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MICRO ECONOMICS THEORY-I

M. A. Economics First Year

Semester – I, Paper-I

Director, I/c

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MICRO ECONOMICS – 101EC21

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M. A. (Economics) : Program Code : 16

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SEMESTER –I

101EC21 - *MICRO ECONOMIC THEORY- I*

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Module II: Consumer Behaviour:

Basic Concepts: Law of demand – Cardinal utility - Ordinal Utility function, Indifference curves, Budget line; Income effects- Price effect and substitution effects – Derivation of demand curve - Slutsky's equation; Revealed preference theory.

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Module IV: Cost functions

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Module V: Market Structure:

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READING LIST

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Lesson : 1

ECONOMICS – DEFINITIONS - SCOPE

1.0 OBJECTIVES OF THE LESSON:

At the end of this lesson you will be able to know:

* The subject matter of Economics
* Economic and Non-Economic Activities
* Basic Economic Activities
* Definitions of Economics
* Scope of Economics
* Distinction Between Micro-Economics and Macro Economics
* Distinction Between Static Economics and Dynamic Economics
* Methods of Scientific Study
* Importance of Economics
* Relationship with other Sciences

CONTENTS:

1.1 INTRODUCTION OF ECONOMICS:

Human wants are unlimited. But the resources to satisfy those wants are limited. If the resources are unlimited in accordance with unlimited wants, economic problem will not arise. Then there is no need of economics also. In reality, the resources are limited and it leads to economic problem. That is why one has to choose the wants that are to be satisfied with the limited resources. For example, an individuals income is Rs. 2,000/-. With this limited income he has to pay rent, feeses of his children and other expenses. In addition, he may have so many wants to satisfy. But with his limited income, he unable to satisfy those wants. Economics is useful in a situation when the wants are unlimited and the resources are limited.

Economics explains the human behaviour between unlimited wants and scarce resources. As the resources are scarce, all wants cannot be satisfied. So the problem of choice will arise. Economics is useful in selecting the uses to which scarce resources can be put. Selecting a resource for one use means foregoing for other uses.

Economics explains the human behaviours between ends and scarce means. In addition, it studies the level of income, fluctuations in employment, economic stability, economic growth and development etc. The objectives of the subject economics are multifaceted that is why an eminent economist states that economics is what economics does.

1.2 ECONOMIC & NON - ECONOMIC ACTIVITIES:

Human activities can be divided into two, namely, economic activities and non-economic activities.

1.2.1 ECONOMIC ACTIVITIES: Activities relating to economy or the activities that are dealt by economics are called as economic activities. Since birth, man consumes different kinds of goods such as milk, rice, books, televisions and services of lawyers and doctors etc. Producing of such goods and services is known as production.

Economic activities such as production and consumption are limited with either money or income. Income can generate or expenditure can proceed in the process of these activities. Example in the process of production income generates. The income earners spends this amount on consumption. Like wise, economic activities will continue. Any person in the activity to satisfy a want by earning income by any person, at any part of the world, or at any time is called as economic activity. Economics considers all kinds of economic activities.

1.2.2 NON - ECONOMIC ACTIVITIES: Activities that can be done with out expecting an monitory benefit or freely for the sake of self satisfaction are come under non-economic activities. In other words, all activities which can be done without monetary intension are called as non-economic activities. Activities such as love, satisfaction, affection, etc… are come under non economic activities.

Religions and cultural activities render free of cost are also considered as non-economic activities. However, non-economic activities may be changed into economic

activities.

1.3 BASIC ECONOMIC PROBLEMS:

Every economy has to face three basic economic problems. It may be capitalist economy or socialist economy or mixed economy, these three problems are the main problems. They are:

1. What is to be produced and in what quantities.
2. How to produce
3. For whom to be produced

1.3.1 WHAT IS TO BE PRODUCED AND IN WHAT QUANTITIES: The first central problem is what goods and services are to be produced and in what quantities because the resources are scarce and they have to allocate among different uses. As the resources are scarce, the society has to decide how much resources are allocate for consumer goods and how much for capital good basing on the priorities. If higher priority given to consumer goods which implies less for capital goods and vice versa. Hence, what is to be produced and in what quantities is an important economic problem.

1.3.2 HOW TO PRODUCE: After deciding the first problem what is to be produced and in what quantities, the next basic problem is to decide the methods or techniques to be used to produce the require goods. There are different kinds of techniques of which the two important are : 1. Labour intensive Technique (Method of using more labour and less capital), 2. Capital intensive technique (Method of using more capital and less labour). Basing on the availability of labour and capital, the countries have to select the technique which is suitable to their conditions. Labour abundant and capital scarce countries adopt labour intensive technique. Where as, capital abundant and labour scarce countries adopt capital intensive technique.

1.3.3 FOR WHOM TO BE PRODUCED: Lastly, the problem is for whom are the goods produced. This problem is allocation of goods among the different members in the society. The goods that are produced in the country are to be distributed among different sections of the society namely labour, producers, land lords etc. What criteria is to be adopted to distribute is the crucial problem. Economists like Adam Smith, Recordo etc are enunciated different theories of distribution. In general, the distribution is depend upon the objectives of the country.

The three basic problems discussed above are important economic problems. In capitalistic economies, these problems will be solved by market mechanism, where as, these problems will be settled by the government in socialist economies. In mixed economies, these problems will be solved by market mechanism as well as the Government and the level of sharing is based on the circumstances.

1.4 DEFINITIONS OF ECONOMICS:

Every science require a definition. Because definition gives the boundaries of that subject. It explains the subject matter that the science deals. So the definition of economics states that what things the economics considers and what are not. However, it is not that much easy to give an appropriate definition for economics in the changing circumstances.

Like any other sciences, different economists gave different kinds of definitions for economics. These definitions can be categorised into four types.

1. Wealth Definition or Adam Smith Definition (18th Century)
2. Welfare Definition or Marshall Definition (19th Century)
3. Scarce Definition or Robbins Definition (20th Century)
4. Growth Definition or Samuelson Definition (20th Century)

1.4.1 WEALTH DEFINITION: Adam Smith, the father of economics defined economics in the year 1776 in his publication ' An enquiry in to Nature and causes of wealth of Nations'. According to Adam Smith economics is a science of wealth. It treats the nature and causes of wealth of nations. Economics like J.B. say, J.S. Mill, Nausa senior etc are also same kind of opinion on economics.

The definitions of economics given by Adam Smith and other reveals that mobilising of wealth is the main aim of economics.

Important Points In Wealth Definition:

1. Economics deals with material wealth.
2. Wealth means material wealth or physical wealth and these are scarcely available.
3. Economics means mobilisation of wealth which can be called economic development.

As this definition gives undue importance to wealth activities but neglected the human welfare, the wealth definition was criticised in many ways.

1. Adam Smith gave undue importance to wealth and neglected human welfare.
2. According to this definition material things only come under the purview of economics but non-material goods and services will not come under economics.
3. Carlyle, Ruskin, Dickens opined and lamented that giving undue importance means lowering the status of man and led economics as mannerism, a dismal science, the science of getting rich.
4. Economists criticised this definition as it leads to over selfishness.

1.4.2 WELFARE DEFINITION: In order to gave a respectable place to economics, Marshall has given a definition by giving emphasis on man and his welfare. He considered wealth is source of human welfare and it is not end in itself. Marshall in his book 'Principles of Economics', in the year 1890, he stated that 'economics is one side a study of wealth; and on the other, and more important side, a part of the study of man Marshall defined economics as '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 requirements of well being. Economists such as, A.C. Pigoue, Edwin Cannon, Beveridge were also defined economics by emphasizing human welfare.

Important Points in Welfare Definition:

1. Human life concerned with social, religions, political and economic aspects. But economics deals only economic aspects.
2. Economic is concerned with the study of man living in a society. It is not concerned with the activities of a isolated man like Robbinson Crusoe.
3. H is implied by Marshall's definition states that material goods only promote human welfare.
4. Marshall has given more importance to human welfare than wealth.

Marshall's wealth definition is an improvement to wealth definition. However, this definition also fall under severe criticism.

Criticism:

1. There are two kinds of goods viz., material and non-material goods (services) that promote human welfare. But Marshall considers only material things and neglected non-material things (services) in his definition.
2. Marshall states that activities which improve human health are considered in Economics. There are certain material activities such as intoxicants are not conductive for human welfare. Still they are considered in economics because they are scarce and have economic value.
3. The word welfare is also criticised by the economists. Welfare is a psychological phenomena. It is subjective and cannot be measurable. The idea of welfare differs individual to individual, place to place and country to country. For example, wine may give pleasure to drunkers, but is harmful for the novice.
4. If the welfare definition is accepted, every time one has to study weather the activity is conducive to human welfare or not. It is not supposed be the function of Economics. Hence, Robbins states that economics is neutral as regards to ends.
5. According to Marshall's definition economics can not studies isolated individuals such as Robbinson Crusoe. Actually, however, economics studies the isolated individuals as well as individuals living in the society.

Lionel Robbins criticised the welfare definition and given a scarcity definition while rectifying the major defects.

1.4.3 SCARCITY DEFINITION: Prof. Lionel Robbins in his publication "Nature and Significance of Economic Science" in the year 1932, defined economics without using the terms wealth and welfare. According to him, 'Economics is the science, which studies human behaviour as a relationship between ends and scarce means which have alternative uses.

Important Points in Scarcity Definition:

1. Human wants are unlimited. When a particular want satisfied another want crop up in its place.
2. The means or resources to satisfy the wants are limited or scarce.
3. These limited resources have alternative uses also.

4. As the limited resources put in one use one has to forego the other uses. Hence, the problem of choice comes in consumer satisfies the wants basing on the intensity.

SUPERIORITIES OF ROBBINS DEFINITION:

1. This definition does not contain the distinction of 'material goods' and 'non-material goods'. Economics considers and explains all kinds of goods.
2. Economics considered as science. It is a systematic body of knowledge. Like pure sciences, Economics is neutral between ends.
3. Economics got universality due to this definition. Economics is a study of human behaviours between unlimited wants and scarce resources, it cannot considers whether an individual leading isolated life or in a society.
4. The definition extended the scope of economics. It is extended to that area where the problem of 'choice' arises.
5. Unlike Marshall, Robbins identified the basic problem of Economics.

Robbins definition is superior over other definitions in several aspects. However, this definition is not free from criticism. Economists, such as, Barbara Woofer, Beveridge, Keynes, Knight etc are criticized the definition.

1. Though Robbins rejects the using of the term 'welfare', the critics states that it is a concealed concept in the definition. As economics is a science of choice means it is implied that the welfare concept extended into economics in loop line.
2. Economists criticized this definition on ethical neutrality. They opined that ethical neutrality leads to deficiency of human touch in economics.
3. Economising scarce resources in relation to ends for the solution of all economic problems is made economics as value theory. According to this definition, economics cannot considers aggregate economic activities such as national income, employment though they come under the purview of economics.
4. Recently, economic growth and economic development are important concepts in economics. But Robbins did not consider these concepts in his definition.
5. Experiences states that economic problems arise not only with scarcity but also plenty. Example Depression of thirties. Robbins has not identified that plenty is also a responsible for economic problem.
6. Some times, the problem of allocating scarce means among given ends, there may be a necessity to consider non-economic problems also.
7. As collective choice is more important than individual choice in socialist countries, this definition cannot be applicable to socialist economies.

Though this definition has several short comings, it is a scientific definition and better than the other definitions.

1.4.4 GROWTH DEFINITION : Recently economic growth occupies important place in the study

of economics. Professor Samuelson refined Robbins definition defined economics by taking choice, economic growth, planning etc into consideration. According to Samuelson 'Economics is the study of how people and society choose with or without money to employ scarce productive resources that could have alternative uses to produce various commodities overtime and distribute them for consumption now or in the near future among various people and groups in the society. Economics analyses the cost and benefits of improving the pattern of resource use'.

SUPERIORITIES OF GROWTH DEFINITION:

1. Samuelson also considered the scarcity of resources and their alternative uses like Robbins.
2. He explained the problems arises in production and distribution while using these scarce resources.
3. He gave importance to economic growth in his definition.
4. He identified not only present problems but also future problems and analysed the factors which are necessary for growth.
5. He has bring the non-economic problems into the purview of economics along with economic problems.
6. He added growth along with scarcity in his definition.

In addition to the above definitions, different economists defined economics in different ways. However, for the sake of convenience, we are limiting to the above definition.

1.5 SCOPE OF ECONOMICS:

Scope of a science means considering the boundaries of the subject. Similarly scope of economics means estimating the boundaries of economics. Basing on the definitions, we can assess the scope of economics upto certain extent. However, we can know the true scope of economics.

1. Subject-matter of Economics
2. Nature of Economics
3. Limitations of Economics

1.5.1 SUBJECT – MATTER OF ECONOMICS: According economists such as Adam Smith, J.S. Mill, J.B. Say, Ricardo, economics is a science of wealth. So, the scope limited to wealth only. Alfred Marshall added the material welfare to wealth in his definition. Later Lionell Robbins defined economics as a human behaviour as a relationship between ends and scarce means which have alternative uses with out mentioning neither wealth nor welfare. The Robbins definition widened the scope of economics and the things like individuals, families, business firms, Government comes under the purview of economics. Hence activities such as consumption, production, exchange distribution, public finance, international business will come under the scope of economics.

1.5.2 NATURE OF ECONOMICS: There is no unanimous opinion among different economists on nature of economics. The discussion on the following will give clear picture about the nature of economics.

A) Economics is a Science or Art ?

B) Economics is positive science or normative science.

1.5.2a. ECONOMICS IS A SCIENCE OR ART?: A systematic body of knowledge ascertainable by observation and experiment is called as science. A science consists of principles, laws, cause and effect relations and generalisations. Economics is considered as science because it comprises of economic principles, laws, cause and effect relations and the laws posses universal validity also. Hence, economics considered as science.

The practical application of scientific principles is called art. Economic principles can be applicable in the society. The causes and effect of poverty come under the purview of science and the activities taken for the removal of poverty is considered as art. Robertson, Robbins considered economics as science, where as, the economists such as Pigoue, Marshall, J.S. Mill considered economics as art.

A science should posses the feature art. Science and art are complementaries. Economics is science as well as art. The discussion on 'economics is science or art' shows how the scope of economics has widened.

1.5.2b. ECONOMICS IS POSITIVE SCIENCE OR NORMATIVE SCIENCE: Robbins brought the controversy weather economics is normative science or positive science. Positive economics concerned to 'what is' where as normative economics is 'what ought to be'. The former is pure science while the latter is an ethical science.

In Robbins view economics is positive science means 'what is'? or pure science. It is unconcerned with the moral or ethical judgements. It is neutral between ends. Economists are unconcerned with the passing of judgement weather an economic activity increase the welfare or not ?

With regard to normative context, economics is a social science. It is the responsibility of the social scientists to take right decisions. Similarly, it is the responsibility of economists to point out the positive and negative features of economic activities or laws. It is also evident that the importance of moral and ethical laws has continuously increasing in the business field.

The above discussion states that economics is not only a positive science but also a normative science of what ought to be. If economics is a pure science, economic welfare will not be increased. There will be no solution to the serious economic problems like unemployment, inflation etc. Hence, the role of economics is more as normative science than positive science. The above discussion reveals that scope has further widened.

1.5.3 LIMITATIONS OF ECONOMICS: It essential to know the limitations of economics to understand the scope of economics. The limitations of economics are :

1. Even though the life of a human being linked with social, cultural, religions, political and economic activities, economics is limited to only economic activities.

2. Economics will not consider the irrational people such as drunkards, misens etc..,
3. It studies the scarce resources in the economy.
4. Economics cannot studies the people who lives in illusions.
5. Economic laws are scientific laws. They explain the cause and effect relationship. Unlike scientific laws, economic laws are not assertive.

The above discussions on subject-matter of economics nature of economics and limitations of economics reveals the scope of economics.

1.6 MICRO AND MACRO-ECONOMICS:

Ragnar Fish was the first economist who divided the subject matter of economics into micro economics and macro economics.

1.6.1 MICRO ECONOMICS: Micro Economics studies the economic activities of individuals (individual consumer of households or firm etc) and small groups of individuals. Micro economics can also be called as price theory. In micro-economic analysis, price determination and allocation of resources is studied three stages, such as, the equilibrium of individual consumers and producers, the equilibrium of a single market and the simultaneous equilibrium of all markets. As this is a study with very small units, in an economy this is called as micro economics.

IMPORTANCE: Micro-Economics got an important place both theoretically and practically in economic analysis. Micro economics is useful :

1. To understand the working of an economy and free enterprise economy in particular.
2. To provide analytical tools for evaluating the economic policies.
3. To provide suitable solutions for efficient allocation of resources.
4. Helpful in understanding the problems of taxation, international trade
5. To examine the conditions of economic welfare.

LIMITATIONS: Micro Economics has got the following limitations :

1. It is concerned with individual units and neglects the whole or aggregates.
2. It based on unrealistic assumptions such as ‘fuel employment’, ‘Leisseinz faire’ etc.
3. Some times it misleads in analysing several economic problems.

1.6.2 MACRO ECONOMICS: Macro Economics studies with the aggregate economic activities. Macro economics can also be called as Income Theory. It studies the economy as a whole and Employment. Economic activities such as total employment, national income, national output, total investment, total consumption etc are dealts in macro economics. It studies the nature of aggregate variables, their inter-relations, their determination and causes of fluctuations in them etc.

IMPORTANCE: The following points shows the importance of macro economics in an economy.

1. It is useful to understand the working of an economy.
2. It is useful to formulate correct economic policies to the country.
3. It is the basis of all plans of economic development of under developed countries.
4. It enable us to properly organise, collect and analyse the data of national income and other social accounts.

LIMITATIONS: Macro Economics is also not free from any limitations.

1. It studies economy as a whole but neglects the individual items.
2. Excessive thinking in terms of aggregates leads to mis-leading impressions. For example, consider that the national income of India increased by 42 per cent and per capita income by 17 per cent during first decade of planning. This looks like a fair record but over looks the inequalities in the redistribution of that increment in income among different social groups.
3. Inspite of all improvement in statistical tools, it is not possible to get satisfactory measures of aggregates as well as averages which form the basic data for macro economics.

1.6.3 INTER RELATIONSHIP BETWEEN MICRO AND MACRO ECONOMICS: There is no clear cut boundaries to distinguish between micro and macro economics. They are interrelated and interdependent. Micro economic theory depend up on macro economics in certain instances, where as, macro economics depend, on micro economic analysis in certain instances. In addition, there is non-interdependence between the two. There are many macro economic problems which are not applicable to individuals vice versa. For example, there can be and usually divergence between-individuals income and his expenditure but for the economy as a whole total income and total expenditure are always equal. In certain cases, in micro point of view, individual savings gives positive results but aggregate savings (economy as a whole) will lead to fall in capital that in turn leads to fall in income and employment etc. Hence, separate study of micro economics and macro economics is inevitable to study the economic problems.

1.7 STATIC ECONOMICS, DYNAMIC ECONOMICS:

Augustive Compte introduced the concept static, dynamics in sociology. J.S. Mill used these concepts in economics. Static in economics implies a state characterised by movement at a particular level without any change. In static economics, analysis made on the assumption that there is no change population, capital, production techniques etc. In other words time element does not taken into consideration.

But actually economy is dynamic changes in population, capital, techniques of production etc may be happened through time. An economic analysis made by taking the changes which continues through time is known as dynamic economics.

Economic statistics and economic dynamics are essential for economic analysis. Because some economic problems can be solved by economic statistics where as, other can be solved by economic dynamics.

1.8 METHODS OF ECONOMIC ANALYSIS:

There are two kinds of scientific methods to analyse the economic problems. They are 1. Deductive method 2. Inductive method. Deductive method means the application of logic to go from the general observations to particular principles. Where as, inductive method deals with particular facts, arranges those facts so as to formulate some empirical generalisations.

1.8.1 DEDUCTIVE METHOD: This method was used by classical economists. They tried to build up the scientific principles. This method starts with indisputable facts about human nature and draw improvences about concrete individual cases. The deductive method is of two kinds, the mathematical and the non-mathematical. Almost all classical economists supported deductive method but mathematical. This method involves the following steps in formulating economic laws.

1. The deductive method is useful in analysing the complex economic phenomenon where cause and effect are inextricably mixed up.
2. It is very simple method and it is easy for application.
3. Analysis and process of logical reasoning where by inferences are drawn.

In this method, we formulate principles on human behaviour, observations and experiments are out of question.

MERITS AND DEDUCTIVE METHOD:

1. As this method is based on more and more complete assumptions, this method is nearer to reality.
2. The principles drawn from this method are of universal validity.
3. The use of mathematical tools in this method brings exactness and clarity. The principles formulated by this method will give scope for further research.
4. The principles developed by deductive method are very useful for the government to make policy decisions.

DEMERITS OF DEDUCTIVE METHOD:

1. There is limited scope for economists to formulate laws in laboratories like physical and biological sciences.
2. It requires high competence on logic.
3. The conclusions derived from deductive reasoning are not applicable universally. Because the premises from which they have been deduced may not hold good at all times and all places.

4. The principles drawn from this method may not be universally valid. If they based on inadequate data.
5. This method is highly abstract and refuse great skill in drawing inferences.

1.8.2 INDUCTIVE METHOD: In this method, principles or laws formed on inductive logic. Which involves the process of reasoning from a particular fact. Basing on the facts, general principles will be developed. Inductive method go up. This from particulars to generates, of hypothesis, generalisation of the principle and verification.

MERITS OF INDUCTIVE METHOD:

1. This method is concrete and synthetic and realistic, it based on facts and explain them as they actually are.
2. This methods helps in-future enquiries.
3. As statistical tools are marks most in this method, there is a significant improvement in analysing the economic problems.
4. This method is dynamic method because the changing economic phenomena can be analysed.
5. This method is more suitable in formulation of economic policies.

DEMERITS OF INDUCTIVE METHOD:

1. It is time consuming and costly.
2. Observation and experimentation have very limited application an a science which deals with human activities.
3. Definitions, sources and methods used in statistical analysis differ from investigator to investigator even for the same problem. Hence, statistical tools are lack of concreteness.
4. This method is useful for natural and physical sciences, but not social science which deals with human behaviour.

These two types of methods are needed for scientific thought as the right and left four are needed for walking.

1.9 IMPORTANCE OF ECONOMICS:

Social science is the study of the totality of mass social behaviour. Development of the society is the main motto of all sciences. Man is the central focus. Economics is one among different social sciences which is very important theoretically as well as practically. For that reason, Mrs. Joan Robbinson told that economics is a box of different economic tools which are useful for giving solutions for different economic problems.

1. Economic is useful to understand functioning of the economy. It will give solution to the three basic economic problems such as what to produce, how to produce and whom to produce.

2. It is helpful to know about market mechanism, price determination mechanism etc.,
3. It gives solution to the basic economic problem i.e., economising scarce resources for optimum utilisation of resources.
4. It suggests suitable tax policy to the economy.
5. Economics useful to analyse the different problems crop up during foreign trade viz : international trade, international finance, Balance of payment, Exchange rates etc.,
6. It gives the required condition for an economy to attain maximum economic welfare.
7. It useful to develop economic model for the economies.
8. It is useful to formulate economic policies for their development.
9. Economics provides various kinds of economic tools, such as, cost-benefit analysis, linear programming etc to analyse the economic problem. Finally, economics is very important because it give right directions to divert the economy in right path.

1.10 RELATIONSHIP WITH OTHER SCIENCES:

Economics is a part of social science which studies the human behaviour. Economics occupies a respectable place among other sciences and it has intimately related political science, history, sociology, ethics, mathematics and statistics etc. The following discussion explains the relation of economics with some of the sciences.

1.10.1 ECONOMICS - POLITICAL SCIENCES: In the beginning, economics is called as political economy and now it is becoming more and more political economy. Economics explains the efforts to improve wealth and welfare, where as, political science explains the political conditions and institutions that influence the economic conditions on a country. Economics and Politics are act and react up on each other. Politics influence the economic conditions and politics are depend on economic situations. Politically colonialism of India is major cause for poverty and backwardness of India.

1.10.2 ECONOMICS – HISTORY: A record of part events is known as history. History explains the contemporary social, economic and political situations. By means of history, we can able to confirm or disprove old theories and discover new ones. History is largely contributed for formulation of theories such as trade cycles, economic growth, international trade etc. Hence, it has been well remarked Economic without History is no root, History with Economics is fruitless.

1.10.3 ECONOMIC – SOCIOLOGY: Sociology is the general science of the society. It studies the relationship of human beings with society Human relations, traditions etc and economic and ethical values etc are dealt in according sociology. Where as, Economics to Marshall is a study of mankind living in a society. Economics studies the economic aspects of the human beings living in a society in a specialised manner. The social life have a great influence on the economic organisation of the society and Economic set up influences the pattern of social life and social life. Hence these two sciences are interdependent. Example

Economic aspects such as population, mobility of labour etc influence the joint family system in the society.

1.10.4 ECONOMICS AND ETHICS: An Ethical values of the society are studied in 4 ethics. Economics is closely related with ethics. It is necessary that the Economic activities must be conducted on a moral plane. Economic development of a society will depend on moral values and sincerity of the individuals in that society. Anti-social activities or non-ethical activities such as black marketing, tax evasion, printing of fake currency etc. are creating negative effect on the society. Hence there is a proverb known as honesty is the best policy. Earlier economic thinker subordinated economics to ethics. But modern economists felt that economics is not concerned with the question right or wrong, good or bad. However, the influence of ethics on economics is inevitable in the study of normative economics or welfare economics.

1.10.5 ECONOMICS – PSYCHOLOGY: Psychology is made use in Economics. The law of choice, which is the most fundamental law of Economics, has a psychological basis. Mill described political economy as a moral or psychological science. Jevons made it even more psychological. To him the theory of economics was the mechanism of utility and say interest", and texture based on a calculus of pleasure and pain". Psychology of the consumer, producer, investor etc., are the basic determinants of economic principles.

1.10.6 ECONOMICS – MATHEMATICS: Economists have increasingly using the mathematics to build economic theories in the form of models. The tendency of using mathematics has led to the building of sophisticated, mathematical models. The relation between economic and mathematics has been increasing day by day. Besides the universality of mathematical language mathematical models afford exactness to economic to economic theories saving them from ambignity. Econometrics is a subject developed by using the sophisticated mathematical tools in economics. Presently, mathematics is using almost all spheres of economics such as planning, international economics etc..

1.10.7 ECONOMICS – STATISTICS: An economists data are statistics. As Ludwig von mises has connected', statistical figures referring to economic events are historical data. They tell us what happened in a non repeatable historical case". These statistics concern measure of the total volume of production of various commodities; the number of employed; the volume of sales; the total amount of payments; index numbers of whole sale and retail prices etc. some of the data are collected by private bodies. Various kinds of statistical tools are used to develop economic law. Statistical information is very useful for planning of the economy. For that season, the student of economics should necessarily know the statistics. Because statistical tools are very useful for formulating economic laws as well as for giving solutions for economic problems.

1.11 SUMMARY:

Economics is a study of human behaviour between ends and scarce means which have alternative uses. The definitions of economics given by different economists are categorised into four, namely wealth definition, welfare definition, scarcity definition and growth definition. Economic problem arises due to scarcity of resources. The important thing in economics is choice. Hence economics is also called as science of choice.

Knowing of the subject matter of economics, whether economics is science or art, or is it a positive or normative science is essential to under the scope of economics. Regnar Frish divided economics as micro and macro economics. Micro economics deals with individual units and macro economics deals with aggregates. These two are interdependent. The economic analysis made by taking time element is dynamic economics, where as, without taking time element is state economics. Like other sciences, economics is a science comprises of various principles, laws and models. There are two scientific methods to formulate economic principles viz., deductive method and inductive methods.

Induction is the process of seasoning from a part to the whole, from particulars to generals or from the individual to the universal.

1.12 IMPORTANT POINTS TO BE REMEMBERED:

1. Activities relating to economy or the activities that are dealt by economics are economic activities.
2. The basic economic problems are what is to produce, how to produce and whom to produce.
3. The definitions given for economics are four, namely, Adam Smith's wealth definition, Marshall's welfare definition, Robbin's scarcity definition and Samuelson's growth definition.
4. A systematic body of knowledge ascertainable by observation and experiment is called as science. The practical application of scientific principles is called as art. Economics is science as well as art.
5. Positive economics concerned to 'what is' and normative, economics is 'what ought to be'.
6. Economics which deals with the study individuals is micro economics, where as, economics which deals with aggregates is macro economics.
7. There are two scientific methods to formulate economic principle viz., deductive method and inductive method.

1.13 KEY CONCEPTS:

1. **Production** : Creation of utility or process of producing goods and services.
2. **Micro Economics** : A study of the economic actions of individuals or a small group of individuals. This may be called price theory.
3. **Macro Economics** : A study of the economic actions of aggregates. This may be called income theory.
4. **Deductive Method** : Deduces new conclusions from fundamental assumptions or from truths established by other methods.

5. **Inductive Method** : Inductive method involves the process of reasoning from particular fact to general principles.
6. **Positive Economics** : Positive economics concerned to 'what is'. This is pure science.
7. **Normative Economics** : Normative economics is 'what ought be'. This is an ethical science.
8. **Static Economics** : Economic analysis made without taking time element under consideration.
9. **Dynamic Economics** : Economic analysis made by taking time element under consideration.

1.14 MODEL QUESTIONS:

I. ESSAY TYPE QUESTIONS:

1. 'What-ever economics concerned with it is not concerned with material welfare' Discuss.
2. Define economics and write its scope.
3. 'Allocation of scarce factors with multiplicity of want is economics' – Discuss.
4. Write the two methods needed for scientific thought ? What are the merits and demerits ?
5. Define Economics. Write its relationship with other sciences.

II. SHORT ESSAY TYPE QUESTIONS:

6. Distinguish between micro and macro economics.
7. Critically examine the wealth definition.
8. Write the scope of economics.
9. Critically examine the welfare definition.
10. Write a note on Basic Economic Problems.

1.15 SUGGESTED READINGS:

1. Gould, J.P. and Ferguson, C.E : Micro Economic Theory
2. Samuelson P.A. & Norhaus W.D. : Economics
3. Jhingan, M.L. : Advanced Economic Theory
4. Dewett K.K. : Modern Economic Theory
5. Ahuja, H.L. : Principles of Micro Economics
6. Telugu Academy : Economic Theory
7. Telugu Academy : Business Economics

MODULE : 2 Lesson : 1

LAW OF DEMAND

1.0 AIMS AND OBJECTIVES:

In this part we discuss, what is demand, types of demand, determinants of demand, law of demand and exceptions. By the end of this part one should understand the following points.

* What is demand, and types of demand
* Demand Function, determinants of demand
* Law of demand
* Exceptions to demand

CONTENTS:

1.1 INTRODUCTION TO DEMAND:

Demand plays a very important role in Business sectors. Because sales and profits of a firm depends upon its demand. A firm will not live without any demand of its goods in the market. Failure and success of a firm depends on demand of the goods. A firm will mobilise resources based on the demand forecastings. Hence, business economists studies the demand and its related things.

1.2 DETERMINANTS OF DEMAND:

Demand for a good depends upon various factors. They are

1. **PRICE OF GOOD:** Demand of a good depends upon its price. A change in price leads a change in demand of a good. The demand falls when the price rises and vice versa.
2. **POPULATION:** In general, demand for a good depends upon population of a country, and number of consumers of that country. Demand is high when the population is more and the demand is low when the population is less.
6. **INCOME AND WEALTH OF CONSUMERS:** Goods demand is based on income of the consumers. If the income changes the quantities puchased will also change.
4. **TASTES AND HABITS OF CONSUMERS:** Demand for a good is based on tastes and habits of the consumers. Demand will change if the tastes and habits of the consumers change.
5. **PRICES OF SUBSTITUTES :** Demand for a good depends upon its substitute goods. The demand is high if there are more substitutes. Moreover, the prices of its substitutises effect its demand. For example, price of coffee effects demand for Tea. Demand for tea is high when the price of coffee is high. The demand for tea is low when the price of coffee is low.
6. **COMPLEMENTARY GOODS:** Complementary good is a related good. Demand for a good depends upon prices of its complementary goods. For example, demand socks depends upon prices of shoes.

1.3 DEMAND AND LAW OF DEMAND:

In general, the demand for a commodity is the quantity bought. But in economic terms demand means economic power of a commodity arises when the person has desire to buy it, and has the ability and willingness to pay for it. In other words, the demand for a commodity is the quantity bought at a given price and at a given time

A peson desires to buy a car. This is his desire. He has the ability to pay for it. But he is firm. So, this is not demand in the same way, there is no demand for a car even though he has a million. But has no desire to purchase a car. Hence, we need two things to demand for a commodity. They are desire and ability to buy.

LAW OF DEMAND:

The law of demand refers the relationship between price of a commodity and demand for it. The law shows, other things being equal "demand rises when the price falls and demand falls when the price rises". Hence, there is an inverse relationship between price and demand.

1.4 DEMAND FUNCTION:

It explains relationship between demand for a good and its determinants. Demand for a commodity depends upon not only its price but also on prices of other goods, income of the consumer, tastes and habits of the consumer etc., Technically this is written as :

$D = f(P, Y, P_r, t)$ where

$D =$ Demand for a commodity

$P =$ Price of the commodity

$P_r =$ Prices of substitutes and complementary goods

$Y =$ Income of the consumer

In the above equation, it is hope that Y_I, P_r, t are fixed. Hence,

$D = f(P)$

1.5 DEMAND SCHEDULE:

A table, which shows the relationship between price and demand is called demand schedule. The demand schedule refers the quantity purchased by a consumer at various prices.

Table No. 1.1

Demand Schedule

Price of Washing Machine(in Rs.)	Demand for Washing Machine
10000	40
11000	35
12000	30
16000	27
14000	22

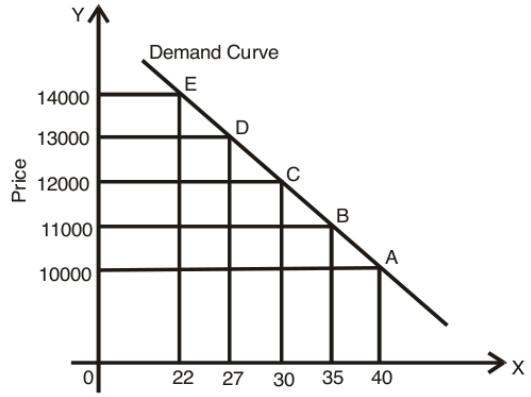
The above Table - 1.1 shows that the consumers buy washing machines at various levels of price. Basing on the table it is said that there is an inverse relationship betwen price and demand.

1.6 DEMAND CURVE:

A curve, which shows the relationships between price and demand is called Demand Curve.

Diagram - 1.1

Demand Curve



In the above Diagram-1.1, we show demand for washing machines on X-axis and price of washing machines on Y - axis. It may be stated, basing on the points, that the demand for washing machines are 40 at Rs. 10000 price level. If the price rises from Rs. 10000 to Rs. 110000 this demand falls from 40 washing machines to 35. In the same way the demand is decreases when the price falls. The points A, B, C, D and E on the demand curve shows various demanded quantities at various prices. All these points are conncected by a line, is called demand curve. The demand curve slopes downwards from left to right.

1.7 TYPES OF DEMAND:

Basing on the values of the demand curves, it is divided into various types of, which the following are the main.

1. Individual demand and market demand
2. Company demand and industry demand
6. Reciprocal Demand and Autonomous demand
4. Price demand, income demand and cross demand

LET US NOW UNDERSTAND THE TYPES :

1. **INDIVIDUAL DEMAND AND MARKET DEMAND:** The demand of a commodity at various prices is the amount. At which this purchased during a period is called individuals demand. The market demand is the sum totals of individual demands that are purchased at various prices during the same period.

2. **COMPANY DEMAND AND INDUSTRY DEMAND:** A group of firms or companies producing a similar product is called industry. The demand for the products of the industry is called industry demand. For example, Demand for soaps in a country is considered as industry demand. Because manufacturing companies of soaps in a country is considered as an industry. It means combination of all firms which produce same goods or close substitutes, is called an industry.

   On the other hand, the demand for the product of a company is called company demand or firm's demand. For example, demand for Pears bath soap is called company demand. Because, different companies produce different soaps, all these soaps are substituties for each other. Hence, demand for all these soaps is called industry demand. Let us examine industry and company demands with an example.

   For example, the demand for all bath soaps in a certain period is 100 million units. But in that the demand for Cinthol soap is 20 millions only. Hence the Cinthal soap's share is 20%, in the total demand. The total demand of 100 millions is industry demand and 20 millions demand is company demand.

6. **RECIPROCAL DEMAND AND AUTONOMUS DEMAND:** Any good which may be desired for personal consumption by consumers is called Autonomus Demand or Direct Demand. For example, demand for food items, by houses is called autonomous demand. Where as the reciprocal demand derived from Autonomous demand, for construction of a house we require brick, cement, iron etc., The demand for these is reciprocal demand. The demand for brick, cement depend on demand for houses. The demand for bricks rises when the demand for houses is increasing. When the demand for houses decreases the demand for bricks falls. In general, demand for consumer goods is called Autonomous demand and demand for producer goods is called indirect demand or reciprocal demand.

