UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

BA ECONOMICS

Core Course

MICRO ECONOMICS-1

I SEMESTER

2019 Admission onwards

CUCBCSS

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UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

Calicut University (P.O), Malappuram, Kerala, India 673635

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Study Material

BA- Economics

(2019 Admission)

I Semester

ECO1B01- Micro Economics -1

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Module I

Exploring the Subject Matter of Economics

Introduction

Welcome to the *science of* economics. Yes, economics is a social science, like chemistry is a physical science. It is true that there are no test tubes and sophisticated equipment required to study economics, but Just as physical sciences are means to understand how the real physical world around us works - our planet, the solar system or the universe - in economics, we try to understand how the economy of a particular region, a country or the global economy works. There are principles or laws of economics (parallel to laws of Chemistry or physics).With the help of these principles; we analyze how an economy works. There is no universally accepted, single, definition of economics. But we can understand what it is about. Many non-economists think that it only concerns the matters of money - how to make or manage money. Not true. Economics is about making choices in the presence of scarcity. The notions "scarcity" and "choice" is very important in economics. You may not see these words in all chapters to come, but they are in the background throughout. Scarcity and choice go together if things were available in plenty (literally) then there would have been no choice problem; you can have anything you want. Unfortunately, this may be true only in heaven, not in the real world. Even the richest person on earth would have to face scarcity and make choice. If nothing else, time is scarce. Ratan Tata, a leading Industrialist of India, between 6 p.m. and 8 p.m. in a particular evening, may have to decide whether to go to a musical concert, or just keep working in his office. Think about the length of syllabi of various subjects that you have to cover before the final exam. We do not need to convince you that time is scarce. Likewise, food, clothing, housing, clean air, drinkable water etc. are scarce in every country in the world, except that the degree of scarcity varies. The point is that *problems of choice arise because of scarcity.* The study of such "choice problems", at the individual, social, national and international level is what economics is about.

Why study economics?

Economics is the study of how societies use scarce resources to produce valuable commodities and distribute them among different people. Behind this definition are two key ideas in economics: those goods are scarce and that society must use its resources efficiently. Indeed, economics is an important subject because of the fact of scarcity and the desire for efficiency. Samuelson and Nordhaus also

provide some insights into the role of economists in Chapter 1 of their book. They declare that, "Throughout the world economists are laboring to collect data and improve our understanding of economic trends." Moreover, as they note, economists are studying and trying to explain a wide and expanding array of activities, ranging from international trade to unemployment and inflation, from investing retirement funds to controlling pollution. Economic analysis, both theoretical and empirical, can generate important insights into individual and aggregate behavior and relationships, and help in society's efforts to use scarce resources in a more efficient manner. The ultimate goal of economic science is to improve the living conditions of people in their everyday lives. Increasing the gross domestic product is not just a numbers game. Higher incomes mean good food, warm houses, and hot water. They mean safe drinking water and inoculations against the perennial plagues of humanity. The study of economics has provided with a systematic framework for analyzing, researching, writing, and teaching about a wide array financial and regional economic issues. Economics has provided with a methodology for understanding and making sense of our complex environment.

Economists are well known for advising the president, prime minister and chief ministers on economic issues, formulating policies at the Reserve Bank, and analyzing economic conditions for investment banks, brokerage houses, real estate companies, and other private sector businesses. They also contribute to the development of many other public policies including health care, welfare, and school reform and efforts to reduce inequality, pollution and crime. The study of economics can also provide valuable knowledge for making decisions in everyday life. It offers a tool with which to approach questions about the desirability of a particular financial investment opportunity, whether or not to attend college or graduate school, the benefits and costs of alternative careers, and the likely impacts of public policies including universal health care and a higher minimum wage.

Micro versus Macro

1. **Microeconomics**

The term 'micro' is derived from the Greek word 'Mikros' which means 'small'. It was, for the first time, used in economic literature by Ragnar Frisch of Oslo University in 1933. Microeconomics as a specialized branch of economics is developed largely by the efforts of Adam Smith. Microeconomics is the branch of economics based on the economic behaviour of small economic units. The economic units studied in microeconomics are consumers, workers, savers, business managers, firms, individual industries and markets. Consumers decide how much of various goods to purchase, workers decide what jobs to take, and business people decide how many workers to hire and how much output to produce. Microeconomics encompasses the factors that influence these choices and the way these innumerable small decisions merge to determine the workings of the entire economy.

Because of the important effects that prices have on these individual decisions, microeconomics is frequently called price theory. Microeconomics, however, is not limited to small issues. Instead, many 'big issues' can best be understood using microeconomics by recognizing that they are composed of numerous smaller parts. Much of our knowledge of economics is on the study of individual behaviour. Microeconomics studies how choices are made at the individual level under conditions of scarcity. If there was no scarcity, there would be no need to make choices. Choice must be made from among alternatives. If there are no alternatives available, then the freedom to choose has little meaning. Microeconomics encompasses the factors that influence the decisions made by millions of individuals and the way these innumerable decisions merge to determine the workings of the entire economy. Consumers decide how much of various goods to purchase, workers decide what jobs to take, and firms decide how much output to produce. Microeconomics examines the allocation decisions of individual consumers and firms. Consumers and firms are guided by the objective of maximization of satisfaction and profits respectively. Since markets are important in the maximization efforts of both consumers and firms, microeconomics studies the markets in detail. The understanding of individual behaviour provides the basis for understanding markets, since a market is comprised of many individual agents. Microeconomic theory is capable of dealing with some of the most important social issues of the day. The important among them are environmental pollution, poverty and welfare programmes, monopolies and consumer wellbeing, labour unions and real wages, rising medical expenditure, discrimination in employment, energy problems, taxation and work incentives.

The uses of Microeconomics

The uses of microeconomics are the following:

a) Microeconomics is useful in analyzing how prices are determined in different markets and how resources are allocated to various uses.

b) Microeconomic theory can be used as basis for conditional predictions. For example, if the demand curve is negatively sloped and supply curve is positively sloped, then a price rise above the equilibrium price will create a surplus on the market.

c) Microeconomic theory provides the analytical tools for economic policies affecting prices and production. The effect of government policies on prices of commodities and wages and their impact on the allocation of resources can be analyzed with the help of microeconomics.

d) Microeconomics can be used to examine the conditions of economic welfare. Economic welfare consists of the subjective satisfactions that individuals get from consuming goods and services and from enjoying leisure. It can suggest methods to raise the level of consumption of goods and services.

e) Microeconomics is useful in decision making in the employment of resources in government programmes. Because of the availability of the tested methods of analyzing costs and benefits of a programme, price theory can help the decision makers in achieving efficiency in the use of scarce resources.

2. Macro Economics:

It is a branch of Economics which deals with aggregates. The word 'Micro Economics and Macro Economics' were first coined by Ragnar Frisch in 1933. John Maynard Keynes is considered as the father of Macro Economics. The main difference between Micro and Macro Economics is shown by the table (1.1).

Table (1.1): Difference Between Micro and Macro Economics

Points Of Difference	Micro Economics	Macro Economics
Unit of study	Individual	Aggregate
Method	Partial Equilibrium	General Equilibrium
View point	Worm's eye view	Bird's eye View
Example	Demand for a pen, salary of a person, utility, cost etc.	National income, aggregate demand, inflation, money supply

Emergence of Macro Economics:

Classical Economists like Adam Smith, David Ricardo, J. B. Say etc. are believed in and argued for 'Laisses faire' and 'Say's law of market'. Laissez faire means least intervention of government in the economy. 'Say's law means "supply creates its own demand". They believed the invisible hand' will ensure equilibrium and full employment. Classical ideas were proved wrong by the Great Depression of 1929-1930 periods in USA. During this period unemployment rate rose from 3% to 25% and the aggregate output in USA fell by about 33%. During this period in 1936 John Maynard Keynes published his book 'The General Theory of Employment Interest and Money'. According to Keynes "Output of an economy is determined by aggregate demand and aggregate supply". This is why a new branch of Economics is emerged. It is called Macro Economics. And John Maynard Keynes is considered as the father of Macro Economics.

Scope of Macroeconomics:

The scope of Macro Economics consists of the following.

1. Theory of National Income
2. Theory of Employment
3. Theory of Inflation
4. Theory of Trade Cycles
5. Theory of economic growth
6. Theory of monetary and fiscal policies.

Importance of Macroeconomics:

The study of Macro Economics is important because it is

1. Helpful to understand the functioning of the economy.
2. Helpful to compare the various economies.
3. Useful in planning and forecasting.
4. Helpful in the formulation of economic policies.

According to Macroeconomic point of view there are four main sectors in an economy. They are following

1. Firms: Tiny production units in an economy are called firms. Their main motive is to produce goods and services and to sell in market to earn profit.
2. Household: A single Individual or group of individuals who takes decisions related to consumption. They consume, save and also pay taxes.
3. Government: It is the regulatory body of the economy. The role of the government is framing laws, enforcing them and delivering justice.
4. External Sector: If refers to the economic transaction of the domestic economy with the rest of the world. The domestic country may sell goods to the rest of the world. If is called export. The domestic country may buy goods from the rest of the world. If is called import.

Limitations of Macro Economics:

Macro Economics suffers the following limitations.

1. It cannot be applied to explain individual behaviour.
2. Conclusions drawn from Macro economic analysis maybe misleading.
3. Macro economics deals with aggregates. Aggregates may be approximation of realities.
4. Most Macro Economics magnitudes are subject to errors and ambiguities

Definitions of Economics

The earlier term for 'economics' was political economy. It was adapted from the French Mercantilist usage of *économie politique*, which extended *economy* from the ancient Greek term for household management to the national realm as public administration of the affairs of state. Sir James Steuart (1767) wrote the first book in English with 'political economy' in the title, explaining that just as: Economy in general [is] the art of providing for all the wants of a family, [so the science of political economy] seeks to secure a certain fund of subsistence for all the inhabitants, to obviate every circumstance which may render it precarious; to provide everything necessary for supplying the wants of the society, and to employ the inhabitants ... in such manner as naturally to create reciprocal relations and dependencies between them, so as to supply one another with reciprocal wants. The title page gave as its subject matter "population, agriculture, trade, industry, money, coin, interest, circulation, banks, exchange, public credit and taxes".

The English word economics is derived from the ancient Greek word oikonomia - meaning the management of a family or a household. It is thus clear that the subject economics was first studied in ancient Greece. What was the study of household management to Greek philosophers like Aristotle (384-322 BC) was the "study of wealth" to the mercantilists in Europe between the sixteenth and eighteenth centuries. Economics, as a study of wealth, received great support from the Father of economics, Adam Smith, in the late eighteenth century. Since then, the subject has travelled a long and this Greek or Smithian definition serves our purpose no longer. Over the passage of time, the focus of attention has been changed. As a result, different definitions have evolved. They are:

1. Adam Smith's Wealth Definition:

The formal definition of economics can be traced back to the days of Adam Smith (1723-90) - the great Scottish economist. Following the mercantilist tradition, Adam Smith and his followers regarded economics as a science of wealth which studies the process of production, consumption and accumulation of wealth. His emphasis on wealth as a subject matter of economics is implicit in his great book 'An Inquiry into the Nature and Causes of the Wealth of Nations' or, more popularly known as 'Wealth of Nations' published in 1776.According to Smith "The great object of the Political Economy of every country is to increase the riches and power of that country." Like the mercantilists, he did not believe that the wealth of a nation lays in the accumulation of precious metals like gold and silver. To him, wealth may be defined as those goods and services which command value-in-exchange. Economics is concerned with the generation of the wealth of nations. Economics is not to be concerned only with the production of wealth but also the distribution of wealth. The manner in which production and distribution of wealth will take place in a market economy is the Smithian 'invisible

hand' mechanism or the 'price system'. Anyway, economics is regarded by Smith as the 'science of wealth.'

Other contemporary writers also define economics as that part of knowledge which relates to wealth. John Stuart Mill (1806-73) argued that economics is a science of production and distribution of wealth. Another classical economist Nassau William Senior (1790-1864) argued "The subject matter of the Political Economics is not Happiness but Wealth." Thus, economics is the science of wealth. However, the last decade of the nineteenth century saw a scathing attack on the Smithian definition and in its place another school of thought emerged under the leadership of an English economist, Alfred Marshall (1842-1924).

Criticisms:

Following are the main criticisms of the classical definition:

i. This definition is too narrow as it does not consider the major problems faced by a society or an individual. Smith's definition is based primarily on the assumption of an 'economic man' who is concerned with wealth-hunting. That is why critics condemned economics as 'the bread-and-butter science'.

ii. Literary figures and social reformers branded economics as a 'dismal science', 'the Gospel of Mammon' since Smithian definition led us to emphasise on the material aspect of human life, i.e., generation of wealth. On the other hand, it ignored the non-material aspect of human life. Above all, as a science of wealth, it taught selfishness and love for money. John Ruskin (1819-1900) called economics a 'bastard science.' Smithian definition is bereft of changing reality.

iii. The central focus of economics should be on scarcity and choice. Since scarcity is the fundamental economic problem of any society, choice is unavoidable. Adam Smith ignored this simple but essential aspect of any economic system.

2. Marshall's Welfare Definition:

Alfred Marshall in his book 'Principles of Economics published in 1890 placed emphasis on human activities or human welfare rather than on wealth. Marshall defines economics as "a study of men as they live and move and think in the ordinary business of life." He argued that economics, on one side, is a study of wealth and, on the other, is a study of man. Emphasis on human welfare is evident in Marshall's own words: "Political Economy or Economics is a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of well-being."

Thus, "Economics is on the one side a study of wealth; and on the other and more important side, a part of the study of man." According to Marshall, wealth is not an end in itself as was thought by classical

authors; it is a means to an end -the end being the promotion of human welfare. This Marshallian definition has the following important features:

i. Economics is a social science since it studies the actions of human beings.

ii. Economics studies the 'ordinary business of life' since it takes into account the money-earning and money-spending activities of man.

iii. Economics studies only the 'material' part of human welfare which is measurable in terms of the measuring rod of money. It neglects other activities of human welfare not quantifiable in terms of money. In this connection A. C. Pigou's (1877- 1959) - another great neo-classical economist - definition is worth remembering. Economics is "that part of social welfare that can be brought directly or indirectly into relation with the measuring rod of money."

iv. Economics is not concerned with "the nature and causes of the Wealth of Nations." Welfare of mankind, rather than the acquisition of wealth, is the object of primary importance.

Criticisms:

Though Marshall's definition of economics was hailed as a revolutionary one, it was criticised on several grounds. They are:

i. Marshall's notion of 'material welfare' came in for sharp criticism at the hands of Lionel Robbins (later Lord) (1898- 1984) in 1932. Robbins argued that economics should encompass 'non- material welfare' also. In real life, it is difficult to segregate material welfare from non-material welfare. If only the 'materialist' definition is accepted, the scope and subject-matter of economics would be narrower, or a great part of economic life of man would remain outside the domain of economics.

ii. Robbins argued that Marshall could not establish a link between economic activities of human beings and human welfare. There are various economic activities that are detrimental to human welfare. The productions of war materials, wine, etc., are economic activities but do not promote welfare of any society. These economic activities are included in the subject-matter of economics.

iii. Marshall's definition aimed at measuring human welfare in terms of money. But 'welfare' is not amenable to measurement, since 'welfare' is an abstract, subjective concept. Truly speaking, money can never be a measure of welfare.

iv. Marshall's 'welfare definition' gives economics a normative character. A normative science must pass on value judgments. It must pronounce whether a particular economic activity is good or bad. But economics, according to Robbins, must be free from making value judgment. Ethics should make value judgments. Economics is a positive science and not a normative science.

v. Finally, Marshall's definition ignores the fundamental problem of scarcity of any economy. It was Robbins who gave a scarcity definition of economics. Robbins defined economics in terms of allocation of scarce resources to satisfy unlimited human wants.

3. Robbins' Scarcity Definition:

The most accepted definition of economics was given by Lord Robbins in 1932 in his book 'An Essay on the Nature and Significance of Economic Science'. According to Robbins, neither wealth nor human welfare should be considered as the subject-matter of economics. His definition runs in terms of scarcity: "Economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses."From this definition, one can build up the following propositions:

(i) Human wants are unlimited; wants multiply -luxuries become necessities. There is no end of wants. If food were plentiful, if there were enough capital in business, if there were abundant money and time -there would not have been any scope for studying economics. Had there been no wants there would not have been any human activity. Prehistoric people had wants. Modern people also have wants. Only wants change and they are limitless.

(ii) The means or the resources to satisfy wants are scarce in relation to their demands. Had resources been plentiful, there would not have been any economic problems. Thus, scarcity of resources is the fundamental economic problem to any society. Even an affluent society experiences resource scarcity. Scarcity of resources gives rise to many 'choice' problems.

(iii) Since the prehistoric days one notices constant effort of satisfying human wants through the scarcest resources which have alternative uses. Land is scarce in relation to demand. However, this land may be put to different alternative uses.

A particular plot of land can be either used for jute cultivation or steel production. If it is used for steel production, the country will have to sacrifice the production of jute. So, resources are to be allocated in such a manner that the immediate wants are fulfilled. Thus, the problem of scarcity of resources gives rise to the problem of choice. Society will have to decide which wants are to be satisfied immediately and which wants are to be postponed for the time being. This is the choice problem of an economy. Scarcity and choice go hand in hand in each and every economy: "It exists in one-man community of Robinson Crusoe, in the patriarchal tribe of Central Africa, in medieval and feudalist Europe, in modern capitalist America and in Communist Russia."

In view of this, it is said that economics is fundamentally a study of scarcity and of the problems to which scarcity gives rise. Thus, the central focus of economics is on opportunity cost and optimisation. This scarcity definition of economics has widened the scope of the subject. Putting aside the question

of value judgment, Robbins made economics a positive science. By locating the basic problems of economics - the problems of scarcity and choice - Robbins brought economics nearer to science. No wonder, this definition has attracted a large number of people into Robbins' camp.

The American Nobel Prize winner in Economics in 1970, Paul Samuelson, observes: "Economics is the study of how men and society choose, with or without the use of money, to employ scarce productive resources which could have alternative uses, to produce various commodities over time, and distribute them for consumption, now and in the near future, among various people and groups in society."

Criticisms:

This does not mean that Robbins' scarcity definition is fault free. His definition may be criticised on the following grounds:

i. In his bid to raise economics to the status of a positive science, Robbins deliberately downplayed the importance of economics as a social science. Being a social science, economics must study social relations. His definition places too much emphasis on 'individual' choice. Scarcity problem, in the ultimate analysis, is the social problem rather an individual problem. Social problems give rise to social choice. Robbins could not explain social problems as well as social choice.

ii. According to Robbins, the root of all economic problems is the scarcity of resources, without having any human touch. Setting aside the question of human welfare, Robbins committed a grave error.

iii. Robbins made economics neutral between ends. But economists cannot remain neutral between ends. They must prescribe policies and make value judgments as to what is good for the society and what is bad. So, economics should pronounce both positive and normative statements.

iv. Economics, at the hands of Robbins, turned to be a mere price theory or microeconomic theory. But other important aspects of economics like national income and employment, banking system, taxation system, etc., had been ignored by Robbins.

Induction and deduction

Economic generalizations describe the laws or statements of tendencies in various branches of economics such as production, consumption, exchange and distribution of income. In the view of Robbins, economic generalizations and laws are statements of uniformities which describe human behaviour in the allocation of scarce resources between alternative ends. The generalizations of economics, like the laws of other sciences, state a relationship between variables and describe those economic hypotheses which have been found consistent with facts or, in other words, have been found to be true by empirical evidence. But a distinction may be drawn between a generalization (law) and a

theory. A generalization just describes the relationship between variables; it does not provide any explanation of the described relation. On the other hand, a theory provides an explanation of the stated relation between the variables, that is, it brings out the logical basis of the generalization. An economic theory or a model derives a generalization through process of logical reasoning and explains the conditions under which the slated generalization will hold true. Generalizations in economics have been derived in two ways:

(1) Deductive Method, and

(2) Inductive Method.

1. Deductive Method

The deductive method is also called abstract, analytical and a priori method and represents an abstract approach to the derivation of economic generalizations and theories. The principal steps in the process of deriving economic generalizations through deductive logic are: (a) perception of the problem to be enquired into; (b) defining precisely the technical terms and making appropriate assumptions, often called postulates or premises; (c) deducing hypotheses, that is deriving conclusions from the premises through the process of logical reasoning; and (d)testing of hypothesis deduced.

(a) Perception of the Problem.

In any scientific enquiry, the analyst or theorist must have a clear idea of the problem to be enquired into. He must know the significant variables regarding whose behaviour and interrelationship he wants to derive generalizations. The perception of the problem is by no means an easy task.

(b) Definition of Technical Terms and Making of Assumption.

The next step in the process of deriving generalisations is to define precisely and unambiguously the various technical terms to be used in the analysis as well as to state clearly the assumptions or postulates he makes to derive generalisations. As mentioned above, assumptions may be behavioural pertaining to the behaviour of the economic variables or they may be technological relating to the state of technology and the factor endowments. The crucial assumptions are made on the basis of observations or introspection. A crucial assumption that has been made in economics is that consumers try to maximize their satisfaction and producers try to maximize their profits. Likewise, it is assumed that investors try to minimise their risk and maximize the expected rate of their profits. Some of the assumptions are made merely to simplify the analysis and may not be quite realistic. The actual economic world is quite complex and full of details in which numerous factors play a part and act and interact on each other. The introduction of simplifying assumptions is quite necessary in order to bring out the importance of really significant factors having a bearing on the problem under investigation. According to Prof. Boulding, economic theory represents just a ‘map’' of real world phenomenon and

not a perfect picture of it. To quote him, “Just as we do not expect a map to show every tree, every blade of grass in a landscape, so we should not expect economic analysis to take into account every detail and quirk of real economic behaviour.”It therefore, follows that each and every assumption made by a theory may not be realistic. The crucial factor in building up a valid theory is whether its predictions arc corroborated by the facts in the world. A correct scientific theory or generalization must be expressed in form of a hypothesis that inconceivably refutable. As mentioned above. Professor Friedman in his now well known article “The Methodology of Positive Economics” has expressed the view that undue importance should not be given to the ‘realism’ of assumptions. What matters most from the viewpoint of scientific theory, according to him is whether it enables us to predict accurately.

(c) Deducing Hypotheses through Logical Deduction.

The next step in deriving generalisations through deductive logic is deducing hypotheses from the assumptions or premises taken. A hypothesis describes relationship between factors affecting a phenomenon; it establishes cause and effect relationship between the variables having a bearing on the phenomenon. Then through logical process, hypothesis is deduced from the assumptions made. This logical reasoning may be carried out verbally or it may be conducted in symbolic terms using the language of what is known as symbolic logic. The geometric or graphic technique is also usually employed to deduce the hypotheses about the relationship between factors besides, the process of logical deduction may be done with the help of more formal mathematics. Nowadays in almost all branches of modern economics, the mathematics as a tool of analysis for deriving economic theories and generalisations is being increasingly used. The use of mathematics in economic analysis proves extremely useful where geometrical methods make the analysis more complicated to comprehend. Besides, the use of mathematical method makes the derivation of economic hypotheses more rigorous and exact. It is worthwhile to note that in deriving analytically sound hypotheses, one should guard against committing logical fallacy in the process of logical deduction. For instance, it is inappropriate to conclude that A must be the cause of B if A happens to precede B. Further, it is logically fallacious to argue that since there exist a high degree of correlation between the two factors, say between the supply of money and the general price level, the former must be the cause of the latter, unless the causation must K logically developed d.

(d) Testing or Verification of Hypotheses.

Hypotheses obtained above have to be verified before they are established as generalisations or principles of economics. For the verification of hypotheses, economists cannot make controlled experiments, because they have to discern uniformities in behaviour patterns of man. As we cannot make experiments with man under controlled conditions, such as in laboratories as physical scientists

make experiments with inanimate objects of nature and biologists make these with animals and plants. Therefore, economists have to rely on correct, this prediction does not enable you to forecast accurately next year output (still less the harvest in the more distant future), which in the event will be affected by many factors besides changes in price.

(d_1) Testing of Economic Hypotheses through Econometrics

In recent years a very useful method to test economic hypothesis has been developed. This is what is now popularly called econometric method. The statistical or econometric method to verify and establish the theoretical generalisations occupies an important place because; there is limited applicability of controlled experimentation in economics. The various statistical methods such as regression analysis have been developed to empirically test the economic hypotheses on the basis of collected economic data. The merit of econometrics is that the degree of functional relationship between relevant economic variables in precise quantitative terms is obtained by it and also the level of significance of the results can also be estimated. Recently, econometric method has been used to establish the precise relationships between money supply and the price level, quantity of money and the national income, consumption and income, capital accumulation and rate of economic growth and so forth.

It may, however, be pointed out that statistical analysis or econometrics alone cannot be used to derive and establish economic principles and theories. Economic hypotheses or theories must be developed logically before we can meaningfully use statistical analysis to test and verify them. Indeed, theory or hypothesis is needed before the selection of the relevant facts and data regarding relevant variables which can be subjected to empirical testing through the methods of econometrics. Prof. Myrdal is quite right, when he says, Theory, therefore, must always be *a priori* to the empirical observation of facts. Facts come to mean something only as ascertained and organized in the frame of a theory. Indeed, facts as part of scientific knowledge have no existence outside such a frame. Question must be arranged logically, to make sense and it helps to understand social reality.

Merits and Demerits of Deductive Method

The deductive approach to establish economic generalisations was extensively used by Classical and Neo-Classical economists such as Ricardo, Malthus, Senior, J S. Mill, Marx, Marshall and Pigou. It still remains popular with modern economists as it has several merits. First, useful mathematical techniques can be employed to derive generalisations of economics. With the aid of rigorous mathematical logic, economic theories can be developed through the process of deduction which can successfully explain economic phenomena.

Secondly, through deductive logic useful economic theorems can be derived without the tenuous and detailed collection and analysis of data which are required under the alternative inductive method. Thus, as compared to inductive method, method of deduction is less time consuming and less expensive.

Thirdly, in view of the limited scope for controlled experimentation in economics, the method of deduction is an extremely useful method of deriving generalisations. This is because multiplicity of forces acts simultaneously on an economic phenomenon and it is not possible to eliminate some of these by means of a controlled experiment. This indicates the crucial importance of deductive logic for building up economic principles or generalisations. Fourthly, the use of sophisticated mathematical methods in the deductive approach enables the economists to introduce accuracy and exactness in economic principles and theories.

In spite of the above mentioned merits, shortcomings of the deductive approach should not be overlooked. The use of deductive method in deriving economic generalisations requires the use of a high level competence in logic and theoretical abstraction. A good deal of care and objectivity is needed to avoid bad logic or faulty economic reasoning. Further, a great demerit of deductive approach is that with it highly sophisticated theoretical models based on highly unrealistic assumptions may be developed which do not have any operational significance. Indeed, such highly irrelevant analytical models with little empirical content and incapable of being used for policy formulation have in fact been developed by economists. Such models are no more than mere "intellectual toys". If economics is to serve as an instrument of social betterment, building of such theoretical models having no operational use should be avoided. Lastly, in the derivation of economic hypotheses and conclusions through deductive logic, assumptions play a crucial role. If the assumptions made are such that when on removing them, economic hypothesis based on them is refuted, then making of these assumptions is not valid. Thus, one who uses deductive approach should always keep in mind to what extent the validity of generalisations derived depends on the assumptions made. For instance, the Keynesian macro analysis is based upon the assumption of a depression ridden capitalist economy with a lot of excess productive capacity. Therefore, a positive harm has been done in applying the Keynesian theories in the context of developing countries such as ours where the assumptions made by Keynes do not hold good. Hence, mere "deductive arm chair analysis" should be avoided, if the scientific character of economics is to be maintained.

2) The Inductive Method

The inductive method which is also called empirical method derives economic generalisations on the basis of experience and observations. In this method detailed data are collected with regard to a certain

economic phenomenon and effort is then made to arrive at certain generalisations which follow from the observations collected. But it is worth mentioning that the number of observations has to be large if it can yield a valid economic generalization. One should not generalize on the basis of a very few observations. Inductive method which also called empirical method was adopted by the "Historical School of Economists". It involves the process of reasoning from particular facts to general principle. This method derives economic generalizations on the basis of (i) Experimentations (ii) Observations and (iii) Statistical methods. In this method, data is collected about a certain economic phenomenon. These are systematically arranged and the general conclusions are drawn from them.

For example**,** we observe 200 persons in the market. We find that nearly 195 persons buy from the cheapest shops, Out of the 5 which remains, 4 persons buy local products even at higher rate just to patronize their own products, while the fifth is a fool. From this observation, we can easily draw conclusions that people like to buy from a cheaper shop unless they are guided by patriotism or they are devoid of commonsense.

Steps of Inductive Method:

The main steps involved in the application of inductive method are:

1. The Problem:

In order to arrive at a generalisation concerning an economic phenomenon, the problem should be properly selected and clearly stated.

2. Data:

The second step is the collection, enumeration, classification and analysis of data by using appropriate statistical techniques.

3. Observation:

Data are used to make observation about particular facts concerning the problem.

4. Generalisation:

On the basis of observation, generalisation is logically derived which establishes a general truth from particular facts.

Thus induction is the process in which we arrive at a generalisation on the basis of particular observed facts. The best example of inductive reasoning in economics is the formulation of the generalisation of diminishing returns. When a Scottish farmer found that in the cultivation of his field an increase in the amount of labour and capital spent on it was bringing in less than proportionate returns year after year, an economist observed such instances in the case of a number of other farms, and then he arrived at the generalisation that is known as the Law of Diminishing Returns. Economics can be a very deductive subject, and economists are used to constructing complicated 'models' of human behaviour which

begin with a number of assumptions. However, economics is also an empirical subject, using inductive methods to explain observed facts. Thus the downward sloping demand curve, for example, can be deduced from general assumptions about how people try to maximise their satisfaction from the purchase of goods and services. On the other hand, demand curves can be built up empirically, that is by observing actual customers reacting to market price changes, and when market researchers, census-takers and opinion pollsters collect necessary information, the data can be used inductively to make economic predictions. In practice it can be very difficult to say where deduction ends and induction begins. Economists need to use both deduction and induction in their work.

Merits of Inductive Method:

(1) Realistic:

The inductive method is realistic because it is based on facts and explains them as they actually are. It is concrete and synthetic because it deals with the subject as a whole and does not divide it into component parts artificially

(2) Future Enquiries:

Induction helps in future enquiries. By discovering and providing general principles, induction helps future investigations. Once a generalisation is established, it becomes the starting point of future enquiries.

(3) Statistical Method:

The inductive method makes use of the statistical method. This has made significant improvements in the application of induction for analysing economic problems of wide range. In particular, the collection of data by governmental and private agencies or macro variables, like national income, general prices, consumption, saving, total employment, etc., has increased the value of this method and helped governments to formulate economic policies pertaining to the removal of poverty, inequalities, underdevelopment, etc.

(4) Dynamic:

The inductive method is dynamic. In this, changing economic phenomena can be analysed on the basis of experiences, conclusions can be drawn, and appropriate remedial measures can be taken. Thus, induction suggests new problems to pure theory for their solution from time to time.

(5) Histrico-Relative:

A generalisation drawn under the inductive method is often histrico-relative in economics. Since it is drawn from a particular historical situation, it cannot be applied to all situations unless they are exactly similar. For instance, India and America differ in their factor endowments. Therefore, it would be

wrong to apply the industrial policy which was followed in America in the late nineteenth century to present day India. Thus, the inductive method has the merit of applying generalisations only to related situations or phenomena.

Demerits of Inductive Method:

However, the inductive method is not without its weaknesses. The main weaknesses of this method are as under:

(1) Misinterpretation of Data:

Induction relies on statistical numbers for analysis that "can be misused and misinterpreted when the assumptions which are required for their use are forgotten."

(2) Uncertain Conclusions:

Boulding points out that "statistical information can only give us propositions whose truth is more or less probable it can never give us certainty."

(3) Lacks Concreteness:

Definitions, sources and methods used in statistical analysis differ from investigator to investigator even for the same problem, as for instance in the case of national income accounts. Thus, statistical techniques lack concreteness.

(4) Costly Method:

The inductive method is not only time-consuming but also costly. It involves detailed and painstaking processes of collection, classification, analyses and interpretation of data on the part of trained and expert investigators and analysts

(5) Difficult to Prove Hypothesis:

Again the use of statistics in induction cannot prove a hypothesis. It can only show that the hypothesis is not inconsistent with the known facts. In reality, collection of data is not illuminating unless it is related to a hypothesis.

(6) Controlled Experimentation not Possible in Economics:

Besides the statistical method, the other method used in induction is of controlled experimentation. This method is extremely useful in natural and physical sciences which deal with matter. But unlike the natural sciences, there is little scope for experimentation in economics because economics deals with human behaviour which differs from person to person and from place to place.

Further, economic phenomena are very complex as they relate to man who does not act rationally. Some of his actions are also bound by the legal and social institutions of the society in which he lives. Thus, the scope for controlled experiments in inductive economics is very little. As pointed Out by

Friendman, “The absence of controlled experiments in economics renders the weeding out of unsuccessful hypo-these slow and difficult.”The controversy which existed among the earlier economists as to whether deductive or inductive approach is more appropriate in developing economic theories and principles has been resolved. The modern viewpoint in this regard is that both are needed for the proper development of scientific economic theories. Indeed, the two are complementary rather than competitive. The modern economists first derive economic hypotheses through the process of logical deduction and then empirically tent them through statistical or econometric methods. Marshall rightly pointed out, “induction and deduction are both needed for scientific thought as the right and left foot are both needed for walking.” Empirical studies made through statistical or inductive method without a theoretical hypothesis to serve as a guide for the selection of data are quite useless.

The derivation of economic generalisations through the approach of deductive logic without empirically testing them through inductive method is also not quite proper. Empirical studies made in inductive approach also bring to light significant economic facts or phenomena which require analytical explanation through deductive logic. For instance, Farm Management Studies in India in the mid fifties led to the discovery of a fact that output per acre on the small-sized farms is higher than that on large farms. This led to the various theoretical explanations of the phenomenon observed in the empirical studies. On the other hand, a theory or hypothesis is first developed through deductive logic from some assumptions and then predictions based on the hypothesis are tested through inductive or statistical method. If the predictions are found to be consistent with facts, the hypothesis or theory stands proved and if the predictions of the theory are found to be inconsistent with facts, it stands rejected.

Positive and Normative Analysis

Often, economists are asked to explain the causes of economic event. Why? For example, is unemployment higher for teenagers than for older workers? Sometimes economists are asked to recommend policies to improve economic outcomes. What, for instance, should the government do to improve the economic well being of teenagers? When economists are trying to explain the world, they are scientists. When they are trying to help improve it, they are policy advisers. To help clarify the two roles that economists play, we begin by examining the use of language. Because scientists and policy advisers have different goals, they use language in different ways. For example, suppose that two people are discussing minimum wage laws. Here are two statements you might hear:

POLLY: Minimum wage laws cause unemployment.

NORMA: The government should raise the minimum wage.

Ignoring for now whether you agree with these statements, notice that Polly and Norma differ in what they are trying to do. Polly is speaking like a scientist: She making a claim about how the world works. Norma is speaking like a policy adviser. She is making a claim about how she would like to change the world. In general, statements about the world are of two types. One type, such as Polly's, is positive. Positive statements are descriptive. They make a claim about how the world is. A second type of statement, such as Norma's, is normative. Normative statements are prescriptive. They make a claim about how the world ought to be. A key difference between positive and normative statements is how we judge their validity. We can in principle, confirm or refute positive statements by examining evidence. An economist might evaluate Polly's statement by analyzing data on changes in minimum wages and changes in unemployment over time. By contrast, evaluating normative statements involves values as well as facts. Norma's statement cannot be judged using data alone. Deciding what is good or bad policy is not merely a matter of science. It also involves our views on ethics, religion, and political philosophy. Positive and normative statements are fundamentally different, but they are often closely intertwined in a person's set of beliefs. In particular, positive views about how the world works affect normative views about what policies are desirable. Polly's claim that the minimum wage causes unemployment, if true, might lead her to reject. Norma's conclusion is that the government should raise the minimum wage. Yet normative conclusions cannot come from positive analysis alone; they involve value judgments as well.

As you study economics, keep in mind the distinction between positive and normative statements because it will help you stay focused on the task at hand. Much of economics is positive. It just tries to explain how the economy works. Yet those who use economics often have goals that are normative. They want to learn how to improve the economy. When you hear economists making normative statements, you know they are speaking not as scientists but as policy advisers.

Value judgments

The third concept of social welfare involves interpersonal comparison of utility which is to be made by introducing explicit value judgements. This concept of social welfare has been propounded by Bergson and Samuelson in their well-known theory of social welfare function. Thus they have described the utility functions of the various persons in the society with the help of a social welfare function. They are of the opinion that changes in social welfare cannot be assessed without making interpersonal comparisons of utility and therefore without making value judgements. It is because of this that this concept of social welfare is able to judge the welfare implications of even those changes in economic organisation and policies that make some people better off and others worse off. Bergson, Samuelson,

Little, Arrow and others are of the opinion that value judgements are most important in welfare economics. But the fact remains that social welfare and changes in it cannot be measured accurately due to heterogeneity of the interests of the various individuals in a society.

Role of Value Judgements

It is important to explain the role of value judgements in welfare economics. Since welfare economics is concerned with the desirability or otherwise of economic policies, the value judgements play a crucial role. As mentioned above, by value judgements or values we mean the conceptions or ethical beliefs of the people about what is good or bad. These conceptions regarding values of the people are based on ethical, political, philosophical and religious beliefs of the people and are not based on any scientific logic or scientific law. There is a great controversy regarding whether value judgements should have any role to play in welfare economies. Robbins and his followers have been asserting that the inclusion of value judgements would make our subject unscientific and therefore, according to them, economists should refrain from making value judgements.

On the other hand, majority of modern economists are of the view that economists should not fight shy of making value judgements if there is a wide consensus about them among the community. Using his knowledge of economics together with these value judgements he should comment upon the desirability or otherwise of economic policies and issues.Professor Paul Streeten rightly says, "Economists cannot and should not refrain from making value judgements if their studies are to be more than a purely formal technique of reasoning, algebra of choice. The technique, the algebra, is important and ought to be as scientific as possible, but it is significant only as a means to study of wealth and welfare and of the way to improve them". It should be noted that as far as the welfare of individual is concerned, though difficult to measure in cardinal terms, economists can measure it in ordinal terms and by observing the act of choice of the individual. For instance, if an individual chooses A rather than B, it shows that his welfare is greater in A than in 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 or group welfare, it encounters difficulties because the measurement of social welfare is not an easy task and involves value judgements and interpersonal comparisons of utility.

This is because the society or group whose welfare we have to judge cannot be regarded as an organic whole, having its own mind. Therefore, social welfare, unlike individual welfare, is not something which resides in the mind of the society. We cannot derive propositions of social welfare from choice

of individuals comprising the society, because individuals choose differently and, therefore, there is no unanimous social choice. 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. It is worth noting that Pareto evolved the concept of social welfare which is said to be free from any value judgements, because it is not based upon any interpersonal comparison of utility. According to Pareto, the social welfare depends upon the welfare of the individuals comprising the society and, according to him, if at least one individual is made better off by certain economic reorganisation and no one being made worse off, the social welfare increases, that is, if any economic reorganisation increases the welfare of one without reducing the welfare of any other, then the social welfare increases.

When such an economic state is reached that through any reorganisation 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. However, Paretian concept of social welfare is confined to only limited issue of welfare economics. Generally, when any economic reorganisation increases the welfare of some, it would reduce the welfare of some others and therefore, in this case, Pareto criteria will not apply. Following Robbins some economists object to making inter-personal comparison of utility to derive welfare propositions, since, according to them, inter-personal comparison of utility is based upon value judgements. However, Kaldor and Hicks by propounding a compensation principle laid the foundations of New Welfare Economics which is supposed to be free from value judgements. According to this compensation principle, if a change in economic organisation increases the welfare of some and reduces the welfare of others, but those who gain in welfare are able to compensate the losers and still be better off than before, then the change in economic organisation will increase the social welfare.

However, Kaldor-Hicks welfare criterion has been subjected to severe criticisms. The claim of Kaldor and Hicks that their criterion is free from value judgements or ethical assumptions has been contested. To quote Professor Baumol, “Both the Kaldor and the Scitovsky tests operate on the basis of an implicit and unacceptable value judgement. By using a criterion involving potential money compensation, they set up a concealed inter-personal comparison on a money basis.” He further writes, “It is no answer to this criticism to say that these criteria are just designed to measure whether production, and hence, potential welfare, are increased by a policy change that these criteria disentangle the evaluation of a production change from that of the distribution change by which it is accompanied. Consider a change in production which increases gin output but reduces the output of

whiskey. If X likes highballs but Y prefers martins, the question whether this is an increase in production is inextricably tied in with the question of the distribution of these beverages between X and Y."

In the end we may note that Professor 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 reorganisations 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 Bergson like Samuelson 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. On the Tightness of Bergson s social welfare function, and his introduction of explicit value judgements in it, Prof. Baumol writes, "Essentially the Bergson criterion must be judged right, if not very helpful.

To decide whether B is better than A, we must certainly employ some value judgements, and unless these judgements are explicit they must be treated with suspicion." Likewise, Professor K. E. Boulding writes: "One must admit that the task of making value judgements explicit is very important. It is obviously preposterous to suppose that one can set up criteria for judgment which are somehow independent of ethical norms". Thus, according to several modern economists such as Samuelson, Little, Boulding welfare economics cannot be purged of value judgements. In fact, the study of welfare economics has been developed to make policy recommendations to promote social welfare. And for doing so economists cannot escape from introducing ethical norms or value judgements since we all take interest in the question concerning happiness and welfare of the society."Welfare economics and ethics cannot, then, be separated. They are inseparable because the welfare terminology is a value terminology……. Getting rid of value judgements would be throwing the baby away with the bath water. The subject is one about which nothing interesting can be said without value judgements for the reason that we take a moral interest in welfare and happiness". It should not be gathered from above that the explicit introduction of value judgements makes the study of welfare economics unscientific. In spite of the explicit introduction of value judgements in welfare studies, the economist's approach can still be scientific in the sense that he scientifically deduces the welfare propositions from the given value judgements.

Scarcity and Choice

Economic theory enunciates the laws and principles which govern the functioning of an economy and its various parts. An economy exists because of two basic facts. First human wants for goods and

services are unlimited, and secondly, productive resources with which to produce goods are services are scarce. With our wants being virtually unlimited and resources being the scarce, a scarcity has to decide how to use its scarce resources to obtain the maximum possible satisfaction of its members. It is this basic problem of scarcity which gives rise to many of the economic problems which have long been the concern of economists.

Scarcity means limitation of the availability of resources in relation to their wants. That means the available resources are not enough to completely satisfy all the wants. By now, you must have already learnt that human beings have unlimited wants. And as the resources with which these wants must be satisfied are limited, we can understand that 'scarcity' is the central economic problem of everyone including individuals, firms and the government, and even the whole world. That is the problem of scarcity exists in all dimensions that are in terms of individual, society as well as countries. For example as far as individual is concerned in search of improving our standard of living we are always striving to have better and more luxurious shelter, latest fashion clothing, full option types of transport, better health care etc. but due to limited resources we cannot satisfy all these wants and in terms of countries Governments are always having difficulties in choosing where to invest there are too many necessities to full fill due to lack of resources. As a result of scarcity each and every person as well as the Government needs to make a choice so that the limited available resources is used efficiently.

It implies that human wants are unlimited but the means to fulfil them are limited. At any one time, only a limited amount of goods and services can be produced. This is because the existing supplies of resources are extremely inadequate. These resources are land, labour, capital and entrepreneurship. These factors of production or inputs are used in producing goods and services that are called economic goods which have a piece. These facts explain scarcity as the principal problem of every society and suggest the Law of Scarcity, The law states that human wants are virtually unlimited and the resources available to satisfy these wants are limited.

