is zero but a price above zero is being charged. This violates the Paretian welfare maximization criterion of equating marginal social cost and marginal social benefit. This is because the benefits of a public good must be provided at a zero marginal social cost.

Suppose potable water is supplied by the municipal corporation. There are two individuals A and B who use it. Both consume the same quantity of water. But they differ in how much they are willing to pay for any given quantity.

This is illustrated in Figure 5.5.7 where D_a and D_b are the demand curves of two individuals A and B respectively. Therefore, demand prices are OP_a and OP_b corresponding to a given quantity OW of water. The curve ΣD is the vertical summation of D_a and D_b curves.

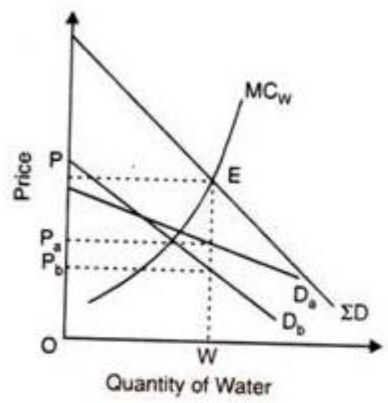

Fig. 5.3.7

The Lindhal equilibrium for a public good exists where the sum of the individual prices equal marginal cost. Therefore,

$OP = OP_a + OP_b = MC_W$

But each consumer is being charged a different price. This is a case of price discrimination because price OP_a is greater than price OP_b for the same quantity of water OW. Hence there is market failure.

5.3.7.1 PublicBads:

There are also public bads in which one person experiencing some disutility does not diminish the disutility of another, such as air and water pollution. Public goods and public bads cannot be handled by the institution of private property. K.E. Boulding has explained public bads with the following example: "If someone drives his car into my living room and pollutes it, One can sue him for damages. This is a private bad. But if someone congests the roads or pollutes the air, however, there is not much one can do about it as an individual. This is public bad."

Market failure is a necessary but not a sufficient condition for intervention. To be truly worthwhile, a government intervention must outperform the market or improve its functions. Second, the benefits from such intervention must exceed the costs of planning, implementation, and enforcement, as well as any indirect and unintended costs of distortions introduced to other sectors of the economy by such intervention.

The presence of decreasing cost or increasing return to scale -case of Natural Monopoly.

A natural monopoly exists in a particular market if a single firm can serve that market at lower cost than any combination of two or more firms. In other words, the presence of decreasing cost or increasing return to scale in the case of Natural Monopoly.

A **natural monopoly** is a monopoly in an industry in which high infrastructural costs and other barriers to entry relative to the size of the market give the largest supplier in an industry, often the first supplier in a market, an overwhelming advantage over potential competitors. Specifically, an industry is a natural monopoly if the total cost of one firm, producing the total output, is lower than the total cost of two or more firms producing the entire production. In that case, it is very probable that a company (monopoly) or minimal number of companies (oligopoly) will form, providing all or most relevant products and / or services. This frequently occurs in industries where capital costs predominate, creating large economies of scale about the size of the market which includes public utilities such as water services, electricity, telecommunications, mail, etc..**Natural monopolies were recognized as potential sources of market failure** as early as the 19th century; John Stuart Mill advocated government regulation to make them serve the public good.

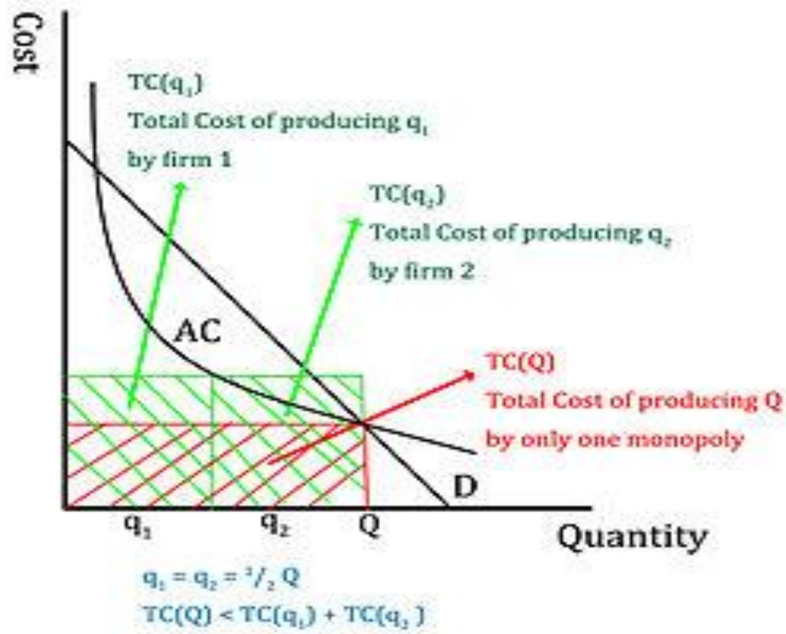

Fig. 5.3.7.1

A graphical explanation of the inefficiencies of having several competitors in a naturally monopolistic market

5.4 Summary

- Perfectly competitive markets are ideal as they guarantee maximization of social welfare. But, in the actual world, such markets are very hard to establish and maintain. Consequently, the contemporary world is described by a preponderance of imperfect markets.
- Economic efficiency of general equilibrium in the framework of Pareto optimality can be attained through exchange efficiency, Production efficiency and allocative efficiency.
- When market fail to reach optimum (conditions of Pareto optimality) the concept of market failure comes into picture. Some of the important reasons of market failure are:
    1. Failure of competition
    2. Imperfect information
    3. Externalities
    4. Existence of public goods.

- All types of imperfect competition (monopoly), oligopoly, monopolistic competition) leads to misallocation of productive resources and thus hampers the achievement of maximum social welfare

5.5 Key Words

Monopoly	This is a structure in which there is only one (dominant) seller.
Oligopoly	This structure has many buyers but few sellers.
Monopolistic competition	In monopolistic competition, there are many sellers who offer similar products that can't be substituted.
Monospony and oligospony	These structures have many sellers, but few buyers.
Asymmetric information	"Asymmetric information" is a term that refers to when one party in a transaction is in possession of more information than the other.
Externalities	Externalities pose fundamental economic policy problems when individuals, households, and firms do not internalize the indirect costs of or the benefits from their economic transactions.
Public bads	Public bads in which one person experiencing some disutility does not diminish the disutility of another, such as air and water pollution.
Public goods	A public good is one whose consumption or use by one individual does not reduce the amount available for others.

5.6 Model questions

- What is Market Imperfection?
- How Market imperfection leads to Market failure
- What is Market Failure?

- What are the factors responsible for Market Failure?

5.7 References

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Unit- 06: Incomplete information

Structure:

6.0. Learning Objectives

The learners will be able to

- Know about the concept of imperfect information.
- Understand the information problem
- Learn different types of asymmetric information
- Evaluate different problem caused by asymmetric information

6.1 Moral Hazard

Definition: Post-contractual Opportunism

The term MH originated from the **insurance** literature. It refers to the adverse effects, from the insurance company's point of view, that insurance can have on the insurer's behaviour.

A owner of a car might purchase accident insurance for his car and then could deliberately engineer an accident to collect the insurance sum.

K.Arrow (1964)- Economic agents could maximize their own utility at the expense of others in situations in which they cannot be made fully responsible for their acts. In other Words, MH is the post-contractual opportunism that arises because actions that have efficiency consequences are not freely observable and so the person taking them may choose to pursue his or her private interests at other's expense.

Examples:

When the performance of an economic agent is monitored more carefully at one or a few margins, he might concentrate and perform well in those measured dimensions, but might neglect or shirk in other dimensions.

-A student might regularly attend college (the measured dimension) but might be totally inattentive in the class-room or even be reading comic in the class room (the dimension difficult to monitor.)

-A labourer might fulfill the quantitative target fixed for obtaining his remuneration, such as the number of hours of work (which may easy to measure) and might neglect the qualitative aspect (which may be difficult to measure) Moral hazard might be a pervasive problem in team production where it is difficult to monitor the contribution of each individual agent separately.

6.2 Causes of Moral Hazard

The followings might all be responsible for Moral Hazard situations

- Asymmetry of Information
- Risk- Aversion
- High Measurement and Enforcement Costs
- Barriers to Contracting etc.

6.3 Solutions

- ✓ **Monitoring:** difficult to monitor quantity & quality of efforts but results of efforts may be monitored (hire a monitor to monitor the monitor), Market monitoring- markets monitored the managers
- ✓ **Incentive Contracts:**Incentive plans based on direct measures of contributions made by individual workers or groups may reduce MH.
- ✓ **Bonding:** In some industries, workers must post bonds to guarantee performance. The bond is sum of money that is forfeited if inappropriate behaviour is detected.They lose if completion is not as agreed.

6.4 Adverse Selection

High measurement cost in the absence of full information might result in adverse selection.Though the insurance literature had long recognized this problem, economists began to take serious note of this problem only after the appearance of George Ackerlof's " the market for lemons" (1970).

Example:

Student admission:

Admission into B.A. degree – requirement- only pass marks in the +2 Exam. and no other correlate of productivity or aptitude, whereas

Admission into other professional courses- requirement- performance in the +2 exam. and an entrance test where other correlates are monitored,

Then the Arts Colleges will experience adverse selection because the applicants who fail to qualify in the other courses might flock to Arts courses.

Example:

Second hand car market:- due to information asymmetry between the buyers and sellers it may be difficult /impossible for the buyers to differentiate between good and bad cars and hence the buyers may offer the same price even for the bad cars. Thus the adverse selection is due to asymmetry of information.

Example:

Money lenders: able to charge very high rates of interest but yet grant loans to those who would otherwise get no loan at all.

Organized money market: charges much lower rates of interest, but offer credit only to 'creditworthy' persons.

Money lenders are able to grant loan to 'high risks' because their

(a) personal knowledge about borrowers and

(b) special ability to enforce the contracts.

If any other person attempt to lend at the same high rate without knowing these conditions - he is likely to attract 'bad risk'- may lead to bankrupt.

6.5 Principal-Agent Problem

Agent is a person employed by another, designated as Principal, to act on his behalf. If the agent has acted within the scope of his authority, actions of the agent are binding on the principal. An agency relationship is established when a principal delegates some rights to an agent, who is bound by contract to represent the interests of the principal.

Example:

Principal-Agent relationship include:

Landlords and Tenants, Owners and Employees, Voters and elected representatives etc.

In hierarchies, when rights are transferred down an organizational ladder, except at the top and bottom levels, each individual is simultaneously a principal and agent. But the interests (utility functions) of the principals and agents do not coincide. So the agent's actions must be effectively constrained. Otherwise agents might make sub-optimal decisions when viewed from the perspective of the principal.

In Principal-Agent relationship, the agent is likely to have more information than the principal because

- He will have more information about his own actions, preferences and abilities, and
- It will cost him less to acquire information about the particulars affecting the individual tasks assigned to him by the principal.

Hence information is distributed asymmetrically between the two.

It is costly for the principal to measure the characteristics and performance of agents. So agents could engage in shirking and opportunistic behaviour.

Agent may have informational advantages in the form of "hidden actions" and "hidden information".

Hidden actions cannot be accurately observed or inferred by others, such as is the case, for example, with workers' (agent's) effort which cannot be costlessly measured by employers (principal).

The problem of hidden information arises when the principal is not in a position to determine whether the agents' actions, even if these could be cost-lessly observed, are in his interest or not-as in the case for example, of a Scan order by a physician (agent) for a patient (principal).Adverse Selection and Moral hazard Situations could develop in Principal-Agent Problems.

6.6 Summary

- Information asymmetry leads to principal agent problem.
- Principal- Agent Problem give rise to the problems of Adverse Selection and Moral Hazard Problem.

6.7 Key Words

Moral Hazard- Hidden action- Post – contractual opportunism.

Adverse Selection – Hidden Information while making the Contract

Principal-Agent Problem – Dichotomy in maximizing the utility functions of Principal and agents. For Example Landlord (Principal) and Tenant (Agent). This emanates from information asymmetry.

6.8 Model questions

1. What is Principal- Agent Problem?
2. What is Moral Hazard Problem?

3. What is Adverse Selection Problem?

6.9 References

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Unit 07: Externalities

Structure:

7.0 Learning Objectives

After going through the unit, learners will

- Understand the concept of externality
- Know about different types of externality
- Evaluate the problem caused by externalities
- Learn the solution to externalities problem
- Understand different solutions given by Pigou and Arrow

7.1 Introduction

An **externality** is the accompanying impact (whether positive or negative) of one agent's consumption or production activity on the utility or technology of another, where this impact is independent of markets or prices. For instance, a smoker's second-hand cigarette smoke that causes a bystander to have an asthma attack is a negative consumption externality. When a nurse gets a flu shot, she not only reduces her own chances of catching the flu, but also reduces the likelihood of transmitting the virus to others, a positive consumption externality. Similarly, the classic example from 1879 England of a confectioner's machinery making it difficult for a cardiologist next door to listen to the heartbeat of his patients is a negative production externality.

Externalities **pose fundamental economic policy problems when individuals, households, and firms do not internalize the indirect costs of or the benefits from their economic transactions**.

The resulting wedges between social and private costs or returns lead to inefficient market outcomes.

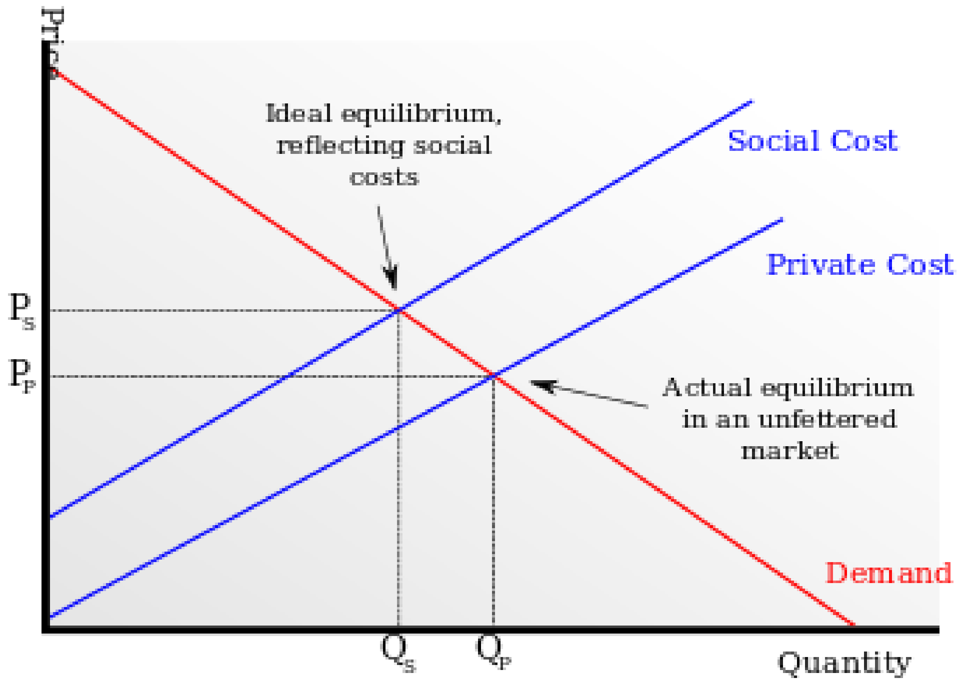


Fig 7.1 Social costs and Private cost

7.2 Externalities

An Externality is a cost or benefit resulting from some activity or transaction that is imposed or bestowed upon parties outside the activity or transaction. Sometimes it is called as spillover or neighborhood effects. In other words, Externality can be defined as the Third Party Cost or Benefit not reflected in market price.

- Real Externality or Technological externality: not reflected in market price
- Pecuniary Externality: embodied in market price

<u>Types</u>

- **Positive Externality**

- MSB > MSC
- indicates inefficiency because it reveals under production situation so market failure occurs

- **Negative Externality**
- MSC > MSB
- indicates inefficiency because it reveals over production situation so market failure occurs

Internalizing Externalities

The followings are the approaches to solve the problem of externalities:

1. Government - imposed taxes and subsidies
2. Private bargaining and negotiation
3. Legal rules and procedures
4. Sale or auction of rights to impose externalities
5. Direct government regulation

7.3 Consumption externality

In economics, consumption externalities exist **when the consumption of others matters explicitly and directly in the utility function of individuals** – that is, when people care intrinsically or are affected directly by knowledge about others' consumption.

This occurs when consuming a good cause either a positive or negative externality to a third party.

Positive consumption externality

When consuming a good gives a benefit to others. Examples include:

- Going to university. Your education gives benefit to rest of society (You can teach others)
- Taking medicine which prevents spread of infectious disease.

Positive consumption externality

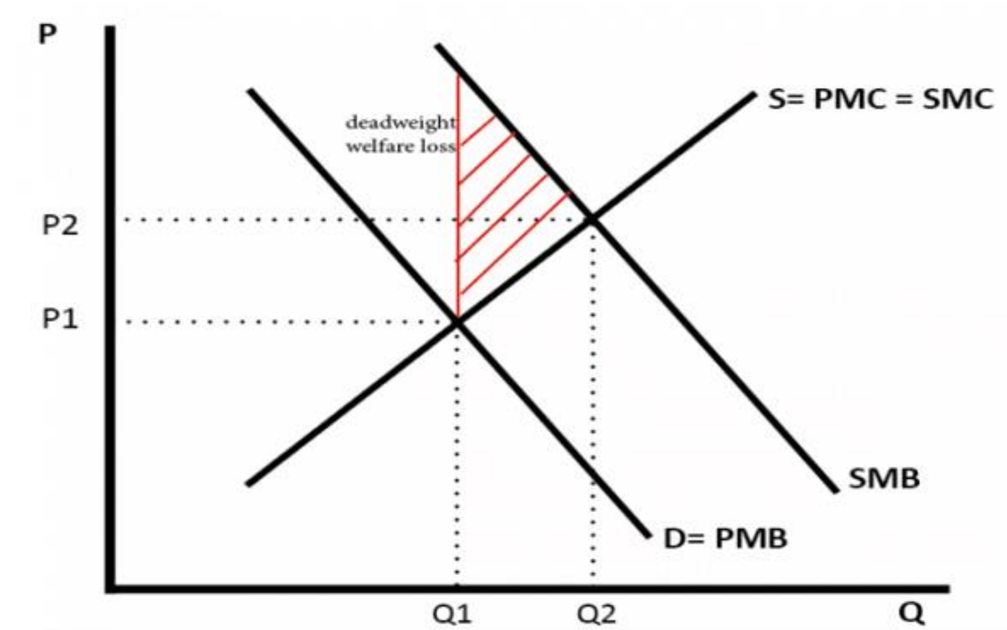


Figure 7.2 positive Consumption externalities

Because there is a benefit to others from your consumption, the social marginal benefit (SMB) is greater than private marginal benefit (PMB)

In a free market, there will be under-consumption of goods with positive consumption externalities.

Output in a free market will be at Q1, but social efficiency is at Q2 (where SMC = SMB)

Negative consumption externality

Consuming a good - causes, a harmful effect on third parties.

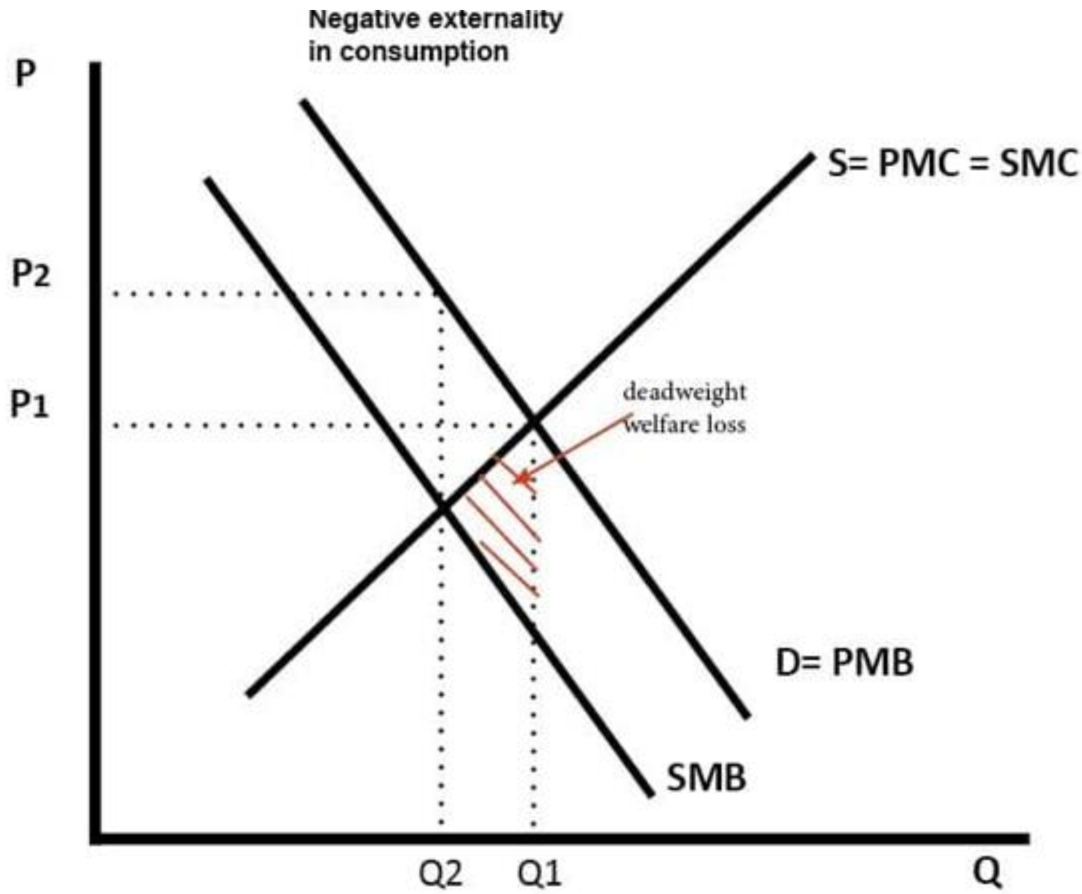


Fig 7.3 **Negative *consumption externality***

In this case, there will be over-consumption of goods with negative consumption externalities in a free market.