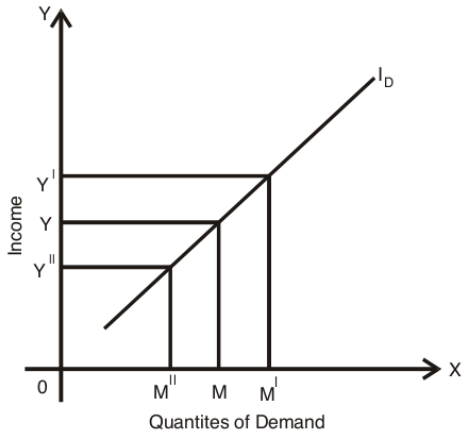
4. **PRICE DEMAND, INCOME DEMAND AND CROSS DEMAND:** Other things being constant, the relationship between price and demand is called price demand. Price demand relationship is indirect or inverse. Other things being equal, a fall in price extends demand and a rise in price contracts demand.

   Other things being equal, the relationship between income and demand is called income demand. The income demand relationship is direct.

   Cross demand refers the relationship between prices of substitutes and complementary goods and their demand, when other things being the same. The relationship between price of substitutes and its demand is directly proportional. The relationship between price of complementary good and its demand is inverse.

   The following diagram - 6.2 shows income demand. Generally, demand increases when income increases Demand decreases when income decreases.

Diagram - 1.2
Income Demand



In the above diagram - 1.2, I_D is income demand curve. OM is the demand at OY level of income. The demand increases from OM to OM' as income increases from OY to OY'. If the income decreases from OY to OY'' the demand also decreases from OM to OM''.

Cross demand curve is shown in the following diagrams.

Diagram 1.2(A)
Substitute goods

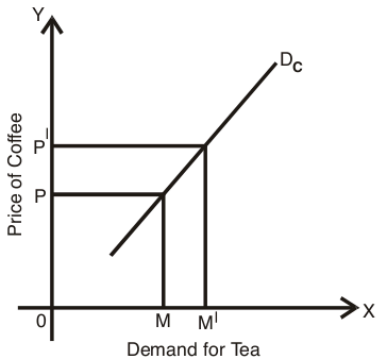


Diagram 1.2(B)
Complementary goods

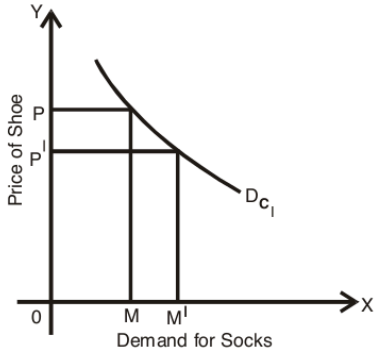


Diagram 1.2(A) shows cross demand for substitute goods and consider tea and coffee as substitutes. It may be observed from the diagram - 1.2(A), as the price of tea rises, demand for coffee increases as people tend to substitute coffee for tea. The cross demand curve slopes upwards from left to right in the case of substitutes. When the price of tea is P the quantities of coffee powder purchased in OM. When the price rise from P to P' the demand for coffee increases from M to M'.

Diagram - 1.2(B) shows cross demand for complementary goods, shoe and socks. It may be observed from this diagram - 1.2(B) as the price of shoes falls, demand for socks increase. The cross demand curve in the case of complementary goods slopes downwards from left to right. When the price of shoe falls from P to P', the demand for socks increases from OM to OM' as shown in the diagram 6.2(B),

1.8 REASONS FOR DOWNWARD SLOPING OF A DEMAND CURVE:

Generally, the demand curve slopes downwards from left to right. We understand the of law of demand as study of the reasons for downward slopping of a demand curve. The reasons are as follows.

1. As there is inverse relationship between price and demand the demand curve slopes downward from left to right.
2. The law of demand is based on the law of diminishing marginal utility. According to the law of diminishing marginal utility each succeeding unit of a commodity gives less satisfaction than the preceeding unit. Hence, for each additional unit a consumer is willing to pay a lower price. As the price falls, he tends to buy more and more units. As the price rises he tends to buy less and less units. Hence, the demand curve falls downwards from left to right.
6. Further, a fall in price induces old buyers to buy more and attracts new buyers. It results in increase in demand. A rise in price reduces purchasing power. It leads to decrease in demand. This is one of the reason for downward sloping of a demand curve.
4. Substitution and income effects are considered as price effect. Income of the consumer effects the quantity of demand. This is medium effect. The real income of consumer will increase when prices of goods decreases. It leads to increase in purchasing power. For example, a fall in price leads to buy more milk. A rise in the price of milk leads to buy less quantity of milk. That is why the demand curve slopes downwards from left to right.
5. Changes in the prices of substitutes effect demand. This is called substitution effect. For example, as the price of coffee rises, keep the price of tea fixed, the demand for tea increases as people try to substitute tea for coffee. Hence, the demand for coffee decreases. Thus, in the case of substitutes the demand curve slopes up from left to right.
6. The demand may not only be effected the above goods but also by some of the other goods. As the price of a commodity falls it is put to more and more uses. As the price of a commodity rises it is put to less and less uses. For example, if the price of

electricity is lowered, the households may use electricity for cooking and heating purposes also.

1.9 EXCEPTIONS TO THE LAW OF DEMAND:

There are some exceptions to the law of demand. These exceptions are aganist to the law of demand. The following are the some of the exceptions to the law of demand.

1. **SUPERIOR GOODS:** Demand for some goods is high, because of their high prices. The consumers of such goods measure their desirability by their prices. For example diamonds and jewellery etc. The consumer estimates his status by their prices. Hence, they buy less of these goods at lower prices and it decrease results in demand instead of increase. They buy more of these goods at higher prices. It results in to increase in demand instead of decrease.

2. **GIFFEN GOODS:** According to Sir. Robert Giffen the law of demand does not apply to necessary goods. This is called Giffen paradox. A rise in prices of essential goods leads to increase in demand for them. For example, a rise in the price of rice caused a severe fall in the real income of the poor people that they were forced to curtail consumption of other expenses and buy more of it, even when its price rises. Thus, the demand for rice is constant even when its price rises. This is called Giften's Paradox.

6. **SPECULATION BUSINESS:** People expect a further rise in price, buy larger quantity than before is called speculations business. A speculative person purchases larger quantitites with a rise in price and smaller quantities with a fall in price. Hence, a rise in price leads to increase in demand. Thus, speculation business is one of the exception to the law of demand.

1.10 SUMMARY:

The demand for any thing at a given price is the amount of it which will be bought per unit of time at that price. This will effect ones my desire and purchasing power. The consumer buys more at lower price and less at higher price. The relationship between price and demand is inverse. Essentials, Giffen goods and speculative business are exceptions to the law of demand. The relationship between income and demand is called income-demand. The relationship between the prices of substitute and complementary goods and its demand is called cross demand.

1.11 POINTS TO REMEMBER:

1. The demand for anything at a given price is the quantity bought. Demand requires desire and ability to buy.
2. Demand for a commodity depends upon price of it, prices of substitutes and complementary goods, income tastes and habits, population etc.
3. The relationship between price and demand is called demand schedule. A curve which shows this relationship is known as demand cruve.

4. The relationship between price and demand in inverse. The relationship between income and demand is positive incase of superior goods and it is negative in case of inferior goods. The relationship between the price of substitute goods and its demand is positive incase of substitutes and it is negative in case of complementaries. The relationship between this price of complementary goods and its demand is inverse.

5. Giffen goods, superior goods and speculation business are not applicable to the law of demand. Hence, these are exceptions to the law of demand.

1.12 KEY CONCEPTS:

1.	**DEMAND**	**:**	The demand for any thing at a given price is the quantity bought.
2.	**LAW OF DEMAND**	**:**	Other things being equal, demand rises when a fall in price, and demand falls where a rise in price.
6.	**SUBSTITUTES**	**:**	A good which is used in place of another good is called substitute good. For example, tea and coffee.
4.	**COMPLEMENTARY GOOD**	**:**	A good, which is used along with other good is called complementary good. For example milk and sugar one used to make coffee.
5.	**CROSS DEMAND**	**:**	The relationship between price of substitute or complementary good, and it's demand.

1.13 MODEL QUESTIONS FOR EXAMINATIONS:

I. ESSAY QUESTIONS:

1. Explain the law of demand and write its exceptions.

II. SHORT QUESTIONS:

1. What is demand? Write different types of demand.
2. Explain the law of demand.
6. Why the demand curve slopes downwards from left to right?

III. VERY SHORT QUESTIONS:

1. Demand Function
2. Reciprocal Demand
6. Individual Demand and Market Demand
4. Company Demand and Industry Demand.

1.14 SELECTED READINGS:

1. Watson - Price Theory and Its uses
2. K.K. Dewett - Modern Economic Theory
6. M.L. Jhingan - Advanced Economic Theory
4. P.A. Samuelson - Economics
5. Stonier and Hogue - Micro Economic Theory
6. G.E. Fuguson - Micro Economic Theory
7. R.G.D. Allen - Mathematical Analysis for Economics
8. R.A. Bilas - Micro Economic Theory

MODULE : 2- Lesson: 2
UTILITY ANALYSIS

2.0 AIMS AND OBJECTIVES:

Utility analysis is an important topic in this economics. The main objective of the consumer in the purchasing of goods and services in to satisfy his wants. In this part we should understand the consumer is in equilibrium in the purchasing of goods. By the completion of this point the students understand the following things.

* What is utility
* Types of Utility Analysis
* Indifference Curve
* Properties of Indifference curve
* Budget Constraints
* Consumer's equilibrium

CONTENTS:

2.1 CARDINAL UTILITY ANALYSIS, ORDINAL UTILITY ANALYSIS:

Utility is the power of a commodity to satisfy human wants. It is defined as the satisfaction experienced by a consumer when the given commodity is consumed. In the process of consumption, man gets satisfaction. Consumption does not mean destruction of matter. It is called destruction of utility. People demand goods because they satisfy their wants. Utility can also be defined as the property of the commodity which satisfies the wants of the consumers. A consumer purchases commodities according to his tastes. A consumer desires a commodity more than another commodity because the first one his more utility. Thus the desire for a commodity by a consumer depends upon the utility he expects to obtain from it. The greater the utility he expects from a commodity, the greater his desire for that commodity. Utility is the subjective thing and resides in the mind of consumer.

Utility analysis is an important topic in this economics. The main objective of the consumer in the purchasing of goods and services is to satisfy his wants. In this point we should understand who the consumer is in equilibrium in the purchasing of goods. There are two analysis to study the consumer's behaviour. They are 1. Cardinal Utility Analysis, 2. Ordinal Utility Analysis. The word utility denotes the want satisfying power of a commodity or service. In general, the meaning of utility and usefulness is one and the same. The same good may give different utilities to different persons.

According to cardinal utility analysis, utility can be measured in members, or in units. By utility in psychological concept. So it cannot be measured in terms of member or units. However, utility can be compared. Good A gives more satisfaction or less satisfaction then good B. but we cannot say by how much utility of one good is more or less than the utility of another. Basing on cardinal utility analysis, law diminishing marginal utility, law of equi-marginal utility and the theory of consumer surplus were explained.

The theory of consumer behaviour postulates that consumers seek to maximize their total utility or satisfaction. On the basis of this postulate, consumption theory explains how a consumer attains level of maximum satisfaction, under given conditions. The consumer behaviour can be expected both under cardinal utility approach and ordinal utility approach. The terms cardinal and ordinal are borrowed from the vocabulary of mathematics. The numbers..1,2,2.... and so on are cardinal numbers. In these numbers, we know that number 2 is twice the size of number..1. In contrast the numbers.. 1st, 2nd, 2rd and so on are ordinal numbers. These numbers are ordered or ranked. In these numbers we cannot know the size +relation of them. The second one might or might not be twice as big as the first one. **Marshall** said that utility of a commodity can be measured quantitatively. He said that a person can express the utility or satisfaction he derived from the goods in quantitative terms. Thus he can say that utility from the consumption of apple is 40 units, and that of orange is 25 units. Thus he can express his satisfaction in terms of quantities.

This type of measurement is called cardinal system. Some economists belonging to the cardinal school measure utility in imaginary units called utils.

2.1 INDIFFERENCE CURVE

The indifference curve is used to replace the neo-classical cardinal utility concept. The technique of indifference curves was invented by Edgeworth, an English economist, in his Mathematical physical in 1981 to prove his theory of barter. Fisher, an American economist in 1892, was tried to analyse elaborately. Later Wilfred Parito in 1906, used this technique to explain his value theory will some modifications. Later, Prof. Hicks and R.S.D. Allen were developed the technique in terms of introspective ordinalism in their classic paper untitled “A Reconsideration of the Theory of Value”. Lastly, Hicks presented its comprehensive Versia in his value and capital in 1929.

The important aspect of indifference curves analysis is the consumer desires several combinations of goods, not a single good. The arrangement of combination of goods set in the order of the level of significance is called the scale of preference. For instance, a consumer is preferred apply and manages or x and y it is called two goods scale of preference. If the consumer prefers three goods scale of preference. To analyse the indifference curve analysis we take two goods scale of preferences combination.

2.3 INDIFFERENCE SCHEDULE:

Let us assume that a consumer prefers two goods scale of preferences. An indifference curve schedule refers various combinations of two goods that are equally satisfactory to the consumer. The consumer considers the following schedule and prefers any combination. It means the consumer is indifference in choosing any combination. Let us assume that the consumer prefers two goods, X and Y, that given equal satisfactory to the consumer. We show such a schedule hereunder.

Table – 2.1

Indifference Schedule

Combination	Good X	Good Y
A	1	12
B	2	8
C	2	5
D	4	9
E	5	2

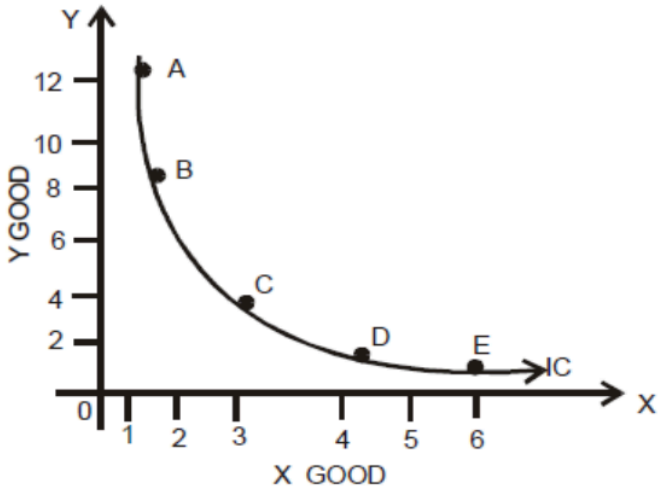
From the above table – 2.1, there are four combinations. They are A, B, C, D and E. Combination A consists one x good and 12 y goods. Combination B consists 2 x goods and 8 y

oods. These two combinations give same satisfaction to the consumer. The other combinations, C, D, E, are also explained in the same way. Hence, he is indifferent among these various combinations.

2.4 INDIFFERENCE CURVE:

An indifference curve represents equal satisfaction of a consumer from two commodities. We shall translate the indifference schedule into a diagram and they get an indifference curve in Diagram – 2.1.

Diagram– 2.1



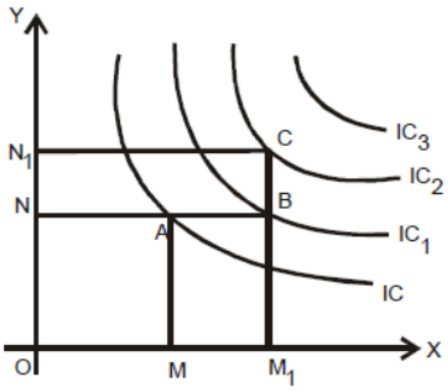
In the above diagram 2.1, we take Good x as OX axis, Good Y on OY axis. If the various combinations are plotted on diagram – 2.1 and are joined by a line, this becomes an indifference curve as 1C in the diagram. The indifference curves shows equal satisfaction of a consumer from various combination of X and Y commodities. 1C is an indifference curve. Each point on the 1C curve is showing equal satisfaction to the consumer. The consumer is indifferent towards various combinations. That is why it is known as indifference curve.

2.5 INDIFFERENCE MAP:

A set of indifference curves is called an indifference map. In this map, every indifference curve, the consumer obtains lesser and greater satisfaction. In this map every indifference curve shows certain level of satisfaction. The right side indifference curve gives higher satisfaction. The right side indifference curves give higher satisfaction, and left side indifference curve gives lower satisfaction. However, each point on an indifference curve gives satisfaction to the consumer. Hence, the set of these indifference curves is called an indifference map.

DIAGRAM – 2.2

INDIFFERENCE MAP



In Figure – 2.2. B point, on the $1C_1$ curve gives more satisfaction than A point, on the 1C curve. Because at point B the consumer getsOM_1 line of x commodity and an level of of y commodity. Thus, point B gives more satisfaction. It means every point on $1C_2$ curve gives more satisfaction than every point on $1C_1$ curve. In the same way $1C_2$ gives more satisfaction than $1C_2$ curve.

2.6 MARGINAL RATE OF SUBSTITUTION:

The marginal rate of substitution shows how much of another or at what rate a consumer is willing to substitute one commodity for another in his consumption pattern. The consumer is willing to use x and y commodity and substituting good y for good x. The rate at which the consumer substitutes Y for X is called the marginal rate of substitution. Symbolically it is denoted as MRS of X for Y. Marginal rate of substitution MRS of X for Y = $\Delta Y / \Delta X$

Table – 2.2

Combination	Good X	Good Y	MRS of X for Y
A	1	12	
B	2	8	**4:1**
C	2	5	**2:1**
D	4	9	**2:1**
E	5	2	**1:1**

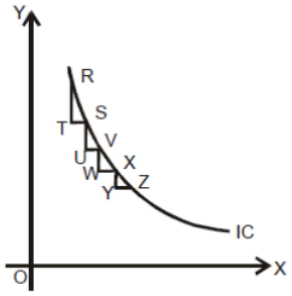
In Table – 2.2, the consumer started with more Y goods and less X goods. The consumer is prepared to forgo u units of y for obtaining an extra unit of X at B combination. Later, the consumer is willing to last 2 units Y for obtaining an extra unit of X. In other words, the consumer is willing to

more Y units for obtaining extra unit of X. It means that the marginal rate of substitution diminishes.

2.7 SCOPE OF AN INDIFFERENCE CURVE:

The marginal rate of substitution, which is explained in the Table – 2.3, is analyzed through an indifference curve. The same thing is analyzed in the following diagram.

DIAGRAM 2.3



In Diagram – 2.3 R and S points on the indifference curve, shows two combinations of X and Y commodities. If the consumer moves from R to S, he is willing to forgo RT level of Y commodity to getting TS level of X commodity. Hence, the marginal rate of substitution of X for Y or MRS of X for Y = RT / TS. It means that the slope of the indifference curve shows the marginal rate of substitution. If the consumer moves from left to right, he is forgo SU level of Y for UV level of X, VW level of Y for WX level of X. The levels of RS, SU, VW of Y commodity is gradually decreasing. Because the marginal rate of substitution decreases when we move from left to right.

2.8 PROPERTIES OF INDIFFERENCE CURVE:

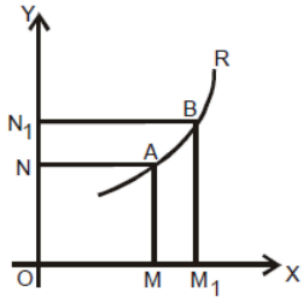
The following properties of indifference curves can be deduced.

1. Indifference curve slope downwards from left to right.
2. Indifference curve is convex to the origin.
3. Indifference curves in never intersect each other.

2.8.1 INDIFFERENCE CURVE SLOPE DOWNWARDS FROM LEFT TO RIGHT:

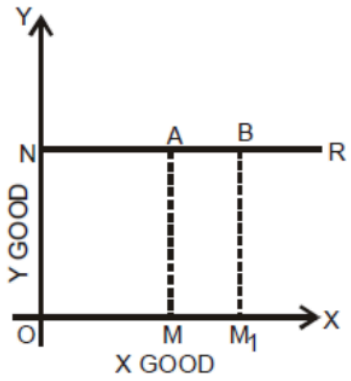
Indifference curves slope downward from left to right or negatively sloped. Look at the diagram 2.4 if an indifference curve slopes from right to left.

Diagram - 2.4



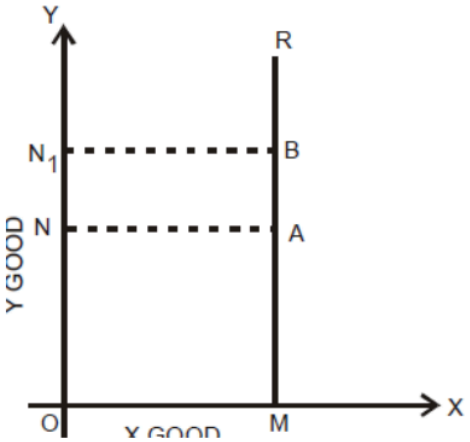
In diagram 2.4, A and B are on the RS curve. At point A, the consumer is obtaining OM level of commodity X ON level of commodity Y. At point B, the consumer is getting OM, level of commodity X and ON, level of commodity Y. It means that is obtaining more units of X and Y commodities at point B. When compared with point A. Therefore, B gives more satisfaction than A. But according to the assumption that both points on RS curve give same level of satisfaction. Hence, RS curve is not an indifference curve. Let us examine another possibility. For instance the indifference curve is a horizontal straight line as shown in the following diagram 2.5.

Diagram - 2.5



In the above diagram - 2.5, NR curve is a horizontal straight line. Point A on this curve shows that the consumer is getting OM level of commodity X and ON level of commodity Y. In the same way, at point B the consumer is getting OM_1 level of commodity X, and ON level of commodity Y. A movement from A to B will increase the quantity of commodity X from OM to DM. Hence, B gives more satisfaction than A. Therefore, NR curve is not a indifference curve. Because it gives various satisfactions. Let us examine another possibility; example the indifference curve is a vertical straight line as shown in the following diagram - 2.6.

Diagram - 2.6

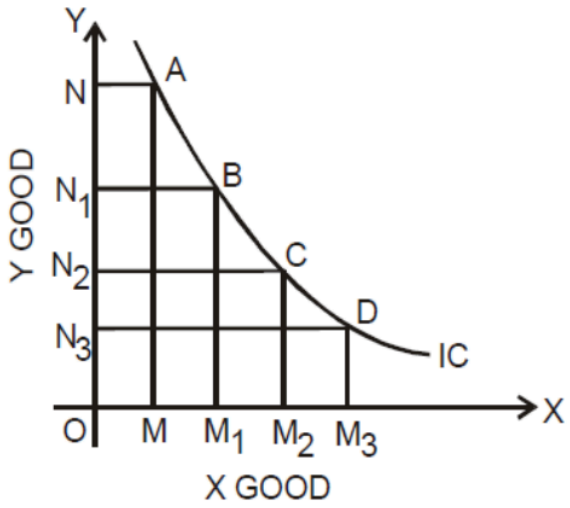


In the above diagram- 2.6, movement from A to B increases the quantity of commodity B, although the quantity of A remains fixed. Therefore B gives more satisfaction than A. So an indifference curve cannot be vertical straight line. From the above analysis, we understood that the indifference curves must slope downward from left to right.

2.8.2 INDIFFERENCE CURVE IS CONVEX TO THIS ORIGIN:

The convexity rule of indifference curves implies that diminishing of marginal rate of substitution. The following diagram showed this.

Diagram 2.7

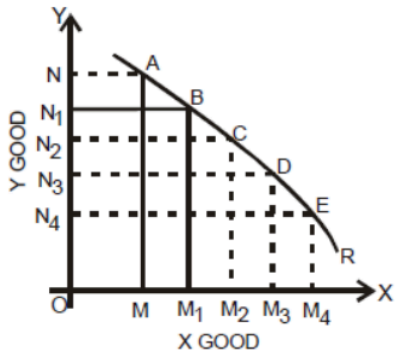


We observed A, B, C and D points on 1C curve in diagram 4.7. OM_1 , MM_1 , MM_2 , M_2M_2 on X - axis shows various quantities of commodity X. At point A the consumer is obtaining OM level of commodity X and ON level of commodity Y. If he moves from A to B, W is forgo NN_1 level of commodity Y for getting MM_1 level of commodity X. The consumer is losing N_1N_2 level of

commodity Y for obtaining M_1M_2 level of commodity X if he moves from point B to point C. In the same way the consumer is willing to give up N_2N_2 level of commodity Y for giving M_2M_2 level of commodity X if he moves from C to D. It means the marginal rate of substitution is decreasing. But it is possible only when the indifference curve is convex to origin.

Let us examine another possibility, for example the indifference curve is concave to the origin. The marginal rate of substitution increases instead of diminishes if the indifference curve is concern to the origin. Increasing marginal rate of substitution is impossible. The increasing marginal rate of substitution indicates various satisfactions on the 1C. Hence, it is not an indifference curve.

Diagram - 2.8

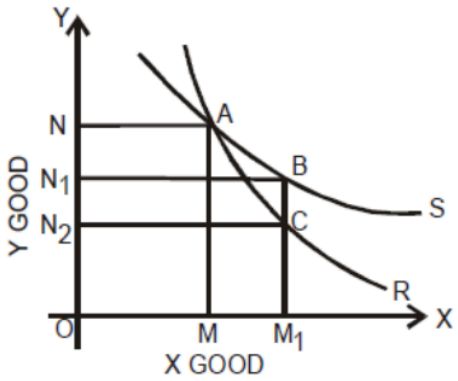


In Diagram - 2.8 R curve is concern to the origin. On the concern curve A, B, C, D and E points are then OM_1, M_1M_2, M_2M_2, M_2M_4 on X axis shows various consumer shifts from point A to point B, the consumer is left NN_1 level of commodity Y for getting MM_1 level of commodity Y for obtaining M_1M_2 level of commodity X. In getting additional units of commodity X, the consumer is for go N_2N_2, N_2N_4 levels of commodity Y. It means the marginal rate of substitution is increasing. Hence, the marginal rate of substitution diminishes when the indifference curve is convex to the origin. Therefore an indifference curves are convex to the origin.

4.8.3 INDIFFERENCE CURVES CAN NEVER INTERSECT EACH OTHER:

The indifference curves can never meet or intersect for cent each other. We can prove this property by showing that if two indifference curves intersect it will lead to observed results.

Diagram - 2.9

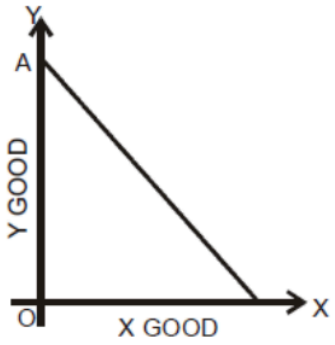


In the diagram – 2.9, the two curves R and S are intersect each other at point A. Hence, the consumer is getting serve satisfaction at point A. Let us examine point B on S curve, and point C on R curve, point B gives more satisfaction than C to the consumer. But the quantity of Y is more at point B and less at point C. Therefore B gives more satisfaction then C. In the diagram point A and point C on the R curve which gives some satisfaction. In the same way A and B points on the S curve gives same satisfaction to the consumer. Therefore A is equal to B and A is equal to C. But B is not equal to C. Hence, R and S curves cannot intersect each other.

2.9 SUBSTITUTES GOODS COMPLEMENTARY GOODS:

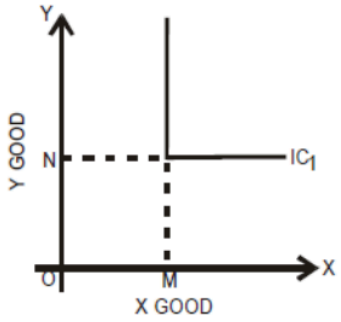
Generally the marginal rate of substitution diminishes. This is a one of the characteristic of indifference curve. But in the case of substitute goods and complementary goods it is different. In the case of substitution goods the consumer substitutes one good for another. Therefore the marginal rate of substitution is constant. For example, ten paisa stamp is equal to two five paisa steps. Hence, he substitutes two five paisa stamps for ten paisa stamp. The indifference curve is shown in the Diagram - 2.10.

Diagram 2.10



In the diagram - 2.10 the slope of indifference curve is constant because of a straight line, it means that the marginal rate of substitution is fixed. It means that the marginal rate of substitution is constant if the two goods are perfect substitutes.

Diagram 2.11



The slope of the indifference curves analyzed in the diagram - 2.11, if the two goods are complementary goods. Left and right shows on the best examples for complementary goods. There is no use of one show without another. Therefore, in the case of complementary goods, the marginal rate of substitution is zero.

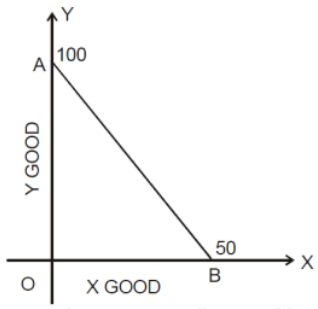
2.10 BUDGET CONSTRAINTS:

An indifference map describes a consumer's preferences for various combinations of goods and services. But the preferences do not really explain all of consumer behaviour. A budget constraint also affects the individual choices, which in turn limit the consumer's ability to consume in light of the prices they must pay for various good and services.

2.10.1 BUDGET LINE:

Let us consider the consumer purchases X and Y commodities with his money income. Suppose that the consumer has a fixed income, say Rs. 100, the price of X is Rs. 2 per unit, and the price of Rs. is one rupee. If the consumer spends his entire income on X, he gets 50 units of X and no Y or, if he spends it on Y alone, he gets 100 units of Y and no X. Therefore the consumer can buy various combinations of goods X and Y, with given income and given prices. This is known as budget line or price line is the following diagram – 2.12.

Diagram 2.12



In the diagram 2.12, we have shown co-ordinates X on X - axis, and commodity Y on - axis. OB is equal to 50 units of commodities X and OA is equal to 100 units of commodity Y. By joining points A and B, we get what is called price line or budget line or combination of commodities X and Y. This line shows all possible combinations of two goods. The slope of this curve depends upon the prices of commodity X and Y. Let us suppose, in case of consumer is M, and the prices of commodity X and Y are P_X and P_Y. If the consumer spends his entire income on X. We get M / P_X units of commodity X (or), if we spends his entire income on Y, we get M / P_Y units of commodity Y (OA). The power of consumer to buy these two combinations is shown by a budget curve. The slope of the budget line shows price ratios.

$$\text{Slope of Budget Line} = \frac{OA}{OB} = \frac{\text{Quantity of commodity Y}}{\text{Quantity of commodity X}}$$

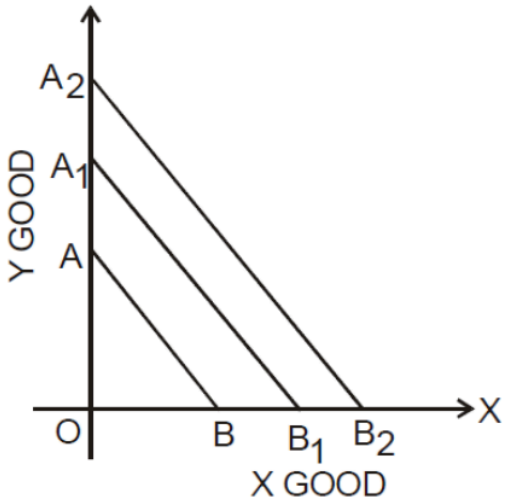
$$= \frac{M}{P_Y} \Big/ \frac{M}{P_X} = \frac{P_X}{P_Y}$$

It means the slope of price line shows price ratio OA of the two commodities. Therefore the price line will be 450 straight line, if prices of the two goods are equal.

2.10.2 CHANGES IN BUDGET LINE:

The budget line depends upon income of the consumer and prices of the two goods. If the prices remain constant a rise in the income level will lead to a shift of the price line to the right in a parallel position, with a rise in income he can buy more of the two goods. For example, if the income of the consumer rises from Rs. 100 to Rs. 120, the consumer can buy 120 units of commodity Y or 60 units commodity X. With a rise in income, he can buy more of the two goods. This is shown in the following diagram – 2.12.

Diagram 2.12

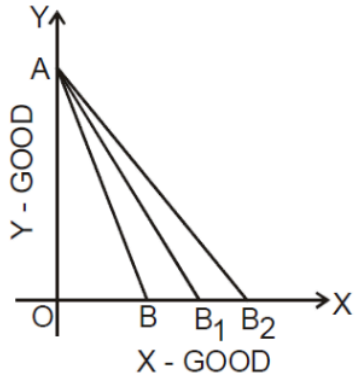


In the diagram – 2.12 AB is the starting budget line. The prices remain constant, but rise in income of the consumer leads to shift the budget from AB to A_1B_1 . The changed budget line is parallel portion to the right. If this income increases again, the price line becomes A_2B_2 . Without any change in price level, the slope of price line does not change.

$$\frac{P_x}{P_y} = \frac{OA}{OB} = \frac{OA_1}{OB_1} = \frac{OA_2}{OB_2}$$

If there is a rise in his income, the price line will shift upward. If there is a fall in his income, the price line will shift downward. The following diagram shows result of the price of commodity X changes which the income of consumer and the price of this commodity Y remains the same.

Diagram – 2.14

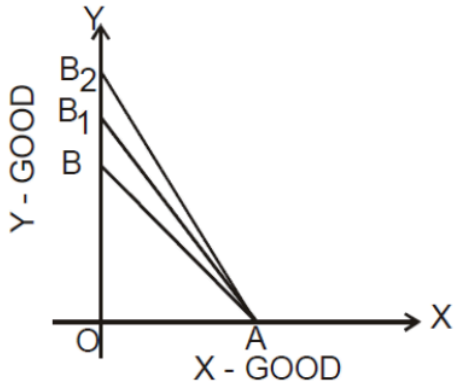


In the diagram – 2.14 AB is the starting budget line. The budget line shifted to AB, if the price of commodity X is fallen. It means, if the price of X fallen, the consumer can buy more of X, while there is no any change in the price level and quantity of commodity X, while Y is constant, the slope of the price line will be changed. When compared prices of commodities of X and Y. Price Ratio of AB budget line OA / OB. The price ratio of AB_1 = OA/ OB_1. The price ratio of AB_2 budget line = OA_2 / OB . However these price ratios are not equal to each other

$$\left[\frac{OA}{OB} \neq \frac{OA}{OB_1} \neq \frac{OA}{OB_2}\right].$$

Suppose the price of commodity Y changes, while the price of commodity X remains fixed is analysed in the following diagram – 2.15.

Diagram – 2.15



The starting budget is AB. If the price of commodity Y changes while X is constant the budget line shifted to A_1B and later to A_2B. However there is a change in the slope of the price line and price ratio. Here also, the price ratios are not equal to each

$$\left[\frac{OA}{OB} \neq \frac{OA_1}{OB} \neq \frac{OA_2}{OB}\right]$$

2.11 CONSUMER'S EQUILIBRIUM:

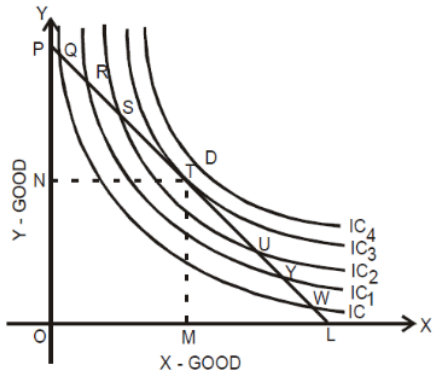
We can explain the equilibrium of the consumer with help of indifference curves. A consumer is in equilibrium when given prices of the two goods, he spends a income on the purchase of two goods in such a way as to get the maximum satisfaction. The following assumptions are taken to explain the consumer's equilibrium.

ASSUMPTIONS:

1. The consumer has a scale of preferences for various combinations of two goods.
2. The consumer has an indifference map showing his preference to purchase commodities X and Y.
2. The income of the consumer is fixed.
4. The prices of goods are remaining constant.
5. All goods homogeneous and divisible.
6. The consumer acts 'rationally' in the sense he tries to maximize satisfaction.

If there is no change in the above assumptions, the consumer spends his limited income on commodities of X and Y. At this stage the marginal rate of substitution and price ratio equal. The consumer is in equilibrium at the point when the price line tangent to an indifference curve. The same thing is analyzed in the following diagram – 2.16.

Diagram 2.16



Y

In the diagram – 2.16, the indifference curve shows various satisfaction of commodity X and Y. PC is the budget line or price line which shows the consumer can buy various combinations of commodities X and Y. The indifference map and price line are shown in the diagram 2.15

In the diagram – 2.16, 1C, 1C1, 1C2, 1C2 and 1C4 are the different indifference curves. IC1 gives more satisfaction than 1C, 1C2 gives more satisfaction that 1C1. IC2 gives more satisfaction 1C2. 1C4 gives more satisfaction than 1C2. Because, a higher indifference curve which lies to the right represents a higher level of satisfaction. Every point on budget line PL shows the consumer buys various combinations of two commodities with his limited income. It means the consumer can buy any combination out of the possible combinations P, Q, R, S, T, U, V, W and L.