Since are live in a world of scarcity, a society can produce only a small portion of goods and services that its people want. Therefore, scarcity of resources gives rise to the fundamental economic problem of choice. As a society cannot produce enough goods and services to satisfy all the wants of its people, it has to make choices. A decision to produce one good requires a decision to produce less of some other good. So choice involves sacrifice. Thus every society is faced with the basic problem of deciding what it is willing to sacrifice to produce the goods it wants the most. For instance, the more roads a country decided to construct the fever resources will there be for building schools. So the problem of choice arises when there are alternative ways of producing other goods. The sacrifice of the alternative (school buildings) in the production of a good (roads) is called the opportunity cost. There

are a number of problems that can arise from choices that are made by people, whether they are individuals, firms or government. Choices or alternatives (or opportunity cost) are illustrated in terms of a production possibility curve and it is explained in the later section.

Basic Problems of an Economy

An economy is a system in which people earn their living by performing different economic activities like production, consumption and investment. In other words, an economy refers to the whole collection of production units in an area (geographical area or political boundary) of a country by which people get their living. An economy is classified into market economy and planned economy. Every economy faces some basic problems. Economic problem is the problem of choice. The problem of choice has to be faced by every economy of the world, whether developed or under developed. Human beings have wants which are unlimited. When these wants get satisfied, new wants crop up. Human wants multiply at a fast rate. The economic resources to satisfy these unlimited wants are limited. In other words, resources or factors of production (they are defined as goods and services needed to carry out production i.e., land, labour, capital and entrepreneurship) are scarce. They are available in limited quantities in relation to the demand. Resources are not only scarce but they also have alternative uses. All this necessitates a choice between which goods and services to produce first. The economy comprising of individuals, business firms, and societies must make this choice. According to Prof. Robbins, “the economic problem is the problem of choice or the problem of economising, i.e., it is the problem of fuller and efficient utilisation of the limited resources to satisfy maximum number of wants. The scarcity of resources creates this situation.” If an economy employs more resources to produce good X, then it will have to forego the production of good Y. Hence, economy has to choose which of the two goods or Y will give more satisfaction. An economy can produce both wheat and rice X Y on the same plot of land. The decision to produce wheat is an outcome of choice.

Causes of Economic Problems

The three main causes of economic problems are:

1. **Human Wants are Unlimited.**

Human beings have wants which are unlimited. Human want to consume more of better goods and services has always been increasing. For example, the housing need has risen from a small house to a luxury house; the need for means of transportation has gone up from scooters to cars, etc. Human wants are endless. They keep on increasing with rise in people's ability to satisfy them. They are attributed to (i) people’s desire to raise their standard of living, comforts and efficiency; (ii) human

tendency to accumulate things beyond their present need, (iii) multiplicative nature of some wants e.g. buying a car creates want for many other things - petrol, driver, car parking place, safety locks, spare parts, insurance, etc. (iv) basic needs for food, water and clothing, (v) influence of advertisements in modern times create new kinds of wants and demonstration effect. Due to these reasons human wants continue to increase endlessly. While some wants have to be satisfied as and when they arise such as food, clothes, shelter, water, etc., some can be postponed e.g. purchase of a luxury car. The priority of wants varies from person to person and from time to time for the same person. Therefore, the question arises as to 'which want to satisfy first' and 'which the last'. Thus, consumers have to make the choice as to 'what to consume' and 'how much to consume'.

3. **Resources are Limited.**

Scarcity of resources is the root cause of all economic problems. All resources that are available to the people at any point of time for satisfying their wants are scarce and limited. Conceptually, anything which is available and can be used to satisfy human wants and desire is a resource. In economics, however, resources that are available to individuals, households, firms and society at any point of time are traditionally natural resources (land). Human resources (labour), capital resources (like machine, building, etc.) and entrepreneurship are scarce. Resource scarcity is a relative term. It implies that resources are scarce in relation to the demand for resources. The scarcity of resources is the mother of all economic problems. It forces people to make choices.

3. Resources have Alternative Uses.

Resources are not only scarce in supply but they have alternative uses. Same resources cannot be used for more than one purpose at a time. For example, Rs.100 can be put in various alternative purposes such as buying petrol, notebook, ice-cream, burger, cold drink, etc. Similarly an area of land can be used for farming or as a playground or for constructing school, college or hospital building or for constructing residential building, etc. But return on the area of a land or utility of putting Rs.100 in various uses varies according to the use of the concerned resources. Thus, people have to make choice between alternating uses of the resources. If the area of land is put to a particular use, the landlord has to forgo the return expected from its other alternative uses. This is termed as opportunity cost. Economics as a social science analyses how people (individuals and the whole society or economy) make their choices between economic goals they want to achieve, between goods and services they want to produce and between alternative uses of their resources which will maximise their gains.

Economic problems are reflected in the form of Central or Basic Problems of an economy.

Any economy - whether market, centrally planned, or mixed- has to face these problems. According to Samuelson, there are three fundamental and interdependent problems in an economic organisation -

what, how for whom -which are grouped under allocation of resources. Allocation of resources means how much of each resource is devoted to the production of goods and services.

1. Allocation of Resources

(a) What Goods to Produce and How Much to Produce?

Due to limited resources, every economy has to decide what goods to produce and in what quantities. If the means were unlimited, then it would lead to a stage of salvation. But the means are limited and the economy must decide the efficient allocation of scarce resources so that both output and output-mix are optimum. An economy has to make a choice of the wants which are important for the economy as a whole. For example, if the economy decides to produce more cloth, it is bound to reduce the production of food. The reason is that resources used to produce food and cloth are limited and given. An economy cannot produce more of both food and cloth. Thus, an economy has to decide what goods it would produce on the basis of availability of technology, cost of production, cost of supplying and demand for the commodity.

b) How to Produce?

It is the question of choice of technique of production. Since resources are scarce, an inefficient technique of production, which would lead to wastage and high cost, cannot be applied. A technique of production which would maximise output or minimise cost should be used. We generally consider two types of techniques of production: labour-intensive and capital-intensive techniques. In labour-intensive technique, more labour and less capital is used. In capital-intensive technique, more capital and less labour is used. For example, it is always technically possible to produce a given amount of wheat or rice with more of labour and less of capital with labour intensive technology) or with (i.e. more of capital and less of labour with capital intensive technology). The same is true (i.e. for most commodities. In the case of some commodities however, choices are limited. For example, production of woollen carpets and other items of handicrafts are by nature labour intensive, while production of cars, TV sets, computers, aircrafts, etc., is capital intensive. In most commodities, however, alternative technology may be available. Alternative techniques of production involve varying costs. Therefore, the problem of choice of technology arises. The guiding principle of this problem is to adopt such technique of production which has least cost to produce per unit of the commodity. At macro level the most efficient technique is the one which uses least quantity of scarce resources. Hence, producers must always produce efficiently by using the most efficient technology. Thus, every economy has to choose the most efficient technique of producing a commodity.

(c) For Whom to Produce?

This is the question of how to distribute the product among the various sections of thesociety. National product is the total output generated by the firms. Goods and services are produced in the economy for those who have the ability (i.e. capacity) to buy them. Ability or capacity or purchasing power of people depends on their income. More income means more capacity to buy. The total output ultimately flows to the households in the form of income, i.e., their wages, rent, profits or interest. There are millions of people in a society. Each one cannot get sufficient income to satisfy all his wants. This raises the problem of distribution of national product among different households. Who should get how much is thus the problem? Thus, guiding principle of this problem is output of the economy be distributed among different sections of the society in such a way that all of them get a minimum level of consumption.

1. Production Possibility Curve (PPC)

1.1 **Production Possibility Set and Curve**

Production possibility set refers to different possible combinations of two goods that can be produced from a given amount of resources and a given level of technology. Production possibility curve or frontier (PPF) shows the various alternative combinations of goods and services that an economy can produce when the resources are all fully and efficiently employed. PPC shows the obtainable options. There is a maximum limit to the amount of goods and services which an economy can produce with the given resources and the state of technology. The resources can be used to produce various alternative goods which are called production possibilities and the curve showing the different production possibilities is called production possibility curve.

Assumptions

Assumptions underlying production possibility curve are:

(a) Economy produces only two goods, X and Y. (Examples of goods X and Y can be gun and butter, wheat and sugar cane, cricket bats and tennis rackets or anything else.)

(b) Amount of resources available in an economy are given and fixed.

(c) Resources are not specific, i.e., they can be shifted from the production of one good to the other good.

(d) Resources are fully employed, i.e., there is no wastage of resources. Resources are not lying idle.

(e) State of technology in an economy is given and remains unchanged.

(f) Resources are efficiently employed (efficiency in production means output per unit of an input).

Production Possibility Schedule and Curve

PP schedule refers to tabular presentation of different possible combinations of two goods that an economy can produce with given resources and available technology. Table 1.2, gives a production

possibility schedule. It shows that, with given resources, an economy can produce either zero unit of X and 21 units of Y or 1 of X and 20 of Y or 2 units of X 18 units of Y or 3 units of X and 15 units of Y or 4 of X and 11 of Y or 5 of X and 6 of Y or 6 units of X and zero units of Y.

Table 1.2: Production Possibility Schedule

Production Possibility	Good X	Good Y
A	0	21
B	1	20
C	2	18
D	3	15
E	4	11
F	5	6
G	6	0

Fig. 1.1 Production Possibility Curve

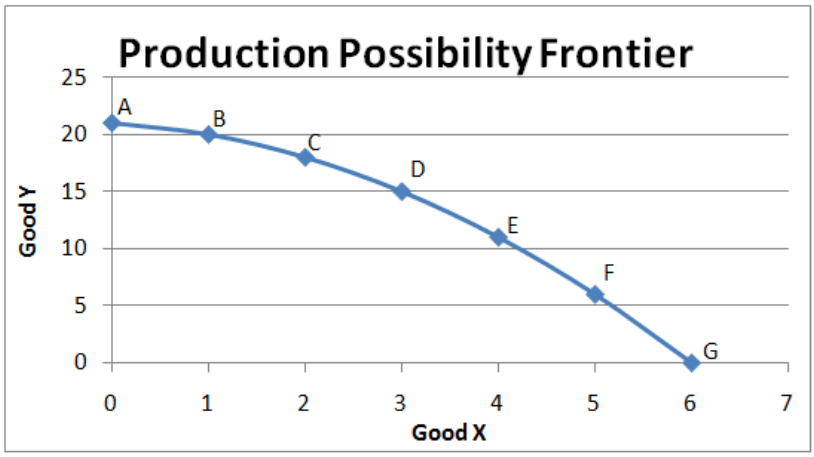


Fig. 1.1 illustrates a production possibility curve. Good X is shown on the x-axis and good Y is shown on the y-axis. AG is the required production possibility curve. It shows, the maximum amount of good X produced, given the amount of the other good. Each alternative possibility, i.e., (0, 21), (1, 20), (2, 18), (3, 15), etc., are plotted and points A, B, C, D, E, F, G are joined by line segments. A smooth PPC is drawn which is based on the assumption that in reality infinite production possibilities exist. The economy can either produce OA of good Y or OG of good X or any other combination shown by points A, B, C, D, E, F or G. All points on the curve are attainable. The problem is that of choice, i.e.,

to choose among the attainable points on the curve. It depends upon tastes and preferences of an individual. This is the basic problem of an economy. Any point inside the curve, indicates unemployment of resources or inefficient use of resources. Any point outside the curve is unattainable given the scarcity of resources. An economy always produces on a PPC.

Features of Production Possibility Curve

Two features of production possibility curve are:

(a) PPC slopes downward. A production possibility curve slopes downward from left to right because under the condition of full employment of resources, production of one good can be increased only after sacrificing production of some quantity of the other good. It is so because resources are scarce. Due to this, production of both goods cannot be increased at the same time. That is why slopes downward.

(b) PPC is concave to the origin. A production possibility curve is concave to the point of origin because of increasing marginal rate of transformation (MRT) or increasing marginal opportunity cost (MOC). Slope of PPC is defined as the quantity of good Y given up in exchange for additional unit of good X.

Slope of Production Possibility Curve

= MRT [Marginal Opportunity Cost]

Marginal opportunity cost is opportunity cost of good X gained in terms of good Y given up. It is also called Marginal Rate of Transformation (MRT).Concave shape means that slope of increase which implies that PPC increases. It means that for producing an additional unit of a good, sacrifice of units of other good (i.e. opportunity cost) goes on increasing. It is because resources are not equally efficient for the production of both goods. Thus, if resources are transferred from production of one good to another, cost increases i.e., MRT or MOC increases. It is called law of increasing opportunity cost.

Shifts in Production Possibility Curve

With discovery of new stock of resources or an advancement in technology, the productive capacity of an economy increases. The economy can produce more good X or more good Y or more of both goods. The effect of economic growth on the production possibility curve to a country is illustrated in Fig. 1.2 and Fig. 1.3.

PPC will shift to the right when:

(a) New stock of resources is discovered.

(b) There is advancement in technology. For example: Government policy of ‘Make in India’.

Look at this example: When training institutes come up, they provide training which raises efficiency of workers. PPC shifts outside.

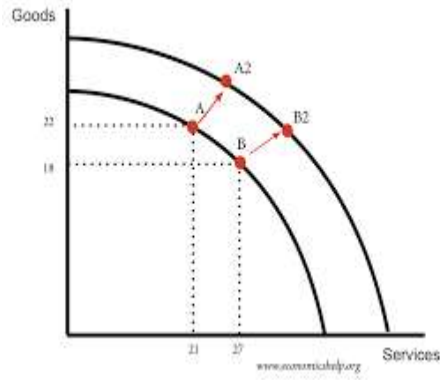
PPC will shift to the left when:

(a) Resources are destroyed because of national calamity like earthquake, fire, war, etc.

For example: When maggi product was destroyed.

(b) There is use of outdated technology.

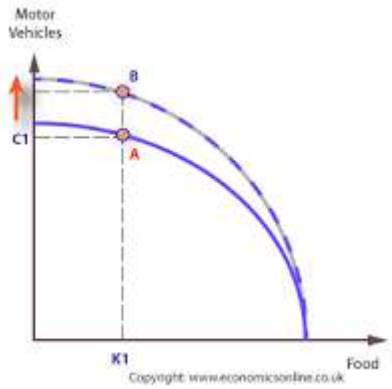
Fig. 1.2 Shift in PPC



In Fig. 1.2, there is an outward shift of the production possibility curve. It shows economic growth of an economy. Economic growth has shifted the production possibility curve outwards and made it possible for an economy to produce more of both the goods. The economy has not stagnated but has developed over a period of time. In a reverse situation, if due to earthquake and floods mass destruction takes place then the country will stagnate. The curve will shift inwards.

In Fig. 1.3, improvement in technology takes place only in one good, good Y. There is no improvement in the technology of producing good X. Thus, more of good Y can be produced. Production possibility curve expands to outwards showing economic growth. Likewise improvement in the technology of producing good X can also be happened without any improvement in the technology of Y.

Fig. 1.3 Shift in PPC

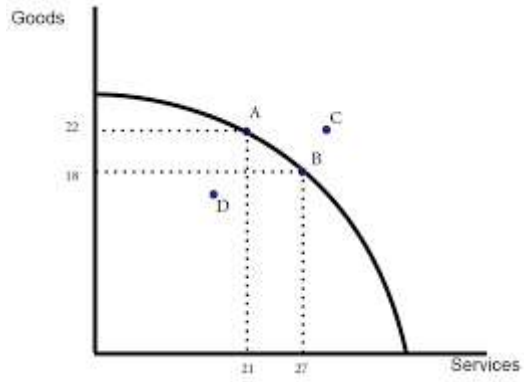


Opportunity Cost

In economic analysis, the concept of opportunity cost is widely used. Opportunity cost is defined as the cost of alternative opportunity given up or surrendered. For example, a piece of land both wheat and sugarcane can be grown with the same resources. If wheat is grown then, opportunity cost of producing wheat is the quantity of sugarcane given up. It is clear that question of opportunity cost arises whenever resources have alternative uses. These resources are not always physical resources; they may be monetary resources or time. For example, the opportunity cost of spending in a restaurant, may be a book that you could have purchased by spending the same amount. Also, opportunity cost of time devoted to studies, effort or work is the leisure or play that could have been enjoyed. In terms of production possibility curve, the slope of the curve at every point measures the opportunity cost of producing more units of good X in terms of X good Y given up.

The concept of opportunity cost can be shown with the help of alternative options given by PPC. In Fig 1.4, movement along production possibilities frontier, from A to B shows a decrease in the goods and increase in services. That is movement from point A to point B shows decrease in goods from 22 to 18 and increase in the production of services from 21 to

Fig. 1.4 Opportunity Cost



27. It implies that 6 units of services can be produced only by sacrificing 4 units of production of goods. It means that 4 units of production of goods becomes an opportunity cost for 6 units of services.

For example: Suppose you choose Science stream. You had two other options: the Arts stream (A) or the Commerce stream (C). If you would have chosen (A), you would have expected a career offering you Rs.3 lakhs annually. If you would have chosen (C), you would have expected a career giving you Rs. 4 lakhs annually. What is your opportunity cost of choosing the Science stream?

Solution: The opportunity cost of choosing the Science stream is the alternative opportunity given up. There are two alternative opportunities: choosing Arts stream or the Commerce stream. The opportunity cost of choosing Science stream is Rs. 4 lakhs (next best alternative use).

Marginal Opportunity Cost

Production possibility curve is also called transformation curve because looking at it, it appears as if one good is being transformed into another. A movement along implies that more of good X is produced by sacrificing the production of a certain amount of good Y.

PPC is also called opportunity cost curve because slope of the curve at each and every point measures opportunity cost of one commodity in terms of alternative commodity given up. The rate of this sacrifice is called the Marginal Opportunity Cost.

Marginal Rate of Transformation (MRT)

It is defined as the ratio of number of units of good sacrificed to produce one additional unit of other good. MRT measures the slope of PP curve. MRT = slope of PPC. Actually MRT is the rate at which the transfer of resources from production of one good to production of other good takes place. Shape of curve depends upon the MRT or MOC.

The Basic Competitive Model

Basic competitive models gives an answer of the control problems of an economy i.e., who makes the decision of what to produce, how to produce and for whom to produce. We know that, economics has been evolved and developed in the framework of a free market economy in which the resources of a society are owned by individuals and firms. Thus a market economy recognises and protects property rights i.e., the rights that govern the ownership, use and disposal of resources and the goods services produced with their help. There are two participants in the market i.e. Producers and Consumers. There are a large number of buyers and sellers in a competitive market and thus they compete among themselves. Producers compete with each other by providing the desired products to the consumers at the lowest possible price and the consumers compete with one another by paying the price for the products they are willing to buy, while others may not be able to afford the product. This is known as the basic competitive model. The basic competitive model is the model which assumes that the firms are interested in profit maximization, consumers are rational or self-interested and the markets are perfectly competitive. The consumers are assumed to be rational as they make choices in their own self-interest i.e. they make a choice such that their satisfaction is maximized. For example, Ram may prefer leisure over work and can exchange a lower income for longer holidays and Rahul may be ambitious and hardworking and willing to work for longer hours to fulfil his dream of buying a bunglow. The firms are also assumed to be rational as they operate with the motive of profit maximization.

Basic assumptions of competitive models/features:

1. Rational self interested consumers

As consumer behaviour assumes that there is a budget constraint through which the consumer makes a rational choice. Rational choice means that consumer tries to maximise their satisfaction or act in a consistent manner given his budget constraint. Given their budget constraint, there will be opportunity set of goods and services. Opportunity set means the combination of goods and services that they can buy the given money income and prices of the goods and services. So rationality assumption about the behaviour of consumer of implies that they will make choice to promote their self interest. Different individual's different taste and preferences affect their rational choice while they pursue their respective self interest.

2. Profit Maximising Firms

Just like consumers, economists assume that they (firms) will also pursue their self interest in making choice. Generally rational behaviour (in terms of firms) means what goods will be produced and in what quantities and also how those products will be produced as guided by the motive of profit maximisation. They also face the constraint of the limited resources.

3. Competitive market

In the basic competitive model neither the firm nor the consumers have any market power to influence the prices of the goods and services they want to sell and buy. In fact it is assumed that the perfect competition prevails in market. Under perfect competition there are large number of buyers and sellers and there is no control over the price level i.e., each firm and consumer is price taker. All the producers produce goods and services with the primary motive of profit. Earning of profits from using resources owned by them also provides incentives to the firms and individuals to produce goods and services efficiently. The price of goods and resources provides information to the individuals and firms about the relative scarcity of different goods and services.

Economic Systems

Every economic system has the following goals: efficiency, equity, security, freedom, and incentives. These goals are a present fixture in every economy; however, each economy may rank these goals differently. The ranking of these goals and the way in which each economy answers the three economic questions reveal what kind of economic system the country has.

Due to the concept of scarcity, every economy must address three main questions: What to make? How to make it? And for whom should it be made? Economic systems are categorized by how these questions are answered.

In a command economy, these questions are answered by a central government made up of an individual or individuals. Traditional economies rely on customs and rituals. Market economies rely on the forces of supply and demand to answer the three questions. The idea of allowing self-interest to

guide prices and supply was introduced by Adam Smith in his book The Wealth of Nations, published in 1776.

MODULE-II

Demand and Supply Analysis

Nature of Demand

In economics, demand refers to the various quantities of a good or service that people will be and able to purchase at various prices during a period of time. It is important to note that a mere desire

for a good or service does not constitute demand. Demand implies both the desire to purchase and ability to pay for the good. Unless demand is backed by purchasing power, it does not constitute demand. Further, demand does not refer to the specific quantity that will be purchased at some particular price, but refer to a series of quantities and their associated prices.

Law of Demand

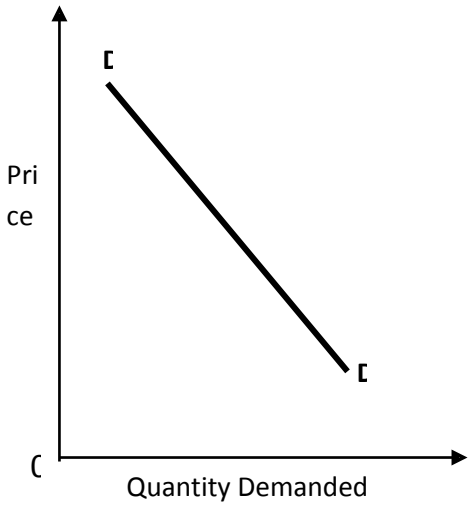
Law of demand expresses the functional relationship between price and quantity demanded. According to the law of demand, other things being equal, if the price of the commodity falls the quantity demanded of it will rise and if the price of the commodity rises, its quantity demanded will decline. Thus, according to law of demand, there is an inverse relationship between price and quantity demanded, other things remaining the same. The other things which are assumed to be constant are tastes and preferences of the consumer, the income of the consumer, prices of related commodities etc. Thus, the law of demand assumes that all things other than price remain constant.

The law of demand can be illustrated through a demand schedule and through demand curve. Demand schedule shows various quantities of good or service that people will buy at various possible prices during some specified period, while holding constant all other relevant economic variables on which demand depends. A demand schedule is presented in the table 2.1 below.

Table 2.1: Demand Schedule

Price	Quantity Demanded
10	20
8	40
6	60
4	80
2	100

We can convert the demand schedule into demand curve by graphically plotting the various price-quantity combinations, as shown below.



It is common practice in economics to measure price on vertical axis and quantity demanded per unit of time on the horizontal axis. Thus, the demand curve is a graph showing the various quantities of a good or service that the people will be willing and able to buy at various possible prices. Demand curve slopes downwards from left to the right. The downward sloping demand curve is in accordance with the law of demand, which describes inverse price-quantity demanded relationship. The various points on the demand curve represents alternative price -quantity combinations.

Reasons for law of Demand

Let us analyse the reasons for the inverse relationship between price and quantity demanded. This is due to both "income effect" and "substitution effect".

When the price of the commodity falls, the consumer can buy more quantity of the commodity with his given income. If he chooses to buy the same amount of the commodity as before, some money will be left with him. That is, consumer's real income or purchasing power increases. This increase in real income induces the consumer to buy more of the commodity. This is called the income effect of the change in price of the commodity. This is the reason why a consumer buys more of a commodity whose price falls. Similarly, an increase in the price of the commodity results in the reduction of real income of the consumer. Hence, the consumer buys less of a commodity whose price rises.

Again, when price of the commodity falls, it becomes relatively cheaper than other commodities. This induces the consumer to substitute the commodity whose price has fallen for other commodities which have now become relatively dearer. This change in quantity demanded resulting from substituting one commodity for another is referred to as substitution effect of the price change. As

a result of this substitution effect, the quantity demanded of the commodity whose price has fallen rises. For normal commodities, the income and substitution effect of a price decline are positive and reinforce each other leading to a greater quantity demanded of the commodity. Apart from the income effect and substitution effect, there is an additional reason why the market demand curve for a commodity slopes downwards. When the price of the commodity is relatively high, only few consumers can afford to buy it. When the price of the commodity falls, a greater number of consumers will be able to afford to buy it. In other words, the size of the market expands. Thus, the quantity demanded increases. This is called the "market size effect".

Exceptions to the Law of Demand

Law of demand is generally believed to be valid in most situations. However, some exceptions have been pointed out. According to Thorestein Veblen, some consumers measure the utility of a commodity entirely by its price. That is, for them, the greater the price of the commodity, the greater it's utility. These consumers demand more of such commodities the more expensive these commodities are in order to impress people. E.g. Diamonds. This form of conspicuous consumption is called "Veblen effect". When the price of such commodities goes up, their prestige value also goes up. Consequently, quantity demanded also will rise and law of demand breaks down.

Another exception to the law of demand is the case of some inferior commodities and was pointed out by 19th century English economist Sir Robert Giffen. He introduced the case of some inferior goods in which there is a direct price-quantity demanded relationship. If the price of an inferior good falls, consumer's real income increases. So, instead of buying more inferior goods, consumers substitute other superior goods. In such case, quantity demanded of inferior goods falls as price falls. After the name of Robert Giffen, such goods are called "Giffen Goods". In the case of Giffen goods, positive substitution effect is smaller than negative income effect when the price of such goods falls. With the rise in the price of such goods, its quantity demanded increases and with the fall in the price, its quantity demanded decreases. Thus, the demand curve will slope upwards to the right and not downward in the case of Giffen goods. It should be noted that Giffen good is an inferior good but all inferior goods are not Giffen goods. Though occurs rarely in the real world, Giffen goods represent an exception to the law of demand.

Determinants of Demand

Income, prices of related goods, taste and preferences of the consumer, expectations, number of buyers in the market, distribution of income etc are likely to affect the demand for the product. These

factors are called “non-price determinants” and are assumed to be constant while deriving the demand schedule and demand curve. But any change in these non-price determinants will change the demand schedule and demand curve. Let us analyse how these factors can affect the demand for the product.

(1) Income: The demand depends up on income of the people. The greater the income of the people, the greater will be their demand for goods and services. If their income increases, people will tend to buy more goods and services than they did before the increase in income. This is the case of most goods and services. Hence economists refer to goods whose demand varies directly with income as “normal goods”. Although most commodities are normal goods, there are cases when consumers may not buy some goods more as their income increases. Instead they buy less. Such goods are called “inferior goods” because as people’s income increases they actually reduce the purchase of such goods.

(2) Prices of related goods: Goods and services may be related to each other in two ways; they may be substitutes or they may be complements. One good is said to be substitute for a second good if it can be used in the place of second good. Example: tea and coffee, beef and chicken. Two goods are said to be complementary if they are used together. Complementary goods are demanded jointly. Example: scooter and petrol, computer and computer software. In general, if the price of a substitute commodity increases, consumers tend to increase their purchases of the substitute in question. Goods are substitutes when an increase in the price of one leads to an increase in the quantity demanded of the other. For instance, if the price of coffee increases, people will substitute tea for coffee and as a result demand for tea increases. On the other hand, if the price of complement falls, people will tend to increase their purchases of the commodity in question. Two goods are complements if a fall in the price of one leads to increase in the quantity demanded of the other. For instance, if the price of scooter falls, the demand for them will increase which in turn will increase the demand for petrol.

(3) Taste and Preferences: The quantity of a commodity that people will buy will be affected by the taste and preferences. Companies spend millions of Rupees in advertisement in an attempt to influence consumer’s tastes in favour of their products. Consumer’s taste and preferences often change and as a result, there is a change in the demand for products. A good for which consumer’s tastes are greater, its demand would be larger. On the contrary, any good goes out of fashion or people’s taste and preferences no longer remain favourable to them, the demand for them decreases.

(4) Expectations: The expectations of the consumers regarding the price in the future will affect present purchases of goods and services. If consumers expect the price of the product to increase in the future, they are likely to increase their present purchases to stock up on the good and thus postpone paying the ensuing higher price for as long as possible. Conversely, if the price is expected to fall in future, consumers will attempt to delay their present purchases in order to take advantage of the lower future prices. The expectations of the consumer about the future change in income will also affect the purchases of goods and services. If people expect substantial increase in their income sometime in the near future, they are likely to buy more goods and services even before the increase in income materialises. If the people expect decrease in their income, they are likely to buy fewer goods and services.

(5) Number of buyers in the market: The quantity of the commodity that people will buy depends on the number buyers in the market for that particular commodity. The greater the number of buyers of a good, the greater the market demand for it. If population increases we can expect the demand for most goods and services to increase as a consequence.

(6) Distribution of income: Distribution of income in the society also affects demand for goods. If the distribution of income is more equal, then the propensity to consume of the society as a whole will be higher which results in greater demand for goods. On the other hand, if the distribution of income is more unequal, then the propensity to consume of the society will be relatively less because propensity to consume of rich people is less than that of poor people.

Types of Demand: Three kinds of demand may be distinguished

(a) **Price demand**: Price demand shows the relationship between price and quantity demanded of a commodity. It refers to various quantities of a commodity demanded at its various prices. (i.e., relationship between Q and $\mathbf{P_x}$)

(b) **Income demand**: Income demand refers to the quantities of a commodity demanded at various levels of income of the consumer. (i.e., relationship between Q and Y)

(c) **Cross Demand**: Cross demand refers to the change in quantity demanded of a commodity owing to a change in the price of related goods - Complements or substitutes. (I.e., relationship between Q and $\mathbf{p_r}$.)

Demand Function

Demand for a commodity is determined by several factors. An individual's demand for a commodity depends on the own price of the commodity, his income, prices of related commodities, his tastes and preferences, advertisement expenditure made by the produces of the commodity, expectations etc. Thus, individual's demand for a commodity can be expressed in the following general functional form,

$$Q_x^d = f(P_x, I, P_r, T, A, E) \text{ where,}$$

Q_x^d = Quantity demanded of commodity "x"; Px= Price of commodity x; I = Income of the individual consumer; P_r= Price of related commodities; T = Tastes and preferences of individual consumer; A = Advertisement expenditure; E = Expectations

The demand function is just a short hand way of saying that quantity demanded , which is recorded in the left hand side depends on the variables that are recorded on the right hand side. For many purposes in economics, it is useful to focus on the relationship between quantity demanded of a good and its own price, while keeping other determining factors constant. Thus, we can write the demand function as:

$$Q_x^d = f(P_x)$$

This implies that the quantity demanded of the commodity x is a function of its own price, other determinants remaining constant.

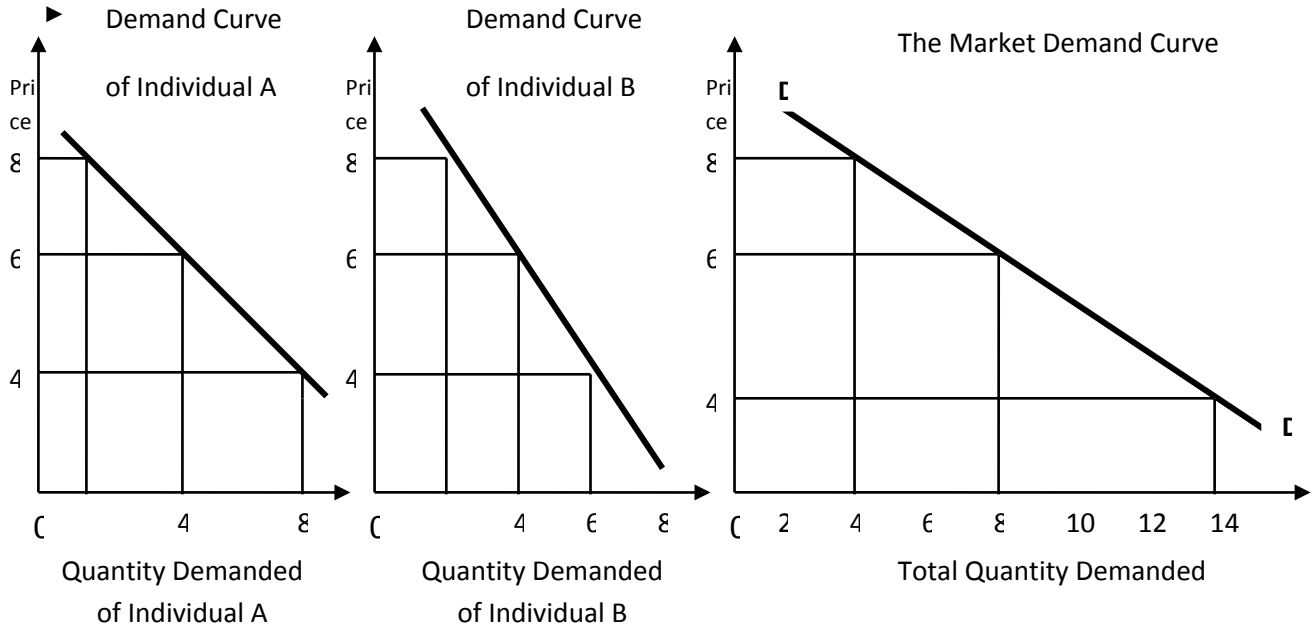
The Market Demand

As mentioned above, the quantity of a product demanded by one individual depends on the product's price, other things being equal. To explain the market behaviour, we need to know the total demand of all individuals. The market demand for a commodity gives the alternative amounts of the commodity demanded at various prices by all individuals in the market during a period of time. To obtain the market demand, we sum the quantities demanded by each individual at a particular price to obtain the total quantity demanded at that price. We repeat the process for each price to obtain market demand schedule at all possible prices. The market demand for a commodity depends on the all the factors that determine the individual's demand. In addition, it also depends on the number of buyers of the commodity in the market. Geometrically, the market demand curve for a commodity is obtained by the horizontal summation of the entire individual's demand curve for the commodity. For sake of

simplicity, let us assume that there are only two individual consumers in the market, individual A and individual B. The individual demand schedules for these two consumers along with the market demand schedule is given below.

Individual A		Individual B		Market Demand	
Price	Quantity Demanded	Price	Quantity Demanded	Price	Quantity Demanded
8	2	8	2	8	4
6	4	6	4	6	8
4	8	4	6	4	14

At price Rs 8, individual A will buy 2 units and individual B will also buy 2 units. The total quantity demanded at Rs 8 is therefore 4 units. This is shown in the market demand schedule. Similarly, the total quantity demanded in the market at Rs 6 is 8 units and 14 units are demanded at Rs 4 in the market. It can be seen that the market demand schedule is the sum of the demands of the individual consumers in the market. A graph of this market demand schedule is called the market demand curve. The market demand curve is shown below



The above figure illustrates the proposition that the market demand curve is the horizontal sum of the demand curves of all the individuals who buy in the market. The market demand curve will also slope downwards from left to the right because the individual demand curves whose lateral summation gives the market demand curve normally slope downward from left to the right.

Elasticity of Demand

We have seen that the demand for a commodity is determined by its own price, income of the consumer, prices of related goods etc. Quantity demanded of a good will change as a result of a change in the size of any of these determinants of demand.

Elasticity measures the sensitivity of one variable to another. Specifically, it is a number that tells us the percentage change that will occur in the variable in response to one percent increase in another variable. Therefore, elasticity of demand refers to the sensitiveness or responsiveness of quantity demanded of a good to a change in its own price, income and prices of related goods. Accordingly, there are three kinds of elasticity of demand .They are

1. Price elasticity of demand
2. Income elasticity of demand
3. Cross elasticity of demand

Price elasticity of demand measures the sensitivity of quantity demanded to change in own price of g good. Income elasticity of demand measures the sensitivity of quantity demanded to change in income of the consumer. While cross elasticity of demand analyses the responsiveness of quantity demanded of one good to changes in the price of another good.

Price elasticity of demand

Price elasticity of demand refers to the responsiveness or sensitiveness of quantity demanded of a good to changes in its own price. In order to have a measure of the responsiveness of quantity demanded of a good to change in its price, that is independent of units of measurement, Alfred Marshall, defined in terms of percentage or relative change in quantity demanded to price. As such, price elasticity of demand is given by the percentage change quantity demanded of a good divided by

the percentage change in its price. The elasticity is usually symbolised by Greek letter eta (η). Thus, we have

$$\eta = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

Now denoting ΔQ for change in quantity demanded and ΔP for the change in price (the symbol Δ is Greek letter delta; it means "the change in") we have the formula for the price elasticity of demand as

$$\eta = \frac{\Delta Q/Q}{\Delta P/P}$$

That is, $\eta = \frac{\Delta Q}{Q} \cdot \frac{P}{\Delta P}$

Or

$$\eta = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Since, price and quantity demanded are inversely related the coefficient of price elasticity of demand (η) is a negative number. In order to avoid dealing with negative values, a minus sign is often introduced into the formula of price elasticity of demand. That is

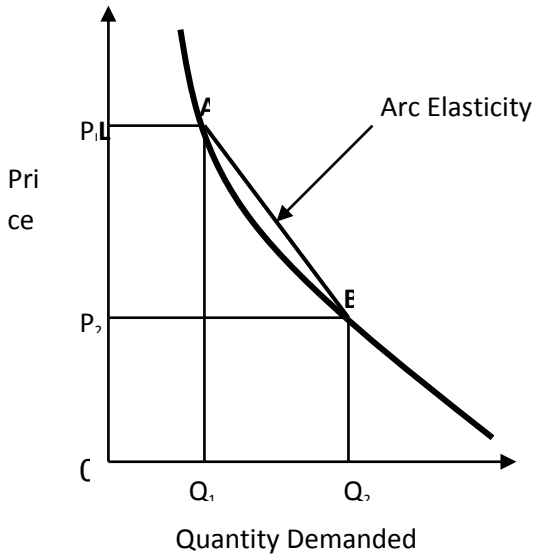
$$\eta = -\frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Thus price elasticity of demand is measured by a ratio; the percentage change in quantity demanded divided by the percentage change in the price that brought it about. For normal negatively slopped demand curves, price elasticity will be negative, but two Elasticities are compared by comparing their absolute values. As such, price elasticity of demand is a pure number that is it has no units of measurement attached to it. This allows meaningful comparison between the price elasticity of demand of different commodities.

The above formula is called point elasticity formula of demand because it measures elasticity at a point on the demand curve. The value obtained for η is just a number like 2 or 5 or ½ and is referred to as the coefficient of elasticity. Since price elasticity is being measured at a point on the market demand curve we are assuming that all other factors that affect market demand remain fixed. The demands for some goods are more responsive to changes in price than those of others. That is, demands for some goods are more 'elastic' than those for others or the price elasticity of demand of some goods is greater than those of others. It should be noted that the terms elastic and inelastic are used in relative sense. In other words, elasticity is a matter of degree only.

The Arc Elasticity Formula

Formula of point elasticity of demand measures the elasticity at particular point on the demand curve. It can be conveniently used when the changes in the price and resultant quantity demanded are infinitesimally smaller. However, when the price change is large, we have to measure elasticity over an arc of the demand curve rather than at a specific point on it. The arc elasticity measures elasticity of demand between two points on the demand curve. That is, arc elasticity is a measure of average elasticity. Consider the following figure.



The initial price is P_1 and corresponding quantity is Q_1. When price falls to P_2, quantity demanded increases to Q_2. The arc elasticity measures elasticity at the point of the cord that connects the two points A and B on the demand curve defined by the initial and new price level. By taking the

average of the two prices and average of two quantities, we can obtain the following formula for the price elasticity of demand

$$\eta = - \frac{\Delta Q}{\Delta P} \cdot \frac{(P_1 + P_2)/2}{(Q_1+Q_2)/2}$$

Or

$$\eta = - \frac{\Delta Q}{\Delta P} \cdot \frac{(P_1 + P_2)}{(Q_1+Q_2)}$$

The new formula is called the arc elasticity of demand formula or average elasticity of demand formula because it measures η between two points on the demand curve. Arc elasticity of demand treats the price and quantity as if they were midway between the initial and new prices and quantities and then uses the point elasticity at this midpoint

Arc elasticity formula should be used when the change in price is somewhat large, but not very large. On the other hand, when the two points on the demand curve are very close together, arc becomes almost identical with the true demand curve and the arc elasticity measurement becomes almost identical with the point elasticity measurement on the demand curve.

Total Outlay Method

Another method to measure price elasticity of demand is known as total outlay or expenditure method. In this method, changes in the total expenditure made on the good as a result of change in its price is analysed to measure price elasticity of demand. But with the total outlay method, we can know only whether price elasticity is equal to one, greater than one or less than one. With this method, we cannot find out the exact coefficient of price elasticity of demand.

If as a result of the change in price of the commodity total expenditure remains the same, then elasticity of demand for the commodity will be equal to unity. This is so because total expenditure made on the commodity can remain the same only if the proportional change in the quantity demanded is equal to proportional change in price. On the other hand, due to fall in price of the commodity, quantity demanded rises and, as result, total expenditure made on the commodity increases, then price elasticity of demand is said to be greater than unity. This is so because with the fall in price of the

commodity, total expenditure can increase only if the proportional change in quantity demanded is greater than the proportional change in the price.

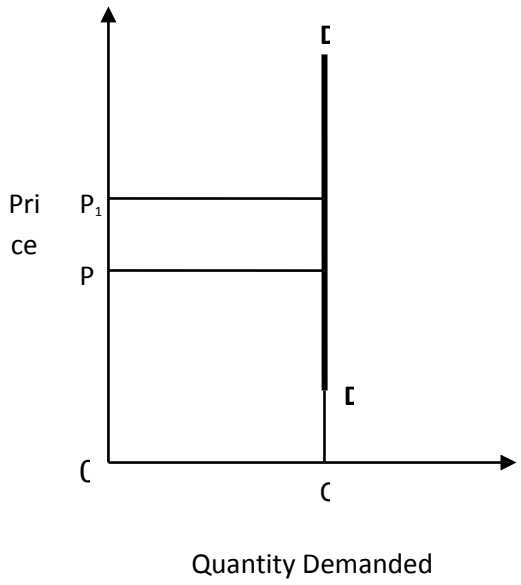
If as a result of fall in the price of the commodity total expenditure decreases, then price elasticity of demand will be less than unity. This is for the reason that with the fall in price, total expenditure can decrease only if proportional increase in quantity demanded is less than proportional change in price. Thus, through the total outlay method, we can find out whether prices price elasticity is equal to unity or greater than unity or less than unity. Note that with this method, we cannot know the precise value of the price elasticity.