Example of negative externality in consumption

- e.g. smoking causes harmful effect to those who breathe in your smoke.

7.4 Production externality

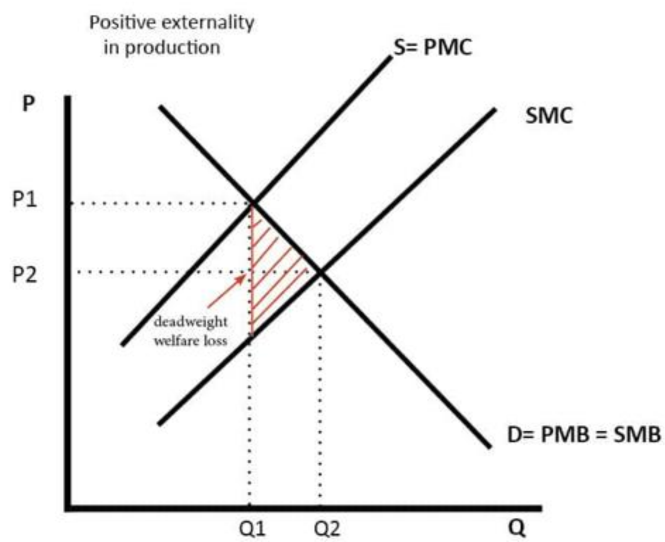
Production externality refers to a side effect from an industrial operation, such as a paper mill producing waste that is dumped into a river. Production externalities are usually unintended, and their impacts are typically unrelated to and unsolicited by anyone. They can have economic, social, or environmental side effects.

Production externalities can be measured in terms of the difference between the actual cost of production of the good and the real cost of this production to society at large. The impact of production externalities can be positive or negative or a combination of both.

Positive Externality in Production

This occurs when producing a good cause a benefit to a third party not directly involved.

Example: A farmer grows apple trees. An external benefit is that he provides nectar for a nearby beekeeper who gains increased honey as a result of the farmers' orchard.



Free market   Socially efficient

Fig: 7.4 Positive production externality

In this case, the social cost is less than the private cost. The beekeeper saves the cost of having to provide a source of nectar.

In this example, it works both ways. The beekeeper provides an external benefit to the apple grower because his bees help to fertilize the apple tree.

Other examples of positive externality in production

- A private school provides an external benefit because the workforce will be more educated in the future and it saves the cost of government education in a publically-funded school.
- Providing a cafe which employs previously homeless people helps to reduce the social problem of homelessness.

Negative Externality in Production

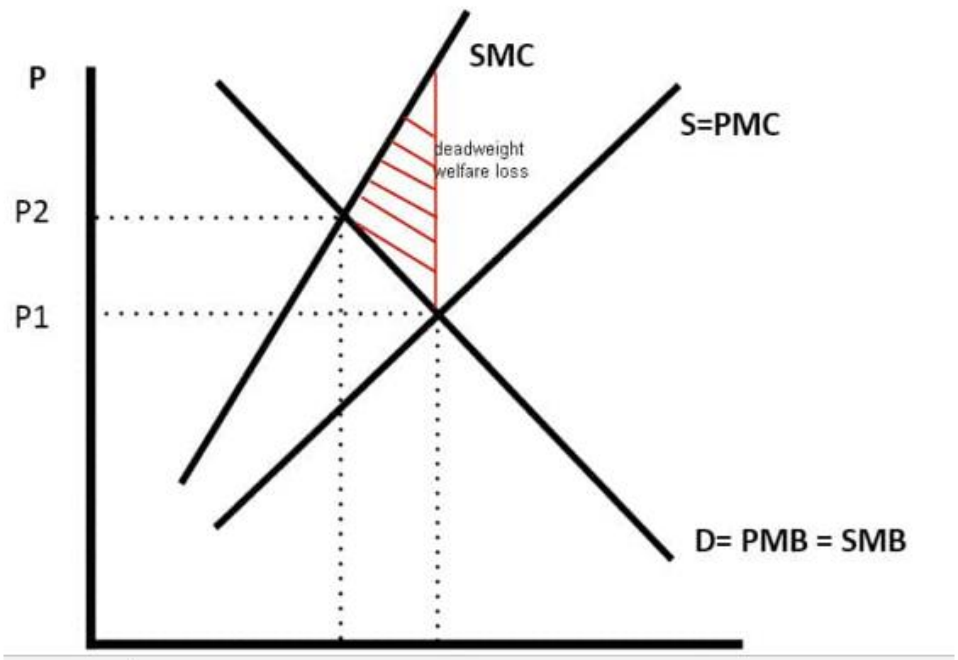


Fig: 7.5 Positive production externality

his is when producing a good causes an external cost to a third party. Therefore, the social cost of production is greater than the private cost

Making furniture by cutting down rainforests in the Amazon leads to negative externalities to other people. Firstly it harms the indigenous people of the Amazon rainforest. It also leads to higher global warming as there are fewer trees to absorb carbon dioxide. The social cost of making furniture is greater than the private cost to a firm.

Other examples of a negative externality in production

- Non-organic vegetable growing. Farmers use fertilizers and pesticides which harm insects and also can get into the food chain, causing health problems in the future.

Pigou on Externalities

In 1920, Arthur C. Pigou wrote *The Economics of Welfare* which is an early exposition of this concept.
Pigou noted that private business pursued their own marginal private interests. However, industrialists were not concerned with any external costs to others in society. In other words, they had no incentive to internalise the full social costs of their actions and this led to a deadweight welfare loss.

Pigou used an example of a contractor building a factory in the middle of a neighbourhood. The factory leads to external costs faced by those living in the locality. These external costs include:

- Pollution,
- Congestion
- Damage to health
- Loss of light

Pigou also used the example of alcohol. Alcohol has a private benefit to firms but also the sale of alcohol leads to additional costs to society in terms of increased demand for healthcare and law and order.

<u>Pigouvian tax</u> – A tax placed on a good to take into account these external costs and move output closer to the level of social efficiency.

Overcoming externalities

To overcome externalities, we require some form of government intervention

- **Tax.** To reduce consumption of negative externalities, we can place a tax on goods with negative externalities
- Subsidy. To increase consumption of positive externalities, we can place a subsidy on these goods.
- Regulation. The government may place regulations which limit the amount of pollution.
- Nudges and behavioural economics – The government could place incentives and make it easier to choose less costly environmental choices.

7.5 Solution to Externality Problem

As externalities are external to the workings of markets, the prices at which trades occur do not reflect their additional costs (in the case of negative externalities) or benefits (in the case of positive externalities). Consequently, the First Welfare Theorem typically fails, i.e., in the presence of externalities, the Walrasian allocation is generally no longer Pareto efficient. We begin by illustrating this inefficiency and then consider three "solutions" that have been suggested to mitigate these problems and that have influenced government policy towards externalities.

Market Inefficiencies

Consumption externalities

The consumption decision of an economic agent affecting the consumption or production decision of another economic agent who are not party to consumption.

Three Solutions

There are several ways to mitigate the inefficiencies that arise from externalities, all of them imperfect in some regard. The most crude of these is **direct regulation** which involves the direct intervention by some governmental body (for example, the US Environmental Protection Agency). However, of particular interest are three partial solutions (hence the quotes in the title of this section) associated with the names of Arthur Pigou, Kenneth Arrow and Ronald Coase which have been extremely influential in formulating economic policy when externalities are present. The nature of the intervention differs in the three cases and these are considered in greater detail below.

7.6 Pigou: Taxes or subsidies

Pigou's idea is a step removed from direct regulation and uses the notion that appropriately taxing an entity that is imposing a negative externality or subsidizing one whose economic activity is associated with positive externalities can mitigate the problem.

The biggest limitation of Pigou's idea is that while in principle it can redress the inefficiency arising from an externality, the information necessary to set the tax/subsidy rates appropriately so as not to overshoot or undershoot the target is not readily available. Yet, much of the taxation of harmful substances with significant negative externalities (such as tobacco or alcohol) or the subsidization of flu shots or public education where there are believed to be significant positive externalities is based on this idea and is widely practiced all over the world.

7.7 Arrow: Missing markets

An important idea associated with Kenneth Arrow in the context of externalities is that of a missing market. For instance, while electricity is a traded product, there is a **missing market** for the ancillary pollution. By creating an artificial market for the externality, the externality may be turned into a traded commodity and thus 'internalized'. If the market for the externality is perfectly competitive, i.e., all traders behave as price-takers, then presumably the Walras equilibrium where the commodity space has been expanded to include the externality will again be Pareto efficient. We examine two mechanisms for regulating pollution externalities that call for trade in emissions: **emission taxes** and **cap-and-trade**.

Emission taxes

This is the tax imposed due to causing pollutions by the firm. For example "**carbon tax**".

Cap-and-trade

An alternative to the emission tax is a cap-and-trade regime.

Coase: Property rights

Ronald Coase, the 1991 Economics Nobel Prize recipient, emphasized the importance of defining property rights in mitigating the problems arising from externalities. He suggested that the role of the government should be limited to assigning property rights and enabling their enforcement in the courts. The affected parties can then mutually negotiate a Pareto efficient outcome provided the transactions costs of doing so are very low. He is probably best known for the so-called Coase "theorem" which he never formally stated but is generally interpreted as follows:

The equilibrium level of an externality is invariant of the assignment of property rights (including the assignment of liability for damage) so long as there are no transactions costs or income effects.

In other words, if a firm pollutes and causes harm to others, the equilibrium level of the externality will be the same, regardless of whether the firm has the right to pollute, or the harmed have the right to clean air, or any other in-between assignment of this right. So, the level of externality may be independent of the assignment of property rights.

7.8 Tragedy of the Commons

Hardin's herder example: When someone adds more cattle to a communal pasture, there is a disparity between the flows of benefits and cost. The **benefits** flow to the person who added more cattle to the communal grazing land and may take the form of greater income from selling more calves or dairy products. The **costs**, however, are shared by all who use the grazing commons and take the form of less feed and degraded pasture conditions.

Hardin's herder example: Thus a self-interested maximizer sees an opportunity to increase his or her herd without limit, receive 100 percent of the income, and share only a fraction of the cost. This is the mechanics of what Garrett Hardin called the "tragedy of the commons," which refers to the incentive for self-interested maximizers to impose ***appropriation externalities*** on the community whose members together rely on the CPR system.

An **appropriation externality** occurs when the act of harvesting resource units from a CPR by an appropriator **subtracts** from what is available to others, or results in damage to the current and/or future productive capacity of the resource. Therefore, appropriation from a common-pool resource imposes negative externalities on other appropriators, which is at the core of the Tragedy of the Commons.

As Hardin (1968) argues: The rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another…. But this is the conclusion reached by each and every rational herdsman sharing the commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit- in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons.

Solutions to Tragedy of the Commons

1. **Privatization** (conversion to private property):

Examples: laws allowing for conversion of "open access" (indigenous lands) to private farms and ranches. Sale of full or parts of the electronic broadcast spectrum to private firms by the govt. Mining Act allowing for conversion of "open access" mineral resources to privately owned mines.

2. **Government Management and control** (conversion to state property): Examples: marine capture fisheries, wildlife, river water, are, coastal ocean, some forest and range lands.

3. **Community ownership and control** (conversion to common property): Examples: Swiss mountain villages and their local alpine meadows and forests; Same in Japanese mountain villages; **Indian Panchayat forests;** Spanish irrigation systems; Inshore fisheries in Brazil and lobster fisheries in Maine; Groundwater basins in Southern California; Oil and natural gas fields in Tax as and Oklahoma

Elinor Ostrom and her colleagues studied thousands of locally self-governed CPR systems all around the world. The idea was to figure out what the sustainable systems had in common, and what the failures had in common.

From this extensive field research Ostrom developed a set of design principles associated with sustainable local community governance of small-scale CPRs.

Ostrm's Design Principles for Successful Local Self-Governance of Small-Scale CPR's

1. **Clearly defined boundaries**: Boundaries regarding who has the right to appropriate from the commons, and regarding the CPR itself, tend to be clearly defined.
2. **Congruence between appropriation and provision rules, and local conditions**: The rules that govern withdrawal of resource units from the CPR are tailored to local conditions. Local conditions include culture, the biomechanics of the CPR and difference between resource users among others. Rules that govern the provision of human-made CPRs similarly match local conditions. This principle argues against the "one rule system fits all" approach to self-governance.
3. 3. **Collective-choice arrangements**: All stakeholders (people who use or are impacted by the CPR) are included in the formation of appropriation/provision rules and in rule adaptation over time.
4. **Monitoring:** Those who actively audit CPR use and conditions are accountable to the appropriator group or may be the appropriators themselves.
5. **Graduated sanctions**: Sanctions or punishments imposed for violation of rules reflect the extent of the harm imposed and the context of the offense, and are established by the appropriator group themselves.
6. **Conflict resolution mechanisms**: Appropriators and their officials have rapid access to low-cost arenas in which to resolve conflicts among appropriators or their appointed officials.
7. **Minimal recognition of the rights to organize**: External government authorities do not block or hinder local self-governance.
8. **Nesting of small-scale governance systems within larger governance systems when localized CPRs are part of large systems:** Layering of governance structures matches the interdependence and complexity of CPR systems.

7.9 Quasilinear Preferences and the Coase Theorem

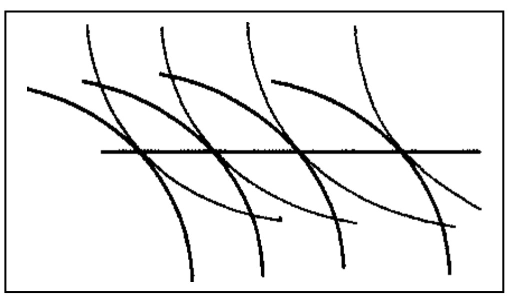
Quasilinear preferences and the Coase theorem. If each consumer's preferences are quasilinear, so that they are all horizontal translates of each other, the set of Pareto efficient allocations will be a horizontal line.

It is argued that as long as property rights were well defined, trade between agents would result in an efficient allocation of the externality. In general, the amount of the externality that will be generated in the efficient solution will depend on the assignment of property rights. In the case of the two roommates, the amount of smoke generated will depend on whether the smoker has the property rights or the nonsmoker has them.

Quasilinear Preferences and The Coase Theorem

But there is a special case where the outcome of the externality is independent of the assignment of property rights. If the agent's preferences are quasilinear, then every efficient solution must have the same amount of the externality.

This case is illustrated below for the Edgeworth box case of the smoker versus the nonsmoker. Since the indifference curves are all horizontal translates of each other, the locus of mutual tangencies—the set of Pareto efficient allocations—will be a horizontal line. This means that the amount of smoke is the same in every Pareto efficient allocation; only the dollar amounts held by the agents differ across the efficient allocations.



If each consumer's preferences are quasilinear, so that they are all horizontal translates of each other, the set of Pareto efficient allocations will be a horizontal line. Thus there will be a unique amount of the externality, in this case smoke, at each Pareto efficient allocation.

The result that under certain conditions the efficient amount of the good involved in the externality is independent of the distribution of property rights is sometimes known as the Coase Theorem. However, it should be emphasized just how special these conditions are. The quasilinear preference assumption implies that the demands for the good causing the exter-nality doesn't depend on the distribution of income. Therefore a reallocation of endowments doesn't affect the efficient amount of the externalities. This is sometimes expressed by saying that the Coase theorem is valid if there are no "income effects."

In this case, the Pareto efficient allocations will involve a unique amount of the externality being generated. The different Pareto efficient allocations will involve different amounts of money being held by the consumers; but the amount of the externality—the amount of smoke—will be independent of the distribution of wealth.

7.10 Summary

- Externality refers to the effect of a contarct on the third party i.e. the society
- Externality may be positive and Negative.
- Externality can be found in consumption and production
- There are various methods and approaches (Pigou, Arrow & Coase etc.) for internalizing the effects of Externality.
- Tragedy of commons associated with the depletion of common property needs be solved by internalizing the effects of externalities.

7.11 Key Words

Externality: Effect of a contract on third party

Pigouvian approach: Related to tax or subsidy for internalizing the effect of externality

Arrow's approach : related to missing market for internalizing the effect of externality

Coase Theorem: related to the assignment of Property rights for internalizing the effect of externality

Quasilinear Preferences: the indifference curves are all horizontal translates of each other

Tragedy of Commons: related to the depletion of Common Property- its effects and solutions

7.12 Model questions

1. Define Externality. Discuss in brief about consumption and Production externalities.
2. Define positive and Negative Externalities.
3. What are the factors responsible for internalizing the effects of externalities?
4. Discuss in brief the Pigouvian and Arrow's approach of internalizing the effects of externalities.

5. Discuss in brief the Coase theorem of internalizing the effects of externalities.

6. What is Tragedy of Commons?

7.13 References

- Herber Bernard P., (1988) Modern Public Finance, 5th Edition, All India Traveller Bookseller, Delhi-110051.

7.14 Additional Readings

- Christopher J. Ellis, Public Economics, Spring 2004

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Unit- 08: Public Goods

Structure:

8.0 Learning Objectives

After studying this module, you will be able to

- Learn the concept of Public goods
- Evaluate whether a good is public good or not
- Understand Free Rider's problem
- Determine the efficient outcome of public goods

8.1 Introduction

Public Goods reflects the Social or Collective Consumption and highlighted the concept of joint or collective consumption with non-exclusion. The most important component of allocative arrangement for the existence of a public sector in a market-oriented society is the concept of joint or collective consumption with non-exclusion. The primary characteristics of jointly consumed economic good is that they are indivisible in the sense that they can be consumed on a non-rival basis by two or more persons at the same time. That is, consumed by one person does not deny consumption to anyone else. In the extreme case of all benefits being indivisible, the good is normally called a pure public good.

Characteristics of Public Goods

Thus the pure public goods has two basic features such as i) Non-excludability and ii) Non-rivalness. On the contrary the features of pure private goods are i) excludability and ii) rivalness.

Features	**Non- Rivalness in Consumption**	**Rivalness in Consumption**
Non-Excludability	(A)	(B)

	Pure Public Goods	Common Property
Excludability	(C) Club Goods	(D) Private Goods

Examples:

A- Pure Public goods: National defense services, flood control system, public water supplies, street lighting, basic research, programmes to fight poverty etc.

B- Common property (Grazing land for cows in the village or meadow or other such properties)

C- Theater, foot-ball match, half-railway compartment, toll gate etc. (i.e. Subject to capacity constraint)

Market failure and Public goods:

Pure public goods are not normally provided at all by the private sector because they would be unable to supply them for a profit. Because, due to the nature of the public goods Free-rider problem arises.

8.2 Free-Rider's Problem

Free-Rider: is an individual who hides or misrepresents his true preferences for a good and expect to get benefit out of the good without paying for it, assuming that the other will pay for it who are simultaneously getting the benefits. In other words Free-rider- " a person who receives the benefit of a good but avoids paying for it."– Since people cannot be excluded from enjoying the benefits once a public good is produced, individuals will withhold paying for the good in hopes that other will finance the good.

Solution: compulsory Taxation by Govt. ---Because it is up to the govt. to decide what proportion of output of public goods is appropriated by the society.

Problems: For this solution, it must estimate the social benefit from the consumption of public goods. Putting a monetary value on the benefits derived from the provision of the public goods is a problematic task. Thus, the electoral system provides an opportunity to assess the public choice of voters through voting. But election are rarely won or lost purely on the grounds of Govt. spending plans.