The consumer does not want P, and L points. Because, at point P, the consumer gets Commodity Y only. At point L, he gets X commodity only. So, the consumers will choose combination of X and Y commodities combinations. However, he would not take combinations Q or W on indifference curve, R and V on 1C1, S or V on 1C2 curve. Because there are laying on low indifference curves. T lies on 1C2 where his budget line is tangent to 1C2 curve and buying OM level of commodities X and ON level of commodity. The consumer is in equilibrium at the point where the price line is tangent to an indifference curve. The consumer can unable to go point D which lies on 1C4 , because his limited income. Therefore, the consumer is in equilibrium at point T where the price line is tangent to the third indifference curve. In other words, the marginal ratio of substitution of X and Y must become equal to price ratio between these two goods. Thus at point T.

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

2.12 TERMINOLOGY:

1. INDIFFERENCE SCHEDULE: It shows schedule of various combinations of two goods that are equally satisfactory to the consumer.

2. INDIFFERENCE CURVE: It is a curve showing the various combinations of two commodities which yield equal utility of satisfaction to the consumer.

2. INDIFFERENCE MAP: It shows number of indifference curves.

4. MARGINAL RATE OF SUBSTITUTION: The amount of a commodity the consumer is willing to give up in order gaining one additional unit of another commodity.

5. BUDGET LINE: A graphical depiction of the various combinations of two selected products that a consumer can afford at specified prices for the products given their particular income level.

6. CONSUMER'S EQUILIBRIUM: The state of balance achieved by an end user of products that refers to the amount of goods and services they can purchase given their present level of income and the current level of prices. Consumer equilibrium allows a consumer to obtain the most satisfaction possible from their income.

2.13 MODEL QUESTIONS FOR EXAMINATIONS:

I. ESSAY QUESTIONS:

1. What do you understand by indifference curve ? Explain their lying and property.
2. What indifference curves? Explain their properties.
2. What are Budget Constraints?
4. How consumer attains equilibrium?

2.14 SELECTED READINGS:

1. Watson, D.S. : Price Theory and its Uses
2. Seth,M.L. : Principles of Economics
2. Ahuja, H.L. : Advanced Economic Theory
4. Jhingan,M.L. : Advanced Economic Theory
5. Dewett K.K.: Modern Economic Theory

LESSON – 3

INCOME, PRICE AND SUBSTITUTION EFFECTS DERIVATION OF DEMAND CURVE FROM PRICE CONSUMPTION CURVE

3.0 AIMS AND OBJECTIVES:

In this chapter, we analyse consumer's equilibrium with the help of indifference curves in ordinary utility analysis as explained in the cardinal utility analysis in the previous chapter. And we analyse the changes in the income of the consumer and prices of goods. By the completion of this section students can understand the following things :

* Consumer's equilibrium
* Income effect
* Substitution Effect
* Price Effect
* Derivation of Demand Curve with Price consumption Curve

CONTENTS:

3.1 INTRODUCTION:

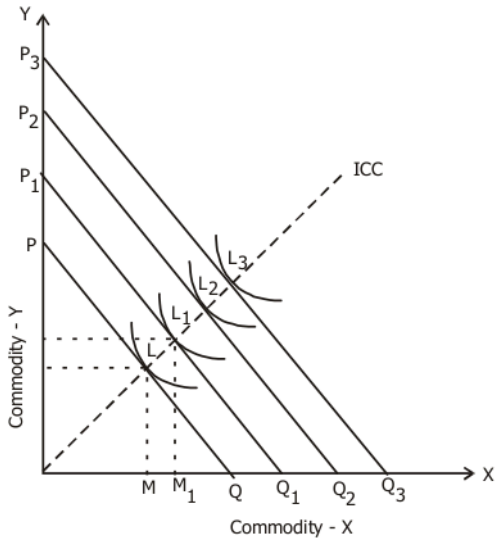
In the previous chapter, we have analysed the properties of indifference curves. The consumer buy a combinations of two goods basing on the prices of these two goods, and amount of money. Purchasing of combination of two goods with limited money. These factors are called opportunity factors. The price line or budget line shows these factors.

Let us explain the consumer's equilibrium with the help of the indifference curves. As explained in previous lesson, higher indifference curves represent higher level of satisfaction, and lower indifference curves represents lower level of satisfaction. Hence, a rational consumer tries to be on the higher curve to obtain higher satisfaction. In this lesson, we do understand consumer's equilibrium and application of indifference curve techniques to other things.

3.2 INCOME EFFECT:

The income effect refers to the changes in demand for X and Y resulting from a change in the income of the consumer, prices of the goods being constant. The diagram - 5.6 shows income effect.

Diagram - 5.6



In the diagram, the consumer first starts with point L where the consumer is in equilibrium. If the income of consumer rises, prices of X and Y being constant, the price line is shifted to P_1Q_1 The budget time P_1Q_1 is tangent IC_1 at point L_1. So, the consumer's equilibrium will shifts from L to

L_1. Point L_1 gives more satisfaction than L. Similarly, the effect of a further increase in income of the consumer creates other equilibrium points L_1, L_2 and L_3. If these equilibrium points are joined we get what is called income consumption curve (ICC). The income consumption curve shows how the consumption of the two goods reach to change in income, when the prices of both the goods are given and fixed. In other words, it shows the changes in demand with a change in income.

Let us now find out what are the superior goods and what are inferior goods with the help of slope ICC. If the consumer buys less of commodity when his income rises, the commodity becomes an inferior good. If the consumer buys more of commodity when his income rises it is a superior good. The following diagram shows the slope of ICC incase of superior good.

Diagram - 3.1 (a)

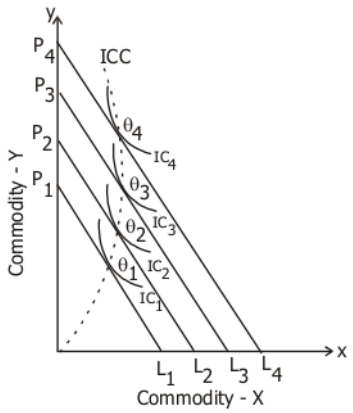
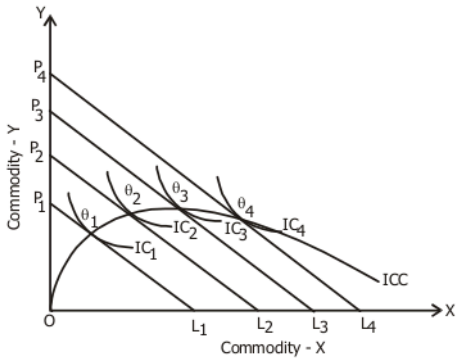


Diagram - 3.1 (b)



In the diagram - 3.1(a) the income consumption curve slopes from left to right. It means that if the income of consumer rises, the consumer buys less of commodity X and more of commodity Y. Hence, Y is superior good and X is inferior good. In the diagram - 3.1 (b), the income consumption curve slopes downwards from left to right. It means that the consumer buys more of commodity X and less of commodity Y as his income increases. Therefore, Y is inferior good and X is superior good.

The income consumption curves shows two things. A) ICC shows income effect. It means the consumer buys more when his income increases B) ICC shows which commodity is nferior and which commodity is superior.

3.3 SUBSTITUTION EFFECT:

The substitution effect shows the change in the quantity of a good purchased which is due only to the change in relative prices, money income remaining constant. It is assumed that when the price of good X falls, Y becomes relatively dearer. The increase in the real income of the consumer as a result of fall in the price of X is so withdrawn that there is in fact no change in his real income so that he is neither better of for worse off than before. The substitution effect is shown as figure 3.2.

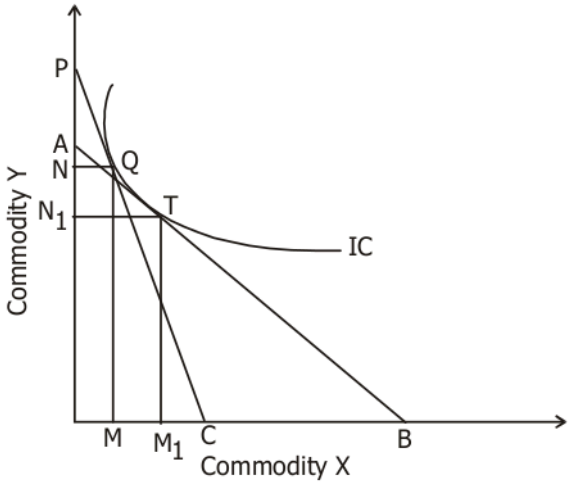


Diagram - 3.2

In the diagram - 5.8, the consumer is in equilibrium at point Q when the budget PL is tangent to the IC buying OM of X and ON of Y. Suppose the price of X falls so that the consumer can buy OM of X instead of OQ if he were to spend the whole of his given money incase on the purchase of good X. But when the price of X falls the price of Y rises in the same proportion by PA. So that the consumer's were budget line AB and he remains on the same indifference curve IC. This is the compensation variation due to the change in relative prices of X and Y, the real income of the consumer remaining constant. Since X has become cheaper and Y dearer, the consumer moves along the difference curve IC from Q to the new equlibrium point T. He substitutes X for Y by buying OM_1 of X and ON, of Y. The movement from Q to T is the substitution effect due to the compensating variation.

3.4 PRICE EFFECT:

The price effect indicates the way the consumer's purchase of good X changes, when its price changes, given his income, tastes and preferences and the price of good Y. The price effect is shown in the following diagram - 3.3.

As shown in the diagram 3.3, the consumer starts with budget line PL, the consumer is in equilibrium at point Q. Suppose the price of X falls, the budget line PL will extend further out to the right as PL_1 showing that the consumer will buy more x than before as X has become cheaper, the consumer will be in equilibrium at point R on the higher difference curve IC_1. In this portion, he will be buying OM_1 of commodity X. If the price of X falls further, so that the relevant price line is PL_2, the consumer will be in equilibrium at point S on the IC_2 curve, and buying OM_2 level of commodity

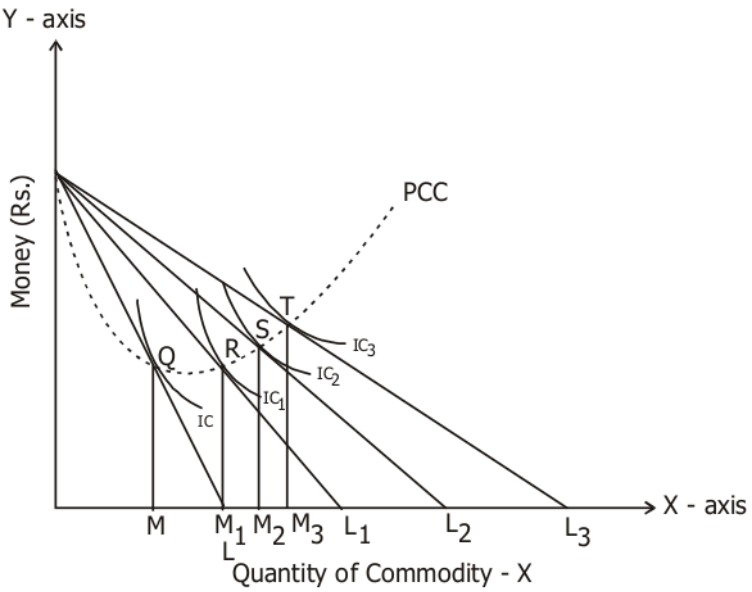


Diagram - 3.3

X. In the same way, we can discover other points of equilibrium for every other price. When all the points such as Q, R, S, T are joined together we have the price consumption curve of commodity X.

Price effect : Income effect + Substitution effect.

3.5 INCOME AND SUBSTITUTION EFFECTS:

According to Slutskey, the price effect is the result of two effects - income effect and substitution effect. The price effect has dual effects. They are :

1. It changes the real income of the consumer.
2. It affords him the opportunity to substitute one good is for the other.

For example a fall in the price of X in a way raises the real income of the consumer when X becomes cheaper he can buy more of it as if his income had increased. On the other hand, a rise in its price causes a decline in his real income by making the good dearer than before. This is the income effect or the price effect, which brings a change in the budget line AB. When a new budget line AB_1 is drawn parellel to it. Secondly, there is the tendency on the part of the ocnsumer to substitute X for Y if the price of X falls. It is as if the increased income is taken away from the consumer so that he remains at the same level of satisfaction. He moves along the same indifference curve. This is the substitution effect. We can show in the following diagram - 5.10. Now the price effect can be broken into income and substitution effect.

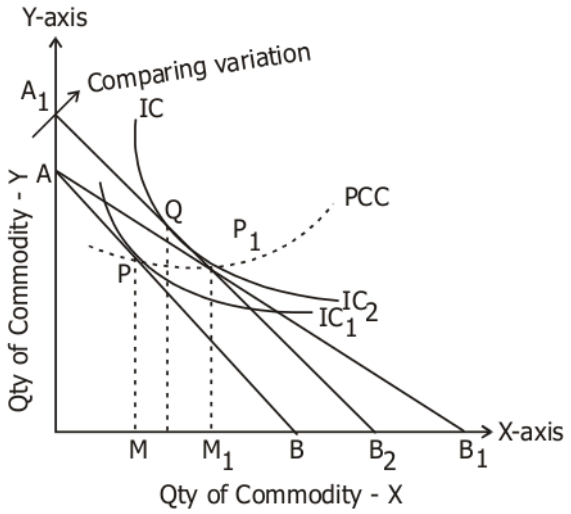


Diagram - 3.4

In the diagram - 3.4, the original budget line is AB. The fall in the price of X leads to a new budget line AB_1. Starting from the equilibrium point P as AB is budget line, the equilibrium position shifts from P to P_1 as the budget line AB_1. The path from P to Q is the price effect. Which comprises the income effect from P to Q as A_1B_2 line which is parallel to AB. This income effect is traced out by the income-consumption curve ICC. But Q cannot be a position of equilibrium as X has become cheaper. The consumer will, therefore, substitute X for Y and this will lead him to move on the same indifference level IC_2 from Q to P_1. This is the substitution effect.

To be precise, with the fall in the price of X, the demand for X increase from OM to OM_1 as the consumer moves from P to P_1 along the curve price line. Of this increase, MM_2 is caused by the income effect, a movement along the ICC curve from P to Q, and M_2M_1 is the result of substitution, A movement from Q to P_1 along the indiifference curve IC_2. Thus

$$\text{Price effect } (MM_1) = \text{Income effect } (MM_2) + \text{Substitution Effect } (M_2M_1)$$

3.6 DERIVATION OF DEMAND CURVE FROM PRICE CONSUMPTION CURVE:

The price-consumption curve indicates various amounts of a commodity bought by a consumer when its price changes. However, the price consumption curve does not explain the relationship between price and quantity demanded. Demand curve solved this problem by showing the relationship between price and quantity demanded. Let us now understand how we derive a

price consumption curve from demand curve.

How a consumer is effected by raising prices, other things being equal, is analysed in the following diagram - 5.11. The income of consumer is OP_1 starting budget line is PL, which is tangent indifference curve 1C at point A. And A is a equilibrium point. If the price of commodity X is increased it leads to shift budget line from PL to PL_1. The new budget line PL_1, is tangent the indifference curve IC_1 at point B. In this position the equilibrium point is B. In this way the further decrease in the price of X changes the equilibrium points from B to C ,, and C to D. By joining the points A, B, C and D with a continuation curve we get the price consumption curve PCC.

Let us now examine various quantities of demand at various prices.

At the equilibrium point A the consumer demands OM level of commodity X and pays $\frac{OP}{OL}$ level of price. At point B the consumer demands OM_1 level of X and pays $\frac{OP}{OL_1}$ level of price. It means that he is demanding more when the price falls. At point C the consumer pays $\frac{OP}{OL_2}$ level of price to demand OM_2 level of quantities. The point D shows, if price falls from $\frac{OP}{OL_1}$ to $\frac{OP}{OL_2}$ leads to increase demand from OM_2 to OM_3. It means that at A, B, C, and D points, which lies on PCC curve, the consumer's demand at various price levels. The following table shows price-demand schedule of the consumer.

Table - 3.1

Demand Schedule

Price of X	Quantity of X Demanded
$\frac{OP}{OL}$	OM
$\frac{OP}{OL_1}$	OM_1
$\frac{OP}{OL_2}$	OM_2
$\frac{OP}{OL_3}$	OM_3

With the above information, we can draw an demand curve as shown in the following diagram by measuring quantites of X demanded on OX axis and price on OY axis.

By joining the points A, B, C, and D which shows various quantities of the commodity purchased at different points. We get the demand curve. The demand curve slopes downwards from left to right as usual and shows the relationship between price and demand. By this way we derive price consumption curve from demand.

Similarity between curve difference were analysis and Marshall's utility analysis, whereas the indifference curve approach and the Marshallian utility analysis are similar in the following aspects, the curve indifference is superior to the latter in several respects.

1. Both approaches shows equilibrium or maximum satisfaction of a rational consumer to maximise.

2. Both techniques embody the same proportionality rule for the consumer to maximise satisfaction or reach an equilirbium position. It means that the marginal rate of substitution of X for Y is equal to price ratio to get the consumer's equilibrium.

$$\text{MRS of X for Y} = \frac{\text{Price of good X}}{\text{Price of Good Y}} \quad \text{---------- (1)}$$

However, the marginal rate of substitution for additional unit of X for Y is equal to the marginal utility ratio of X and Y commodities.

$$\text{It means that MRS of X for Y} = \frac{\text{M.U. of X}}{\text{M.U. of Y}} \quad \text{---------- (2)}$$

$$\text{Therefore } \frac{\text{M.U. of X}}{\text{M.U. of Y}} = \frac{\text{Price of X}}{\text{Price of Y}} \quad \text{---------- (3)}$$

By cross multiplication of the second equation, we get

$$\frac{\text{M.U. of X}}{\text{Price of X}} = \frac{\text{M.U. of Y}}{\text{Price of Y}} \quad \text{---------- (4)}$$

3. Both the approaches assume diminisihing utility. But the Marshallism utility analysis followed the diminishing marginal utility analysis and whereas the indifference curve analysis followed the marginal rate of substitution.

4. Both approaches apply the psychological method.

3.7 USES OF INDIFFERENCE CURVE ANALYSIS

The indifference curve technique is not mearely a tool of theoritical analysis. It can be also put to practical use in several economic spheres. As such it occupies an important place in applied economics. It can be applied in consumption, production, supply of labour, taxation, welfare economics etc. We shall now discuss about each.

1. **IMPOSITION OF DIRECT AND INDIRECT TAXES:** The indifference curve technique helps Governments in the imposition of direct and indirect taxes. With the help of indifference technique we can understand whether a tax is acceptable or not.

2. **EFFECT OF A SUBSIDY:** The indifference curve technique can be used to measure the effects of government subsidy on low income groups. Suppose the government supplies food grains at concessional rates, the price difference being paid by the Government. This is actually being done by the various state governments.

3. **RATIO:** Usually, rationing consists of given specific and equal questioning of goods to each individuals, the other, rather liberal, scheme is to allowan individual more or less quantity of the rational goods according to his tastes. It can be shown with help of indifference curve analysis as under.

4. **INDEX NUMBERS:** Another use of indifference curve analysis can be made in the field of index numbers. Suppose a consumer buys only two commodities, X and Y only in two different time periods 1980 and 1981 at two different price ratios with the help of indifference curve technique the problem of standard living increased or decreased in 1980 as compared with 1981 of consumer can be solved. It is, however, assumed that consumer's taste for the two commodity does not change in 1981.

5. **IN SOLVING THE PROBLEM OF EXCHANGE:** With the help of indifference curve technique the problem of exchange between two individuals can be discussed. We take two consumers A and B who posses two goods X and Y in fixed quantities respectively. The problem is how they can exchange the goods possed by each other. This can be solved by constructing an Edgeworth Biwely box diagram as the basis of their performance maps and the given supplies of goods.

From the above discussion the indifference curve technique is useful in solving the unomic problems. Not only that but also it is useful in solving the various other problems.

3.8 SUPERIORITY OF INDIFFERENCE CURVE TECHNIQUE:

The indifference curve technique is superior in many ways over Marshall's utility analysis.

1. The Marshallian utility analysis is based on two important assumptions. They are, utilities can be measured and all goods are independent. But according to the indifference curve technique, the consumer prefers various combinations of two goods, not a single commodity. In fact, the utility which a commodity possesses for a consumer is something subjective and psychological and therefore cannot be

measured quantitatively. And all goods are not independent.

2. The Marshallian utility analysis is based on the assumption that the marginal utility of money is constant. But the indifference curve technique is not based as this assumption. So, the indifference curve technique is superior to the Marshallian utility analysis.

3. Both approaches require the same conditions for consumer's equilibrium. However, the indifference curve technique is based on less unrealistic assumptions.

4. Changes in the prices of goods (a fall in price) leads to maximum satisfaction of a consumer is the superiority of the indifference curve technique.

5. The indifference curve technique explains income and substitution effects separately to analyse the result of a fall in the price of a consumer. A fall in the price leads to increase the real income. If a fall in the price encourages the consumer to substitute a higher price commodity instead of it. This is known as substitution effect. However, satisfaction of consumer will not change. This is called 'change of compensation'. This type of analysis is not available in Marshallian analysis.

6. The Marshallian utility analysis assumed that the marginal utility of money is constant and utility of a commodity is based on qualitating of the good (independent good). But the indifference curve analysis is not having this type of unrealistic assumptions. Moreover, it analyses results of the changes in substitutes goods.

From the above reasons the indifference curve technique is superior over Marshallian utility analysis.

3.9 CRITICISM OF INDIFFERENCE CURVE ANALYSIS:

The indifference curve analysis is no doubt regarded superior to the utility analysis of Marshall's but some of the economists criticised the theory on the following grounds.

1. Prof. Robertson does not find anything new in the indifference curve technique and regards it simply as the 'old wine in a new bottle'. It replaces utility by preferences of consumer and introspection cardinalism by introspective ordinalism. It substitues marginal utility by marginal rate of substitution. Instead of Marshall's proportionality rule, the indifference curve technique, analysed by Hicks and Allen, equates the marginal rate of substiution to the price ratio.

2. Prof. Armstrong criticised the theory. He opined that the marginal rate of substituion is based on the marginal utility analysis of Marshall.

3. According to this theory the consumer has complete knowledge of preferences of two goods. But it is an assumption.

4. The indifference curve technique can analyse consumer's behaviour in respect of two goods. But it is difficult when more than two goods are involved.

5. This analysis assumes that consumer's tastes and habits remain unchanged. But this is not correct.

6. The indifference curve is supposedly smooth and continuous. This is unrealistic.

7. An individual's consumption is often affected by level of consumption of others. Of no notice is taken of this in this analysis.

8. This theory has failed to explain consumer's behaviour in choices involving risk and uncertainity.

However, inspite of these weaknesses, the indifference technique is now a days largely considered superior to the marginal utility of Marshall.

3.10 CONCLUSION:

Given the income of the consumer and the price of X and Y, the various combinations of X and Y the consumer can buy is indicated by the price line. The slope of this curve shows price ratio of two goods. The slope of an indifference can shows the marginal rate of substitution. The consumer is in equilibrium where the price ratio is equal to the marginal rate of substitution. It means the consumer is in equilibrium where the price line is tangent to indifference curve. The increase in quantity of a commodity purchased, when the income of the consumer increases is called income effect. Price effect shows how the consumption of commodity X changes, as its price changes, the consumer's income and price of Y remaining the same. The price effect is the result of income and substitution effects.

The price consumption curve traces the effect of a change in price on the quantity demanded of a good. But it does not directly relate to the quality demanded.

Basing an importance, the indifference curve analysis is superior to the marginal utility analysis even though there are some similarities among them.

3.11 KEY CONCEPTS:

1.	**PRICE LINE**	:	The price line indicates the amounts of the commodities with a given amount of money we can buy.
2.	**INCOME EFFECT**	:	The increase in the quantity purchased of a commodity when the income of the consumer increases.
3.	**SUBSTITUTION EFFECT**	:	The increase in quantity purchased of a commodity when its price falls.
4.	**PRICE EFFECT**	:	The price effect shows how the consumption of commodity X changes, as its price changes.

3.12 MODEL QUESTIONS FOR EXAMINATIONS:

I. ESSAY QUESTIONS

1. Explain the consumer's equilibrium through the help of indifference analysis.

   Hints : Write what is budget line and later explain consumer's equilibrium through the help of indifference curve analysis.

2. Show how price effect is a combination of income effect and substitution effect with the help of indifference curve.

   Hints : Explain price, income, substitution effects with the help of indifference curve.

3. Explain how the indifference curve analysis is superior to the marginal utility of Marshall.

   Hints : Write similarity between indifference curve analysis and marginal utility analysis and explain how the indifference curve technique is superior to marginal utility analysis.

II. SHORT QUESTIONS

1. Explain consumer's equilibrium with the help of indifference curve .....?
2. Explain substitution effect with an example and a diagram.

   Hint : Write point 5.6 of this section.

III. VERY SHORT ANSWER QUESTIONS

3. Discuss income and substitution effects of Hicks through a diagram.

   Hints : Write points 5.5 and 5.6 of this lesson.

4. Explain the effect of a change in price on consumer's equilibrium through a indifference curve.

   Hints : Write 5.7 of this section.

5. Explain price and substitution effects with the help of indifference curve technique.

   Hints : Write 5.6 and 5.7 parts of this section.

6. What price consumption curve ? Is it possible to draw a demand curve from it?

   Hints : Write 5 Part 5.9 in this section.

7. Explain criticism of indifference curve analysis.

   Hints : Write part 5.12 of this section.

II. VERY SHORT QUESTIONS:

1. Budget Line
2. Price Consumption Curve
3. Income consumption curve
4. Substitution Effect
5. Superiority of Indifference curve technique
6. In Direct and Indirect taxes which is acceptable?

3.13 SELECTED READINGS:

1.	Watson, D.S.	:	Price Theory and its Uses
2.	Seth, M.L.	:	Principles of Economics
3.	Ahuja, H.L.	:	Advanced Economic Theory
4.	Jhingan, M.L.	:	Advanced Economic Theory
5.	Dewett K.K. and	:	Modern Economic Theory
6.	Telugu Academy	:	Economic Theory

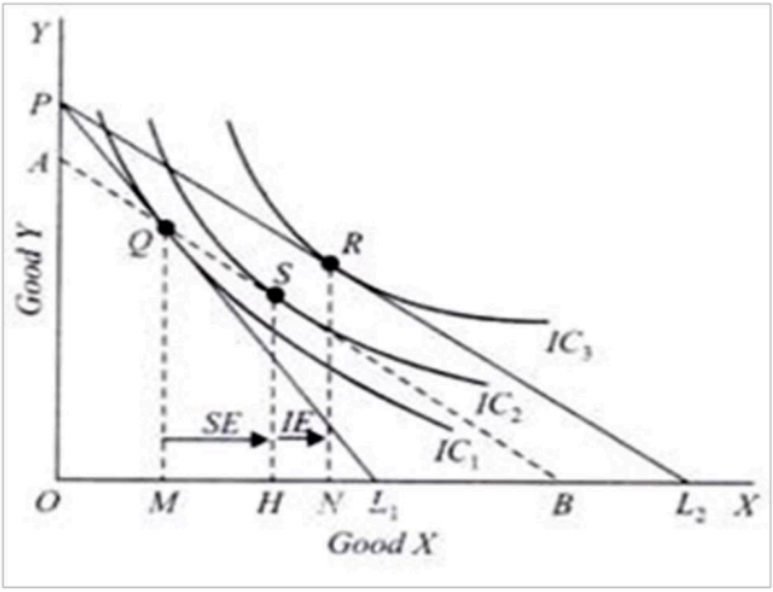
MODULE : 2- Lesson: 4
UTILITY ANALYSIS

4.0 AIMS AND OBJECTIVES: The aim of the lesson is to make the students understand the concept of slutsky's equation on substitution and income effect. Further the students will also understand the theory of revealed preference from this lesson.

CONTENTS:

4.0 SLUTSKY'S EQUATION

The concept of Price effect is also dealt by Slutsky. Slutsky has presented a slightly different version from Hicks on substitution and income effect of a price change. It was Slutsky who first divided the price effect into income and substitution effect. His theory or method can be explained through a diagram below. With a particular price-income situation, the consumer is in equilibrium at Q on indifference IC_1. With the fall in the price of X, other things remaining the same, the price line would shift to PL_2. With the price line PL_2. The consumer would be in a new equilibrium of R on the indifference curve IC_3. This move from Q to R represents the price effect. To know the substitution effect if the consumer's money income is reduced by such an amount that the counsumer could buy, if he so desires, the old combination of Q. thus a price line AB is drawn, which is parallel to PL_2 and it is drawn in such as way that it passes through the point Q.



With the new price line AB, the consumer can have Q, if he desires, but actually he would like to buy a new combination rather than be on Q as X is cheaper than before. He would like to move to IC_2 on the budget line AB and gain equilibrium at S. The movement from Q to S represents the Slutsky's substitution effect. If now the money taken away from the consumer is restored to him, he will move from S on indifference curve IC_2 to R on indifference IC_3. This movement from S to R represents income effect. The movement from Q to R is price effect and that can be divided into two. Q to S as substitution effect and S to R as income effect. Therefore price effect is a combination of income and substitution effect.

The concept explained by Slutsky can be explained in a different way. The Slutsky's equation in economics is named after Eugen Slutsky (1880–1948). The equation demonstrates that the change in the demand for a good, caused by a price change, is the result of two effects:

1. A Substitution Effect, the result of a change in the relative prices of two goods;
2. An Income Effect, the effect of a change in price resulting in a change in the consumer's purchasing power.

The Slutsky's equation decomposes the change in demand for good *i* in response to a change in the price of good *j*:

$$\frac{\partial x_i(\mathbf{p},w)}{\partial p_j} = \frac{\partial h_i(\mathbf{p},u)}{\partial p_j} - \frac{\partial x_i(\mathbf{p},w)}{\partial w} x_j(\mathbf{p},w),$$

Where $h(\mathbf{p},u)$ is the Hicksian demand and $x(\mathbf{p},w)$ is the Marshallian demand, at the vector of price levels $\mathbf{p}$, wealth level (or, alternatively, income level) w, and fixed utility level u

given by maximizing utility at the original price and income, formally given by the indirect utility function $v(\mathbf{p}, w)$. The right-hand side of the equation is equal to the change in demand for good *i* holding utility fixed at *u* minus the quantity of good *j* demanded, multiplied by the change in demand for good *i* when wealth changes.

The first term on the right-hand side represents the substitution effect, and the second term represents the income effect. Note that since utility is not observable, the substitution effect is not directly observable, but it can be calculated by reference to the other two terms in the Slutsky's equation, which are observable. This process is sometimes known as the Hicks decomposition of a demand change.

The same equation can be rewritten in matrix form to allow multiple price changes at once:

$$\mathbf{D_p x}(\mathbf{p}, w) = \mathbf{D_p h}(\mathbf{p}, u) - \mathbf{D_w x}(\mathbf{p}, w)\mathbf{x}(\mathbf{p}, w)^\top,$$

where $\mathbf{D_p}$ is the derivative operator with respect to price and $\mathbf{D_w}$ is the derivative operator with respect to wealth.

The matrix $\mathbf{D_p h}(\mathbf{p}, u)$ is known as the **Slutsky matrix**, and given sufficient smoothness conditions on the utility function; it is symmetric, negative semidefinite, and the Hessain of the expenditure function.

Derivation

While there are several ways to derive the Slutsky equation, the following method is likely the simplest. Begin by noting the identity $h_i(\mathbf{p}, u) = x_i(\mathbf{p}, e(\mathbf{p}, u))$ where $e(\mathbf{p}, u)$ is the expenditure function, and *u* is the utility obtained by maximizing utility given **p** and *w*. Totally differentiating with respect to p_j yields the following:

$$\frac{\partial h_i(\mathbf{p}, u)}{\partial p_j} = \frac{\partial x_i(\mathbf{p}, e(\mathbf{p}, u))}{\partial p_j} + \frac{\partial x_i(\mathbf{p}, e(\mathbf{p}, u))}{\partial e(\mathbf{p}, u)} \cdot \frac{\partial e(\mathbf{p}, u)}{\partial p_j}.$$

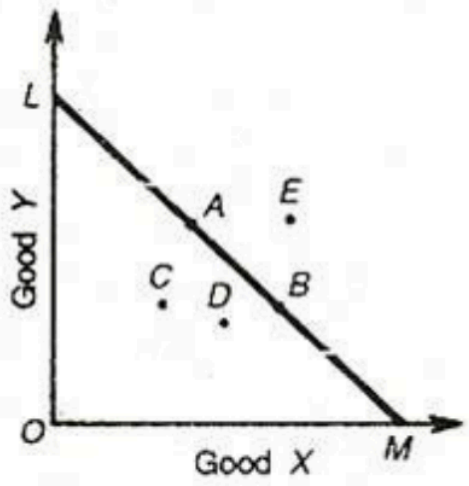
Making use of the fact that $\frac{\partial e(\mathbf{p}, u)}{\partial p_j} = h_j(\mathbf{p}, u)$ by Shephard's lemma and that at optimum, $h_j(\mathbf{p}, u) = h_j(\mathbf{p}, v(\mathbf{p}, w)) = x_j(\mathbf{p}, w)$, where $v(\mathbf{p}, w)$ is the indirect utility function one can substitute and rewrite the derivation above as the Slutsky's equation.

4.2 REVEALED PREFERENCE THEORY

An economic theory of consumption behavior which asserts that the best way to measure consumer preferences is to observe their purchasing behavior. Revealed preference theory works on the assumption that consumers have considered a set of alternatives before making a purchasing decision. Thus, given that a consumer chooses one option out of the set, this option must be the preferred option. Revealed preference theory was introduced by Paul Samuelson in 1938. The theory is useful for analyzing consumer choice empirically.

Prof. Samuelson's theory of demand is based on the revealed preference axiom or hypothesis which states that choice reveals preference. The theory is based on ordinal utility analysis. Revealed preference theory considers utility to be just comparable and not quantifiable. Prof. Tapas Majumdar has described Samuelson's revealed preference theory as "Behaviourist Ordinalist". This highlights two basic features of revealed preference theory namely – it applies behaviouristic method and it uses the concept of ordinal utility.

A consumer buys a combination of two goods either because he likes this combination in relation to others or this is cheaper than others. Suppose the consumer buys combination A rather than combination B. C or D. It means that he reveals his preference for combination A. He can do this for two reasons. First, combination A may be cheaper than the other combinations B, C, D. Seconds combination A may be dearer than others and even then he likes it more than other combinations. In such a situation, it can be said that A is revealed preferred to B, C, D or B, C, D are revealed inferior to A. This is explained in Figure below.



Given the income and prices of the two goods X and Y. LM is the price-income line of the consumer. The triangle OLM is the area of choice for the consumer which shows the various

combinations of X and Y on the given price- income situation LM. In other words, the consumer can choose any combination between A and B on the line LM or between C and D below this line. If he chooses A, it is revealed preferred to B. Combinations C and D are revealed inferior to A because they are below the price-income line LM. But combination E is beyond the reach of the consumer being dearer for him because it lies above his price-income line LM. Therefore, A is revealed preferred to other combinations within and on the triangle OLM.

It should be noted that Prof. Samuelson's revealed preference theory is based upon strong form of preference hypothesis. Strong ordering implies that there is definite ordering of various combination in consumer's scale of preferences and therefore the choice of a combination by a consumer reveals his preference which is definite for all that over all the other alternatives open to the consumer. Therefore, under strong ordering, relation of indifference between various alternative combinations is ruled out.

This theory rests on the assumption known as 'consistency postulate', which means no two observations of the choice behaviour are made which provide conflicting evidence to the individual's preference. In other words, it means that if an individual chooses A rather than B in one particular instance, then he cannot choose B rather than A in any other instance. Thus consistency postulate requires that if once A is revealed to be preferred to B by an individual then B cannot be revealed to be preferred to A by him at any other time when A and B are present in both the cases.

4.2.1 Superiority of Revealed Preference Theory:

The revealed preference approach is superior to the Hicksian ordinal utility approach to consumer behaviour.

1. It does not involve any psychological introspective information about the behaviour of the consumer. Rather, it presents a behaviouristic analysis based on observed consumer behaviour in the market. Thus the revealed preference hypothesis is more realistic, objective and scientific than the earlier demand theorems.
2. It avoids the "continuity" assumption of the utility and indifference curve approaches. An indifference curve is a continuous curve on which the consumer can have any combination of the two goods. Samuelson believes that there is discontinuity because the consumer can have only one combination.
3. The Hicksian demand analysis is based on the assumption that the consumer always behaves rationally to maximise his satisfaction from a given income. Samuelson's demand theorem is superior because it completely dispenses with the assumption that the consumer always maximises his satisfaction.

4. This theory provides the basis for welfare economics in terms of observable behaviour based on consistent choice.

4.2.2 Defects of the Revealed Preference Theory:

There are, however, certain weaknesses in Samuelson's revealed preference theory.

1. Neglects Indifference:

It neglects indifference in the consumer behaviour. It is, of course, true that the consumer does not reveal his indifference in a single-valued demand function in or on the budget line when he chooses a particular set of goods at point R on the budget line LM. But it is possible that there are points like A and B on every side of a given point R, shown within the circle in Figure below, towards which the consumer is indifferent. If this criticism by Armstrong is accepted, then Samuelson's fundamental theorem breaks down. Suppose the price of X rises.