Degrees of Elasticity of Demand

The value of price elasticity of demand ranges from zero to infinity. That is, $0 \leq \eta \leq \infty$. Based on the value of elasticity or degree of responsiveness of quantity demanded, price elasticity of demand is classified into five categories. They are: (i) Perfectly inelastic demand, (ii) Inelastic demand, (iii) Unitary elastic demand, (iv) Elastic demand, (v) Perfectly elastic demand. Now let us analyse each of them in detail:

(1) Perfectly inelastic demand

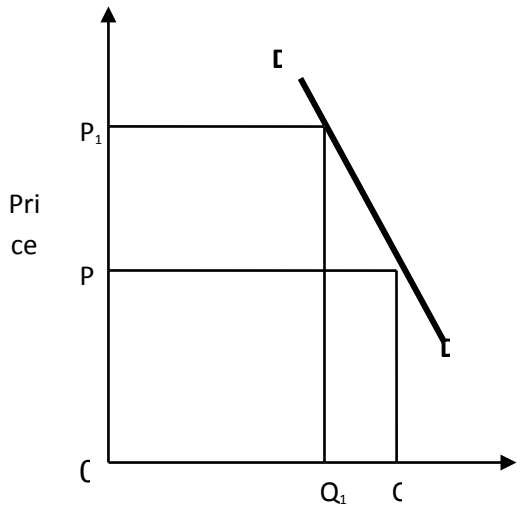
When quantity demanded does not change as a result of change in price, demand is said to be perfectly inelastic. Quantity demanded is unchanged when price changes or demand shows no response to change in price. In other words, same quantity will be bought whatever the price may be. Numerical value of elasticity will be zero ($\eta = 0$) when there is perfectly or completely inelastic demand. The following figure illustrates the case of perfectly inelastic demand.



A change in price from P to Pl leaves quantity demanded unchanged at Q units. That is, quantity demanded does not change at all when price changes.

(2) Inelastic Demand

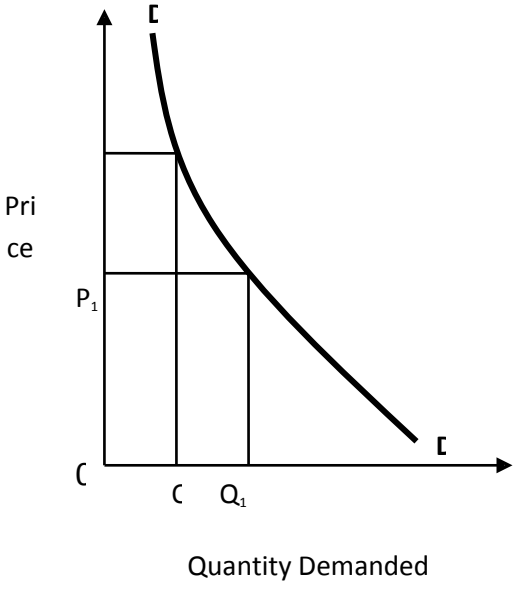
As long as there is some positive response of quantity demanded to change in price, the absolute value of elasticity will exceed zero. The greater the response, the larger the elasticity. However, when percentage change in quantity demanded is less than percentage change in price, demand is said to be inelastic. That is, a certain percentage change in price leads to a smaller percentage in quantity demanded. The coefficient of elasticity will be less than one but greater than zero ($0< \eta <1$) when demand is inelastic. This is shown below.



When change in price from OP to OP_1 causes a less than proportionate change in quantity demanded. That is, quantity demanded changes by a smaller percentage than the change in price.

(3) Unitary Elastic Demand

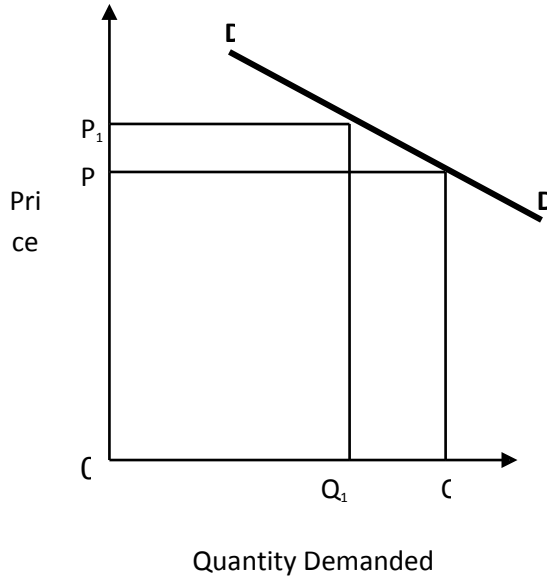
If a certain percentage change in price leads to an equal percentage change in quantity demanded, then demand said to have unitary elasticity. Unitary elasticity is the boundary between elastic and inelastic demand. The coefficient of elasticity will be equal to one when demand is unitary elastic ($\eta=1$). The demand curve having unitary elasticity over its whole range is shown below



OP and OQ are the initial price and quantity. A fall in price from OP to OP_1 causes an equal proportional change in quantity demanded from OQ to OQ_1.

(4) Elastic Demand

When the percentage change in quantity demanded exceeds the percentage change in price, the demand is said to be elastic. That is, a certain percentage change in price leads to a greater percentage change in quantity demanded. The value of coefficient of elasticity will be greater than one but less than infinity when demand is elastic ($1<\eta<\infty$). This is shown below.

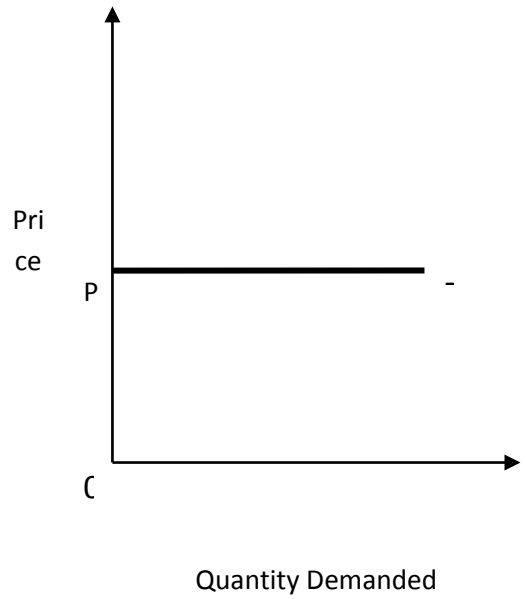


Quantity Demanded

An increase in price from OP to OPl causes a more than proportionate increase in quantity demanded as shown by the change in quantity demanded from OQ to OQl. Thus, a small rise in price brings in more than proportionate fall in quantity demanded.

(5) Perfectly Elastic demand

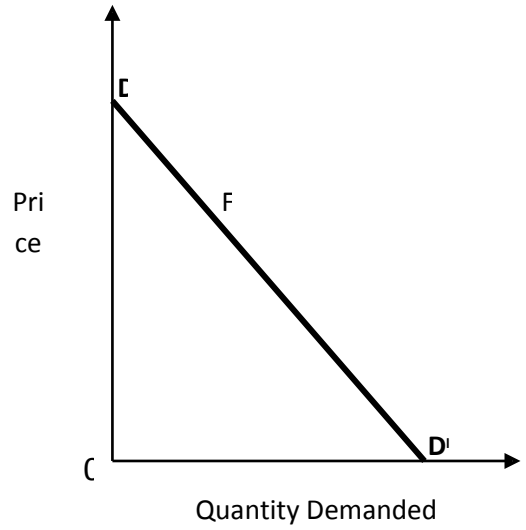
If a small change in price leads to an infinitely large change in quantity demanded, we can say that demand is perfectly elastic. When demand is perfectly elastic, small price reduction will raise demand to infinity. At the same time, a slightest rise in price causes demand to fall to zero. At the going price, consumers will buy an infinite amount (if available).above this price, they will buy nothing. The coefficient of elasticity will be infinity when demand will be infinite when demand is perfectly elastic ($\eta = \infty$). The graph for perfectly elastic demand is shown below.



When it is perfectly elastic, demand curve is a horizontal straight line. In his case an infinitely large amount can be sold at the going price OP. A small price increase from OP decreases quantity demanded from an infinitely large amount to zero (hyper sensitive demand).

Price elasticity on a linear Demand Curve

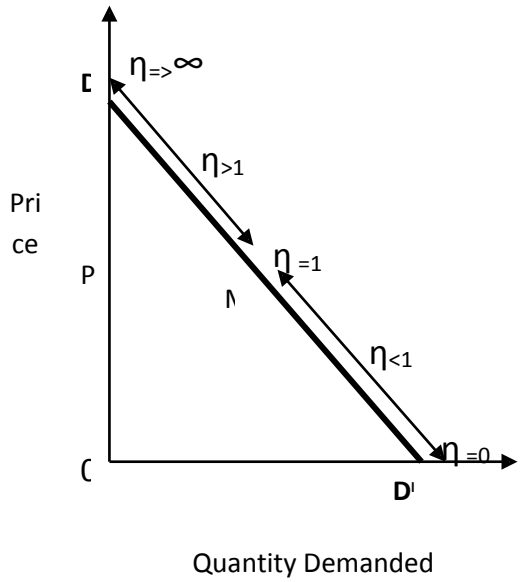
When demand curve is linear, the price elasticity can be computed graphically. Consider the following linear demand curve.



Graphically, the point elasticity of a linear demand curve is the ratio of the segment of the line to the right and to the left of the particular point. That is,

$$\eta = \frac{\text{Lower segment}}{\text{Upper segment}}$$

In the above demand curve, the elasticity at point F is the ratio FD^{l}/FD. Given this graphical measurement of point elasticity, it is obvious that at mid-point of a linear demand curve, price elasticity will be equal to unity ($\eta = 1$), as shown below.



In the figure, at the mid-point of the curve M, the coefficient of elasticity $\eta = 1$. At points to the right of M, elasticity is less than unity ($\eta < 1$). At any points to the left of M, elasticity will be greater than unity ($\eta > 1$). At point D the elasticity approaches infinity ($\eta => \infty$). At point D^{l}, the coefficient of elasticity is zero ($\eta = 0$).

Thus, elasticity of a negatively slopped demand curve varies between infinity at the price axis to zero at the quantity axis. At the price axis, since Q=0, elasticity is infinity. As we move down the demand curve price falls and quantity demanded rises steadily, elasticity falls. At the quantity axis, where P=0, elasticity is also zero.

Determinants of price Elasticity of Demand

Important determinants of elasticity of demand of a commodity with respect to its own price are explained below.

(1) Availability of Substitutes

One of the most important factors likely to influence the price elasticity of demand for a commodity or service is whether or not substitutes are available. If a commodity has many close substitutes, its demand is likely to be elastic. This is so because if the price of that commodity rises buyers will switch to some of many close substitutes available. Hence quantity demanded of that commodity will tend to fall significantly. The greater the possibility of substitution, the greater the price elasticity of demand for it. On the other hand, if there are not many substitutes quantity demanded will tend to fall as a result of the higher price, but not by much. That is, if there are few or no close substitutes, demand tend to be inelastic.

(2) Nature of the commodity

Whether the commodity is a luxury or a necessity has some effect on its price elasticity of demand. In general, necessities are price inelastic. If the price of a basic necessity increases, say by 10%, quantity demanded will not probably fall by that proportion. Consumers tend to sacrifice some other commodities rather than a substantial reduction in the quantity of necessities. On the other hand, luxury goods are price elastic. An increase in the price of luxury good is likely to cause a more than proportionate decrease in the quantity bought, other things being equal.

(3) Time Period

The time period being considered will also have some effect on the elasticity of demand for the product. In general, the longer the time period being considered, the more elastic the demand is likely to be. This is largely due to the fact that it takes time for people to substitute one commodity for another. At the same time, in the short run, substitution of one commodity by another is not so easy. Hence demand tends to be relatively inelastic.

(4) Number of Uses

In general, the greater the number of uses of a commodity has, the more price elastic the demand for that commodity is likely to be. A decrease in the price of a commodity that has large number of uses (milk, for example) more of it will be bought to allocate to different uses. On the other hand, if the commodity has only one or two uses, it is unlikely that a fall in its price will cause a significant increase in quantity demanded.

(5) Proportion of income spent on the commodity

Another factor that is likely to affect price elasticity of demand is the proportion of income spent on the commodity. If only a negligible percentage of consumer's income is spend on the commodity, the demand for that commodity is likely to be inelastic. An increase in the price of such commodity has no appreciable effect on the consumer's budget. Example, matches, soap. The greater the proportion of income spent on the commodity the greater will be its price elasticity of demand.

Income Elasticity of Demand

The responsiveness or sensitiveness of quantity demanded of a commodity to changes in income of the consumer is termed as income elasticity of demand. It is the proportionate or percentage change in quantity demanded resulting from proportionate change in income. Thus we have

$$\eta_y = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Now denoting ΔQ for small change in quantity demanded and ΔY for the small change in income we may symbolically write the formula for the income elasticity of demand as

$\eta_y = \Delta Q/Q \ / \Delta Y/Y$ That is, $\eta_y = \Delta Q/ Q \ . Y/ \Delta Y$ Or $\eta_y = \Delta Q/ \Delta Y \ . Y/Q$

For the most commodities, increase in income leads to increase in quantity demanded. Therefore, income elasticity is positive. If the resulting percentage change in quantity demanded is larger than the percentage change in income, income elasticity will exceed unity ($\eta_y>1$). Then the commodity's demand is said to be income elastic. If the percentage change in quantity demanded is smaller than the percentage change in income, income elasticity will be less than unity ($\eta_y<1$). Then the commodity's demand is said to be income inelastic. If the percentage changes in income and quantity demanded are equal, income elasticity will be unity ($\eta_y=1$). The commodity's demand is said to have unitary income elasticity of demand. Unitary income elasticity represents a useful dividing line.

There is also a relationship between income elasticity for a commodity and proportion of income spent on it. If the proportion of income spend on the commodity increases as income increases, then the income elasticity of demand for the commodity is greater than unity ($\eta_y>1$). If the proportion of income spend on the commodity decreases as income rises, then the income elasticity of demand for the commodity is less than unity ($\eta_y<1$). At the same time, if the proportion of income

spend on the commodity remains the same as income rises, then the income elasticity of demand for the commodity is equal to unity (η_y=1).

If the commodity is normal, a rise in income causes more of it to be consumed. Other things being equal, this means a rightward shift in the commodity's demand curve. Thus, income elasticity will be positive for normal commodities. In the case of such commodities, an increase in income leads to an increase in quantity demanded. On the other hand, if the commodity is inferior, a rise in income causes less of it to be demanded. This implies a leftward shift in the commodity's demand curve. Thus income elasticity for inferior commodities will be negative. In the case of inferior commodities increase in income will lead to fall in quantity demanded. The boundary case between normal and inferior commodities occurs when a rise income leaves quantity demanded unchanged so that income elasticity is zero. Zero income elasticity implies that quantity demanded of the commodity is quite unresponsive to changes in income. Zero income elasticity is significant because it represents a dividing line between positive income elasticity on one side and negative income elasticity on the other.

A normal commodity can be further classified as necessities and luxury using income elasticity. A commodity is considered as necessity if the income elasticity is less than unity. That is, in the case of necessities, the proportion of income spends on it falls as income rises. A commodity is considered to be luxury if its income elasticity is greater than unity. The proportion of consumer's income spends on luxuries rises as his income increases.

It should be said that, sometimes, the same commodity can be regarded as a luxury by some individuals or at some income levels and as a necessity or even as inferior commodity by other individuals or at other income levels.

Cross Elasticity of Demand

The responsiveness of quantity demanded of one commodity to changes in the prices of other commodities if often of considerable interest. The responsiveness or sensitiveness of quantity demanded of one commodity to the changes in the price of another commodity is called cross elasticity of demand. Thus, cross elasticity of demand can be defined as percentage or proportionate change in quantity demanded of commodity X resulting from a proportionate change in the price of commodity Y. the cross elasticity of commodity X with respect to the price of Y (η_{XY}) can presented as

η_{XY} = Percentage change in quantity demanded of X

Percentage change in price of Y

We may symbolically write the formula for the cross elasticity of demand as:

$\eta_{XY} = \Delta Q_X/Q_X \,/\, \Delta P_Y/P_Y$; That is, $\eta_{XY} = \Delta Q_X / Q_X \,.\, P_Y / \Delta P_Y$

Or

$$\eta_{XY} = \Delta Q_X / \Delta P_Y \,.\, P_Y / Q_X$$

Where ΔQ_X is the change in quantity demanded of X, ΔP_Y is the change in price of Y, P_Y is the original price of Y and Q_X is the original quantity of X. The coefficient of cross elasticity can vary from minus infinity to plus infinity. Substitute goods have positive cross elasticity and complementary goods have negative cross elasticity.

If η_{XY} is positive, the commodities X and Y are said to be substitutes. X and Y are substitutes if more of X is purchased when price of Y goes up. That is, an increase in P_Y leads to an increase in Q_X as X is substituted for Y in consumption. For example, consumers usually purchase more coffee when price of tea rises. Thus coffee and tea are substitutes or competing goods. In response to the rise in the price of one good, the demand for the other good rises.

On the other hand, if η_{XY} is negative, X and Y are said to be complementary goods. When X and Y are complementary goods, less of X will be purchased when the price of Y goes up. That is, an increase in P_Y leads to a reduction in Q_X (and Q_Y). For example consumers usually purchase fewer scooters when the price of petrol goes up. Thus scoter and petrol are complements. Other examples of commodities that are complements are bread and butter, tea and sugar and so on. In the case of complements, a rise in the price of one good brings about a decrease in demand for the other, as they are consumed together. If η_{XY} is zero, X and Y are independent commodities. A change in price of Y has no effect on the quantity demanded of X. this may be the case with cars and pencils, telephones and chewing gum and so on.

It should be noted that the value of η_{XY} is not equal to the value of η_{YX} since the responsiveness of Q_X to the change in P_Y need not be equal to the responsiveness of Q_Y to the change in P_X. For example, a change in the price of tea is likely to have a greater effect on the quantity of sugar (a complement of tea) demanded than the other way around, since tea is more important of the two in terms of total expenditure.

The concept of cross elasticity of demand is very significant in economic theory. The classification of commodities into substitutes and complementary is in terms of cross elasticity of demand. Again, a high positive cross elasticity of demand is often used to define an industry since it indicates that various commodities are similar. Besides we can also classify different market structures on the basis of cross elasticity of demand.

Demand Forecasting.

Accurate demand forecasting is essential for a firm to enable it to produce the required quantities at the right time and to arrange well in advance for the various factors of production. Forecasting helps the firm to assess the probable demand for its products and plan its production accordingly.

Demand Forecasting refers to an estimate of future demand for the product. It is an "objective assessment of the future course of demand". It is essential to distinguish between forecast of demand and forecast of sales. Sales forecast is important for estimating revenue,

cash requirements and expenses. Demand forecast relate to production inventory control, timing, reliability of forecast etc...

Types of Demand Forecasting.

Based on the time span and planning requirements of business firms, demand forecasting can be classified into short term demand forecasting and long term demand forecasting.

Short term Demand forecasting: Short term Demand forecasting is limited to short periods, usually for one year. Important purposes of Short term Demand forecasting are given below;

Making a suitable production policy to avoid over production or underproduction.

1. Helping the firm to reduce the cost of purchasing raw materials and to control inventory.
2. Deciding suitable price policy so as to avoid an increase when the demand is low.
3. Setting correct sales target on the basis of future demand and establishment control. A high target may discourage salesmen.
4. Forecasting short term financial requirements for planned production.
5. Evolving a suitable advertising and promotion programme.

Long term Demand Forecasting: this forecasting is meant for long period. The important purpose of long term forecasting is given below;

1. Planning of a new unit or expansion of existing on them basis of analysis of long term potential of the product demand.
2. Planning long term financial requirements on the basis of long term sales forecasting.
3. Planning of manpower requirements can be made on the basis of long term sales forecast.

4. To forecast future problems of material supply and energy crisis.

Demand forecasting is a vital tool for marketing management. It is also helpful in decision making and forward planning. It enables the firm to produce right quantities at right time and arrange well in advance for the factors of production.

Methods of Demand Forecasting (Established Products)

Several methods are employed for forecasting demand. All these methods can be grouped into survey method and statistical method.

Survey Method.

Under this method, information about the desire of the consumers and opinions of experts are collected by interviewing them. This can be divided into four types;

1. Opinion Survey method: This method is also known as Sales- Force –Composite method or collective opinion method. Under this method, the company asks its salesmen to submit estimate for future sales in their respective territories. This method is more useful and appropriate because the salesmen are more knowledgeable about their territory.

2. Expert Opinion: Apart from salesmen and consumers, distributors or outside experts may also be used for forecast. Firms in advanced countries like USA, UK etc...make use of outside experts for estimating future demand. Various public and private agencies sell periodic forecast of short or long term business conditions.

3. Delphi Method: it is a sophisticated statistical method to arrive at a consensus. Under this method, a panel is selected to give suggestions to solve the problems in hand. Both internal and external experts can be the members of the panel. Panel members are kept apart from each other and express their views in an anonymous manner.

4. Consumer Interview method: under this method a list of potential buyers would be drawn and each buyer will be approached and asked about their buying plans. This method is ideal and it gives firsthand information, but it is costly and difficult to conduct. This may be undertaken in three ways:

A) Complete Enumeration – in this method, all the consumers of the product are interviewed.

B) Sample survey - in this method, a sample of consumers is selected for interview. Sample may be random sampling or Stratified sampling.

C) End-use method – the demand for the product from different sectors such as industries, consumers, export and import are found out.

Statistical Methods

It is used for long term forecasting. In this method, statistical and mathematical techniques are used to forecast demand. This method is relies on past data. This includes;

1. Trent projection method: under this method, demand is estimated on the basis of analysis of past data. This method makes use of time series (data over a period of time). Here we try to ascertain the trend in the time series. Trend in the time series can be estimated by using least square method or free hand method or moving average method or semi-average method.

2. Regression and Correlation: these methods combine economic theory and statistical techniques of estimation. in this method, the relationship between dependant variables(sales) and independent variables(price of related goods,income,advertisement etc..) is ascertained. This method is also called the economic model building.

3. Extrapolation: in this method the future demand can be extrapolated by applying binomial expansion method. This is based on the assumption that the rate of change in demand in the past has been uniform.

4. Simultaneous equation method: this means the development of a complete economic model which will explain the behavior of all variables which the company can control.

5. Barometric techniques: under this, present events are used to predict directions of change in the future. This is done with the help of statistical and economic indicators like:

   Construction

   contract,

   Personal

   income

   Agricultural

   income

   Employmen

   t

   GNP

   Industrial production

   Bank deposit etc…

Factors Affecting Demand Forecasting.

The following are the important factors governing demand forecasting:

1. Prevailing Business conditions (price level change, percapita income, consumption pattern, saving, investments, employment etc..,
2. Condition within the Industry (Price –product-competition policy of firms within the industry).
3. Condition within the firm. (Plant capacity, quality, important policies of the firm).
4. Factors affecting Export trade (EXIM control, EXIM policy, terms of export, export finance etc..,)
5. Market behavior
6. Sociological Conditions (Population details, age group, family lifecycle, education, family income, social awareness etc...)
7. Psychological Conditions (taste, habit, attitude, perception, culture, religion etc…)
8. Competitive Condition (competitive condition within the industry)

Nature of Supply

Supply refers to the various quantities of a good or service that sellers will be able to offer for sale at various prices during a period of time. It shows how price of a good or service is related to the quantity which the sellers are willing and able to make available in the market. As in the case of demand, supply refers not to a specific quantity that will be sold at some particular price, but to a series of quantities and a range of associated prices. Supply is a desired flow. That is, it shows how much firms are willing to sell per period of time, not how much they actually sell.

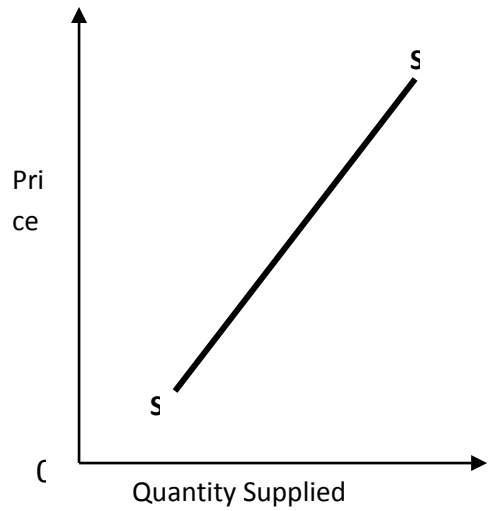
Law of Supply

The functional relationship between price and quantity supplied is called the law of supply. According to the law of supply, as the price of the commodity falls, the quantity supplied decreases or alternatively, as the price of the commodity rises the quantity supplied increases, other things being equal. Therefore, there is a direct relationship between of the commodity and quantity supplied.

The law of supply can be illustrated through a supply schedule and supply curve. Supply schedule is a table that shows various quantities of a good or service that sellers are willing and able to offer for sale at various possible prices during some specified period. A supply schedule is presented below

Price	Quantity Supplied
5	40
10	60
15	80
20	100
25	120

Supply schedule shows that as price rises, a greater quantity is offered for sale. By plotting the information contained in the supply schedule on a graph we can derive the supply curve as shown below.



The supply curve is a graph showing various quantities of a good or service that sellers are willing and able to offer for sale at various possible prices. The supply curve

slopes upwards because of the direct relationship between price and quantity supplied. Note that the entire supply curve represents supply while a point on the supply curve represents quantity supplied at some specific price.

Why there is a direct relationship between price and quantity supplied? The main reason is that higher prices serve as an incentive for sellers to offer greater quantity for sale. The sellers or producers can be induced to produce and offer a greater quantity for sale by higher prices. It is assumed that sellers or producers aim to maximise profit from the production and sale of the commodity. The higher the prices of the commodity, other things being equal, the greater the potential gain producers can expect from producing and supplying it in the market. Moreover, increases in price may invite new suppliers in the market.

Determinants of Supply

The quantity of a good or service that sellers are willing and able to offer for sale depends on the price of good or service. The non-price factors such as prices of related products, input prices, technology, expectations and number of producers in the market are likely to affect supply. Let us analyse each of them.

(1) Prices of related products

Goods can be substitutes or complements in production. Goods are substitutes in production if they are produced as alternatives to each other. Example: rice and vegetables (as farmer can produce one or the other on the same piece of land). Goods are complements in production if they are produced together; the production of one good implies the production of the other. Complements in production are also called ‘joint products’. Example sugar and molasses, beef and hides. In general, if the price of a substitutable product increases, sellers will tend to reduce the supply of the substitute in question. At the same time, if the price of a complement in production falls, the supply of the good in question will also falls.

(2) Prices of inputs

An increase in the production cost will results in a reduction in the supply of the product. Payments for factor inputs represent a significant part of production cost. The higher the

prices of these inputs, the greater the cost of production will be and the supply will be less. On the other hand, a reduction in input prices will cause an increase in supply.

(3) Technology

Overtime, knowledge and production technologies change and it will affect the supply of the product. A technological change that decreases cost will increase profits earned at any given price. Since increased profitability leads to increased production, it will cause an increase in supply.

(4) Expectations

If producers expect prices to rise in the future, now they might begin to expand their productive capacity and thus increase their present output levels. However, it is also possible that expectations of higher future prices may lead producers into building up stocks now so that they will have larger quantity to sell at future higher prices. Such action will reduce current supply. Therefore, generalisation should not be made about the effects of expected price changes on supply.

(5) Number of Producers: Obviously, the number of sellers in the market will have some effect on the total market supply. This is so because the market supply of a good or service is the sum of the quantities offered for sale by all individual sellers in the market. We can expect market supply to increase as number of sellers' increases and to decrease as number of sellers' decreases.

Supply Function

Like demand, supply also depends on many things. In general, quantity supplied of a product is expected to depend on own price, prices of related products, prices of inputs, state of technology, expectations, number of producers (sellers) in the market etc. This list can be summarised in a supply function

$Q_X^S = f(P_x, P_r, P_i, T, E, N)$

Where.,

Q_X^S = Quantity supplied of commodity x

P_x= Price of the commodity x

P_r= Prices of related products

P_i = Prices of inputs

T = State of technology

E = Expectations

N = Number of producers in the market

For a simple theory of price, we need to know how quantity supplied varies with the product's own price, all other things being held constant. Thus we can write the supply function as

$$Q_X^S = f(P_x)$$

That is, quantity supplied of commodity x is a function of its own price, other determinants are assumed to remain constant.

Elasticity of Supply

The concept of elasticity of supply closely parallels that of elasticity of demand. Though quantity supplied is influenced by a number of factors, we will focus on the commodity's own price as a factor influencing supply. That is, we will be concerned with price elasticity of supply.

Price elasticity of supply measures the responsiveness or sensitiveness of quantity supplied of a commodity to a change in its price. It is given by the percentage change in the quantity supplied of a commodity divided by the percentage change in price. Letting ε (Greek letter epsilon) stand for the coefficient of price elasticity of supply, we have,

$$\varepsilon = \frac{\text{percentage change in quantity supplied}}{\text{Percentage change in price}}$$

Being expressed in terms of relative or percentage changes, the price elasticity of supply is a pure number. That is, it has no units attached to it. The value of price elasticity of

supply does not change when the units of measurement are changed. This allows meaningful comparisons in the price elasticity of supply of different commodities.

Using the point elasticity formula

$$\varepsilon = \frac{\Delta Q/Q}{\Delta P/P}$$

That is,

$$\varepsilon = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Where ΔQ represents change in the quantity supplied and ΔP represents change in price. Since quantity supplied and price move in the same direction, supply curves normally have positive slope. Therefore, supply elasticity is normally positive. It will be anything between zero and infinity ($0 \leq \varepsilon \leq \infty$).

Point elasticity of supply measures elasticity at a particular point on the supply curve. More frequently, we measure elasticity of supply by using arc elasticity formula between two points on the supply curve. Arc elasticity of supply measures the average of two prices and the average of two quantities. Letting P_1 refer to the lower of the two prices and Q_1 being quantity and P_2 to the higher of the two prices and Q_2 the corresponding quantity, we can measure arc elasticity of supply by

$$\varepsilon = \frac{\Delta Q}{\Delta P} \cdot \frac{(P1 + P2)/2}{(Q1+Q2)/2}$$

Or

$$\varepsilon = \frac{\Delta Q}{\Delta P} \cdot \frac{(P1 + P2)}{(Q1+Q2)}$$

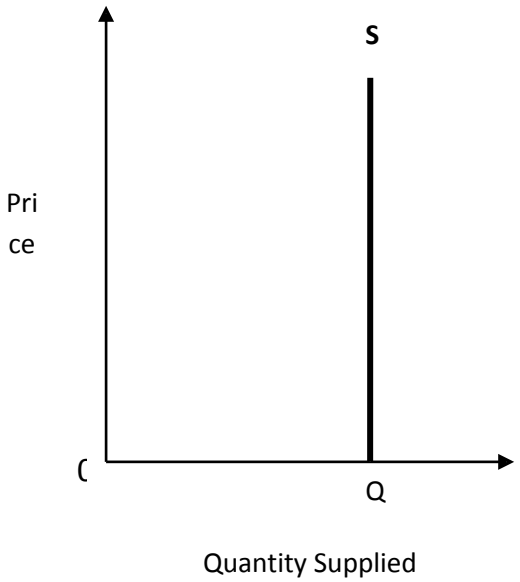
Degrees of Supply Elasticity

When the supply curve is upward sloping, the elasticity of supply will be anything between zero and infinity. On the basis of the value of the coefficient of elasticity of supply

we can classify it into the following five categories: (i) Perfectly inelastic supply, (ii) Inelastic supply, (iii) Unitary elastic supply , (iv) Elastic supply, (v) Perfectly elastic supply. Let us each one of them in detail.

(1) **Perfectly Inelastic Supply**

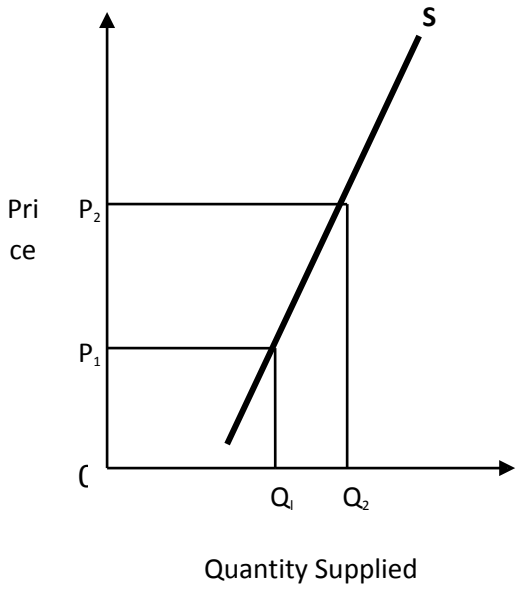
When the quantity supplied of a commodity does not change at all in response to the change in price, elasticity of supply is said to be perfectly inelastic. This is the case of zero elasticity (ε = o) and the supply curve will be vertical straight line, as shown below.



The supply curve has zero elasticity since the same quantity Q is supplied whatever the price.

(2) **Inelastic Supply**

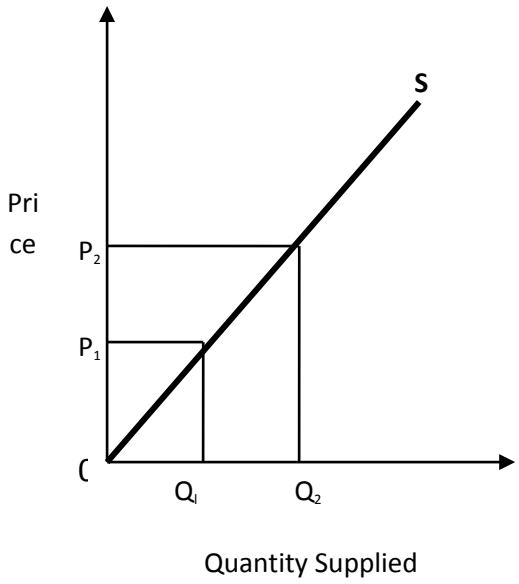
If the percentage change in quantity supplied is smaller than the percentage change in price, supply is said to be inelastic. The value of the coefficient of supply will be greater than zero but less than unity ($0<\varepsilon<1$). If a linear supply curve crosses or cuts the horizontal (quantity) axis, supply is inelastic, as shown below.



A change in price from P_1 to P_2 causes less than proportional change in quantity supplied from Q_1 to Q_2.

(3) Unitary Elastic Supply

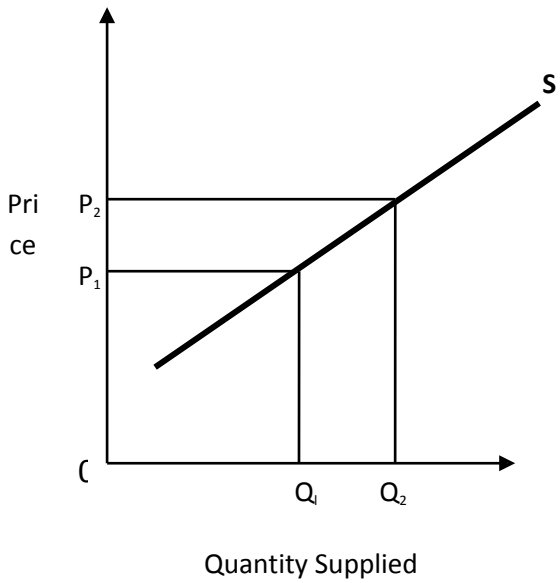
If the percentage change in quantity supplied is equal to percentage change in price, supply is said to be unitary elastic. The value of coefficient of elasticity will be equal to one ($\varepsilon = 1$) when supply is unitary elastic. If linear supply curve passes through the origin, supply is unitary elastic regardless of its scope. This is illustrated below.



The figure shows that any straight line has a unitary elasticity indicating that the percentage change in quantity equals the percentage change in price between any two points on the curve.

(4) Elastic Supply

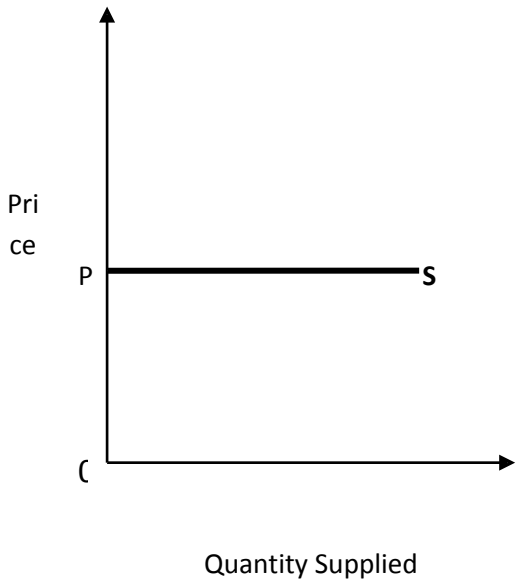
If the percentage change in quantity supplied is greater than percentage change in price, supply is said to be elastic. The value of the coefficient of elasticity will be greater than unity ($1<\varepsilon$) when the supply is elastic. A linear supply curve indicates an elastic supply if it cuts the vertical (price) axis.



An increase in price from P_1 to P_2 causes more than proportionate increase in quantity supplied from Q_1 to Q_2.

(5) Perfectly Elastic Supply

At any given price infinite quantity is supplied, supply is said to be perfectly elastic. The coefficient of elasticity will be infinity ($\varepsilon=\infty$) when supply is perfectly elastic. Perfectly elastic supply curve is depicted by a horizontal supply curve parallel to quantity axis.



The supply curve has infinite elasticity at price OP. Nothing at all will be supplied at price below OP, while an infinitely large quantity will be supplied at price OP.

Determinants of Elasticity of Supply

The following are important factors that affect elasticity of supply

(1) Time

The time period under consideration has a significant effect on the price elasticity of supply. If the time period is very short, an increase in price does not significantly affect the quantity offered for sale. If a certain quantity of a commodity has already been produced and brought to the market, an increase in price does not cause a large quantity to be offered for sale, because the quantity is fixed. As the time period under consideration becomes longer, supply tends to become more elastic. Sellers will be able to respond more easily to changes in the prices of their products.

(2) Change in cost of Production

Elasticity of supply of a commodity depends upon the ease with which increases in output can be obtained without bringing about a rise in cost of production. It also depends on how easily producers can shift from the production of other products to the one whose price has risen. For example, if agricultural land and labor can be readily shifted from one crop to another, the supply of any one crop will be more elastic than if labor cannot be shifted.

(3) Storage Cost

The elasticity of supply for goods that are not perishable and can be stored at relatively low cost tends to be greater than that for perishables and goods with high storage cost. If price of item that can be stored cheaply falls, sellers may respond by withdrawing the items from the market and storing it. If the price of such an item rises, suppliers may be in a position to release some extra quantities from storage onto the market. These options may not be feasible in the face of high cost of storage.

(4) Responsiveness of Producers

The elasticity of supply for a product depends on the responsiveness of producers to change in price. If producers do not respond positively to the increases in prices, the quantity supplied of the product would not increase as a result of rise in its price. A producer is said to be rational if he raises the supply following the rise in price to maximize his profit. However, producers do not always exhibit profit maximizing behavoiur and as r result do not raise the supply in response to the rise in price.

(5) Production substitutes and complements

If a product has large number of substitutes in production, its supply is likely to be elastic. If the price of such a product falls, producers can shift resources into the production of any of the many substitutes. On the other hand, production complements are goods that are produced together. These are joint products. The supply of relatively minor joint product is likely to be inelastic.

Uses of Elasticity

Knowledge of elasticity of demand is very useful and often necessary in reaching correct decisions in business and government. The following are the important uses and applications of elasticity of demand.

(1) Pricing Decisions of Business Firms

The business firms must take into account the elasticity of demand when they take decisions regarding pricing of products. This is because change in price of a product will bring about change in quantity demanded depends upon the coefficient of elasticity. If the demand for the product of the firm happens to be elastic, then any attempt on the part of the firm to raise the price will bring about a fall in total revenue. Thus instead of gaining from the increase in price, it will lose substantial part of its revenue. On the other hand, if the demand for the product happens to be inelastic, then increases in price will lead to increase in total revenue. Thus, for fixing an optimum or profit maximizing price, the firm cannot ignore the elasticity of demand for the product.

(2) Government Tax Policy

The elasticity of demand is also significant in the field of tax policy by the government. Government must take into account the elasticity of demand for the product before imposing and/or tax on it. This is because it is only when tax is imposed on the commodity with price inelastic demand, which will raise a great deal of revenue of the government. At the same time, if the demand for the commodity is price elastic, a rise in price caused by tax will bring about large decline in quantity demanded and as a result government revenue will also decline

(3) Importance in international trade

The concept of elasticity of demand is also important in the field of international economics. The decisions of country's to undertake devaluation of their currencies or not to the improve balance of payment depends upon the coefficient of elasticity of exports. As a result of devaluation, price of imports will increase and price of exports will fall. If the world demand for country's exports is inelastic, the fall in the prices of exports as a result of devaluation will lower their export earnings rather than increasing it. On the other hand, if the world demand for country's exports is elastic, then the fall in the prices of exports due to devaluation will bring about large increase in their quantity demanded which increase export earnings and will improve balance of payment position of the country.

Market Equilibrium

The market equilibrium occurs when the prevailing price equates quantity demanded to quantity supplied. It refers to the price-quantity pair at which this takes place. Consumers bring demand to the market for buying goods to satisfy their wants. Producers or sellers bring

supply of their goods to the market to sell them and earn profit. The market demand and supply determine prices of goods and services exchanged between buyers and sellers. Thus, market equilibrium is reached when market demand for and market supply of a good are equal and as a result, equilibrium prices and equilibrium quantities are determined. At such equilibrium, buyers find that they are able to buy exactly the same amount that they are demanding at the prevailing price and sellers are able to sell exactly the amount they are willing to supply at the prevailing price. In other words, there is no incentive for anyone in the market to change their behaviour. Thus equilibrium is the condition, which once achieved tends persist in time.

By bringing together the market demand and supply schedules we can see how market forces determine equilibrium price and quantity of the good. The following table presents a hypothetical demand and supply schedules of commodity X.

Price of commodity X (P_X in Rupees)	Quantity Supplied (Q_X^S)	Quantity Demanded (Q_X^D)	Surplus (+) Shortage(-)	Pressure on Price
5	140	20	120	Downward
4	100	40	60	Downward
3	60	60	0	Equilibrium
2	40	80	-40	Upward
1	20	100	-80	Upward

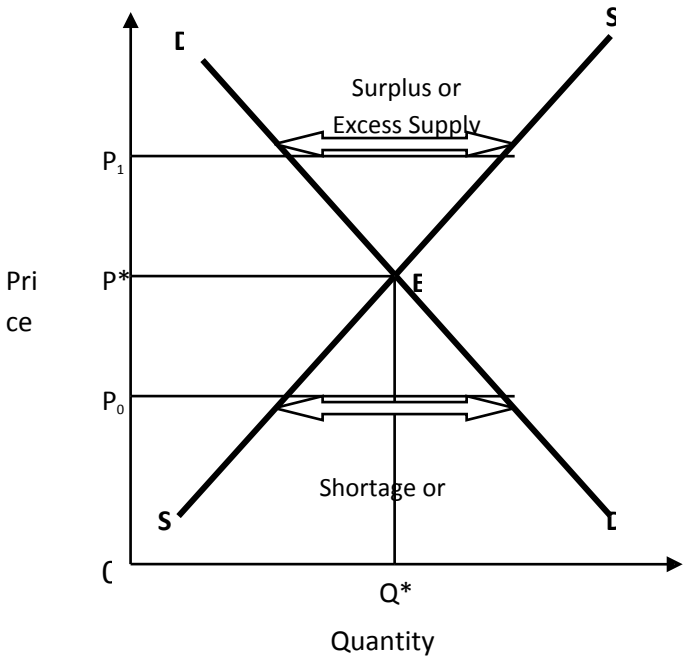
When the price of commodity X is Rs 1, buyers are willing and able to purchase 100 units but sellers are willing and able to offer only 20 units for sale. Therefore, there is a shortage of 80 units. At price of Rs 5, buyers are willing and able to purchase only 20 units while sellers are willing to offer 140 units. Therefore, there will be a surplus of 120 units in the market. Let us now consider a price of Rs 3. At this price, buyers are willing to purchase 60 units and sellers are willing to offer 60 units for sale. That is, at this price, there is neither

a surplus nor a shortage. Quantity supplied of commodity is equal to the quantity supplied. Thus P_X = Rs 3 is the equilibrium price and $Q_X^S = Q_X^D$ =6o is the equilibrium quantity.