8.3 Demand for Public Goods

The aggregate demand for a public good is **the sum of marginal benefits to each person at each quantity of the good provided**. The economy's marginal benefit curve (demand curve) for a public good is thus the vertical sum all individual's marginal benefit curves.

The aggregate demand for a public good is derived differently from the aggregate demand for private goods.

To an individual consumer, the total benefit of a public good is the dollar value that he or she places on a given level of provision of the good. The marginal benefit for an individual is the increase in the total benefit that results from a one-unit increase in the quantity provided. The marginal benefit of a public good diminishes as the level of the good provided increases.

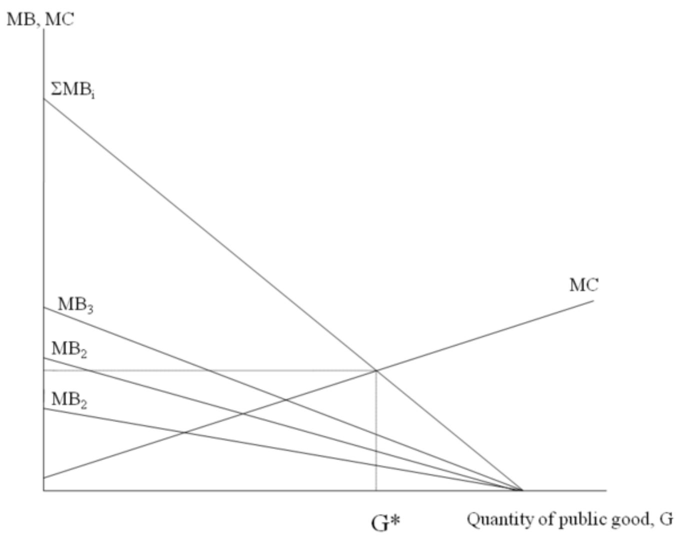
Public goods are non-rivalries, so everyone can consume each unit of a public good. They also have a fixed market quantity: everyone in society must agree on consuming the same amount of the good. However, each individual's willingness to pay for the quantity provided may be different. The individual demand curves show the price someone is willing to pay for an extra unit of each possible quantity of the public good.

The aggregate demand for a public good is the sum of marginal benefits to each person at each quantity of the good provided. The economy's marginal benefit curve (demand curve) for a public good is thus the vertical sum all individual's marginal benefit curves. The vertical summation of individual demand curves for public goods also gives the aggregate willingness to pay for a given quantity of the good.

Demand for a Public Good refers to the sum of the individual marginal benefit curves (MB) represent the aggregate willingness to pay or aggregate demand (∑MB). The intersection of the aggregate demand and the marginal cost curve (MC) determines the amount of the good provided.

This is in contrast to the aggregate demand curve for a private good, which is the horizontal sum of the individual demand curves at each price. Unlike public goods, society does not have to agree on a given quantity of a private good, and any one person can consume more of the private good than another at a given price.

The efficient quantity of a public good is the quantity that maximizes net benefit (total benefit minus total cost), which is the same as the quantity at which marginal benefit equals marginal cost.



8.4 Public goods and Pareto-efficiency

Pareto efficient (optimal) level of provision of public good is such that cannot be altered in any way so that at least one person would be made better off without making anybody worse off.

The Pareto optimal provision of a public good in a society occurs when the sum of the marginal valuations of the public good (taken across all individuals) is equal to the marginal cost of providing that public good. These marginal valuations are, formally, marginal rates of substitution relative to some reference private good, and the marginal cost is a marginal rate of transformation that describes how much of that private good it costs to produce an incremental unit of the public good. This contrasts to the Pareto optimality condition of private goods, which equates each consumer's valuation of the private good to its marginal cost of production.

For an example, consider a community of just two consumers and the government is considering whether or not to build a public park. One person is prepared to pay up to $200 for its use, while the other is willing to pay up to $100. The total value to the two individuals of having the park is $300. If it can be produced for $225, there is a $75 surplus to maintaining the park, since it provides services that the community values at $300 at a cost of only $225.

The classical theory of public goods defines efficiency under idealized conditions of complete information, a situation already acknowledged in Wicksell (1896). Samuelson emphasized that this poses problems for the efficient provision of public goods in practice and the assessment of an efficient Lindahl tax to finance public goods, because individuals have incentives to underreport how much they value public goods. Subsequent work, especially in mechanism design and the theory of public finance developed how valuations and costs could actually be elicited in practical conditions of incomplete information, using devices such as the Vickrey–Clarke–Groves mechanism. Thus, deeper analysis of problems of public goods motivated much work that is at the heart of modern economic theory.

8.5 Summary

- A *public good* has two key characteristics: it is nonexcludable and nonrivalrous. These characteristics make it difficult for market producers to sell the good to individual consumers.
- *Nonexcludable* means that it is costly or impossible for one user to exclude others from using a good.
- *Nonrivalrous* means that when one person uses a good, it does not prevent others from using it.

8.6 Key Words

Public Goods : Goods having the characteristics of non-rivalness and non-excludability

Free riders: Resposiblity of all is responsibility of none. Everybody interested to enjoy their rights but no-body is interested for taking the responsibly to pay for it.

8.7 Self-check questions

1. What are the two key characteristics of public goods?
2. Name two public goods and explain why they are public goods.
3. Provide two examples of goods/services that are classified as private goods/services even though they are provided by a federal government.

8.8 References

- Gregory N Mankiw, (2008) Principles of Economics, 6th Edition, Change learning IndiaPrivate Limited, New Delhi.
- Maddala G S,(2004) Microeconomics, Theory and Applications, McGraw-HillEducation (India) Pvt Limited.
- Herber Bernard P., (1988) Modern Public Finance, 5th Edition, All India Traveller Bookseller, Delhi-110051.

8.9 Additional Readings

- Pindyck R S and Daniel Rubinfeld (1922), Microeconomics, 14th Edition, PearsonEducation Inc

Block 03

Partial and General Equilibrium

Unit- 09: A partial equilibrium analysis versus general equilibrium analysis

Structure:

9.0 Learning Outcomes

After studying this module, you shall be able to

- Know about the analysis of microeconomic theory
- Learn about the two approaches adopted for the analysis
- Also learn about the purpose and use of these approaches in detail

9.1 Introduction

The analysis of microeconomic theory has two approaches – partial equilibrium and general equilibrium approach. The first approach is based on the analysis of a particular sector or part (say equilibrium in the rice market or a particular input market etc.) of the economy in isolation.

When we study the behaviour of individual decision making units and the working of individual markets for commodities and inputs under various market structures, it is a case of partial equilibrium analysis. It can be said that the partial equilibrium approach deals with each market independently without considering the effects of changes of other markets on the concerned market. The advantage of this is that it permits the analyst to focus upon one thing at a time and thus allays the confusion that can arise if all the things are considered together. The partial equilibrium analysis does not examine how the various individual pieces fit together to form an integrated economic system. This task is left to 'general equilibrium analysis'. The general equilibrium analysis recognizes the fact of interdependence among different economic units. Interdependence in the economy make partial equilibrium analysis overly simple because demand and supply in one market depend on prices determined in other markets. General equilibrium analysis broadens the perspective, taking into account the interactions and interdependencies within the various parts of the economy and seeks to analyze the determination of equilibrium in this situation.

9.2 Partial equilibrium analysis

9.2.1 Characteristics of partial equilibrium approach

In Microeconomic analysis we study the market for a particular commodity or a particular factor input. The price of a commodity is determined when the demand for that commodity is equal to its supply. The wage rate is determined when the demand for labour is equal to its supply. The interest rate is determined when the demand for savings is equal to its supply. In all these markets, the equilibrium is attained at the point where the demand and supply are equal and no one has the incentive to upset the position. This kind of analysis is called partial equilibrium analysis. It focusses on determination of equilibrium prices and quantities in a market independent of effect from other markets. In analyzing what is going on in one market, we ignore what is going on in other markets. Such an equilibrium is called 'partial', that is the equilibrium price of a single commodity or a single factor input is derived under the assumption that all other commodity prices or factor input prices in the economy are fixed. The basic characteristic of a partial equilibrium approach is the determination of the price and quantity in a commodity market or in a factor input market by demand and supply curves. In the words of Professor Stigler “a partial equilibrium is one which is based on only a restricted range of data, a standard example is price of a single product, the prices of all other products being held fixed during the analysis.”

9.2.2 Consideration of this analysis

1. Behaviour of individuals

In partial equilibrium analysis, we consider the behaviour of individual decision making units and individual markets, viewed in isolation. It examines how an individual maximizes his satisfaction subject to his income constraint; how a firm minimizes its costs of production; how a firm maximizes profits under various market conditions; how the prices and employment of each type of input is determined.

2. No inter-connections

The partial equilibrium analysis does not take into account the inter-connections that exist between an individual economic unit and the rest of the economy. These inter-connections are taken care of under the generic assumption of ceteris paribus. In other words, in partial equilibrium analysis we study utility or profit maximizing behaviour and decisions in each segment of the economy as if they were independent of the other segments of the economy. For example, when we study the behaviour of households in their role as consumers who allocate their income among various goods and services so as to maximize their utility subject to their income constraint, we conveniently assume that the incomes are given. Income of the consumers depends upon the magnitude of factor services demanded and supplied in the factor market.

Under the assumption of ceteris paribus we conveniently avoid this inter-connection. Thus we are able to isolate the study of consumer behaviour from other parts of the economy. Likewise, when we study the cost–minimizing behaviour of a business firm, we limit ourselves to the given prices of inputs and the known state of technology. We consider the production decisions in isolation, and ignore the influence of such factors as the demand for the product and related goods, which are, in turn, influenced by employment, income and tastes of consumers. Similarly, when we study the profit maximizing behaviour of a business firm, we limit ourselves to one product market and the study of each market rests on the ceteris paribus assumptions. Relationships with other markets are ignored.

In short, partial equilibrium analysis studies the behaviour of individual economic segments in isolation, and ignores their interdependence.

9.2.3 Use of Partial equilibrium analysis

Partial equilibrium analysis is helpful for two types of problems:

(a) When we are interested in analyzing economic changes in any particular industry. For example, effect of labour strike in steel industry. Each market in partial equilibrium analysis is regarded independent of the other.

(b) To assess initial effects of government policies (Excise or custom duty on some particular product). Partial equilibrium analysis studies these initial effects. For example, impact of a labour strike in the steel industry would first be felt upon steel production: this can be termed as first–order impacts. Later on there will be spillover effects on the entire economy. This is termed as the second and higher order impacts. The second and higher order impacts would be felt in the next immediate steel–using industry and finally in the whole economy. The partial equilibrium analysis is basically concerned with measuring the first– order impacts only as opposed to the general equilibrium analysis which attempts to measure second and higher order impacts of a change.

9.3 General Equilibrium Analysis

It is an extensive study of a number of economic variables, their inter–relation and interdependence for analyzing the working of the economic system as a whole. The essential feature of an economy can be summed up in the phrase “everything depends on everything else”. In other words the fundamental feature of any economic system is the inter-dependence among its constituent parts. The markets of the commodities and all productive factors are inter–related, and the prices in all markets are simultaneously determined. For example, consumers' demand for various goods and services depends on their tastes and incomes. Consumers' incomes, in turn, depend on the demand and supply of the various inputs. The demand for factor inputs by firms depends not only on the state of technology but also on the demand for the final goods they produce. The demand for these goods depends on consumers incomes, which, depend on the demand for the factors of production. Thus change in one market affects other markets, which, in turn, affects the original market. The disturbance in one market permeates the entire economy and the general equilibrium analysis concerns itself with the changes caused in the whole economy. General equilibrium analysis seeks to determine the equilibrium in an economy, recognizing the fact of inter– connections and interdependence among the different products and factor markets. Here any change in one market affect other markets (spillover effect) and is affected by other markets (Feedback effects).

Professor Stigler has aptly remarked that "the theory of general equilibrium is the theory of inter– relationship among all parts of the economy." Take any economy, interdependence among its constituent parts is a fundamental feature. Thus, inter–relationship among markets are taken explicitly into account. In other words, it explicitly takes into account the spill-over effects and feedback effects while determining the prices and quantities in all markets simultaneously. Spill-over effect is a price or quantity adjustment in one market caused by price and quantity adjustment in other related markets. If the equilibrium in one sector is disturbed by a policy or due to some event then when this sector tries to achieve its new equilibrium position, it disturbs the equilibrium in all the other or inter–related sectors and these sectors in turn derive a new equilibrium. An example, a change in the demand and price of new domestically produced automobiles will immediately affect the demand and price of the inputs of automobiles (such as steel, glass and rubber) as well as demand, wages and income of auto workers. The demand and price of gasoline and of public transportation (as well as wages and income of workers in these industries) are also affected. These affected industries have spillover effects on still other industries, until the entire economic system is more or less developed, and all prices and quantities are affected. This is like throwing a rock in a pond and examining the ripples emanating in every direction until the stability of the entire pond is affected. The size of the ripples declines as they move farther and farther away from the point of impact. Similarly, industries further removed or less related to the automobile industry are less affected than more closely related industries. The effects that a change in the automobile industry has on the rest of the economy will have repercussions through changes in relative prices and incomes on the automobile industry itself. These effects are called feedback effects which are likely to significantly modify the original partial equilibrium conclusions (price and output) reached by analyzing the automobile industry in isolation.

9.3.1 Purpose of this analysis

General equilibrium analysis has two basic purposes:

(a) It provides a means of examining and analyzing the economic system as a whole.

(b) It provides a systematic approach to study after effects (second or higher order effects) of an economic change.

General equilibrium is therefore defined as a state in which all markets and all decision making units are in simultaneous equilibrium. Any economy is said to be in the state of general equilibrium if there prevails a set of prices that can equate demand and supply, and produce equilibria in every product and factor market that are mutually consistent.

9.4 Summary

1. Partial Equilibrium Analysis Studies the behavior of individual decision making units and individual markets, viewed in isolation. For example, producers maximize profit subject to their production technology and resource constraints; likewise, consumers maximize utility subject to their taste and budget constraints. Similarly, changes in a single market are examined in isolation from other markets. This approach to economic analysis is called the partial equilibrium analysis. The advantage of this is that it permits the analyst to focus upon one thing at a time and thus allays the confusion that can arise if all the things are considered together.

2. The partial equilibrium analysis does not take into account the inter-connections that exist between an individual economic unit and the rest of the economy. These inter connections are taken care of under the generic assumption of certain paribus. In other words, in partial equilibrium analysis we study utility or profit maximizing behavior and decisions in each segment of the economy as if they were independent of the other segments of the economy.
3. A general equilibrium exists when all markets in an economy are in simultaneous equilibrium. It seeks to determine the equilibrium of an economy by analyzing the behavior of all interconnected and interdependent economic units and segments. Therefore general equilibrium analysis is concerned with the determination of equilibrium in all markets simultaneously

Unit- 10: Walrasian excess demand and input-output approaches to general equilibrium

Structure:

10.0 Learning Outcomes

After studying this module, you shall be able to

- Know about the Walrasian excess demand approach and intent-extent approach to general equilibrium
- Learn that a general equilibrium exists if each market is cleared at a positive price with all decision making units being in simultaneous equilibrium.
- Identify that Walrasian system asserts that the excess demand is inversely related to price.

- Understand that input-output analysis is an analysis of inter-industry relations of the network of intermediate products, passing from one industry to another, or sold as final products to the consumers
- Identify the assumptions to the consumers and limitations of input-output analysis.

10.1 Introduction

General equilibrium theory deals with the problem of whether the independent action of each decision making unit, the consumer or the firm, leads to a position in which equilibrium is reached by all. A general equilibrium exists if each market is cleared at a positive price, with all decision marking units being in simultaneous equilibrium. Leon Walras (1834-1910), in his book ‘Elements of Pure Economics’ introduced the idea of simultaneous determination of prices of all the markets through the interaction with one another. With the help of simultaneous equations of demand and supply of all the markets in the economy he described an unique solution for all the variables and also described the stability conditions of the equilibrium through the process of adjustments taking place. The basic of the stability of the equilibrium in Walrasian system asserts that the excess demand is inversely related to price, i.e., the increase in the excess demand occurs due to decrease in prices.

10.2 Walrasian Excess Demand Approach to General Equilibrium

Walrasian system asserts that the excess demand is inversely related to price. The excess demand price is defined as the difference between the price that buyers are willing to pay and the price that sellers are charging for a given quantity. Mathematically, the excess demand at price P can be defined as

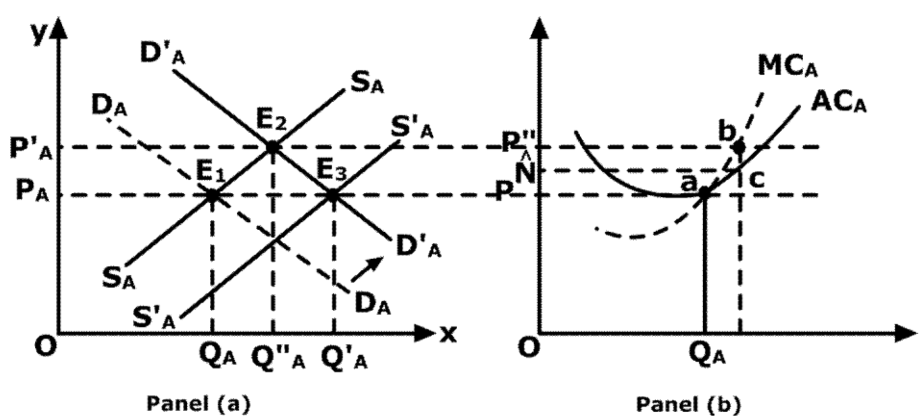
$$E(P) = D(P) - S(P)$$

Where, D (P) is demand price and S (P) is supply price.

It is positive or E (P) > 0 if D (P) > S (P)

It is negative or E (P) < 0 if D (P) < S (P)

The general equilibrium analysis describes the mechanism of determination of prices. Simultaneously in each market so that there is neither excess demand nor excess supply while all the economic agents individually attain their respective competitive goals. All the markets in the economy are interdependent on each other. Clearly, any disturbance in one market not only changes the equilibrium position of the concerned market but also creates impact on the equilibrium positions of other markets in the economy. In what follows we will examine the impact of changes in demand in one market on all other markets in the economy. For the sake of simplicity we assume that there are only two sectors in the economy, say I and II. Suppose that because of some favorable condition the demand for commodity A has increased at the same prices, i.e., the market demand curve of commodity A has shifted out to the right because of change in preference pattern of the consumer as shown in diagram 10.1 panel (a).



Sector I

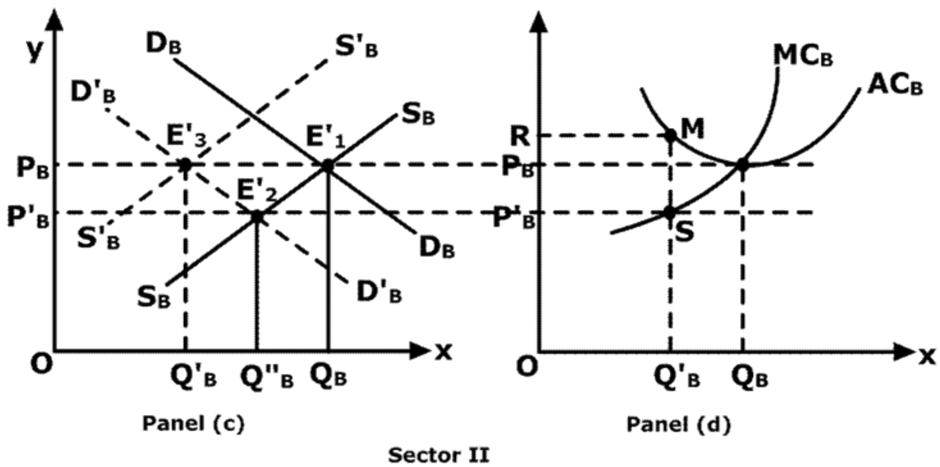


Figure 10.1 Market Adjustment Mechanism

In the diagram the initial level of equilibrium in sector I is at point E_1. The initial demand and supply curves of commodity A are represented by D_A and S_A respectively. Equilibrium point E_1 gives us equilibrium price P_A and equilibrium quantity Q_A. The equilibrium of each firm in industry A is illustrated in figure 10.1(b). At equilibrium the firm produces Q_A at which AC=MC=Price=MR. Panel (b) should refer to the equilibrium of a firm in the industry A. Similarly, the initial equilibrium position of commodity market B are illustrated in Figure 10.1 panel (c) and panel (d). The commodity market B is in equilibrium at Price P_B, at which demand for B equals its supply. Likewise, the each firm in Sector II will produce Q_B at which AC=MC=Price=MR.