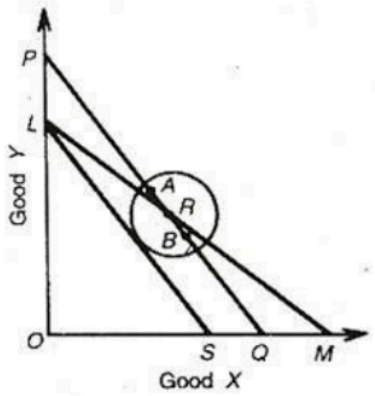


Figure 14.4

As a result, his new budget line is LS. Now give the consumer some extra money to enable him to buy the same combination R on the line PQ. In this new price- income situation, suppose he chooses point B below R towards which he is indifferent. This is based on Armstrong's assumption that the consumer is indifferent between points around the chosen point.

But the choice of B on the PQ line means that the consumer buys more of X when its price has risen.

This breaks down the Samuelson theorem because with the rise in the price of X, its demand has expanded instead of shrinking.

2. Not Possible to Separate Substitution Effect:

Samuelson's Fundamental Theorem is conditional and not universal. It is based on the postulate that positive income elasticities imply negative price elasticities. Since the price effect consists of the income and substitution effects, it is not possible to isolate the substitution effect from the income effect on the level of observation. If the income effect is not positive, price elasticity of demand is indeterminate. On the other hand, if the income elasticity of demand is

positive, the substitution effect following a change in price cannot be established. Thus, the substitution effect cannot be distinguished from the income effect in the Samuelson's Theorem.

3. Excludes Giffen Paradox:

Samuelson's revealed preference hypothesis excludes the study of the Giffen Paradox, for it considers only positive income elasticity of demand. Like the Marshallian Law of Demand, the Samuelsonian Theorem fails to distinguish between negative income effect of a Giffen good combined with a weak substitution effect and a negative income effect with a powerful substitution effect.

4. Consumer does not choose only one Combination:

The assumption that the consumer chooses only one combination on a given price-income situation is incorrect. It implies that the consumer chooses something of everything of both the goods. But it is seldom that anybody purchases something of everything.

5. Choice does not reveal Preference:

The assumption that "choice reveals preference" has also been criticised. Choice always does not reveal preference. Choice requires rational consumer behaviour. Since a consumer does not act rationally at all times, his choice of a particular set of goods may not reveal his preference for that. Thus the theorem is not based on observed consumer behaviour in the market.

6. Fails to derive Market Demand Curve:

The revealed preference approach is applicable only to an individual consumer. Negatively inclined demand curves can be drawn for each consumer with the help of this approach by assuming 'other things remaining the same.' But this technique fails to help in drawing market demand schedules.

7. Not Valid for Game Theory:

According to Tapas Majumdar, the revealed preferences hypothesis "is invalid for situations where the individual choosers are known to be capable of employing strategies of a game theory type."

8. Fails in Risky or Uncertain Situations:

The revealed preference theory fails to analysis consumer's behaviour in choices involving risk or uncertainty. If there are three situations, A, B, and C, the consumer prefers A to B and C to A. Out of these, A is certain but chances of occurring B or C are 50-50. In such a situation, the consumer's preference for C over A cannot be said to be based on his observed market behaviour.

8.3 MODEL QUESTIONS FOR EXAMINATIONS:

I. ESSAY QUESTIONS:

1. Explain slutsky's equation?
2. Explain the theory of Revealed preference.
3. Critical examine revealed preference theory.
4. How Slutsky explained the price effect is a combination of income and substation effect>

4.4 SELECTED READINGS:

1. Watson, D.S. : Price Theory and its Uses
2. Seth,M.L. : Principles of Economics
2. Ahuja, H.L. : Advanced Economic Theory
4. Jhingan,M.L. : Advanced Economic Theory
5. Dewett K.K.: Modern Economic Theory

Lesson 1/Module III

Production function – Basic Concepts

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Structure:

1.0 Objectives:

The unit is expected to provide knowledge about the Production Function and relating concepts. After going through the lesson, the learner is able to

- Understand about the meaning of production function.
- Acquires knowledge about basic concepts of production function.
- Analyse short run and long run analysis of production function.
- Explain the equilibrium of firm.

1.1 Introduction:

The whole theory of consumer behaviour centre on the maximisation of utility. Maximisation of utility in turn depends on the production of goods and services. But, the production of goods and services should be organised, so that a good or and service will be produced with as possible as minimum amount of resources. Usually the factors of production such as land, labour, capital, raw material are used as inputs, so as to produce output such as food grains, automobiles, electrical appliances, telecommunications etc. Hence, any activity that uses resources and creates consumer satisfaction is said to be production. Thus, factories, offices, hospitals and colleges all engage in the production. The process of production is termed as technology. Given the technology, different combination of inputs can be used to produce a given level of output. For example, one unit of commodity say X may be produced using two different inputs namely labour (L) and capital (K) in three different ways and is shown geometrically in Figure 1.1

	Labour units	Capital units
Process P_1	1	3
Process P_2	3	2
Process P_3	4	1

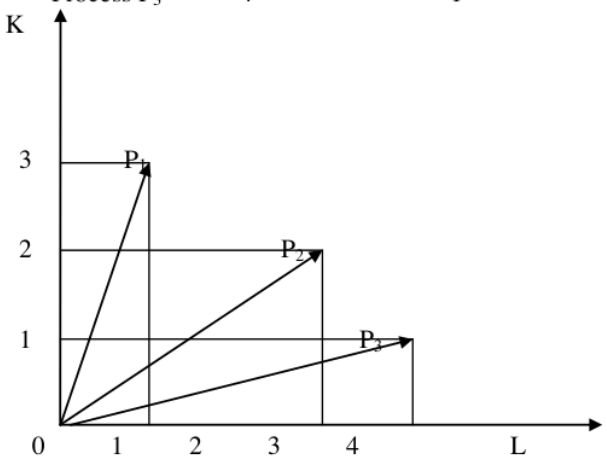

Figure 1.1: Production Process

Thus, production is nothing but transforming the inputs into outputs. The functional relationship between inputs and output is known as production function. In this lesson we shall discuss various concepts relating to production function.

1.2 The Concept of Production Function:

The Production function explains how the output changes in response to changes in inputs in a given time. Thus, the production function implies the transformation of inputs into output at any particular time period. Given two methods of production A and B, method A is said to be technically efficient compared to method B, if A uses less of at least one factor and no more of other factor compared to method B. Production function specifies a technical relationship between output and inputs. This relationship assumes a functional form depending upon the manufacturing process, the prevailing technology, availability of inputs and factor prices. The production function can be written mathematically as

$$Y = f(N, L, K, R, \mu, \alpha)$$

where Y = amount of output

N = land or natural resources

L = amount of labour

K = amount of capital

μ = returns to scale parameter

α = efficiency parameter

All the above variables are measured per unit of time and represent flows. The production function expressed in general form specifies the technological relationship between quantities of inputs and outputs. But, production function does not take into account the prices of factors of production i.e., inputs.

The production function according to traditional economic theory assumes only two factors of production namely capital and labour, so that it can be written as

$$Y = f(L, K, \mu, \alpha)$$

The parameter 'μ' is known as returns to scale and implies the long run analysis of laws of production. The parameter 'α' is the efficiency parameter, which implies the higher level of output achieved by a firm A when compared to firm B, when both firms employed the same amount of inputs. Thus, the efficiency is attributed to entrepreneurial abilities. Production function can be represented as a curve on two – dimensional graph as shown in Figures 1.2 and 1.3.

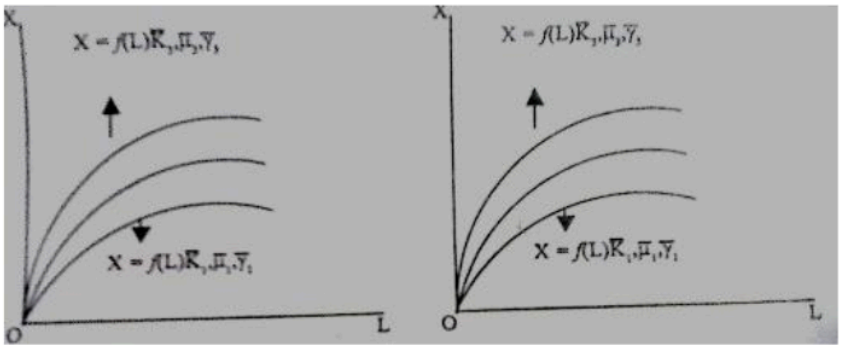

Figure 1.2 $K_1 < K_2 < K_3$

Figure 1.3 $L_1 < L_2 < L_3$

The production functions for a single commodity can be represented by means diagrams shown in the above Figures. Thus, production function is represented by a curve. In Figure 1.2 there appear three curves such that each represents the relationship between output Y and input L, given that K, μ, α. Thus, as the input L increases, the output Y increases, ceteris paribus. This is shown as a movement along the curve. However, if capital K and or μ, and or α increases, then there will be an upward shift in the production function Y = f (L). In a similar way, Figure 1.3 shows the relationship between output Y and capital input K given L, μ, α. Thus, as the input K increases, the output Y increases, ceteris paribus. This is shown as a movement along the curve. However, if labour L and or μ, and or α increases, then there will be an upward shift in the production function Y = f (K).

1.3 Marginal Product of Factors:

The marginal product of a factor is defined as the change occurred in output due to a small change in one input, when all other factors are kept constant. The slopes of the production function curves shown in Figures 1.2 and 1.3 gives the marginal products of factors namely labour and capital respectively. In mathematical terms the partial derivatives of the production function with respect to the factor gives the marginal product of the factor. Thus, given the production function as Y = f (L, K), then the partial derivative of Y with respect to labour L i.e., Marginal product of labour is given by

$$MP_L = \partial Y/\partial L$$

while the partial derivative of Y with respect to capital K i.e., Marginal product of capital is given by

$$MP_K = \partial Y/\partial K$$

The marginal product of a factor may be positive, zero or negative. However, the theory of production concentrates only on the efficient part of the production function, i.e., the range of output over which the marginal product of a factor is either positive or even diminishing.

1.4 Isoquants:

An isoquant is defined as the locus of all technically efficient methods of producing a given level of output. Thus, it is the locus of all different combinations of factors of production used for producing a given level of output. An isoquant is also known as the equal – product curve or product isoquant and represents the production function. A production isoquant is convex to the origin. Hence, it will be similar to indifference curve. The following Figure 1.4 depicts the production isoquant AB which shows different combinations of two factors of production namely labour and capital that can be used to produce a given level of output of commodity X. Thus, the amount or level of output produced throughout the isoquant curve AB is same, while combination of labour and capital used differ from point to point on AB. Thus, an isoquant explains the substitutability between factors of production. In other words we may increase the use of labour by decreasing the use of capital (or vice versa) so as to produce the same level of output. Figure 1.5 shows the isoquant map which consist of whole array of isoquants. Each isoquant such as X_1, X_2, X_3, X_4 represents different levels output. Moreover, moving from X_1 to X_4, each isoquant represents a higher order level of output.

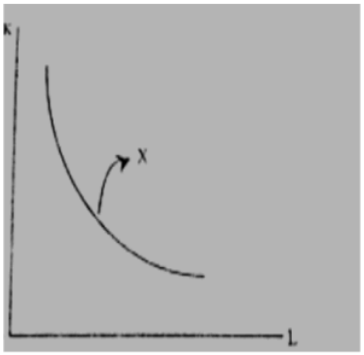

Figure 1.4: Isoquant

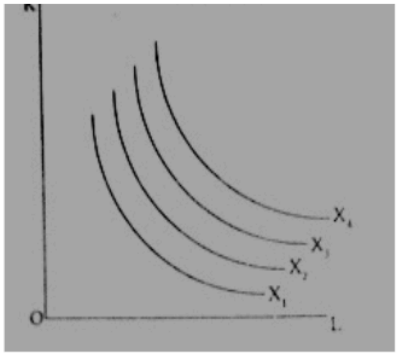

Figure 1.5 Isoquant Map

1.4.1 Types of Isoquants:

Depending on the degree of substitutability between factors of production, an isoquant may assume different shapes. They can be discussed as linear isoquant, input-output isoquant, kinked isoquant and convex isoquant.

1.4.1.1 Linear Isoquant:

If a given amount of commodity is produced by using only labour or only capital or infinite number of combinations of labour and capital, then the isoquant assumes linear shape (straight line) as shown in the Figure 1.6 and is called as linear isoquant. In this case, the factors of production are perfectly substitutable. From the Figure, it is understood that,

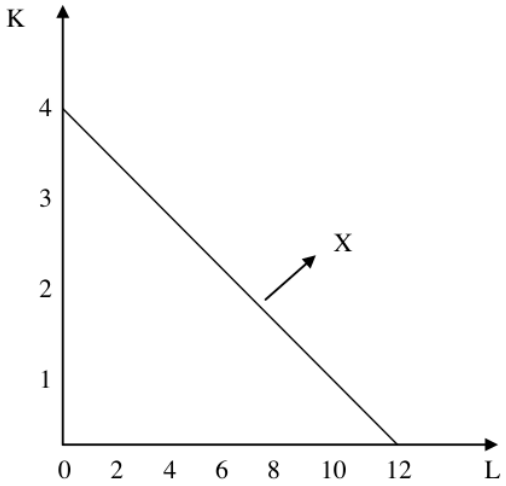

Figure 1.6: Linear Isoquant

certain amount of output can be produced using 4 units of capital alone or 12 units of labour alone or different combinations labour and capital such as 3.5 units of labour + 1.5 units of

capital or 3 units of labour + 3 units of capital or 6 units labour + 2 units capital or 9 units of labour + 1 unit of capital etc. (we can consider infinite number of such combinations)

1.4.1.2 Input-output isoquant:

If any commodity can be produced using only one method, then it is not possible to substitute one factor for another. In other words, in order to produce a given level of output, we have to use fixed proportions of two factors of production. Thus, the factors of production are said to be strictly complementary. In such a case, the isoquant takes the shape of a right angle. This isoquant is also known as 'Leontief Isoquant' named after W.W. Leontief, who invented the input-output analysis. Figure 1.7 presents the input-output isoquant. Thus, in order to produce certain level output of a commodity, we have to use 4 units of capital and 10 units of labour. This is the only way to produce that commodity and no other combination or method is available.

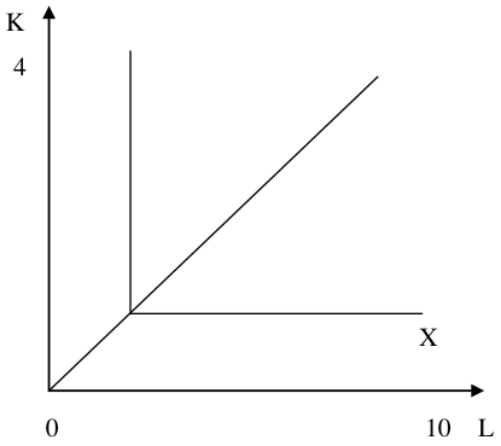

Figure 1.7: Input-output Isoquant

1.4.1.3 Kinked Isoquant:

If there exits limited number of processes for producing any one commodity, then the isoquant is said to be kinked isoquant. It is because substitutability of factors is possible only at the kinks as shown in the Figure 1.8. This isoquant is also known as activity analysis – isoquant or linear programming isoquant as the isoquant is basically used in linear programming problem. In the Figure, P_1, P_2, P_3, P_4 are only four processes available for the production of a commodity. These processes are limited to four on account of limited substitutability between the two factors of production namely labour and capital. Thus, the commodity X can be produced only with the limited combinations of the two factors, as shown by the kinks.

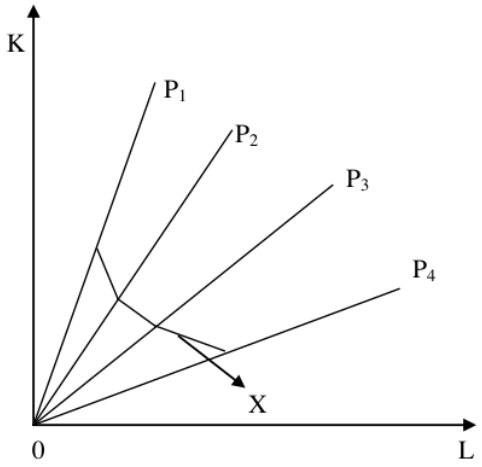

Figure 1.8: Linear - Programming Isoquant

1.4.1.4 Convex – Isoquant:

Convex Isoquant is the generally used in traditional economic theory. In this case, the substitutability between two factors of production namely capital and labour is assumed to be continuous only over a certain range of output. However, beyond the range of output, factors cannot be substitutable. Thus, the commodity can be produced by various combinations of labour and capital as shown by the Figure 1.9.

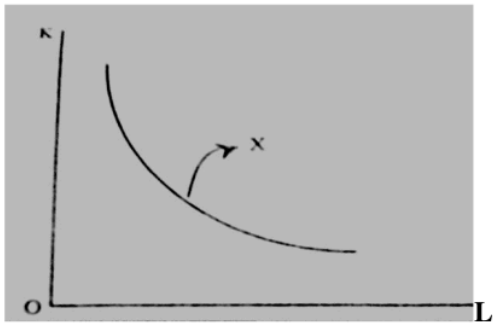

Figure 1.9: Convex Isoquant

1.4.2 Features of Isoquants:

The following are some important features of production isoquants:

1. Isoquants are convex to the origin.
2. Higher order isoquants represent higher levels of output.
3. Isoquants will never intersect each other.
4. The slope of the isoquant decreases as we move down from left to right along the isoquant.

1.5 Ridge Lines:

We know that the slope of the production function gives the marginal products of factors. The marginal product of a factor may be positive, zero or negative. The locus of the points of isoquants where the marginal product of the factors is zero is defined as a ridge line. We can define two ridge lines corresponding to two factors of production known as upper ridge line and lower ridge line. Thus, upper ridge line is obtained as the locus of the points of isoquants where marginal product of capital is zero i.e., at points a, b and c in the Figure 1.10. Similarly, lower ridge line is obtained as the locus of the points of isoquants where marginal product of labour is zero i.e., at points d, e and f in the Figure. Any processes lying outside the ridge lines are said to be in efficient, as the marginal product of factors are negative. Hence, only those processes lying inside the ridge lines are said to be efficient, as the marginal product of factors are positive. Thus, the efficient production is represented by the range of isoquants over which they are convex to the origin.

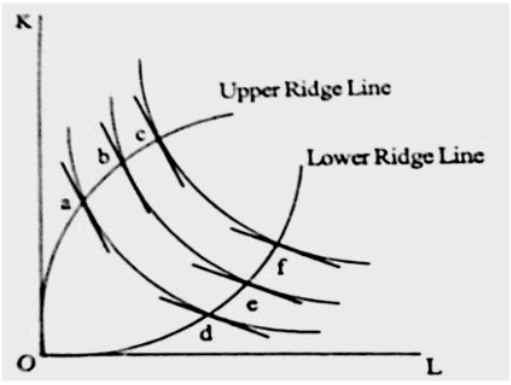

Figure 1.10 Set of Isoquants

1.6 Marginal Rate of Substitution:

From the features of isoquants, we know that an isoquant is convex to the origin and slopes downwards from left to right. From the Figure 1.11, the slope of isoquant is given by $(-\partial K/\partial L)$ and it measures the degree of substitutability of the factors of production. Thus, the slope of the isoquant gives the rate of technical substitution between the factors and is known as marginal rate of technical substitution i.e., MRS of the factors.

$$MRS_{LK} = -\partial K/\partial L$$

We know that marginal product of labour is given by $MP_L = \partial Y/\partial L$

Also marginal product of capital is given by $MP_K = \partial Y/\partial K$

Now consider $MP_L/ MP_K = (\partial Y/\partial L)/ (\partial Y/\partial K) = \partial K/\partial L$

Hence, we can write that $MRS_{LK} = -\partial K/\partial L = MP_L / MP_K$

Thus, the marginal rate of substitution is equal to the ratio of the marginal product of the factors.

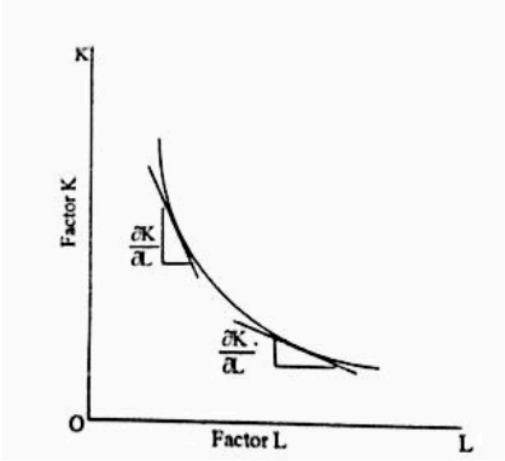

Figure 1.11: Marginal Rate of Substitution

1.7 Elasticity of Substitution:

The elasticity of substitution measures the degree of substitutability between the factors of production. The elasticity of substitution is a pure number and independent of unit of measurement of factors of production. It is defined as the ratio of percentage change in the capital labour ratio to percentage change in the marginal rate of technical substitution. Usually it is denoted by σ.

Thus, we can write elasticity of substitution

i.e., σ = [Percentage change in (K/L)]/ [Percentage change in MRS]

= [d (K/L)(K/L)/[d(MRS)/MRS)]

The elasticity of substitution i.e., σ is said to be a better measure of degree of substitutability compared to the MRS as σ is independent of unit of measurement of factors of production.

1.8 Product Lines:

A product line explains the changes in output. It shows the increase in output through changes in isoquants i.e. shifts in isoquants. Output can be expanded through increasing both factors of production or a single factor of production. Thus, product line shows the increase in output through the movement from lower order to higher order isoquant. However, it is important to note that that a product line does not take into account the prices of factors of production. Thus, product line describes the various alternative paths of expanding output, without depending on the factors of production.

Figure 1.12 shows the product line for a given level of capital, if another factor namely labour changes. Thus, the product line will be a horizontal line parallel to the X axis along which the variable factor i.e., labour is represented. In other words, the product line shows the increased output due to increased labour L, when capital K is constant.

Figure 1.13 shows the product line, when both factors of production namely capital K and labour L are changing. In this case, the product line will be a straight line passing through the origin, assuming that the production function is homogenous. Thus, in the Figure, the two lines from the origin represent the product lines, when both factors are allowed to vary. In case of non-homogenous production functions, the product lines will no longer be straight lines, but their shape will be twiddly as shown in Figure 1.14.

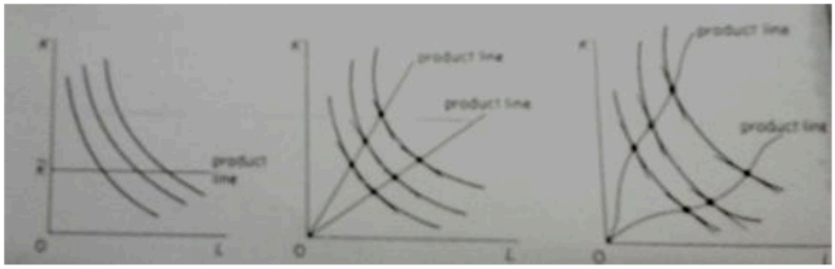

Figure 1.12 **Figure 1.13** **Figure 1.14**

Product line for K given **Homogenous Production function** **Non homogenous Production function**

1.9 Isoclines:

An isocline is defined as the locus of points of different isoquants at which the MRS of factors is constant. If the production function is homogenous, then the isoclines will be straight lines through the origin. Along any one isocline the K/L ratio will be constant. However, the K/L ratio will be different for different isoclines (Figure 1.13). In case of non-homogenous production functions, then the isoclines will no longer be straight lines, but their shape will be twiddly (Figure 1.14).

1.10 Production Function – Short Run Analysis:

Production function analysis can be attempted considering the time period such as short run and long run. Short run refers to a time period during which only some factors of production can be varied, while some other factors of production are fixed. Thus, in the short run, increase in output can be achieved through increased usage of variable factors. In the short run on account of combining variable factors with the fixed factors, the proportion

between variable and fixed factors will change. Such type of changes in the proportions can be analysed as 'Law of variable Proportions'. In other words, short run analysis of production function is characterised by the 'Law of Variable Proportions'.

The 'law of variable proportions', also known as the 'law of diminishing returns' has been developed by David Ricardo and Alfred Marshal. The law of variable proportions describes the relationship between inputs and output given the technology. According to the law, when increased number of units of one variable factor say labour is combined with a fixed factor say capital, total output increases at an increasing rate in the first stage, then increases at a diminishing rate in the second stage and thereafter ultimately decreases in the third stage. Thus, usually if one of the factors is fixed, then the returns associated with the variable factor will ultimately diminish.

The short run analysis can be explained with the hypothetical numerical example given in Table 1.1. Let us suppose that a firm is producing output, using fixed amount of 5 units of capital and variable input of labour.

Table 1.1: Total, Marginal and Average Product of Labour

Capital (K)	Labour (L)	Output (X) Total Product of Labour (TP_L)	Marginal Product of Labour (MP_L)	Average Product of Labour AP_L	
5	0	0	-	-	
5	1	10	10	10	
5	2	36	26	18	
5	3	72	36	24	
5	4	112	40	28	STAGE I
5	5	150	38	30	
5	6	180	30	30	
5	7	196	16	28	
5	8	208	12	26	
5	9	216	8	24	
5	10	220	4	22	STAGE II
5	11	220	0	20	
5	12	216	– 4	18	
5	13	208	– 8	16	STAGE III
5	14	196	– 12	14	

From the Table it is clear that, the total output increased from 0 units to 220 units when number of workers gradually increased from 0 to 11. However, with the employment of 12,13 and 14 workers, total output decreased to 216, 208 and 196 units respectively. Hence, the firm is not supposed to employ more than 11 workers, as there is fall in the output with increased workers.

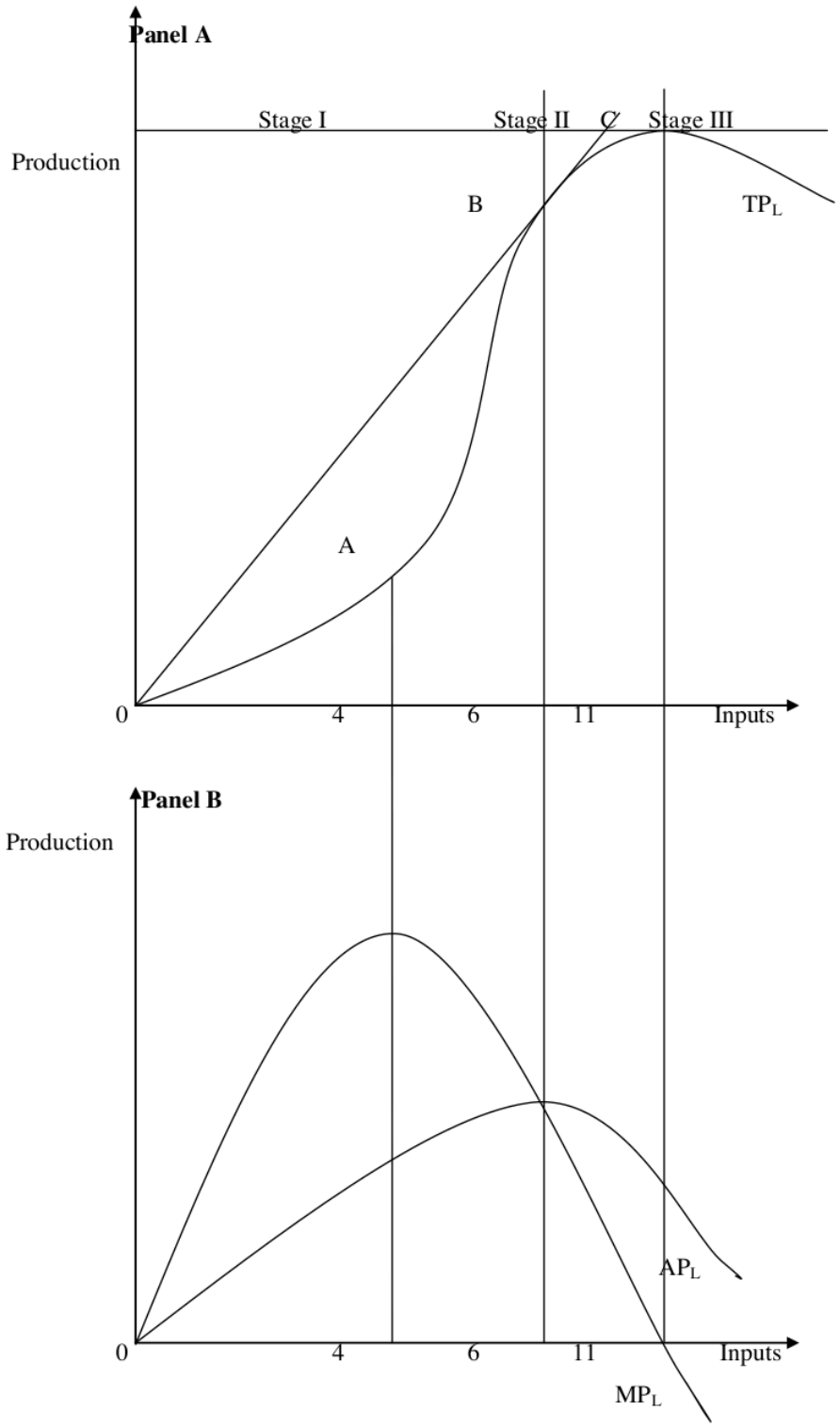

Figure 1.15: The Law of Variable Proportions

1.10.1 Marginal Product:

By definition, marginal product of labour is the addition made to the total product by employing one more additional unit of labour. Thus, it is the rate of change total output X with respect to change in the number of labour employed L and can be written as $MP_L = \partial X/\partial L$. From the Table 1.1, it is clear that, marginal product of labour increases with increased employment of labour and reached maximum level of 40 when 4 labourers are employed. However, marginal product of labour declined and becomes zero when 11 labourers are employed and thereafter with the increased employment of labour, the marginal product of labour becomes negative.

1.10.2 Average Product:

Average product of labour is defined as the ratio of total output to the number of workers employed to produce that output level. Thus, it is given by $AP_L = X/L$ where X is the total output produced while L is the number of workers employed. From the Table 1.1, it is clear that, average product of labour increases with increased employment of labour and reached maximum level of 30 when 5 labourers are employed and is constant at 30 even when 6^{th} labourer was employed. However, average product of labour declined thereafter with the increased employment of labour.

From the behaviour of marginal product of labour (MP_L) and average product of labour AP_L as noticed from the Table, the relationship between MP_L and AP_L are such that $MP_L > AP_L$ up to employment of 5 labourers and $MP_L = AP_L$ when 6^{th} labourer is employed and beyond the employment of 6 labourers $AP_L > MP_L$.

1.10.3 Three Stages of Production:

When a variable factor is combined with a fixed factor, the relationship between inputs and output can be divided into three stages and is shown in Figure 1.15. Panel A shows the behaviour of Total Product i.e., total output curve, while Panel B shows the behaviour of marginal and average product curves and their relationship.

Stage I:

During the first stage, total output increased to 220 units when employment of labour gradually increased from 0 to 11 and thereafter declined with increased employment of labour. With the increased employment of labour, the Total Product curve (total output) TP_L is noticed to increase at an increased rate up to point 'A' (up to employment of 4 labourers), thereafter increased at a diminishing rate up to the point B (up to employment of 6 labourers). Thus, first stage is shown from origin to point B. During this stage at point B, $AP_L = MP_L$ and

AP_L increased and reached the maximum point (at 6^{th} unit of labour), while MP_L also increased but reached the maximum point (at 4^{th} unit of labour, even before AP_L reached maximum) and thereafter declined.

Stage II:

The second stage is shown from point B to point C. During this stage total output continued to increase at a diminishing rate and ultimately reached the maximum at point C (up to employment of 11^{th} unit of labour). At the same time, MP_L is noticed to be zero, while AP_L declining, but $AP_L > MP_L$.

Stage III.

The third stage is shown beyond the point C. During this stage the total output starts declining and MP_L becomes negative, while AP_L continues to decline, but is noticed to be positive. However, firms will not operate as additional employment of labour becomes inefficient.

Considering the three stages, the second stage which covers a range of output where MP_L is positive but diminishing is said to be an efficient zone of production for the firms to operate.

Thus, the law of variable proportions is applicable in all those cases where some inputs are allowed to vary, while keeping some other inputs are kept constant, so that variable inputs are combined with fixed inputs.

1.11 Production Function – Long Run Analysis:

The analysis of production in the long run case refers to the situation where all factors of production are variable. Thus, in the long run output can be expanded by changing all factors of production. The long run production function can be analysed in terms of the laws of returns to scale.

Let us consider the production function given by $Y = f(L, K)$ where Y is the output, L and K are labour and capital inputs. In the long run, in order to increase output Y, let both inputs namely labour L and capital are increased by certain proportion say 's' times, so that output may increase in the same proportion i.e., s times or more than proportion i.e., > s times or less than proportion i.e., < s times. This can be written mathematically as follows:

If both labour and capital inputs are increased by's' times then

If $f(sL, sK) = s^n f(L, K) = s^n.Y$, then the given production function is said to be homogenous function of degree 'n'. The degree of homogeneity is used to measure the returns to scale. Thus, if n = 1, it means that if inputs are increased by's' times, then output

will also expand exactly by‘s’ times i.e., in the same proportion. It implies the operation of constant returns to scale. Such a production function is called as linear homogenous production function. If n >1, it means that if inputs are increased by‘s’ times, then output will expand by greater than ‘s’ times (greater than proportion). It implies the operation of increasing returns to scale. If n < 1, it means that if inputs are increased by‘s’ times, then output will expand by less than ‘s’ times (less than proportion). It implies the operation of diminishing returns to scale. Thus, if we cannot express f (sL, sK) = s^n f (L, K), then such a production function is said to be non-homogenous.

The three cases of operation of returns to scale can be diagrammatically as shown in Figures.

1.11.1 Constant Returns to Scale:

In this case, if inputs are increased at a specific proportion then output will also increase by the same proportion. Thus, if factors of production are doubled i.e., becomes 2L and 2K, then output will also be doubled i.e., becomes 2X. Similarly, if factors of production are increased by 3 times i.e., becomes 3L and 3K then output will also be increased by 3 times i.e., becomes 3X. From the following Figure 1.16, it is clear that oa = ab = bc i.e., the distance the between successive isoquants along an isocline will be constant.

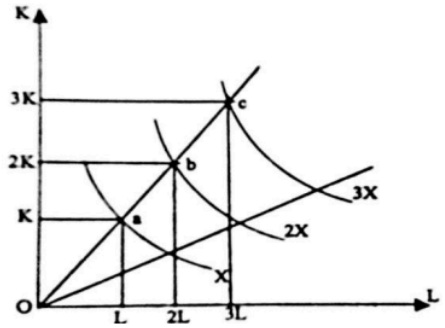

Figure 1.16 Constant Returns to Scale

1.11.2 Increasing Returns to Scale:

In this case, if factors of production are doubled i.e., becomes 2L and 2K, then output will be increased by more than doubled i.e., more than 2X (shown at point b_1). Similarly, if factors of production are increased by 3 times i.e., becomes 3L and 3K, then output will be increased by more than 3 times i.e., becomes more than 3X. From the following Figure 1.17, it is clear that oa > ab > bc i.e., the distance the between successive isoquants along an isocline will decrease.

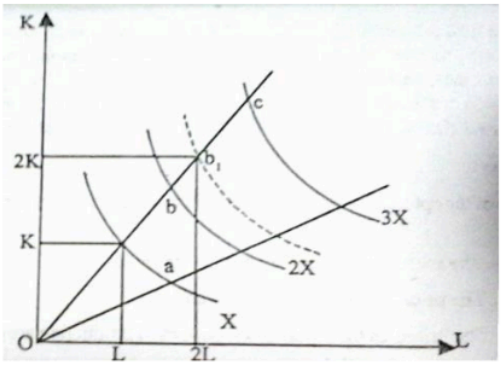

Figure 1.17 Increasing Returns to Scale

1.11.3 Decreasing Returns to Scale:

In this case, if factors of production are doubled i.e., becomes 2L and 2K, then output will be increased by less than doubled i.e., less than 2X (shown at point a_1). Similarly, if factors of production are increased by 3 times i.e., becomes 3L and 3K, then output will be increased by less than 3 times i.e., becomes less than 3X. From the following Figure 1.18, it is clear that oa < ab< bc i.e., the distance the between successive isoquants along an isocline will increase.

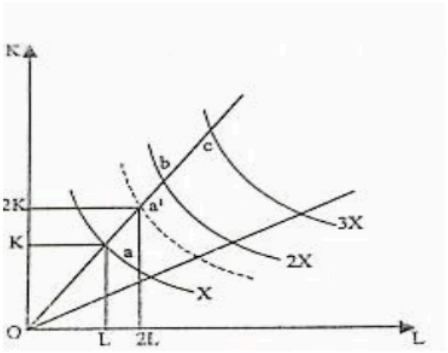

Figure 1.18 Decreasing Returns to Scale

1.12 Equilibrium of the Firm:

The firm is said to be in equilibrium, when it maximises its profits. A firm can maximise its profits by minimising the cost for a given level of output. Altertnatively, the firm can also maximise its profits by maximising its output for a given level of cost. In both the cases in order to maximise profits, the firm employs optimal combination of inputs. Such an optimal combination of inputs is known as least – cost combination of inputs. We consider the following assumptions:

1. The goal of the firm is maximisation of profits
2. The price of output is given i.e., P
3. The prices of per unit factors are given i.e., w is the wage rate and r is the price of capital.