At any other price other than the equilibrium price of Rs = 3, market forces are set in motion to raise or lower the price. At the prices above the equilibrium price, the quantity supplied exceeds the quantity demanded. For example, at P_X = Rs 4, sellers are willing to put 100 units of commodity X on the market but buyers are willing to take only 40 units. There will be surplus or excess quantity supplied of the commodity. Then the sellers will attempt to dispose this surplus by lowering the price. As price falls, a greater quantity will be demanded. At lower prices sellers supply smaller quantities and buyers demand larger quantities until the equilibrium price of Rs 3 is reached, at which the quantity supplied of 60 units of commodity X equals the quantity demanded and market clears.

On the other hand, at prices below the equilibrium price, the quantity supplied fall short of quantity demanded. For example, at P_X = Rs 2, buyers are willing to purchase 80 units but sellers will be able to offer only 40 units. There is a shortage or excess quantity demanded. Unhappy with the shortage, and wanting more commodity X, buyers will bid up the price to induce sellers to supply them the desired amount. Then the sellers offer a greater quantity at higher prices. The price will again settle at P_X = Rs 3, because at this price, the quantity demanded equals quantity supplied. Note that, price of Rs 3 is the only price that will prevail in the market. There will be no tendency of this price to change. Such a price is referred to as equilibrium price and quantity traded or exchanged at this price is called equilibrium quantity. The market for the product is said to be in equilibrium when the quantity demanded equals the quantity supplied at a specific price.

The determination of equilibrium price and quantity can also be shown graphically by bringing together the market demand and market supply curve on the same graph, as shown below.



The intersection of market demand curve DD and market supply curve SS at point E defines the equilibrium price P* and the equilibrium quantity Q*. At the equilibrium price, quantity demanded is equal to the quantity supplied. Because there is no excess demand or excess supply there is no pressure for the price to change further.

As said above, the equilibrium between demand and supply is not reached at once. There is the process of changes and adjustments which ultimately results in equilibrium price and quantity. Suppose that price is above the equilibrium level, say at P_1. At such higher price, there is excess supply or surplus of the commodity. Then the sellers would begin to lower prices in order to sell their excess suppliers. This surplus is eliminated as prices fall, quantity demanded increases and quantity supplied would decrease until the equilibrium price P* is reached, at which quantity demanded = quantity supplied. The opposite will happen if the price is below the equilibrium price, say at P_0. There will be excess demand or shortage. Consumers are unable to purchase the entire commodity they want at below-equilibrium prices and they bid up the price. This would put upward pressure on price and quantity supplied increases and until price eventually reach the equilibrium price P*, and the market clears.

Thus, through the process of adjustment in price and quantity, eventually equilibrium price and quantity are determined at which quantity demanded and supplied are equal. As long as demand and supply do not change, the equilibrium point remains the same. But in

should be noted that, at a particular point in time, the observed market price may or may not be the equilibrium price. All we know is that market forces always push the market price towards the equilibrium price when they are not equal. We can also assume that, in the absence of price controls, the market price is the equilibrium price.

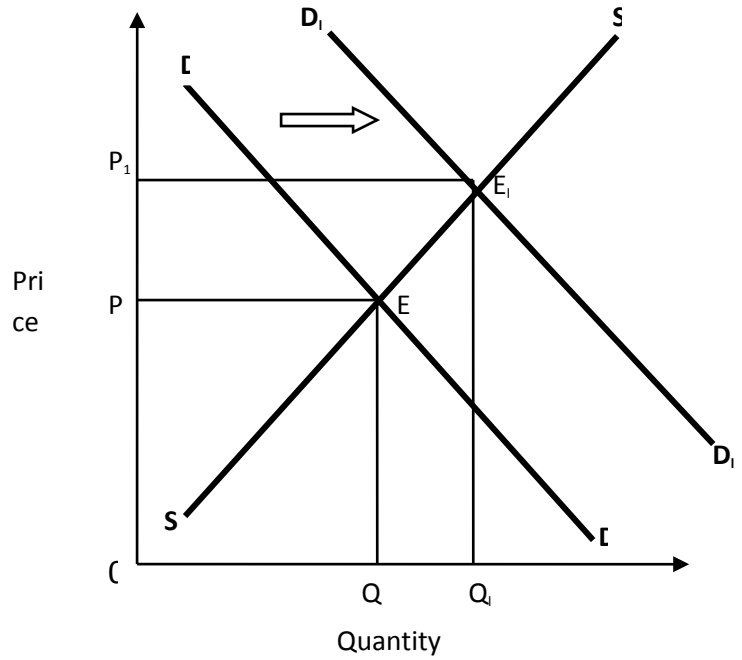
Changes in Market Equilibrium: Comparative Static Analysis:

Changes in either demand or supply cause changes in market equilibrium. Several forces bringing about changes in demand and supply are constantly working which will affect the equilibrium price and quantity of the commodity. Increase or decrease in demand, supply being the unchanged will change the market equilibrium. Similarly, increase or decrease in supply, the demand being unchanged would also affect the equilibrium price and quantity. Both demand and supply of goods may change simultaneously causing a change in market equilibrium. In order to study the shifts in demand and supply curve affect the equilibrium, we use the method known as "comparative statics". That is, we start from a position of equilibrium and then introduce the changes to be studied. The new equilibrium position is determined and compared with the original equilibrium position. The differences between the two equilibriums must result from the change that was to be introduced.

Adjustments to changes in demand

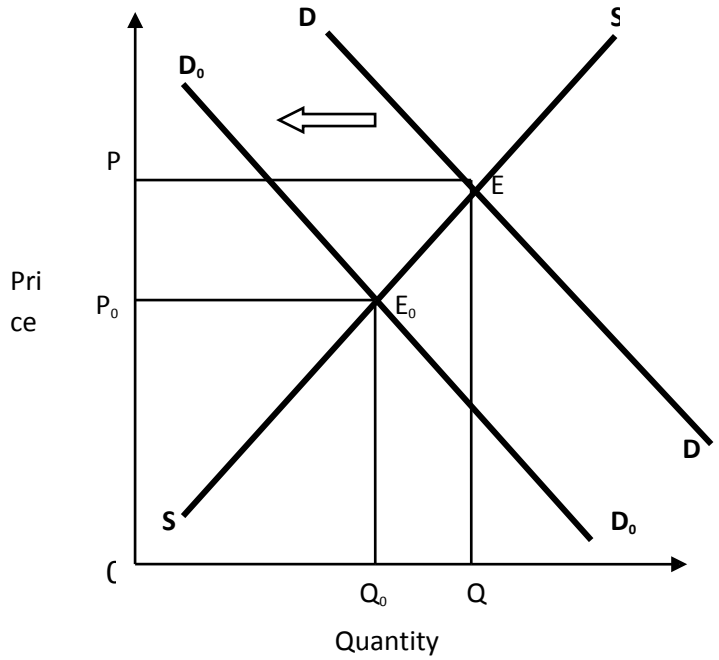
We have seen that the market demand curve of a commodity shifts as a result of a change in consumer's income, their tastes and preferences, prices of related goods (that is, substitutes and complementary goods), the number of buyers in the market and as a result of change in the distribution of income. Given the market supply curve of a commodity, an increase or decrease in demand will cause change in market equilibrium.

Let us begin with the increase in demand. As a result of change in the non-price determinants of demand, demand curve shifts upwards to the right, an increase in demand is said to have occurred. An increase in demand, resulting from for example, an increase in income of the consumer, will cause an increase in both the equilibrium price and quantity bought and sold, as shown below.



DD and SS is the original market demand and supply curve. Both curves intersect at point E and equilibrium price is OP and equilibrium quantity of OQ. As a result of an increase in demand, the entire demand curve shift to the right to the new position $D_1 D_1$, while supply curve remaining the same. It can be seen that, at old price OP, there is shortage or excess demand. This will put upward pressure on the price and it rises to OP_1, where quantity demanded equals quantity supplied and new market equilibrium is attained at E^1. thus as result of an increase in demand we could expect that the buyers pay higher price (OP_1) and sellers produce a greater quantity (OQ_1) than before the change.

Now let us examine the case with the decrease in demand. As said above, a decrease in demand means entire demand curve shifts to a lower position to the left due to factors such as fall in income of the consumer, fall in the price of substitutes etc. A decrease in demand for the product causes a decrease in both equilibrium price and equilibrium quantity bought and sold as shown below.



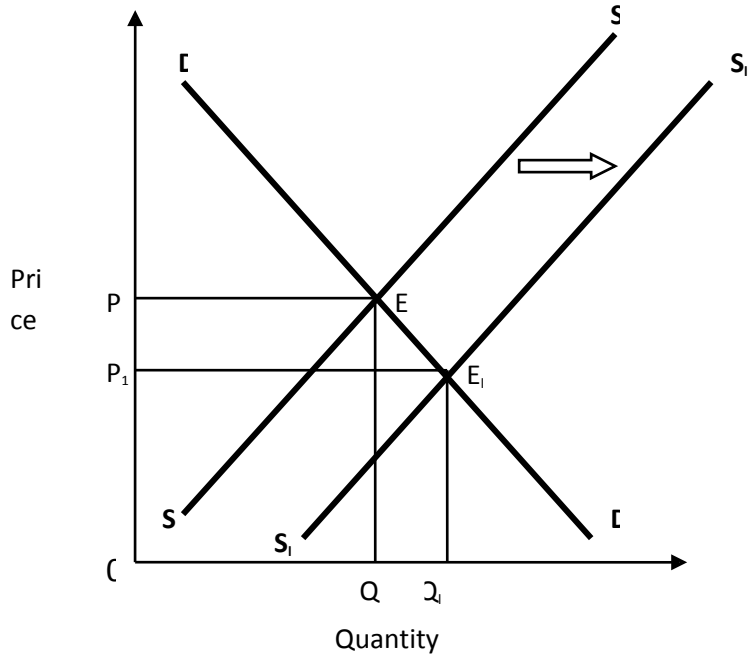
The intersection of original market demand curve DD and supply curve SS defines the equilibrium price OP and equilibrium quantity OQ. As a result of decrease in demand, demand curve shifts to the left to take the new position D_oD_o while the supply curve remaining the same. Both curves intersect at point E_o and equilibrium price is OP_o and equilibrium quantity is OQ_o. Both equilibrium price and quantity are lower than the initial equilibrium position. This is due to the fact that, when there is a decrease in demand and supply remaining the same, there will be a surplus or excess supply. This would put a downward pressure on the price until the surplus is eliminated from the market.

Adjustments to changes in supply

Now let us analyse the impact of changes in supply on the equilibrium price and quantity of the commodity, the demand for the commodity remaining the same. We have seen that the market supply curve for a commodity shifts as a result of changes in the price of related commodities, input prices, technology, number of producers in the market, expectations etc. An increase in supply causes a rightward shift of the supply curve while decrease in supply causes a leftward shift of supply curve.

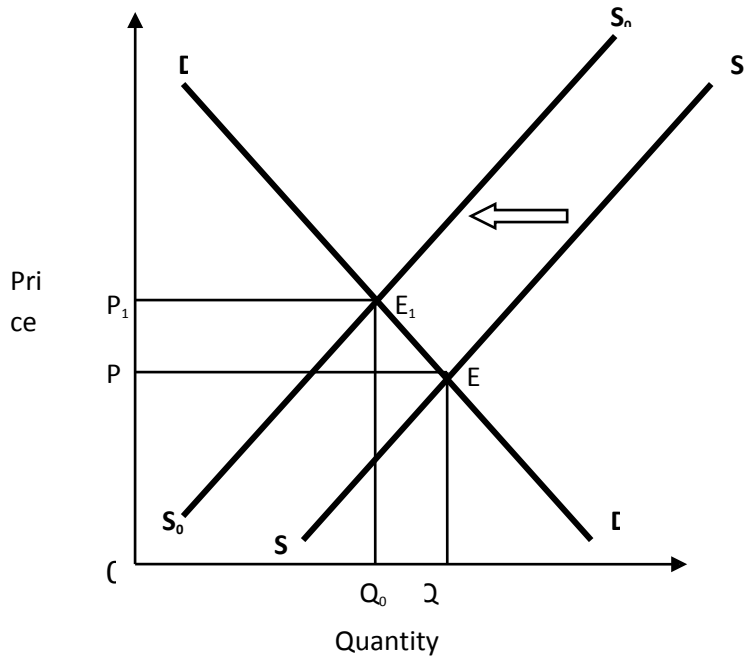
Let us first examine the case of increase in supply. An increase in supply implies producer's supply more of the commodity as a result of factors like decrease in the price of inputs, improvement in technology etc. An increase in the supply of the commodity, demand

being the same, causes a decrease in the equilibrium price and an increase in equilibrium quantity bought and sold, as shown below.



DD and SS is the original market demand and supply curve. Both intersects at point E and determine equilibrium price at OP and equilibrium quantity at OQ. Now as a result of decrease in price of inputs, for example, supply increases causing a rightward shift in supply curve to S_1S_1. When supply increases, demand being the same, there will be a temporary surplus or excess supply in the market. In order to get rid of their surplus, sellers reduce the prices and prices drops to OP_1, which is new equilibrium price defined by the intersection of new supply curve S_1S_1 and demand curve DD. As price falls quantity demanded increases and new equilibrium quantity is OQ_1. Thus, an increase in supply results in lower equilibrium price but larger equilibrium quantity.

Let us now analyse the effect of decrease in supply on the equilibrium price and quantity. A decrease in supply can occur due to factors like increase in the price of inputs used in the production, rise in the price of production substitutes, imposition of tax on the sales/production by the government etc. A decrease in the supply for the commodity, demand being the same causes an increase in the equilibrium price and decrease in the equilibrium quantity bought and sold. This is shown below.



DD and SS is the original demand and supply curve and OP is the equilibrium price and OQ is the equilibrium quantity. A decrease in supply, as a result of increase in price of inputs for example, is shown by the leftward shift in the supply curve. The new supply curve SoSo intersects the given demand curve DD at E_l. New equilibrium price is OP_l, which is higher than old price OP and new equilibrium quantity is OQ_l, lower than old quantity OQ. Thus, decrease in supply leads to the rise in price and fall in equilibrium quantity.

Algebraic Explanation to Market Equilibrium

Let us analyse demand, supply and market equilibrium by using elementary algebra. We have seen that demand function can be expressed as

$$Q_d = f(P, I, P_r, T, A, E) \text{ where,}$$

Q_d = quantity demanded

P= price of commodity

I = income of the individual consumer

P_r= price of related commodities

T = tastes and preferences of individual consumer

A = advertisement expenditure

E = expectations

Let us assume that income, prices of related commodities, tastes, advertisement and expectation are constant. The demand function now becomes a relation between price and quantity demanded and may be expressed as

$Q_d = f(P)$

If we assume that a linear relationship between price and quantity demanded, we can express the demand function as

$Q_d = a - bP$ …….. $(a>0, b>0)$

Where 'a' represents constant intercept term and value of 'a' shows the quantity demanded when price is zero. '–b' represents the slope of demand function, which is approximately negative since the demand curve is downward sloping (so that when price rises quantity demanded falls). For example, a demand function could take the form of an equation such as :

$Q_d = 100 - 2P$

Similarly supply function can be expressed as

$Q_S = f(P, P_r, P_i, T, E, N)$

Where ;

Q_s= quantity supplied of commodity

P= price of the commodity

P_r= prices of related products

P_i = prices of inputs

T = state of technology

E = expectations

N = number of producers in the market

If we assume that prices of related products, prices of inputs, technology, expectations and number of producers are constant, then the supply function can be expressed as

$Q_S = f(P)$

As in the case of demand function, let us assume a linear relationship between price and quantity supplied, we can express the supply function as

$Q_S = -c + dP$ ……(c >0, d>0)

Where –c is the constant intercept term so that supply curve crosses the price axis at a positive price. The term 'd' is the slope of the supply function. The positive slope means that the supply curve is upward sloping so that when price rises quantity supplied also rises. For example, a supply function could be of the form

$Q_S = -60 + 5P$

To determine equilibrium price and quantity, we must bring the demand and supply function together. The demand and supply function gives us two equations and three unknowns (namely Q_d Q_S and P). We know that, at equilibrium, quantity demanded of a commodity (Q_d) is equal to the quantity supplied (Q_S) so that there is neither a shortage nor a surplus in the market.

Hence,

$Q_d = Q_S$

This equation completes the model and allows us to obtain a unique solution. The complete model is:

$Q_d = a - bP$

$Q_S = -c + dP$

$Q_d = Q_S$

By solving the system of equations for P and Q we will obtain the market equilibrium price and quantity

Example 1:

Consider the following demand and supply equations

$Q_d = 50-4P$

$Q_S = -10 + 8P$

Since in equilibrium $Q_d = Q_S$,

We have

$50-4P = -10+ 8P$

$60 = 12P$

$P = 60/12 = 5$

By substituting P=5 in either the demand or supply equation we will get Q=30. Hence the equilibrium price is 5 and equilibrium quantity is 30.

Example 2:

Consider the following demand and supply equations

$Q_d = 80-10P$

$Q_S = -40 + 20P$

At equilibrium $Q_d = Q_S$,

So we have

$80-10P = -40+ 20P$

$120 = 30P$

$P = 120/30 = 4$

By substituting P=4 in either the demand or supply equation we will get Q=40. Hence the equilibrium price is 4 and equilibrium quantity is 40.

Example 3:

Consider the following demand and supply equations

$Q_d = 32-3P$

$Q_S = -12 + 8P$

Since in equilibrium $Q_d = Q_S$,

We have

$32-3P = -12+ 8P$

$44 = 11P$

$P = 44/11 = 4$

By substituting P=4 in either the demand or supply equation we will get Q=20. Hence the equilibrium price is 4 and equilibrium quantity is 20.

Module III

Theory of Consumer Behaviour

The Consumer Behaviour and Demand

The purpose of the theory of demand is to determine the various factors that affect demand. Demand is a multivariate relationship, that is, it is determined by many factors simultaneously. The traditional theory of demand has concentrated on four determinants, viz, Price of the commodity, prices of the related goods, income and tastes. The market demand is assumed to be the summation of the demands of individual consumers. Thus the traditional theory of demand starts with the examination of the behaviour of the consumer. The consumer is assumed to be rational. Given his income and the market prices of the various commodities, he plans spending of his income so as to attain the highest possible satisfaction or utility (This is the axiom of utility maximization). Further it is assumed that the consumer has full knowledge of all the information relevant to his decision, ie., he has complete knowledge of all the available commodities, their prices and his income.

Utility Analysis

The word utility denotes the want satisfying power of a commodity or service. An individual demands a particular commodity because of the satisfaction he could receive from consuming it. A commodity possesses utility if it satisfies an economic want. Goods may be poisonous or dangerous to one's health, but it possesses utility for those who want them. Utility is thus subjective and does not carry any ethical connotation.

Total and Marginal Utility

An individual demands a particular commodity because of the satisfaction or utility that can be received from consuming it. When the consumer buys a commodity, he receives them in units 1, 2, 3, 4, etc. when the unit increases, the utility he receives also increases. The sum total of utilities obtained by the consumer from different units of a commodity is the total utility. In the illustration that follows the total utility of 2 units is 18 (10 + 8) utils. It is 24 (10 + 8 + 6) utils from 3, 28 (10 + 8 + 6 + 4) from 4 etc.

Table 3.1: Total Utility and Marginal Utility

(1) Units of commodity X	(2) TU in Utils	(3) MU in Utils
0	0	--
1	10	10
2	18	8
3	24	6
4	28	4
5	30	2
6	30	0
7	28	−2

Marginal utility is the net addition to total utility resulting from one unit change in consumption or stock. It is the addition to total utility by having an additional unit of the commodity. In other words marginal utility of a commodity is the loss in utility if one unit less is consumed. When the consumer consumes the 3rd unit, the total utility becomes 24 utils. Thus the marginal utility of the 3rd unit is 6 utils (24−18). Algebraically, the marginal utility (MU) of n^{th} unit of a commodity is the total utility of n units minus the total utility of n−1units.

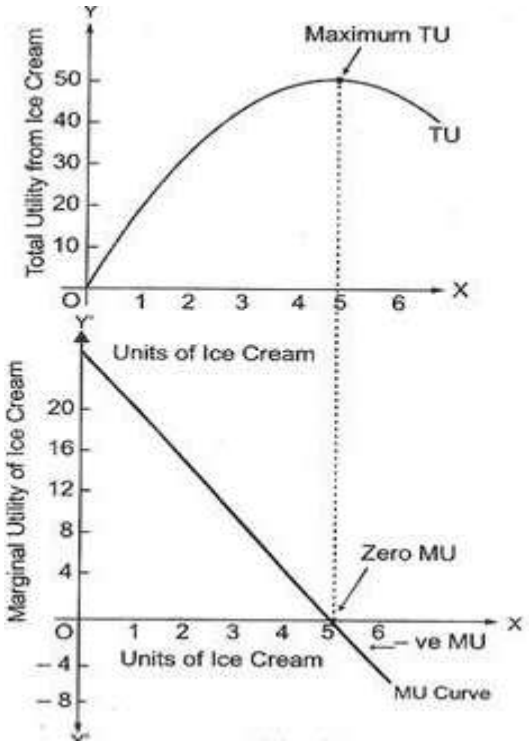
Thus

The relation between total and Marginal Utility is shown in the table -1. The first two columns of the table give an individual's hypothetical total utility (TU) schedule from consuming various alternative quantities of commodity X per unit of time. As shown in the table as the individual consumes more units of commodity X per unit of time, total utility increases. Column (1) and (3) of the table show the individual's marginal utility (MU) schedule for commodity X. The value in column (3) is obtained from column (2), ie., the difference between successive values. For example, if the individual's consumption of commodity X goes from zero units to 1 unit, the TU goes from zero utils to 10 utils. Then the marginal utility is 10 utils (MU_x =10 – 0). Similarly if the consumption of commodity rises from 1 unit to 2 units, total utility rises from 10 to 18, giving a marginal utility of 8 (18 – 10).

Up to a point, the more units of a commodity the individual consumes per unit of time, the greater are the total utility he receives. Though total utility increases, the extra or marginal utility received from consuming each additional unit of the commodity usually decreases. As

shown in the table, so long as total utility is increasing, marginal utility is decreasing up to the 5th unit. When total utility is maximum at the 6th unit, MU is zero. This is the saturation point. When consumption goes beyond this point, total utility decreases and marginal utility becomes negative (7th unit in the table). Such additional units give disutility or dissatisfaction to the consumer. So it is of no use having them. This relationship is shown in the figure: 3.1.

Figure 3.1



Cardinal and Ordinal Utility

In order to attain his objective of maximisation of utility, the consumer must be able to compare the utility of the various 'baskets of goods' which he can buy with his income. There are two basic approaches to the problem of comparison of utilities – the Cardinalist approach and the Ordinalist approach.

The cardinalist school postulated that utility can be measured. It means that an individual consumer attach specific values or number of utils from consuming each quantity of good or combination of goods. While some economist suggested the measurement of utility in monetary unit, others suggested its measurement in subjective units called utils. The

ordinalist school postulated that utility is not measurable, but is an ordinal magnitude. As per this notion, a consumer need not know in specific units the utility of various commodities to make his choice. While ordinal utility only ranks various consumption bundles, cardinal utility provides an actual index or measure of satisfaction.

Cardinal Utility Theory

The Marshallian utility analysis is based on cardinalism. The cardinal utility theory is based on certain assumptions.

1. The consumer is rational. He aims at the maximisation of his utility subject to his income constraint.
2. Cardinal Utility: The utility is a cardinal concept which assumes utility is measurable and additive.
3. Utility is measurable in terms of money.
4. Constant Marginal Utility of Money: this assumption is necessary if monetary unit is used as the measure of utility.
5. Diminishing Marginal Utility: The marginal utility of a commodity diminishes as the consumer acquires larger quantities of it. (Utility gained from successive units of a commodity diminishes).
6. Consumer has full knowledge of the availability of commodities and their technical qualities.
7. Consumer possesses perfect knowledge of the choices of commodities open to him.
8. Consumer knows the exact prices of various commodities, and their utilities are not influenced by variation in their prices
9. There are no close substitutes

The Law of Diminishing Marginal Utility (LDMU)

Cardinal utility analysis explains two basic laws of consumption.

1. Law of Diminishing Marginal Utility and

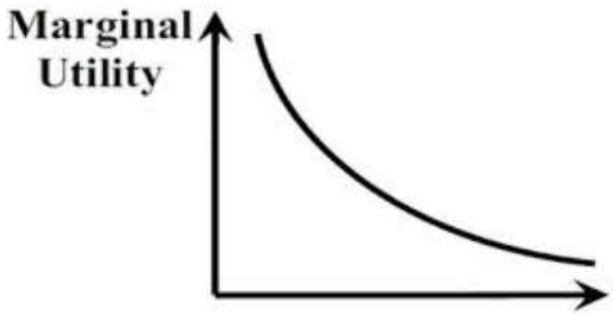
2. Law of Equi-Marginal Utility

The Law of Diminishing Marginal Utility

This is one of the laws related to consumer satisfaction and refers to common experience of every consumer. This law is known as Gossen's first law (due to Jevons).

Marshall states the law thus, "the additional benefit which a person derives from a given increase of his stock of a thing diminishes with every increase in stock that he already has". It means that, under certain conditions, the additional satisfaction which a person derives from successive units of a thing goes on diminishing. The additional satisfaction means the marginal utility. The basis of the law is underlined in the explanation of marginal utility concept whose diagram follows the pattern such as in figure: 3.2.

Figure: 3.2



The Law of Equi-Marginal Utility

The law of equi-marginal utility (Known as Gossen's second law, law of maximum satisfaction, law of substitution etc) is another important law of consumption. Marshall defined it as: "If a person has a thing which he can put to several uses, he will distribute it among these uses in such a way that it has the same marginal utility in all" This means that, in the process of utility maximization, consumer substitutes goods with higher utility for those with lesser utility. In doing this, he relates the price of various goods with their utility and equates the marginal utility –price ratio of various goods (Thus known as proportionality rule). In the case of two commodities, the proportionality rule sets the conditions of consumer's equilibrium as

In the actual market money is taken as a composite commodity. So the action of the consumer is to balance the marginal utility of a particular commodity with that of money. Thus the above condition will become.

Consumer's Equilibrium

Consumer will be in equilibrium when he attains a position of maximum satisfaction and would have no further incentive to make any change in his purchase.

Equilibrium with one commodity

The Law of Diminishing Marginal Utility tells us the position of a consumer's equilibrium in the case of a one commodity model. In such cases, consumer will go on buying successive units till the marginal utility of the commodity becomes equal to price. If price falls, he will buy more and MU will come down to the level of price. On the other hand, if price rises, the consumer will buy less and MU goes up to the level of price. Thus equilibrium is defined as the equality of price and marginal utility. Ie., $MU_x = P_x$ (It is to be noted that in the case of a free good, the consumer will be in equilibrium when MU is zero. (Since $P_x = 0$, equilibrium is at the point where $MU_x = 0$).

Two Commodity Model

In the case of a two commodity model, the consumer will be in equilibrium when he equalises the marginal utility-price ratio of two goods. ie., . In general, the equilibrium condition for 'n' commodity model, is or

Indifference Curve Analysis

The indifference curve analysis is one of the ordinalist approaches to demand analysis. It explains consumer behaviour in terms of his preferences or ranking for different combinations of two goods, say X and Y. An indifference curve is a graphic device for showing consumer's preferences. It is the locus of points of particular combinations of goods which yield the same utility to the consumer so that he is indifferent as to the particular combination he consumes. Thus, an indifference Curve represents various combinations of commodity X and Y that provide same level of satisfaction to the consumer.

The basic assumptions of the theory

1. Rationality: The consumer is assumed to be rational. He aims at the maximisation of his utility, given his income and market prices

2. Utility is ordinal: The consumer can rank his preferences according to the satisfaction of each basket. (only ordinal measurement is required for comparison purposes)

3. Diminishing Marginal rate of Substitution(DMRS): The IC is convex to the origin and shows the diminishing rate of MRS.

4. Consistency and Transitivity of Choice: It is assumed that the consumer is consistent in his choice. If in one period, the consumer chooses bundle A over B, he will not choose B over A in another period where A and B are present. This consistency assumption may be symbolically written as If A > B, then B is not >A .

   The transitivity character suggests that if bundle A is preferred to B, and B is preferred to C, then bundle A is preferred to C. Symbolically, If A > B and B > C, then A > C.

5. Completeness: The consumer's scale of preference is complete so that he can state whether he prefers one combination to the other, or is indifferent between them.

6. Non satiation : A consumer prefers more to less

7. Continuity or substitutability: An Indifference Curve is smooth and continuous which means that the two goods are highly divisible and that leads to satisfaction also change in a continuous manner.

8. There are two goods X and Y

9. The consumer possesses complete information about the prices of the goods in the market

10. The prices of the two goods are given

11. The consumer's tastes, habits and income remain the same throughout the analysis

Indifference Curve

An Indifference Curve is the locus of points of particular combinations of goods, which yield the same utility or level of satisfaction to the consumer. An indifference curve is drawn from the indifference schedule of the consumer. The latter shows the various combinations of the two commodities such that the consumer is indifferent to those combinations. An imaginary indifference schedule representing various combinations of goods X and Y is given in table: 3.3.

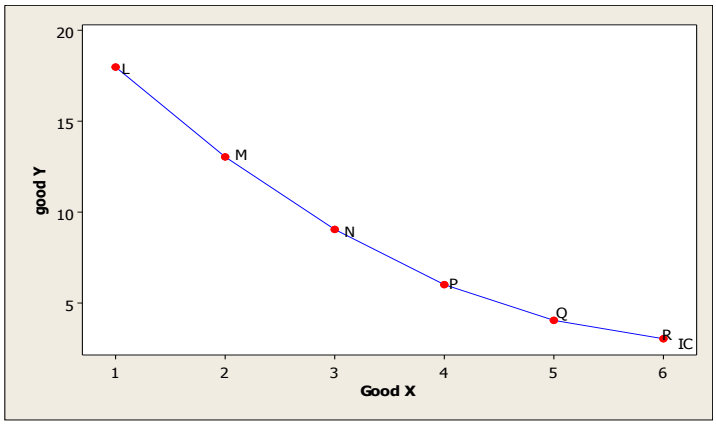
Table.3.3

Indifference Schedule

Combination		Good X	Good Y
1	L	1	18
2	M	2	13
3	N	3	9
4	P	4	6
5	Q	5	4
6	R	6	3

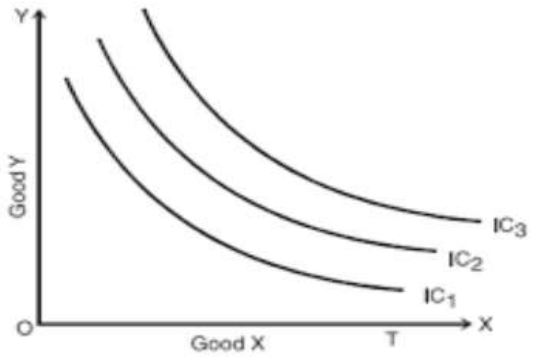
In the above schedule, the consumer is indifferent whether he buys the first combination (18 units of Y and 1 unit of X) or second combination (13 units of Y and 2 units of X) or any other combination. All combinations give him equal satisfaction. Now we shall represent this schedule by a diagram which gives an indifference curve figure: 3.6.

Figure 3.6



The Indifference Curve IC is the locus of the points L, M, N, P, Q and R showing the combinations of goods X and Y between which the consumer is indifferent. This is an Iso-utility curve showing equal satisfaction at all its points. A single indifference curve concerns only one level of satisfaction. But there are a number of ICs representing different levels of satisfaction. A diagram comprising a set of indifference curves form an indifference map. An indifference map shows all the indifference curves which rank the preferences of the consumer. An indifference map is depicted in figure 3.7. The curves that are farther away from the origin represent higher levels of satisfaction as they have larger quantities of X and Y. In the figure all points on IC_3 are preferred to all the points on IC_2 or IC_1. Thus IC_3 is preferred to IC_2. It indicates higher level of satisfaction than IC_2 and so on.

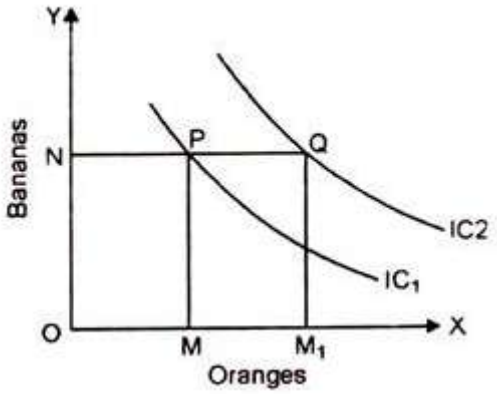
Figure 3.7



Properties of Indifference Curves

1. A higher IC to the right of another represents a higher level of satisfaction and preferable combinations of goods.

Figure 3. 8

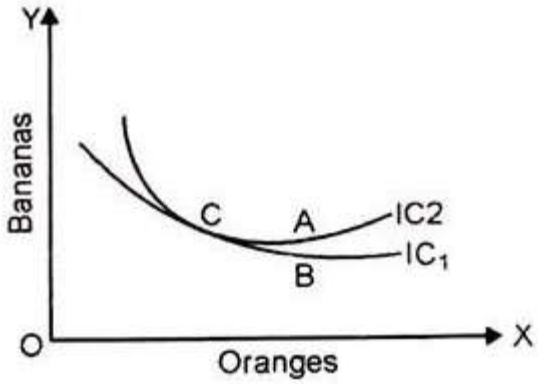


In the figure: 3.8, IC_2 represents higher levels of satisfaction. For example, combination Q on IC_2 is preferable to any combinations like P or N on IC_1.

2. Indifference Curves are negatively slopped: The indifference curves are slopping downward from left to right. It denotes that if the consumer is to stay on the same level of satisfaction, decrease in the quantity of one commodity Y must be followed by an increase in the quantity of other commodity X in the combination. In other words, to make the consumer indifferent, a decline in the utility due to a decrease in the quantity of one commodity in the combination must be compensated by an increase in the utility of the other commodity.

3. Indifference curve can neither touch nor intersect each other. If they did so, the point of intersection would imply two different levels of satisfaction, which is impossible. The absurdity of the intersection can be presented in the figure.

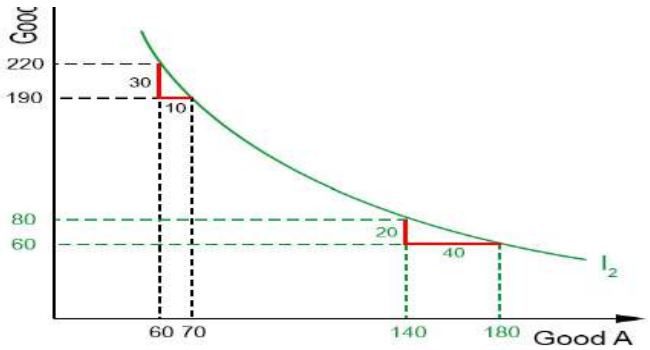
Figure 3.9



Point A on IC_2 indicates a higher level of satisfaction than B on IC_1 since it lies farther away from the origin. But point C which lies on both curves yield same level of satisfaction as point A and B. This is absurd since A is preferred to B. The same absurdity can be proved if two ICs are touched each other i.e, A is preferred to B, but B = C and A = C.

4. An IC cannot touch either axis. By definition IC represents locus of points representing combinations of two goods. Touching of an IC with any axis means, it has no units of the commodity representing that axis.
5. Indifference curves are convex to the origin: The convexity rule implies that as the consumer substitutes X for Y, the marginal rate of substitution diminishes. It means that as the amount of X increases by equal amounts that of Y diminishes by smaller amounts. This implies that the slope of the curve becomes smaller as we move to the right.

Figure 3.10



In most cases, indifference curves are bowed inward. This has to do with the marginal rate of substitution (MRS). We know that the marginal utility of consuming a good decreases as its supply increases (see also diminishing marginal utility). Therefore consumers are willing to give up more of this good to get another good of which they have little. Let's look at the graph above (3.10) to illustrate this. If a consumer has a lot of good B, the MRS is 3 units of good B per unit of good A. If she has more of good A, the MRS is 0.5 units of good B per unit of good A. In other words, if they have a lot of good B, they are more willing to trade some of it in to get an additional unit of good A and vice versa. Because of this relationship, the indifference curve is bowed inward (i.e., convex).

6. Indifference curves are not necessarily parallel to each other: Though falling negatively to the right, the rate of fall will not be the same for all ICs. The slope may vary according to the difference in Marginal Rate of Substitution between the two goods.

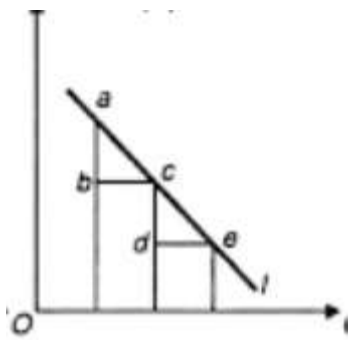
Some Special Types of IC

Indifference curves are usually negatively slopped and convex to the origin. But there may be exceptions to the general principle of DMRS. This may lead to the special types of ICs having straight, concave or L shaped (right angled)

1. **Straight line IC**

If MRS between two commodities is constant, the indifference curve will be a straight line slopping downwards to the right at 45^0 angle to either axis. In figure: 3.11, **ΔY is the same throughout (ab = cd)corresponding to same ΔX, ie., bc = de)**

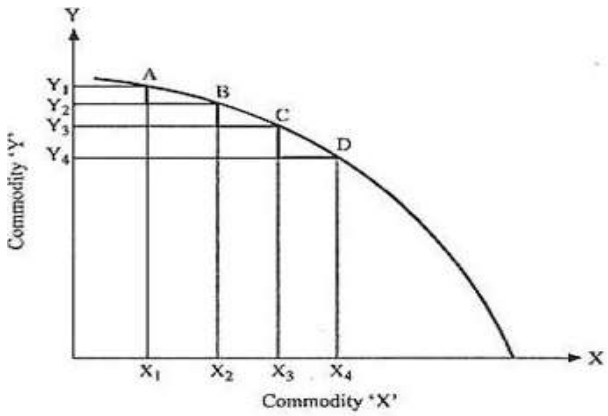
Figure 3.11



Concave IC

If MRS between the commodities is increasing, the indifference curve will be concave to the origin. In the figure, Δ Y :ab< cd and ΔX : ab=bc = cd

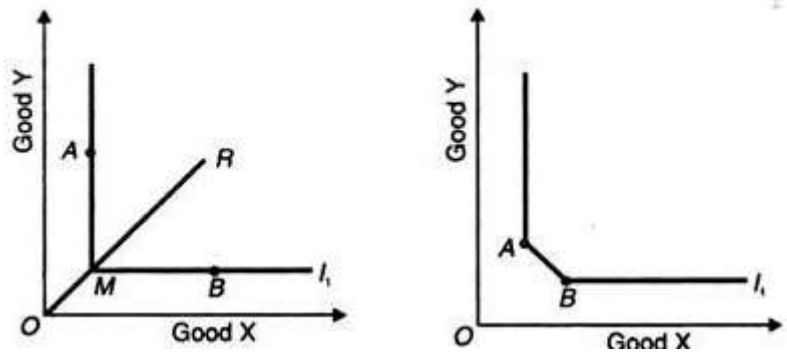
Figure 3.12



L Shaped IC

In the case of perfect complementary, the MRS between two goods is zero. The indifference curves for such goods are L shaped (Figure: 3.13A). In the case of ordinary complementary, the rate of substitution is low on or near the curvature of the curve as shown in figure: 3.13 B.

Figure : 3.13 A Figure: 3.13 B

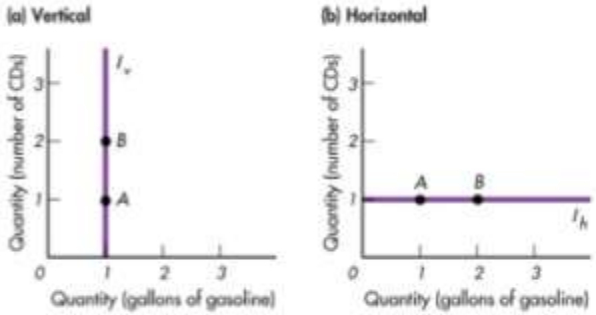


Horizontal or Vertical IC

If one of the goods in combination is a neuter, ie., consumer is indifferent between having more or less of the commodity, the indifference curve may be either horizontal or vertical.

Horizontal indifference curve would indicate that good X is a neuter (Figure: 3.14 B), Whereas Vertical IC would indicate that commodity Y is a neuter (Figure: 3.14 A)

Figure: 3.14



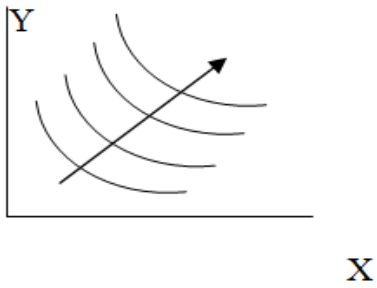
The Consumer's Income and Price Constraints

A rational consumer always tries to maximize his satisfaction. Ie., a consumer always tries to reach the highest IC (as denoted by the arrow in the 3.15). But there are constraints or limitations faced by a consumer in satisfying his or her wants. Two constraints are important in this regard.

1. The consumer has to pay price for the commodity and
2. The consumer has a given income to spend on goods.

Thus, the amount of goods that a consumer can purchase over a given period of time is limited by the consumer's income and the price of the goods. It implies that the consumer faces a budget constraint due to his or her limited income and the given prices of goods. This constraint is represented by the tool of Budget Line.

Figure 3.15

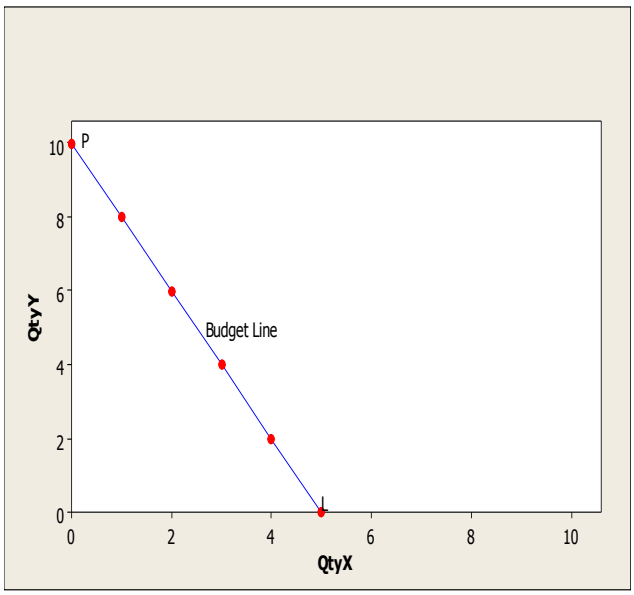


Budget Line

Consider two commodities X and Y. Let the price of X be Rs.2 per unit and the price of Y Rs.1. Also let the consumer's budget be Rs.10 at a time period. Then 5 unit of X could be bought by the consumer if he spent the whole budget on X, or 10 units of Y could be bought if the consumer spent the Rs.10 for Y. Now a straight line between these two points 5X and 10Y shows every possibility of spending the budget on the two commodities at their given prices.

This straight line between 5X and 10Y is the budget line (also known by various names: budget restraint, consumption possibility line, expenditure line, price line, price opportunity line and price income line).

Figure 3.16



The consumer can buy 5X and 0Y, 4X and 2Y or 3X and 4Y and so on. (An illustration of the some possible combinations on which Rs. 10 can be allocated is shown in the table 3.4.