Now suppose that there is an outward shift in demand curve of sector A due to change in any factor which influences demand (either change in consumer income, change in consumer preferences or increase in the price of its substitute goods etc.) except price of A. The new demand curve is D'_A. This cuts the initial supply curve S_A at point E_2 which gives new equilibrium price $P_A^{'}$ and new equilibrium quantity Q''_A. In this situation, if consumers are purchasing more of commodity A (at higher price P'_A) with their same income level, they must have to reduce their expenditure in other sector, i.e., in sector II. So they will purchase less of commodity B, which is reflected by the inward shifting of the demand curve of commodity B from D_B to D'_B. All this happens because of the interdependence of all the sectors of the economy.

In this changed situation, competitive firms in sector I will produce more of commodity A at higher prices P_A'. The new equilibrium E_2 is not at the minimum point of AC_A. It is higher (vertically) than AC_A which implies positive profit (TR > TC) in sector I. The total profit is given by the area NC bP'_A in the diagram 10.1 panel (b). On the other hand in sector II, the new equilibrium price P'_B is lower than the average cost or at the output level Q'_B. As such, the position is that the firms in industry A are making supernormal profits while firms in industry B are incurring losses. Some firms in industry B are therefore forced to quit the industry and some are induced to transfer their resources to industry A.

The process of adjustment will continue till such time a new general equilibrium is achieved in the economy. The new general equilibrium for sector I is E_3 and that of sector II is E'_3.

Comparing the new state of equilibrium E3 and E'_3 with the initial state of equilibrium E_1 and E'_1, it is clear that there will be change in the resource allocation in the economy. In the new general equilibrium, more resources will be allocated for the production of commodity A compared to the initial one and obviously less will be allocated for commodity B.

To sum up, due to the change in consumer's preference in favour of commodity A caused by an exogenous factor, demand for commodity A has increased and for commodity B decreased. As a result, price of commodity A increases and that of commodity B decreases, temporary till a new general equilibrium is achieved in which there is more quantity traded of commodity A at its original price and less quantity traded of commodity B at its original price.

10.3 Input–Output Approach to General Equilibrium

The input–output analysis has been pioneered by Wassily

W. Leontief. It is an application of general equilibrium theory. It is concerned with an empirical study of interdependence among various parts or sectors of the economy. It helps in determining the optimum level of production for each industrial unit (given the resources and technology);

such that the demand for its product is fully met, i.e., there are no shortages or surpluses in the economy.

The analysis divides the economy into a number of sectors or industries including households and the government as “industries” of final demand. Each industry is viewed as selling its output to other industries; these outputs become inputs for the purchasing industries. Likewise, each industry is viewed as a purchaser of the outputs of other industries. Thus, the interdependence of each industry on the other is established. The input–output analysis is thus an analysis of inter-industry relations of the network of intermediate products, passing from one industry to another, or sold as final products to the consumers.

10.3.1 Assumptions of Input-Output Analysis

Input-output analysis is based on following assumptions:

- The economy can be divided into a finite number of sectors (industries). Each industry produces only one homogenous commodity. No industry produces joint products.
- Each industry uses inputs in rigidly fixed proportion. In other words, the input requirement per unit of output in each industry/ sector remain fixed and constant.
- Factor and commodity prices are given.
- The production function of the producing sectors is linearly homogeneous, i.e., the production in every industry is subject to constant returns to scale.

10.3.2 Uses of Input–Output Analysis

Input–output analysis has a wide range of applications:

- Input–output analysis is used to obtain projections of demand, output, employment and investment for a country or region.
- Input–Output analysis is helpful in providing necessary information for formulation of economic policies. It is used in economic development planning, studies of inter-regional and international economic relationships.

- Input–Output analysis is useful for national income accounting as it provides detailed breakdown of the macro aggregates and the money flows.
- The inter relations between various sectors, as revealed in the input–output table, provide indication regarding prospective trends in which they are likely to combine with each other.
- Given a certain final output target, it can show the production requirements of various sectors.

10.3.3 Limitations of Input–Output Analysis

Despite its many useful applications, the input–output analysis has many shortcomings which are given below:

- The input–output analysis is based on the assumption of fixed input co-efficient or proportions. Over time, technology and input prices change, and these are likely to greatly affect the proportions in which inputs are combined in the production of many commodities. This necessitates frequent and continuous updating of input– output tables, which are very costly and time consuming.
- Input–output analysis is based on linear equations relating outputs of one industry to inputs of the others. This appears unrealistic
- In the input–output analysis labour is the only input which is considered scarce. This is not true in practice.
- Final demand (i.e., the purchases by consumers and the government) in the input– output analysis is taken as given and treated as independent of the production sector.

Though input–Output analysis has its short–comings, yet it is considered an important tool for the analysis of economic decisions of the government and in development planning.

10.3.4 Model of Input–Output Analysis

Input–output is a method of analysis, in which the economy is represented by a set of linear production functions describing the inter relationship among all sectors/ industries. Because it deals with interdependence between industries, in that sense input–output model is a general equilibrium theory. This model involves following steps;

(i) Construction of input–output table (also known as transaction matrix)
(ii) Computing technical co–efficient
(iii) Formulating a set of simultaneous equations
(iv) Solving the simultaneous equations to obtain the values of the unknowns in general equilibrium problem.

Construction of input–output Table, we have assumed that our simplified economy has only two industries (I and II)

Input-Output Transaction Table

Producing sector ↓	Using Sector →			
	I	II	Final demand	Gross output
I	300	600	100	1000
II	400	1200	400	2000
Primary inputs	20	10	–	30

In the input–output transaction table Row1 shows that industry I has produced 1000 units of output, of which 300 units are used up by itself (industry I), 600 units are used up by industry II. In this way, 900 units have been used up as intermediate inputs by the two industries, only 100 units are available for final consumption. The second row shows that industry II had produced 2000 units of output, of which 400 units are used by industry I, 1200 units by industry II itself, and only 400 units are available for final consumption. Again out of 2000 units produced by industry II, 1600 units are used up as intermediate inputs. The last row shows the amount of primary input (labour) used by the two industries.

In the above table, the first column shows the inputs required by industry I to produce 1000 units of output–requires 300 units of its own output, 400 units of output of industry II, 20 units of primary input.

The second column of the table shows the inputs required by industry II to produce 2000 units of output requires 600 units of industry I's output, 1200 units of its own output, 10 units of primary input.

The column of final demand shows that for final consumption the economy needs 100 units of industry I's output, and 400 units of industry II's output. The last column shows the total output produced by the two industries and the total requirement of primary input (labour).

Generalizing to n industries, we write input–output table as follows:

Producing sector ↓	Using Sector →				Final demand	Gross output
	I	II	III	...... n		
I	X_{11}	X_{12}	X_{13}	...... X_{1n}	F_1	X_1
II	X_{21}	X_{22}	X_{23}	...... X_{2n}	F_2	X_2
III	X_{31}	X_{32}	X_{33}	...... X_{3n}	F_3	X_3
–	–	–	–	–	–	–
–	–	–	–	–	–	–
–	–	–	–	–	–	–
n	X_{n1}	X_{n2}	X_{n3}	X_{nn}	F_n	X_n

Where,

$X_1, X_2 \ldots X_n$ is total output of different sectors/ industries in an economy

$F_1, F_2 \ldots F_n$ is amount of final demand

$X_{11}, X_{12}, \ldots X_{1n}$ is amount of output of sector/industry I used as inputs in sectors/ industries I, II, III, … n.

$X_{21}, X_{22} \ldots X_{2n}$ is amount of output of sector industry II used as inputs in sectors/ industries I, II, …n. and so on.

From above table we get

$$X_1 = X_{11} + X_{12} + X_{13} + \ldots + X_{1n} + F_1$$

So in general if we sum up the outputs, we get

$$X_i = \sum_{j=1}^{n} X_{ij} + F_i$$

Where (i = 1, 2,...n)

X_i = Total amount of the i^{th} sector/ industry

X_{ij} = Output of the i^{th} sector/ industry used as input in the j^{th} sector.

Fi = Final demand for the i^{th} sector/ industry product.

(ii) Technology Matrix which would indicate the amount of the output of the i^{th} sector (industry) which is used as input to produce one unit of output of the j^{th} sector (industry). We call it

a_{ij} i, j = 1…..n

Given constant return to scale, a_{ij} will be constant and fixed for all i's and j's

Now $aij = \frac{X_{ij}}{X_j}$

Or $X_{ij} = a_{ij} \times X_j$

The above given input–output Transaction Table can be put in terms of Technological co-efficient matrix.

Technological co-efficient matrix

Producing sector ↓	Using Sector →			Final demand	Gross output
	I	II	...... n		
I	$X_{11}\times 1$	$X_{12}\times 2$	.....$a_{1n}\times n$	F_1	X_1
II	$X_{21}\times 1$	$X_{22}\times 2$	..... $a_{2n}\times n$	F_2	X_2
–	–	–	–	–	–
–	–	–	–	–	–
–	–	–	–	–	–
n	$a_{n1}\times 1$	$a_{n2}\times 2$	$a_{nn}\times n$	F_n	X_n

We know $X_{ij} = a_{ij} \times X_j$

Where, X_{ij} is the output of industry/sector i required to produce the output of industry/sector j, and is proportionate to the output of industry j, the co-efficient of proportionality being the input–output co-efficient a_{ij}. Its value is usually positive but less than unity; if sector/ industry j does not buy any inputs from industry/ sector i, its value will be zero. In symbols;

$O \leq aij \leq 1$

10.4 Formulating a Set of Simultaneous Equations

If there are n industries (sectors) the following is true for each of them;

$$X_i = \sum_{j=1}^{n} X_{ij} + F_i \quad i, j = 1, 2, 3 \ldots n$$

Or $X_i = \sum_{j=1}^{n} a_{ij} X_j + F_i$, *for all i*

Equation (3) is the balance equation which states that the output of any commodity i is used either as the input for the production of commodities j or as the final demand. This is an equilibrium condition which states that the quantity of output supplied is equal to the quantity of output demanded.

10.4.1 Solving the Simultaneous Equations to Obtain Solution

Equation (4) above can be put in a matrix form

$$\begin{bmatrix} X_1 \\ X_2 \\ . \\ . \\ . \\ X_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & \ldots a_{1n} \\ a_{21} & a_{22} & a_{2n} \\ . & & \\ . & & \\ . & & \\ a_{n1} & a_{n2} & a_{nn} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ . \\ . \\ . \\ X_n \end{bmatrix} + \begin{bmatrix} F_1 \\ F_2 \\ . \\ . \\ . \\ F_n \end{bmatrix}$$

This matrix can be represented in the form of an equation:

$X = AX + F$

X = Total Output Vector

A = Input-Output Co–efficient Matrix

F = Final Demand Vector Now, we have

$X = AX + F$

$X – AX = F$

$X [1 – A] = F$

$X = [1 – A]^{-1} F$

Where I is identity Matrix.

A is Technology Matrix and I-A is called Leontief Matrix. By Solving the above given equation, we can determine the output levels for various industries (sectors) of an economy.

10.5 Summary

- The fundamental feature of any economic system is the interdependence of its constituent parts. The partial equilibrium theory is an inadequate tool for analyzing this interdependence between the basic microeconomic units- the consumers and firms. General equilibrium theory, on the other hand, is basically designed to deal with the problem of interdependence. It seeks to analyze the interaction of the consumer and the firms in the determination of prices and quantities of goods and factor inputs.
- Any disturbance in one market not only changes the equilibrium condition of the concerned market but also creates impacts on the equilibrium conditions of other markets in the economy. All the markets in the economy are interdependent of each other, General equilibrium exists in an economy when all the markets in the economy are in equilibrium simultaneously.
- Walrasian system asserts that the excess demand is inversely related to price, i.e., the increase in the excess demand occurs due to decrease in prices.

- The input-output analysis has been pioneered by Leontief. It is an application of general equilibrium theory. It is concerned with an empirical study of interdependence among various parts or sectors of the economy.
- The input-output analysis divides the economy into a number of sectors or industries, including households and the government as “industries” of final demand: Each industry is viewed as selling its output to other industries; these outputs become inputs for the purchasing industries is viewed as a purchaser of the outputs of other industries. Thus, the interdependence of each industry on the other is established.

Unit- 11: Existence, stability, and uniqueness of equilibrium

Structure:

11.0 Learning Outcomes

After studying this module, you shall be able to

- Know the meaning of equilibrium
- Understand the existence of equilibrium.
- Identify the problems in the existence of equilibrium
- Learn about the stability and uniqueness of equilibrium

11.1 Introduction

The concept of equilibrium forms the core of economic theory. The Modern economics is known as equilibrium economics. The concept has been derived from two Latin words 'acquas' which means equal and 'libra' which means balance. So, the term equilibrium means the state of balance from which there is no tendency to move. An equilibrium may or may not exist. Apart from the existence problem, two other problems are associated with an equilibrium; the problem of its uniqueness and the problem of stability. These problems can best be understand with the partial equilibrium example of a demand-supply model.

11.2 Meaning of Equilibrium

Like any economic term, equilibrium can be defined in various ways. According to professor Machlup, an equilibrium is "a constellation of selected interrelated variables so adjusted to one another that no inherent tendency to change prevails in the model which they constitute. This concept has been clarified by professor T.Scitovosky by stating that "a person is in equilibrium when he regards his actual behaviour as the best possible under the circumstances, and feels no urge to change his behaviour so long as circumstances remain unchanged".

The same is true to the equilibrium of a firm and that of an industry. Thus, equilibrium means the position reached by the individual, the firm or the industry from which there is no tendency to move. From the point of view of an individual consumer equilibrium will be reached at a point when he gets maximum satisfaction from his given income spent on different goods and services. Similarly, for an individual producer, equilibrium position will be attained when he gets maximum profit. The industry will be regarded to be in equilibrium when there exists no tendency for the size of the industry to change, i.e., when no existing firms want to leave the industry or no new firms wish to enter into it. All this discussion boils down to the fact that an equilibrium position is that where everyone in the whole system believe that he cannot improve his lot by altering his behavior.

11.3 Existence of Equilibrium

It is clear that, in a perfectly competitive market of a particular commodity, an equilibrium price is obtained when the quantity offered by sellers at that price equals the quantity demanded by buyers. It implies that the forces of demand and supply operating in such a market are in balance. That is, the intersection of the demand and supply schedules will determine the market equilibrium price. Taking a simple linear demand function $Q_d = a_1 - b_1P$, and a linear supply function $Qs = a_2 + b_2P$, we can solve the system for equilibrium price P_e and equilibrium quantity Q_e as follows;

$$Q_d = a_1 - b_1P$$

$$Q_s = a_2 + b_2P$$

Now in equilibrium $Q_d = Q_s = Q_e$

So, $a_1 - b_1P_e = a_2 + b_2P_e$

$$\Rightarrow a_1 - a_2 = b_1P_e + b_2P_e$$
$$\Rightarrow a_1 - a_2 = (b_1 + b_2)P_e$$
$$\Rightarrow P_e = \frac{a_1 - a_2}{b_1 + b_2} \qquad (1)$$

Now , $Q_e = a_2 + b_2P_e = a_2 + b_2 \times \frac{a_1 - a_2}{b_1 + b_2}$ (from 1)

$$\Rightarrow \frac{a_2b_1 + a_2b_2 + a_1b_2 - a_2b_2}{b_1 + b_2}$$

$$Q_e = \frac{a_2b_1 + a_1b_2}{b_1 + b_2} \qquad (2)$$

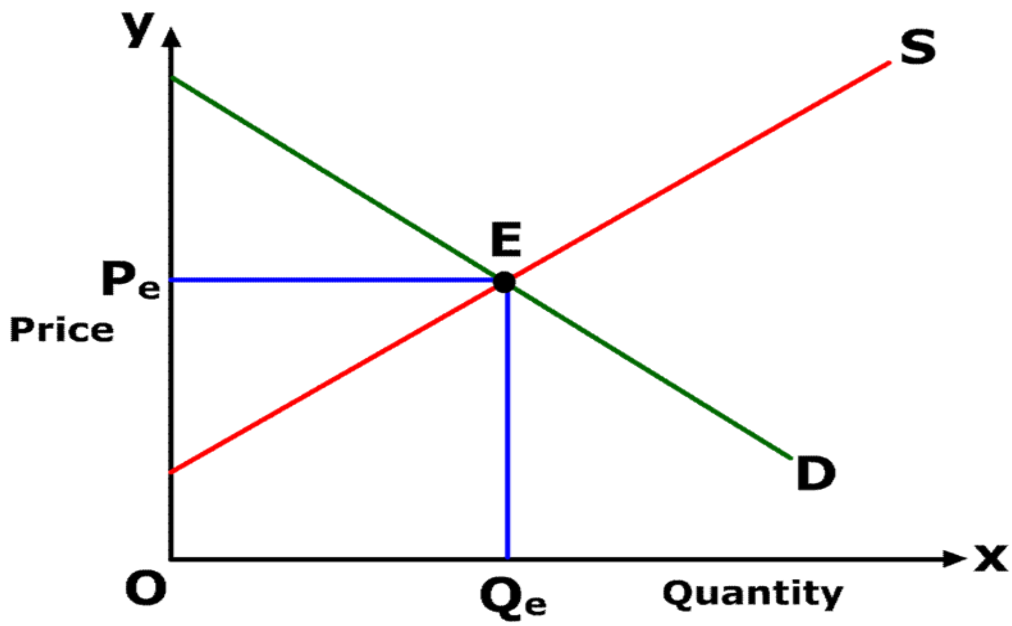


Fig. 11.1: Market Equilibrium.

Consumers attain equilibrium at every point on the demand curve D since it represents their planning curve and embodies their maximizing behaviour. At every point on the supply curve producers attain equilibrium in the sense of maximizing profit or minimizing cost. Since point E lies on both demand and supply curves consumer's and producer's equilibrium coincide. Their chosen positions are mutually consistent. Also at point E the market for the good is at rest, the opposing forces are in balance.

11.3.1 Necessary conditions of Existence of Equilibrium

At this juncture, it is necessary to emphasize that both demand and supply schedules must intersect for existence of an equilibrium. Mere downward sloping demand and upward sloping supply schedules do not ensure that both will intersect and an equilibrium price will be determined. In other words there is no guarantee that equilibrium will exist. Even when the demand curve is downward sloping and supply curve is upward sloping there can be situations when equilibrium does not exist at all as shown in Figure 11.2

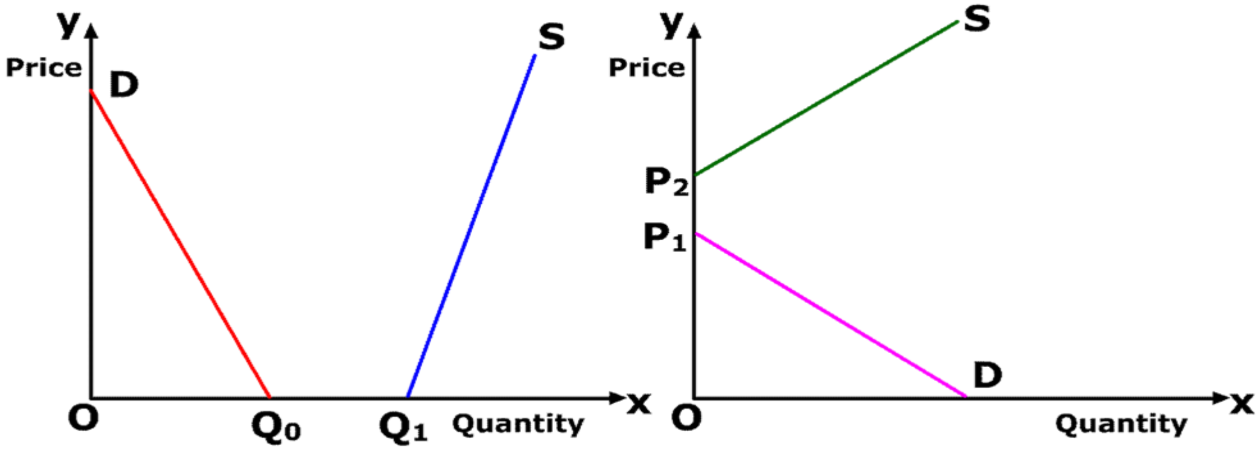


Fig. 11.2: Non- existence of market equilibrium

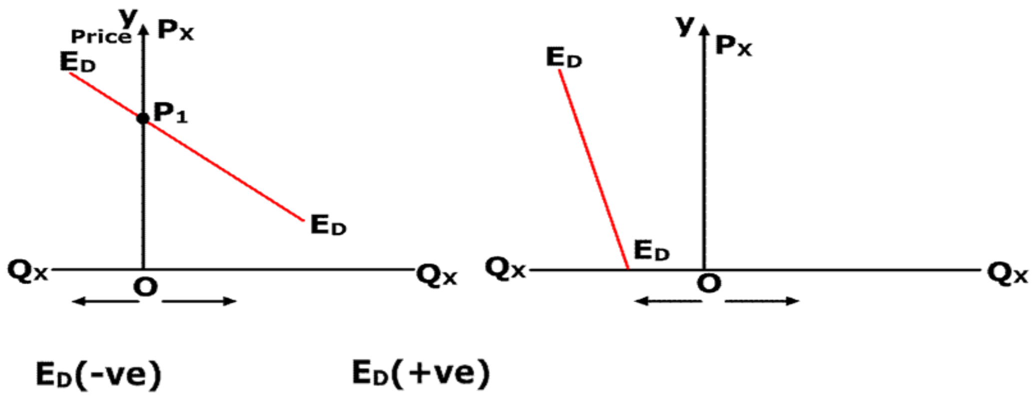
In the situation depicted above no equilibrium is possible even though demand curve is downward sloping and supply curve is upward sloping. In the first case there is no positive price at which demand equals supply. In fact, even at zero price there is excess supply. This is particularly true for the free goods of nature such as clean air, open space, etc. however, this can change over time. For example, clean air was once free, but the increasing industrialization and deforestation has put now same social value or price on it, although not a market price as yet, since we are becoming conscious of environmental constraints upon economic growth.