1.12.1 Maximisation of output subjected to given level of output:

Let the production function be given by X = f (L,K) while given factor prices i.e., labour and capital be given by w and r respectively. The firm is said to be in equlibrium when it produces maximum output, given the total cost and input prices. From the Figure 1.19, it is clear that the firm can produce a maximum level of output X_2 at point 'e' where the budget line i.e., isocost line is tangent to the isoquant X_2. Thus, optimal combination of factors of production is said to be L_2 and K_2, given the factor prices as w and r. Though, it is deseriable to produce higher level of output (more than X_2), but it is not possible on account of cost constraint. Similarly, other points on AB or below it lie on lower level of isoquant. Hence, X_2 is the maximum possible amount that the firm can produce under the given assumptions. At the point of tangency 'e', the slope of the isocost line i.e., w/r is equal to the slope of the isoquant i.e., MP_L/MP_K . Thus, we can write $w/r = MP_L/MP_K = MRS_{L,K}$ which is said to be the first condition of equilibrium. The second condition is that isoquants should be convex to the origin.

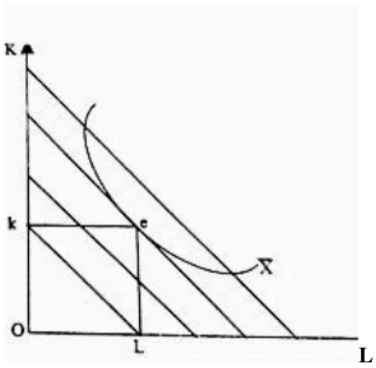

Figure 1.19 Least Cost Combination of Inputs

1.12.2 Minimisation of cost for a given level of output:

The equilibrium conditions for the firm in this case are also same as that of maximisation of output for a given level of cost. However, in this case we have a single isoquant, which implies the desired level of output and a number of isocost lines (shown in figure 1.20). The isocost lines are parallel to each other as they are drawn on the assumption

of constant prices of factors and consequently have the same slope w/r. The firm mimimises its costs by deploying factor combination of capital and labour as determined by the point of tangency between the isoquant and lowest isocost line. Thus, equilibrium occurs at point 'e' given by the least cost combination of the factors K and L with an ouput given by the isoquant. Points above 'e' implies higher costs, while points below 'e' though lower costs, yet it is not possible to achive the ouput level of X. In this case also the conditions of equilibrium are given by $w/r = MP_L/MP_K = MRS_{L,K}$ which is said to be the first condition of equilibrium while the second condition is that isoquants should be convex to the origin.

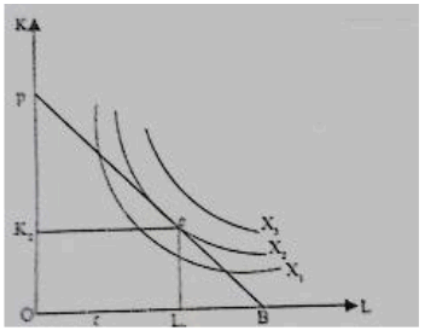

Figure 1.20: Maximisation Output

1.13 Expansion Path:

Expansion of output can be achieved through employing constant level of all or atleat one factor and is known as short run expansion path. Alternatively, output can also be expanded by varying all factors of production and is known as long run expansion path.

1.13.1 Expansion Path – Long Run:

Longrun is the period during which all factors of production are changed, so as to expand the output. The main objective of the firm is to identify the optimal way of expanding output, so as to maximise the profits. Given the factor prices and given production function, the optimal expansion path is determined by the points of tangency of successive isoquants and successive isocost lines. If the production function is homogenous, the expansion path will be a straight line throgh the origin as shown by OA (Figure1.21). However, if the production function is non homogenous, the optimal expansion path will no longer be a straight line, even if the ratio of prices of factors remains constant (Figure 1.22).

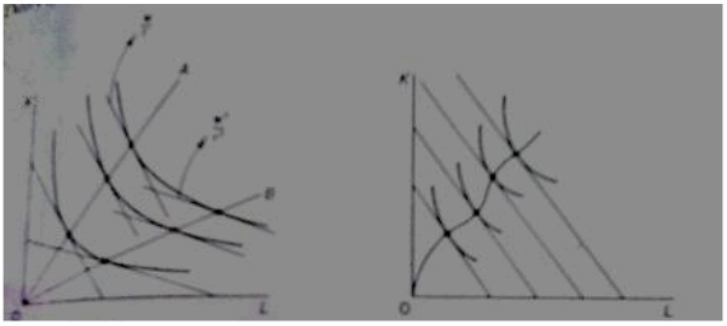

Figure1.21 Expansion Path – Long Run Figure1.2

1.13.2 Expansion Path – Short Run:

In the short run, ouput can be expanded by increasing the factor labour, while keeping consant the other factor namely capital. In the short run, as the the prices of factors are constant, the firm will not be in a position to maximise profits as capital is constant. Hence, in the short run, given the capital (as constant), the firm can expand output only along the line KK (Figure1.23).

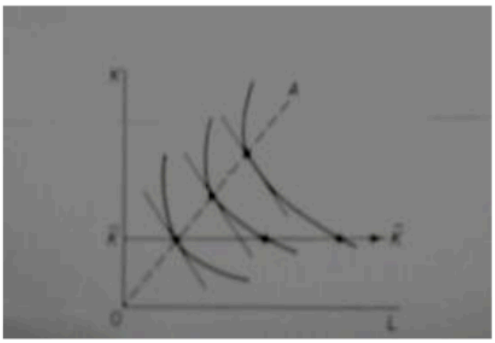

Figure1.23: Expansion Path – Short Run

1.14 Summary:

The Production function explains how the output changes in response to changes in inputs in a given time. Thus, the production function implies the transformation of inputs into output at any particular time period. The marginal product of a factor is defined as the change occurred in output due to a small change in one input, when all other factors are kept constant. The slopes of the production function curves gives the marginal products of factors namely labour and capital respectively. An isoquant is defined as the locus of all

technically efficient methods of producing a given level of output. Thus, it is the locus of all different combinations of factors of production used for producing a given level of output. An isoquant is also known as the equal – product curve or product isoquant and represents the production function. A production isoquant is convex to the origin. Isoquants are convex to the origin. Higher order isoquants represent higher levels of output. Isoquants will never intersect each other. The locus of the points of isoquants where the marginal product of the factors is zero is defined as a ridge line. The slope of the isoquant gives the rate of technical substitution between the factors and is known as marginal rate of technical substitution i.e., MRS of the factors and is equal to the ratio of the marginal product of the factors.

The elasticity of substitution measures the degree of substitutability between the factors of production. A product line explains the changes in output. It shows the increase in output through changes in isoquants i.e. shifts in isoquants. An isocline is defined as the locus of points of different isoquants at which the MRS of factors is constant. Production function analysis can be attempted considering the time period such as short run and long run. Short run refers to a time period during which only some factors of production can be varied, while some other factors of production are fixed. The analysis of production in the long run case refers to the situation where all factors of production are variable. A firm can maximise its profits by minimising the cost for a given level of output. Altertnatively, the firm can also maximise its profits by maximising its output for a given level of cost. In both the cases in order to maximise profits, the firm employs optimal combination of inputs. Such an optimal combination of inputs is known as least – cost combination of inputs. The ratio of factors prices should be equal to the ratio of marginal product of factors is the first condition of equilibrium, while isoquants should be convex to the origin will be the second condition.

1.15 Glossary

- Production function
- Marginal product of a factors
- Isoquant
- Marginal rate of technical substitution
- Elasticity of substitution
- Product line
- Isocline
- Law of variable Proportion

1.16 Model Questions:

1. Explain the concept of production function and examine the marginal product of factors.
2. Define term isoquant and explain various types of isoquants.
3. Examine the concept of Marginal Rate of Substitution.
4. Explain the concept of Elasticity of Substitution.
5. Explain the concept of product lines.
6. Define the term isoclines.
7. Examine the short run analysis of production function.
8. Discuss the long run analysis of production function.
9. Define the term expansion path and disnguish between long run and short run expansion path.

1.17 Further Readings:

- Koutsoyiannis. A., Modern Micro economics, The Macmillan Press Ltd., Hongkong, 1981.
- Bilas, R.A.,Micro Economic Theory, McGraw Hill, Tokyo, 1971.
- Henderson J.M., and Quandt. R.M., Micro Economic Theory: A Mathematical Approach, McGraw Hill.

Lesson 2/Module III

Linear Programming

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Structure:

2.0 Objectives:

The unit is expected to provide knowledge about Linear Programming. After going through the lesson, the learner is able to

- Understand about Linear Programming Problem.
- Able to formulate economic problems as Linear Programming Problem.
- Solve the Linear Programming Problem.

2.1 Introduction:

The technique of Linear Programming was developed in 1947 by the US Mathematician G.B. Dantzig for the purpose of scheduling the complicated procurement activities of the US Air force. Linear means that the relationships handled under this technique are same as those represented by straight lines. Programming means systematic planning or decision making. The systematic planning or decision making is done by the firm in relation to production. The individual firm is often confronted with a number of possible productivity processes or combinations and it is the responsibility of the management of the firm to select the least cost process or combination among a number of alternative processes or combinations. In the previous lesson we have learned that the theory of firm helps the firm in arriving at the least – cost combination of the factors of production. However, the technique of linear programming was developed, which helps in the determination of least – cost combination of the factors of production. Hence, linear programming is said to be a popularly used mathematical technique for determining the optimum allocation of resources for obtaining a particular objective when there are alternative uses of resources such as money, manpower, machines, materials and other resources. Linear programming can be used to solve a wide variety of problems. For example, revenue of firm can be maximised subject to constraints relating to availability of capital, labour and raw materials. Similarly, cost can be minimised subject to technical specifications, advertisement requirements and demand for output etc. Similarly, we can consider nutrition problem. Suppose a food manufacturing company wish to determine the quantities of two different types of foods to be manufactured subject to nutrition constraints such as proteins, vitamins and calories. Similarly, an advertisement agency trying to maximise the advertisement reach to as possible as large number of people subject to constraints put by different advertisement alternatives such as electronic media, news paper, radio and budget allocation etc.

2.2 Basic Concepts of Linear Programming:

1. The main objective of linear programming technique is to help the business firm to make optimal choice among a number of alternatives. The idea behind resource allocation may be profit maximisation, output maximisation, cost minimisation etc., subject to constraints or conditions. Thus, the technique gives numerical solution to the optimization problems, keeping given constraints into account.

2. The linear programming approach is useful in problems where the total effectiveness can be expressed as linear function of individual allocations and the limitations on resources may result in linear equalities or inequalities of the individual allocations.
3. Linearity is the fundamental assumption of linear programming. From the jargon of Economics linearity implies the constant returns. Thus, it means that not only marginal products and average products are equal, but also the prices of inputs and outputs are given.
4. A process is yet another basic important concept of linear programming. A process is also called as activity. A process is said to be a combination of relevant inputs to produce a particular output. Thus, a process uses factors such as capital, labour raw material etc., in fixed proportions.
5. Every linear programming should have an objective function. The objective function specifies the main idea of the problem i.e., whether to maximize or minimize the variable of interest. For example, profit, output, sales etc., are to be maximized, while costs, losses etc., are to be minimized. The objective function is also known as criterion function.
6. Constraints are yet another important concept on which a linear programming problem depends. Constraints are also known as restraints and are nothing but limitations relating resource availability. For example, a firm wish to maximize output may face the problem of availability of capital, labour, raw materials, fuels etc. Hence, the firm is expected to maximize its output subject to the resource availability constraints. The constraints are mathematically known as inequalities. The inequalities may be of less than or equal to ($\leq$) type when fewer resources are available. Similarly, inequalities may be of more than or equal to ($\geq$) type when minimum resources are needed.
7. A feasible solution to a linear programming problem can be obtained only when all constraints are defined. Feasible solution is that set of solution which satisfies the constraints. For example, in case of a consumer, feasible solutions are all the possible combinations of commodities which he can possibly buy given his income and prices of the commodities. Thus, feasible solutions for the consumer are all those combinations of two goods that lie on the budget line or that lie to the left of the budget line. Similarly, a feasible solution to the firm consists of all combinations of two inputs that lie either on the iso-cost line or to the right of the iso-costline.

8. Finally, the optimum solution to the linear programming problem is the best of the feasible solutions. Generally, a given linear programming problem consists of an optimum solution. However, in exceptional cases, there exist multiple optimum solutions which are equally good.
9. In case of a linear programming problem consisting of only two decision variables, the optimum solution can be obtained by using graphical method.
10. In case of a linear programming problem consisting of more than two decision variables, the optimum solution can be obtained by using simplex method. However, even if there are two decision variables, then also simplex method can be used. But, finding optimum solution, using simplex method involves tedious calculations.

2.3 Advantages of Linear Programming Problem:

1. Linear programming helps management of a firm in obtaining optimum solution, so that the firm can utilise its productive factors in judicious and rational manner.
2. It improves the quality of decisions as linear programming implies optimum solution through mathematical techniques.
3. It can be used to solve allocation type problems.
4. It helps in identifying bottlenecks in production process.
5. It goes a long way in improving skills of business executives.

2.4 Limitations of Linear Programming Problem:

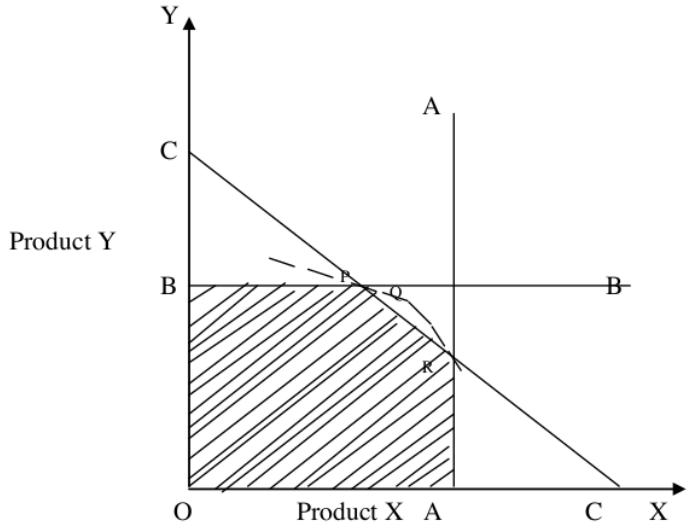
1. Linear programming is based on the assumption of perfect divisibility of resources. Accordingly, the solution is expected to assume any value. However, in reality certain resources may not be perfectly divisible.
2. Linear programming assumes linear relationship between variables. However, it is not always possible to have linear objective function and linear constraints.
3. The techniques ignore the effect of time, as simplex method is an iterative procedure and time consuming.
4. The technique can be adopted only under conditions of certainty. Thus, under the conditions of uncertainty about resources, the technique cannot be applied.
5. The technique is useful, only when there is single objective. However, in reality business may deal with more than one objective.

2.5 Maximising Revenue:

In order to understand the linear programming problem, let us consider the example of a firm maximising revenue. Let us consider a firm producing two products X and Y, where

production is subject to three constraints A, B and C wishes to maximise its revenue. Let us also suppose that the two products can be produced in different proportions. According to linear programming technique, the revenues are maximised when iso-revenue lines touch the corners of linear segmented production possibility curves. The conventional theory of firm also shows how the firm produces different proportions of two products using production possibility curve and iso-revenue lines. However, the production possibility curves are smooth and continuous in case of conventional theory, while in linear programming problem the production possibility curves are linear segmented.

In linear programming problem, the firm will decide its production proportions within the limits imposed by the constraints. Let the three constraints A, B and C relates to assembling, packaging and transport departments of the firm which imply limited capacities of respective departments. Now, with the help of the following graph 2.1, we explain how the firm maximise its revenue, producing two products X and Y subject to the three constraints A,B and C. Constraint A limits the production of X i.e., no more than OA of X can be produced. Constraint B limits the production of Y i.e., no more than OB of Y can be produced. Thus, the rectangle area formed by the two lines AA and BB indicates the combined effects of the two constrains A and B. Constraint C limits the production of both X and Y. The shaded portion represents the feasible solution. BP, PR, RA constitute the linear segment production possibility. The firm can produce any combination of X and Y inside the shaded portion, while it is not possible to produce any combination of X and Y represented by a point located outside the portion.



Graph 2.1: Maximising Revenue

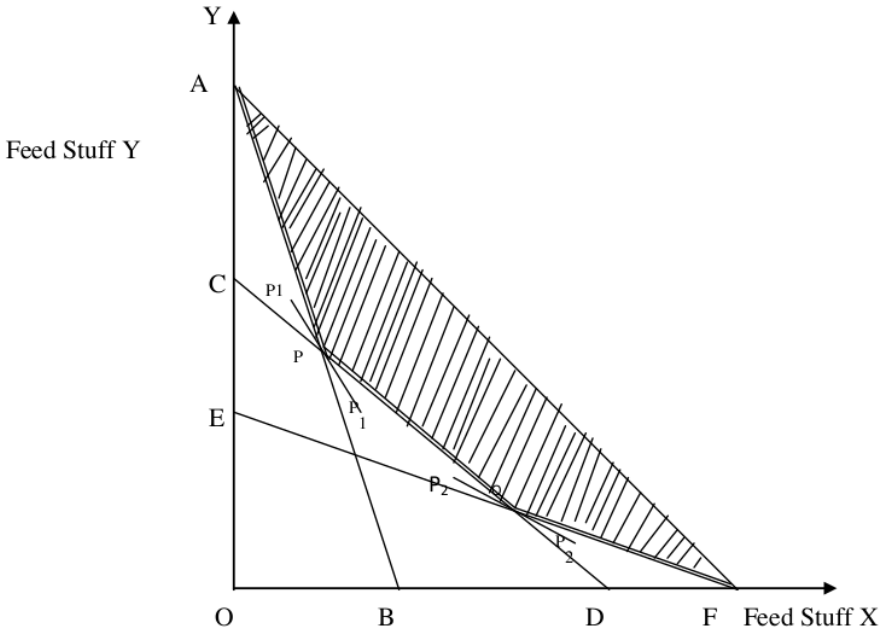
The iso-revenue lines have also shown in the graph. The dashed line Q is regarded as iso-revenue line. This shows the highest point of iso-revenue lines with the same slope that the firm is capable of reaching, given the feasible portion of production. The iso-revenue line Q touches the linear segmented production possibility curve at P. The corner is thus located at point P. At this point the firm produces more of Y than X, because the slope of iso-revenue line Q, the price of Y is much higher than the price of X. Let us know suppose that the prices of X and Y are different and are represented by the slope of the iso-revenue line R. With this iso-revenue line the firm goes to the corner R, producing more of X than Y, because the price of X is much higher than the price of Y.

2.6 Minimising Costs:

In order to understand how to minimise cost, let us consider the least expensive diet problem. The technique of linear programming was first used to tackle the least cost diet problem. Let us suppose that a farmer feed animals with two varieties of feed stuffs X and Y, so that the diet should contain minimum amount of three nutrients A, B and C. Now the problem is to minimise the feed cost subject to nutrition constraints. The problem can be explained with the help of the following graph 2.2.

Let feed stuff X be represented along the axis X, while feed stuff Y is represented along the axis Y. The minimum daily requirement of nutrient I is satisfied by OB kilograms of feed stuff X or by OA kilograms of feed stuff Y. Thus, the line AB explains how to combine feed stuffs X and Y to meet the requirements of nutrient I. From the graph, it is clear that feed stuff X is richer in nutrient I because fewer amount of it is required. Similarly, the lines CD and EF explain how to combine the two feed stuffs, so as to meet the minimum requirements of nutrients II and III. The thick line APQF with segments AP, PQ and QF explain how to combine two feed stuffs, so as to meet three nutrient constraints. The thick line APQF appears like an isoquant, though it is not a smooth curve. Any point on APQF or to the above it in the shaded portion represents the feasible solution space. In order to obtain the optimum solution, we are required to consider the prices of the two feed stuffs. The ratios of the prices of two feed stuffs X and Y are represented by the iso-cost lines shown by lines P_1P_1 and P_2P_2. It is clear that iso-cost line P_1P_1 touches the lowest position P. Thus, the Point P represents optimum diet when the price ratio is indicated by the P_1P_1. Hence, feed stuff Y is cheaper with a lower price per kilogram. The optimum solution is to feed more kilograms of Y than X. However, if the prices are indicated by the iso-cost line P_2P_2 then the optimum solution would be Q, because feed stuff X is cheaper than Y. If we assume that the price ratio

is given by the slope of line P_1P_1 then P will be the optimum solution. It may be noted that P is not a tangency point, but is a corner. The fact is that unique optimum solution in linear programming is always represented by a corner.



Graph 2.2: Minimising Costs

2.7 The General Linear Programming Problem – Mathematical Approach:

The general linear programming Problem consisting of n decision variables and m constraints can be written as follows:

The objective function can be written as

Optimise $Z = c_1X_1 + C_2X_2 + \ldots\ldots\ldots\ldots + C_nX_n$ ---------- (1)

Subject to

$a_{11}X_1 + a_{12}X_2 + \ldots\ldots\ldots\ldots + a_{1n}Xn \geq \text{or} \leq b_1$

$a_{21}X_1 + a_{22}X_2 + \ldots\ldots\ldots\ldots + a_{2n}Xn \geq \text{or} \leq b_2$

$a_{31}X_1 + a_{32}X_2 + \ldots\ldots\ldots\ldots + a_{3n}Xn \geq \text{or} \leq b_3$

..... ---------- (2)

.....

$a_{m1}X_1 + a_{m2}X_2 + \ldots\ldots\ldots\ldots + a_{mn}Xn \geq \text{or} \leq b_m$

and

$X_1, X_2, \ldots\ldots\ldots\ldots$ Xn all ≥ 0 ---------- (3)

The linear equation given by (1) is known as objective function and it can be maximized or minimized as per the requirement.

The in equations given (2) by are known as constraints. In a given linear programming problem, the constraints may be of less than equal type ($\leq$) or they may be of greater than equal to type ($\geq$). However, in certain problems both types of inequalities may exist.

The in equations given by (3) are known as non-negative restrictions, which imply that the decision variables may assume certain positive values or assumes zero, but cannot assume negative values.

2.8 Solution to Linear Programming Problem – Graphical Method:

The following stepwise procedure is adopted to find out solution of any given problem having two decision variables and any number of constraints.

1. Formulate mathematically the linear programming problem, based on the given information.
2. Convert the given constraint in equations in to equations, by simply ignoring the given inequalities.
3. Find out the coordinates corresponding to each and every equation obtained in step 2. In order to obtain coordinates, Put X_1=0 in each equation, so that one can arrive at the value of X_2. Similarly, Put X_2=0 so that we can obtain the value of X_1. Thus, corresponding to each equation considered, one can arrive at the coordinates (X_1, X_2) representing each and every equation of step 2.
4. Represent the coordinates corresponding to each equation on a graph so that, we can arrive straight lines corresponding to equations obtained in step 2.
5. Based on the given constraint in equations, determine the feasible solution space bounded by the drawn straight lines. Shade the feasible solution space and name the vertices (intersecting points of axes with the drawn straight lines and also intersection points of drawn straight lines) with alphabets.
6. Find out the coordinates of vertices of the feasible solution space. If the vertex is on X – axis, then Y – coordinate will be zero, while if the vertex is on Y – axis, then X – coordinate will be zero. If the vertex is the point of inter section of any two straight lines, then solve the two straight lines, so as to obtain coordinates of the intersecting vertex.

7. Find out the value of the objective function at each and every vertex and select the optimum value.

2.9 Numerical Example:

Let us suppose that a firm produces two different products I and II. Each product has to undergo three operations before it takes the final shape. As usual, the main objective of the firm is to find how much of products I and II be produced with the maximum capacity available for each operation so as to maximise the total net revenue. The revenue per unit of product I is Rs. 2, while the same for product II is Rs. 5 per unit. Cutting operation for one unit of product I require 1 hour, while the same for product II require 4 hrs. Mixing operation for one unit of product I require 3 hrs, while the same for product II requires 1 hour. Packing operation for one unit of product I and II each requires 1 hour. The maximum capacity available for each of cutting, mixing and packing operations is given as 24 hrs, 21 hrs and 9 hrs respectively. Formulate the given problem as linear programming and solve it so as to obtain maximum total net revenue.

2.9.1 Formulation of Linear Programming Problem:

Let $X_1$and X_2 be the amount of product I and product II that the firm has to produce. Since, revenue per unit of product I and II is given as Rs. 2 and Rs. 5 per unit respectively, the total revenue the firm can be written as $R = 2X_1 + 5X_2$. Since, total net revenue is to be maximised, the objective function can be written as

Max. $R = 2X_1 + 5X_2$

Based on the given information, the constraints can be written as follows:

Cutting operation for one unit of product I and II requires 1 hour and 4 hrs respectively, while maximum available capacity of cutting operation is given by 24 hrs. Hence, the cutting constraint can be written as

$X_1 + 4X_2 \leq 24$

Mixing operation for one unit of product I and II requires 3 hrs and 1 hour respectively, while maximum available capacity of mixing operation is given by 21 hrs. Hence, the mixing constraint can be written as

$3X_1 + X_2 \leq 21$

Packing operation for one unit of each product I and II requires 1 hour, while maximum available capacity of packing operation is given by 9 hrs. Hence, the packing constraint can be written as

$X_1 + X_2 \leq 9$

The non negative restrictions can be written as $X_1 \geq 0$, and $X_2 \geq 0$

Now the linear programming problem can be written as

Max. $R = 2X_1 + 5X_2$

$X_1 + 4\,X_2 \leq 24$

$3X_1 + X_2 \leq 21$

$X_1 + X_2 \leq 9$ and

$X_1 \geq 0, X_2 \geq 0$

2.9.2 Solution to Numerical Problem:

As given problem is formulated mathematically as LPP shown above, let us solve it. Converting the given constraint in equations as equations, we can write

$X_1 + 4\,X_2 = 24$ ---------- (1)

$3X_1 + X_2 = 21$ ---------- (2)

$X_1 + X_2 = 9$ ---------- (3)

Let us find out the coordinates corresponding to above three equations

Consider (1) and put $X_1 = 0$, so that $4\,X_2 = 24 \quad \therefore X_2 = 6$

Now put $X_2 = 0$, so that $X_1 = 24$

$\therefore$ Coordinates representing (1) are (24, 6)

Similarly, coordinates representing (2) are (7, 21)

Similarly, coordinates representing (3) are (9, 9)

Let us plot the above coordinates corresponding to (1), (2) and (3) on graph 2.3

Feasible solution space is given by OABCD (shaded portion). Let us find out the coordinates of vertices OABCD.

O being the origin coordinates of O are (0,0)

Coordinates of A are (7,0)

Coordinates of B are given by the point of intersection of straight lines (2) and (3). So solving (2) and (3)

$3X_1 + X_2 = 21$ ---------- (2)

$X_1 + X_2 = 9$ ---------- (3)

We can arrive at $X_1 = 6$ and $X_2 = 3$ $\therefore$ Coordinates of B are (6,3)

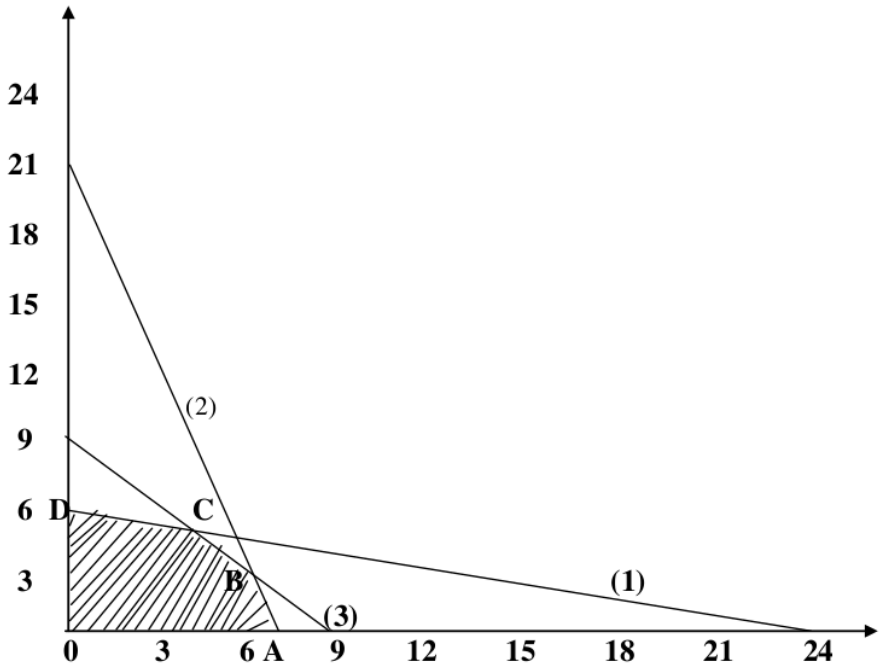
Coordinates of C are given by the point of intersection of straight lines (1) and (3). So solving (1) and (3)

$X_1 + 4\,X_2 = 24$ ---------- (1)

$X_1 + X_2 = 9$ ---------- (3)

We can arrive at $X_1 = 4$ and $X_2 = 5$ ∴ Coordinates of C are (4,5)

Coordinates of D are (0.6)



Graph 2.3

Now let us find out the value of $R = 2X_1 + 5X_2$ at each of vertices OABCD

Value of R at O (0,) is $R_O = 2(0) + 5(0) = 0$ ∴ $R_O = 0$

Value of R at A (7,0) is $R_A = 2(7) + 5(0) = 14$ ∴ $R_A = 14$

Value of R at B (6,3) is $R_B = 2(6) + 5(3) = 27$ ∴ $R_B = 27$

Value of R at C (4,5) is $R_C = 2(4) + 5(5) = 0$ ∴ $R_C = 33$

Value of R at D (0,6) is $R_D = 2(0) + 5(6) = 0$ ∴ $R_D = 30$

Since, value of R is maximum at C (4,5), the solution obtained to the given problem is that maximum revenue is Rs. 33 when the firm produces 4 units of product I and 5 units of product II.

2.10 Summary:

Linear programming is a mathematical technique which can be employed to find out optimum value of any required variable of interest, which is subject to certain constraints. For example, a firm while maximising its output may face certain constraints such as limited amount of capital, minimum amount of raw material which should be used to produce per unit of output, maximum amount of machine hours available etc. Hence, keeping in view of such constraints into account the firm is expected to maximise its output. In linear programming problem, the given information should be formulated mathematically so as to find out the solution. The linear programming problem should inevitably consist of an objective function which is to be maximised or minimised. Further, constraints are to be considered along with non-negative restrictions. A linear programming problem consisting of only two decision variables can be solved using graphical method, while in case of more than two variables one can make use of simplex method. However, simplex method is not discussed in this lesson.

2.11 Glossary

- Linearity
- Optimum values
- Objective function
- Constraints
- Non-negative restrictions
- Feasible solution
- Optimum solution
- Graphical method
- Simplex method

2.12 Model Questions:

1. Explain what is linear programming problem? How it is useful in Economics?
2. What are the advantages and limitations of linear programming?
3. Explain how a general linear programming problem can be formulated mathematically?
4. Explain how an objective function can be maximised using linear programming problem.

5. Explain how an objective function can be minimised using linear programming problem.
6. Solve the following linear programming problem:

   Maximise: $Z = 20\ X + 50\ Y$

   Subject to: $2\ X + 3\ Y \geq 120$

   $X + Y \geq 40$

   $2\ X + 1.6\ Y \geq 90$

   and $X, Y \geq 0$

7. Minimise: $C = 2\ P + 3\ Q$

   Subject to: $P + Q \geq 6$

   $2P + Q \geq 7$

   $P + 4Q \geq 8$

   and $P, Q \geq 0$

8. Minimise: $Z = 20\ X_1 + 40\ X_2$

   Subject to: $36\ X_1 + 6\ X_2 \geq 108$

   $3\ X_1 + 12\ X_2 \geq 36$

   $20\ X_1 + 10\ X_2 \geq 100$

   and $X_1, X_2 \geq 0$

2.13 Further Readings:

- Watson & Getz, Price Theory and its Uses, Khosla Publishing House, New Delhi
- Mehta & Madnani, Mathematics for Economists, Sultan Chand & Sons, New Delhi
- Gupta.P.K & Hira. D.S., Operations Research, S. Chand & Company, New Delhi
- Kapoor. V.K, Operations Research, Sultan Chand & Sons, New Delhi

Lesson 3/Module IV

Williamson's Model of Managerial Discretion

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Structure:

3.0 Objectives:

The unit is expected to provide knowledge about the Managerial theory of the firm. After going through the lesson, the learner is able to

- Understand about the Managerial Utility Function
- Acquires knowledge about Managerial Discretion
- Analyse the Managerial Discretion Model of Williamson
- Explain the implications of the Model of Williamson

3.1 Introduction:

Oliver E. Williamson has developed (1964) managerial utility maximisation objective as against profit maximisation. It is one of the managerial theories and is also known as the managerial discretion theory. Williamson hypothesised that profit maximization would not be the objective of the managers of a joint stock organisation. According to Williamson in case of large modern firms, shareholders and managers are two separate groups. The former wants maximum return in their investment and hence they are interested in maximisation of profits. The managers on the other hand have consideration other than profit maximisation in their utility functions. Thus, the managers are interested not only in their own emoluments, but also in the size of their staff and expenditure on them. Thus, Williamson's theory is related to the maximisation of the manager's utility which is a function of the expenditure on staff and emoluments and discretionary funds.

3.2 The Managerial Utility Function:

According to Williamson, managers have discretion in pursuing managerial functions. Managers are interested to maximise their own utility rather than to maximise the profits of the firm. It is because, profit maximisation maximises the utility of owners and shareholders of the firm as they want maximum return on their investment. However, the managers are interested not only in their own emoluments, but also in the size of their staff and expenditure on them.

The managerial utility function includes variables such as salary, job security, power, status, dominance, prestige and professional excellence of managers. Among all these variables, salary is the only quantitative variable and is thus measurable. The other variables are non-pecuniary, which are non-quantifiable. Hence, those non-pecuniary variables are to be imputed through proxy variables. The variables such as expenditure on staff salary, management slack, discretionary investments can be assigned nominal values. Thus, these will be used as proxy variables to measure the real or unquantifiable concepts like job security, power, status, dominance, prestige and professional excellence of managers, appearing in the managerial utility function.

The Utility function or "expense preference" of a manager can be written as

$$U = f(S, M, I_D)$$

where U is the Utility function and f denotes the functional relationship.

S is the expenditure on the staff including managerial salaries. It includes not only the manager's salary, but also other forms of monetary compensation received by him from the

business firm. Moreover, it also includes the number of staff under the control of the manager as close relationship exists between the number of staff and the manager's salary.

M is the managerial emoluments which consists of those non-essential management perks such as entertainment expenses, lavishly furnished offices, luxurious cars etc., which helps to retain the managers in the firm. These perks, even if not provided would not make the manager quit his job, but these are incentives which enhance their prestige and status in the organisation in turn contributing to efficiency of the firm's operations.

I_D is the discretionary investment which refers to the amount of money kept at manager's disposal so as to spend it at his own discretion. For example, spending on furniture, decoration material etc. Such a provision of discretionary investment satisfies the ego of managers and gives them a sense of pride. These give a boost to the manager's esteem and status in the organisation, so that they can be retained in the firm.

3.3 Model Based Relations and Definitions:

In order to understand the William's model, one should be familiar with the following relations and definitions:

3.3.1 The Demand Curve:

The demand of the firm is known and is a downward slopping curve. The demand function is given by

$$X = f(P, S, \epsilon)$$

Where X is the output, f denotes the functional relationship, P is the price, S is the expenditure on staff and ϵ is the state of environment, which William calls it as demand shift parameter. It reflects the autonomous changes in demand. Further, it is assumed that the demand is negatively related with price, but is positively related with staff expenditure and the shift parameter. Hence, an increase in price results in a down ward shift of demand curve, while an increase in the staff expenditure will results in an upward shift of the demand curve. Similarly, any change in shift parameter say increase in income results in an upward shift of the demand curve. Thus, the relationship can be written as

$$\partial P/\partial X < 0; \quad \partial P/\partial S > 0; \quad \partial P/\partial \epsilon > 0$$

3.3.2 The Production Cost:

The total cost of production increases with an increase in the production of output. Thus, the cost function can be written as $C = f(X)$ such that $\partial C/\partial X > 0$.

3.3.3 Concepts of Profit:

The following are different concepts of profit that are being used in the Williamson's Model

(a) Actual Profit (π):

Actual Profit (π) is defined as the Revenue (R) from sales less Cost of production (C) and Expenditure on Staff (S).

Thus, Actual profit can be written as $\pi = R - C - S$

(b) Reported Profit (π_R):

Reported profit (π_R) is defined as the Actual Profit (π) less Managerial Emoluments (M). It is that profit, which is reported to tax authorities by deducting perks of the managers.