Table 3.4: Feasible combinations of Goods X and Y with a budget of Rs.10.

Combination	Good X (Units)	Good Y (Units)
A	5	0
B	4	2
C	3	4

D	2	6
E	1	8
F	0	10

The price line PL shows the combinations of goods X and Y, given their prices, when he spends his income totally on them. The budget equilibrium of the line is represented algebraically as **.** Where I represent income, P_x is the price of good X and P_y is the price of good Y. The budget equation is the equation of the line connecting the points P and L where .

The consumer can buy any quantity inside the triangle. But the purchase of any quantity within the budget line means the consumer is not spending all of the income Rs.10. (In the diagram prices and the budget are represented indirectly by the physical quantities). The slope of the budget line is the ratio of the prices of the two commodities. The ratio is , the price of X divided by the price of Y. Thus for any budget line, In our example, the slope = 2/1 = 2.

If both prices were equal, the slope of the budget line would be unity. If the slope is less than unity (Px/Py< 1), x has the lower price. If the slope is higher than unity (Px/Py>1), Y has the lower price.

For many purpose it is convenient to let the horizontal axis represent amounts of a commodity and the vertical axis an amount of money income per time period. Then X is a commodity and Y is money income. In this case Y stands for other commodities (represented by money income).

By assuming that a consumer spends all of his incomes on goods X and Y, we have the budget equation ……(1)

By rearranging, …..….(2)

Dividing both sides of equation (2) by P_y, ……..(3)

The first term on the right hand side of equation (3) is the vertical or Y-intercept of the budget line and is the slope of the budget line. In our example, the slope of the budget line refers to the rate at which the two goods can be exchanged for one another in the market. Ie., 2Y for 1X.

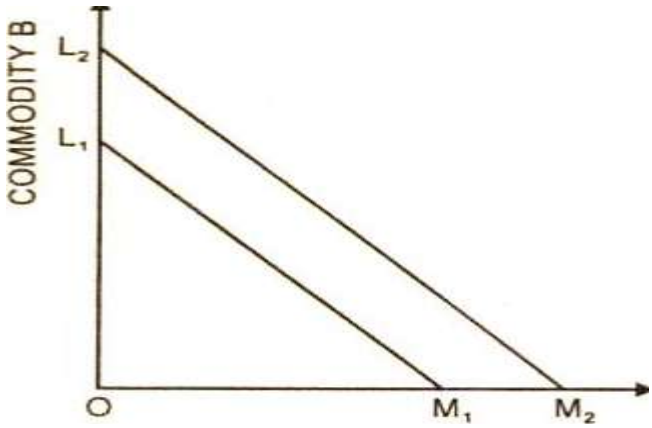
Changes in Income, prices and Budget Line

From the foregone discussion, it is clear that the position of the budget line depends on the size of the budget as well as the relative prices. A particular budget line refers to a specific level of the consumer's income and specific prices of the two goods. Thus, any change in income or price of either goods cause a change in the budget line. The consequence of such changes may be analysed as under.

Change in Income

When only the consumer's income changes, the effect will be a parallel shift in the budget line. Here, the slope of the budget line remains unchanged. When income increases budget line shift upwards parallel to the right. Converse to this, budget line shifts downwards when income decreases.

Figure 3.17

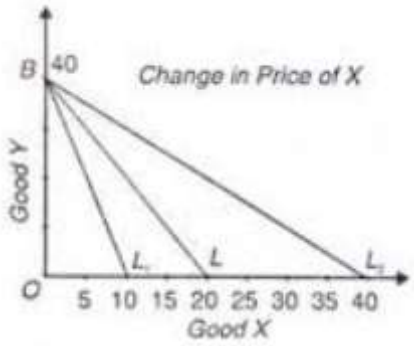


In the figure, Budget line PL denotes 10Yor 5X when income is Rs.10. When income increase to Rs.15 the consumer can purchase 15Y or 7.5X. Following a decrease in income, the consumer can purchase either 5Y or 2.5X at an income of Rs.5. Thus the three budget lines corresponding to three levels of income are parallel and their slopes are equal.

Changes in Prices of good X

If only the price of good X changes, the vertical or Y intercept remains unchanged. If price of X falls, the budget line rotates upward or counter clockwise. In the figure3.18, PL is the budget line where, Px is Rs. 2 and income is Rs.10. When price of X decrease to Rs.1, the budget line rotates upwards as PL'. But the budget line will rotates downward to PL'' when the price of X increases. Here, though the vertical intercept remains the same, the horizontal intercept and the slope of the budget line changes.

Figure 3.18

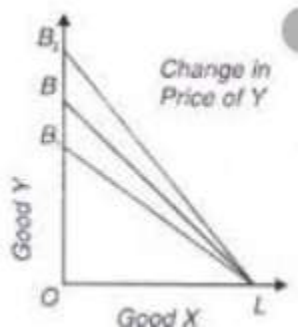


For the original budget line (BL), the slope is . When Price of X falls to Rs.1 slope is and when Price of X increases to Rs.4, slope is .

Changes in Price of good Y

In the case of a change in the price of Y alone, the horizontal or X intercept will be the same. At the same time budget line will rotate upwards if Price of y falls and downwards if Price of y rises.

Figure 3.19



In figure 3.19, BL is the original budget line where Price of y is Rs.1 per unit. When price of Y decreases to Rs. 0.5, the new vertical intercept is QY=20 (P') and the slope of budget line is . When Price of y = 2, the new Y intercept is QY=5 (P) and the slope is .

Consumers Choice

A rational consumer tries to maximise utility or satisfaction. Thus the consumer's problem is to choose the most preferred affordable bundle ('best' bundle) among the alternatives open to him.

In this context, our attempt is to examine how the consumer determines which goods to purchase and in what quantities to achieve this end. Now we have all the tools required to analyse the consumer's choice problem. The budget line shows the income and price constraints faced by the consumer. The indifference curve represents the tastes and preference of the consumer (preference ordering).

Utility Maximization

A consumer is in equilibrium when he maximises his satisfaction from given income and given prices of goods. A rational consumer maximises utility by trying to attain the highest indifference curve possible, given his income and prices of goods (budget line). This occurs where an indifference curve is tangent to the budget line. At the point of tangency, the slope of indifference curve (the MRSxy) and the slope of the budget line (Px/Py) are equal. The point of tangency satisfies three conditions for utility maximisation (the conditions for the constrained utility maximisation, consumer optimisation or consumer equilibrium).

1. The consumer spends all his income. Ie., This means that the consumer is on the budget line,
2. The slope of indifference curve and the slope of budget line should be the same. Ie., and
3. Indifference curve should be convex to the origin.

The utility maximisation is illustrated in the figure: 3.20, where consumer indifference curves and budget line are brought together.

Figure 3.20

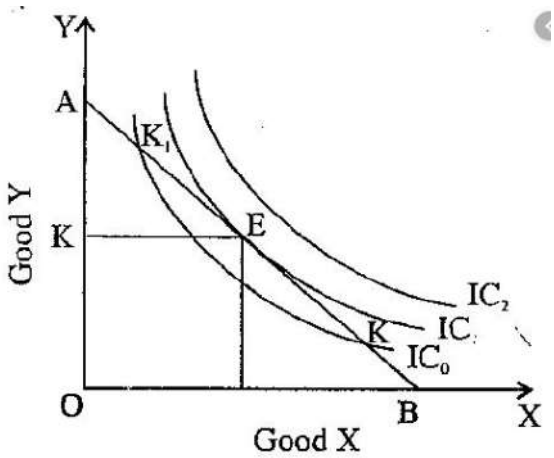


Figure shows that the consumer maximises utility at point E where indifference curve IC_1 is tangent to budget line AB. At point E, consumer is on the budget line (thus satisfies first condition of given income) and slopes of the budget line and indifference cure are equal, MRSxy = Px/Py, (satisfied second condition).

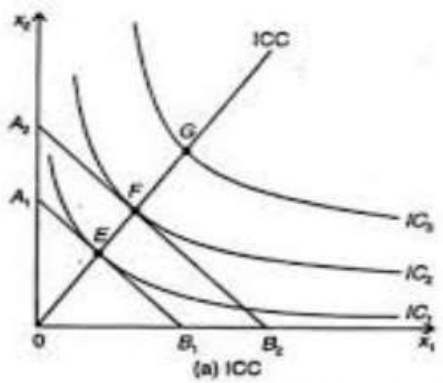
Thus the consumer can increase his satisfaction by purchasing less of Y and more of X until he reaches at point E. On the other hand, at point K, MRSxy is <Px/Py. So the consumer can increase his satisfaction by purchasing less of X and more of Y until he reaches point E. The consumer cannot reach indifference cure IC_2 with the given income and prices of two goods X and Y. Thus E is the only combination that corresponds to utility maximisation or consumer equilibrium.

Changes in Income and Engels's Curve

So far we have discussed that utility maximisation point or equilibrium point is characterised by tangency of the budget line with an indifference curve. The position of this point depends on (a) the budget line and (b) preferences that determine the shape and location of indifference curves. The budget line in turn depends on prices and income of the consumer. A change in consumer's income shifts his budget line. This shift affects consumer purchases and leads to a new optimum (equilibrium) position.

If the income of the consumer alone changes, while prices and consumer's tastes remain constant, the effect it will have on his purchases is known as the income effect. If the income of the consumer increases, his budget line will shift upward to the right, parallel to the original budget line. On the contrary, a fall in the income will shift the budget line inward to the left. These lines are parallel to each other because relative prices remain unchanged.

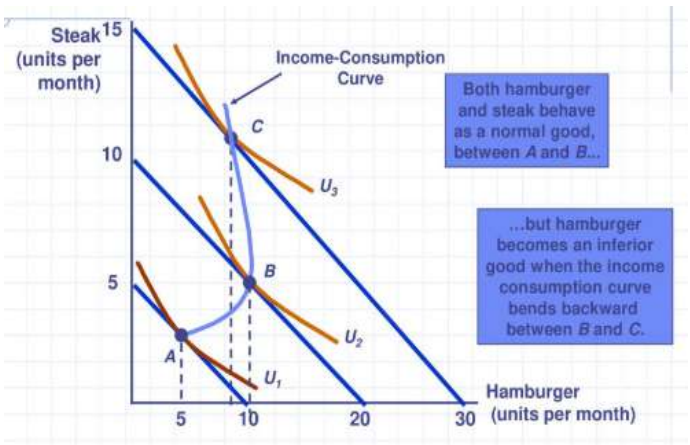
Figure 3.21



In the figure 3.21, when the budget line is A_1B_1, the utility maximisation point is E where budget line is tangent with indifference curve IC_1. If income of the consumer alone increases, price line will move to the right as budget line A_2B_2 and the new utility maximisation point is F where the budget line A_2B_2 touch the indifference curve F. As income increases further, A_3B_3 becomes the budget line and G is the utility maximisation point. By joining the optimum points E, F and G we get the income consumption curve for the consumer. Thus the income consumption curve is the locus of consumer optimum points resulting when only the consumer's income varies. Thus ICC shows the income effect, ie., the effect of changes in consumer's income on the purchases of the two goods. In order to give more attention on the consumer's purchase of just one good, say commodity X we may take X on as commodity X and Y as the money income (measured on the vertical axis). Accordingly the indifference curves will show the trade off between various quantities of good X and various amounts of money.

In general, the higher a consumer's income, the more will be the quantity of a commodity the person will buy. Commodities bought in larger quantities when income rises are called normal goods. Thus, in the case of normal goods, the income consumption curve slopes upward to the right (as shown in the figure: 3.22). The direction of ICC depends on the nature of goods (normal, inferior or giffen).

Figure 3.22



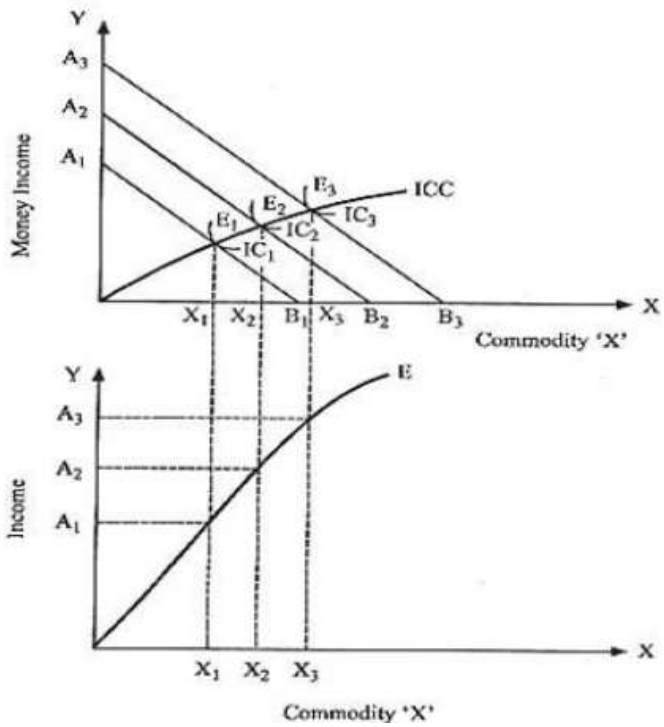
In the figure income consumption curve has a positive slope up to a point and curve is negatively increased beyond the point. This indicates that consumption of X increases along with increasing in income up to a certain level, but less of X is consumed after this level. This type of goods is inferior goods.

Income Consumption Curve and Engel Curve

The Engel curve shows the amount of a good that the consumer would purchase per unit of time at various consumption levels. (Curves are named after Ernest Engel, the German statistician of the nineteenth century who pioneered studies of family budgets and expenditure patterns). Sometimes, Engel curves show the relationship between income and expenditures on various goods rather than the quantity purchased of various goods. We can derive Engel curve from income consumption curves. Now, let us derive an Engel curve for good X from the ICC.

With income M_1 (represented by budget line PL) consumer maximises utility at point Q in the upper panel of figure. Accordingly, he purchases OA unit of commodity X. As income increases from M_1 to M_2 and M_3 the budget line shifts upward to P_1L_1 and P_2L_2 respectively. Following this shifts, consumer equilibrium points should shifts from Q to R and to S. The amount of commodity X that the consumer would purchase also move from points A to B and to C.

Figure 3.23



In upper panel of Figure three parallel budget lines A_1B_1, A_2B_2 and A_3B_3 correspond to OA_1, OA_2 and OA_3 levels of money income respectively, prices of the commodities remaining constant. The income consumption curve (ICC) is obtained by joining different equilibrium

points E_1, E_2 and E_3. Each equilibrium point on the ICC corresponds to a particular quantity of commodity 'X'. Each point on the ICC also corresponds to a particular money income. The various pairs of the income and the quantity purchased of commodity 'X' ((OA_1, OX_1), (OA_1, OX_2) and (OA_3, OX_3)) corresponding to three equilibrium points E_1, E_2 and E_3 are plotted in the lower panel of the figure to obtain the Engel curve. This Engel curve indicates the relationship between the income level and the quantity of the commodity purchased by the consumer.

Thus, the Engel curve is derived from the income consumption curve and shows the quantity of X that the consumer would purchase at various income levels. The slopes of Engel curve depends on the nature of goods. Engel curve rises rapidly in the case of necessities. The case is shown in figure: 3.24A, where a given increase in income ($OM_1 = M_1M_2 = M_2M_3$) leads to a proportionately smaller increase in the quantity purchased of X ($OX1 > Q_1Q_2 > Q_2Q_3$).

Figure 3.24 A

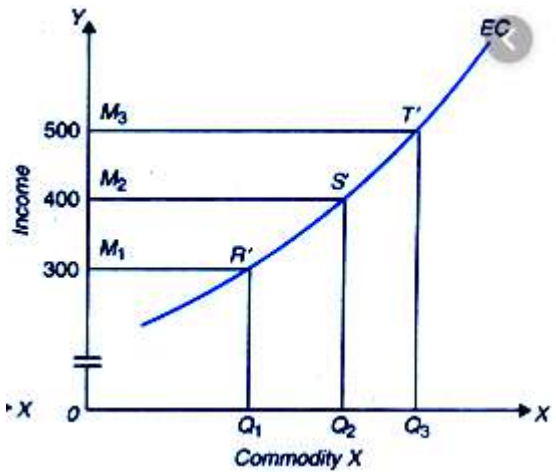
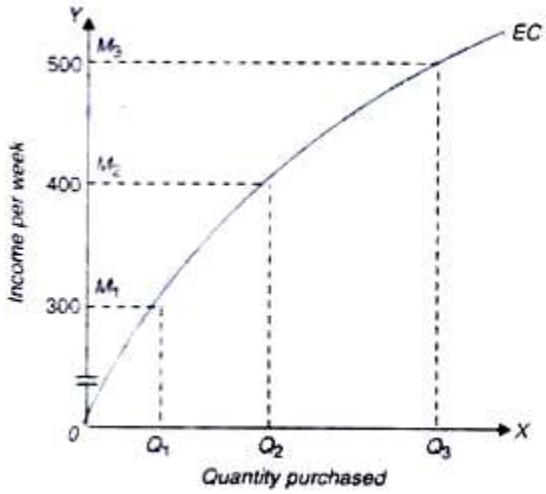


Figure 3.24 B



Engel curve rise only gently in the case of luxuries. Figure 3.24 B corresponds to such goods where a given increase in income ($OM_1 = M_1M_2 = M_2M_3$) leads to a proportionately larger increase in the quantity purchased of the good ($OQ_1 < Q_1Q_2 < Q_2Q_3$).

Necessities and luxuries together refer to normal goods. In the case of normal goods, Engel curve is upward slopping from left to right, showing the positive relationship between income and purchase of the commodity. In the case of an inferior good, the consumer purchases less quantity of the commodity as income increases. The Engel curve for an inferior good is slopping backward from right to left. If the good is a neutral one (such as salt), the Engel Curve is a vertical line.

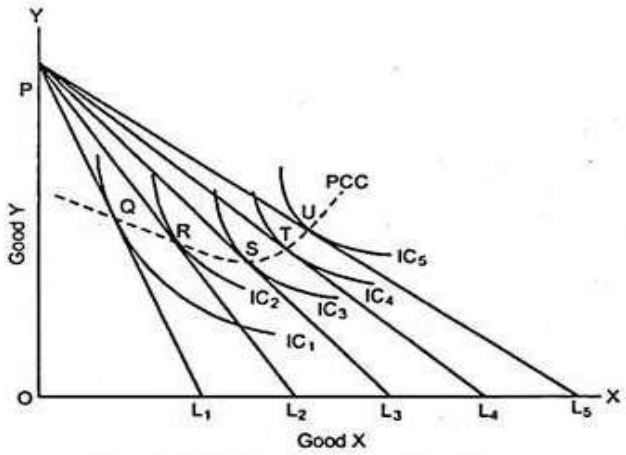
Changes in Price

A change in commodity prices changes the consumer's budget line, (as the price ratio alone changes) and this affect consumer's optimum point and the purchases.

Now, we examine how the consumer reaches a new optimum point when the price of a good changes, but the price of other good, income of the consumer and tastes remain unchanged. The effect on the purchase due to a change in the price of a commodity is the price effect and is represented by the price consumption curve.

We can derive the consumer's price consumption curve for good X by changing the price of good X while holding the price of good Y, income and tastes constant. The price-consumption curve for good X is the locus of consumer optimum points resulting when the price of good X only varies. This is shown in the figure: 3.25.

Figure 3.25



In the figure, with budget line PL consumer is in optimum at point Q, where indifference curve u1 is tangent to the budget line P_1L_1 and the consumer purchase X_1 units of X and Y_1 units of Y. Now, suppose the price of good X falls from the initial level. This reduction would cause the consumer's budget line to become flatter or to extend further out to the right as PL_2 showing that the consumer would purchase more units of X than before as X has become cheaper. Now R will be the equilibrium. The budget line PL_3 shows a further fall in the price of X. The new optimum point would be the tangency point S. By joining three optimum points Q, R, and S, we get the price consumption curve for this consumer.

Substitution Effect and Income Effect

As we have seen, the fall in the price of good X alone (given the price of Y) increases its demand. This is the price effect which is the result of two separate forces at work called the substitution effect and income effect

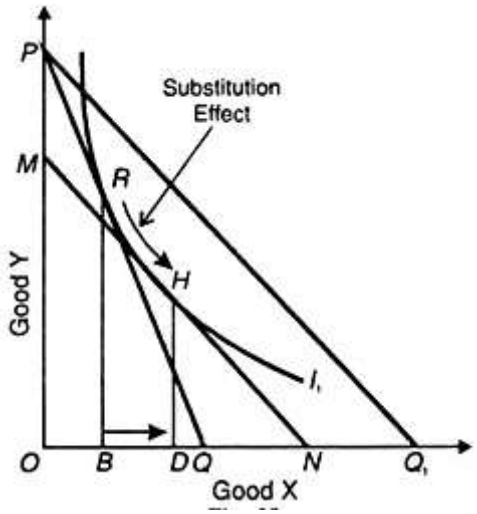
Substitution effect relates to the change in the quantity demand of a good when its price changes resulting only from the relative price change and independent of the change in income. When the price of good X falls, X becomes cheaper relative to other commodities and consumers tend to substitute X for other commodities. This always tends to increase in the quantity demanded of good X.

The income effect relates to the change in the quantity purchased of good resulting only from the change in real income that accompanies a price change. There are two approaches to the measurement of the substitution effect, one by Hicks and the other by Slutsky.

Hick's Substitution Effect

Prof. Hicks explanation of substitution effect is in terms of compensating variation method. In Hicksian version, "the substitution effect is the increase in the quantity bought as the price of the commodity falls, after 'adjusting ', income so as to keep the real purchasing power of the consumer the same as before. This adjustment in income is called compensating variation and is shown graphically by a parallel shift of the new budget line until it becomes tangent to the initial indifference curve". Thus, the increase in the real income, following a reduction in the price is withdrawn so as to leave the consumer neither better off nor worse off than before. The substitution effect is explained in the figure 3.26. PQ is the original budget line which is tangent to the indifference curve I. R is the equilibrium point where the consumer purchases OB unit of X. Suppose the price of X falls so that the new budget line is PQ_1. With the fall in the price of X the real income of the consumer increases.

Figure 3.26

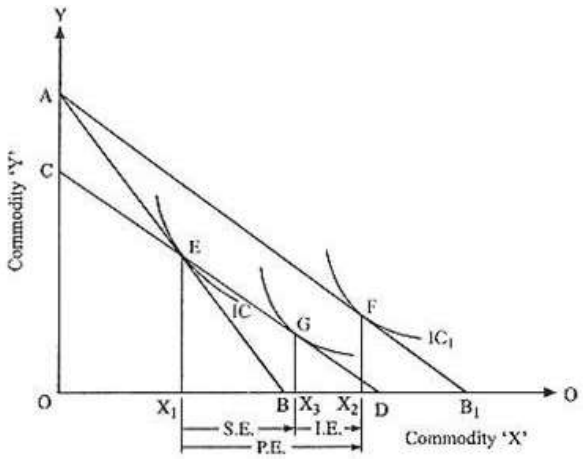


To make the compensating variation in income or to keep the consumer's real income constant, take away the increase in his income so as to bring him back to the original level of satisfaction (indifference curve I). In terms of the figure, this is equal to PM or NQ_1 of income. Then the new budget line after adjusting the income is MN which is tangent with the original indifference curve at H (not at R). Now the consumer buys OD unit of X. Now, as a result of fall in the price of X, consumer substitute X for Y and moves from point R to H. This movement is called the substitution effect. The substitution effect is always negative and the price quantity relation is inverse.

Slutsky's Substitution Effect

Slutsky explained the substitution effect by taking the apparent real income of the consumer as constant. In this case the adjustment in real income is made so as to leave the consumer on the same bundle of the two goods as before the price change. The consumer's movement to a higher indifference curve after this adjustment represent a substitution effect. Hicks call this method as the cost difference method. The method is shown in the figure 3.27.

Figure 3.27



AB is the original budget line and E is the optimum point where OX_1 of X is purchased. Now AB_1 is the new budget line following a price reduction. The increase in real income is taken away by adjustment to leave him on the same bundle E. Thus the budget line AB_1 is shifted parallel to CD which passes through point E. Now the consumer would not be in equilibrium at point E since the indifference curve is not tangent with the budget line CD. He will move to point F on a higher indifference curve, where CD is tangent to it. Since both line AB and CD have the same purchasing power, the difference between their equilibrium position E and F is due to the price effect. Thus an increase in the quantity of X represented by a movement from E to G is the Slutsky's Substitution Effect.

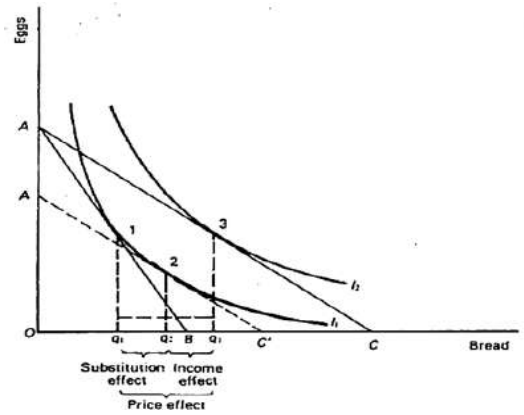
The Income Effect

The income effect relates to the change in the quantity purchased of a good resulting only from the change in income of the consumer. A fall in the price of good X represents an increase in the income of the consumer, because the consumer can now reach the same indifference curve with a smaller income. The extra income thus earns can be allocated between this good and other commodities.

Separation of Price Effect in to Substitution and Income Effects

The total effect of a price change (Price effect) can be separated in to two components as substitution effect and income effect. The process of decomposition is explained in the figure 3.28.

Figure 3.28



AB is the original budget line where the consumer maximises utility at point 1. Now, if the price of bread falls, the budget line takes new position as AC. This decrease in the price of bread causes an increase in the real income of the consumer. Now, to bring the consumer back to the original level of satisfaction (indifference curve I_1), a compensating variation in income is to be made. AC^1 is the new budget line after this compensating variation. Now the consumer maximises utility at the combination represented by point 2 which is tangent with the budget line I_1. Now the shift from point 1 to 2 on the indifference curve I_1 (movement from q_1 to q_2 on the horizontal axis) is due to the substitution effect.

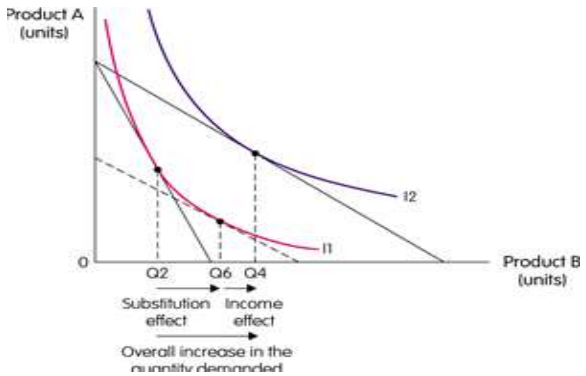
Now, if the income, taken as compensating variation is given back to the consumer, he could purchase more of bread and eggs and could attain a higher level of satisfaction. So an increase in purchase following this increase in (real) income is the income effect. In the figure, movement from 2 to 3 (on a higher indifference curve I_2) is due to the income effect (movement from q_2 to q_3 on the horizontal axis). Thus the total effect of a price change (price effect) is the sum of two effects (Substitution Effect and Income Effect). In the figure, $q_1q_3 = q_1q_2 + q_2q_3$. Or movement from 1to 3 = 1 to 2 + 2 to 3. Ie., Price Effect = Substitution Effect + Income Effect.

Income and Substitution Effect for different types of goods

1. **Normal Goods**

Normal goods are those goods whose purchases increase with increase in income. In the case of such goods, income effect works in the same direction to that of substitution effect. Thus income effect strengthens substitution effect and the total effect leads to an increase in quantity following a fall in price. The case is shown in the figure 3.29. Movement from Q_2 to Q_6 is due to substitution effect and the movement from Q_6 to Q_4 is due to the income effect.

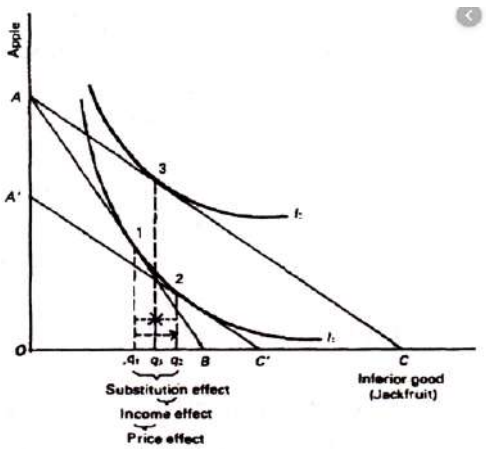
Figure 3.29



Inferior Goods

In the case of inferior goods, income effect works in the direction opposite to that of substitution effect. But the strength of income effect is not enough to cancel out substitution effect totally. As a result, when price of X falls, more units of X will be bought. In figure 3.30, movement from 1to 2 is substitution effect and 2 to 3 is income effect. The demand law (inverse relationship between quantity demanded and price) operates in such goods.

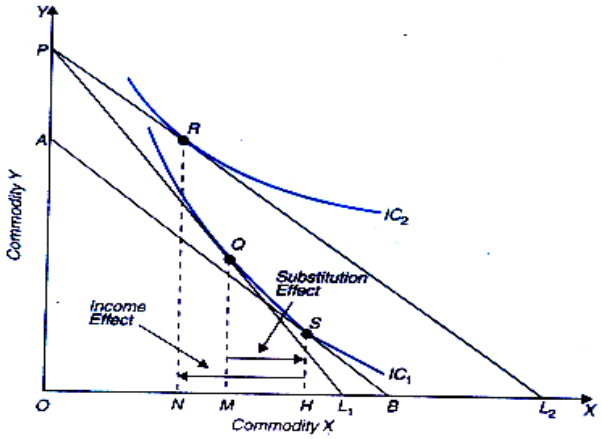
Figure 3.30



Giffen Goods

Giffen goods are special types of inferior goods. In such goods income effect works opposite to substitution effect and is higher than it.

Figure 3.31



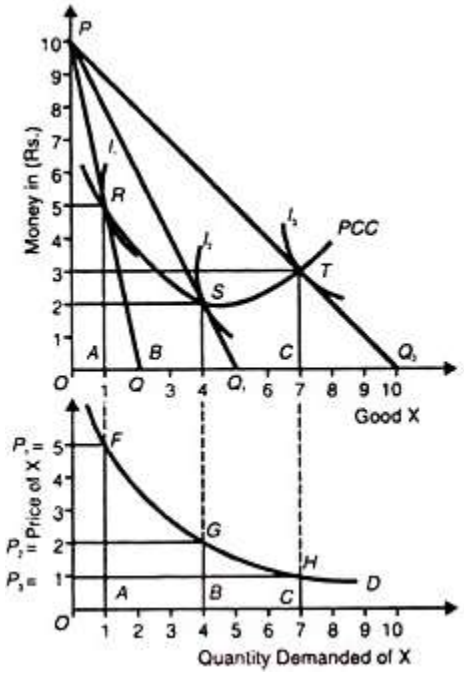
As shown in the figure: 3.31, when price falls substitution effect causes an increase in the quantity purchased (movement from Q to S). But the income effect causes a reverse movement and the quantity that would purchase decline with increase in real income (movement from S to R). Thus, the net effect to price change is a decrease in quantity demanded of X following a fall in the price of it. This case depicts the violation of demand law.

Derivation of Demand Curve Using Indifference Curve approach

In the case of indifference curve analysis (ordinal utility approach), the demand curve is derived from the price consumption curve. A price consumption curve represents the points of tangency of successive budget lines and higher indifference curves. The process of derivation of demand curve is illustrated with an example.

Suppose a consumer has a given income of Rs.10 (OP in the figure: 3.32) and the price of commodity X is falling from 5 to 3 and to 2. In the upper portion of the figure, money income is taken on the vertical axis and good x on the horizontal axis. PQ, PQ_1 and PQ_2 are the budget lines on which R,S and T are the equilibrium position forming the Price consumption Curve, PCC. The consumer buys OA,OB and OC units of X respectively at these points on the PCC. If the total money income of the consumer is divided by the number of goods to be bought with it, we get per unit price of the good. For OA units of X, he pays OP/OQ price, for OB units OP/OQ_1: and for OC units OP/OQ_2.

Figure: 3.32



The combination of price and units of commodity are represented by points R, S and T in the upper part of the figure: 3.32. These points in the PCC are plotted on the lower portion of the diagram where prices of X are taken on the vertical axis and units of X on the horizontal axis. Point F is got by drawing perpendicular from point R through point A. Similarly, draw perpendiculars from S and T through B and C for having G and H on the lower figure. These points are joined by a curve which forms the demand curve. This curve (demand curve) shows the inverse relationship between price and quantity demanded.

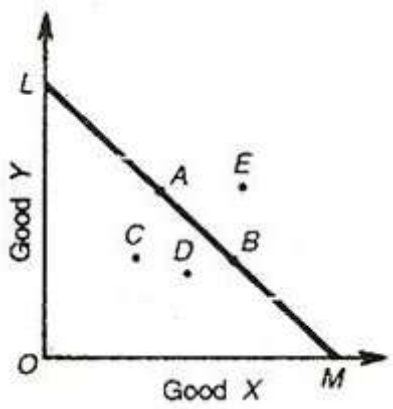
Revealed Preference Theory

Indifference Curve analysis shifted the approach from cardinalism to ordinalism. At the same time, it retained the assumption of introspection. Prof. Samuelson attempted to shift the basis from introspection to observation. Thus revealed preference theory is a behaviourist ordinal utility analysis. The revealed preference hypothesis has made possible the establishment of the 'law of demand' directly on the basis of the revealed preference axiom. Thus this hypothesis (R.P hypothesis) is considered as a major breakthrough in the theory of demand.

Revealed Preference Axiom

Prof. Samuelson's theory of demand is based on revealed preference axiom which states that choice reveals preference. According to this hypothesis, the consumer is supposed to reveal the nature of his preferences. He shows the good he would prefer to purchase in a given situation even though he may not be able to show his scale of preference on an indifference map.

Figure: 3.33

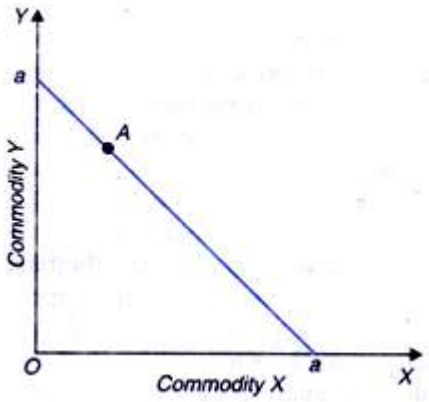


In the figure 3.33, with the price line LM the consumer has many alternative bundles defined by the area of triangle LOM. If the consumer chooses point A, this reveals consumer's definite preference for this combination over all other combinations available (on the budget line as well as within the budget line)

Strong and Weak Ordering

Strong ordering is a distinguishing feature of Samuelson's theory. In a strong ordering, each item in a consumer's scheme of purchase is assigned a definite place or number and at each number there is only one item so that the consumer definitely reveals his preferences. In the revealed preference case, while a consumer is choosing a point among alternatives he shows his definite preference over all other points. This is a case of strong ordering. Hicks explain the strong ordering diagrammatically. He assumed 2 commodities X and M, where X is an individual good and M is a composite good representing all goods and services other than good X.

Figure: 3.34



Given the income of the consumer and the prices of goods, the price income situation is represented by budget line aa and the choices open to the consumer are shown by points in or on the triangle a0a. The point A on the line aa represents the actual choice of the consumer. This choice shows that the consumer has a definite preference for A over all other points in or on the triangle a0a (letters of the alphabet are strongly ordered).

Weak Ordering

In weak ordering, there may be some items which cannot be arranged in order or preference. In such cases, some items may be incapable of being arranged in front of one another. A weak ordering consists of division in to groups where ordering is not possible within the group. But sequence of groups may be strongly ordered. For eg., ordering of people on the basis of birth days without regard to years.

In the indifference curve analysis, consumer preference is based on weak ordering. The different combinations on the same indifference curve are equally desirable.

Fundamental theorem of Consumption theory

Samuelson has tried to demonstrate the inverse relationship between price and the quantity demanded of a commodity using Revealed Preference hypothesis. He states the demand theorem under the title "Fundamental Theorem of Consumption Theory". For the explanation of the theory, he made certain assumptions.

1. Rationality: The consumer is assumed to behave rationally. He prefers the bundle of goods having more quantities of the commodities. The consumer seeks to maximise his satisfaction from the resources he has.

2. Consistency: The consumer behaves consistently. If he chooses combination A in a situation in which combination B was also available to him, he will not choose B in any other situation in which A is also available.

   Symbolically, If A > B, then B is not greater than A. This is the two term consistency.
3. Transitivity: If, in any particular situation, A is preferred to B and B is preferred to C, then the consumer must prefer A to C. Symbolically, if A > B and B > C, then A > C. This is the three term consistency.

4. The income elasticity of demand is positive: The consumer demands more commodities when income increases and less when income decreases.

5. Consumer's Choice reveals his preference for the chosen combination among the alternative combinations.

6. Strong Ordering: Strong ordering is a distinguishing feature of Samuelson's theory.

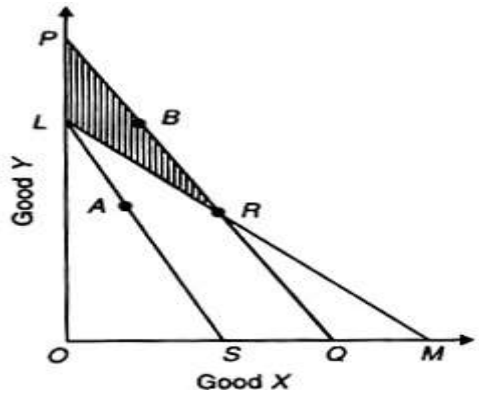
The Theory

Based on the assumptions, Samuelson stated his fundamental theorem of consumption theory (also known as demand theorem), thus: "any good (simple or composite) that is known always to increase in demand when income alone rises must definitely shrink in demand when its price alone rises". It means that when income elasticity of demand is positive, price elasticity of demand is negative. This can be shown for rise as well as for a fall in the price of a good.

Rise in Price

Consider a consumer who spends his entire income on 2 goods X and Y. Now, given the income and prices of goods, consumer's budget line is LM. Suppose that the consumer chooses point R where he spends all income on X and Y.

Figure: 3.35



If the price of X rises, the consumer could purchase less units of X at given prices. With rise in price, real income decreases and the budget line will change as LS. Now, given the triangle of choice OLS, the equilibrium R is beyond the budget line and the consumer will choose a combination like A which contain less units of X (since price of X has risen).

In order to compensate the loss in real income as a result of rise in the price of X let us give SQ amount of money to enable him to buy original combination R. Then PQ becomes new budget line which is parallel to LS and passing through point R. Prof. Samuelson calls this extra money 'over compensation'.

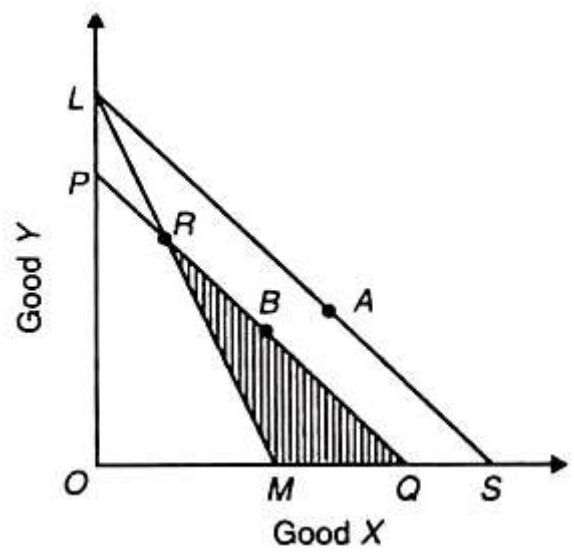
The new area of choice is OPQ. Since point R was preferred in the original budget line LM, the consumer will not choose any points lying below R on the RQ segment of budget line PQ (represent lesser satisfaction and its choice will prove inconsistent behaviour. He cannot have more of X when its price has risen). The consumer will, therefore, reject all combinations below R and choose either R or any higher combination (such as A) lying on PR part of the price line PQ. If he selects R, it will mean that he is buying the same amount of goods X and Y as before price rise. On the other hand, if he chooses any combination above R on the PR portion of PQ (such as A), it will mean that he is buying less of X and more of Y. This represents a substitution effect of a price rise, (since some units of Y have been substituted for some units of X which has become dearer).

If the extra money once given in the form of compensatory variation is taken back, the consumer's choice combination will be to the left of Q (say point A) on the budget line PL', showing a reduction in the purchase of X when there is a reduction in income of the consumer (since income elasticity of demand X is positive). Thus, the theory establishes the inverse relationship between price and the quantity demanded when price of good X has risen (when income elasticity is positive, price elasticity is negative).

Fall in price

The demand theorem can also be proved in the case of a fall in price. It can be defined thus: "Any good (simple of composite) that is known always to decrease in demand when money income alone falls must definitely expand in demand when its price alone falls". The case is explained in figure 3.36:

Figure: 3.36



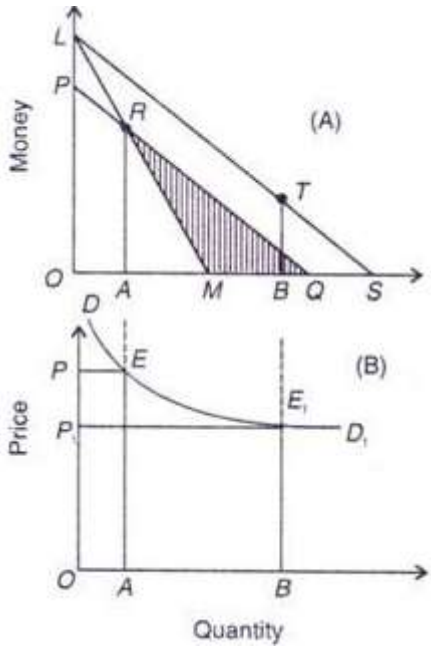
In the original price- income line LM, consumer chooses a combination R. When price of X falls, the real income increases so that the consumer could purchase more units of X and Y. This is shown by the budget line LS. The consumer now feels better off than before. If he is to purchase the original combination R, we have to take away from him some money to leave him neither better off nor worse off than before. This is shown by the new budget line drawn in the figure which passes through point R (a reduction of money income equivalent to QS). Now original combination (before fall in price) R is available. The PR portion represents the combinations which are rejected for choosing R. Thus in the new situation; the consumer would choose either R or any point to the right of R representing more units of X. Now, if the money withdrawn from the consumer is given back, the consumer will choose combination representing more of X because income elasticity is positive. Thus the movement will be to a point like R where the units of X increase with a reduction in the price of X. The inverse relation between price and quantity establishes again.

Derivation of Demand Curve from Revealed Preference Theory

We can derive the demand curve of an individual from the Revealed Preference Hypothesis. The process is shown in the figure 3.37. Assume that the consumer has the budget line LM and choose the combination of goods denoted by R. Suppose the price of X falls so that the new budget line facing the consumer is LS. This represents an increase in real income.

In panel (A) of figure money is measured on the vertical axis and good X on the horizontal axis. In panel (B) vertical axis measure price of the commodity. We can show that the consumer's new combination will include a larger quantity of X.

Figure 3.37



Firstly, we make a 'compensating variation' of the income. Ie., reduction of income so as to reduce the income of consumer just enough to purchase combination R if he wishes to buy it. Following the compensating variation, the consumer's income is just enough to purchase the original combination if he wishes so. The new budget line PQ passes through point R and is parallel to LS. The combination R, which was selected at the original situation, is available at the present situation. Thus the consistent behaviour requires the selection of either R or any point to the right of R in the new budget line LS (say point T). If the money taken from the consumer is returned to him, the consumer will again be at a point such as T to the right (sine income elasticity is positive).