In the second case, the minimum price at which the good will be supplied exceeds the maximum price the buyers are willing to pay, hence there exists no market for the commodity in question, and thus no equilibrium is possible.

11.3.2 Problem in Existence of Equilibrium

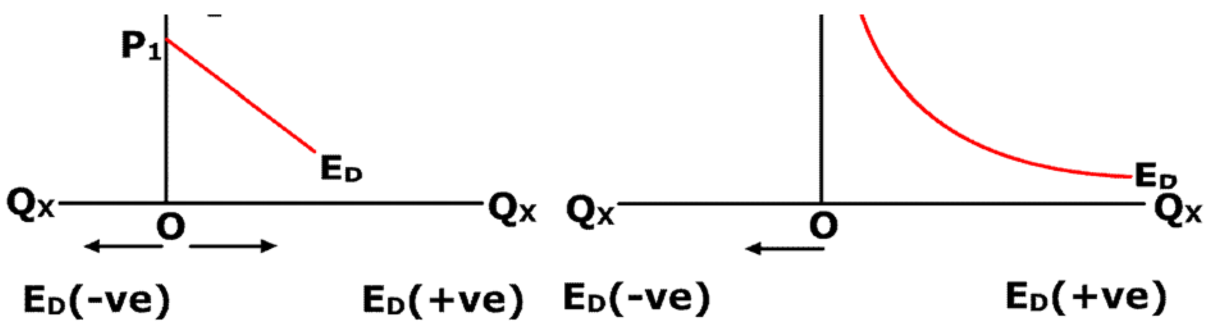
We can use an alternative way of analyzing the problem of existence of equilibrium, by using an excess demand function. The term equilibrium means a state of balance; it occurs when desired purchase equal desired sales. When at a particular price, quantity demanded equals quantity supplied ($Q_D = Qs$), we say market is in equilibrium. At such equilibrium price, there is neither excess demand nor excess supply. Thus an equilibrium price can be defined as the price at which the excess demand is zero. At a price below equilibrium price demand exceeds supply and hence excess demand is positive. As price keeps on falling positive excess demand goes on increasing. Now at a price above the equilibrium price supply exceeds demand and hence excess demand is negative. As price keeps on rising negative excess demand tends to increase. The excess demand curve as a function of price is downward sloping. In Figure 11.3(a), equilibrium exists at P1 and the equilibrium price is OP_1. For equilibrium to exist, demand and supply curves must intersect at some positive price In Figure 11.3 (b), no positive price exists as excess demand is zero.

Hence no equilibrium. Even at zero price, excess demand is negative. Such a good must be a free good, i.e., air



(a)CASE OF EQUILIBRIUM **Fig. 11.3** (b) CASE OF NO EQUILIBRIUM

In the following two cases, equilibrium will not exist.



(a)CASE OF EQUILIBRIUM **Fig. 11.4** (b) CASE OF NO EQUILIBRIUM

This must be a case of multiple equilibria. Within the price range P_1-P_2, excess $d^d = 0$, this implies $D^d = S^s$ for all those prices leading to more than one equilibrium points. ii) Or this situation also can arise if the D^d & S^s curves are given as in Fig 11.4(a) the excess demand function has a gap in the price range P_1P_2. At a price above OP_2 no demand is forthcoming and at price OP_1 no supply is forth coming. Equilibrium does not exist.

In Figure 11.4(b) the excess demand function is rectangular hyperbola and lies in the non-negative quadrant. At a very high price excess demand tends towards zero but never actually becomes zero. The curve is asymptotic (the curve comes closer and closer to x-axis and y-axis but never touches them). Hence no equilibrium is possible.

Thus the existence of equilibrium is related to the problem whether the consumers and producers behaviour ensures that the demand and supply curves intersect at some positive price.

11.4 Uniqueness of Equilibrium

Existence of equilibrium is no guarantee that such an equilibrium will be unique. Uniqueness implies that there exists only one positive price at which demand equals supply, or excess demand for the good equals zero. However, in the following situation there exists more than one positive price at which demand equals supply. Such possibilities arise when either the demand curve or the supply curve or both the curves do not behave normally.

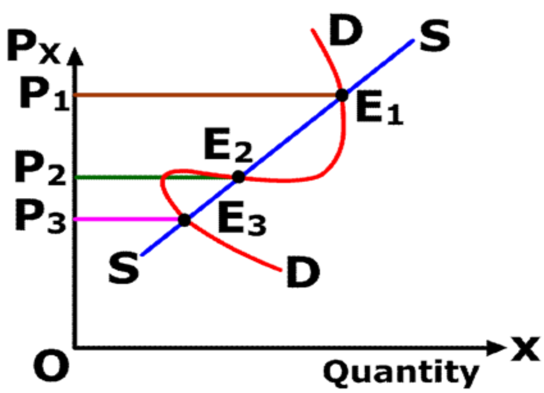


Fig. 11.5 (a)

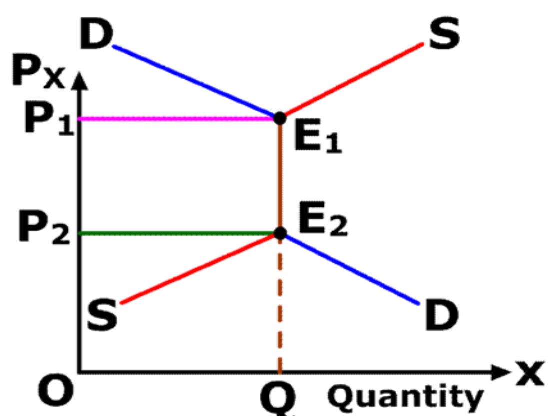


Fig. 11.5 (b)

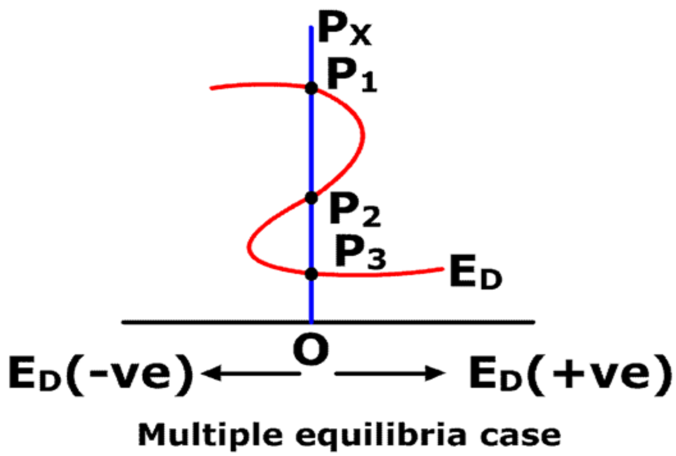


Fig. 11.5 (c)

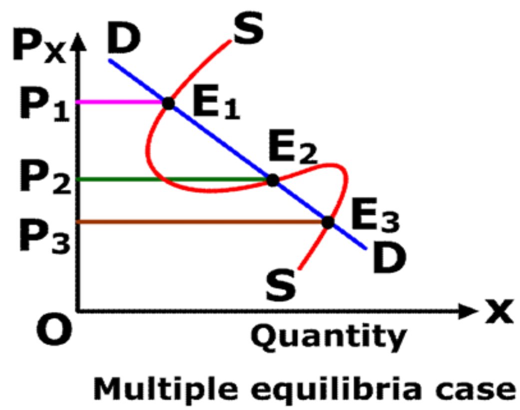


Fig. 11.5 (d)

Multiple equilibria cases

In Figure 11.5 (d) demand curve DD and supply curve SS intersect each other at E_2 where OP_2 is equilibrium price and OQ is quantity demanded as well as quantity supplied. If price increases to OP_1, then the new equilibrium will be at point E_1, where the quantity demanded and quantity supplied remain equal at OQ. Thus, between the price range P_1P_2 (or E_1E_2) there are multiple equilibrium points. For example, multiple equilibrium arise when a negatively sloping demand curve is intersected by a backward bending supply curve at more than one points, as shown in Figure 11.5(e). Supply curve SS intersects demand curve DD at points R and K, yielding multiple equilibria.

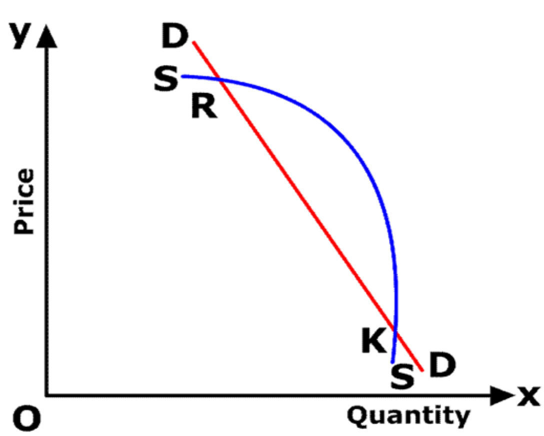


Fig. 11.5 (e)

The cases of multiple equilibria are however rare and not of much practical importance.

11.5 Stability of Equilibrium

An equilibrium can be stable or unstable. A stable equilibrium means that both price and quantity would converge to some point if disturbed; or loosely speaking, the state of balance between forces of demand and supply will be restored. On the other hand, unstable equilibrium is characterized by imbalance between the demand and supply forces, hence price has a tendency to move away from the equilibrium point. Stability of equilibrium can be analyzed using two adjustment hypothesis–

(i) Walrasian adjustment process
(ii) Marshallian adjustment process

11.5.1 Walrasian Adjustment Process

The Walrasian adjustment process works through price movements, while the Marshallian adjustment process works through quantity movements.

(A) The Walrasian stability conditions state that when excess demand is positive, buyers tend to raise their bids (prices) and if negative the sellers tend to lower their prices. In other words, Walras assumes that it is price that adjusts itself to quantity changes. The excess demand price is defined as the difference between the price that buyers are willing to pay and the price that sellers are charging for a given quantity.

(B) Mathematically the excess demand at price P can be defined as

$$E (P) = D (P) – S (P)$$

It is positive or $E (P) > 0$ if $D (P) > S (P)$

It is negative or $E (P) < 0$ if $D (P) < S (P)$

(C) In Figure 11.6 when excess demand is positive ($P_1F > P_1C$), that is, the quantity demanded is greater than the quantity supplied, the buyers will bid the price upward and when the price rises, demand falls and supply increases and the initial equilibrium position is reached at E. If the excess demand is negative ($P_2A < P_2B$), that is, the quantity supplied is greater than the quantity demanded, the sellers will lower the price from OP_2 to OP. Thus, according to the Walrasian stability condition, when excess demand is positive, then the buyers will increase the price, and if it is negative, then the sellers will reduce the price, as a result of which the equilibrium position is restored at E as shown in Figure 11.6 below.

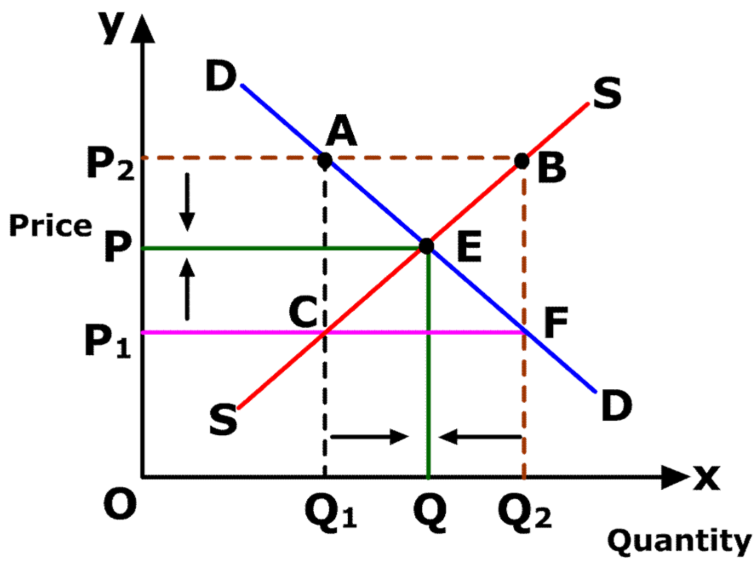


Fig. 11.6

11.5.2 Marshallian Adjustment Process

The Marshallian stability condition states that producers will tend to increase the supply of the product when the excess demand price is positive and will reduce it when it is negative. In other words, Marshallian analysis is based upon the assumption that quantity adjusts to price changes. In figure 11.6 when excess demand price is positive ($AQ_1 > CQ_1$), that is, the demand price is greater than supply price, it means that consumers are ready to pay more price than is being charged by the producers. This will induce the producers to increase the supply from OQ_1 to OQ which will lead to a decrease in price and then again leads to increased demand; as a result of which equilibrium will be restored at the initial equilibrium position E. On the other hand, when the excess demand price is negative ($FQ_2 < BQ_2$), that is, the demand price is less than supply price, it means that the consumers are willing to pay a lower price than is being charged by the producers. This will induce producers to decrease the supply from OQ_2 to OQ which will lead to increase in price and that again leads to increased supply; as a result of which equilibrium will be restored at the initial equilibrium point E.

11.5.3 Comparison of Walrasian and Marshallian Analysis

It is clear that the conditions of stability given by Walras and Marshall are satisfied simultaneously if the demand curve is negatively sloped and supply curve is positively sloped. According to Walras, equilibrium is defined as the price which equates quantity demanded and quantity supplied. In Marshallian analysis, equilibrium is defined as the quantity which equates demand price with supply price.

In case, the supply curve is negatively sloped, the two stability conditions cannot be fulfilled simultaneously rather both will hold in opposite directions. If an equilibrium is stable in the Marshallian sense, then the equilibrium will be unstable in the Walrasian sense and vice- versa. We may explain it with the help of negatively scoped supply curve which intersects the normal demand curve at several points, as shown in Figure 11.7 below:

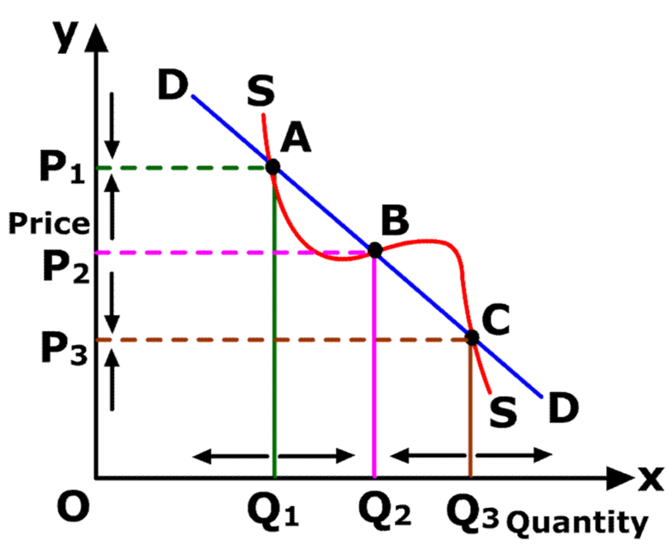


Fig. 11.7

A, B and C are three points of equilibrium, where quantity demanded is equal to quantity supplied. According to Walras, the successive equilibrium points A, B and C are alternatively stable and unstable. The demand curve intersects the supply curve from below at A and C, and therefore, the equilibrium is stable at these points. In other words, the supply curve is steeper than the demand curve at A and C that is why, the equilibrium is stable. Similarly, the demand curve intersects the supply curve from above at point B, the equilibrium is unstable. In other words, the supply curve becomes less steep than the demand curve at point B that is why, the equilibrium is unstable. In figure 13.7 equilibrium points A and C are Walrasian stable but Marshallian unstable and equilibrium point B is Walrasian unstable but Marshallian stable.

On the other hand, According to Marshall, if the demand curve lies above the supply curve and then intersects the latter, as on points E and G, the points of intersection will result in stable equilibrium. On the contrary, if the demand curve lies below the supply curve and the point where they intersect (point F) will be a point of unstable equilibrium. Such a case is illustrated in Figure 11.8 below;

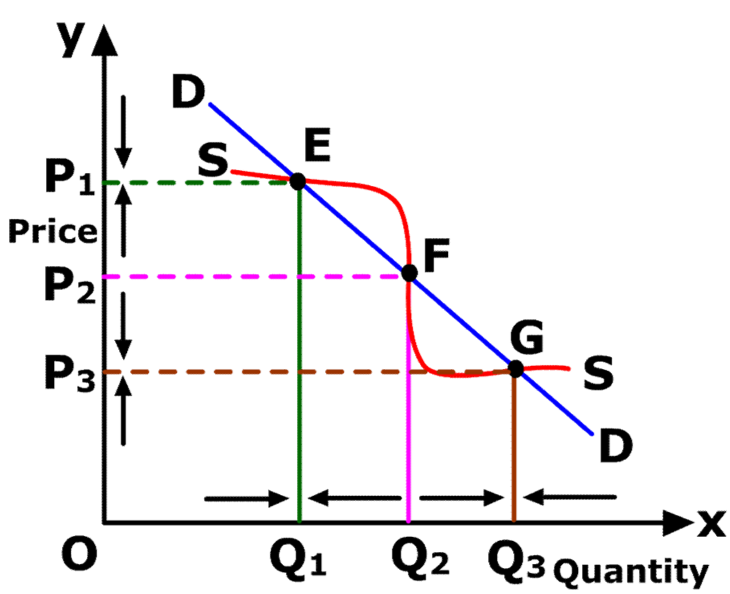


Fig. 11.8

This figure shows equilibrium points E and G are Walrasian unstable and Marshallian stable whereas equilibrium point F is Walrasian stable but Marshallian unstable.

Thus the two approaches given by Marshall and Walras regarding the stability conditions o equilibrium are just opposite to each other. It is because both Marshall and Walras have taken different time periods in their analysis. Walras has explained stability and un- stability assuming a short period in which adjustment is made by changes in price. Walras viewed adjustment process as a price correction process (short-run adjustment process). Marshall, on the other hand, defines stability conditions in the context of equilibrium in which the adjustment is made by quantity changes. Marshall viewed adjustment process as a quantity correction process (Long-run adjustment process).

11.6 Summary

- Equilibrium in a competitive goods market implies that the forces operating in the market from the demand side exactly balances the forces operating in the market from the supply side. Equilibrium price is the price at which quantity traded at that price is the equilibrium quantity for that market.
- The excess demand for good x is defined as the difference between demand for good x and supply of good x. That is, Ex=Dx-Sx

  At equilibrium Dx=Sx and hence Ex equals zero. At a price below equilibrium price demand exceeds supply and hence excess demand is positive. As price keeps on falling positive excess demand goes on increasing. Now at a price above the equilibrium price supply exceeds demand and hence excess demand is negative excess demand tends to increase. The excess demand curve as a function of Price is downward sloping.
- Even if equilibrium exist, there is no guarantee that such an equilibrium will be unique. Uniqueness implies that there exists only one positive price at which demand equals supply, or excess demand for the good equals zero. There are situations where more than one positive price prevails. In such cases we have multiple equilibrium; more than one set of prices at which demand and supply forces are in balance. Such possibilities arise when either the demand curve or the supply curve do not behave normally.
- Stability of equilibrium can be analyzed using two adjustment hypothesis-

(a) Walrasian adjustment process

(b) Marshallian adjustment process

The Walrasian adjustment process works through price movements, while the Marshallian adjustment process works through quantity movements.

- In Walras, equilibrium is defined as the price which equates quantity demanded and quantity supplied. In Marshall, equilibrium is defined as the quantity which equates demand price with supply price.