Thus, Reported Profit can be written as $\pi_R = \pi - M = R - C - S - M$

(c) Minimum Profit (π_0):

Minimum profit ($\boldsymbol{\pi_0}$) is the profit after tax which should be paid to the shareholders as dividend. If shareholders are not paid at least some profit, they may resort to sell their shares or vote for a change in the top management. If either of these occurs, it will affect the job security of the managers. Hence, to satisfy the shareholders, minimum profit should be earned by the firms. So, the reported profit should be at least as high as the minimum required profit plus the tax amount to be paid.

Hence, it implies that $\pi_R \geq \pi_0 + T$ where T is tax

The Tax function can in turn be written as

$$T = \overline{T} + t.\ \pi_R$$ where t is the unit profit tax and $\overline{T}$ is lumpsum tax

(d) **Discretionary Profit (π_D):**

Discretionary Profit (π_D) is the Actual Profit (π) less minimum profit (π_0) and Tax (T).

Thus, Discretionary Profit can be written as $\pi_D = \pi - \pi_0 - T$

(e) Discretionary Investment (I_D):

Discretionary Investment (I_D) is the Reported Profit (π_R) less minimum Profit (π_0) and the Tax (T).

Thus, Discretionary Investment can be written as $I_D = \pi_R - \pi_0 - T$

3.4 The Simplified Model of Managerial Discretion:

It is a model in which we assume that there are no managerial emoluments i.e., $M = 0$, so that actual profit becomes the reported profit i.e., $\pi = \pi_R$. The simple model can be stated as

$$\text{Max } U = f(S, I_D)$$

$$\text{Subject to } \pi \geq \pi_0 + T$$

As there are no managerial emoluments i.e., M = 0, discretionary investment absorbs all the discretionary profit. Hence, managerial utility function can be written as

$$U = f [s, \pi - \pi_0 - T]$$

For the sake of simplicity, let us suppose that there is no lumpsum tax, so that $T = t \pi$

So, the managerial utility function can be written as $U = f [s, \pi - \pi_0 - t \pi]$ (using $T = t \pi$)

$\therefore$ The managerial utility function can be written as $U = f [s, (1 - t) \pi - \pi_0]$

where $(1 - t) \pi - \pi_0 = \pi_D$ is the discretionary profit.

Now using Figure 3.1, the equilibrium of the firm can be explained. Expenditure on staff i.e., S is measured on X – axis, while the discretionary profit i.e., π_D is measured on the Y – axis. The curves shown in the Figure are indifference curves and each curve shows the combination of S and π_D, which gives the same satisfaction to the managers. As usual, the indifference curves are convex to the origin and imply diminishing marginal rate of substitution between staff expenditure and discretionary profit.

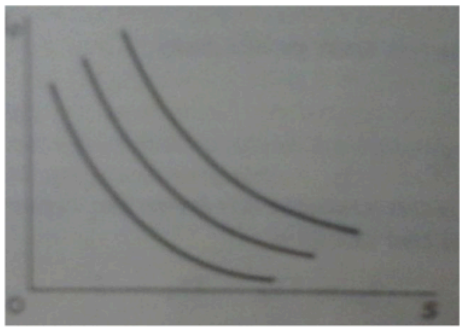

Figure 3.1

The relationship between S and π_D is determined by the profit function i.e.,

$$\Pi = f (X) = f (P, S, €)$$

Unit profit tax i.e., t and minimum profit i.e., π_0 are exogenously given by the tax laws and demand for dividends of share holders. Assuming that output is chosen optimally following the condition of MR = MC and the market environment is given i.e., €, the relationship between π_D and S is shown in the Figure 3.2.

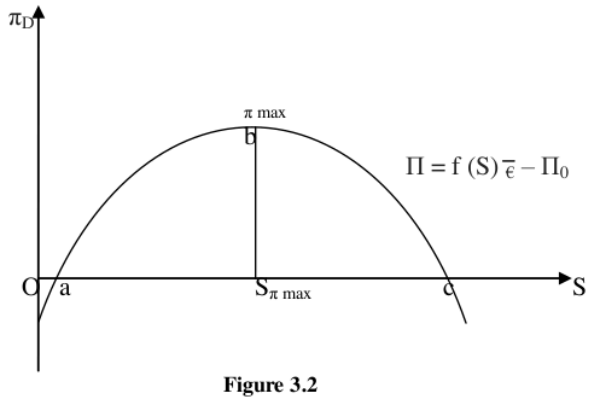

Figure 3.2

At the initial stages of production and up to the level of output, where profits reach their maximum level i.e., point b (in the Figure 3.2), both discretionary profits and staff expenditures increase. However, if production exceeds this level, profits will start declining, but staff expenditures continue to increase. If the staff expenditure exceeds point c, the minimum profit constraint is not satisfied and hence to the right of c is not feasible solutions. Thus, it is clear that the drawn profit curve does not include the minimum profit requirement π_0.

The minimum acceptable profit can also be shown by drawing the profit function $\pi = f(S)_{\overline{P},\overline{\epsilon}}$ as shown in Figure 3.3. The equilibrium of the firm is determined by the point of tangency between the staff expenditure curve (S) with the highest possible managerial indifference curve as shown by the point e. Given the indifference curves have a negative slope, it follows that the equilibrium solution will be always on the falling portion of S curve. It shows the preference of managers for staff expenditure. In this model, the staff expenditure i.e., S^* will be greater than that of profit maximiser i.e., $S_{\pi\ max}$. Moreover, Williamson's model implies higher output, lower price and lower level of profit than the profit maximisation model.

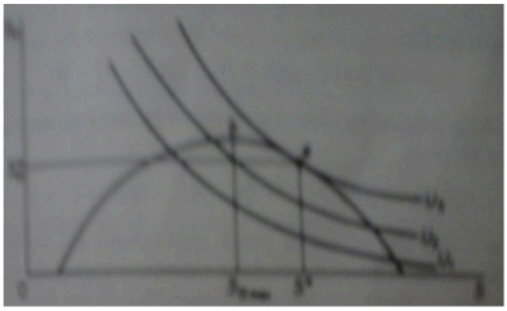

Figure 3.3

3.5 The General Model of Managerial Discretion:

The model may be written as

$$\text{Max } U = f(S, M, \pi_R - \pi_0 - T) \quad \text{---------- (1)}$$

$$\text{Subject to } \pi_R \geq \pi_0 + T \quad \text{---------- (2)}$$

The marginal utility w.r.t different components in the utility function are assumed to be diminishing but positive. Hence, the above constraint (2) becomes redundant, so that the above problem can be regarded as straightforward maximisation problem.

Substituting $\pi_R = \pi - M = R - C - S - M$ ---------- (3)

and $T = \overline{T} + t.\ \pi_R = \overline{T} + t\,(R - C - S - M)$ ---------- (4) in (1)

we can write $U = f\{S, M, [(1 - t)(R - C - S - M - \pi_0]\}$

Now defining the ratio of retained profits to actual profits as ρ i.e., $\rho = \pi_R/\pi$

We can also write $\pi_R = \pi.\rho$ ---------- (5)

Consider the expression for π_R and using (5), we can write $\pi_R = \pi - M = \pi.\rho$ ------- (6)

$\therefore M = (1 - \rho)\,\pi = (1 - \rho)(R - C - S)$ where $(1 - \rho)$ is the proportion of profits absorbed by emoluments.

Now the managerial utility function can be written as

$$U = f\{S, [(1 - \rho)(R - C - S)], [\rho(1 - t)(R - C - S) - \pi_0]\} \quad \text{---------- (7)}$$

As the tax rate (t) and minimum profit requirement (π_0) are exogenously determined, the utility function ultimately depends on output (X), expenditure on staff (S) and the proportion of retained profits to actual profits (ρ). Hence, in order to maximise the utility function U, the managers are expected to concentrate on these three policy variables namely X, S and ρ.

Let the first order partial derivatives of U w.r.t S, M and I_D be denoted by U_1, U_2 and U_3 respectively, so that we can write $\partial U/\partial S = U_1$, $\partial U/\partial M = U_2$ and $\partial U/\partial I_D = U_3$

The total differential of the managerial utility function $U = f(S, M, I_D)$ can be written as

$$dU = \partial U/\partial S\,(ds) + \partial U/\partial M\,(dM) + \partial U/\partial I_D\,(I_D) \quad \text{---------- (8)}$$

It can be rewritten as

$$dU = U_1(ds) + U_2(dM) + U_3\,(dI_D) \quad \text{----------(9)}$$

where $M = (1 - \rho)(R - C - S)$ and $I_D = \rho\,(1 - t)(R - C - S) - \pi_0$

Considering the total differential (9), finding the partial derivatives and equating to zero

$$\partial U/\partial X = U_2\,[(1 - \rho)\,(\partial R/\partial X - \partial C/\partial X)] + U_3\,[\rho\,(1 - t)\,(\partial R/\partial X - \partial C/\partial X)] = 0 \text{ ----- (10)}$$

$$\partial U/\partial S = U_1 + U_2\,[(1 - \rho)\,(\partial R/\partial S - 1] + U_3\,[\rho\,(1 - t)\,(\partial R/\partial S - 1)] = 0 \text{ ---------- (11)}$$

$$\partial U/\partial \rho = U_2\,[(-1)\,(R - C - S)] + U_3\,[(1 - t)\,(R - C - S)] = 0 \text{ ---------- (12)}$$

From equation (10), we arrive at

$$(\partial R/\partial X - \partial C/\partial X) + [U_2\,(1 - \rho) + U_3\,(\rho)\,(1 - t)] = 0 \quad \text{---------- (13)}$$

The equation will be satisfied only when

$$\partial R/\partial X - \partial C/\partial X = 0 \Rightarrow \partial R/\partial X = \partial C/\partial X \text{ i.e., } MR = MC \quad \text{---------- (14)}$$

as all the three elements in the second expression of the LHS of (13) are positive by assumption. Thus, in Williamson's model also, the firm makes the production decision by equating MR = MC.

From equation (11), solving for $\partial R/\partial S$ we arrive at

$$\partial R/\partial S = 1 - \frac{U_1}{U_2\,(1 - \rho) + U_3\,(\rho)\,(1 - t)} \quad \text{---------- (15)}$$

Given that, by assumption all the elements in (15) are positive, it implies that $\partial R/\partial S < 1$

This condition implies that at equilibrium the managerial firm will employ administrative staff beyond the level, i.e., beyond where MR = MC. Thus, there is a tendency for the managerial firm to overspend on staff, to employ more administrative staff than a profit – maximising firm.

From equation (12), we arrive at

$$(R - C - S)\,[-U_2 + U_3\,(1 - t)] = 0$$

For this equation to be satisfied, the second factor should be equal to zero as $(R - C - S) > 0$

$$\Rightarrow [-U_2 + U_3\,(1 - t)] = 0$$

$$\therefore U_2 = (1 - t)\,U_3 \quad \text{---------- (16)}$$

This condition implies that in Williamson's model some amount of profit will be absorbed as emoluments. However, this amount depends on the tax rate. Thus, Higher the tax rate t, the

smaller will be U_2/U_3 so that the smaller will be marginal rate of substitution of emoluments for discretionary investment and the more will be spent on M and the less on discretionary investment. Given that the marginal utilities have known values as determined by the manager's preferences, the solution of (14), (15) and (16) gives the equilibrium values of the policy variables output (X), expenditure on staff (S) and the proportion of retained profits to actual profits (ρ). It is pertinent to note that the second order conditions are satisfied by the assumption of diminishing, but positive marginal utilities of three components of the managerial utility function.

3.6 Implications of the Model:

In order to understand the implications of Williamson's model let us compare the model with the profit maximiser model.

For the profit maximiser, $\pi = R - C - S$ and $\pi_R = \pi$ so that $\rho = 1$

The profit maximiser will choose the values of X and S which maximise his profit

i.e., $\pi = R - C - S$

The first order conditions can be obtained as

$\partial\pi/\partial X = 0 \Rightarrow \partial R/\partial X - \partial C/\partial X = 0$ or $\partial R/\partial X = \partial C/\partial X$ $\therefore MR = MC$ ------ (1)

$\partial\pi/\partial S = 0 \Rightarrow \partial R/\partial S - 1 = 0$ $\therefore \partial R/\partial S = 1$ ---------- (2)

Now we can tabulate the equilibrium conditions of the two models as follows:

Table 1: Comparison of Williamson and Profit Maximiser Models

	Williamson Model	Profit Maximiser Model
Equilibrium Conditions	MR = MC $(\partial R/\partial S) < 1$ $\rho < 1$	MR = MC $(\partial R/\partial S) = 1$ $\rho = 1$
Values of M, S, I_D	M > 0 S > 0 $I_D > 0$	M = 0 S = 0 $I_D = 0$

From the above Table, it is clear that the Managerial Emoluments (M) and Discretionary Investment (I_D) will be zero in the case of profit maximiser. However, in case of Williamson's model both $M > 0$ and $I_D > 0$. Moreover, in Williamson's model, the expenditure on staff will be larger i.e., $S_W > S_{\pi\ max}$ as the profit maximiser will spend on staff up to the point, where MR on staff will be equal to MC from staff. However, the utility maximising managers will employ the staff beyond that point.

The first order condition for equilibrium is found to be same i.e., MR = MC in both models. But, no definite prediction can be made about the level of output. Generally, the optimal output will not be same in the two models, as output depends on staff expenditure (S)

and these will be larger in Williamson's model. Based on $S_W > S_{\pi\ max}$, it is inferred that $X_W > X_{\pi\ max}$, but, it may not necessarily be true. The result of increased staff expenditures on the level of output depends on the particular relationship between X and S in the two models.

Thus, it is concluded that, expenditure on staff (S), managerial emoluments (M) and discretionary investment (I_D) will be larger in case of a firm that maximises utility when compared to a firm that maximises profits. However, it is not possible to draw general conclusion about level of output in the two models.

3.7 Comparison of Williamson's Model and Profit Maximiser:

Let us examine the effects of shift in demand, change in unit profit tax and imposition of lumpsum tax on the levels of the policy variables namely output, staff expenditure and proportion of retained profits to actual profits.

3.7.1 A Shift in the Market Demand:

Shift in the market demand can be denoted by shift factor € which will appear in the demand function. The resulting effects of such a shift on X, S and ρ in the two models can be identified as follows:

Table 2: Effect of Shift in the Market Demand

Policy Variables	Williamson's Model	Profit Maximiser Model
X	$\partial X/\partial € > 0$	$\partial X/\partial € > 0$
S	$\partial S/\partial € > 0$	$\partial S/\partial € > 0$
ρ	$\partial \rho/\partial € > 0$	$\partial \rho/\partial € = 0$

A shift in demand will result in an increase in both output (X) as well as expenditure on staff (S) in both models. As two models shows the same predictions with regard to direction changes in both X and S due to a shift in demand, we cannot identify whether the firm is a utility maximiser or profit maximiser just based on only changes in these variables. An upward shift in demand will not affect ρ in a profit maximiser model, while it will lead to a reduction in ρ in case of a utility maximiser. According to Williamson a shift in demand will increase slack payments faster than the increase in the actual profits. Thus, an increase in slack payments in boom and a decrease in slack payments in recession implies that the firm is of the Williamson type rather than a profit maximiser.

3.7.2 An Increase in the Unit Profit Rate:

The effect of an increase in the unit profit rate on policy variable X, S and ρ can be tabulated as follows:

Table 3: Effect of Increase in the Unit Profit Rate

Policy Variables	Williamson's Model	Profit Maximiser Model
X	$\partial X/\partial t > 0$	$\partial X/\partial t = 0$
S	$\partial S/\partial t > 0$	$\partial S/\partial t = 0$
ρ	$\partial \rho/\partial t < 0$	$\partial \rho/\partial t = 0$

An increase in the unit profit rate will not change the equilibrium level of output (X), and staff expenditure (S) in case of a profit maximising firm. A profit maximising firm cannot avoid the burden of an increase in the unit profit rate by changing its output or price or staff expenditure, unless the burden is so high as to lead the firm to close down. On the other hand in Williamson's model, the firm will be able to avoid part of the tax burden by increasing its staff expenditure and its slack payments and reporting a lower level of profit for taxation.

3.7.3 Effects of a lumpsum Tax:

The effect of a lumpsum tax on policy variable X, S and ρ can be tabulated as follows:

Table 4: Effects of a lumpsum Tax

Policy Variables	Williamson's Model	Profit Maximiser Model
X	$\partial X/\partial T < 0$	$\partial X/\partial T = 0$
S	$\partial S/\partial T < 0$	$\partial S/\partial T = 0$
ρ	$\partial \rho/\partial T > 0$	$\partial \rho/\partial T = 0$

The imposition of a lumpsum tax will not change the short run equilibrium level of output (X) and staff expenditure (S) in case of a profit maximiser, which cannot avoid the burden of tax. However, the imposition of lumpsum tax in case of Williamson's model results in a reduction of output, staff expenditure and slack payments.

3.7.4 Change in Fixed Costs:

Increase in fixed costs has similar impact just like lumpsum tax. Thus, an increase in fixed costs will not affect the short run equilibrium level of output (X) and staff expenditure (S) in case of a profit maximiser, while it will lead to a reduction of output, staff expenditure and slack payments in case of a utility maximiser.

3.8 Summary:

Oliver E. Williamson has developed (1964) managerial utility maximisation objective as against profit maximisation. According to Williamson managers have discretion in pursuing managerial functions. Managers are interested to maximise their own utility rather than to maximise the profits of the firm. It is because, profit maximisation maximises the utility of owners and shareholders of the firm as they want maximum return on their

investment. However, the managers are interested not only in their own emoluments, but also in the size of their staff and expenditure on them. The managerial utility function includes variables such as salary, job security, power, status, dominance, prestige and professional excellence of managers. Among all these variables, salary is the only quantitative variable and is thus measurable. Managerial Emoluments (M) and Discretionary Investment (I_D) will be zero in the case of profit maximiser. However, in case of Williamson's model both $M > 0$ and $I_D > 0$. Moreover, in Williamson's model, the expenditure on staff will be larger i.e., $S_W > S_{\pi max}$ as the profit maximiser will spend on staff up to the point, where MR on staff will be equal to MC from staff. However, the utility maximising managers will employ the staff beyond that point.

Thus, it is concluded that, expenditure on staff (S), managerial emoluments (M) and discretionary investment (I_D) will be larger in case of a firm that maximises utility when compared to a firm that maximises profits. However, it is not possible to draw general conclusion about level of output in the two models.

3.9 Glossary:

- Expense Preference
- Staff Expenditure
- Managerial Emoluments
- Actual Profit
- Reported Profit
- Minimum Profit
- Discretionary Profit
- Discretionary Investment

3.10 Model Questions:

1. What is a managerial utility function? Explain
2. Explain Williamson's simple model of managerial discretion
3. Examine Williamson's general model of managerial discretion
4. Critically discuss the similarities and differences between Williamson's model and Profit maximiser model

3.11 Further Readings:

- Koutsoyiannis. A., Modern Micro economics, The Macmillan Press Ltd., Hongkong, 1981.

Lesson 4/Module III

Cobb-Douglas, CES, Trasnslog and Leontief's Production Functions

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Structure:

4.0 Objectives:

The unit is expected to provide knowledge about production functions namely Cobb – Doulas, CES, Translog and Leontief. After going through the lesson, the learner is able to

- Understand about Mathematical form of said production functions.
- Able to interpret the properties of said production functions.

4.1 Introduction:

Production function analysis occupies central position in the theory of firm as it provides an insight into a firm's response to changing economic variables, usually labour and capital. The production function analysis can be successfully employed to (i) examine the nature of returns to scale so as to conclude whether the firm should be expanded or not (ii) analyse the degree of returns to scale, so as to know whether the scarce capital could be economised in the firm (iii) compute factors' marginal productivities, so as to infer which factor should be used more in firm's expansion.

A production function is a complex analytical tool which describes the maximum output can be obtained from a given set of inputs in the existing state of technological knowledge. In other words a production function can be regarded as an embodiment of technology which yields maximum output from the way in which the inputs cooperate with each other to produce a given level of output. The technology that is embodied in a production function has four important characteristics which according to Brown is said to be abstract technology. These are (i) the efficiency property (ii) the degree of returns to scale (iii) the degree of factor intensity and (iv) the elasticity of substitution.

The first characteristic i.e., the efficiency property may be measured through a parameter which indicates the overall quality of the technology. An increase in such a parameter increases the level of output, given the other characteristics of abstract technology. The second characteristic i.e., the degree of returns to scale measures the proportionate increase in output resulting from a proportionate increase in inputs. The third characteristic i.e., the factor intensity measures the quantum of capital used in relation to other inputs in the production process. The fourth characteristic i.e., the elasticity of substitution measures the proportionate change in relative factor input prices due to a proportionate change in the marginal rate of substitution.

In this guide line we discuss the properties considering various types of production functions such as Cobb – Doulas, CES, Translog and Leontief.

4.2 Cobb-Douglas Production Function:

The Cobb-Douglas form was developed and tested against statistical evidence by Charles Cobb and Paul Douglas during 1927–1947. Based on the empirical observation Cobb and Douglas inferred properties of production function and suggested mathematical form. The Cobb–Douglas production function is a particular functional form of the production function, popularly used to represent the technological relationship between the amounts of two or more inputs, particularly physical capital and labour, and the amount of output that can be produced by those inputs. The general form of the Cobb – Douglas function is given by

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

where Q = output, Q >0; K = capital input, K >0; L = labour input L >0; A = constant, A >0 α and β are parameters which indicates the elasticity of output with respect to inputs namely capital and labour.

4.3 Characteristics of Cobb-Douglas Production Function: The following are the important characteristics of Cobb –Douglas production function.

4.3.1 It is a Homogenous Function:

Homogeneity of the function can be examined by making proportionate changes in each input. Let us suppose that capital and labour inputs are increased by 't' times, so that we can write

$$f(tK, tL) = A (tK)^{\alpha} (tL)^{\beta} = A\, t^{\alpha} K^{\alpha}\, t^{\beta} L^{\beta} = t^{\alpha+\beta} A K^{\alpha} L^{\beta} = t^{\alpha+\beta} Q$$

$$\therefore f(tK, tL) = t^{\alpha+\beta} Q$$

Thus, Cobb –Douglas production function is a homogenous function of degree α+β, which indicates the extent of operation of returns to scale in the following manner:

Case (i): If α+β = 1, it is a situation where in the percentage increase in output is exactly equal to the percentage increase in labour and capital implying the operation of constant returns to scale and the function is said to be a linear homogenous function.

Case (ii): If α+β > 1, it is a situation where in the percentage increase in output is more than the percentage increase in labour and capital implying the operation of increasing returns to scale.

Case (iii): If α+β < 1, it is a situation where in the percentage increase in output is less than the percentage increase in labour and capital implying the operation of diminishing returns to scale.

4.3.2 The Average Products of Capital and Labour:

By definition, average product of capital is the ratio of total output produced to the total capital input used. Thus, average product of capital can be written as $AP_K = Q/K$ Similarly, average product of labour can be written as $AP_L = Q/L$

4.3.3 The Marginal Products of Capital and Labour:

The Cobb – Douglas production function can be written as $Q = A K^{\alpha} L^{\beta}$

The first order partial derivative of Q with respect to K is given by

$$\partial Q/\partial K = \partial/\partial K[A K^{\alpha} L^{\beta}]$$
$$= AL^{\beta} \ \partial/\partial K[K^{\alpha}]$$
$$= AL^{\beta} \alpha K^{\alpha - 1}$$
$$= \alpha AL^{\beta} K^{\alpha}/K$$
$$\therefore \ \partial Q/\partial K = \alpha (Q/K) = \alpha. AP_K$$
$$\therefore \ MP_K = \alpha. AP_K$$

Thus, marginal product of capital is given by α times average product of capital.

The first order partial derivative of Q with respect to L is given by

$$\partial Q/\partial L = \partial/\partial L[A K^{\alpha} L^{\beta}]$$
$$= AK^{\alpha} \ \partial/\partial L[L^{\beta}]$$
$$= AK^{\alpha} \beta L^{\beta - 1}$$
$$= \beta AK^{\alpha} L^{\beta}/L$$
$$\therefore \ \partial Q/\partial K = \beta (Q/L) = \beta. AP_L$$
$$\therefore \ MP_L = \beta. AP_L$$

Thus, marginal product of labour is given by β time's average product of labour.

4.3.4 Elasticity of Output with respect to Capital and Labour:

Elasticity of output with respect to capital is represented by α and it measures the percentage change in output due to given percentage change in capital. Similarly, elasticity of output with respect to labour is represented by β and it measures the percentage change in output due to given percentage change in labour. Thus, α and β are individually said to be partial elasticities, while the two coefficients together measure the total percentage change in output for a given percentage change in the two inputs namely capital and labour.

We know that marginal product of capital is given by α times average product of capital i.e., $MP_K = \alpha. AP_K$

$$= \alpha (Q/K)$$
$$\therefore \alpha = MP_K/ (Q/K) = (K/Q) MP_K = MP_K/AP_K$$

Thus, elasticity of output with respect to capital is given by $\alpha = (K/Q)\, MP_K$ or it is the ratio of marginal product of capital to average product of capital.

We know that marginal product of labour is given by β times average product of labour

i.e., $MP_L = \beta . AP_L$

$= \beta\ (Q/L)$

$\therefore \beta = MP_L/(Q/L) = (L/Q)\, MP_L = MP_L/AP_L$

Thus, elasticity of output with respect to labour is given by $\beta = (L/Q)\, MP_L$ or it is the ratio of marginal product of labour to average product of labour.

4.3.5 Factor Intensity:

It is measured by α/β and is given by

$\alpha/\beta = [MP_K/AP_K]/[MP_L/AP_L] = [MP_K/MP_L]/[AP_K/AP_L]$

= Ratio of MP of capital to labour/ Ratio of AP of capital to labour

Factor intensity indicates the extent of techniques that are used in the production process. The higher the value of this ratio, the more capital intensive techniques are followed, while a lower value of this ratio implies the use of more labour intensive techniques.

4.3.6 Elasticity of Substitution:

Each and every firm try to maximise its profits or minimise its costs, considering the factor prices into account. Hence, the firm is interested to know about the extent of elasticity of substitution between factors of production. The measure of substitution between factors of production is known as elasticity of technical substitution. Thus, elasticity of substitution is a pure number and measures the extent to which the substitution between the factors can take place. The elasticity of substitution between two factors namely capital (K) and labour (L) is defined as the proportionate change in the ratio between the factors due to proportionate change in rate of technical substitution (RTS) and is denoted by σ.

$$\therefore \text{Elasticity of substitution i.e., } \sigma = \frac{\text{Proportionate change in the ratio between the factors L,K}}{\text{Proportionate change in RTS between L,K}}$$

$$= \frac{[\Delta\ (K/L)]/(K/L)}{\Delta\ RTS/\ RTS_{LK}} \text{ or } \frac{[\Delta\ (L/K)]/(L/K)}{\Delta\ RTS/\ RTS_{KL}}$$

$$= \frac{d\ (K/L)}{(K/L)} \quad \frac{RTS_{LK}}{d\ RTS} \text{ where d stands for change i.e., } \Delta$$

$$= \frac{d\,[\log (K/L)]}{d\,[\log (RTS)]}$$

Since, RTS of K for L is the ratio of MP of labour to capital which will be equal to ratio of factor prices, we can write the elasticity of substitution as follows

$$\therefore \text{Elasticity of substitution i.e., } \sigma = \frac{d\,[\log (K/L)]}{d\,[\log (r_1/r_2)]}$$

Further, it can also be written as

$$\therefore \text{Elasticity of substitution i.e., } \sigma = \frac{(L/K)\, d\,(K/L)}{(r_2/r_1)\, d\,(r_1/r_2)}$$

Let us find out the elasticity of substitution i.e., σ for Cobb – Douglas production function using the the above formula.

We know that marginal product of capital and labour from 4.2.3 as

$MP_K = \alpha\,(Q/K)$ and $MP_L = \beta\,(Q/L)$

$$\therefore \text{Ratio of marginal product of labour to capital} = \frac{MP_L}{MP_K} = \frac{\beta\,(Q/L)}{\alpha\,(Q/K)} = \frac{\beta K}{\alpha L} = \frac{r_1}{r_2}$$

$$\therefore \text{Elasticity of substitution i.e., } \sigma = \frac{(L/K)\, d\,(K/L)}{(r_2/r_1)\, d\,(r_1/r_2)} = \frac{(L/K)\, d\,(K/L)}{(\alpha L/\beta K)\, d\,(\beta K/\alpha L)} = \frac{(L/K)\, d\,(K/L)}{(L/K)\, d\,(K/L)} = 1$$

$\therefore$ Elasticity of substitution i.e., $\sigma = 1$

4.3.7 Efficiency Parameter:

The constant 'A' in the Cobb-Douglas production function is known as efficiency parameter. The situation of two firms having the same values of K, L, α, β but still producing different quantities of output can be attributed to the superior organisation and entrepreneurship of one of the firms which results in different efficiencies. The more efficient firm have a larger value of 'A' than the less efficient one.

4.3.8 Limitations of Cobb- Douglas Production Function:

1. Manderhausen pointed out that the variables used in Cobb – Douglas production function namely output, capital and labour were each functions of time variable and hence pointed out that the relationship between output, capital and labour as visualized by Douglas was spurious and resulted simply from their relative rates of growth.

2. The Cobb – Douglas function implies that at least some quantity of each input must be used if output is to be non zero. But, in practice such a condition does not hold good.
3. Cobb – Douglas function considers only two factors namely capital and labour and ignores raw materials. In fact raw materials play an important role in the production process.
4. The property of unitary elasticity of substitution is criticized by Brown. In the case Cobb – Douglas production function, the elasticity of substitution between labour and capital has been constrained to assume a value of unity, irrespective of the empirical situation. Hence, a better approach is to allow the elasticity of substitution to vary in accordance with the empirical situation.

4.4 Constant Elasticity Substitution (CES) Production Function:

Just like the Cobb – Douglas production function, the CES function has also a constant elasticity of substitution, but unlike the Cobb – Douglas function, the elasticity of substitution is not constrained to be unity. At the same time, the Cobb – Douglas function can be deduced from the CES function as a special case. The striking contrast between Cobb – Doulas and CES functions is that while the former is based on the observation that the wage rate was a constant proportion of output per head, the latter is based upon the observation that output per head is a changing proportion of wage rate. Though, it was H.D. Dikenson, who for the first time mentioned about the CES function, Arrow, Chenery, Minhas and Solow estimated the CES function and hence the function is popularly known as ACMS or SMAC function.

The ACMS function can be written as

$$Q = A\left[\delta (K)^{-\rho} + (1-\delta)(L)^{-\rho}\right]^{-\mu/\rho}$$

Where 'Q' is the output, 'L' and 'K' is labour and capital inputs respectively, 'A' is efficiency parameter. This parameter in CES function is similar to that of 'A' in the Cobb – Douglas function. Higher values of 'A' result in larger volume of output, regardless of inputs and $A > 0$. 'δ' is also a constant which is known as distribution parameter and indicates the relative contribution of capital and labour to the total output. Thus, 'δ' is the capital intensity factor coefficient, while $(1 - \delta)$ is the labour intensity factor coefficient and $0 < \delta < 1$. 'ρ' is still another constant which is known as substitution parameter. The value of elasticity of substitution can be obtained with the help of ρ and $\rho > -1$. The constant 'μ' represents the

scale parameter and $\mu > 1$ implies increasing returns to scale, $\mu = 1$ implies constant returns to scale, while $\mu < 1$ implies the diminishing returns to scale.

The CES function under the assumption of returns to scale can be written as

$$Q = A\left[\delta (K)^{-\rho} + (1-\delta) (L)^{-\rho}\right]^{-1/\rho}$$

Where 'Q' is the output, 'L' is the labour input, 'K' is the capital input, 'A' is the efficiency parameter, 'δ' is the distribution parameter and ρ is the substitution parameter (as exaplained above).

4.5 Characteristic Features of CES Function:

The following are the important characteristics of Cobb –Douglas production function.

4.5.1 It is a Homogenous Function:

Homogeneity of the function can be examined by making proportionate changes in each input. Let us suppose that capital and labour inputs are increased by 't' times, so that we can write

$$f(tK,tL) = A[\delta (tK)^{-\rho} + (1-\delta) (tL)^{-\rho}]^{-1/\rho}$$

$$= A\left[\left\{(t)^{-\rho}\right\}^{-1/\rho} \delta (K)^{-\rho} + \left\{(t)^{-\rho}\right\}^{-1/\rho} (1-\delta) (L)^{-\rho}\right]^{-1/\rho}$$

$$= (t)\ A\left[\delta (K)^{-\rho} + (1-\delta) (L)^{-\rho}\right]^{-1/\rho}$$

$$= (t)\ Q$$

∴ CES function is a homogenous function of degree 1 which implies constant returns to scale. Hence, the above version of CES function is said to be a linear homogenous function.

4.5.2 The Marginal Products of Capital and Labour:

Consider the CES function given by

$$Q = A\left[\delta (K)^{-\rho} + (1-\delta) (L)^{-\rho}\right]^{-1/\rho}$$

The first order partial derivative of Q with respect to K is given by

$$\partial Q/\partial K = A (-1/\rho)\left[\delta (K)^{-\rho} + (1-\delta) (L)^{-\rho}\right]^{(-1/\rho)-1} \delta (-\rho) (K)^{(-\rho)-1}$$

$$\partial Q/\partial K = \frac{\delta}{(A)^{\rho}}\left[\frac{Q}{K}\right]^{1+\rho} = MP_K$$

The first order partial derivative of Q with respect to L is given by

$$\partial Q/\partial L = A(-1/\rho)\left[\delta (K)^{-\rho} + (1-\delta)(L)^{-\rho}\right]^{(-1/\rho)-1} (1-\delta)(-\rho)(L)^{(-\rho)-1}$$

$$\partial Q/\partial L = \frac{(1-\delta)}{(A)^{\rho}} \left[\frac{Q}{L}\right]^{1+\rho} = MP_L$$

4.5.3 Elasticity of Substitution:

Consider the CES function given by

$$Q = A\left[\delta (K)^{-\rho} + (1-\delta)(L)^{-\rho}\right]^{-1/\rho}$$

We know that least cost combination is given by ratio of marginal products of factors is equal to the ratio of input prices i.e., $MP_L / MP_K = r_1/r_2$

Substituting the values of MP_L and MP_K in the above relation

$$\frac{\frac{(1-\delta)}{(A)^{\rho}}\left[\frac{Q}{L}\right]^{1+\rho}}{\frac{\delta}{(A)^{\rho}}\left[\frac{Q}{K}\right]^{1+\rho}} = \frac{r_1}{r_2}$$

$$\Rightarrow \left[\frac{1-\delta}{\delta}\right]\left[\frac{K}{L}\right]^{1+p} = \frac{r_1}{r_2}$$

$$\Rightarrow K/L = \left[\frac{r_1}{r_2}\right]^{(1/1+p)}\left[\frac{\delta}{1-\delta}\right]^{(1/1+p)} = m\left[\frac{r_1}{r_2}\right]^{(1/1+p)}$$

where $m = \left[\frac{\delta}{1-\delta}\right]^{(1/1+p)}$

By definition, Elasticity of substitution i.e., $\sigma = \frac{(L/K)\, d(K/L)}{(r_2/r_1)\, d(r_1/r_2)} = \frac{d(K/L)/d(r_1/r_2)}{(K/L)/(r_1/r_2)}$

Substituting the expression for K/L in the above formula

$$\sigma = \frac{d\left[m (r_1/r_2)^{1/(1+p)}\right]/d[r_1/r_2]}{m\left[(r_1/r_2)^{1/(1+p)}\right][r_1/r_2]} = \frac{(m/1+p)[r_1/r_2]^{(1/1+p)-1}}{m[[r_1/r_2]^{(1/1+p)-1}} = \frac{1}{1+\rho}$$

$\therefore$ Elasticity of substitution for CES function i.e., $\sigma = 1/(1+\rho)$

Thus, the value of elasticity depends on the value of ρ as follows:

If $\rho = 0$, then $\sigma = 1$, hence CES function reduces to Cobb – Douglas function

If $\rho = -1$, then $\sigma = \alpha$

If $-1 < \rho < 0$, then $\sigma > 1$

If $\rho > 0$, then $\sigma < 1$

If $\rho = \alpha$, then $\sigma = 0$

4.5.4 The Behaviour of Marginal Product of Factors:

The marginal product of one factor say labour will increase, when there is an increase in the usage of other factor say capital. Thus, if capital and labour are substitutable for each other and if capital is substituted for labour, then marginal product of labour will increase.

4.5.5 Limitations of CES Production Function:

Brown pointed out the following limitations of CES function.

1. The combined effect of scale economies of a firm for a given technology and scale economies that may result from the implementation of a new technology for a given scale of operations are represented by one parameter 'A'.
2. Generalization of the function to 'n' factors of production is a troublesome task.
3. Some specification problems are associated with the estimation of CES function.
4. The non-linearity feature of CES function makes it difficult to estimate the function.

Despite the above limitations, the estimation of CES function enables us to study all the four characteristics of "abstract technology" viz., efficiency, returns to scale, factor intensity and elasticity of substitution.