Consumer surplus - Marshall and Hicks

Then concept of consumers' surplus is originally introduced by a French engineer, Arsene Julis. Dupuit in 1844. Then it is propounded by Alfred Marshall and Prof J.R. Hicks.

According to Marshall, Consumer's surplus is the excess of what we are prepared to pay over what we actually pay for a commodity. It is the difference between what we are prepared to pay and what we actually pay. Thus, Consumer's surplus = what one is prepared to pay minus what one actually pays. We can put it in the form of an equation thus:

Consumer's Surplus = Total Utility – Total Amount Spent.

We can illustrate the concept of consumer's surplus with the help of the table (3.5) given below:

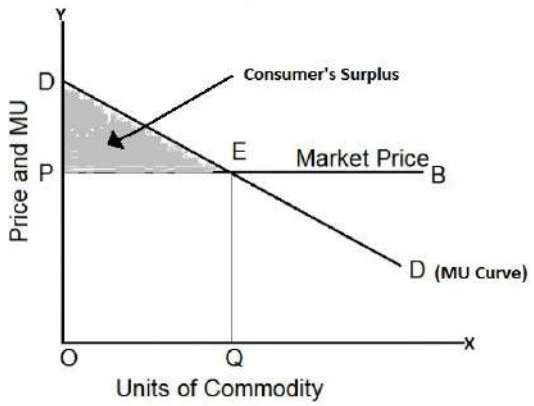
Units consumed	Marginal utility	Price per unit	Consumers surplus
1	20	8	12
2	15	8	7
3	12	8	4
4	10	8	2
5	8	8	0

It is assumed in the above table that the price of the product is Rs 8/- P per unit. The consumer will purchase as many units as make his marginal utility equal to the price.Thus he will purchase 5 units and pays 8/- per unit. In this way he will spend in all Rs. 40. But the total utility of the 5 units is equal to 65 units. He thus gets a consumer's surplus equal to (65 – 40) = 25 units.

Diagrammatic Representation:

We can represent consumer surplus with the help of the following figure (3.38).

Figure 3.38



In the figure

Total utility derived by the consumer: ODEQ

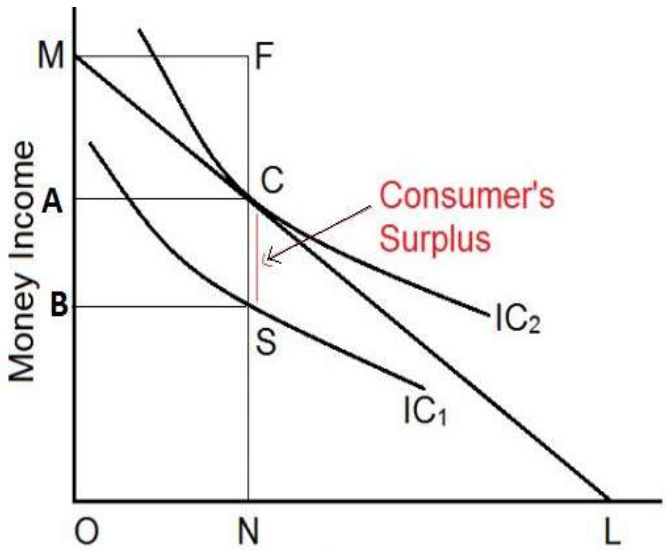
Total price paid by the consumer: OPED

Therefore consumers surplus: ODEQ – OPEQ =PDE

J.R. Hicks' Method of Measuring Consumer's Surplus

Prof. J.R. Hicks and R.G.D. Allen have criticised Marshallian assumptions of consumer's surplus and introduced indifference curve approach to measure consumer's surplus. Hicksian consumer's surplus is explained in the following figure (3.39):

Figure 3.39



In figure, horizontal axis measures commodity A and vertical axis measures money income of the consumer. The explanation of the concept can be done in two steps.

Step 1: Assume that the consumer does not know the price of commodity A. This means that there is no price line or budget line to optimize his consumption. Therefore, he is on the combination S on indifference curve IC1. At point S, the consumer has ON quantity of commodity A and OB amount of money. This implies that the consumer has spent FS amount of money on ON quantity of commodity A.

Step 2: Assume that the consumer knows the price of commodity A. Hence, he can draw his price line or budget line ML. With this price line ML, the consumer realizes that he can shift to a higher indifference curve IC2. At equilibrium point C, the consumer has ON quantity of the commodity and OA amount of money. This implies that the consumer has spent less amount of money than expected for ON quantity of commodity A.. Therefore, CS is the consumer's surplus.

Therefore Hicksian Consumer surplus is

(a) The movement from a lower to a higher indifference curve.

(b) The spending of less money on a commodity than expected

(c) The possession of more money income than expected

The Hicks' version of measuring consumer's surplus attains results without Marshall's doubtful assumption. Hence, Hicks' version is considered to be superior to that of Marshall's.

Module IV

Theory of Production and Costs

1. Production

Firms are economic organizations that purchase inputs and sell outputs. Production refers to the transformation of inputs to outputs, i.e., raw materials to goods. Here production refers not to just the production of goods but the production of services as well. Production creates the supply that allows our needs and wants to be satisfied.

Production is one of the main focuses in economics. Production theories have existed long before Adam Smith, but were only refined during the late 19th century. The theory of production is an effort to explain the principles by which a business firm decides how much of each commodity that it sells (its outputs or products) it will produce, and how much of each kind of labour, raw material, fixed capital good, etc., that it employs (its inputs or factors of production) it will use. The theory involves some of the most fundamental principles of economics. These include the relationship between the prices of commodities and the prices (or wages or rents) of the productive factors used to produce them and also the relationships between the prices of commodities and productive factors, on the one hand, and the quantities of these commodities and productive factors that are produced or used, on the other.

Production is also an activity that creates or adds to current or future utility. Production creates three types of utility.

Form utility: This refers to production process of changing the form of the inputs, i.e. converting the raw material into items possessing utility. For e.g. changing the form of clay to a pot, wood to table, iron to furniture.

Place utility: Change the place of resources from the place where they have no use or limited use to another place where they have greater use. For e.g. transporting gold ore from the mine to the factory and to markets, apples transported from Shimla (production centre) to other parts of the country. Here utility is created or enhanced by the production process of transporting one point where they have limited utility to another place where they have more utility.

Time utility: This refers to the production process of making available materials at times when they are not normally available. For example, industries involved in dried fruits make them available in a time when it is normally not available (off season).

Hence we see that the production activity that converts raw wool is converted to woollen cloth is creation of form utility, the production activity that transports cloth to markets is creation of place utility and the production activity (service of a textile shop) that make woollen clothes in winter is creation of time utility.

Thus the production process involves the use of factors of production. Of the various factors of production, land is a natural resource and labour, capital and entrepreneur are considered as human resources in the sense that they secondary in nature. Land in economics does not mean soil or earth's surface alone, but refers to all free gifts of nature which would include natural resources, fertility of soil, water, air etc. All production involves some dealing of man with nature(e.g. law of variable proportions). As John Stuart Mill put it, 'man can only move matter, not create it'. The utilisation of natural resources is indeed indispensable in production. There can be no doubt about this. When in certain theoretical conceptualizations this fact is not visible, then this does not mean that it is not there. It only means that the authors have for simplicity set aside the problem by assuming that natural resources are available in abundance. This amounts to assuming that their services are 'free goods'. Labour in economics refers to 'mental and physical effort directed to produce goods or services'. However, note that, the work done for the sake of pleasure or affection does not represent labour in economics. For example, if a person performs a musical show for his friends, it will not be counted as labour since it is done for the sake of pleasure. Capital is that part of wealth of an individual or community which is used for further production of wealth. Note that capital is a 'stock' concept in economics and it helps to yield a periodical return called income which is a 'flow' concept. Capital is often called 'produced means of production' or 'man made instruments of production'. E.g. factories, bridges etc. Capital formation is a term that refers to a sustained increase in the stock of real capital in a country. In other words, capital formation means investment creation. Entrepreneur mobilises all the factors of production, i.e., land, labour and capital, and combines them in the right proportion to initiates the process of production. In this process the entrepreneur bears the risk involved in it. An entrepreneur takes key decisions like (a) whether to produce or not (b) how much to produce (c) what input combination to use (c) what type of technology to use.

Probably the most important challenge in the production function is the combination of the factors of production in the right proportion. This requires not only entrepreneurial skills, but also knowledge about the best available technology. While entrepreneurial skill ensures economic efficiency, availability of technology ensures technical efficiency. (Details of parameters of economic efficiency and technical efficiency are discussed later in the chapter)

1.a. Practical applications of the production theory

A theory of production is the statement of technical and technological relationships between inputs and output. We know that when more and more factors of production -labour, capital, land, time, space and raw materials- are employed, total production increases. For example, when a farmer uses more and more of land, labour, agricultural equipments and machinery, irrigation and fertilizers, his total farm production increases. Production increases even if some factor (say, land) is held constant and other factors are increased, till production capacity of land is reached. These facts indicate that there is a relationship between the quantity of factors used and the quantity produced. Production theory analyses this relationship. More precisely, the theory of production explains and formalises the nature of relationships between the factors (inputs) used and output. Thus, the main function of the production theory is to analyse and make generalisations about the relationship between the inputs and the output. In simple words, production theory seeks to answer the following queries: When more and more units of a variable factor (say, labour) is used with a fixed factor (say, capital), how does the total output behave? When all the factors are increased by some proportion, does the output increase in the same proportion? In other words, if the inputs are doubled, will the output be doubled or increase at a different rate? Information on such items will be of immense practical use to producers in taking decisions.

The various decisions a business enterprise makes about its productive activities can be classified into three layers. The first layer includes decisions about methods of producing a given quantity of the output in a plant of given size and equipment. It involves the problem of what is called short-run cost minimization. The second layer, including the determination of the most profitable quantities of products to produce in any given plant, deals with what is called short run profit maximization. The third layer, concerning the determination of the most profitable size and equipment of plant, relates to what is called long-run profit maximization. All these complexities are described in the study of the production function.

There are two special classes of production functions that are frequently mentioned in textbooks but are seldom seen in reality.

2.1. Homogeneous production functions: The production function $Q=f(X_1,X_2)$ is said to be homogeneous of degree n, if given any positive constant k, $f(kX_1,kX_2)=knf(X_1,X_2)$.

When $n>1$, the function exhibits increasing returns, and decreasing returns when $n<1$. When it is homogeneous of degree 1, it exhibits constant returns.

2.2Homothetic functions: are a special class of homogeneous function in which the marginal rate of technical substitution is constant along the function.

2.3Aggregate production functions: Production functions are normally built for a firm or industry. But, in macroeconomics, production functions for whole nations are sometimes constructed. In theory they are the summation of all the production functions of individual producers, however this is an impractical way of constructing them. This is because for the economy as a whole there are many types of outputs and services. Also, there are many types of capital goods including office buildings, factory equipment, airplanes, and other durable goods. Finally, there are many types of labor, from unskilled workers to brain surgeons. There are also methodological problems associated with aggregate production functions. Economists use a process called aggregation to come up with a single measure of output that summarizes all of the different goods and services produced in the economy. The weights are closely related to the relative prices of the goods. That is, an expensive surgery will have a higher weight in the aggregation process than an inexpensive pen. (The aggregate measure of output is called real gross domestic product, or real GDP.)

2.4 Fixed Coefficients Production Function: A production function associates the maximum level of output producible with given amounts of inputs. If the inputs must be combined in fixed proportions, like the ingredients of a recipe in a cookbook, the function is a fixed coefficients production function. It is also called a Leontief function, after its inventor, the economist and Nobel Prize winner, Wassily Leontif. For example, call centers require a one-to-one proportion between workers and telecommunication equipment. The isoquants for such a production function are L-shaped (with the kink on the 45 degree line).

We will now see in detail three types of production functions.

2.5 Linear Production function

The simplest possible production function is a linear production function. A Linear Production Function is a production function that assumes a perfect linear relationship between inputs and total output.

Example: Given a Linear Production Function Q = 20 K + 40 L. If this firm employed 8 units of capital and 17 workers then how much output would they produce?

20 x 8 + 40 x 17 = 840 units of output

2.5. a. Homogenous Production Function

A production function is said to be homogenous if it satisfies the following condition.

Consider a production function Q = f(X, Y). As you know, in the long run all the factors of production can be increased. Suppose we increase both the factors x and y by the same proportion, k. To effect this change we multiply each input factor is by a positive real constant k. The new level of output is Q* and can be represented as

Q* = f (kX, kY).

Now, if we can take k out of the brackets as a common factor (if k can be completely factored out from Q*), then the new level of output Q* can be expressed as a product of k (to any power v) and the initial level of output.

That is Q* = $k^v f$ (X, Y) or Q* = k^vQ

In such cases, where k can be completely factored out is called a homogeneous production function. The formal definition is as follows.

A homogenous production function is a function such that if each of the inputs is multiplied by a real constant k, then k can be completely factored out of the function.

If $k$can not be completely factored out, the production function is non homogenous.

The power v of k is called the degree of homogeneity of the function and is used to measure the return to scale of a function.

As you know returns to scale is the long run analysis of production. The Law of Returns to scale postulates that when all inputs are increased by 1 %: if output increases by 1% it is constant returns to scale; if output increases by less than 1% it is decreasing returns to scale; if output increases by more than 1% it is increasing returns to scale.

Using the power v of k, we can state:

If $v = 1$, it is constant returns to scale

If $v < 1$, it is decreasing returns to scale

If $v > 1$, it is increasing returns to scale

A production function for which $v = 1$ and so returns to scale are constant is called a linearly homogenous production function. Since this implies that when we increase all the factors of production in equal proportions, the output is also increased by the same ratio. Hence such production functions are also called Constant Returns to scale (CRS) production functions.

Returns to scale are measured mathematically by the coefficient of the production function. For example, given a production function $X = b_0L^{b1}K^{b2}$, the returns to scale are measured by the sum b1 + b2.

Uses of a production function

A production function is helpful in the following ways.

1. When the physical quantities of inputs are specified, production function helps to estimate the level of production.

2. When the Q (quantity of output) is fixed, production function gives the different combination of inputs which yields the same level of output.

3. Production function helps to determine the technically efficient combination of inputs and also to select the least cost combination of inputs when the budget constraint is given.

4. Production function helps to estimate the degree of returns to scale prevailing in the process of production.

5. The marginal product of different factors can be obtained from production function.

Production function can be fitted to a particular firm or to a sector or industry or to an economy as a whole. Generally, for a given technology, production function remains the same. As the technology changes, production function will also change. The nature and type of production function depends upon data, time period of investigation and the type of technology employed.

Starting in the early 1950's until the late 1970's production function attracted many economists. During the said period a number of specifications or algebraic forms relating inputs to output were proposed, thoroughly analyzed and used for deriving various conclusions. Especially after the end of the 'capital controversy', search for new specification

of production functions slowed down considerably. We will first concentrate on short run production function. Then we would move to long run or multi-output production function.

Short Run and Long run Analysis of Production

Having seen a production function, we now move to the analysis of production functions. The analysis of production is usually divided into two distinct categories, the short run analysis of production and the long run analysis of production. This distinction is necessary due to the fact that the relation between various inputs and outputs vary at different time intervals. For example, some factors of production like labour can be varied in very short span of time while to vary a factor of production like land requires much longer span of time. The distinction between short run and long run is made more clear in the following section.

1. Short Run and Long Run

All inputs can be divided into two categories: i) fixed inputs and ii) variable inputs. A fixed input is one whose quantity cannot be varied during the time under consideration. The time period will vary depending on the circumstances. Although any input may be varied no matter how short the time interval, the cost involved in augmenting the amount of certain inputs is enormous; so as to make quick variation impractical. Such inputs are classified as fixed and include plant and equipment of the firm.

On the other hand, a variable input is one whose amount can be changed during the relevant period. For example, in the construction business the number of workers can be increased or decreased on short notice. Many builder firms employ workers on a daily wage basis and equal change in the number of workers is made depending upon the need. The amount of milk that goes in the production of butter can be altered quickly and easily and is thus classified as a variable input in the production process.

Whether or not an input is fixed or variable depends upon the time period involved. The longer the length of the time period under consideration, the more likely that the input be variable and not fixed. Economists find it convenient to distinguish between the short run and the long run. The short run is defined to be that period of time when some of the firm’s inputs are

fixed. Since it is most difficult to change plant and equipment among all inputs,

the short run is generally accepted as the time interval over which the firm's land and equipment remain fixed. In contrast, the long run is that period over which all the firm’s

inputs are variable. In other words, the firm has the flexibility to adjust or change its environment.

Production processes of firms generally permit a variation in the proportion in which inputs are used. In the long run, input proportions can be varied considerably. For example, at Tata Motors Limited, an automobile dye can be made on conventional machine tools with more labour and less expensive equipment, or it can be made on numerically controlled machine tools with less labour and more expensive equipment i.e. the amount of labour and amount of equipment used can be varied. On the other hand, there are very few production processes in which inputs have to be combined in fixed proportions. Consider, Ranbaxy or Smith-Kline-Beecham or any other pharmaceutical firm. In order to produce a drug, the firm may have to use a fixed amount of aspirin per 10 gm of the drug. Even in this case a certain (although small) amount of variation in the proportion of aspirin may be permissible. If, on the other hand, no flexibility in the ratio of inputs is possible, the technology is scribed as fixed proportion type.

To conclude we may put it like this. The short run is a time period where only the variable factors of production can be altered, e.g. labour. Long run is a time period where all the factors of production may be varied. All factors become variable here. The firm can make changes in the amount of both the factors – fixed as well as variable. Hence, supply can be adjusted here according to demand in the long run.

Basis	Short Period	Long Period
1. Implication	This is a time period which is less than the time period required to make changes in fixed factors.	This is a time period in which all factors of production can be changed.
2. Output	Output can only be increased by making changes in the quantity of variable factors of production.	Output can be increased by making changes in the quantity of both variable and fixed factors of production.
3. Nature of factors of production	Factors of production here can be grouped into two categories (i) fixed factors (ii) variable factors	In the long run, there is no distinction between fixed factors and variable factors.
4. Effect on price	Here demand plays a dominant role in the determination of price of a commodity.	In the long period, supply can be adjusted according to any change in demand. So, demand and supply play equal role in price determination.

Now let us proceed to the analysis of production. First we the short run analysis of production and then the long run analysis of production.

2. The short run production function / Production with a single variable input / The law of variable proportions / The law of diminishing returns / Law of returns to a factor

The short run analysis of production assumes that labour is the only factor of production which is variable. Consider a production function in the agricultural sector where the quantity of land is fixed at one acre. We examine what happens to production as we add more and more units of labourers to this fixed piece of land.

Before we move on the example let us familiarise ourselves with certain concepts. Product implies the amount of goods produced by a firm during a given period of time. Generally, three concepts are used in this context, viz, (a) total product (b) marginal product and (c) average product. Total Product (TP) or Total Physical Product (TPP) refers to the total amount of goods produced by a firm with the given inputs during a specified period of time. It is the total physical output corresponding to each set of inputs. As the quantity of an input is increased, total product increases. But the rate of increase in total product varies at different levels of factor employment. In the short run, a firm can expand its total output only by increasing the variable factors. Average Product (AP) or Average Physical Product (APP) is the per unit production of the variable factor. Thus . For example, suppose 20 units of a variable factor (labour) produces 100 units of output, then the Average Product of labouris . Thus the average product of labour in this example is 5 units of out put. Marginal Product (MP) or Marginal Physical Product (MPP) is the addition to total product as we use one more unit of the variable factor. For example, suppose the output level is 100 kgs of wheat when we use 3 employees in an acre of land. Now assume that in the next agricultural cycle one more labourer is employed to cultivate the same one acre of land. Now the output increases to 120 kgs of wheat. So we can say that the additional contribution of the additional labourer is 120 – 100 = 20 kgs of wheat. In other word the Marginal Product of labour (MP_L) is 20 units. Thus Note that here we used AP_L and MP_L to indicate that it is representing the contribution of labour alone, since the other factor, land, is assumed to be constant.

Now let us see what happens to TP, AP_L and MP_L as more and more units of the variable factor (labour) is added to the fixed factor (capital).

Table 1 : The law of variable proportions

	Fixed Factor (Land)	Variable Factor (Labour)	Total Product	Average Product of Labour AP_L	Marginal Product of Labour	Stage of production
A	1	0	0	0	0	I Stage
B		1	8	8	8	
C	1	2	18	9	10	
D	1	3	30	10	12	
E	1	4	48	12	18	
F	1	5	65	13	17	
G	1	6	78	13	13	
H	1	7	84	12	6	II Stage
I	1	8	88	11	4	
J	1	9	90	10	2	
K	1	10	90	9	0	
L	1	11	88	8	−2	III satge
M	1	12	84	7	−4	

The table shows that as we add more and more units of labourers to one acre of land, the following changes take place.

1. We start with one acre of land zero labourers, as a hypothetical case. Then we add one labourer to the piece of land. Now total production is 8 units, average production is 8 units and marginal production is also 8 units. MP = 8 implies that the additional / marginal contribution of the first labourer is 8 units. When we add the second labourer to this agricultural land, the TP increases to 18. AP is 9 and MP is 10. Note that AP and MP etc are all exclusive contributions of labourer as land is fixed. As we add the 3rdlabourer, TP

increased to 30. Now the MP is 12. When TP increases to 48, MP is 18 and so on. And finally when TP reaches maximum (90), MP becomes 0. When TP declines (from 90 to 88 and to 84), MP becomes negative. All these show the clear relationship between TP and MP. The MP shows the rate of change of TP.

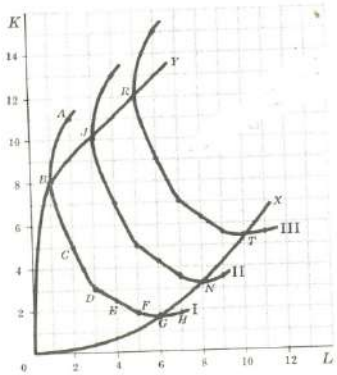
We may also see a peculiarity in the behaviour of total product, if we examine the relation between TP and MP. TP increases at an increasing rate initially (from A to G). You may note that in this range TP is increasing. MP is also increasing. But you can observe a change in the pattern of MP from H to K. In this range, TP continues to increase. But MP declines in this range. This implies that TP is increasing at a decreasing rate. Finally from L to M, TP declines. As a result the rate of change of total product, MP becomes negative.

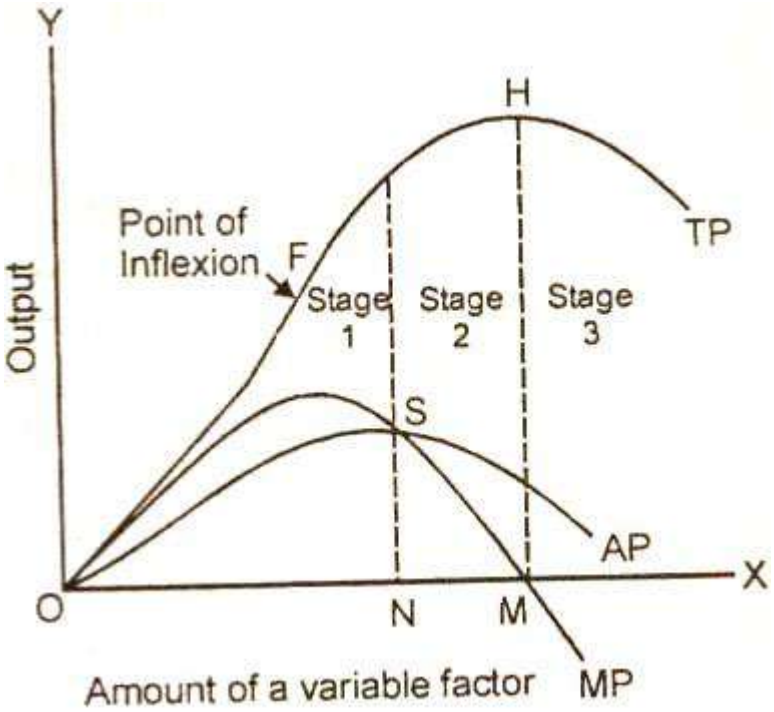
Before moving further, you may note one more thing from this table. You have seen from the headings above that the short run analysis of production is also known as the law of variable proportions. The reason can be made clear from the table. The table shows what happens to output as the proportion in which the inputs are mixed varies. In other words, it means that initially we mixed the two inputs in the ratio 1:1, then 1:2, 1:3 and so on, that is the ratio varies as we proceed forward in the production process.

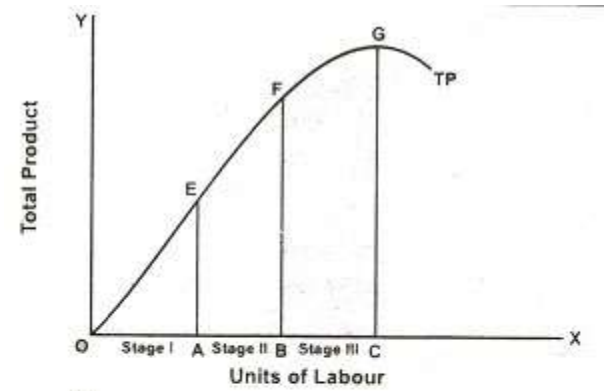
These changes can be grouped into three stages for effective analysis. These stages are shown in the following diagram, where we plot the TP, AP and MP curves.

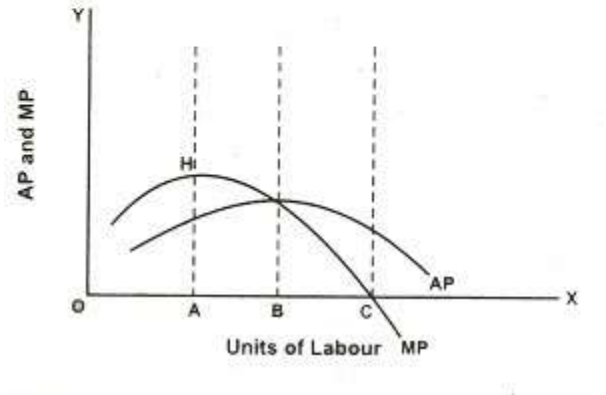
FIGURE 1. (Law of variable proportions)

This can be represented in two ways. One, with the TP, AP and MP curves in the same panel. Two, with the TP curve in the top panel and the AP and MP curves in the bottom panel. We have represented both diagrams below.Note that these diagrams are not drawn based on the data given in the table.









Note that the shape of the AP_L and MP_L curves are determined by the shape of the corresponding TP curve. The MP_L curve reaches a maximum before the AP_L curve. As long as the AP_L is rising, the MP_L is above it; when the AP_L is falling, the MP_L is below it; when AP_L is maximum, the MP_L is equal to AP_L. This behaviour is due to the following reason. For the AP_L to rise, the addition to TP (the MP_L) must be greater than the previous AP_L; for the

AP_L to fall, the addition to TP (the MP_L) must be less than the previous average; for the AP_L to remain unchanged, the addition to TP (the MP_L) must be equal to the previous average.

Stages of Production

Stage I

Stage one is from the point of origin to the point where AP is maximum. This phase contains two distinct stages. The first stage is where the TP curve increases at an increasing rate and the second stage is when TP curve increases at a decreasing rate. The border between the two stages is marked by point F on the TP curve (first digram). We have already shown the reason for this behaviour in the table. Geometrically point F is called the inflection point, where the curvature of the curve changes from concave to convex or convex to concave. Stage I also witnesses the point where MP reaches its maximum. Note that at the end of stage I where AP is at its maximum MP cuts AP. This implies that at this point MP is equal to AP.

You may verify all this from the Table 1. Though this diagram is not drawn based on the data from the table, all the basic relations in the table are depicted in the graph. MP reaches maximum at point E where the MP is at 18 (and AP is at 12). MP starts declining from this point and at G it becomes equal to AP at the value of 13. Note that 13 is the maximum of AP.

Stage II

Stage II goes from the point where the AP is maximum to the point where the TP is maximum or MP is zero. Here TP continues to increase at a diminishing rate and reaches a maximum. AP starts declining. MP continues to fall and reaches zero.

Stage III

Stage III covers the range where the TP is declining or MP is negative. Here TP starts to decline. AP continues to decline. But note that AP never reaches zero or becomes negative. MP continues to fall, but within the negative zone.

Now let us see why the different stages occur.

Stage I occurs because here better utilisation of the fixed factor takes place as additional units of the variable actor are employed. The short run analysis of production, as you have seen in the heading, is also known as the law of diminishing returns. This is because the diminishing returns start operating at the point where MP begins to decline. This occurs because too much labour is used to work in one acre of land.

Stage II is an ideal stage because here TP is increasing. AP and MP, though are decreasing, remains positive.

Stage III is a stage where TP starts declining and MP is negative. Let us go back to Table 1. Consider point M where the TP is 84 with 1 acre of land and 12 labourers. Suppose the farmer decides that in the next agricultural cycle, we will reduce the number of labours by 1, but all other factors (the duration of work, inputs used, implements used etc.) remain the same. We can read from the table that in the next agricultural cycle when the number of labourers was reduced by 1, the TP increased to 88. The question is what was the 12^{th}labourer doing in the field, what was his actual contribution. This is given by his MP, which we can read from the table as −4. The same trend repeats with the 11^{th}labourer. When the 10^{th}labourer is removed, the output did not increase, but remained constant at 90. It implies that the MP of the 10^{th}labourer is zero. Such situations where the marginal contribution of a labourer is either 0 or –ve are called disguised unemployment.

Now the question is which of the three stages will be chosen by a rational producer. A profit maximising producer will not choose stage I. This is because in stage I by adding one more unit of labour, the producer can increase the average productivity of all units. Thus, it would be unwise on the part of the producer to stop production in this stage. It will also be equally irrational to produce in stage III. In this stage the producer can increase output by reducing labour input and thus reduce cost of production. We may say that stage I for labour corresponds to stage III for land (the MP of land is negative). Thus the economically meaningful stage is stage II.

3. The long run production function / Production with two variable inputs / The law of returns to scale

In the long run all the factors are variable. So we need not make an assumption that one input is fixed and the other is variable. As a result of this flexibility in the use of inputs, we can change the scale of operation of a firm; a small scale firm can become medium scale, a medium scale firm can become large scale and so on. So the long run analysis of production which shows what happens to output as the scale of operation itself is changed is called the laws of returns to scale.

Laws of Returns to scale

The laws of returns to scale may be explained like this.

Suppose all inputs are increased by 10%. There are three possible out comes:-

: if output increases by 10 %, it is constant returns to scale

: if output increases by more than 10 %, it is increasing returns to scale

: if output increases by less than 10 %, it is decreasing returns to scale

Thus,

Constant returns to scale refers to the situation where output changes by the same proportion as inputs. i.e., if all inputs are doubled, output also doubles.

Increasing returns to scale refers to the situation where output changes by a larger proportion than the inputs. i.e., if all inputs are doubled, output more than doubles.

Increasing returns to scale refers to the situation where output changes by a smaller proportion than the inputs. i.e., if all inputs are doubled, output less than doubles.

A numerical example of long run returns to scale					
Units of Capital	Units of Labour	Total Output	% Change in Inputs	% Change in Output	Returns to Scale
20	150	3000			
40	300	7500	100	150	Increasing
60	450	12000	50	60	Increasing
80	600	16000	33	33	Constant
100	750	18000	25	13	Decreasing

In the example above, we increase the inputs of capital and labour by the same proportion each time. We then compare the % change in output that comes from a given % change in inputs.

In our example when we double the factor inputs from (150L + 20K) to (300L + 40K) then the percentage change in output is 150% - there are increasing returns to scale.

In contrast, when the scale of production is changed from (600L + 80K0 to (750L + 100K) then the percentage change in output (13%) is less than the change in inputs (25%) implying a situation of decreasing returns to scale.

The returns to scale can be represented in terms of diagram using isoquants. This diagram is given later in this book after we discuss the equilibrium of the producer.

4. The Equilibrium of the Producer

The equilibrium of the producer is analysed using the tools of isoquant and isocost. Let us familiarise ourselves with these tools.

Isoquant

The word 'iso' is of Greek origin and means 'equal' or 'same'. An isoquant is a curve along which quantity is the same. So the isoquant is also called equal product curve. An isoquant is equivalent o the concept of Indifference curve you studied under the analysis of consumer equilibrium. The only difference is that instead of two goods x and y used by a consumer, here we use two inputs labour and capital used by a producer. Here since we are dealing with physical quantity of production, the output can be expressed in terms of numbers. For eg. we may say the output from isoqunat I is K or 100, output from isoquant II is 2K or 200, output from isoqunat III is 3K or 300 and so on. Remember that this was not possible under indifference curve analysis.

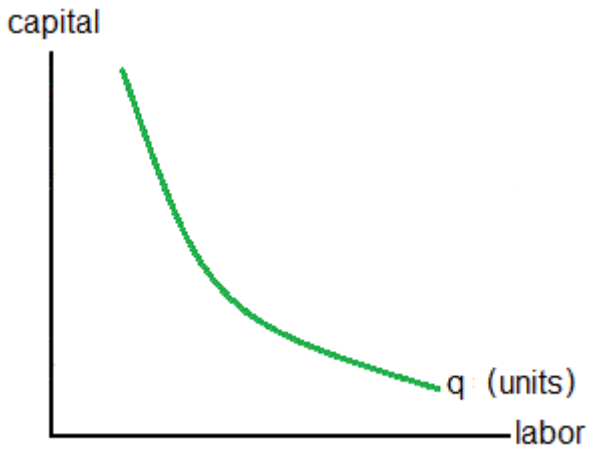
We shall get into further details. Consider a production function which uses two inputs labour and capital.

Table 2

	Isoquant	
	Labour (L)	Capital (K)
A	2	12
B	1	10
C	2	5
D	3	3
E	4	2.3
F	5	1.7
G	6	1.2
H	7	0.8
I	8	1

Table 2 shows a production situation where both the inputs labour and capital are varied simultaneously. For instance, at situation A we use 2 L and 12 K. When we move to situation B, there is change in the quantities of both labour and capital. Now we use 1 unit of labour and 10 units of capital. In situation C, we increase quantity of labour to 2 and reduce the quantity of labour to 5 and so on. Since all factors are variable, we are dealing with the long run. Now the assumption here is that all the different combinations of labour and capital from A to I give the same level of output. If we plot the different combinations of labour and capital (A to I) that give the same quantity of output on a graph, we get an isoquant.

Thus an isoquant is the locus of different combinations of labour and capital that gives the consumer the same level of output. In other words, an isoquant shows the various combinations of two inputs that can be used to produce a specific level of output. Since output remains the same at all points on an isoquant, they are also called equal product curves.



Properties of isoquant

(1) Isoquants are negatively slopped in the relevant range [we will explain what is meant by the relevant range later in this chapter] (2) Isoquants are convex to the origin (3) higher the isoquant, higher is the level of production (4)two isoquants never intersect.

Now we explain what is meant by property number (3) and (4). Consider Table 3. Here we have added data for two more sets of isoquants. As you can see in Isoquant I, point A corresponds to 2 L and 12 K, the same point in Isoquant II corresponds to 4 L and 11 K

which represents higher quantity of input and hence naturally higher level of output. Similarly point A corresponds to 6 L and 13 K in Isoquant III which represents a still higher quantity of input and hence naturally still higher level of output. Thus it is clear that higher the isoquant, higher is the level of production. Due to the same reason, two isoquants can not intersect. If they intersect, it would mean that the output is the same at that point.

If we plot the information in Table 2 on a graph, we get a family of isoquants representing different levels of output which is often referred to as an isoquant map.

Table 3

	Isoquant I		Isoquant II		Isoquant III	
	Labour (L)	Capital (K)	Labour (L)	Capital (K)	Labour (L)	Capital (K)
A	2	12	4	11	6	13
B	1	10	3	10	5	12
C	2	5	4	7	6	9
D	3	3	5	5	7	7
E	4	2.3	6	4.2	8	6.2
F	5	1.7	7	3.5	9	5.5
G	6	1.2	8	3.2	10	5.2
H	7	0.8	9	3	11	5
I	8	1	10	3.7	12	5.9

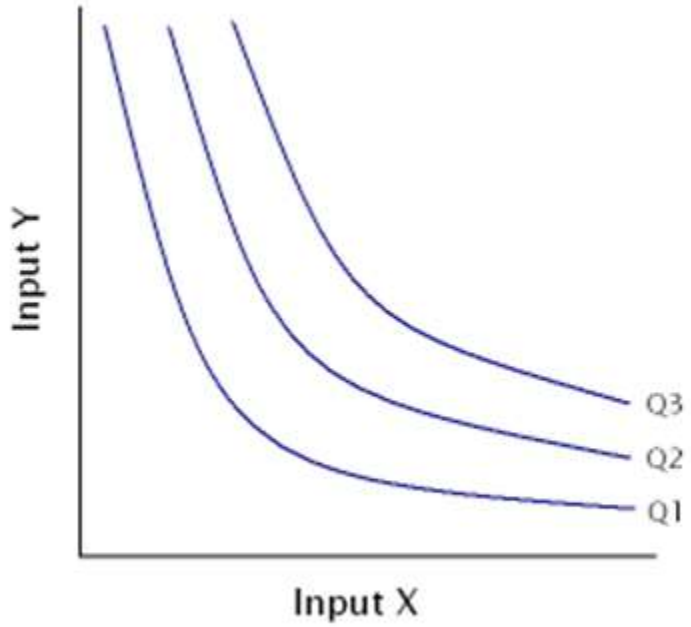
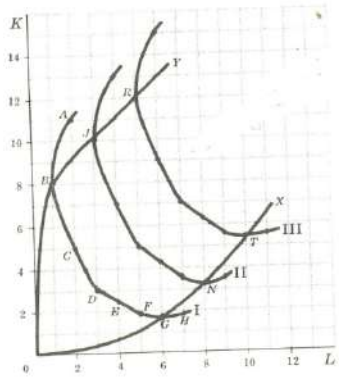


Fig. An Isoquant Map

(Note that the above figure is not drawn strictly based on the data in table 2.)

Now let us concentrate on the first property we stated in the properties of isoquants, that is, isoquants are negatively slopped in the relevant range. What is the relevant range? Go back to Table 2. Consider points A and B for Isoquant I. If move in reverse direction, you may observe that at B we are using 1 L and 10 K. As we move to A, the quantities of both the inputs increase; that is; units of labour increases to 2 and units of capital increases to 12. This is economically inefficient because efficiency means using less of one input as we use more of the other input. The same can be observed at the other end of the Isoquant also, that is, as we move from H to I. At H, the producer uses 7 L and 0.8 K. At point I, quantities of both the inputs increase, L increases to 8 and K increases to 1. Such economically irrelevant points could be seen at both extremes of all the isoquants. If we draw a line to separate the economically relevant regions from economically irrelevant regions, such a line is called a ridge line. We can have an upper ridge line on the top and a lower ridge line at the bottom. The area between the ridge lines are economically relevant regions and the area outside the ridge lines are economically irrelevant regions.

The figure below shows the upper and lower ridge lines.



The property also says within the relevant range the isoquants are negatively sloped. This implies that if the firm wants to use more L, it must to use less K to produce the same level of output (same level of output means remaining on the same isoquant).

Another assumption is that in the relevant range the isoquants are convex to the origin. The property of convexity could be explained using the concept of MRTS.

MRTS

Marginal Rate of Technical Substitution indicates the amount of one input the producer is willing to give up to get an additional unit of another input and still produce the same level of output. MRTS is equivalent o the concept of MRS you studied under the analysis of consumer equilibrium.

When defined in terms of the two inputs, labour and capital, we used in this example; MRTS can be defined like this. The Marginal Rate of Technical Substitution of L for K ($MRTS_{LK}$) refers to the amount of K that a firm can give up by increasing the amount of L used by one unit (and still produce the same level of output, i.e., remain on the same isoquant). Note that as we move down an isoquant, the MRTS diminishes. It is because of the diminishing nature of MRTS that in the relevant range the isoquants are convex to the origin.

The $MRTS_{LK}$ can be found using the concept of Marginal Physical Product or Marginal Product we have already studied. $MRTS_{LK} = MP_L / MP_K$, which is equivalent to the slope of the isoquant.

In Table 4 you can see that in isoquant I, (ignoring the irrelevant regions), as the producer moved from B to C, to get one additional unit of labour, he gave up 5 units of capital. i.e. to increase the quantity of L from 1 to 2, he reduced the quantity of capital by 5 units from 5 to 6. Again to increase L from 2 to 3, he reduced K by 2 units from 5 to 3. This can be observed

for other points also. The same is applicable for isoquant II. Thus the table clearly shows that the $MRTS_{LK}$ diminishes as we move down an isoquant.

Table 4

	Isoquant I			Isoquant II		
	Labour (L)	Capital (K)	$MRTS_{LK}$	Labour (L)	Capital (K)	$MRTS_{LK}$
A	2	12	-	4	11	-
B	1	10	-	3	10	-
C	2	5	5	4	7	3
D	3	3	2	5	5	2
E	4	2.3	0.7	6	4.2	0.8
F	5	1.7	0.6	7	3.5	0.7
G	6	1.2	0.5	8	3.2	0.3
H	7	0.8	0.4	9	3	0.2
I	8	1	-	10	3.7	-

We can represent diminishing MRTS between two factors diagrammatically using an isoquant.

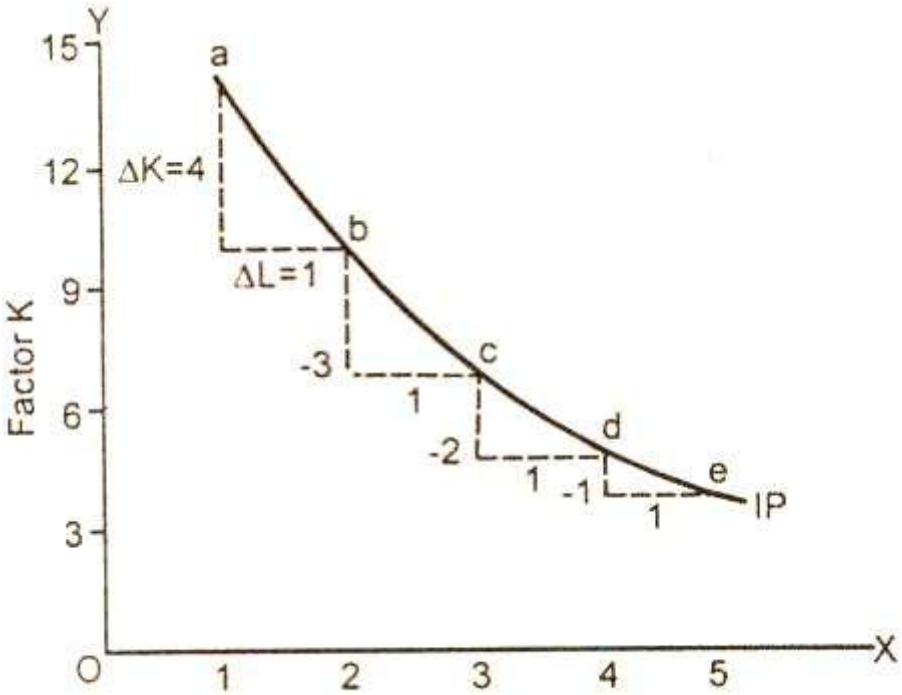


Fig. 12.8

As we can see in the figure, when the firm moves down from point (a) to point (b) and it hires one more labor, the firm gives up 4 units of capital (K) and yet remains on the same isoquant at point (b). So the MRTS is 4. If the firm hires another labor and moves from point (b) to (c), the firm can reduce its capital (K) to 3 units and yet remain on the same isoquant. So the MRTS is 3. If the firm moves from point (C) to (D), the MRTS is 2 and from point D to e, the MRTS is 1. The decline in MRTS along an isoquant as the firm increases labor for capital is called Diminishing Marginal Rate of Technical Substitution. (Note that in drawing this figure students often make a mistake. You have to keep constant the length of the line representing ΔL. At the same time, the length of the line representing ΔK needs to be steadily reduced. This implies that as we move down an isoqunat to get an additional unit of L the amount of K that we are willing to give up reduces. Quite often I have seen students reducing the length of both lines as we move down the isoquant.)