Unit- 12: Introduction to Welfare Economics and Pareto Optimality

Structure:

12.0 Learning Outcomes

After studying this module you shall be able to:

- Know the concept of welfare economics
- Learn about pareto-optimality

12.1 Introduction

Welfare economics studies the conditions under which the solution to a general equilibrium model can be said to be optimal. This requires among other things, an optimal allocation of factors among commodities and an optimal allocation of commodities (i.e. distribution of income) among consumers. In welfare economics attempt is made to establish criteria or norms, with which to judge or evaluate alternative economic states and policies from the view point of the society's well- being. In the words of Oscar Lange, "welfare economics establishes norms of behavior which satisfy the requirements of social rationality of economic activity." The term "Social rationality" of economic activity is to be interpreted as that activity which ensures optimum allocation of resources and therefore guarantees maximum social welfare. In this context Oscar Lange says, “The norms of behavior established by welfare economics are supposed to guarantee the optimal allocation of economic resources of the society.”

The inter-relationship among various parts of the economy implies that certain specific change in one past of the economy affects resource allocation in all other parts of the economy. Thus, a central problem in welfare economics relates to whether a specific change in resource allocation will increase or decrease its social welfare.

12.2 Pareto-Optimality Criterion

Developed by the Italian economist, Vilfredo Pareto, the Pareto optimality criterion is the cornerstone of modern welfare economics. The criterion is used to determine whether the social welfare is higher in one economic situation than in another.

According to the Pareto optimality criterion, a distribution of inputs among commodities and of commodities among consumers is Pareto optimal or pare to efficient if, no reorganization of production or consumption is possible by which some individuals are made better off (in their own judgment) without making someone else worse off.

In other words, Pareto optimal is a situation in which it is impossible to make anyone better off without making someone else worse off. This situation is also called Pareto efficient. It follow that any change that improves the well- being of some individuals without reducing the well-being of others, clearly improves the welfare of society as a whole and should be undertaken. This will move the society from a Pareto non-optimal position to Pareto optimum. Once at Pareto optimum, no reorganization of production and exchange is possible that makes someone better off without, at the same time, making someone else worse off.

In a Pareto optimal state of an economy, it is impossible to make any one better off without making someone worse off by any of the following three means;

1. Re allocation of the already available goods among consumers.

2. Re allocation of inputs among producers (in order to increase the output of some goods without reducing the output of any other good.)
3. Changing the composition of output that is, producing more of some and less of others.

Let us examine each of these three situations.

1. Allocation of goods among consumers: Efficiency in Exchange

Pareto optimality (or efficiency) in exchange is achieved when allocation of commodities among the consumers is such that it is not possible to increase the satisfaction of any person without reducing the satisfaction of someone else Pareto optimality (or efficiency) in exchange can be achieved only when all consumers have the same marginal rate of substitution between the same pair of goods. This marginal condition, with reference to two commodity and two- consumer model, may be expressed as

$$MRS_Y^A = MRS_{XY}^B$$

In a situation, where this condition is not fulfilled, it is always possible to increase the total welfare by transferring some units of a commodity from a person who derives lower utility to the person who derives greater utility.

The Pareto optimum allocation of commodities among the consumers is illustrated by using Edgeworth Box diagram, as presented in Figure 1.

Pareto used ordinal utility functions to represent consumer's preferences as well as welfare levels, using a two consumer economy A and B we can indicate their welfare levels by means of indifference curves mapping which satisfy the normal properties of consumers preference ordering. The indifference curves for consumer A, convex to origin OA, are given by A_1, A_2, A_3 and A_4. The indifference curves of consumer B, convex to origin OB, are given by B1, B2, B_3 and B_4. The dimensions of the box are given by the total amount of the two commodities owned by the two consumers together. Any point inside the box indicates how the total amount of the two commodities is distributed between the two consumers.

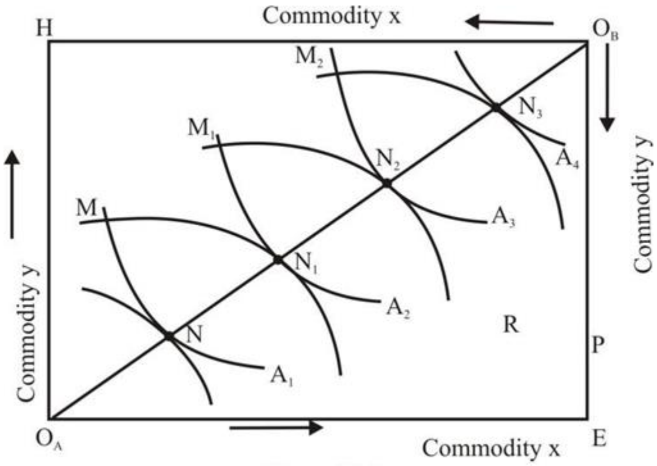


Fig. 12.1: Edgeworth Box diagram; Efficiency in exchange

In Figure 12.1 above, at points N, N_1, N_2 and N_3 the indifference curves of consumers A and B are tangential to each other. This would imply that MRS^A must equal MRS^B at each of these points. The marginal rates of substation between commodities x and y are the same for both the consumers, A and B. Since marginal rate of substitutions are equal no scope exists for improving the welfare of any one consumer unless the welfare of the other consumer is reduce. When marginal rate of substitutions are not equal as at points like M, M_1 and M_2, opportunities exist for improving the welfare of one consumer without reducing the welfare of any other consumer in the economy. Such points (or states of the economy) are called Pareto in optimal points. It must be noted that Pareto optimality is often called Pareto efficiency? While Pareto in optimality is referred to as Pareto in efficiency. The locus of the points of tangencies defines the contract curve $O^N{}_AN_1N_2N_3O_B$. Once consumers A and B are on the contract curve, it is impossible to make either of them better off without making the other worse off. Thus, the contract curve shows the locus of Pareto optimal or efficient allocation of commodities. As mentioned above, the marginal condition for a Pareto optimal resource allocation requires that the MRS between two commodities be equal for both consumers, i.e.

$MRS_{XY}{}^A = MRS_{XY}{}^B$

It can be shown that the above argument can be extended for any number of commodities and any number of consumers.

Therefore, we conclude that the marginal condition for a Pareto optimal or efficient allocation of goods among consumers requires the equality of MRS between any numbers of commodities for all consumers.

2. Optimal allocation of factors; Efficiency in production.

Like efficiency of exchange, we can also explore the efficiency in production. Efficiency in production or pareto optimality in allocation of resources requires that factors (L and K) are so allocated in the production of two commodities, x and y, that it is not possible to increase the output of one commodity, by reallocation factors, without causing a decrease in the production of the other. The marginal condition that must be fulfilled to achieve Pareto optimality in resource allocation is that marginal rate of technical substitution (MRTS) between L and K is the same for both x and y produced by two firms. That is, for all producers of x and y,

$MRTS_{LK}^{X} = MRTS_{LK}^{Y}$

Pareto optimality in the allocation of factors between the two products and also between the two firms has been diagrammatically shown in terms of Edgeworth Box diagram in Figure 2. The analysis is analogous to one developed to present the marginal condition of optimum allocation of goods between the consumers.

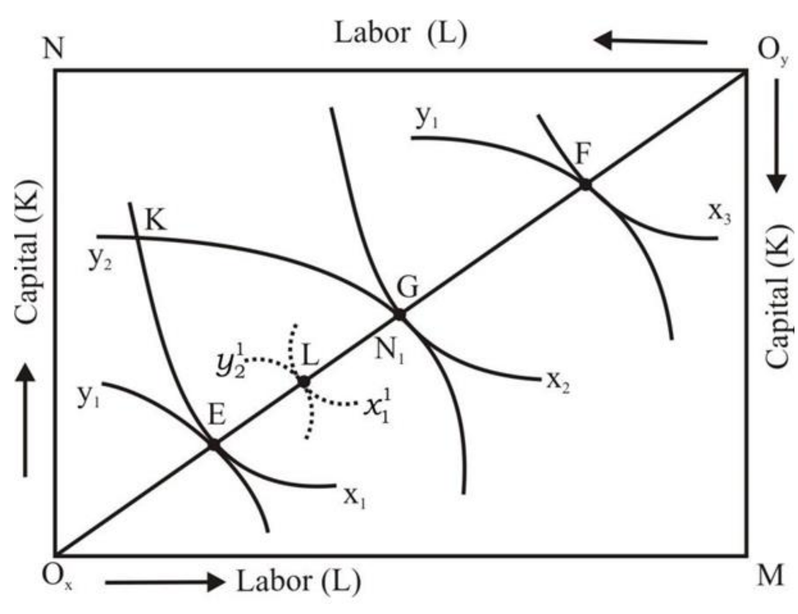


Fig. 12.2: Edgeworth Box diagram; Efficiency in production

In Figure 2, the dimensions of the box are quantities of labour and capital which are available for production of commodities x and y. Isoquant map for x is given by x_1, x_2 and x_3 with origin OX. Isoquants for y are given by y_1, y_2 and y_3, Isoquant map of y with origin as Oy, is inverted and superimposed on the map of x. The equilibrium is achieved where the isoquants of x and y are tangential to each other. The efficiency locus or contract curve of production Ox EG F Oy is obtained by joining these points. That is, the condition $MRTS_{LK}^{X} = MRTS_{LK}^{Y}$ is fulfilled along the efficiency locus.

Since, K is not on the contract curve of production, a reallocation of labour and capital in such a way as to move to a point on the contract curve will allow production of more of one or both commodities without reducing the output of other.

For instance, at point E, more y and the same amount of x are produced; while as L the output of both x and y are higher.

Once we are on the contract curve, it is impossible to increase the output of either good without reducing the output of the other; thus, the allocation of resources among the producers of x and y is Pareto optimal. It may be noted that there are several points on the contract curve of production and each of them represents the optimum allocation of labor and capital as between the two firms producing commodities x and y. But which one of them is best cannot be said on the basis of Pareto criterion because movement along the contract curve in either direction represents such factor re-allocation which increases the output of one and reduces the output of another firm.

12.3 Optimal Composition

Given fixed quantities of commodities, the consumption efficiency ensures their efficient exchange between individuals. Likewise, the production efficiency condition ensures efficient use of resources, given fixed amount of resources, in producing different commodities. The third condition for Pareto efficiency is product-mix efficiency. That is, the mix of commodities produced by the economy must reflect the preferences of those in the economy. The economy must produce along the production possibilities curve at a point that reflects the preferences of consumers. Intuitively this can be done by simply equating the rates of substitution between x and y on both production and consumption sides. Since $MRTS_{XY}$ shows the rate at which x and y are transformed in production and MRS_{XY} show the rate at which consumers are willing to exchange x and y the two ratios must be equal in the equilibrium. This gives the Pareto optimum condition for product- mix. That is, it requires equality between MRT in production and MRS in Consumption for every pair of commodities and for every individual. In the case of a very simple economy composed of only two commodities and two individual (A and B), Pareto optimality in production and consumption requires that

$$MRT_{XY} = MRS_{XY}^{A} = MRS_{XY}^{B}$$

The product-mix efficiency condition thus requires a simultaneous equilibrium in production and consumption as shown in Figure 12.3. For example, corresponding to point E on the production possibility curve, the total production OX_1 and OY_1 should be distributed between individuals A and B such that the slope of the tangent of point E (MRT_{XY}) is the same as of the tangent at point L on the exchange efficiency locus ($MRS^A = MRS^B$). The same rules would apply for point F as well should this combination of OX_o and OY_o be chosen, given the resource endowments.

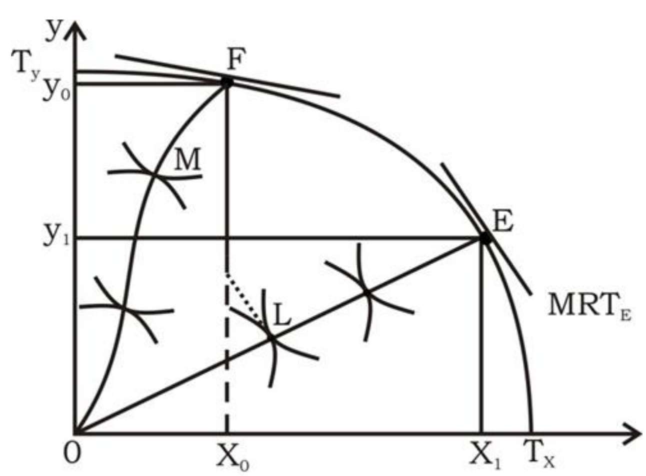


Fig. 12.3

This means then product-mix being produced at points E and F on the production possibility curve is consistent with the preferences of the two consumers, under the different situations.

Therefore, composition of production at point E and consumption pattern of individuals at point L would ensure maximum satisfaction and represent Pareto optimal product mix. Likewise, same inference can be drawn with regard to point F on the production possibility curve which is consistent with the preferences of the two consumers at point M. This is because having attained equilibrium at these points, through any further re-allocation of resources and changing the product mix we cannot increase satisfaction of one without reducing the satisfaction of the other, or increase the satisfaction of both.

Role of value Judgments in welfare economics

Welfare economics examines the conditions for economic efficiency in the production of output and in the exchange of commodities, and equity in the distribution of income. The maximization of society's well-being requires the optimal allocation of inputs among commodities and the optimal allocation of commodities (i.e., distribution of income) among consumers. The conditions for the optimal allocation of inputs among commodities and exchange of commodities among consumers requires that

$$MRT_{XY} = MRS_{XY}^{A} = MRS_{XY}^{B}$$

These are objective criteria devoid of ethical connotation or value judgments. On the other hand, it is impossible to objectively determine the optimal distribution of income. This necessarily requires inter-personal comparisons of utility and value judgments. For example, imposing a tax of Rs. 1000 on individual A and giving it as a subsidy to individual B will certainly make B better off and A worse off. But who is to say that the society composed of both individuals is better or worse off as a whole? Determining this involves comparing the utility gained by individual B (i.e., making interpersonal comparison of utility). And even if A has a high income and B has a low income to begin with, different people will have different opinions on whether this increases social welfare, reduces it or leaves it unchanged.

Therefore, no entirely objective or scientific rule can be defined. There is a great controversy regarding whether value judgments should have any role to play in welfare economics. Robbins and his followers have been asserting that the inclusion of value judgments would make our subject unscientific and therefore, according to them, economists should refrain from making value judgments. On the other hand, majority of modern economists are of the view that economists should not deliberately avoid making value judgments. If there is wide consensus about them among the community. Using his knowledge of economics together with these value judgements he should comment upon desirability or otherwise of certain policies and issues.

As regards the welfare of individual is concerned, it can be measured in ordinal terms by specifying preferences. For instance, if an individual chooses state a rather than state b, it shows that his welfare is grater in state a then in state b, Thus, choice by an individual is an objective test for knowing and comparing his welfare in different economic states. Therefore, what promotes individual welfare or not can be tested and verified. However, when welfare economics has to judge the social welfare, it encounters difficulties, because the measurement of social welfare is not an easy task and contains value judgements and interpersonal comparisons of utility. We cannot derive propositions of social welfare from choice of individuals comprising the society. Individual choices differ because various individuals have different tastes, preferences and ethical beliefs and therefore different value judgements. The vital issues in welfare economics are concerned with social welfare and devising certain criteria to judge the social welfare.

Therefore, welfare economics cannot be purely objective or free from value judgements.

According to Vilfredo Pareto the social welfare depends upon the welfare of the individuals comprising the society and, according to his optimality criterion, if at least one individual is made better off by certain economic reorganization and no one being made worse off, the social welfare increases, that is, if an economic reorganization increases the welfare of one without reducing the welfare of any other, then the social welfare increases. When a certain economic state is reached, when through any reorganization it is not possible to make at least one individual better off with no other being worse off, this is called the state of maximum social welfare or Pareto optimum. Also, Nicholas kaldor and John Hicks propounded a compensation principle of welfare which is free from value judgements. According to this compensation principle, if a change in economic organization increases the welfare of some and reduces the welfare of others, and those who again in welfare are able to compensate the losers and still be better off than before, then he change in economic organization will increase the social welfare. Abraham Bergson has pursued a different line of approach to welfare economics. He has propounded the concept of social welfare function in which a set of value judgements is explicitly introduced and with this social welfare function, the economists can judge the desirability of certain economic reorganization or policy changes. These value judgements, according to Bergson, "must be determined by its compatibility with the values prevailing in the community the welfare of which is being studied".

Followers of Abraham Bergson like Samuelsson and I.M.D. Little are of the view that welfare economics cannot be separated from value judgements, because any statement about increase or decrease of social welfare necessarily involves value judgements. Since welfare economics has been developed to make policy recommendations to promote social welfare, economists cannot escape from introducing ethical norms or value judgements.

12.4 Summary

1. Welfare economics studies the conditions under which the solution to the general equilibrium model can be said to be optimal. It examine the conditions for economic efficiency in the production of output and in the exchange of commodities, and for equity in the distribution of income.
2. Pareto was the first economist who provided a positive criterion for comparing alternative states of the economy the paretian criterion says that if it is possible to improve the standard of at least one person in moving from state 1 to state 2 without decreasing the standard of standard of anybody else, then state 2 is ranked superior to state by society. In other words it is desirable to move from state 1 to state 2 and this movement is considered as Pareto improvement. However, when it is not possible to improve the standard of someone else.
3. The basic marginal conditions of pareto optimality may be summarized as follows:
   (a) Marginal condition of Exchange optimality: It means that the marginal rate of substitution (MRS) between any pair of goods must be the same for all the consumers.

$$\mathbf{MRS_{XY}^{A} = MRS_{XY}^{B}}$$

(b) Marginal condition for production optimality

That is, the marginal rate of technical substitution (MRTS) between any pair of factors must be equal for all commodities and all firms.

$$\mathbf{MRTS_{LK}^{A} = MRTS_{LK}^{B}}$$

(c) Marginal condition in product Mix

$$\mathbf{MRT_{XY} = MRS_{XY}^{A} = MRS_{XY}^{B}}$$

It means that the marginal rate of transformation (MRT) between any pair of goods must be equal to the marginal rate of substitution for any pair of goods.

4. The value of judgements are unavoidable in welfare economics as ‘welfare’ itself is an ethical term. Any theorems pertaining to choices among various situations to maximize welfare are also ethical and must rest on some obvious or hidden value judgements.
5. Value judgements are open to argument, criticism and disagreement. As a result, welfare theory which depends on value judgements is bound to be normative in character

Block 04

General Equilibrium Analysis:

Production & Exchange

Unit- 13: General equilibrium in exchange

Structure:

13.0 Learning Outcomes

After studying this module, you shall be able to

- Know about the general equilibrium in exchange
- Understand how Exchange takes place in general equilibrium
- Learn about the assumption of general equilibrium in exchange
- Understand the Utility Possibility curve

13.1 Introduction

General Equilibrium analysis seeks to determine the equilibrium in an economy, recognizing the fact of interconnections and inter dependence among the different products and factor markets. In this section, we examine general equilibrium of exchange for a very simple economy composed of only two individuals and two commodities.