4.6 Transcendental Logarithmic Production Function:

The CES production function allows the elasticity of substitution to be different from zero or unity and remains constant at all levels of input. However, estimation of CES production function is difficult in view of non-linear nature of the function. In view of such limitations associated with CES function, Christenson, Jorgensen and Lu developed the Transcendental Logarithmic Production Function in 1972 which is popularly known as Translog production function. The translog function consists of linear as well as non-linear terms and is useful to deal with more than two inputs. The translog function can be written in logarthimic form and approximated by second order Talyor series. The translog function can be written as

$$\ln Q = \ln \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln X_i + (1/2) \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln X_i \ln X_j$$

where Q is output, X_i and X_j (i = 1,2...n and j = 1,2....n) are inputs, α_0 is the efficiency parameter, α_i (i = 1,2.....n) and β_{ij} (i = 1,2....n and j = 1,2....n) are unknown parameters.

The marginal product of factor i in translog production function is given by

$$\partial \ln Y/\partial \ln X_i = \alpha_i + \sum_{J=1}^{n} \beta_{ij} \ln X_j$$

It is to be noted that the marginal product of a translog production function is formally a Cobb-Douglas production function.

The marginal rate of transformation between two production factors can be determined as

$$\frac{\partial \ln Y}{\partial \ln X_i} = \frac{\alpha_i + \sum_{i=1}^{n} \beta_{ij} \ln X_i}{\alpha_j + \sum_{J=1}^{n} \beta_{ij} \ln X_j}$$

It is important to mention that C.E. Ferguson (1979) demonstrated that the marginal product is equal to the elasticity of scale.

For simplicity sake let us consider a case of only three inputs namely capital, labour and raw materials, so that the function can be written as

$$\ln Q = \ln \alpha_0 + \alpha_1 \ln K + \alpha_2 \ln L + \alpha_3 \ln M + (1/2)\, \beta_{11} (\ln K)^2 + (1/2)\, \beta_{22} (\ln L)^2 + (1/2)\, \beta_{33} (\ln M)^2 + \beta_{12} \ln K \ln L + \beta_{32} \ln L \ln M + \beta_{31} \ln M \ln K$$

Where *Q* is the output, *K* is capital input, L is labour input, and M is material input. α_0 is the intercept or the constant term. α_1, α_2 and α_3 are first order derivatives, while β_{11}, β_{22} and β_{33} are second order derivatives. β_{12}, β_{23} and β_{31} are second order cross derivatives.

Assuming perfect competition, output elasticity with respect to input equals to the cost share of that input. Thus, we can get a system of equations from differentiating the translog production function with respect to each factor input as follows:

$$\partial \ln Q/\partial \ln K = \alpha_1 + \beta_{11} \ln K + \beta_{12} \ln L + \beta_{13} \ln M$$

$$\partial \ln Q/\partial \ln L = \alpha_2 + \beta_{22} \ln L + \beta_{21} \ln K + \beta_{23} \ln M$$

$$\partial \ln Q/\partial \ln M = \alpha_3 + \beta_{33} \ln M + \beta_{32} \ln L + \beta_{31} \ln K$$

where α_1, α_2 and α_3 represents the average cost share of capital, labour and material respectively. β_{11}, β_{12} and β_{13} represents the constant capital share elasticity with respect to capital, capital share elasticity with respect to labour, and capital share elasticity with respect to material input respectively. Similarly, β_{33}, β_{32} and $\beta_{31}$are constant material share elasticity with respect to capital, with respect to labour and with respect to materials.

The estimation of translog function requires higher level of mathematical knowledge and hence discussed very briefly.

4.7 Leontief Production Function:

Leontief assumes fixed coefficients of production with only one technique of producing each output.

If there are 'n' producing sectors then the production of sector n will be represented by

$$X_n = f(X_{1n}, X_{2n}, X_{3n} \ldots\ldots\ldots X_{nn}, L_n)$$

Where X_n is the output produced by 'n' sector by drawing $X_{1n}, X_{2n}, X_{3n} \ldots\ldots\ldots X_{nn}$ units of inputs respectively from the output of 1,2,3.....n-1 sectors and its own output (n th sector) and L_n units of primary input i.e., labour. From the assumption of fixed input requirements, in order to produce one unit of j^{th} commodity, the input used of the i^{th} commodity must be a fixed amount. Thus, we can write $a_{ij} = X_{ij}/X_j$ or we can write $X_j = X_{ij}/a_{ij}$. Thus, to produce one unit of j^{th} commodity, fixed input of i^{th} commodity is to be used. For the sake of simplicity, let us consider only two sectors 1 and 2 along with labour (L) and capital (K), while l_1 and b_1 are labour – output and capital output coefficients as the production function requires a fixed minimum amount of factors. However, such technique of production leads to wastage of resources and bottlenecks. But, to avoid wastage of resources and bottlenecks, the production function can be written as:

$$X_1 = \text{Min}\ (X_{11}/a_{11}, X_{21}/a_{21}, L_1/l_1, K_1/b_1)$$

This production function will be L – shaped.

In order to represent the production function graphically, let us consider only two inputs say input from sector X_2 and labour (L), so that the above production function can be written as

$$X_1 = \text{Min}\ (X_{21}/a_{21}, L_1/l_1)$$

Thus, $X_1 \leq X_{21}/a_{21}$ and $X_1 \leq L_1/l_1$

or it can also be written as $X_{21} \geq a_{21} X_1$ and $L_1 \geq l_1 X_1$ with at least one equality holds good, the other input will be wasted . The production function can be shown graphically as Fig 4.1. The input X_1 is represented along the horizontal axis, while labour input is represented along the vertical axis. From the graph $X_1 = 1$ is the isoquant when the output of X_1 is 1unit, $X_1 = 2$ is the isoquant when the output of X_1 is 2units and $X_3 = 3$ is the isoquant when the output of X_1 is 3units respectively and are all L – shaped. Thus, $OP_1 = 1$, $OP_2 = 2$ and $OP_3 = 3$. Hence, $OP_1 = P_1P_2 = P_2P_3$. At point P_1, the input drawn from sector 2 will be $X_{21} = 1$. $(a_{21}) = a_{21} = OM_1$. At the same time labour input used will be $L_1 = l_1\ (1) = l_1 = ON_1$

The slope of $OP_1 = P_1M_1/OM_1 = l_1/a_{21}$. Since, input coefficients remain constant; the slope of the ray OP_1 remains constant. Further, as O, P_1, P_2 and P_3 are on the same ray, no input along this ray will be wasted.

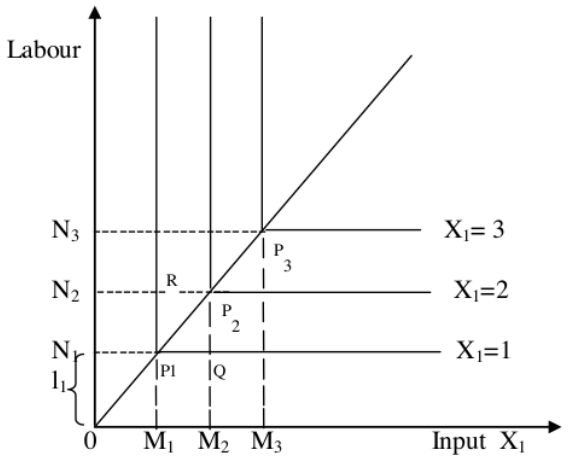

Figure 4.1

Similarly, $OM_2 = 2\ a_{21}$ or $ON_2 = 2\ l_1$. Thus slope of $OP_2 = P_2M_2/OM_2 = 2\ l_1/\ 2\ a_{21} = l_1/a_{21}$ Thus, in order to double the output of X_1, both inputs should be exactly doubled and to triple the output of X_1, both inputs should be exactly tripled, if there is to be no wastage. However, let us consider the point Q on the RHS of the isoquant $X_1 = 1$ output. Here, labour used is only ON_1 which is sufficient to produce one unit of X_1, but input X_2 is as much as OM_2. Thus input X_2will be wasted up to M_1M_2. Similarly, labour input will be wasted at point R and at all points on P_1R. However, both inputs cannot be wasted. Further, if L and X_2 are used in larger quantities, then one could reach the second isoquant and so on.

4.8 Summary:

The Cobb–Douglas production function is a particular functional form of the production function, popularly used to represent the technological relationship between the amounts of two or more inputs, particularly physical capital and labour, and the amount of output that can be produced by those inputs. Cobb –Douglas production function is a homogenous function and its elasticity of substitution is given by unity. Just like the Cobb – Douglas production function, the CES function has also a constant elasticity of substitution, but unlike the Cobb – Douglas function, the elasticity of substitution is not constrained to be unity. At the same time, the Cobb – Douglas function can be deduced from the CES function as a special case. The translog function consists of linear as well as non-linear terms and is useful to deal with more than two inputs. The translog function can be written in logarthimic form and approximated by second order Talyor series. Leontief assumes fixed coefficients of production with only one technique of producing each output.

4.9 Glossary:

- Cobb–Douglas production function
- CES production function
- Translof production function
- Leontief production function
- Linear homogenous function
- Elasticity of substitution
- Average and marginal products

4.10 Model Questions:

1. Explain Cobb-Douglas production function and its propperties and limitations.
2. Examine the CES production function and its propperties and limitations.
3. What is a Translog production function? How it is superior compared to Cobb-Doulas and CES functions.
4. Explain Leontief production function.

4.11 Further Readings:

- Mehta & Madnani, Mathematics for Economists, Sultan Chand & Sons, New Delhi
- Koutsoyiannis. A., Modern Micro economics, The Macmillan Press Ltd., Hongkong, 1981.

Lesson 2/Module IV

Baumol's Sales Revenue Maximization Model

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Structure:

2.0 Objectives:

The unit is expected to provide knowledge about sales revenue maximisation as suggested by W.J Baumol, as an alternative goal to profit maximisation. After going through the lesson, the learner is able to understand:

- Conditions of profit maximisation
- Baumol's static model with and without advertisement
- Bamoul's dynamic model with and without advertisement

2.1 Introduction:

As an alternative goal to profit maximisation, W.J. Baumol developed the theory of sales revenue maximisation. The theory is explained through two basic models known as static single period model and dynamic multi product model. These two models are discussed by considering with and without advertising aspects. Before discussing the Baumol's theory, let us discuss about conditions for profit maximisation.

2.2 Profit Maximisation:

Profit is the main driving force behind any economic activity. Hence, each and every firm try to maximise its profits. So, let us understand the conditions required to maximise profits. Profit maximisation conditions can be obtained by using maxima-minima method of differential Calculus. Profit can be arrived by subtracting all costs from the sales revenue. Thus, it can be written as $\prod = \mathbf{R} - \mathbf{C}$ where $\prod$ denotes the Profit, R denotes the Revenue and C denotes the Cost. Let X denotes the quantity of output produced.

The first order derivative of profit ($\prod$) with respect to output (X) can be written as

$d\prod/dX = dR/dX - dC/dX$

Equating the first order derivative to zero and solving

$d\prod/dX = 0 \Rightarrow dR/dX - dC/dX = 0$

$\Rightarrow dR/dX = dC/dX$

$\therefore$ MR = MC, which is the first order condition (since, first order derivative of revenue w.r.t output implies MR, while first order derivative of cost w.r.t output implies MC)

The second order derivative of $\prod$ with respect to output X can be written as

$d^2\prod/dX^2 = d^2R/dX^2 - d^2C/dX^2$

For maximisation of output, the second order derivative should be less than zero

i.e., $d^2\prod/dX^2 < 0 \Rightarrow [d^2R/dX^2 - d^2C/dX^2] < 0$

$\Rightarrow d^2R/dX^2 < d^2C/dX^2$

$\Rightarrow d/dx\ (dR/dX) < d/dx\ (dC/dX)$

$\Rightarrow d/dx\ (MR) < d/dx\ (MC)$

$\Rightarrow$ Change in MR < Change in MC

$\Rightarrow$ MC should cut the MR from below, which is the second order condition

Thus, the profit maximisation conditions are:

1. Marginal Revenue should be equal to Marginal Cost.
2. MC should cut the MR from below.

2.3 Baumol's Static Models:

The model is based on the following assumptions.

1. The time horizon of a firm is a single period.
2. In this period the firm tries to maximize its total sales revenue subject to the profit constraint.
3. The profit constraint is determined by the demand and expectations of the shareholders, the banks and other financial institutions.
4. Cost curves are U – shaped and the demand curves are downward sloping.

According to Baumol, revenue or sales maximisation rather than profit maximisation is consistent with the actual behaviour of firms. Baumol quotes evidence to suggest that short-run revenue maximisation may be consistent with long-run profit maximisation. But, sales maximisation is regarded as both short-run as well as long-run goal of the management. Sales maximisation is not only a means, but an end in itself. Baumol provides a number of arguments in support of his theory. Further, according to Baumol

1. A firm gives more importance to the magnitude of sales and is much concerned about declining sales.
2. If the sales of a firm are declining, banks, creditors and the capital market will not come forward to provide finance to it.
3. With fall in sales, the distributors and dealers may not show interest in business activity.
4. With fall in sales consumers may not buy its product because of its unpopularity.
5. Firm reduces its managerial and other staff with fall in sales.
6. If sales are large, due to economies of scale, the firm expands and earns large profits.
7. Salaries of workers and management also depend to a large extent on more sales and the firm offers bonus and other facilities.

2.3.1 A Single Product Model – Without Advertising:

According to Baumol, sales maximisation means maximisation of total revenue. However, it does not imply the sale of large quantities of output, but refers to the increase in money sales (in rupee, dollar, etc.). Sales can increase up to the point of profit maximisation, where the marginal cost equals marginal revenue. If sales are increased beyond this point, money sales may increase only at the expense of profits. But, the oligopolistic firm wants its money sales to grow even though it earns minimum profits. Minimum profits refer to the amount which is less than maximum profits. The

minimum profits are determined on the basis of firm's need to maximize sales and also to sustain growth of sales. Minimum profits are required either in the form of retained earnings or new capital from the market.

The firm also needs minimum profits so as to finance future sales. The minimum profits are also essential for a firm for which pays dividends to share capital holders and for meeting other financial requirements. Thus, minimum profits serve as a constraint on the maximisation of a firm's revenue. According to Baumol, maximum revenue will be obtained only at an output, at which the elasticity of demand is unity, i.e., at which marginal revenue is zero.

Baumol's model can be explained with the help of Figure 2.1. In the Figure, output is represented along the horizontal axis while, total revenue, total cost and profit are represented along the vertical axis. TC is the total cost curve, TR the total revenue curve, TP the total profit curve and MP the minimum profit or profit constraint line.

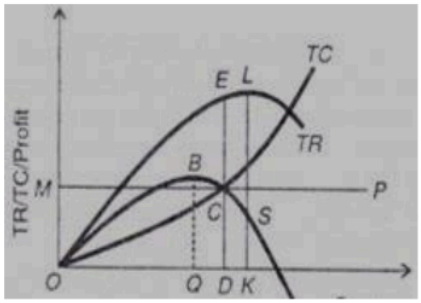

Figure 2.1

The firm maximises its profits at OQ level of output, which corresponding to the highest point B on the TP curve. But, the aim of the firm is to maximise its sales rather than profits. Its sales maximisation output is OK, where the total revenue KL is the maximum at the highest point of TR. It is important to note that, this sales maximisation output level OK is higher than the profit maximisation output OQ. However, sales maximisation is subject to minimum profit constraint. Suppose the minimum profit level of the firm is represented by the line MP. The output OK will not maximise sales as the minimum profits OM are not being covered by total profits KS. For maximisation of sales, the firm should produce that level of output which not only covers the minimum profits, but also gives the highest total revenue consistent with it. This level of output is represented by OD where the minimum profits DC (equal to 0M) are consistent with DE amount of total revenue at the price DE/OD i.e., total revenue/total output.

Baumol's model of sales maximisation points out that the profit maximisation output OQ will be smaller than the sales-maximisation output OD, and price is higher than under sales maximisation. The reason for a lower price under sales maximisation is that both total revenue and total output are equally higher, while under profit maximisation, total output is much less as compared to total revenue. Let us suppose that QB is joined to TR in Figure 2.1. "If at the point of maximum profit" writes Baumol, "the firm earns more profit than the required minimum, it will pay the sales maximiser to lower his price and increase his physical output."

2.3.2 A Single Product Model – With Advertising:

Baumol also explained that the profit constraint under sales maximisation is also effective in advertising and thereby increases the firm's revenue. In Figure 2.2, expenditure on advertising is represented along the horizontal axis, while total revenue, total costs and profit are represented along the vertical axis.

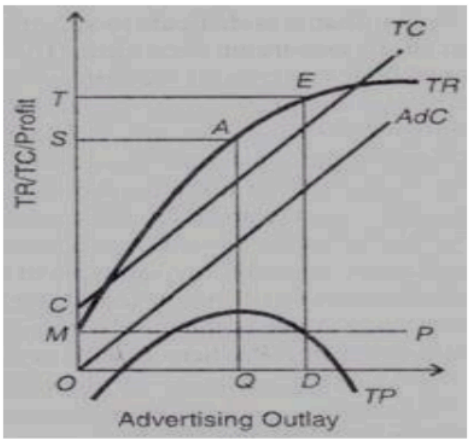

Figure 2.2

TR, TC and TP are total revenue, total cost and total product curves respectively. The 45° line from the origin shown as OAdC is the advertisement cost curve. Total cost curve TC is obtained by adding a fixed amount of other costs equal to OC to the AdC curve. Here, production costs OC are assumed to be independent of advertising costs. The total profit curve TP can be obtained as the difference between the TR curve and the TC curve. MP is the minimum profit constraint line. The profit maximisation firm will spend OQ on advertising and its total revenue will be OS which is equal to QA. On the other hand, given the profit constraint MP, the sales maximisation firm will spend OD on advertising and earn OT which is equal to DE as the total revenue. Thus, the sales maximisation firm spends more on advertising OD than the profit maximisation firm OQ as OD > OQ and also earns higher

revenue DE than the latter QA as DE > QA, at the profit constraint MP. Thus, it will always pay the sales maximiser to increase his advertising outlay until he is stopped by the profit constraint.

2.3.3 A Single Product Model – With Fixed Costs:

Equilibrium position of a sales maximiser will be affected due to an increase in fixed costs. In such a case, he will reduce his level of output and increase his price, as the increase in fixed costs push the total product curve downwards. Based on the profit constraint, the sales maximiser will shift the increase in costs on to the consumers by charging higher prices.

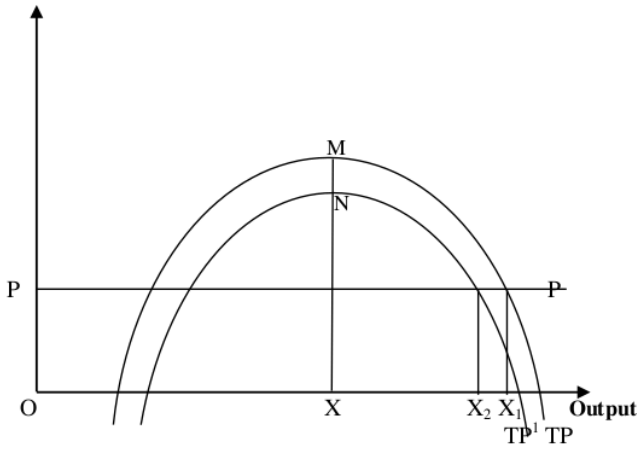

Figure 2.3

According to Baumol, firms in the real world change their output and price whenever their overhead costs increase. Thus, Baumol points out that sales maximisation hypothesis have a better predictive performance than the traditional profit maximisation hypothesis. For instance, the imposition of a lumpsum tax will not affect the price and output of such a firm rather it will bear the entire burden of the lumpsum tax. From the Figure 2.3, let us suppose that a lumpsum tax equal to MN is imposed. Consequently increase in fixed costs shift the total costs upwards and the total profits curve downwards i.e., TP^1. Subject to the profit constraint PP, the firm will reduce its output to OX_2 and will increase its price. The increased price will be shifted on to the consumers. It is important to note that there is no change in the profit maximisation output OX, despite the increase in fixed costs due to the lumpsum tax.

However, if a specific tax says sales tax imposed, it will result in shift of the profit curve downwards and to the left as shown in Figure 2.4. Given the profit constraint PP, the sales maximising firm will reduce the output from OX_2 to OX_3. It will raise the price and the tax burden will be shifted on to the buyers. The profit maximisation firm will reduce its

output from OX to OX_1 and raise its price. However, it is clear that the reduction in output of the sales maximising firm will be larger than that of the profit maximisation firm as $X_3X_2 > XX_1$.

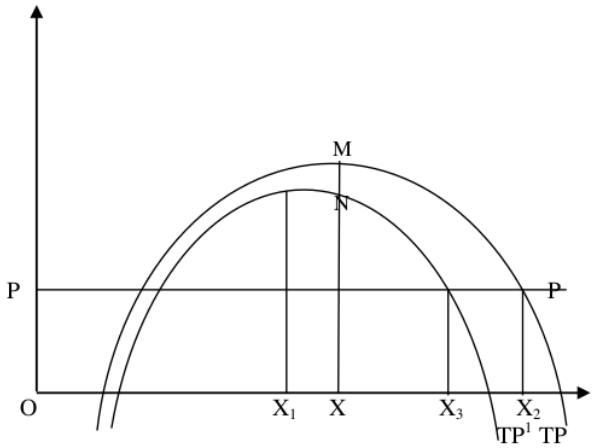

Figure 2.4

2.3.4 Model with Multiproduct:

According to Baumol, a firm which produce many products, the sales maximisation firm avoid unprofitable inputs and outputs. The model can be explained with the help of Figure 2.5.

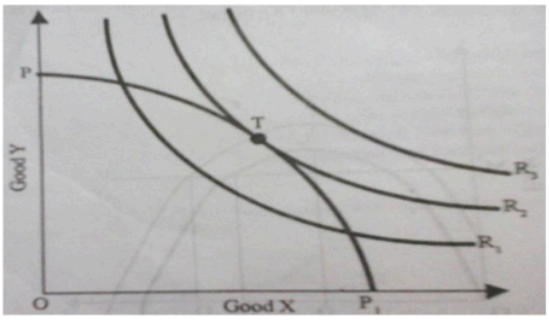

Figure 2.5

Good X is represented along the X – axis, while good Y is represented along the Y – axis. The curve PP represents all combinations of X and Y which can be produced with a fixed outlay. The curves R_1, R_2, and R_3 are iso - revenue curves which yield a fixed revenue from all combinations of X and Y on each of these curves. The point of tangency between curves PP and R_2 i.e., 'T' is the point of profit maximisation. This is also the point of revenue maximisation, because it lies on the highest attainable iso-revenue curve R_2 which is consistent with the given outlay as represented by the curve PP. Thus, it is clear that the two

types of the firms yield the same results when they use the same inputs in identical quantities and employ them exactly in the same manner.

However, according to Baumol, the sales maximisation firm make use of the difference between the maximum level of profits and the minimum level of profits i.e., profit constraint to increase its revenue. Baumol calls this difference as a fund of sacrificeable profits. This fund of sacrificeable profits will be allocated among the different outputs, markets, inputs etc., in a way which maximises total dollar or rupee sales. This relationship indicates that even in case of sales maximising firm, relatively unprofitable inputs and outputs are to be avoided, whatever the level of total outlay and total revenue.

2.4 Evaluation of the Static Models:

Just like any economic theory, Baumol's static models of sales maximisation are said to be superior when compared to profit maximisation models and at the same time Baumol's static models of sales maximisation are also subjected to criticism.

2.4.1 Superiority of the Model:

Baumol's sales maximisation theory has some important merits which make it superior to the profit maximisation model of the firm.

1. The sales maximising firm prefers to have larger sales when compared to profits. Since, it maximises its revenue when MR equal to zero, it will charge lower prices than that is charged by the profit maximising firm.

2. The sales maximising output of the firm will be larger than the profit maximising output.

3. The sales maximising firm would spend more on advertising in order to earn larger revenue than the profit maximising firm subject to the minimum profit constraint.

2.4.2 Criticism against the Model:

Baumol's sales maximisation model is subjected to the following criticism.

1. Rosenberg has criticised the use of the profit constraint for sales maximisation by Baumol. Rosenberg has shown that it is difficult to specify exactly the relevant profit constraint for a firm.
2. Shepherd pointed out that, under oligopoly a firm faces a kinked demand curve and if the kink is large enough, total revenue and profits would be maximum at the same level of output. So, both the sales maximising firm and the profit maximising firm would not be producing different levels of output.

3. Hawkins demonstrated that, Shepherd's conclusions become invalid, if the firm is engaged in any form of non-price competition such as good packaging, free service, advertising etc. When the sales maximising firm spends more on advertising, its output will be more than that of the profit maximising firm. This is because, the kink of the former's demand curve will occur to the right of the kink of the profit maximising firm.
4. Hawkins also shown that Baumol's conclusion of a sales-maximising firm will in general produce and advertise more than a profit-maximising firm, is invalid.
5. According to Baumol, in the case of multiproduct also, revenue and profit maximisation yields the same results. However, Williamson has shown that sales maximisation yields different results from profit maximisation.
6. Baumol's static model ignores the interdependence of the prices of oligopolistic firms.
7. Baumol's static model fails to explain "observed market situations in which price are kept for considerable time periods in the range of inelastic demand."
8. Baumol's static model ignores not only actual competition, but also the threat of potential competition from rival oligopolistic firms.
9. Prof. Hall in his analysis of 500 firms came to the conclusion that firms do not operate in accordance with the objective of sales maximisation.

Despite the criticism against the Baumol's static model, yet the sales maximisation forms an important goal of firms in the present day business world.

2.5 Baumol's Dynamic Model:

Baumol's static model is said to suffer on account of short-time horizon of the firm and consideration of exogenously determined profit constraint. Hence, in the dynamic model, Baumol not only extended the time horizon, but also considered endogenously determined profit constraint.

1. The firm tries to maximize the rate of growth of sales over its life time.
2. Profit is an important source of financing growth of sales and thus said to be an instrumental variable, which is endogenously determined.
3. As usual, demand curves are downward slopping, while cost curves are U – shaped.

Unlike, the static model, profit in dynamic model is not considered as a constraint, but regarded as an instrumental variable. Using profit, the top management of the firm is

expected to achieve its goal of maximum rate of growth of sales. Growth may be achieved through internal and external financial sources. However, external sources of finances may not available adequately and thus subjected to limits. Hence, profits are said to be the important source of financing the rate of growth of sales revenue. For the sake of simplicity, let us assume that growth of sales revenue will entirely be financed by profits.

2.5.1 The Multi-period Model:

Let us suppose that sales revenue i.e., R increases at a growth rate of g per cent. Over its lifetime the firm will have a stream of revenues

$$R, R(1+g), R(1+g)^2, \ldots\ldots\ldots\ldots\ldots R(1+g)^n$$

Using the discount formula, the present value of these future streams of revenues can be written as

$$R, R[(1+g)/(1+i)], R[(1+g)/(1+i)]^2, \ldots\ldots\ldots\ldots\ldots R[(1+g)/(1+i)]^n$$ where i is the rate of discount. The discount rate is exogenously given by the expectations and risk preferences of the firm. Moreover, the discount rate is higher than market rate of interest as it includes subjective assessment of risk.

The total present value i.e., discounted value of all future revenues can be written as

$$S = \sum R\,[\,(1+ g)/(1+ i)]^t \text{ where } t = 0,1,2\ldots\ldots\ldots n$$

The firm tries to maximise the present value of the stream of sales revenue over its life time, by choosing appropriate values for the current i.e., initial level of sales revenue i.e., R and its growth rate i.e., g. The total present value i.e., S is positively related with both R and g. The present value of the stream of revenues will be higher for higher R and g values. Thus, the firm should choose as large as possible values of R and g.

The rate of growth i.e., g is a function of current sales (R) and profits (π) and hence can be written as $g = f(\pi, R)$ and the profit function in turn can be written as $\pi = f(R, g, i, C)$ where C denotes the cost. The growth function is actually derived from the profit function and is shown in Figure 2.6.

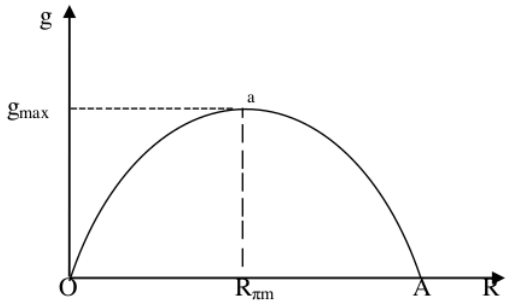

Figure 2.6

Expansion of the firm will depend on the current level of profits as the retained portion of profits is the source of growth. Hence, the highest attainable growth rate will occur at the point of maximum level of profits. Beyond the level of sales revenue i.e., $R_{\pi m}$, where profits are maximised, the growth rate will decline as profits are declining. Thus, up to the point 'a', both the current sales revenue R and its rate of growth g increase simultaneously. However, beyond the point 'a', current sales revenue continues to increase, but the rate of growth declines. Hence, beyond $R_{\pi m}$ sales revenue and growth become competing goals. The firm has to choose between higher current revenue growing at a lower growth rate over time and lower current sales growing faster over time. There exists infinite combination of values of g and R that the firm may choose. Among all such possible values, the firm will choose that combination values of g and R that maximise the present value of the future stream of sales S.

In order to find out the equilibrium of the firm, we have to consider an additional tool known as iso-present-value. This curve shows all combinations of g and R that yield the same S. Let us consider the expression for S given by

$$S = \sum R [(1+ g)/(1+ i)]^t \text{ where } t = 0,1,2.....n$$

Thus, S is positively related to both g and R and is negatively related to i. Given i, which is exogenously determined, the simplest relationship between these variables can be written as

$$S = b_1 g + b_2 R \quad \text{---------- (1)}$$

where b_1 and b_2 are constants, which can be estimated from the past performance. From this equation 'g' can be expressed as

$$g = (1/b_1) S - (b_2/b_1) R \quad \text{---------- (2)}$$

Using this equation, we may find any iso-present-value curve.

Let us suppose the values of b_1 and b_2 as 250 and 0.5 respectively and substituting them in (2) $g = (1/250) S - (0.5/250) R$

It can be written as $g = 0.004 S - 0.002 R$ ---------- (3)

For S = 10 and for different values of R, we can arrive at corresponding g values as follows:

If S = 10 and R = 0 $\Rightarrow$ g = 0.04

If S = 10 and R = 1 $\Rightarrow$ g = 0.038

If S = 10 and R = 2 $\Rightarrow$ g = 0.036

If S = 10 and R = 20 $\Rightarrow$ g = 0

Similarly, For S = 20 and R = 0 $\Rightarrow$ g = 0.08

If S = 20 and R = 1 $\Rightarrow$ g = 0.078

If S = 20 and R = 2 $\Rightarrow$ g = 0.076

If S = 20 and R = 40 $\Rightarrow$ g = 0

On plotting the pairs of values of g and R on a graph and joining them with straight line, we obtain the iso-present-value curves for S = 10 and 20 as shown in Figure 2.7

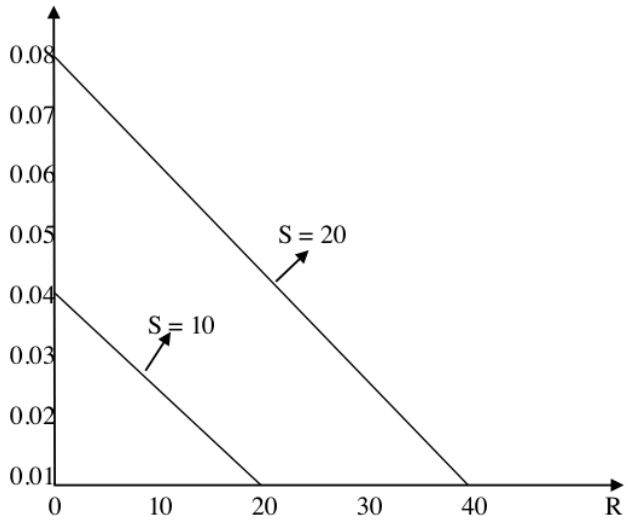

Figure 2.7

Under our assumptions the iso-present-value curves will be downward-slopping and will be parallel to one another. The slope of these curves is given by the ratio of the coefficients b_1 and b_2. The firm will choose the highest possible iso-present-value curves. Thus, the firm is said to be in equilibrium at the point of tangency of the growth curve i.e., OaA to the highest S curve at point M in the Figure 2.8. The point of tangency gives the equilibrium values of g* and R*, which is the attainable rate of growth and the level of current sales which maximises the present value of the stream of future revenues i.e., S*.

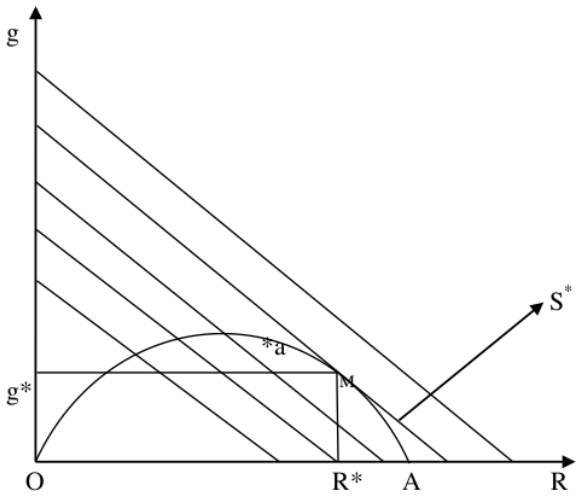

Figure 2.8

The curve OaA shows the attainable growth rate i.e., g for any given value of current sales revenue i.e., R. Growth is financed out of current profits and the growth curve is derived from the profit curve i.e., Oπ in the Figure 2.9.

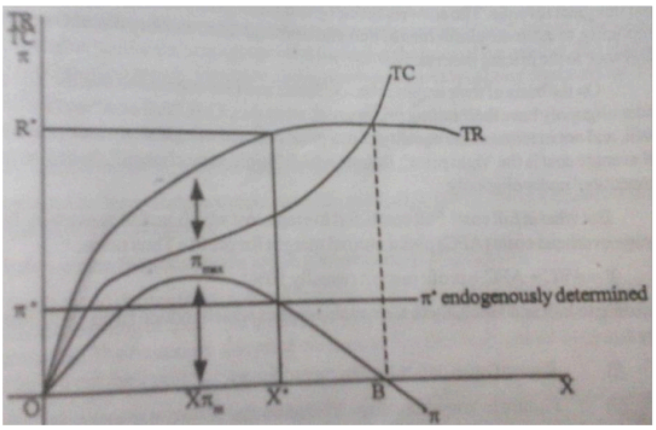

Figure 2.9

It is to be noted that at the origin and at the output level OB total profit is zero and hence the rate of growth is zero. Given R*, we can determine the equilibrium level of output from the total revenue curve in the figure. The sales maximisation firm will produce output X* and will sell it at a price equal to OR*/OX*. Given the equilibrium output X* and the

profit function, the profit constraint is now endogenously determined at π^*. In other words, the sales maximisation firm will require a profit level of π^* in order to finance the optimal growth rate g*.

The multi period model can be modified so as to allow for an exogenously determined minimum acceptable level of profit, for advertising, for non-price competition activities and for multiproduct activities. The findings of the multi period model are same as that of single period model as follows:

In the absence of advertising, output will be higher and price will be lower for a sales maximisation firm when compared to a profit maximisation firm. However, if advertisement is considered, the results may be different under different conditions. Advertising expenditures will be higher for a sales maximisation firm due to the assumption of a monotonic positive relation between sales revenue and advertising expenditure. However, an increase in overhead costs results in a reduction in output and a hike in price.

Imposition of a lumpsum tax also yields similar results such as increase in price and reduction in output. If lumpsum tax is imposed on a firm by the government, so as to achieve redistribution of income away from the firm, its goal may not be attained as the sales maximisation firm will shift the burden of tax on to the customers by charging higher prices. In case of imposition of a specific tax, the sales maximisation firm reduce its output to a large extent and increases its price heavily when compared to a profit maximisation firm.

A shift in market demand to the right will result in an increase in output as well as advertising, while the effect on price may not be certain. An increase in variable costs will lead the sales maximisation firm to a relatively more increase in price and a relatively more reduction in output when compared to profit maximisation firm.

2.6 Summary:

W.J. Baumol developed the theory of sales revenue maximisation as an alternative goal to profit maximisation. The theory is explained through two basic models known as static single product model and dynamic multi product model. Profit is the main driving force behind any economic activity. Hence, each and every firm try to maximise its profits. The profit maximisation conditions are; Marginal Revenue should be equal to Marginal Cost and MC should cut the MR from below.

According to Baumol, revenue or sales maximisation rather than profit maximisation is consistent with the actual behaviour of firms. Baumol quotes evidence to suggest that short-run revenue maximisation may be consistent with long-run profit maximisation.

2.7 Glossary:

- Single product model
- Multiproduct model
- Advertising
- Profit maximiser
- Sales maximiser
- Lumpsum tax
- Specific tax

2.8 Model Questions:

1. Examine the conditions for profit maximisation.
2. Discuss Baumol's static model.
3. Outline the assumptions of Baumol's static model.
4. Evaluate the Baumol's static model.
5. Examine Baumol's dynamic model.