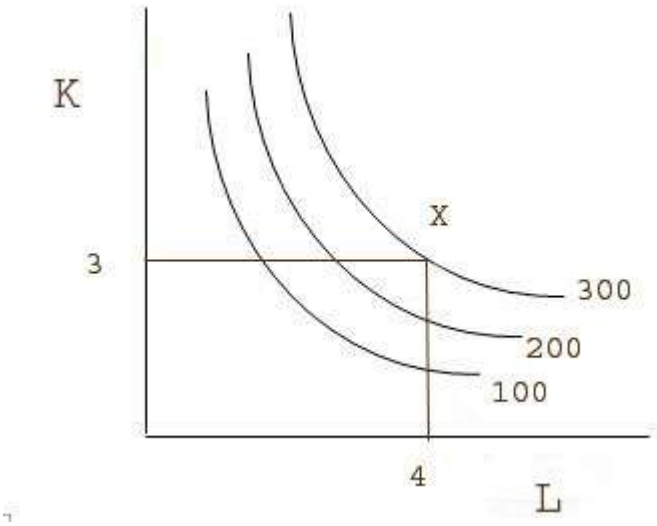
Elasticity of factor substitution

The marginal rate of technical substitution as a measure of the degree of substitutability of factors has a serious limitation. The limitation is that it depends on the units of measurement of the two factors used. A better measure of the substitutability of the factors is provided by the concept of elasticity of substitution. The elasticity of substitution is defined as the percentage change in the capital – labour ration divided by the percentage change in the rate of technical substitution.

The elasticity of substitution is a pure number independent of the units of measurement of K and L, since both the numerator and the denominator are measured in the same units. It is this feature that makes 'elasticity of factor substitution' a much better measure of substitutability.

Isocost

Since the highest isoquant represents the highest level of output, the producers always want to reach the highest possible isoquant. But the aspirations of the producer need not match with the real world situation as in the process of maximisation of output the producer has to face certain constraints. For example, suppose our producer wants to reach figure X on isoquant III in the figure.



The problem is the figure shows that to produce 300 units of output on isoquant III, the producer should use 3 units of capital and 4 units of labour. We have not examined whether the producer has enough funds to procure these inputs. For this we should have information on the per unit price of labour (wage) and capital (interest). We should also know the amount of money (total outlay) available with the producer to invest in this project.

Least Cost Factor Combination: Producers Equilibrium or Optimal Combination of Inputs

The analysis of production function has shown that alternative combinations of factors of production, which are technically efficient, can be used to produce a given level of output. Of these, the firm will have to choose that combination of factors which will cost it the least. In this way the firm can maximise its profits. The choice of any particular method from a set of technically efficient methods is an economic one and it is based on the prices of factors of production at a particular time. The firm can maximise its profits either by maximising the level of output for a given cost or by minimising the cost of producing a given output. In either case, the factors will have to be employed in optimal combination at which the cost of production will be the minimum. There are two ways to determine the least cost combination of factors to produce agiven output. That is,

(a) Finding the total cost of factor combinations

(b) Geometrical method

(a) Finding the Total cost of Factor Combinations

Here we try to find the total cost of each factor combination and choose the one which has the least cost. The cost of each factor combination is found by multiplying the price of each factor by its quantity and then summing it for all inputs. This is illustrated in the Table.

Table: Choosing the Lowest Cost of Production Technique

echnique	**Capital(units)**	**Labour (units)**	**Capital Cost Rs.**	**Labour Cost Rs.**	**Total Cost Rs.**
1	2	3	4	5	6
A	6	10	500×6 = 3000	400×10 = 4000	7000
B	2	14	500×2 =1000	400×14 = 5600	6600

It is assumed that 100 units of output is produced per week and the price of capital and the wage of labour are Rs. 500 and Rs. 400 per week respectively. We assume that there are only two technically efficient methods of producing the output and they are labelled A and B. The table demonstrates that the total cost of producing 100 units of output is Rs. 7000 per week using t

echnique A and Rs. 6600 per week using technique B. The firm will choose technique B, which is an economically efficient (or lowest cost) production technique at the factor prices assumed in the above example. If either of the factor prices alters the equilibrium proportion of the factors will also change so as to use less of those factors that display a price rise. Therefore, we will have a new optimal combination of factors. This can again be found out by calculating the cost of different factor combinations with the new factor prices and choosing the one that costs the least.

2. Geometrical method

Equilibrium of the producer

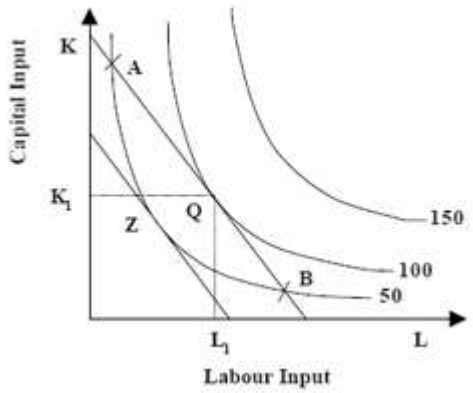
We have thus seen that in an isoquant map the producer's ambition is to reach the highest isoquant. But his aspirations are constrained by the limited income and prices of the two commodities. If we superimpose his aspirations (isoquant map) with the reality (isocost), we get the equilibrium of the producer.

A producer is in equilibrium when he attains maximum output with given total outlay. In other words, the producer is in equilibrium when the highest possible isoquant is tangent to the isocost. At the point of tangency the absolute slope of the isoquant is equal to the absolute slope of the isocost. (Absolute slope means slope without considering –ve or +ve sign). So at equilibrium the slope of isoquant $MRTS_{LK}$ is equal to the slope of isocost P_L/P_K.

At equilibrium $MRTS_{LK} = P_L/P_K$.

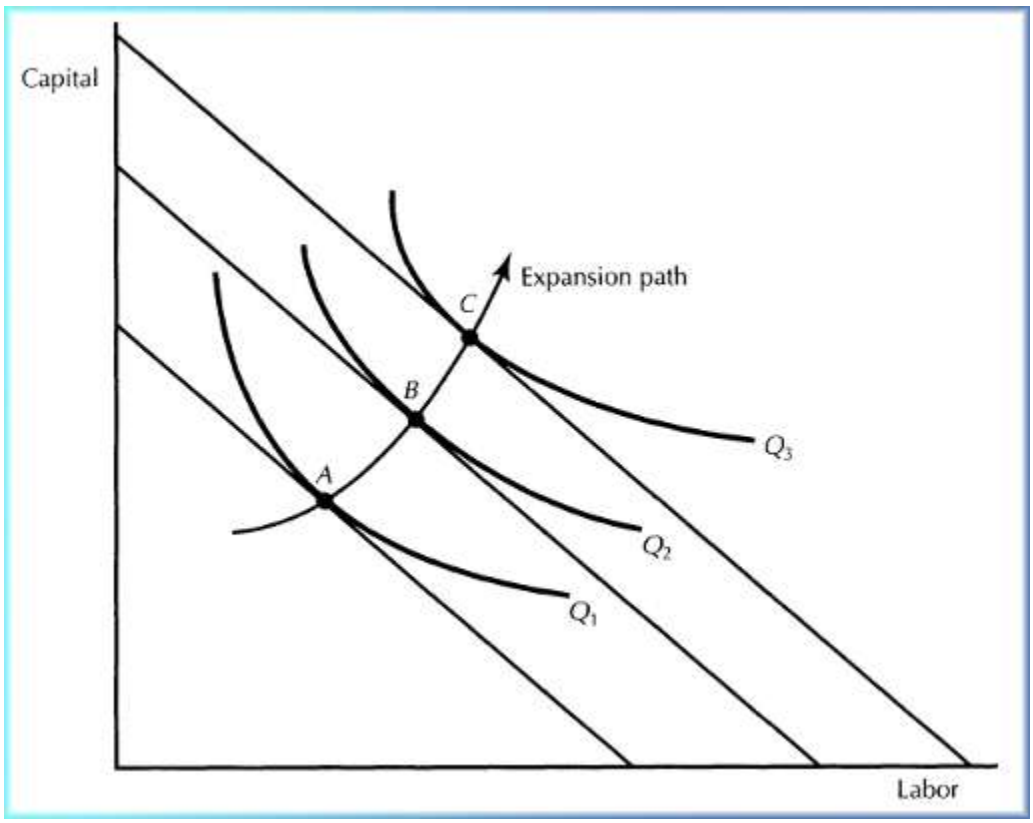
Since $MRTS_{LK} = MP_L/MP_K$ we may also write

Figure of Equilibrium



Suppose in the example we discussed for developing the isocost, the total outlay of the producer increases from Rs. 6 to Rs. 10. This will result in a rightward shift of the isocost to 10 L and 10 K. On the other hand if the total outlay of the producer declines to Rs. 3, the isocost will shift to the left to 3 K and 3 L. (We have already given graphical representation of such shifts in isocost lines.) These shift in the isocost lines over the isoquant map results in shift in points of equilibrium. For instance a shift in the budget line from 3 K – 3 L to 6 K – 6L shifts the equilibrium from E to E_1 in the figure ..... Similarly a shift from 6 K – 6 L to 10 K – 10 L, will result in a right ward shift of equilibrium point to E_2. If we join these different points of equilibrium by a line, we get the expansion path. Put in simple language, an expansion path shows the path through which the output will expand when the total outlay changes. The expansion path is same as the income consumption curve under the indifference curve analysis.

Figure of Shift in Expansion Path

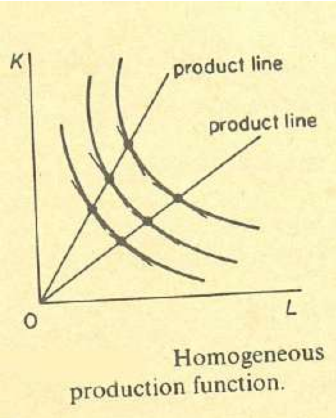


The expansion path shown here is a straight line through origin. This means that as output is expanded, the K/L ratio remain the same. The K/L ratio is the slope of the expansion path. This remains the same because the shift in the isocost lines does not imply change in input prices or the input price ratio P_L/P_K. That is why the isocost lines are shifted parallel to itself.

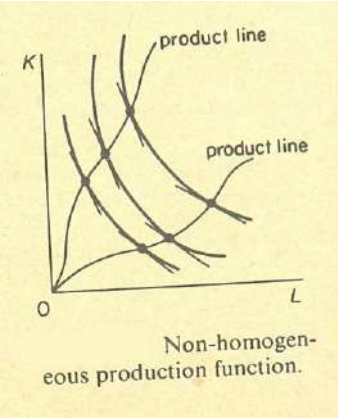
Isocline

An isocline is the locus of points of different isoquants at which the MRS of factors is constant. In other words, the line joining points on different isoquants at which the MRTS (the slope of isoquant) is constant is called an isocline. Thus, an expansion path is a particular type of isoclines along which output expands while factor prices remain constant.

If the production function is homogenous, the isoclines are straight lines through the origin. Along any one isoclines the K/L ration is constant. (fig .....). If the production function is non homogenous, the isoclines will not be straight lines, but their shape will be twiddly. The K/L ratio changes along each isoclines. (fig .....)



Homogeneous production function.



Non-homogen-eous production function.

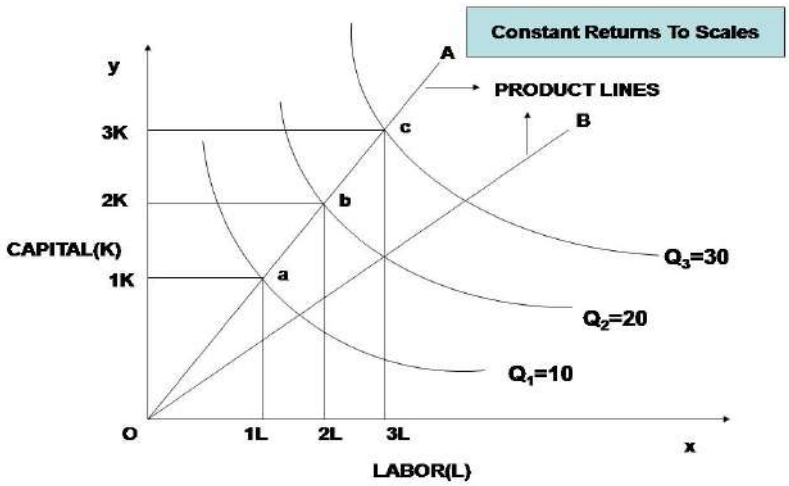
Graphical representation of Laws of returns to scale

The long run analysis of production or the 'Laws of returns to scale' we discussed earlier in this unit, can now be represented in terms of graphs using isoqunats and the expansion path.

First we shall show the concept in three different diagrams and then we shall use one single diagram to represent the three concepts.

Constant Returns to scale

In this stage the scale of inputs and outputs change (increase or decrease) proportionately. This can be explained with the help of the following figure;



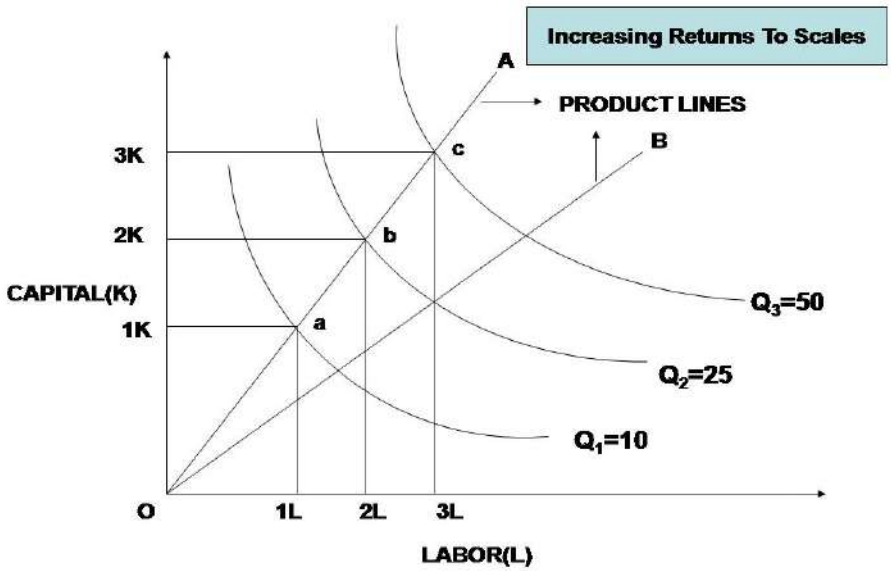
In the above figure product lines or expansion paths OA and OB indicate two hypothetical techniques of production and isoquants Q1 (10 units), Q2 (20 units) and Q3 (30 units) indicate three different levels of output. In the figure movement from point a to b indicates the doubling of both the inputs, from 1K + 1L to 2K + 2L. When inputs are doubled the outputs are also doubled, i.e. from 10 units to 20 units. Similarly, the movement from point b to c shows the increment in inputs from 2K + 2L to 3K + 3L, which is 50% increment. This 50% increment leads to the increment of output from 20 units to 30 units, which is also 50%. This kind of input output relationship exhibits the constants returns to scale.

Reasons for constant returns to scale : The constant returns to scale arise due to the limits of economies to scale (Detailed explanation of the concept of economies of scale / diseconomies of scale is given later in this chapter where we discuss cost of production. Please read that section for a proper understanding). The producers are unable to efficiently manage the inputs with gradual increase in scale. After certain time period when economies of scale end and diseconomies are yet to begin, the returns to scale appear to be constant. Various

communication and coordination, management (personnel, financial, marketing) problems increase with increase in input and output, which leads to diseconomies. Constant returns to scale are transitional stage between increasing and decreasing returns to scale.

Increasing returns to scale

Increasing Returns to Scale prevails when output increases faster than inputs, i.e., percentage increase in output exceeds percentage increase in inputs. This implies that output increases more than proportionately to the increase in input and the rate of increase in output goes on increasing with each subsequent increase in input. For e.g. if all the inputs of production are increased by 100% the output increases by 150% and so on. In this kind of input-output relationship Increasing Returns to Scale exists. This can be explained with the help of the following diagram;



In the above diagram Q1, Q2 and Q3 are the isoquants showing three different levels of output – 10 units, 25 units and 50 units respectively. Product lines OA and OB show the relationship between inputs and outputs. The movement from point a to b indicates the increment of combination of inputs (labour and capital) from 1K+1L to 2K+2L. The movement also shows the increment in output from 10 units to 25 units. This shows that when inputs are increased by double the output increases by more than double, which explains the concept of increasing returns to scale. The case is same in the case of movement from point b to c as well.

Reasons for increasing return to scale: The increasing returns to scale is possible because of "economies of scale". (Detailed explanation of the concept of economies of scale / diseconomies of scale is given later in this chapter where we discuss cost of production. Please read that section for a proper understanding). The possible economies to scale are;

(a) Higher Degree of Specialisation: Due to increase in number of inputs, for e.g. labor and machines, higher degree of specialization of both labour and managerial cadre is possible. The use of specialized labour and management helps in increasing productivity per units of inputs by utilizing their cumulative efforts and thus contributes in increasing returns to scale.

(b) Technical and managerial indivisibilities: Most of the machines and equipments can be better used only in certain range of output. Such inputs, used in production process are given in a definite size and which cannot be divided into small parts to suit small scale productions. For example, half a turbine cannot be used, a part of locomotive machine cannot be used and similarly, half of a manager cannot be employed. Because of the indivisibility of these inputs, they have to be employed in a minimum quantity even if scale of production is much less than their capacity output. Therefore when scale of production is increased by increasing all inputs, the productivity of indivisible factor increases exponentially, this results in increasing returns to scale.

(c) Dimensional relations: In some cases, due to increased dimensions, output rises faster than inputs, which leads to increasing returns to scale. For instance let us consider an example of a tank manufacturer. When he uses 6 metal plates of 1 square feet each, he can produce a water tank of capacity 1 cubic feet. But when he uses 6 metal plates of 2 cubic feet each he can produce a water tank of capacity 8 cubic feet. In this example when inputs are doubled the output is 8 times, i.e. the concept of increasing returns to scale prevails in this example.

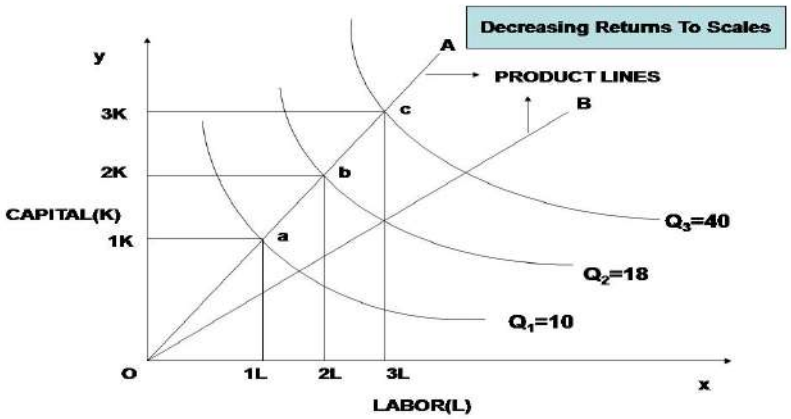
(d) Marketing economies: The greater requirements of inputs and the corresponding increase of outputs lead to various marketing economies. For e.g. when raw materials are purchased in bulk, the purchaser can purchase them at a cheaper price. Similarly suppliers also favour the bulk purchaser and the good quality raw materials are delivered timely. These factors finally help to increase output fast.

(e) Risk bearing economies: Big producers can bear more business risks than small producers. With increase in scale of inputs and outputs, risk bearing capacity also increases.

Big firms can plan and diversify products and markets fast that are helpful to raise output fast.

Decreasing Returns to scale

The decreasing return to scale prevails when the output increases slower than inputs and vice-versa. Or we can say that when output increases less than proportionately to increase in inputs (capital and labour) and the rate of rise in output goes on decreasing, it is called decreasing return to scale. This can also be explained with the help of the following figure;



In the above figure OA and OB are the product lines indicating two hypothetical techniques of production and isoquants Q1 (10 units), Q2 (18 units) and Q3 (40 units) indicate three different levels of output. When both the inputs are doubled, i.e. from 1K + 1L to 2K + 2L the output increases from 10 units to 18 units (that is 80% increase), which is less than the proportionate increase in inputs. Similarly the movement from point b to c indicates the increment in the inputs by 50%, whereas the increment in output is only 33.33%. This shows decreasing returns to scale.

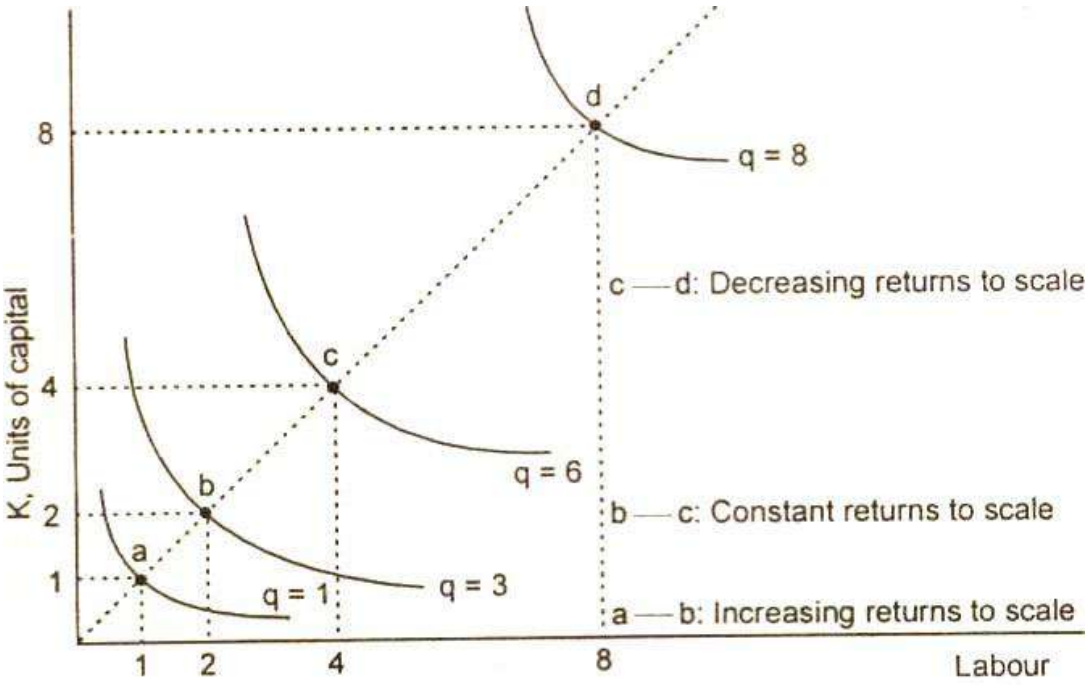
Reasons for decreasing returns to scale: Decreasing returns to scale arises mainly because of diseconomies of scale. Some of the diseconomies which cause decreasing returns to scale are;

(a) Managerial inefficiency: Diseconomies begin to start first at the management level. Managerial inefficiencies arise from expansion of scale itself, which eventually decreases the level of output.

(b) Exhaustibility of natural resources: It also leads to the decreasing returns to scale. For e.g. doubling the size of the coal mining plant does not double the coal output because of limitedness of coal deposits or difficult accessibility to coal deposits.

(c) Inefficient control: When the size of the firm is small the owner can efficiently handle and control all the departments individually. With increase in size of the firm (increase in inputs and outputs), various departments are created. Thereby controlling efficiency may decrease creating hindrances in production.

The following figure represents the three concepts of increasing, decreasing and constant returns to scale in a single diagram.



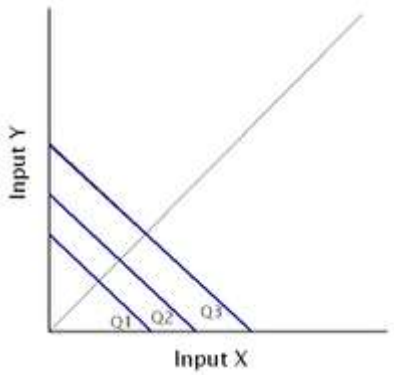
The figure shows that when a firm uses one unit of labour and one unit of capital, point a, it produces 1 unit of quantity as is shown on the q = 1 isoquant. When the firm doubles its outputs by using 2 units of labour and 2 units of capital, it produces more than double from q = 1 to q = 3.

So the production function has increasing returns to scale in this range. Another output from quantity 3 to quantity 6. At the last doubling point c to point d, the production function has decreasing returns to scale. The doubling of output from 4 units of input, causes output to increase from 6 to 8 units increases of two units only.

Exceptional isoquants

The normal isoquant is convex to the origin. It is often referred to as the 'smooth convex isoquant', because it assumes continuous substitutability of the two factors K and L. However there are some exceptional isoquants. An isoquant is the locus of all the technically efficient methods for producing a given level of production. The production isoquant may assume various shapes depending on the degree of substitutability of factors.

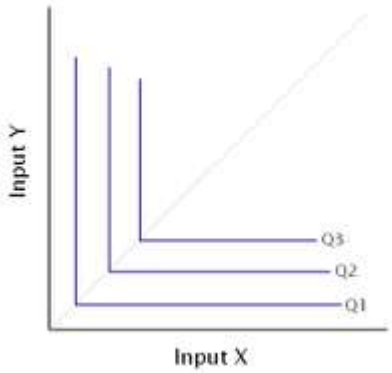
(a) Linear Isoquant: In this case, the isoquant would be straight lines as in the figure. This type assumes perfect substitutability of factors of production. In this case, labour and capital are perfect substitutes, that is, the rate at which labour can be substituted for capital in production is constant. This implies that the MRTS between the two factors remain constant all along the isoquant, i.e, the assumption of DMRTS is not applicable here.



This isoquant envisages that a given commodity may be produced by using only capital or only labour or by an infinite combination of labour and capital. At point A on the isoquant the level of output can be produced with capital alone (i.e. without labour). Similarly, point B indicates that the same level of output can be produced with labour alone (i.e. without any capital). Though this may look unrealistic because capital and labour are not perfectly substitutable, there could be other situations where it is applicable. For example consider a production situation in a bakery where the oven can be heated using either LPG or electricity. Here LPG can be completely substituted by electricity.

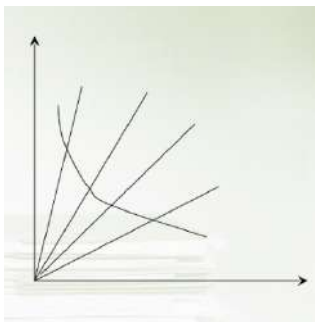
(b) Fixed Proportion Isoquant: This isoquant assumes zero substitutability of the factors of production. There is only one method of producing any one commodity. In this case, the isoquant takes the form of a right angle as in Fig.

Fig. 3.10: Right Angled Isoquant



In this case, labour and capital are perfect complements, that is, labour and capital must be used in fixed proportion shown by point C. The output can be increased only by increasing both the quantity of labour and capital in the same proportion depicted at the point C. This isoquant is called input-output isoquant or Leontief isoquant after Leontief, who invented the input-output analysis.

(c) Kinked Isoquant:



This isoquant assumes only limited substitutability of capital and labour. There are only a few processes for producing any one commodity. This is shown in Fig. where A1, A2, A3 and A4 show the production process and Q is the kinked isoquant. In this case, the substitutability of factors is possible only at the kinks. This type of isoquant is also called 'activity analysis iso quant' or 'linear programming isoquant' because it is basically used in linear programming problems. This is more realistic type of isoquant because engineers, managers and production executives consider the production process as a discrete rather than continuous process.

Now, our usual isoquant: - the Smooth Convex Isoquant:This type of isoquant assumes continuous substitutability of capital and labour over a certain range, beyond which the factors cannot substitute each other. (Recall the relevant regions and irrelevant regions we separated using ridge lines). The traditional economic theory has adopted this isoquant for analysis since it is uncomplicated. Further, this is an approximation to the more realistic form

of a kinked isoquant because as the number of process become infinite, the isoquant becomes a smooth curve. Therefore, this isoquant is useful in the analysis of real world situations.

Economies of Scale

The study of economies of scale is associated with large scale production. Today there is a general tendency to organize production on a large scale basis. Mass production of standardized goods has become the order of the day. Large scale production is beneficial and economical in nature. "The advantages or benefits that accrue to a firm as a result of increase in its scale of production are called 'Economies of Scale'. They have close relationship with the size of the firm. They influence the average cost over different ranges of output. They are gain to a firm. They help in reducing production cost and establishing an optimum size of a firm. Thus, they help a lot and go a long way in the development and growth of a firm. According to Prof. Marshall these economies are of two types, viz Internal Economies and External Economics. Now we shall study both of them in detail.

I. Internal Economies

Internal Economies are those economies which arise because of the actions of an individual firm to economize its cost. They arise due to increased division of labour or specialization and complete utilization of indivisible factor inputs. Prof. Cairncross points out that internal economies are open to a single factory or a single firm independently of the actions of other firms. They arise on account of an increase in the scale of output of a firm and cannot be achieved unless output increases. The following are some of the important aspects of internal economies.

1. They arise 'with in' or 'inside' a firm.

2. They arise due to improvements in internal factors.

3. They arise due to specific efforts of one firm.

4. They are particular to a firm and enjoyed by only one firm.

5. They arise due to increase in the scale of production.

6. They are dependent on the size of the firm.

7. They can be effectively controlled by the management of a firm.

8. They are called as "Business Secrets "of a firm.

Kinds of Internal Economies:

1. Technical Economies

These economies arise on account of technological improvements and its practical application in the field of business. Economies of techniques or technical economies are further subdivided into five heads.

a) Economies of superior techniques: These economies are the result of the application of the most modern techniques of production. When the size of the firm grows, it becomes possible to employ bigger and better types of machinery. The latest and improved techniques give place for specialized production. It is bound to be cost reducing in nature. For example, cultivating the land with modern tractors instead of using age old wooden ploughs and bullock carts, use of computers instead of human labour etc.

b) Economies of increased dimension: It is found that a firm enjoys the reduction in cost when it increases its dimension. A large firm avoids wastage of time and economizes its expenditure. Thus, an increase in dimension of a firm will reduce the cost of production. For example, operation of a double-decker instead of two separate buses.

c) Economies of linked process: It is quite possible that a firm may not have various processes of production within its own premises. Also it is possible that different firms through mutual agreement may decide to work together and derive the benefits of linked processes, for example, in dairy farming, printing press, nursing homes etc.

d) Economies arising out of research and by - products: A firm can invest adequate funds for research and the benefits of research and its costs can be shared by all other firms. Similarly, a large firm can make use of its wastes and by-products in the most economical manner by producing other products. For example, cane pulp, molasses, and bagasse of sugar factory can be used for the production of paper, varnish, distilleries etc.

e) Inventory Economies. Inventory management is a part of better materials management. A big firm can save a lot of money by adopting latest inventory management techniques. For example, Just-In-Time or zero level inventory techniques. The rationale of the Just-In-Time technique is that instead of having huge stocks worth of lakhs and crores of rupees, it can ask the seller of the inputs to supply them just before the commencement of work in the production department each day.

2. Managerial Economies:

They arise because of better, efficient, and scientific management of a firm. Such economies arise in two different ways.

a) Delegation of details: The general manager of a firm cannot look after the working of all processes of production. In order to keep an eye on each production process he has to delegate some of his powers or functions to trained or specialized personnel and thus relieve himself for co-ordination, planning and executing the plans. This will enable him to bring about improvements in production process and in bringing down the cost of production.

b) Functional Specialization: It is possible to secure economies of large scale production by dividing the work of management into several separate departments. Each department is placed under an expert and the rest of the work is left into the hands of specialists. This will ensure better and more efficient productive management with scientific business administration. This would lead to higher efficiency and reduction in the cost of production.

3. Marketing or Commercial economies:

These economies will arise on account of buying and selling goods on large scale basis at favourable terms. A large firm can buy raw materials and other inputs in bulk at concessional rates. As the bargaining capacity of a big firm is much greater than that of small firms, it can get quantity discounts and rebates. In this way economies may be secured in the purchase of different inputs.

A firm can reduce its selling costs also. A large firm can have its own sales agency and channel. The firm can have a separate selling organization, marketing department manned by experts who are well versed in the art of pushing the products in the market. It can follow an aggressive sales promotion policy to influence the decisions of the consumers.

4. Financial Economies

They arise because of the advantages secured by a firm in mobilizing huge financial resources. A large firm on account of its reputation, name and fame can mobilize huge funds from money market, capital market, and other private financial institutions at concessional interest rates. It can borrow from banks at relatively cheaper rates. It is also possible to have large overdrafts from banks. A large firm can float debentures and issue shares and get subscribed by the general public. Another advantage will be that the raw material suppliers, machine suppliers etc., are willing to supply material and components at comparatively low rates, because they are likely to get bulk orders. Thus, a big firm has an edge over small firms in securing sufficient funds more easily and cheaply.

5. Labour Economies

These economies will arise as a result of employing skilled, trained, qualified and highly experienced persons by offering higher wages and salaries. As a firm expands, it can employ a large number of highly talented persons and get the benefits of specialization and division of labour. It can also impart training to existing labour force in order to raise skills, efficiency and productivity of workers. New schemes may be chalked out to speed up the work, conserve the scarce resources, economize the expenditure and save labor time. It can provide better working conditions, promotional opportunities, rest rooms, sports rooms etc, and create facilities like subsidized canteen, crèches for infants, recreations. All these measures will definitely raise the average productivity of a worker and reduce the cost per unit of output.

6. Transport and Storage Economies

They arise on account of the provision of better, highly organized and cheap transport and storage facilities and their complete utilization. A large company can have its own fleet of vehicles or means of transport which are more economical than hired ones. Similarly, a firm can also have its own storage facilities which reduce cost of operations.

7. Over Head Economies

These economies will arise on account of large scale operations. The expenses on establishment, administration, book-keeping, etc, are more or less the same whether production is carried on small or large scale. Hence, cost per unit will be low if production is organized on large scale.

8. Economies of Vertical integration

A firm can also reap this benefit when it succeeds in integrating a number of stages of production. It secures the advantages that the flow of goods through various stages in production processes is more readily controlled. Because of vertical integration, most of the costs become controllable costs which help an enterprise to reduce cost of production.

9. Risk-bearing or survival economies

These economies will arise as a result of avoiding or minimizing several kinds of risks and uncertainties in a business. A manufacturing unit has to face a number of risks in the business. Unless these risks are effectively tackled, the survival of the firm may become difficult. Hence many steps are taken by a firm to eliminate or to avoid or to minimize various kinds of risks. Generally speaking, the risk-bearing capacity of a big firm will be

much greater than that of a small firm. Risk is avoided when few firms amalgamate or join together or when competition between different firms is either eliminated or reduced to the minimum or expanding the size of the firm. A large firm secures risk-spreading advantages in either of the four ways or through all of them.

· **Diversification of output** Instead of producing only one particular variety, a firm has to produce multiple products. If there is loss in one item, it can be made good in other items.

· **Diversification of market**: Instead of selling the goods in only one market, a firm has to sell its products in different markets. If consumers in one market desert a product, it can cover the losses in other markets.

· **Diversification of source of supply**: Instead of buying raw materials and other inputs from only one source, it is better to purchase them from different sources. If one person fails to supply, a firm can buy from several sources.

· **Diversification of the process of manufacture**: Instead adopting only one process of production to manufacture a commodity, it is better to use different processes or methods to produce the same commodity so as to avoid the loss arising out of the failure of any one process.

II. External Economies

External economies are those economies which accrue to the firms as a result of the expansion in the output of whole industry and they are not dependent on the output level of individual firms. These economies or gains will arise on account of the overall growth of an industry or a region or a particular area. They arise due to benefit of localization and specialized progress in the industry or region. Prof. Stonier & Hague points out that external economies are those economies in production which depend on increase in the output of the whole industry rather than increase in the output of the individual firm The following are some of the important aspects of external economies.

1. They arise ‘outside’ the firm.

2. They arise due to improvement in external factors.

3. They arise due to collective efforts of an industry.

4. They are general, common & enjoyed by all firms.

5. They arise due to overall development, expansion & growth of an industry or a region.

6. They are dependent on the size of industry.

7. They are beyond the control of management of a firm.

8. They are called as “open secrets” of a firm.

Kinds of External Economies

1. Economies of concentration or Agglomeration

They arise because in a particular area a very large number of firms which produce the same commodity are established. In other words, this is an advantage which arises from what is called ‘Localization of Industry’. The following benefits of localization of industry is enjoyed by all the firms-provision of better and cheap labor at low or reasonable rates, trained, educated and skilled labor, transport and communication, water, power, raw materials, financial assistance through private and public institutions at low interest rates, marketing facilities, benefits of common repairs, maintenance and service shops, services of specialists or outside experts, better use of by-products and other such benefits. Thus, it helps in reducing the cost of operation of a firm.

2. Economies of Information

These economies will arise as a result of getting quick, latest and up to date information from various sources. Another form of benefit that arises due to localization of industry is economies of information. Since a large number of firms are located in a region, it becomes possible for them to exchange their views frequently, to have discussions with others, to organize lectures, symposiums, seminars, workshops, training camps, demonstrations on topics of mutual interest. Revolution in the field of information technology, expansion in inter-net facilities, mobile phones, e-mails, video conferences, etc. has helped in the free flow of latest information from all parts of the globe in a very short span of time. Similarly, publication of journals, magazines, information papers etc have helped a lot in the dissemination of quick information. Statistical, technical and other market information becomes more readily available to all firms. This will help in developing contacts between different firms. When inter-firm relationship strengthens, it helps a lot to economize the expenditure of a single firm.

3. Economies of Disintegration

These economies will arise as a result of dividing one big unit in to different small units for the sake of convenience of management and administration. When an industry grows beyond

a limit, in that case, it becomes necessary to split it in to small units. New subsidiary units may grow up to serve the needs of the main industry. For example, in cotton textiles industry, some firms may specialize in manufacturing threads, a few others in printing, and some others in dyeing and coloring etc. This will certainly enhance the efficiency in the working of a firm and cut down unit costs considerably.

4. Economies of Government Action

These economies will arise as a result of active support and assistance given by the government to stimulate production in the private sector units. In recent years, the government in order to encourage the development of private industries has come up with several kinds of assistance. It is granting tax-concessions, tax-holidays, tax-exemptions, subsidies, development rebates, financial assistance at low interest rates etc.

It is quite clear from the above detailed description that both internal and external economies arise on account of large scale production and they are benefits to a firm and cost reducing in nature.

5. Economies of Physical Factors

These economies will arise due to the availability of favorable physical factors and environment. As the size of an industry expands, positive physical environment may help to reduce the costs of all firms working in the industry. For example, Climate, weather conditions, fertility of the soil, physical environment in a particular place may help all firms to enjoy certain physical benefits.

6. Economies of Welfare

These economies will arise on account of various welfare programs under taken by an industry to help its own staff. A big industry is in a better position to provide welfare facilities to the workers. It may get land at concessional rates and procure special facilities from the local governments for setting up housing colonies for the workers. It may also establish health care units, training centres, computer centres and educational institutions of all types. It may grant concessions to its workers. All these measures would help in raising the overall efficiency and productivity of workers.

Diseconomies of Scale

When a firm expands beyond the optimum limit, economies of scale will be converted in to diseconomies of scale. Over growth becomes a burden. Hence, one should not cross the limit.

On account of diseconomies of scale, more output is obtained at higher cost of production. The following are some of the main diseconomies of scale

1. Financial diseconomies. . As there is over growth, the required amount of fiancée may not be available to a firm. Consequently, higher interest rates are to be paid for additional funds**.**

2. Managerial diseconomies. Excess growth leads to loss of effective supervision, control, management, coordination of factors of production leading to all kinds of wastages, indiscipline and rise in production and operating costs.

3. Marketing diseconomies. Unplanned excess production may lead to mismatch between demand and supply of goods leading to fall in prices. Stocks may pile up, sales may decline leading to fall in revenue and profits.

4. Technical diseconomies. When output is carried beyond the plant capacity, per unit cost will certainly go up. There is a limit for division of labor and specialization. Beyond a point, they become negative. Hence, operation costs would go up.

5. Diseconomies of risk and uncertainty bearing. If output expands beyond a limit, investment increases. The level of inventory goes up. Sales do not go up correspondingly. Business risks appear in all fields of activities. Supply of factor inputs become inelastic leading to high prices.

6. Labour diseconomies. An unwieldy firm may become impersonal. Contact between labor and management may disappear. Workers may demand higher wages and salaries, bonus and other such benefits etc. Industrial disputes may arise. Labor unions may not cooperate with the management. All of them may contribute for higher operation costs.

II. External diseconomies. When several business units are concentrated in only one place or locality, it may lead to congestion,, environmental pollution, scarcity of factor inputs like, raw materials, water, power, fuel, transport and communications etc leading to higher production and operational costs.

Thus, it is very clear that a firm can enjoy benefits of large scale production only up to a limit. Beyond the optimum limit, it is bound to experience diseconomies of scale. Hence, there should be proper check on the growth and expansion of a firm.

Internalization of External Economies

It implies that a firm will convert certain external benefits created by the government or the entire society to its own favourwith out making any additional investments. A firm may start

a new unit in between two big railway stations or near the air port or near the national high ways or a port so that it can enjoy all the infrastructure benefits. Similarly, a new computer firm can commence its operations where there is 24 hours supply of electricity. Hence, they are also called as privatization of public benefits. Such type of efforts is to be encouraged by the government.

Externalization of Internal Diseconomies

In this case, a particular firm on account of its regular operations will pass on certain costs on the entire society. A firm instead of taking certain precautionary measures by spending some amount of money will escape and pass on this burden to the government or the society. For example, a firm may throw chemical or industrial wastes, dirt and filth either to open air or rivers leading to environmental pollution. In that case, the government is forced to spend more money to clean river water or prevent environmental pollution. This is a clear case of externalized internal diseconomies. It is to be avoided at all costs.

Some economists divide economies of scale into another category. Viz, Real Economies orPecuniary Economies.

Real Economies

Real economies are those associated with a reduction in the physical quantity of inputs, raw materials, various types of labour and various types of capital. Real economies are normally divided into the following four categories. (a) production economies (b) selling or marketing economies (c) managerial economies and (d) transport and storage economies. (We have discussed these concepts in detail already).

Pecuniary Economies

Pecuniary economies are economies realised from paying lower prices for the factors used in the production and distribution of the product, due to bulk buying by the firm as its size increases. Such economies are monetary in nature and they do not imply an actual decrease in the quantity of inputs used. It is experienced by the firm in the form of lower prices paid for raw materials (bought at discount due to bulk buying), lower interest rates, lower cost of finance and probably lower wages. Note that lower wages can happen only if the firm becomes so large as to acquire the power of a labour monopolist, i.e, the firm is able to provide all or most of the employment in the sector.

Economies of Scope

A closely related concept is economies of scope, where the economies arise out of diversity rather than size.

It is a common factor to observe that when a single-product firm expands its volume of output, it would enjoy certain economies of scale. As a result, production cost per unit declines and more output is obtained at lower cost of production. Sometimes they would enjoy certain other external benefits due to the overall improvements in the entire area or city in which operates. Apart from these two types of benefits, we also come across another type of benefits in recent years. They are popularly known as economies of scope.