13.2 General Equilibrium in Exchange

In this module, we examine general equilibrium of exchange for a very simple economy composed of only two individuals (A and B) and two commodities (X and Y): In this exchange system, we assume that there is no production. That is, we consider the case when two commodities are provided to the individuals in the economy from outside the system. Such possessions are called the initial endowments of individuals A and B. Now, suppose the individuals engage in an exchange 80 as to maximize their satisfaction. This process of exchange can be better understood through the Box diagram (named after the neo-classical English economist of the early twentieth century F.Y. Edgeworth who popularized the use of box diagrams in economics). The dimensions of the box measures total quantity of x, measured along the x-axis, and total quantity of y, measured along the y-axis. Each point in the Edgeworth Box diagram represents all feasible allocations in this simple economy. Consider Figure 13.1 where a box with a certain fixed dimensions has been drawn. Along the x-axis we measure the commodity X and along the y-axis we measure the commodity Y. The total available amount of commodity x is O_AF and of commodity y is O_AG. The available amounts of the two commodities, O_AF and O_AG, determine the dimension of the box, which is given and fixed. The quantity of x available with the individual A is measured from left to right along the x-axis with bottom left-hand corner O_A as the point of origin. And, quantity of commodity

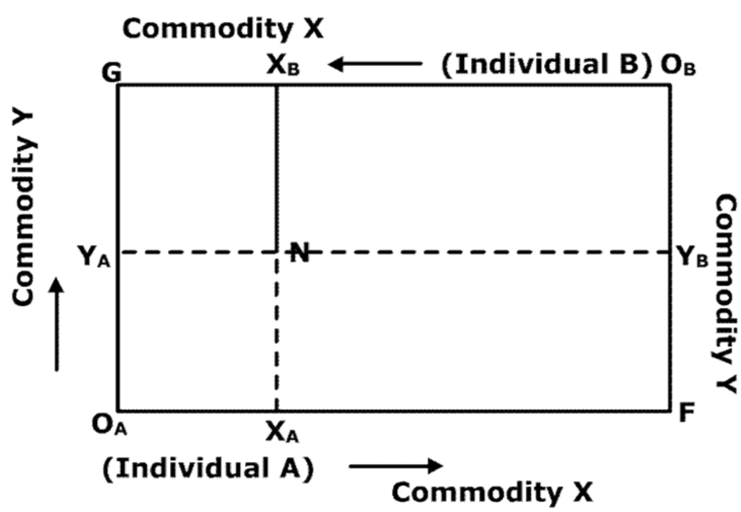


Fig. 13.1

Y available with the individual A measured along the y-axis from bottom to top with the point of origin O_A. For individual B, the top right hand corner O_B has been taken as the origin and with the given quantities of x and y, the quantity of x available for consumption for individual B is measured right to left, from the point of origin, measured, top to bottom, from the point of origin O_B, and the quantity of y available for B is O_B. Consider a point N lying inside the box O_A G O_B F. The allocation to individual A is $O_A X_A$ of commodity A and $O_A Y_A$ (X_AN) of commodity B. While the allocation to individual B would be $O_B X_B$ of commodity X and X_B N of commodity Y. Note that $O_A X_A$ and $O_B X_B$ would add up to O_AF And X_A N plus X_B N would add upto O_AG. This implicit assumption means that there is total usage of each and every commodity for the economy as a whole. Thus, by construction, any point in the box represents the division of total quantity of X or Y in between individuals A and B so that

$$X_A + X_B = X$$

$$y_A + y_B = Y$$

In the Edgeworth Box diagram we also draw the indifference curves of the two individuals A and B depicting their scale of preferences between the two commodities X and Y. we can depict the individuals preferences by maps of their indifference curves as shown in Figures 13.2 (a) and (b) having the usual properties of smoothness and convexity-to-origin

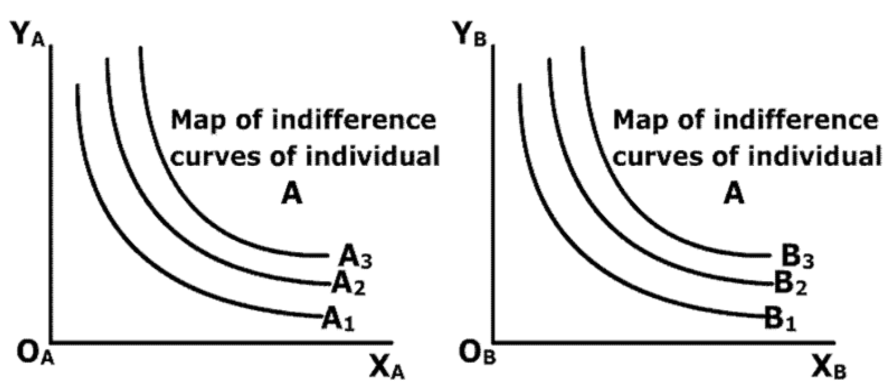


Figure 13.2

General equilibrium of Exchange is based on the following assumptions

Assumptions:

(1) Two individuals A and B endowed with fixed amounts of only two commodities x and y

(2) Both individuals know each other’s preferences

(3) Each individual will take prices as given and optimize accordingly.

With the above assumptions, the general exchange equilibrium would lie same where on the Contract curve, that is, the line which passes through the tangency point line of the indifference curves of the two individuals. At these tangency points of indifference curves, $MRSx_1y$ of individual A is equal to the MRS_{xy} of individual B. Any point where the indifference curves are tangent, constitutes a consumption point where no further gains from trade or exchange are possible. Thus, the general equilibrium of exchange will occur general equilibrium of exchange will occur when the following condition holds good:

$$MRS^A_{xy} = MRS^B_{xy}$$

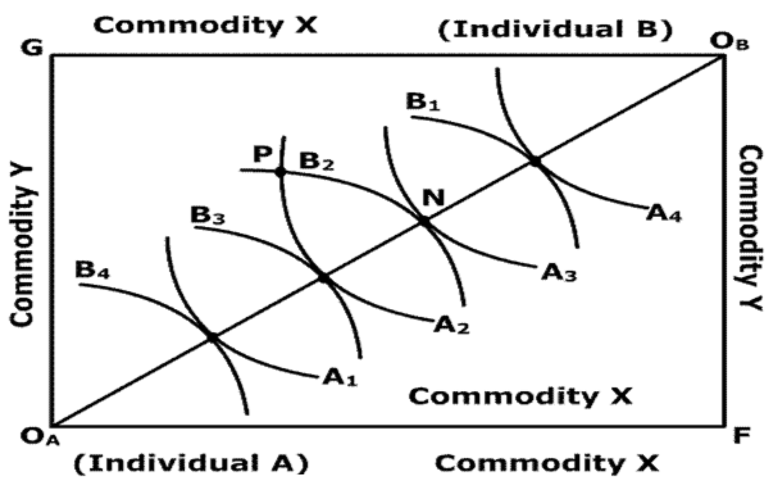


Figure 13.3

Edgeworth Box diagram for Exchange

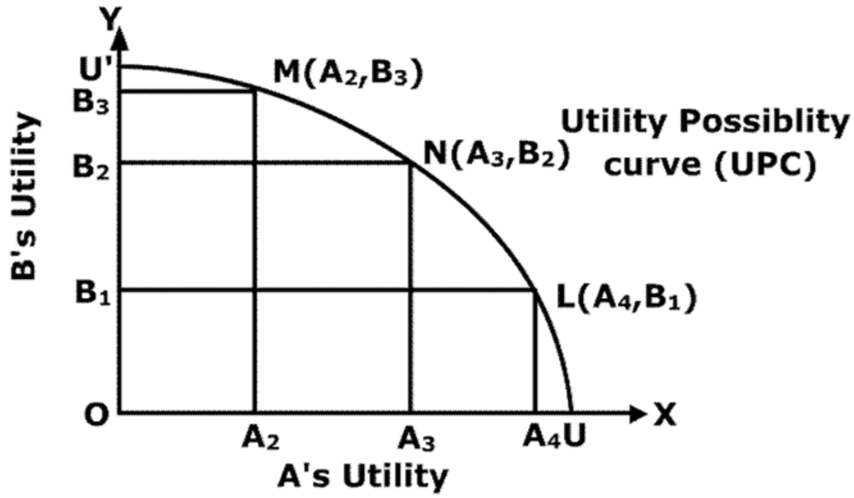


Figure 13.4

Recall the equilibrium condition, $MRS^{A}_{xy} = MRS^{B}_{xy}$, which tells us that an efficient exchange is obtained where the indifference curves of individuals A and B are tangential to each other; We can hence obtain a locus of these efficiency points known as the contract curve-given by O_AMNLO_B in Figure 13.3. Any movement along the contract curve is a gain of utility to one individual and loss to the other. Contract curve it-self does not depend on the initial endowment. Contract curve describes all the possible efficient outcomes of mutually advantageous trade or exchange from starting anywhere in the Edgeworth Box. Given the initial endowment Point, We can get the subset of the contract curve that each individual prefers to his initial endowment. In Figure 13.3, if P is the initial endowment point, both the individuals, A and B, will be better off at all points between M and N on the contract curve O_AMNLO_B.

From the above discussion it follows that given the initial endowment point P the general equilibrium of exchange can occur somewhere between M and N on the contract curve. On all points between M and N, the exchange equilibrium can exist. Although equilibrium will exist at a point on the contract curve, there is no unique position of exchange equilibrium; all points between M and N on the contract curve are possible equilibrium positions.

13.3 Utility Possibility Curve

UTILITY possibility curve is derived from consumption contract curve. By plotting the consumption contract curve of Figure 13.3 form the output space into a utility space, we get the corresponding utility possibility curve as shown in Figure 13.4. It shows the various combinations of utilities derived by individuals A and B (i.e, U_A and U_B) when this simple economy is in general equilibrium in exchange. We measure A's utility on x-axis and B's utility on y-axis. In Figure 13.4, u u' is a utility possibility curve which shows the various levels of utilities derived by two individuals A and B of the society resulting from the redistribution of a fixed bundle of goods and its consumption by them. Note that the points in the Edgeworth Box diagram Figure 13.3, Located away from the consumption contract curve are inside this utility possibility curve For example, point P is inside the utility possibility curve and hence shows an inefficient allocation of x and y commodities between individuals A and B. Utility possibility curve in Figure 13.4 shows the utility levels of individuals A and B across the efficiency locus for the given levels of $\bar{X}$ and $\bar{y}$ is plotted shown by points M, N and L.

13.4 Summary

- The general equilibrium of exchange occurs at a point on the contract curve where the marginal rate of substitution between the two goods (MRSxy) of the two individuals is the Same. The exchange equilibrium cannot be at a point in the Edgeworth Box Which is not on the contract curve. This is because at a point which is not on the contract curve indifference curves of two individuals intersect each other and therefore in original rate of substitution (MRSxy) are not equal to each other.
- Utility possibility curve is derived from consumption contract curve. It shows the various combinations of utilities received by individuals A and B. When the economy is in general equilibrium. It is the focus of maximum utility for one individual for any given level of utility for the other individual.

Unit- 14: General Equilibrium in Production

Structure:

14.0 Learning Outcomes

After studying this module, you shall be able to

- Know about the general equilibrium in production
- Understand how production takes place in general equilibrium framework
- Learn how to derive production possibility frontier

14.1 Introduction

We now extend our analysis of general equilibrium to the sphere of production. We will now discuss general equilibrium or production in a simple economy in which no exchange takes place.

14.2 General Equilibrium in production

We now proceed to examine the general equilibrium of production in a simple economy (in which no exchange takes place). We list the chief assumptions of the model below: Assumptions

1. There are 2 factors of production, labour (L) and capital (K), which are perfectly homogenous and perfectly divisible. The total endowment of each factor of production in the economy is fixed and given.
2. There are 2 commodities, x & y produced in the economy; each commodity is homogeneous and perfectly divisible. The production functions of x and y exhibit constant returns to scale and are independent of each other. Further, the isoquant maps of both x and y are well-behaved, i.e, smooth and convex-to-origin, implying a diminishing marginal rate of technical substitution's (MRTS)
3. There is perfect competition in commodity and factor markets.
4. Technology is given
5. Labour and capital can be transferred freely from the production of x to y and vice versa. To examine general equilibrium of production, we deal with a very simple economy that produces two commodities (x & y) with only two inputs, labour (L) and capital (K). We construct an Edgeworth Box diagram for production from the isoquants for commodities x & y. Isoquants maps of x & y commodities are depicted in Figure 14.1 (a) and (b) respectively. Assuming the amounts of labour and capital as given and fixed, the Edgeworth Box diagram can be constructed as shown in Figure 14.2. The measurements of the box are quantities of labour and capital which are to be allocated between two products / industries. The tangency contract curve for production contract curve for production $O_x^{TBCD}O_y$ is obtained by joining these tangency points of the isoquants of x & y. That is, the condition $MRTS^X{}_{LK} = MRTS_{LK}{}^Y$ is satisfied along the Contract curve.

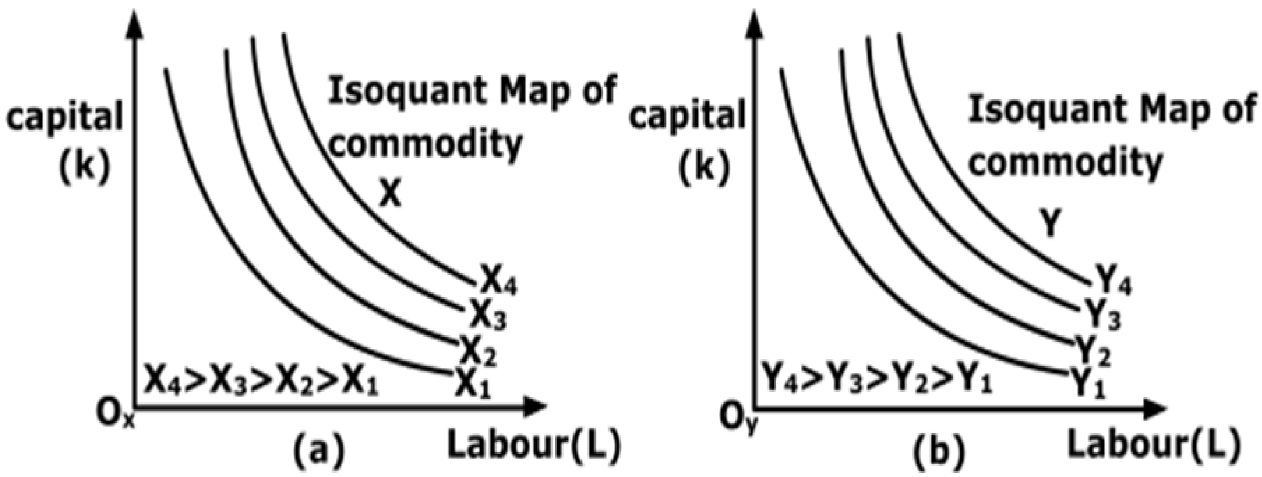
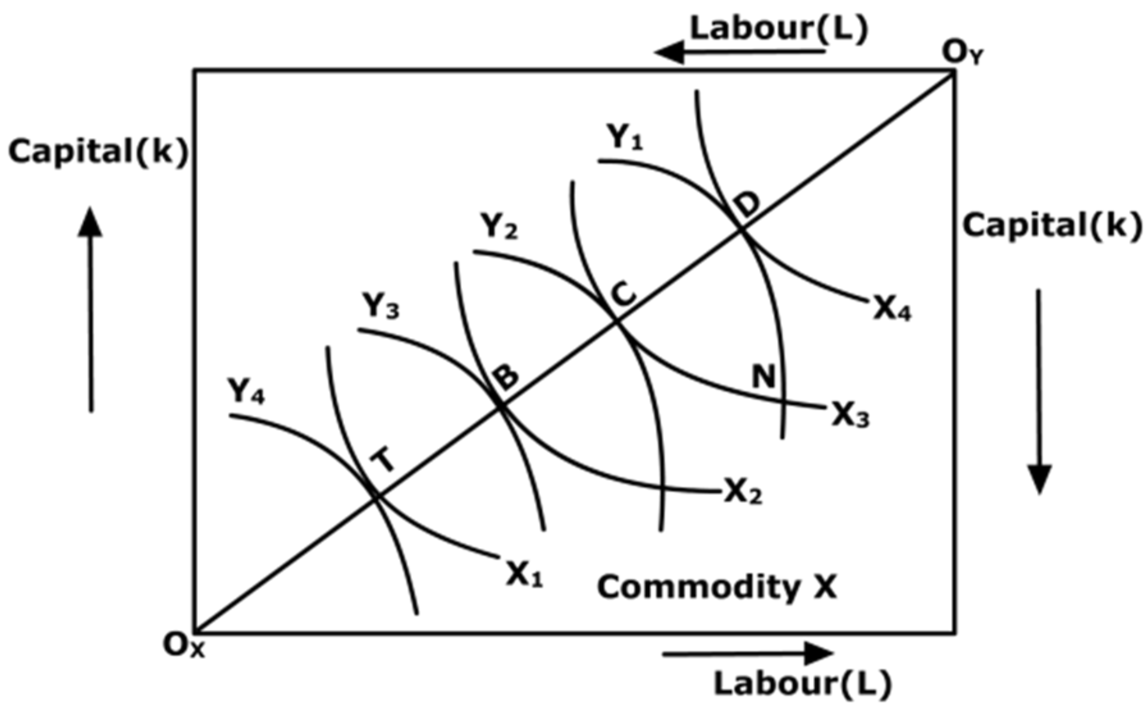


Figure 14.1



Edgeworth Box diagrem for Production

Figure 14.2

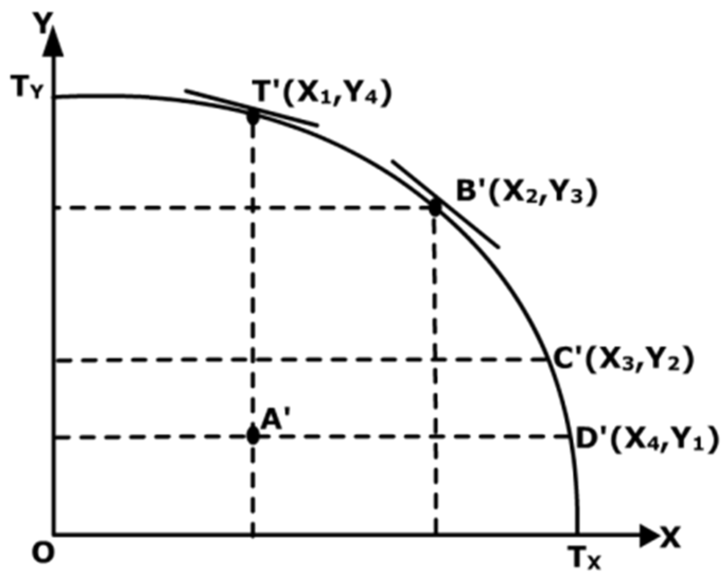
It can be depicted that the general equilibrium of production would occur somewhere on this contract curve for production. The distribution of factors stated by the point away from the contract curve such as point A cannot be the possible position of general equilibrium of production. This is due to the fact that from the point A where isoquant X_2 and isoquant Y_2 are intersecting, the 2 firms can move by re-distributing resources between the two commodities (through trading or exchange of resources of factors) to a point B or C on the production contract curve where the output of one commodity increases without the reduction in output of the other.

And, if through trading and reallocation of factors, the two firms move to any point between B and C on the contract curve, this economy can move from a point not on the contract curve to a point on the contract curve and expand its output of either or both commodities. Once on its production contract curve, the economy can only increase the output of either commodity by reducing the output of the other. It is clear from Figure 14.2, if we make a move form point B to point C, it is impossible to increase the output of either commodity without reducing the output of the other; here the economy increases its output of commodity x but its output of commodity y falls. For an economy of many commodities and many factor inputs, the general equilibrium of production occurs where the marginal rate of technical substitution (MRTS) between any pair of factor inputs is the same for all commodities and producers using both inputs.

It is important to state that a point of general equilibrium of production is not distinctive since it may befall at any point on the production contract curve, depending on initial endowment point where from we started. For example, with initial endowment point A as in Figure 14.2 we can, through re distribution of factors, move to & attain general equilibrium at any point on the segment BC of the contract curve for production. Further with a different initial endowment point N in the Edgeworth Box diagram 14.2, there will be a different point of general equilibrium of the two factor markets assessing allocation of resources between the production of the 2 commodities but also the simultaneous equilibrium of the product markets of two commodities x and y indicating quantity demanded of each commodity equals the quantity supplied.

14.3 Derivation of Production Possibility Frontier

We know that all efficient input combinations must lie or the production contract curve O_XTBCDOy (Figure 14.2). For each output of a commodity there corresponds a given output of the other commodity. For example, in Figure 14.2, when x_1 units of x are produced, the amount of y obtainable is y_4 with x_2 units of xy attainable are y_3, and so on. In Figure 14.2 we have points T, B, C & D on the production contract curve O_XT BCDOy. From this production contract curve of Figure 14.2 from input space to output space, we get the corresponding production possibility frontier or product transformation curve), as shown in Figure 14.3



Production possibility frontier

Figure 14.3

Corresponding to points T, B, C and D in the input space of Figure 14.2, we get the points T', B', C', and D' in the output space of Figure 14.3. By joining points T', C' and D' we derive the production possibility frontier or transformation curve of x for y, T_x T_y shown in Figure 14.3.

The PPF or transformation curve depicts the several combination of commodities x and y that the economy can produce by fully utilizing all of the fixed amounts of labour and capital with the best technology available. Since the production contract curve shows all points of general equilibrium of production, so does the PPF, i.e, the production possibility frontier shows the maximum amount of either commodity which the economy can produce, given the amount of the other commodity that the is being produced by the economy. It is worth stating that a point inside the production possibility curve corresponds to a point off the production contract curve and indicates that the economy is not in general equilibrium of production, and it is not utilizing its inputs, of labour and capital most efficiently. For example, point A' inside the PPF (T_x Ty) in Figure 14.3 Corresponds to point A in Figure 14.2 at which isoquants x_2 and y_2 intersect. Now by simply reallocating some of the fixed labour and capital available between the production of x and y, the economy can increase its output of y only (and move from point A' to point T') as depicted in Figure 14.3, it can increase the output of x only by moving from point A' to D' or it can increase its output of both x and y (the movement from point A' to B'). Thus, a production possibility frontier or transformation curve depicts how 1 commodity is converted into another by transferring resources from the production of 1 commodity into the production of the other commodity. It is concave to the origin which implies that the amount of commodity y that has to be given up so as to produce an additional unit of x goes on increasing as we produce more of commodity x. This implies the operation of diminishing return in the production of x commodity. Given a point on the transformation curve such as B', the slope of the curve at that point measures the MRT between the 2 commodities x & y. MRT of commodity x for commodity y (MRT_{xy}) indicates the sum of that the economy must sacrifice, at a particular point on the production possibility curve, so as to release just sufficient labour and capital to produce one additional unit of x. we define the marginal rate of transformation as follows.

$MRT_{xy} = -\frac{\Delta y}{\Delta x}$ = the absolute value of the slope of PPF at that point = $\frac{MC_x}{MC_y}$

Thus, MRTxy is the rate at which one commodity is transformed into another and is equal to the ratio of marginal costs of production of the two commodities.

14.4 Summary

- The economy is in general equilibrium of production when it is on its production contract curve. Production contract curve is the focus of tangency points of the isoquants for x and y at which the MRTS of labour for capital is the same in the production of x and y. That is, the economy is in general equilibrium of production when

$$MRTS_{LK}^{X} = MRTS_{LK}^{Y}$$

- The PPF curve depicts the several combinations of commodities x and y that the economy can produce by fully utilizing all of the fixed amounts of labour and capital with the best technology available.
- The amount of commodities y that the economy must give up, at a particular point on the PPF, so as to release just enough labour and capital to produce one additional unit of commodity x, is known as the marginal rate of transformation of x and y (MRTXY). This is specified by the absolute value of the slope of the PPF at that point.

Unit- 15: General equilibrium in exchange and production

Structure:

15.0 Learning Outcomes

After studying this module, you shall be able to

- Know the assumptions made in general equilibrium of exchange and production.
- Learn about the role of transformation curve in the equilibrium mechanism.
- Identify general condition for equilibrium in production and exchange.
- Know the diagrammatic explanation of the equilibrium mechanism.

15.1 Introduction

Now that we have examined general equilibrium in a pure exchange economy with no production and the general equilibrium of production in a simple economy in which no exchange takes place, we are in a position to explain the simultaneous general equilibrium of production and exchange. In what follows we make use of the production possibility frontier and the contract curve for exchange to explain the condition of general equilibrium of production and exchange together.

15.2 Assumptions for General Equilibrium of Exchange and Production

Assumptions for General Equilibrium in Production and Exchange

In this module we examine the simultaneous general equilibrium in exchange and production. We list the major assumptions:

1. There are two factors of production, labour (L) and capital (k), which are perfectly homogeneous and divisible. The total endowment of each factor of production in the economy is fixed.
2. There are two commodities, x and y produced in the economy; each commodity is homogeneous and divisible. The production function of x and y exhibit constant returns to scale. Further, the isoquant maps of both x and y are well behaved, i.e., downward sloping and convex to origin, implying a diminishing marginal rate of technical substitution (MRTS).
3. There are two consumers, A and B, whose preferences are shown by the ordinal indifference curves which are downward sloping, convex to origin.
4. The goal of each consumer is utility maximizations subject to his income constraint.
5. The goal of each firm is profit maximization subject to technological constraint.
6. The factors of production are owned by the consumers.
7. There is full employment of factors of production and all incomes received by their owners, A and B are spent.
8. Both product and factor markets are perfectly competitive

15.3 Equilibrium Mechanism

We now can use production possibility frontier and the contract curve for exchange to examine how our very simple economy composed of two individuals (A and B), two commodities (x and y), and two factor inputs (L and K) can reach simultaneously general equilibrium of production and exchange.

Transformation curve

To begin with, we need to draw a transformation curve. The transformation curve shows the various combinations of commodities x and y that the economy can produce by fully utilizing all of the fixed amounts of labor (L) and capital (K) with the best technology available. It will be recalled that each point of the transformation curve corresponds to a point on the production contract curve which shows all combinations of two commodities which satisfy the condition of general equilibrium of production. The slope of transformation curve or production possibility frontier at a particular point gives the marginal rate of transformation of X for Y (MRT_{xy}) at that point. It measures by how much this economy must reduce its output of y in order to transfer enough labour and capital to produce an additional unit of x. The economic meaning of the transformation curve is the rate at which one commodity can be "transformed" into the other.

The general equilibrium of production can occur at any of the points on the given transformation curve or the production possibility frontier. Now, the question which confronts us is which of the points on the transformation curve represents simultaneously general equilibrium of production and exchange. To analyze the general equilibrium of output mix, we have to introduce in our analysis the consumers' preference pattern. There are two consumers, A and B, whose preferences are shown by the ordinal indifference curves which are downward sloping, convex to the origin.

Condition for General Equilibrium of Exchange and Production

We can reach general equilibrium by simply equating the rates of substitution between x and y on both production and consumption sides. Since MRT_{xy} shows the rate at which one commodity is transferred into another in the production process and marginal rate of substitution (MRS_{xy}) measures the rate at which consumers are willing to exchange one commodity for the other, the two ratios must be equal in the equilibrium. This gives the equilibrium condition for production and exchange simultaneously. That is, it requires equality between marginal rate of transformation (MRT) in production and marginal rate of substitution (MRS) in consumption for every pair of commodities and for every individual, i.e.

$$MRT_{xy} = MRS_{xy}^{A} = MRS_{xy}^{B}$$

This equilibrium is shown in Figure 15.1

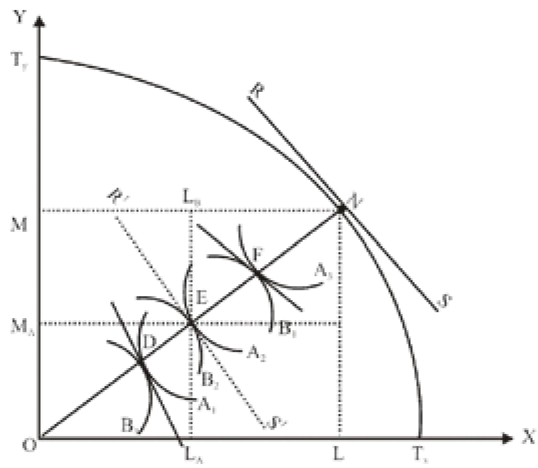


Figure 15.1

In Figure 15.1 T_x T_y is the transformation curve, which is derived from the production contract curve. Thus, every point on transformation curve shows general equilibrium in production. Suppose that this economy produces OL units of x and OM units of Y, given by point N on transformation curve (Production Possibility Curve) T_x T_y. Corresponding to point N, we formulate the Edgeworth box diagram for exchange between the two individuals A and B. Given the indifference curves of individuals A and B, and the amount of output as shown by point N on the transformation curve, we derive consumption contract curve as ODEFN Which is the locus of tangency points between different indifferent curves of individuals A and B. Every point on the contract curve for exchange is point of general equilibrium of exchange. There are several points on the production possibility frontier (Transformation curve), each representing different production equilibrium indicating a different output-mix of the two goods. It will be recalled that each point of the transformation curve corresponds to a point on the production contract curve which shows all combinations of two goods. Which satisfy the condition of general equilibrium of production.

However, to be simultaneously in general equilibrium of production and exchange, the marginal rate of transformation of commodity x for commodity y (MRT_{xy}) in production must be equal to the marginal rate of substitution of commodity x for commodity y in consumption (MRS_{xy}) for individual A and B. That is, the mix of commodities produced by the economy must reflect the preferences of those in the economy. The economy must produce along the production possibility curve at a point that reflects the preferences of consumers. For example, corresponding to point N on the production possibility frontier (Transformation curve) T_x T_y, the total production of OL units of x and OM units of y should be distributed between individuals A and B such that the common slope of indifference curves of individual A and individual B at point E equals the slope of production possibility frontier (T_x T_y) at the point of production N. Consumption equilibrium point E reveals that out of total output OL of commodity X, the amount L_A is being consumed by individual A and the remaining amount of x goes to individual B for consumption. Out of total output OM of commodity y, the amount M_A is consumed by A and the remaining amount by the B.

This position of general equilibrium of production &exchange indicates that factor markets of labour ,capital & product markets of commodity x and commodity y are simultaneously in equilibrium.

15.4 Summary

For the economy to be Simultaneously in general equilibrium of production and exchange, the marginal rate of transformation of x for y in production must be equal to the MRS of substitution of x for y in consumption for individuals A and B That is.

$$MRT_{xy} = MRS_{xy}^{A} = MRS_{xy}^{B}$$

Geometrically, this corresponds to the point on the contract curve for exchange at which the common slope of the indifference curve of the two individuals equals the slope of the PPF at the point of production.

Unit- 16: General Equilibrium and Perfect Competition

Structure:

16.0 Learning Outcomes

After studying this module, you shall be able to

- Know about general equilibrium of exchange
- Learn the equilibrium conditions of general equilibrium
- Understand general equilibrium under perfect competition in both exchange and production

16.1 Introduction

The general equilibrium of exchange occurs of a point on the contract curve where the marginal rate of substitution between the two commodities (MRS_{xy}) of the two individuals is the same. Likewise, the general equilibrium of production occurs at a point on the production contract curve where marginal rate of technical substation between the 2 factors in the production of two commodities by the two firms is the same. Similarly, the general equilibrium of production together with the general equilibrium of exchange requires that the marginal rate of transformation (MRT_{xy}) not only be equal to marginal rate of substitution (MRS_{xy}) of the consumers but also MRS_{xy} of the two consumers be equal to each other. It is important to state that point of general equilibrium is not distinct since it may befall at any point on the contract curves, depending on a starting point, that is, initial endowment point. However, with perfect competition in the product and factor markets, only one such equilibrium case can be realized, i.e. the general equilibrium can be unique, of course, it depends upon the initial endowment point. Let us discuss how it works in each case.

16.2 Perfect Competition and General Equilibrium of exchange

Let us first explain general equilibrium of exchange under competitive condition. Under perfect competition, the number of sellers is assumed to be so huge that the share of each seller in the total supply of a product is very small. Therefore, no single seller can affect the market price by altering his supply. Similarly, the number of buyers is so large that the share of each buyer in the total demand is very small and that no single buyer can influence the market price; he takes the prices of goods x and y, as given Consumer A maximizes his satisfaction by equating his marginal rate of substitution (MRS_{xy}) with the given price ratio.

$$\text{Thus, } MRS_{xy}^{A} = \frac{P_x}{P_y}$$

Similarly, the individual B would be maximizing his satisfaction when

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

Since under the assumption of perfect competition both the individuals A and B will be facing same prices, it follows that $MRS_{xy}^{A} = MRS_{xy}^{B} = \frac{P_x}{P_y}$ is the required condition for unique general equilibrium of exchange, under the conditions of perfect competition. Consider (In Figure 16.1) an economy containing 2 individuals A & B who consume two commodities x & y. Suppose, the initial endowments of individuals A & B is given by point R. PP' is the price line with the price ratio ($\frac{P_x}{P_y}$), which is drawn through the initial endowment point R. It is this line which becomes the budget line for the two consumers. This PP' budget line also passes through two tangent indifference curves at point E in Figure 1. With initial endowment point R as the starting point and point E where they reach the equilibrium position, individual A has sold commodity x and bought commodity y, where as individual B has purchased x and sold commodity y. Given the price ratio $(\frac{P_x}{P_y})$ of the two commodities by the slope of the budget line PP[1]' the two individuals reach equilibrium at point E where the quantity of commodity x demanded by B equals the quantity of commodity x supplied by A and, similarly, quantity demanded of commodity y equals the quantity supplied of commodity y.

Thus, point E is a location of competitive equilibrium and therefore general equilibrium of exchange exists. General equilibrium is a set of prices at which quantity demanded equals the quantity supplied in each and every market, Market clearing equilibrium determines not only the final allocation of commodities between two consumers but also unique price ratio equal to the each consumers MRS between two commodities x and y at the equilibrium point. It may be distinguished that not all prices are in accordant with general equilibrium under perfect competition. For illustration, price ratio of the 2 commodities shown by the price line SS' which also passes through the initial endowment point R.

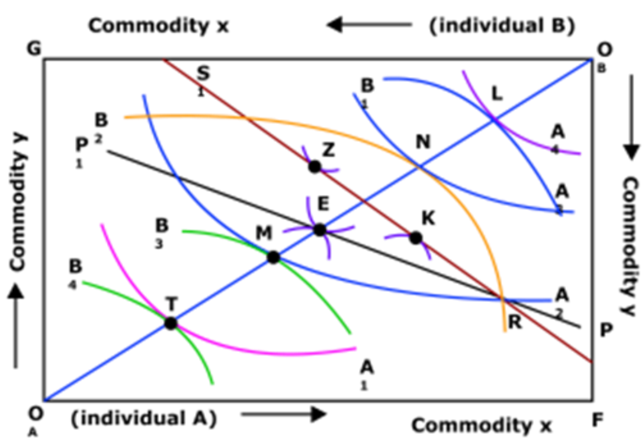


Figure 16.1

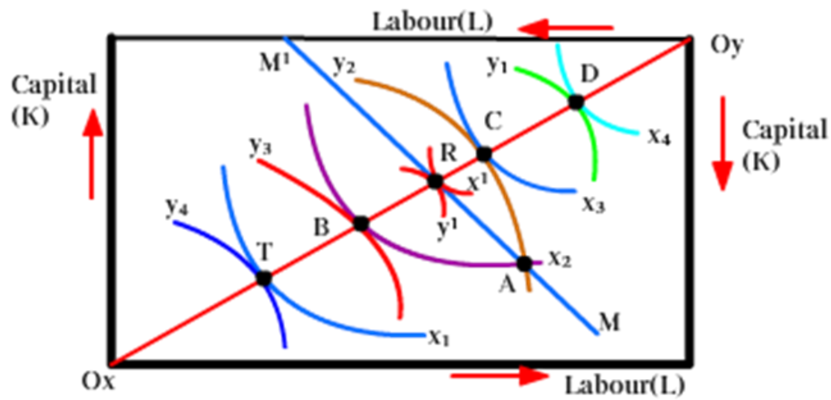


Figure 16.2

Given the new price line SS', individual A is in equilibrium at Z and individual B is in equilibrium at K. That is, markets of 2 commodities x and y are not in equilibrium because the Marginal rate of substitution between x and y of the 2 individuals are not equal to price ratio $(\frac{P_x}{P_y})$ at the same point. Hence there is excess demand in one market or excess supply in other market. Thus, with new price ratio line SS'. The markets of two commodities are not in equilibrium

16.3 Perfect Competition and General Equilibrium of production

General equilibrium of production occurs on the production contract curve where the marginal rate of technical substitution between any 2 inputs in any two firms is similar. The marginal rate of technical substitution (MRTS) is the amount that 1 input can be reduced if another input is increased by one unit, while total output remains constant. It can be said that when the MRTS LK in the production of commodity x equals the $MRTS_{LK}$ in the production of commodity y along the production contract curve, the general equilibrium of production is said to occur, i.e.

$(MRTS_{LK})^x = (MRTS_{LK})^y$ ………………..(1)

is the condition of equilibrium.

Profit maximizing firms under a competitive economy choose a mix of inputs such that the MRTS of different inputs is equal to the relative prices of those inputs. In case of 2 commodities x & y;

two factor inputs labor (L) & capital (K); remunerations of labour is w and that of capital is r, the profit maximizing condition is

$(MRTS_{LK})^x = \frac{w}{r}$

And $(MRTS_{LK})^y = \frac{w}{r}$ ……………….(2)

Under the assumption of perfect competition, all the firms face same factor price ratio $(\frac{w}{r})$. From (1) and (2) we get

$(MRTS_{LK})^x = (MRTS_{LK})^y = (\frac{w}{r})$

If all firms face the same relative prices of inputs, their MRTS will all be the same, and general equilibrium of production will result. Thus, the general equilibrium of production which means that the economy is on its production possibility curve requires that the MRS between any 2 inputs be similar in all uses. In Figure 16.2, A is the initial endowment point, and relative factor input price ratio $(\frac{w}{r})$ line MM’ passes through this point and is tangent to x’, y’ isoquants of x and y commodities at point R of the production contract curve. The production equilibrium is not unique, the where and at what point on the contract curve depend on consumers demand for x and y.

16.4 Perfect Competition and General Equilibrium of production and Exchange

General equilibrium of production and exchange requires that consumer’s MRS must be equal to the MRT. In a two factor labor (L) & capital (k), two commodities x & y and two consumers A and B economy, the general equilibrium of production and exchange occurs at a point where the following condition is fulfilled:

$MRT_{xy} = (MRS_{xy})^{A} = (MRS_{xy})^B$ ………………………..(1)

Perfectly competitive market results in an efficient distribution of goods among consumers. Each consumer maximizes his utility by equating MRS to the ratio of commodity prices.

For consumer A,

$(MRS_{xy})^A = \frac{P_x}{P_y}$

Similarly for consumer B,

$(MRS_{xy})^B = \frac{P_x}{P_y}$

Since competitive markets establish a uniform price for each commodity, the ratio $\frac{P_x}{P_y}$ will be same for all consumers. Thus,

$(MRS_{xy})^A = (MRS_{xy})^B$ ……………………….(2)

Perfectly competitive market results in an efficient allocation of inputs. Each firm produces at least cost by equating MRTS between the factor inputs to the factor input price ratio.

For commodity X, $(MRTS_{LK})^x = \frac{w}{r}$

For commodity Y, $(MRTS_{LK})^y = \frac{w}{r}$

Since in perfect competitive market factor input prices are same for all firms we have

$(MRTS_{LK})^x = (MRTS_{LK})^y = \frac{w}{r}$ ……………(3)

Marginal rate of transformation between two commodities MRT_{xy} is equal to the ratio of marginal cost of production of 2 commodities. Thus

$MRT_{xy} = \frac{MC_x}{MC_y}$

Perfect competitive economy results in an efficient output mix. Each profit maximizing firm would equate the price of a commodity with its marginal cost of production. Thus,

$$MC_x = P_x$$

$$MC_y = P_y$$

We know the slope of the production possibility curve (transformation curve) is also equal to the ratio of the marginal costs of production. Thus, at equilibrium in perfect competition.

$MRT_{xy} = \frac{MC_x}{MC_y} = \frac{P_x}{P_y}$

Since the consumers and firms face the same price ratio of the 2 commodities, we have

$MRT_{xy} = (MRS_{xy})^{A} = (MRS_{xy})^{B} = \frac{P_x}{P_y}$

Thus, the basic condition of general equilibrium, that the MRS must equal the MRT, will be satisfied in a competitive economy because firms set the MRT equal to relative prices, and consumers set their MRS equal to relative prices.

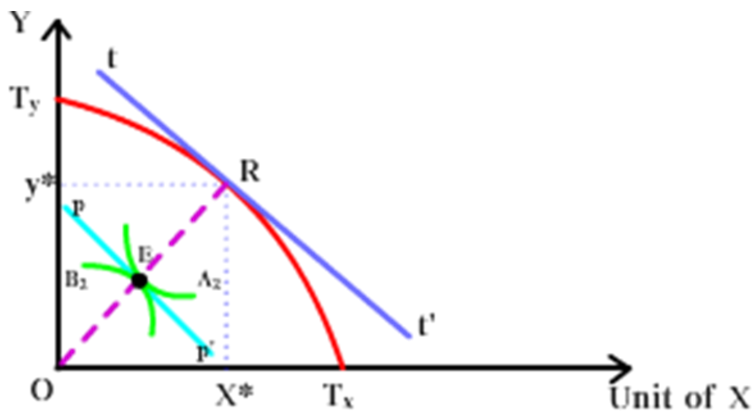


Figure 16.3

This figure explains the equality between MRS_{xy} and MRT_{xy}

Here Slope of PP' = Slope of tt'

$MRT_{xy} = (MRS_{xy})^{A} = (MRS_{xy})^{B} = \frac{P_x}{P_y}$

16.5 Summary

In a perfectly competitive system, the factors and commodities markets will achieve an economically efficient outcome.

(a) Efficiently in Exchange

In perfect competition all consumers face the same prices; as a result all consumers in equilibrium equate their MRS_{xy} to product price-ratio, i.e.

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

(b) Efficiency in production

Efficiency in production requires that MRTS between any 2 factors be the same for all the commodities. With reference to 2 products, x and y and 2 factors, L and K, in our model, this condition may be expressed as $MRTS_{LK}^{X} = MRTS_{LK}^{Y}$

Profit maximizing firms are in equilibrium, with respect to a product (say x) where

$MRTS_{LK} = \frac{W}{R}$

When factor market is perfectly competitive W and R are each the same for all the firms using L and K, Therefore,

$MRTS_{LK}^{X} = MRTS_{LK}^{Y} = \frac{W}{R}$

(c) Efficiency in production and exchange

We know $MRS_{xy} = \frac{P_x}{E}$

In perfect competition, a profit maximizing firm sets its optimum combination of output. Where, $MRT_{xy} = \frac{\Delta Y}{\Delta X} = \frac{MC_x}{MC_y}$

We also know that in a perfectly competitive market $MC_x = P_x$ and $MC_y = P_y$

Therefore,

$MRT_{xy} = \frac{MC_x}{MC_y} = \frac{P_x}{P_y}$

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

Therefore, $(MRS_{xy})^{A} = (MRS_{xy})^{B} = MRT_{xy} = \frac{MC_x}{MC_y} = \frac{P_x}{P_y}$

Thus all marginal conditions of efficiency are met in the perfectly competitive framework.

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