Economies of scope may be defined as those benefits which arise to a firm when it produces more than one product jointly rather than producing two items separately by two different business units. In this case, the benefits of the joint output of a single firm are greater than the benefits if two products are produced separately by two different firms. Such benefits may arise on account of joint use of production facilities, joint marketing efforts, or use of the same administrative office and staff in an organization. Sometimes, production of one product automatically results in the production of another by-product leading to a reduction in average cost of production.

Diseconomies of Scope

Diseconomies of scope may be defined as those disadvantages which occur when cost of producing two products jointly are costlier than producing them individually. In this case, it would be profitable to produce two goods separately than jointly. For example, with the help of same machinery, it is not possible to produce two goods together. It involves buying two different machineries. Hence in this case, production costs would certainly go up.

Cobb Douglas Production Function

Out of all the production functions used in economics, the most popular production function is the Cobb Douglas production function, also known as the C-D function. In economics, the Cobb Douglas form of production functions is widely used to represent the relationship of an output to inputs. Though similar functions were originally used by Knut Wicksell (1851–1926), the Cobb-Douglas form was developed and tested against statistical evidence by Charles Cobb and Paul Douglas.

In the 1920s the economist Paul Douglas was working on the problem of relating inputs and output at the national aggregate level. A survey by the National Bureau of Economic Research found that during the decade 1909-1918, the share of output paid to labour was fairly constant at about 74% , despite the fact the capital/labour ratio was not constant. He enquired of his friend Charles Cobb, a mathematician, if any particular production function might account for this. This gave birth to the original Cobb-Douglas production function which they propounded in their 1928 paper, 'A Theory of Production'.

The general form of a C-D function is stated as

where: Q = total production (the monetary value of all goods produced in a year), L = labour input, K = capital input and A = total factor productivity or technology, which is assumed to be a constant. Here α and β are the output elasticities of labour and capital, respectively. These values are constants and are determined by available technology. Output elasticity measures the responsiveness of output to a change in levels of either labour or capital used in production, ceteris paribus. For example if $\alpha = 0.15$, a 1% increase in labour would lead to approximately a 0.15% increase in output.

It is generally said that a strict C-D function assumes constant returns to scale as $\alpha + \beta = 1$.(since the returns to scale are measured mathematically by the coefficient of the production function).

Cobb and Douglas were influenced by statistical evidence that appeared to show that labour and capital shares of total output were constant over time in developed countries. However, now many economists doubt whether constancy over time exists. But at your level of understanding, we say that for a C-D function, $\alpha + \beta = 1$

2.6.a. Properties of a C-D function

1). CD function is linearly homogenous of degree one. This means that when input is increased by λ, output also increases by λ.

2) Average products of capital and labour can be expressed in terms of ratios of inputs.

Average product of labour can be obtained by dividing the production by the amount of labour.

$Q = A L^{\alpha} K^{\beta}$

$AP_L = =$

$=$

$=$

$=$ since

$=$

Thus we have shown that the AP_L can be expressed as the raion of the two inputs K and L

Similarly

$AP_K = =$

$=$

$=$

$=$ since

$=$

3). Marginal product of capital and labour can be expressed in terms of ratios of inputs.

Thus the marginal product of capital (MP_K) can be expressed in terms of ratios of inputs L and K. It is also equal to β times AP_K. That is,

Similarly the marginal product of capital (MP_L) can be expressed in terms of ratios of inputs L and K. Symbolically It is also equal to α times AP_L. That is,

4. CD function satisfies Euler's theorem.

5. Elasticity of substitution of a CD function is unity*.

(*The elasticity of substitution was introduced independently by John Hicks (1932) and Joan Robinson (1933) to measure the degree of substitutability between any pair of factors. Elasticity of substitution is the elasticity of the ratio of two inputs to a production function with respect to the ratio of their marginal products. It measures the curvature of an isoquant and thus, the substitutability between inputs, i.e. how easy it is to substitute one input for the other.)

6. Factor intensity: In C-D function $Q = A L^{\alpha} K^{\beta}$, the factor intensity is measured by the ratio . The higher this ratio, the more labour intensive the technique; the lower the ratio, the more capital intensive the technique.

7. A strict CD function represents constant returns to scale since $\alpha + \beta = 1$.

2.6.b Importance of a C-D function

The C-D function is an analytical tool commonly used in economics which has the following uses.

1. C-D function can be used to determinate marginal productivity of labour and capital. Hence it can be used in the determination of wages and interest.
2. The parameters α and β of the function represents elasticity coefficient. These elasticity coefficients are helpful in inter-sectoral comparison in an economy and for the long run analysis of production i.e. returns to scale. As in the usual case of a C-D function, when $\alpha + \beta = 1$, we have constant returns to scale and the function is linear homogenous.
3. C-D function helps to compute elasticity values for inter sectoral comparisons.
4. C-D function is widely used in econometrics.
5. This production function helps us to study the different laws, of returns to scale.
6. This function is used to test laws of returns and substitutability of factors

2.6.c. Limitations of a C-D function

Cobb and Douglas were influenced by statistical evidence that appeared to show that labour and capital shares of total output were constant over time in developed countries; they explained this by statistical fitting least-squares regression of their production function. However, there is now doubt over whether constancy over time exists. Neither Cobb nor Douglas provided any theoretical reason why the coefficients α and β should be constant over time or be the same between sectors of the economy. Remember that the nature of the machinery and other capital goods (the K) differs between time-periods and according to what is being produced. So do the skills of labor (the L).

The Cobb-Douglas production function was not developed on the basis of any knowledge of engineering, technology, or management of the production process. It was instead developed because it had attractive mathematical characteristics, such as diminishing marginal returns to either factor of production. Crucially, there are no micro foundations for it. In the modern era,

economists have insisted that the micro-logic of any larger-scale process should be explained. The C-D production function fails this test. It is thus a mathematical mistake to assume that just because the Cobb-Douglas function applies at the micro-level, it also applies at the macro-level. Similarly, there is no reason that a macro Cobb-Douglas applies at the disaggregated level.

1. A C-D function contains only two inputs labour and capital, but actually there may be more capital.
2. The parameter α and β can represent the labour and capital share only if there is perfect competition for labour and capital.
3. In most of the case this production function represents constant returns to scale. Other possibilities are sidetracked.
4. This function assumes that, technological conditions remain constant. But the production change due to change in technology is reality. Thus this function is based on the unrealistic assumption of stagnant technology.

Costs

Explicit and implicit costs, opportunity cost, private cost, social cost, economic cost,accounting cost, sunk cost, fixed and variable cost, marginal and average cost –Shortrun and Long run cost curves - Modern theory of costs - Short- run costs - AFC,AVC, ATC – Longrun L shaped cost curves.

Basic concepts

1.**Explicit costs**

Explicit costs are the actual out- of –pocket expenditure of the firm to purchase or hire the inputs it requires in production. These expenditures include the wages to hire labor, interest on borrowed capital, rent on land and buildings, and the expenditures on raw and semi finished materials.

2. **Implicit costs**

Implicit costs refer to the value of the inputs owned and used by the firm in its ownproduction processes. The value of these owned inputs must be imputed or estimated from what these inputs could earn in their best alternative use.

3.**The opportunity cost.(Economic Cost)**

The opportunity cost of producing a particular good is the cost in terms of other goods which might have been produced using the same resource.

4. private costs

Private costs are the opportunity costs incurred by individuals and firms in the process ofproducing goods and services.

5.**Social costs** are the costs incurred by society as a whole in the process of producing goods and services.

6. ***Accounting cost*****:**

Monetary value of economic resources used in performing an activity.

7. **Sunk cost**

In economics and business decision-making, a sunk cost is a cost that has already beenincurred and cannot be recovered. The cost is "sunk" because it was a one-time expenseand cannot be recovered once spent.

8. **Total fixed costs**

Total obligations of the firm per time period for all fixed inputs. These include payments for renting the plant and equipment , most kinds of insurance, property taxes, and salaries of administrative staff etc.

9. **Total variable costs**

Total obligation of the firm per period for all the variable inputs of the firm. These include payments for raw materials, fuels, most types of labor, excise taxes and so on.

10**. Average fixed cost**

Average Fixed cost equals total fixed costs divided by output.

11. **Average variable cost**

Average variable cost equals total variable costs divided by output.

12.**Average total cost**

Average total cost is obtained by total cost divided by output. It is also defined as the sum total of average variable cost and average fixed cost. ATC=AFC+AVC.

13. **Marginal Cost**

The marginal Cost is defined as the change in total cost which results from a unit change in output. Graphically, the MC is the slope of the TC curve.

14**. The planning curve**

The long run cost curve is the planning in the sense that it is a guide to the entrepreneur in his decision to plan the future expansion of his output.

15. **Envelop curve**

In the traditional theory of the firm, the long run cost curve is called envelop curve,because it envelops the short run curves.

16**. Excess capacity**

A situation in which actual production is less than what is achievable or optimal for a firm. Excess capacity is shown with the help of short run average variable cost curve i.e. if the actual production is to the left of the minimum point of SAVC , the firm producing below capacity or operating with excess capacity.

17. **Reserve capacity**

In the modern theory of the cost the business men will choose the size of the plant which allow him to produce his anticipated output more efficiently and with maximum flexibility when factors like demand changes cyclically and seasonally. In such situation the plant will have capacity larger than expected average level of sales. Such capacity is called reserve capacity.

18. Load factor

The level of utilization of the plant which firms consider as normal is called the load factor of the plant**.**

Determinants of Costs

Cost behavior is the result of many factors and forces. But it is very difficult to determine in general the factors influencing the cost as they widely differ from firm to firm and even industry to industry. However, economists have given some factors considering them as general determinants of costs. They have enough importance in modern business set up and decision making process. The following factors deserve our attention in this connection.

1. Technology

Modern technology leads to optimum utilization of resources, avoid all kinds of wastages, saving of time, reduction in production costs and resulting in higher output. On the other hand, primitive technology would lead to higher production costs.

2. Rate of output: (the degree of utilization of the plant and machinery)

Complete and effective utilization of all kinds of plants and equipments would reduce production costs and under utilization of existing plants and equipments would lead to higher production costs.

3. Size of Plant and scale of production

Generally speaking big companies with huge plants and machineries organize production on large scale basis and enjoy the economies of scale which reduce the cost per unit.

4. Prices of factor inputs

Higher market prices of various factor inputs result in higher cost of production and vice-versa.

5. Efficiency of factors of production and the management

Higher productivity and efficiency of factors of production would lead to lower production costs and vice-versa.

6. Stability of output

Stability in production would lead to optimum utilization of the existing capacity of plants and equipments. It also brings savings of various kinds of hidden costs of interruption and learning leading to higher output and reduction in production costs.

7. Law of returns

Increasing returns would reduce cost of production and diminishing returns increase cost.

8. Time period

In the short run, cost will be relatively high and in the long run, it will be low as it is possible to make all kinds of adjustments and readjustments in production process.

Thus, many factors influence cost of production of a firm.

Cost-Output Relationship: Cost Function.

Cost and output are correlated. Cost output relations play an important role in almost all business decisions. It throws light on cost minimization or profit maximization and

optimization of output. The relation between the cost and output is technically described as the "COST FUNCTION". The significance of cost-output relationship is so great that in economic analysis the cost function usually refers to the relationship between cost and rate of output alone and we assume that all other independent variables are kept constant. Mathematically speaking TC = f (Q) where TC = Total cost and Q stands for output produced.

However, cost function depends on three important variables.

1. Production function

If a firm is able to produce higher output with a little quantity of inputs, in that case, the cost function becomes cheaper and vice-versa.

2. The market prices of inputs

If market prices of different factor inputs are high in that case, cost function becomes higher and vice-versa.

3. Period of time

Cost function becomes cheaper in the long run and it would be relatively costlier in the short run.

Types of cost function

Generally speaking there are two types of cost functions.

1. Short run cost function.

2. Long run cost function.

Cost-Output Relationship and Cost Curves in the Short-Run

It is interesting to note that the relationship between the cost and output is different at two different periods of time i.e. short-run and long run. Generally speaking, cost of production will be relatively higher in the short-run when compared to the long run. This is because a producer will get enough time to make all kinds of adjustments in the productive process in the long run than in the short run. When cost and output relationship is represented with the help of diagrams, we get short run and long run cost curves of the firm. Now we shall make a detailed study of cost output relations both in the short-run as well as in the long run.

Meaning of Short Run

Short-run is a period of time in which only the variable factors can be varied while fixed factors like plant, machinery etc. remains constant. Hence, the plant capacity is fixed in the short run. The total number of firms in an industry will remain the same. Time is insufficient either for the entry of new firms or exit of the old firms. If a firm wants to produce greater quantities of output, it can do so only by employing more units of variable factors or by having additional shifts, or by having over time work for the existing labor force or by intensive utilization of existing stock of capital assets etc. Hence, short run is defined as a period where adjustments to changed conditions are only partial.

The short run cost function relates to the short run production function. It implies two sets of input components – (a) fixed inputs and (b) variable inputs. Fixed inputs are unalterable. They remain unchanged over a period of time. On the other hand, variable factors are changed to vary the output in the short run. Thus, in the short period some inputs are fixed in amount and a firm can expand or contract its output only by changing the amounts of other variable inputs. The cost-output relationship in the short run refers to a particular set of conditions where the scale of operation is limited by the fixed plant and equipment. Hence, the costs of the firm in the short run are divided into fixed cost and variable costs. We shall study these two concepts of costs in some detail

1. Fixed costs

These costs are incurred on fixed factors like land, buildings, equipments, plants, superior type of labor, top management etc. Fixed costs in the short run remain constant because the firm does not change the size of plant and the amount of fixed factors employed. Fixed costs do not vary with either expansion or contraction in output. These costs are to be incurred by a firm even output is zero. Even if the firm close down its operation for some time temporarily in the short run, but remains in business, these costs have to be borne by it. Hence, these costs are independent of output and are referred to as unavoidable contractual cost.

Prof. Marshall called fixed costs as supplementary costs. They include such items as contractual rent payment, interest on capital borrowed, insurance premiums, depreciation and maintenance allowances, administrative expenses like manager’s salary or salary of the permanent staff, property and business taxes, license fees, etc. They are called as over-head

costs because these costs are to be incurred whether there is production or not. These costs are to be distributed on each unit of output produced by a firm. Hence, they are called as indirect costs.

2. Variable costs

The cost corresponding to variable factors are discussed as variable costs. These costs are incurred on raw materials, ordinary labor, transport, power, fuel, water etc, which directly vary in the short run. Variable costs directly and proportionately increase or decrease with the level of output. If a firm shuts down for some time in the short run; then it will not use the variable factors of production and will not therefore incur any variable costs. Variable costs are incurred only when some amount of output is produced. Total variable costs increase with increase in the level of production and vice-versa. Prof. Marshall called variable costs as prime costs or direct costs because the volume of output produced by a firm depends directly upon them. It is clear from the above description that production costs consist of both fixed as well as variable costs. The difference between the two is meaningful and relevant only in the short run. In the long run all costs become variable because all factors of production become adjustable and variable in the long run. However, the distinction between fixed and variable costs is very significant in the short run because it influences the average cost behavior of the firm. In the short run, even if a firm wants to close down its operation but wants to remain in business, it will have to incur fixed costs but it must cover at least its variable costs.

Cost-output relationship and nature and behavior of cost curves in the short run

In order to study the relationship between the level of output and corresponding cost of production, we have to prepare the cost schedule of the firm. A cost-schedule is a statement of a variation in costs resulting from variations in the levels of output. It shows the response of cost to changes in output. A hypothetical cost schedule of a firm has been represented in the following table.

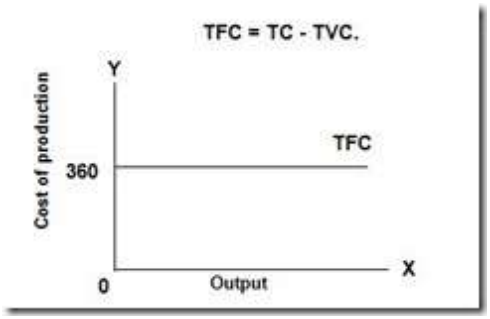
Output in Units	**TFC**	**TVC**	**TC**	**AFC**	**AVC**	**AC**	**MC**
0	360	–	360	–	–	–	–
1	360	180	540	360	180	540	180
2	360	240	600	180	120	300	60

3	360	270	630	120	90	210	30
4	360	315	675	90	78.75	168.75	45
5	360	420	780	72	84	156	105
6	360	630	990	60	105	165	210

On the basis of the above cost schedule, we can analyse the relationship between changes in the level of output and cost of production. If we represent the relationship between the two in a geometrical manner, we get different types of cost curves in the short run. In the short run, generally we study the following kinds of cost concepts and cost curves.

1. Total fixed cost (TFC)

TFC refers to total money expenses incurred on fixed inputs like plant, machinery, tools &equipments in the short run. Total fixed cost corresponds to the fixed inputs in the short run production function. TFC remains the same at all levels of output in the short run. It is the same when output is nil. It indicates that whatever may be the quantity of output, whether 1 to 6 units, TFC remains constant. The TFC curve is horizontal and parallel to OX-axis, showing that it is constant regardless of out put per unit of time. TFC starts from a point on Y-axis indicating that the total fixed cost will be incurred even if the output is zero. In our example, Rs 360=00 is TFC. It is obtained by summing up the product or quantities of the fixed factors multiplied by their respective unit price.



2. Total variable cost (TVC)

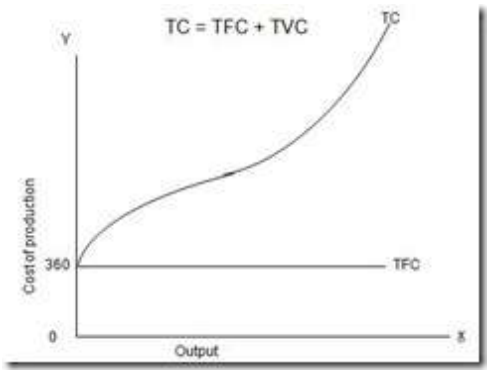
TVC refers to total money expenses incurred on the variable factor inputs like raw materials, power, fuel, water, transport and communication etc, in the short run. Total variable cost corresponds to variable inputs in the short run production function. It is obtained by summing up the production of quantities of variable inputs multiplied by their prices. The

formula to calculate TVC is as follows. TVC = TC-TFC. TVC = f (Q) i.e. TVC is an increasing function of out put. In other words TVC varies with output. It is nil, if there is no production. Thus, it is a direct cost of output. TVC rises sharply in the beginning, gradually in the middle and sharply at the end in accordance with the law of variable proportion. The law of variable proportion explains that in the beginning to obtain a given quantity of output, relative variation in variable factors-needed are in less proportion, but after a point when the diminishing returns operate, variable factors are to be employed in a larger proportion to increase the same level of output. TVC curve slope upwards from left to right. TVC curve rises as output is expanded. When out put is Zero, TVC also will be zero. Hence, the TVC curve starts from the origin.

3. Total cost (TC)

The total cost refers to the aggregate money expenditure incurred by a firm to produce a given quantity of output. The total cost is measured in relation to the production function by multiplying the factor prices with their quantities. TC = f (Q) which means that the T.C. varies with the output. Theoretically speaking TC includes all kinds of money costs, both explicit and implicit cost. Normal profit is included in the total cost as it is an implicit cost. It includes fixed as well as variable costs. Hence, TC = TFC +TVC.

TC varies in the same proportion as TVC. In other words, a variation in TC is the result of variation in TVC since TFC is always constant in the short run.

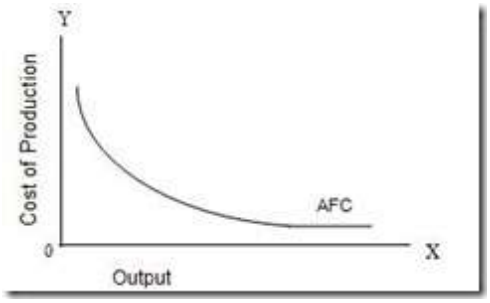


The total cost curve is rising upwards from left to right. In our example the TC curve starts from Rs. 360-00 because even if there is no output, TFC is a positive amount. TC and TVC have same shape because an increase in output increases them both by the same amount since TFC is constant. TC curve is derived by adding up vertically the TVC and TFC curves.

The vertical distance between TVC curve and TC curve is equal to TFC and is constant throughout because TFC is constant.

4. Average fixed cost (AFC)

Average fixed cost is the fixed cost per unit of output. When TFC is divided by total units of out put AFC is obtained**,** Thus, AFC = TFC/Q



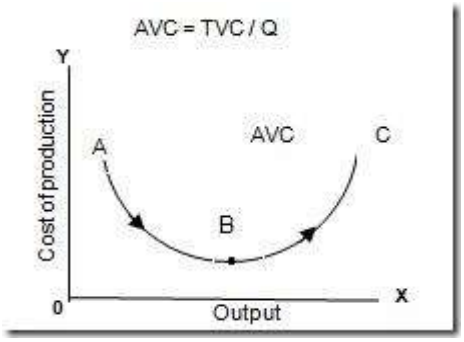
AFC and output have inverse relationship. It is higher at smaller level and lower at the higher levels of output in a given plant. The reason is simple to understand. Since AFC = TFC/Q, it is a pure mathematical result that the numerator remaining unchanged, the increasing denominator causes diminishing cost. Hence, TFC spreads over each unit of out put with the increase in output. Consequently, AFC diminishes continuously. This relationship between output and fixed cost is universal for all types of business concerns.

The AFC curve has a negative slope. The curve slopes downwards throughout the length. The AFC curve goes very nearer to X axis, but never touches axis. Graphically it will fall steeply in the beginning, gently in middle and tend to become parallel to OX-axis. Mathematically speaking as output increases, AFC diminishes. But AFC will never become zero because the TFC is a positive amount. AFC will never fall below a minimum amount because in the short run, plant capacity is fixed and output cannot be enlarged to an unlimited extent.

5. Average variable cost: (AVC)

The average variable cost is variable cost per unit of output. AVC can be computed by dividing the TVC by total units of output. Thus, AVC = TVC/Q. The AVC will come down in the beginning and then rise as more units of output are produced with a given plant. This is because as we add more units of variable factors in a fixed plant, the efficiency of the inputs first increases and then it decreases.

The AVC curve is a U-shaped cost curve. It has three phases.



a) Decreasing phase

In the first phase from A to B, AVC declines, As output expands, AVC declines because when we add more quantity of variable factors to a given quantity of fixed factors, output increases more efficiently and more than proportionately due to the operation of increasing returns.

b) Constant phase

In the II phase, i.e. at B, AVC reaches its minimum point. When the proportion of both fixed and variable factors are the most ideal, the output will be the optimum. Once the firm operates at its normal full capacity, output reaches its zenith and as such AVC will become the minimum.

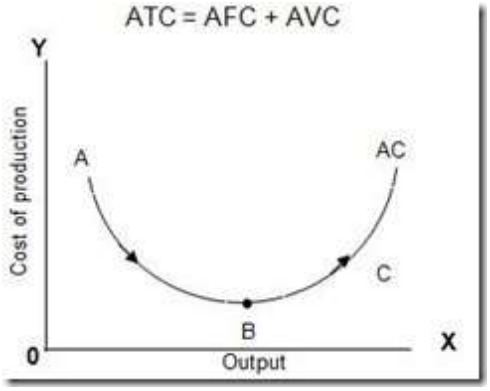
c) Increasing phase

In the III phase, from B to C, AVC rises when once the normal capacity is crossed, the AVC rises sharply. This is because additional units of variables factors will not result in more than proportionate output. Hence, greater output may be obtained but at much greater AVC. The old proverb "Too many cooks spoil the broth" aptly applies to this III stage. It is clear that as long as increasing returns operate, AVC falls and when diminishing returns set in, AVC tends to increase.

6. Average total cost (ATC) or Average cost (AC)

AC refers to cost per unit of output. AC is also known as the unit cost since it is the cost per unit of output produced. AC is the sum of AFC and AVC. Average total cost or average cost is obtained by dividing the total cost by total output produced. AC = TC/Q Also

AC is the sum of AFC and AVC. In the short run AC curve also tends to be U-shaped. The combined influence of AFC and AVC curves will shape the nature of AC curve.



As we observe, average fixed cost begin to fall with an increase in output while average variable costs come down and rise. As long as the falling effect of AFC is much more than the rising effect of AVC, the AC tends to fall. At this stage, increasing returns and economies of scale operate and complete utilization of resources force the AC to fall. When the firm produces the optimum output, AC becomes minimum. This is called as least – cost output level. Again, at the point where the rise in AVC exactly counter balances the fall in AFC, the balancing effect causes AC to remain constant.

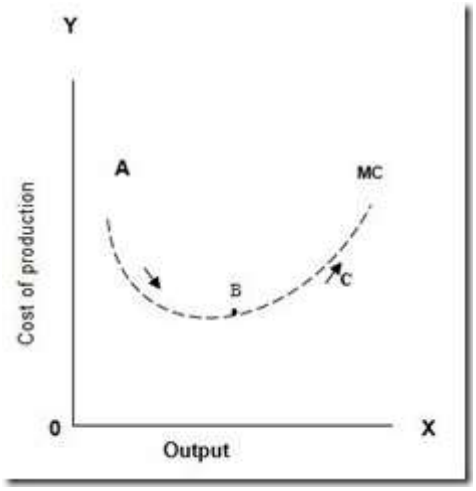
In the third stage when the rise in average variable cost is more than drop in AFC, then the AC shows a rise, When output is expanded beyond the optimum level of output, diminishing returns set in and diseconomies of scale starts operating. At this stage, the indivisible factors are used in wrong proportions. Thus, AC starts rising in the third stage. The short run AC curve is also called as "Plant curve". It indicates the optimum utilization of a given plant or optimum plant capacity.

7. Marginal Cost (MC)

Marginal Cost may be defined as the net addition to the total cost as one more unit of output is produced. In other words, it implies additional cost incurred to produce an additional unit. For example, if it costs Rs. 100 to produce 50 units of a commodity and Rs. 105 to produce 51 units, then MC would be Rs. 5. It is obtained by calculating the change in total costs as a result of a change in the total output. Also MC is the rate at which total cost changes with output. Hence, MC = D TC / D TQ. Where D TC stands for change in total cost and D TQ stands for change in total output.

Also $\mathbf{MC_n = TC_n - TC_{n-1}}$

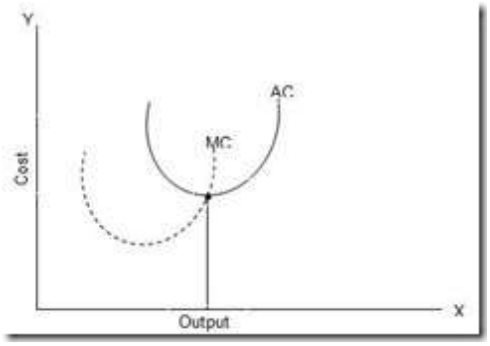
It is necessary to note that MC is independent of TFC and it is directly related to TVC as we calculate the cost of producing only one unit. In the short run, the MC curve also tends to be U-shaped. The shape of the MC curve is determined by the laws of returns. If MC is falling, production will be under the conditions of increasing returns and if MC is rising, production will be subject of diminishing returns.



The table indicates the relationship between AC & MC

Output in Units	**TC in Rs.**	**AC in Rs.**	**Difference in Rs. MC**
1	150	150	–
2	190	95	40
3	220	73.3	30
4	236	59	16
5	270	54	34
6	324	54	54
7	415	59.3	91
8	580	72.2	165

Relation between AC and MC



From the diagram it is clear that:

1. Both MC and AC fall at a certain range of output and rise afterwards.

2. When AC falls, MC also falls but at certain range of output MC tends to rise even though AC continues to fall. However, MC would be less than AC. This is because MC is attributed to a single unit where as in case of AC, the decreasing AC is distributed over all the units of output produced.

3. So long as AC is falling, MC is less than AC. Hence, MC curve lies below AC curve. It indicates that fall in MC is more than the fall in AC. MC reaches its minimum point before AC reaches its minimum.

4. When AC is rising, after the point of intersection, MC will be greater than AC. This is because in case of MC, the increasing MC is attributed to a single unit, where as in case of AC, the increasing AC is distributed over all the output produced.

5. So long as the AC is rising, MC is greater and AC. Hence, MC curve lies to the left side of the AC curve. It indicates that rise in MC is more than the rise in AC.

6. MC curve cuts the AC curve at the minimum point of the AC curve. This is because, when MC decreases, it pulls AC down and when MC increases, it pushes AC up. When AC is at its minimum, it is neither being pulled down or being pushed up by the MC. Thus, When AC is minimum, MC = AC. The point of intersection indicates the least cost combination point or the optimum position of the firm. At output Q the firm is working at its “Optimum Capacity” with lowest AC. Beyond Q, there is scope for “Maximum Capacity” with rising cost.

Cost Output Relationship in the Long Run

Long run is defined as a period of time where adjustments to changed conditions are complete. It is actually a period during which the quantities of all factors, variable as well as fixed factors can be adjusted. Hence, there are no fixed costs in the long run. In the short run, a firm has to carry on its production within the existing plant capacity, but in the long run it is

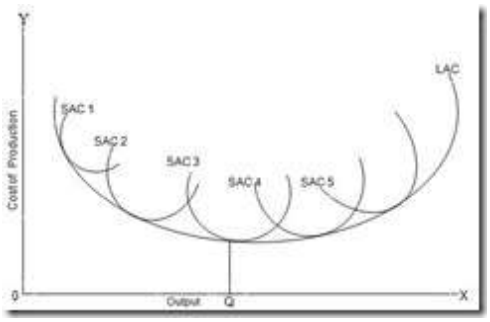
not tied up to a particular plant capacity. If demand for the product increases, it can expand output by enlarging its plant capacity. It can construct new buildings or hire them, install new machines, employ administrative and other permanent staff. It can make use of the existing as well as new staff in the most efficient way and there is lot of scope for making indivisible factors to become divisible factors. On the other hand, if demand for the product declines, a firm can cut down its production permanently. The size of the plant can also be reduced and other expenditure can be minimized. Hence, production cost comes down to a greater extent in the long run.

As all costs are variable in the long run, the total of these costs is total cost of production. Hence, the distinction between fixed and variables costs in the total cost of production will disappear in the long run. In the long run only the average total cost is important and considered in taking long term output decisions.

The LAC curve

Long run average cost is the long run total cost divided by the level of output. In brief, it is the per unit cost of production of different levels of output by changing the size of the plant or scale of production.

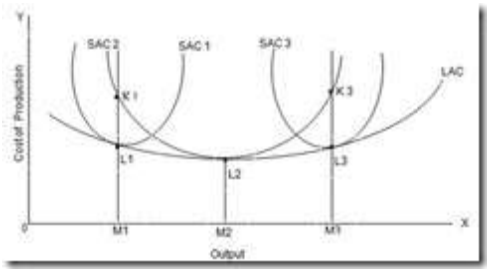
The long run cost – output relationship is explained by drawing a long run cost curve through short – run curves as the long period is made up of many short – periods as the day is made up of 24 hours and a week is made out of 7 days. This curve explains how costs will change when the scale of production is varied.



The long run-cost curves are influenced by the laws of return to scale as against the short run cost curves which are subject to the working of law of variable proportions.

In the short run the firm is tied with a given plant and as such the scale of operation remains constant. There will be only one AC curve to represent one fixed scale of output in the short run. In the long run as it is possible to alter the scale of production, one can have as many AC curves as there are changes in the scale of operations. In order to derive LAC curve, one has

to draw a number of SAC curves, each curve representing a particular scale of output. The LAC curve will be tangential to the entire family of SAC cures. It means that it will touch each SAC curve at its minimum point.



Production cost difference in the short run and long run.

In the diagram, the LAC curve is drawn on the basis of three possible plant sizes. Consequently, we have three different SAC curves – SAC1, SAC2 and SAC3. They represent three different scales of output. For output OM3 the AC will be L2M2 in the short run as well as the long run. When output is to be expanded to OM3, it can be obtained at a higher average cost of production. K3, M3 is the short run AC because, scale of production would remain constant in the short run. But the same output of OM3 can be produced at a lower AC of L3M3 in the long run since the scale of production can be modified according to the requirements. The distance between K3L3 represent difference between the cost of production in the short run and long run.

Similarly, when output is contracted to OM1 in the short run, K1M1 will become the short run AC and L1M1 will be the long run AC. Hence, K1L1 indicates the difference between short run and long run cost of production. If we join points L1, L2 and L3 we get LAC curve.

Important features of long run AC curves

1. Tangent curve

Different SAC curves represent different operational capacities of different plants in the short run. LAC curve is locus of all these points of tangency. The SAC curve can never cut a LAC curve though they are tangential to each other. This implies that for any given level of output, no SAC curve can ever be below the LAC curve. Hence, SAC cannot be lower than the LAC in the long run. Thus, LAC curve is tangential to various SAC curves.

2. Envelope curve

It is known as Envelope curve because it envelopes a group of SAC curves appropriate to different levels of output.

3. Flatter U-shaped or dish-shaped curve

The LAC curve is also U shaped or dish shaped cost curve. But It is less pronounced and much flatter in nature. LAC gradually falls and rises due to economies and diseconomies of scale.

4. Planning curve

The LAC cure is described as the Planning Curve of the firm because it represents the least cost of producing each possible level of output. This helps in producing optimum level of output at the minimum LAC. This is possible when the entrepreneur is selecting the optimum scale plant. Optimum scale plant is that size where the minimum point of SAC is tangent to the minimum point of LAC.

5. Minimum point of LAC curve should be always lower than the minimum point of SAC curve

This is because LAC can never be higher than SAC or SAC can never be lower than LAC. The LAC curve will touch the optimum plant SAC curve at its minimum point.

A rational entrepreneur would select the optimum scale plant. Optimum scale plant is that size at which SAC is tangent to LAC, such that both the curves have the minimum point of tangency. In the diagram, OM2 is regarded as the optimum scale of output, as it has the least per unit cost. At OM2 output LAC = SAC.

LAC curve will be tangent to SAC curves lying to the left of the optimum scale or right side of the optimum scale. But at these points of tangency, neither LAC is minimum nor will SAC be minimum. SAC curves are either rising or falling indicating a higher cost

Managerial Use of LAC

The study of LAC is of greater importance in managerial decision making process.

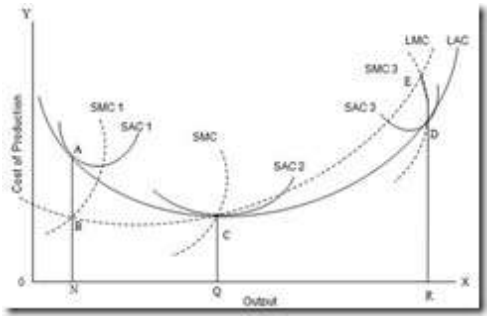
1. It helps the management in the determination of the best size of the plant to be constructed or when a new one is introduced in getting the minimum cost output for a given plant. But it is interested in producing a given output at the minimum cost.

2. The LAC curve helps a firm to decide the size of the plant to be adopted for producing the given output. For outputs less than cost lowering combination at the optimum scale i.e., when

the firm is working subject to increasing returns to scale, it is more economical to under use a slightly large plant operating at less than its minimum cost – output than to over use smaller unit. Conversely, at output beyond the optimum level, that is when the firm experience decreasing return to scale, it is more economical to over use a slightly smaller plant than to under use a slightly larger one. Thus, it explains why it is more economical to over use a slightly small plant rather than to under use a slightly larger one. Thus, it explains why it is more economical to over use a slightly small plant rather than to under use a large plant.

3. LAC is used to show how a firm determines the optimum size of the plant. An optimum size of plant is one that helps in best utilization of resources in the most economical manner.

Long Run Marginal cost



A long-run marginal cost curve can be derived from the long-run average cost curve. Just as the SMC is related to the SAC, similarly the LMC is related to the LAC and, therefore, we can derive the LMC directly from the LAC. In the diagram we have taken three plant sizes (for the sake of simplicity) and the corresponding three SAC and SMC curves. The LAC curve is drawn by enveloping the family of SAC curves. The points of tangency between the SAC and the LAC curves indicate different outputs for different plant sizes.

If the firm wants to produce ON output in the long run, it will have to choose the plant size corresponding to SAC1. The LAC curve is tangent to SAC1 at point A. For ON output, the average cost is NA and the corresponding marginal cost is NB If LAC curve is tangent to SAC1 curve at point A, the corresponding LMC curve will have to be equal to SMC1 curve at point B. The LMC will pass through point **B**. In other words, where LAC is equal to SAC curve (for a given output) the LMC will have to be equal to a given SMC.

If output OQ is to be produced in the long run, it will be done at point c which is the point of tangency between SAC2 and the LAC. At point C, the short –run average cost (SAC2) and the short-run marginal cost (SMC2) are equal and, therefore, the LAC for output OQ is QC and the corresponding LMC is also QC. The LMC curve will, therefore pass through point C.

Finally, for output OR, at point D the LAC is tangent to SAC3. For OR output at point E LMC is passing through SMC3. By connecting points B ,C and E, we can draw the long-run marginal cost curve.

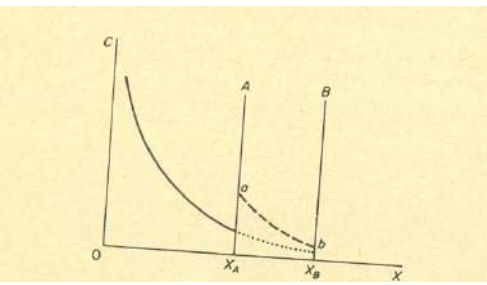
Introduction to Modern Cost Curves

The traditional theory of the firm has hypothesised U shaped cost curves. However many economists argue based on theoretical and empirical evidences that the cost curves are saucer shaped or 'L' shaped, rather than U shaped. This implies that the bottom portion where the costs are stable lasts longer than the traditional view.

(a) The average fixed cost curve

The modern theory assumes that the businessman will start his planning with a figure for the level of output which he anticipates selling, and he will choose the size of plant which will allow him to produce this level of output more efficiently and with maximum flexibility. So the plant will have capacity larger than the 'expected average' level of sales, because the businessman wants to have some reserve capacity. This is because businessman will want to be able to meet seasonal and cyclical fluctuations in his demand. Such fluctuations cannot always be met efficiently by a stock of inventory policy. This is possible only if a reserve capacity is available. This implies that the businessman will not choose the plant which will give him the lowest cost today, but rather that equipment which will allow him the greatest possible flexibility.

Under these circumstances the AFC curve will be as in the following figure.



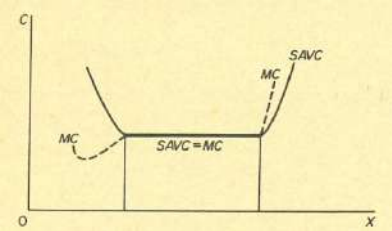
The firm has some 'largest-capacity' units of machinery which set an absolute limit to the short-run expansion of output (boundary B in figure). The firm has also small-unit machinery,
which sets a limit to expansion (boundary Ain figure). This, however, is not an
absolute boundary, because the firm can increase its output in the short run (until the

absolute limit B is encountered), either by paying overtime to direct labour for working longer hours (in this case the AFC is shown by the dotted line in figure), or by buying some additional small-unit types of machinery (in this case the AFC curve shifts upwards, and starts falling again, as shown by the line abin figure).

(b) The average variable cost

As in the traditional theory, the average variable cost of modern microeconomics includes the cost of: (a) direct labour which varies with output (b) raw materials (c) running expenses of machinery.

The SAVC in modern theory has a saucer-type shape, that is, it is broadly U-shaped but has a flat stretch over a range of output (see the following figure).

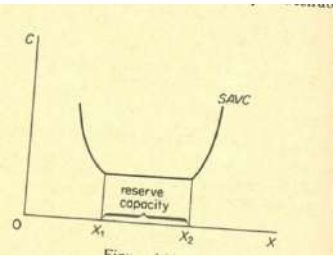


The flat stretch corresponds to the built-in-the-plant reserve capacity. Over this stretch the SAVC is equal to the MC, both being constant per unit of output. To the left of the flat stretch, MC lies below the SAVC, while to the right of the flat stretch the MC rises above the SAVC.

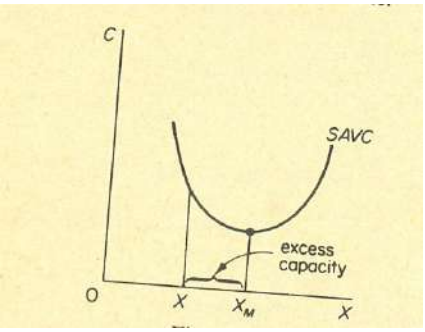
The falling part of the SAVC shows the reduction in costs due to the better utilisation of the fixed factor and the consequent increase in skills and productivity of the variable factor (labour). With better skills the wastes in raw materials are also being reduced and a better utilisation of the whole plant is reached. The increasing part of the SAVC reflects reduction in labour productivity due to the longer hours of work, the increase in cost of labour due to overtime payment (which is higher than the current wage), the wastes in materials and the more frequent breakdown of machinery as the firm operates with overtime or with more shifts.

The innovation of modem microeconomics in this field is the theoretical establishment of a short-run SAVC curve with a flat stretch over a certain range of output.

The reserve capacity makes it possible to have constant SAVC within a certain range of output as shown in the following figure. (This figure is further explained after the next figure)



It should be clear that this reserve capacity is planned in order to give the maximum flexibility in the operation of the firm. It is completely different from the excess capacity which arises with the U-shaped costs of the traditional theory of the firm. The traditional theory assumes that each plant is designed without any flexibility; it is designed to produce optimally only a single level of output (X_M in the following figure)



If the firm produces an output X smaller than X_M there is excess (unplanned) capacity, equal to the difference $X_M - X$. This excess capacity is obviously undesirable because it leads to higher unit costs.

In the modern theory of costs the range of output X_1-X_2 in the figure reflects the planned reserve capacity which does not lead to increases in costs. The firm anticipates using its plant sometimes closer to X_1 and at others closer to X_2. On the average the entrepreneur expects to operate his plant within the X_1- X_2 range. Usually firms consider that the 'normal' level of utilisation of their plant is somewhere between two-thirds and three-quarters of their capacity, that is, at a point closer to X_2 than to X_1. The level of utilisation of the plant which firms consider as 'normal' is called 'the load factor' of the plant

(c)The average total cost

The average total cost is obtained by adding the average fixed (inclusive of the normal profit) and the average variable cost at each level of output. The ATC is shown in the following figure.

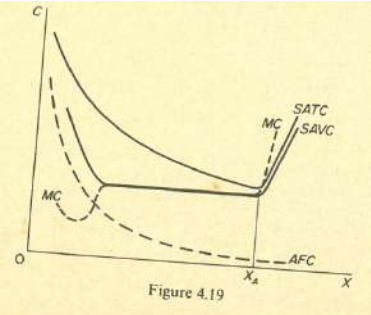


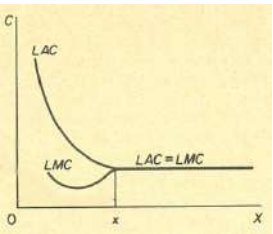
Figure 4.19

The ATC curve falls continuously up to the level of output (X_A) at which the reserve capacity is exhausted. Beyond that level ATC will start rising. The MC will intersect the average total cost curve at its minimum point.

Long Run costs in modern microeconomic theory:

The 'L' Shaped Scale Curve

All costs are variable in the long run and they give rise to a long-run cost curve which is roughly L -shaped. The production costs fall continuously with increases in output. At very large scales of output managerial costs may rise. But the fall in production costs more than offsets the increase in the managerial costs, so that the total *LAC* falls with increases in scale.



Engineering cost curves

Engineering costs are derived from engineering production functions. Each productive method is divided into sub-activities corresponding to the various physical-technical phases of production for the particular commodity. For each phase the quantities of factors of production are estimated and finally the cost of each phase is calculated on the

basis of the prevailing factor prices. The total cost of the particular method of production is the sum of the costs of its different phases.