2.8 Further Readings:

- Koutsoyiannis. A., Modern Micro economics, The Macmillan Press Ltd., Hongkong, 1981.

Lesson 4/Module IV

Marris's Model of Managerial Enterprise

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Structure:

4.0 Objectives:

The unit is expected to provide knowledge about the Managerial Enterprise theory of the firm. After going through the lesson, the learner is able to

- Understand about the goals of firm as visualised by Marris
- Acquires knowledge about Managerial constraints
- Analyse the Managerial Enterprise Model of Marris

4.1 Introduction:

Robin Marris (1964) has developed a dynamic balanced growth maximising model of the firm. According to Marris, modern big firms are managed by managers and the shareholders who decide about the management of the firms. The managers aim at the maximisation of the growth rate of the firm, while the shareholders aim at the maximisation of their dividends and share prices. To establish a link between such a growth rate and the share prices of the firm, Marris develops a balanced growth model in which the manager chooses a constant growth rate at which the firm's sales, profits and assets grow.

4.2 Goals of the Firm:

According to Marris, the goal of the firm is the maximisation of the balanced rate of growth of the firm. It means the maximisation of the rate of growth of demand for the products of the firm and also maximisation of the growth of its capital supply. It can be written as

$$\text{Maximise } g = g_D = g_c$$

where g = Balanced growth rate

g_D = Growth of demand for the products of the firm

g_c = Growth of the supply of capital

However, while pursuing this maximum balanced growth rate the firm is expected to face two constraints. Firstly, a constraint set by the available managerial team and its skills. Secondly, a financial constraint set by the desire of managers to achieve maximum job security. The rationalisation of this goal is that by jointly maximising the rate of growth of demand and capital, the managers achieve maximisation of their own utility as well as of the utility of the owners-shareholders.

The utility function of managers include variables such as salaries, status, power and job security, while the utility function of owners includes variables such as profits, size of output, size of capital, share of the market and public image. Thus, utility function of managers can be written as

$$U_M = (\text{Salaries, Power, Status, Job Security})$$

while the utility function of owners can be written as

$$U_O = f^* (\text{Profits, Capital, Output, Market Share, Public Esteem})$$

Where U_M and U_O are utility functions relating to managers and owners respectively.

According to Marris, managers do not maximise the absolute size of the firm, but the rate of growth i.e., the change in size of the firm. Further, Marris also argues that since growth happens to be compatible with the interests of the shareholders in general, the goal of maximisation of the growth rate seems to be given. There is no need to distinguish between the rate of growth of demand, which maximises the utility of managers and the rate of growth of capital supply, which maximises the utility of owners, since in equilibrium these growth rates are equal.

Based on arguments of Marris, it follows that the utility function of owners can be written as

$$U_O = f^*(g_c)$$

where g_c = rate of growth of capital.

Marris also implicitly assumes that salaries, status and power of managers are strongly correlated with the growth of demand for the products of the firm. Thus, managers will enjoy higher salaries and will have more prestige when the faster is the rate of growth of demand. Therefore, the managerial utility function may be written as

$$U_M = f(g_D, s)$$

where g_D = Rate of growth of demand for the products of the firm

s = a measure of job security.

Marris, following Penrose, argues that there is a constraint to g_D set by the decision making capacity of the managerial team. According to Marris 's' can be measured by a weighted average of three crucial ratios namely the liquidity ratio, the leverage- debt ratio and the profit-retention ratio, which reflect the financial policy of the firm.

Marris is of the opinion that job satisfaction is an exogenously determined constraint by assuming that there is a saturation level for job security. A higher Job security i.e., above the saturation level, the marginal utility from an increase in job security is zero, while below the saturation level the marginal utility from an increase in 's' is infinite. With this assumption the managerial utility function becomes

$$U_M = f(g_D, \bar{s})$$

where $\bar{s}$ is the security constraint. Thus, in the initial model there are two constraints – the managerial team constraint and the job security constraint – reflected in a financial constraint.

4.3 Constraints:

As pointed out, maximisation of the balanced growth rate of the firm is expected to face two constraints namely managerial constraint and financial security constraint. Let us understand about those constraints.

4.3.1 The Managerial Constraint:

Marris considered the Penrose effect and according to the theory of Penrose, at any particular time period, the capacity of the top management is given i.e., there is a ceiling to the growth of the firm set by the capacity of its managerial team. The managerial capacity can be increased by hiring new managers, but there is a definite limit to the rate at which management can expand and remain competent i.e., efficient.

Moreover according to Penrose theory, decision-making and the planning operations of the firm depends on the teamwork and co-operation of all managers. Coordination and cooperation require experience. A new manager requires time before he is fully ready to join the teamwork necessary for the efficient functioning of the organisation. Thus, although the 'managerial ceiling' is receding gradually, the process cannot be speeded up.

Further, the 'Research and Development' (R & D) department sets a limit to the rate of growth of the firm. The R & D department is said to be the source of new ideas and new products, which affect the growth of demand for the products of the firm. The nature of work in the R & D department also requires the 'teamwork'. The department cannot be expanded quickly, simply just by hiring more personnel, as new scientists and designers require time before they can efficiently contribute to the teamwork of the R & D department.

Thus, the managerial constraint and the R & D capacity of the firm set limits both to the rate of growth of demand (g_D) and the rate of growth of capital supply (g_c).

4.3.2 The Job Security Constraint:

Generally, managers in any firm want job security. The desire of managers for security is reflected in their preference for service contracts, generous pension schemes, and their dislike for policies which endanger their position by increasing the risk of their dismissal by the owners. Hence, Marris suggests that job security is attained by adopting a prudent financial policy.

The risk of dismissal of managers arises if their policies lead the firm towards financial losses or render the firm attractive to takeover raiders. The risk of dismissal of managers is largely avoided by

(a) Non involvement with risky investments. The managers choose projects which guarantee a steady performance, rather than risky ventures, which may be highly profitable, if successful, but will endanger the managers' position if they fail. Thus, the managers become risk avoiders.

(b) Choosing a 'prudent financial policy'. The policy consists of determining optimal levels for three crucial financial ratios, the leverage (or debt ratio), the liquidity ratio, and the retention ratio.

(i) The leverage or debt ratio is defined as the ratio of debt to the gross value of total assets of the firm. Thus, it can be written as

$$\left[\begin{matrix}\text{Leverage}\\ \text{or}\\ \text{Debt ratio}\end{matrix}\right] = \frac{\text{Value of debts}}{\text{Total assets}} = \frac{D}{A}$$

The managers do not want excessive borrowing, because the firm may become insolvent and becomes bankrupt, due to demand for interest payments and repayment of loans, notwithstanding the good prospects that the firm may have.

(ii) The liquidity ratio is defined as the ratio of liquid assets to the total gross assets of the firm and can be written as

$$\left[\begin{matrix}\text{Liquidity}\\ \text{ratio}\end{matrix}\right] = \frac{\text{Liquid assets}}{\text{Total assets}} = \frac{L}{A}$$

(iii) The retention ratio is defined as the ratio of retained profits i.e., net of interest on debt to total profits and can be written as

$$[\text{Retention ratio}] = \frac{\text{Retained profits}}{\text{Total profits}} = \frac{\Pi_R}{\Pi}$$

The three financial ratios are combined into a single parameter, which is called the 'financial security constraint' and let us denote with '$\bar{a}$'. The financial security is exogenously determined by the risk attitude of the top management. It is not a simple average of the three ratios, but rather a weighted average, the weights depending on the subjective decisions of managers.

$$a_1 = \text{liquidity ratio} = \frac{L}{A}$$

$$a_2 = \text{leverage ratio} = \frac{D}{A}$$

$$a_3 = \text{retention ratio} = \frac{\Pi_R}{\Pi}$$

Marris postulates that the overall '$\bar{a}$' is negatively related to a_1, and is positively related to a_2 and a_3. Thus, $\bar{a}$ increases, if either the liquidity is reduced or the debt ratio is raised by increasing external finance (loans) or the proportion of retained profits is increased. Similarly, '$\bar{a}$' declines, if the managers increase the liquidity of the firm or reduce the proportion of external finance (D/A) or reduce the proportion of retained profits or a combination of all three.

Further, Marris also implicitly assumes that, there is a negative relation between 'job security' i.e.,'s' and the financial constraint '$\bar{a}$'. If '$\bar{a}$' increases by either reducing a_1 or increasing a_2 or increasing a_3, the position of the firm becomes more vulnerable to bankruptcy and/or to takeover raids and consequently the job security of managers is reduced. Thus, a high value of '$\bar{a}$' implies that the managers are risk takers, while a low value of '$\bar{a}$' shows that managers are risk avoiders. The financial security constraint sets a limit to the rate of growth of the capital supply 'g_c', in Marris model.

4.4 The Model:

The managers aim at the maximisation of their own utility, which is a function of the growth of demand for the products of the firm, so that it can be written as

$$U_M = f(g_D)$$

The owners and shareholders aim at maximisation of their own utility, which Marris assumes to be a function of the rate of growth of the capital supply, so that it can be written as

$$U_O = f(g_C)$$

The firm is in equilibrium when the maximum balanced growth rate is attained, i.e., the condition for equilibrium is

$$g_D = g_C = g^* \text{ maximum}$$

The first stage in the solution of the model is to derive the 'demand' and 'supply' functions, i.e., to determine the factors that determine g_D and g_c. Marris establishes that the factors that determine g_p and g_c can be expressed in terms of two variables, the diversification rate i.e., 'd' and the average profit margin i.e., 'm'.

4.4.1 The Instrumental Variables:

The firm will first of all determine its financial policy, i.e., the value of the financial constraint $\bar{a}$, and subsequently it will choose the rate of diversification d, and the profit margin m, which maximise the balanced growth rate g*.

The financial constraint i.e., '$\bar{a}$' implies freedom of choice of the financial policy of the firm. The firm can affect its rate of growth by changing its three security ratios namely leverage, liquidity, dividend policies. The firm can choose its diversification rate d either by a change in the style of its existing range of products or by expanding the range of its products. In Marris's model price is given by the oligopolistic structure of the industry. Hence, price is not actually a policy variable of the firm. Marris seems to treat price as a parameter (given)

rather than as a policy variable at the discretion of the firm. Similarly, Marris assumes that production costs are given.

Further, Marris also expressed that the firm can choose the level of its advertising i.e., A, and of its research and development activities R&D. Since, the price P and the production costs C are given, then it is follows that a higher A and/or R&D expenditures will imply a lower average profit margin and vice versa, a low level of A and/or R&D implies a higher average profit rate. Implicit in Marris's model is the average cost pricing rule.

$$\overline{P} = \overline{C} + A + (R \& D) + m$$

where $\overline{P}$ = price, given from the market, $\overline{C}$ = production costs, assumed given

A = advertising and other selling expenses, R & D = research and development expenses

m = average profit margin

Clearly m is the residual and can be written as

$$m = \overline{P} - \overline{C} - (A) - (R \& D)$$

Given $\overline{P}$ and $\overline{C}$, m is negatively correlated with the level of advertising A and R & D expenditures. Thus, m is used as a proxy for the policy variables A and R&D. However, it is to be noted that all the policy variables are combined into three instruments namely the financial security coefficient i.e., $\overline{a}$, the rate of diversification i.e., d and the average profit margin i.e., m.

The next step is to define the variables that determine the rate of growth of demand g_D and the rate of growth of supply g_c and express these rates in terms of the policy variables, a, d and m.

4.4.2 The Rate of Growth of the Demand (g_D):

It is assumed that the firm grows by diversification. However, growth by merger or takeover is excluded from this model. The rate of growth of demand for the products of the firm depends on the diversification rate d, and the percentage of successful new products k i.e., $g_D = f_1 (d, k)$ where d is the diversification rate. It is defined as the number of new products introduced per time period and k is the proportion of successful new products. Diversification may take two forms.

Firstly, the firm may introduce a completely new product, which has no close substitutes, which creates new demand and thus, competes with other products for the income of the consumer. Marris calls this as differentiated diversification and is considered as the most important form in which the firm seeks to grow since, there is no danger of encroaching on the market of competitors and hence provoking retaliation.

Secondly, the firm may introduce a product, which is a substitute for similar commodities already produced by existing competitors. This is called imitative diversification and is almost certain to induce competitors' reactions. Given the uncertainty regarding the reactions of competitors, the firm prefers to diversify with new products. The greater the values of d, the larger will be the rate of growth of demand.

The proportion of successful new products i.e., k depends on the rate of diversification i.e., d on their price, the advertising expenses and the R & D expenditure as well as on the intrinsic value of the products.

$$k = f_3 (d, P, A, R\&D, \text{intrinsic value})$$

As far as the intrinsic value of the new product is concerned, Marris considered Galbraith's and Penrose's thesis that a firm can sell almost anything to the consumers by an appropriately organised selling campaign, even against consumers' resistance. He implicitly combines intrinsic value with price, i.e., price is associated with a given intrinsic value. Price is assumed to have reached equilibrium in some way or other. Thus, price is taken as given, despite the fact that the product is new.

k depends on the advertising i.e., A, the R & D expenditures and on d. The higher value of A and/or R&D, the larger will be the proportion of successful new products and vice versa. Marris considered m, the average profit margin as a proxy for these two policy variables. Given that m is negatively related to A and R&D, the proportion of successful new products is also negatively correlated with the average profit margin.

k also depends on d, the rate of new products introduced in each period. If a very large number of new products are introduced very quickly, the proportion of fails increases. Thus, although the rate of growth of demand g_D is positively correlated with the diversification rate (d), g_D increases at a decreasing rate as d increases, due to the rate of introduction of new products outrunning the capacity of the personnel involved in the development and the marketing of the products.

There is an optimal rate of flow of new ideas from the R & D department of the firm. If the research team is pressed to speed up the development process of new products, there is no time to research the product and/or its marketability adequately. Furthermore, top management becomes overworked when the rate of introduction of new products is high and the proportion of unsuccessful products is bound to increase.

Thus, it can be summarised as

$$g_D = f_1(d, m)$$

$$\frac{\partial g_D}{\partial d} > 0 \text{ (but declining)}$$

$$\frac{\partial g_D}{\partial m} < 0$$

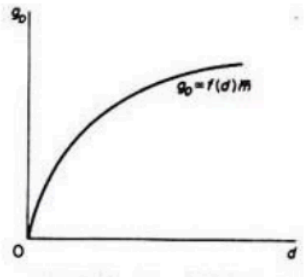


Figure 4.1 $g_D = f(d)$ given m

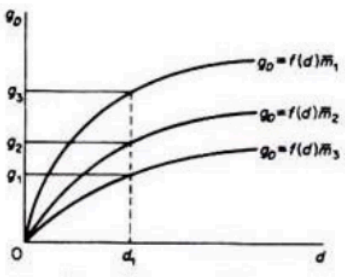


Figure 4.2 $g_D = f(d,m)$

Figure 4.1 and 4.2 shows the g_D function. The average rate of profit is constant along any g_D curve. However, the curve shifts downwards as m increases such as $\overline{m}_1 < \overline{m}_2 < \overline{m}_3$. This is due to the negative relationship between g_D and m. With a given rate of diversification (for example, at d_1 in Figure 4.2) and given the price of the products, the lower m, the larger the A and/or the R & D expenses and hence the larger the proportion of successful products and the higher the growth of demand ($g_3 > g_2 > g_1$). Of course, the monotonic positive relationship between d and A (and R & D), which is implied by Galbraith's and Penrose's hypothesis and is adopted by Marris is highly questionable on a priori and empirical grounds.

4.4.3 The Rate of Growth of Capital Supply (g_C):

It is assumed that the shareholders or owners aim at the maximisation of the rate of growth of the corporate capital, which is taken as a measure of the size of the firm. Corporate capital is defined as the sum of fixed assets, inventories, short term assets and cash reserves. The rate of growth is financed from internal as well as external sources. The source of internal finance for growth is profits, while external finance may be obtained by the issue of new bonds or from bank loans. However, according to Marris the main source of finance for growth is profits.

Under Marris's assumptions, the rate of growth of capital supply is proportional to the level of profits and it can be written as

$$g_C = \overline{a}\ (\Pi)$$

where $\overline{a}$ = the financial security coefficient and Π = level of total profits

The security coefficient '$\bar{a}$' is assumed to be constant and exogenously determined in this model. However, this assumption may be relaxed at a later stage. It should be stressed however, that so long as $\bar{a}$ is constant, growth g_c and profits Π are not competing goals, but are positively related and higher profits imply higher rate of growth.

The next step is to express g_c in terms of the policy variables d and m. The level of total profits depends on the average rate of profit m and on the efficiency of the performance of the firm as reflected by its overall capital output ratio K/X and can be written as

$$\Pi = f_4 (m, K/X)$$

But, Π and m are implicitly positively correlated (an increase in the average profit margin results in an increase in the total profits), so it can be written as

$$\partial\Pi/\partial m > 0$$

However, the relationship between Π and K/X is more complicated. The K/X ratio is said to be a measure of efficiency of the activity of the firm, given its human and capital resources. The overall K/X ratio is not a simple arithmetic average of the capital/output ratios of the individual products of the firm, but is a function of the diversification rate d and so it can be written as

$$(\overline{K}/X) = f_5 (d)$$

Given $\overline{K}$, the relation between X and d is up to a certain level of d is positive, reaches a maximum, and subsequently output declines with further increase in the number of new products. The overall output increases initially with d due to a better utilization of the team in the R & D department as well as of the skills of the existing managerial team. Output reaches a maximum, when the d is at its optimum level allowing the optimal use of the managerial team and the R & D personnel. Beyond that point, the total output X decreases with further increases in d and the efficiency of the firm falls. It is because the R&D personnel are overworked and the decision-making process becomes inefficient, as there is not enough time allowed for the development of new products or for the study of their marketability. Hence, the success rate for new products falls and efficiency declines.

Substituting for K/X in the profit function, we can write

$$\Pi = f_4 (m, d)$$

The relationship between Π and d is initially positive, but reaches a maximum, and then declines as d is further accelerated.

We now substitute Π in the g_c function

$$g_C = \bar{a}.[f_4(m, d)]$$

The rate of growth of capital is determined by three factors namely the financial policies of the managers, the average rate of profit and the diversification rate.

Marris assumes in his initial model that $\bar{a}$ is a constant parameter, which is exogenously determined by the risk attitude of managers, while there is a positive relation between g_c and m and it can be written as

$$\partial g_C / \partial m > 0$$

The relationship between g_c and d is not monotonic. The rate of growth of capital g_c is positively correlated with d up to the point of optimal use of the R & D personnel and the team of managers. However, as g_c is negatively correlated with d, beyond that point a higher d implies hastening up of the diversification process and so implies inefficient decisions. This leads to fall in the overall profit level and results in low availability of internal finance and consequently a lower rate of growth g_c.

Figure 4.3 shows the relationship between g_c and d, while keeping $\bar{a}$ and m constant. However, if we allow both d and m to change, while keeping $\bar{a}$ constant, we obtain a family of $g_c = f_2(d, m)$ curves (Figure 4.4). The average profit rate is depicted as a shift factor of the $g_c = f(d)$ curve. The higher the average profit rate, the further from the origin the g_c curves will be ($\bar{m}_1 < \bar{m}_2 < \bar{m}_3$). These curves are drawn under the assumption that $\bar{a}$ is constant.

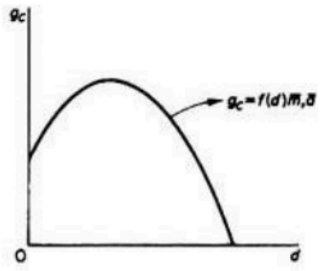


Figure 4.3 $g_C = f(d)$ given m and a

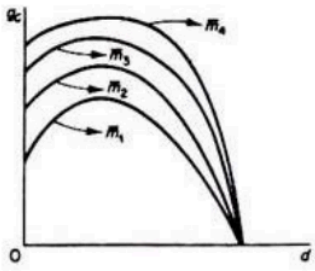


Figure 4.4 $g_C = f(d,m)$ given a

Summarising the above arguments, we may present Marris's model in its complete form as follows:

$g_D = f_1(m, d)$ – (Demand-growth Equation)

$\Pi = f_4(m, d)$ – (Profit Equation)

$g_C = \bar{a}.[f_4(m, d)]$ – (Supply of Capital Equation)

$\bar{a} < a^*$ (Security Constraint)

$g_D = g_c$ (Balanced Growth Equilibrium Condition)

where $\bar{a}$ is exogenously determined by the risk-attitude of managers. The level of profit Π is endogenously determined. The variables m and d are the policy instruments. Given the balanced growth equilibrium condition, we have in fact one equation in two unknowns (m and d, given $\bar{a}$). Thus, we can write

$$f_1(m, d) = \bar{a}.[f_4(m, d)]$$

4.4.4 The Equilibrium of the Firm:

The model cannot be solved as is under identified, unless one of the variables m or d is determined by the managers. Once, the managers define '$\bar{a}$' and one of the other two policy variables, the equilibrium rate of growth can be determined.

Figure 4.5 presents the equilibrium of the firm and is obtained by superimposing Figures 4.2 and 4.4. Given their shapes, the g_D and g_c curves associated with a given profit rate intersect at some point. For example, the g_D and g_c curves corresponding to m intersect at point A; the g_D and g_c curves associated with m_2 intersect at point B, and so on. By joining all such points of intersection of g_D and g_c curves corresponding to the same level of m, we can obtain the Balanced Growth Curve (BGC), given the financial coefficient $\bar{a}$.

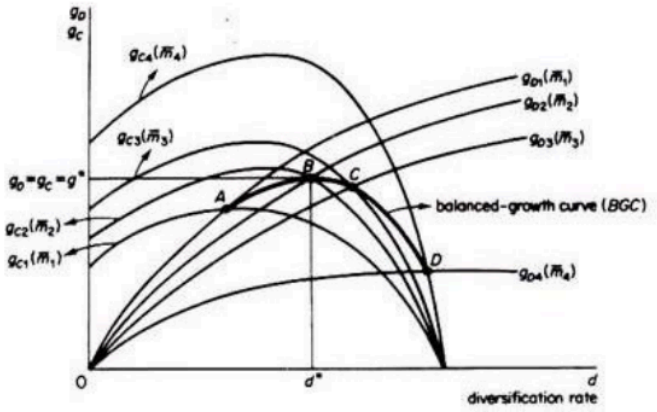


Figure 4.5

The firm is said to be in equilibrium, when it reaches the highest point on the balanced growth curve. The firm decides its financial policy, denoted by $\bar{a}$. It next chooses subjectively a value for either m or d. With these decisions taken, the firm can find its maximum balanced growth rate, consistent with $\bar{a}$ and with the chosen value of one of the other two policy variables. In Figure 4.5, the BGC corresponding to $\bar{a}$ is ABCD. The balanced growth rate g* is defined by the highest point B of this BGC. This g* rate is compatible with a unique pair of values of the policy variables m* and d*. If the firm chooses

d*, then m* is simultaneously determined; alternatively, if the firm chooses m*, then d* is simultaneously determined from the function

$$g^* = f_1 (m^*, d^*) = \bar{a}. [f_4 (m^*, d^*)]$$

Substituting m* and d* in the profit function

$$\Pi = \bar{a} [f_4 (m, d)]$$

We find the level of profit Π* required to finance the balanced growth rate g*. Thus, profit is endogenously determined in Marris's model. Furthermore, growth and profit are not competing goals (so long as $\bar{a}$ is constant). From the g_c function

$$g_c = \bar{a} . (\Pi)$$

it is obvious that higher profit implies higher growth rate. However, if the financial coefficient $\bar{a}$ is allowed to vary, then profits and growth become competing goals.

The question is does the BGC have a maximum? Marris argues that, so long as either (or both) of the g_c or g_D curves flattens out or bends, there will always be a maximum point on the BGC curve. Furthermore, depending on the shape of the g_c and the g_D curves, the BGC may have a flat stretch, which indicates that there are several optimal solutions. The g* may be achieved by a large number of combinations of the values of the policy variables m and d (given $\bar{a}$ is already chosen).

It is only if the g_c curve is parallel to the d – axis [$g_c = f(m)$ but, $g_c \neq f(d)$] and the g_D curves are straight upwards sloping curves [implying that $g_D = f(d, m)$, but $k \neq f(d)$ and hence the g_D curve does not flatten out] that the BGC increases continuously, never reaching a maximum. This situation is however, improbable given the capacity for efficient decision making of the managerial team and the capacity for well explored new products of the R & D department of the firm.

These cases are graphically shown in Figures 4.6 to 4.9. Figure 4.6 shows the case where $g_c \neq (d)$, while $g_D = f (d, m)$. The g_c curve becomes parallel to the d – axis, showing that g_c does not vary as d increases. The g_c curve shifts upwards (parallel to itself) as the average profit margin increases, given that g_c and m are positively related. The balanced growth curve has a maximum defined by the curvature of the $g_D = f (m, d)$ function (the maximum g occurs at point e_3 in Figure 4.6).

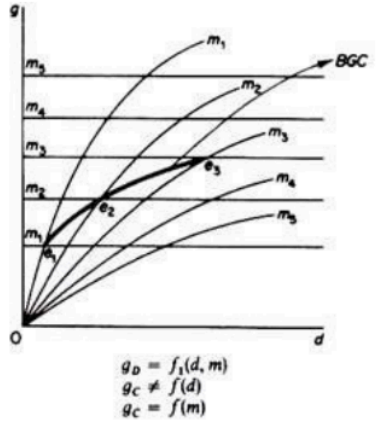


Figure 4.6

Figure 4.7 presents the case where $g_n = f_1(m, d)$, and $g_c = f_2(d, m)$. But, the curve g_D becomes a straight line through the origin, showing that g_D has a constant slope irrespective of changes in the diversification rate. The g_D curve shifts downwards towards the x-axis as m increases. The balanced-growth curve has still a maximum (e_2), due to the curvature of the g_c function.

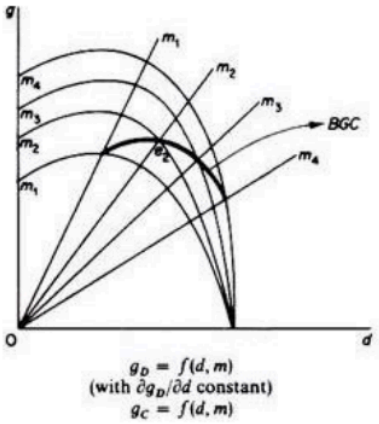
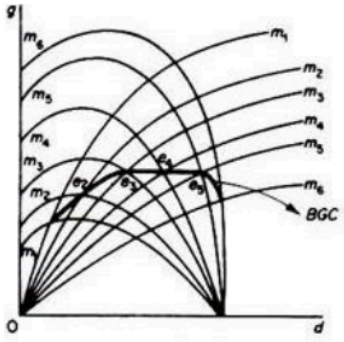


Figure 4.7

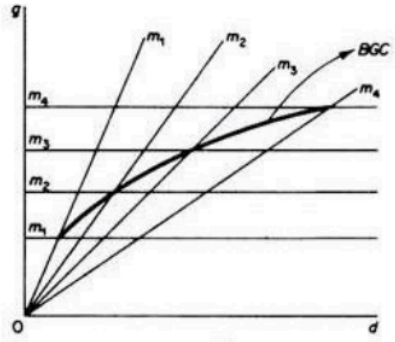
Figure 4.8 shows a platykurtic balanced growth curve the g_D and g_c functions have several points of intersection (due to their shapes) that lie on a straight line. The flat part of the balanced growth curve implies that the same optimal (maximum) g* may be achieved by a very large number of combinations of m and d.



$g_D = f(m, d)$
$g_C = f(m, d)$

Figure 4.8

The Figure 4.9 shows the improbable case of a balanced growth curve which never reaches a maximum (explosive growth).



$g_D = f(m, d), \quad \frac{\partial g_D}{\partial d}$ constant

$g_D \neq f(d), \quad g_C = f(m)$

Figure 4.9

4.5 Maximum Rate of Growth and Profits:

Marris argues that in the real world the financial coefficient $\overline{a}$ is not a constant, but varies. Changes in $\overline{a}$ clearly affect g_c, given

$$g_c = \overline{a}\ (\Pi) = \overline{a}\ [f_4(m, d)]$$

A change in $\overline{a}$ will shift the g_c curves, if $\overline{a}$ increases the g_c curves will shift upwards, while if $\overline{a}$ is reduced the g_c curves will shift downwards. The new set of g_c curves intersects the given set of g_D curves at new points, which form a new balanced growth curve. Given

that the relationship between g_c and $\bar{a}$ is positive ($\partial g_D/\partial a > 0$), an increase in $\bar{a}$ leads to an increase in the rate of growth.

An increase in $\bar{a}$ will occur, if one or more of the three security ratios changes. The value of $\bar{a}$ will be higher, if the liquidity ratio (a_1) is lowered or if the debt ratio (a_2) is increased or if the retention ratio (a_3) is increased. This is due to the fact that $\bar{a}$ is positively related to a_2 and a_3, but negatively related to a_1.

Clearly an increase in $\bar{a}$, however realised, implies a less 'prudent', more risky policy of the managers, since any decrease in the liquidity ratio or an increase in the indebtedness or an increase in the retained profits (which implies a reduction in the paid dividends) reduces the job security of the managers.

Graphically an increase in $\bar{a}$ is shown by an upwards shift of the BGC (to the position $A^1B^1C^1D^1$ in Figure 4.10). Given the g_D curves, the highest point of the new BGC will be above the highest point of the original BGC. This implies that the balanced rate of growth g cannot be maximised unless $\bar{a}$ assumes its highest optimal value a*. Consequently in equilibrium $\bar{a} = a^*$, i.e., the financial constraint takes the form of equality at equilibrium.

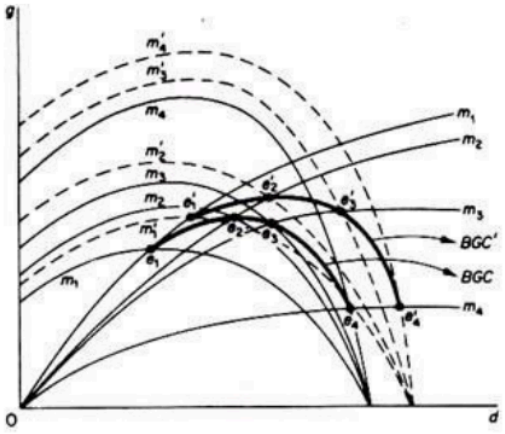


Figure 4.10

Marris also argues that if $\bar{a}$ is allowed to vary, growth and profits may become competing goals. If $\bar{a}$ is lowered below its optimum value a*, the growth rate is reduced, but the profit level Π may be raised. A lower value of $\bar{a}$ (given the d rate) denotes a shift to a lower balanced growth curve, which implies the intersection of g_D and g_c curves corresponding to a higher 'm' and hence a higher Π, since Π is a positive function of m (Figure 4.11).

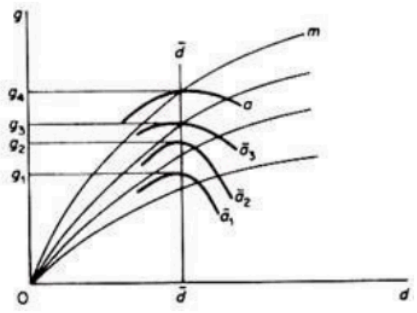


Figure 4.11 $\bar{a}_1 < \bar{a}_2 < \bar{a}_3 < \bar{a}_4$

Thus, although when $\bar{a}$ is held constant, maximising the growth rate implies maximising profit (g and Π are not competing goals), when $\bar{a}$ is allowed to vary, growth and profits become competing goals if $\bar{a}$ is treated as a variable, the firm cannot maximise both the rate of growth and profit. This explains that under some circumstances managers' objectives (for higher g) and stockholders' objectives (for higher Π) may conflict. It should, however, be clear that $\bar{a}$ cannot be increased beyond a certain value determined by the minimum profit requirements of the shareholders; otherwise the job security of managers decreases dangerously.

If the solution of the model does not yield Π adequate to satisfy the stockholders, $\bar{a}$ will be reduced (via, for example, a lowering of the retention ratio), until the maximum obtainable balanced growth rate is consistent with a level of profit that is satisfactory. This implies that managers seek to maximise the growth rate subject to a minimum profit constraint.

4.6 Comparison of Marris's Firm with a Profit Maximiser:

The imposition of either a unit profit tax or a lumpsum tax will lead to a reduction in the level of total profit Π. A growth maximiser will react to a profit tax by reducing his growth rate, reducing his output and raising his price. A profit maximiser will not react to a profit tax in the short run.

An increase in fixed cost will not affect the equilibrium of a profit maximiser in the short run. A growth maximiser, faced with an increase in fixed costs, will react by reducing his output and his rate of growth.

The advertising (A) and the research and development (R & D) expenditures will be higher for a growth maximiser than for a profit maximiser.

There will be slack payments to the administrative staff in case of Marris's firm, while slack is zero for a profit maximiser.

The profits of a growth maximiser are smaller than the profits of a profit maximiser.

In the profit-maximisation model Π and g are always positively correlated, while in Marris's model this positive correlation will be observed only (i) if '$\bar{a}$' is constant and is set equal to its optimal value a*, or (ii) if a* is the same for all firms in the market (while firms are heterogeneous in respect of efficiency). If however, $\bar{a} < a^*$, or if firms do not have the same a*, then g and Π may not be correlated at all, or may even be negatively correlated. Thus, the observed negative correlation coefficient between g and Π in several applied studies could be explained by firms having different a* or setting $\bar{a} < a^*$.

4.7 Summary:

Robin Marris developed the managerial enterprise theory in 1964. According to the theory, modern firms are managed by managers as well as shareholders. A manager aims to maximize the rate of growth of the firm, while the shareholders try to maximize the dividend and increase the share price. Marris's model of managerial enterprise is based on the goal of the manager to increase the balanced growth of the firm. This balance is achieved by offsetting two opposite goals namely maximisation of the growth of demand for goods/services of the firm and maximisation of growth of capital. To maximize growth in capital, the management must distribute as much profit as possible to the shareholders. To increase the demand, more customers should present for the firm's goods or services. This is achieved by using as much of the firm's profits for investment and increases the firm's growth. This would increase the management's utility at the sacrifice of shareholder utility. To achieve this balance, it is necessary to employ two constraints namely managerial constraint and job security constraint or financial constraints.

4.8 Glossary:

- Utility function of Managers
- Utility function Owners
- Managerial Constraint
- Job Security Constraint
- Liquidity Ratio
- Leverage Ratio
- Retention Ratio
- Rate of growth of demand
- Rate of growth of capital supply

4.9 Model Questions:

1. What are goals of firm in Marris's Model?
2. Examine the constraints in Marris's Model
3. Discuss the equilibrium of firm in Marris's Model.
4. Compare Marris's firm with a profit maximiser and point out the salient features of Marris Model

4.10 Further Readings:

- Koutsoyiannis. A., Modern Micro economics, The Macmillan Press Ltd., Hongkong, 1981.

MODULE : 5 Lesson : 1

CLASSIFICATION OF MARKETS

1.0 AIMS AND OBJECTIVES:

The aim of this chapter is to study the classification of markets and factors imfluencing the extent of market. We also generally observe the importance of time element in the determination of price and differences between market price and normal price.

CONTENTS:

1.1 INTRODUCTION:

In general sense market is a place where the sellers and buyers gather in order to sell and buy a particular commodity. But in Economics market is not related to only a particular place. Selling and buying transactions may take place from distant places with the help of telephone. Posts etc... or Market is a place where the buying and selling transactions take place. The market as per chapman, "the term market refers not necessarily to a place but always to a commodity and the buyers and sellers who are in direct competition with one another". The market must have a commodity. There must be the existance of buyers and sellers. More over there must be a competition among the buyers and sellers.

1.2 CLASSIFICATION OF THE MARKETS:

Markets can be classified in different ways:

1. **ON THE BASIS OF COMPETITION:** On the basis of comeptition, the markets can be classified into two - (a) Perfect Competition, (b) Imperfect Competition.

(a) PERFECT COMPETITION: Perfect competition is a market in which there are many firms selling identical products with no firm is large enough relative to the entire market to be able to influence the market price. Therefore, a perfectly competitive market is said to exist, when there is a large number of producers producing the identical products. The prevailing price in known to all buyers and sellers.

FEATURES OF PERFECT COMPETITION: Perfect Competition is having the following features:

(i) In this competition there are large number of buyers and sellers.

(ii) In this market the goods, produced by all the firms are homogeneous or identical.

(iii) In perfect competition every firm has the freedom to enter the market and exit from the market.

(iv) The buyers and sellers must have perfect information with regard to the prices of commodities at different supplies and demand forces.

(v) There must be perfect mobility of factors of production.

(vi) The prices of the commodities are uniform in perfect competition.

(vii) The transport costs should not be included in the cost of production.

(viii) There is a difference between firm and industry in perfect competition.

(b) IMPERFECT COMPETITION: The concept of imperfect competition was mainly propounded by Mrs. Joan Robinson. In this market the individual firms exercise their control over the price to a small extent or greater extent.

FEATURES OF IMPERFECT COMPETITION: The following are the main features of imperfect competition.

(i) There is imperfect mobility of the factors of production in imperfect competition.

(ii) Product differcutiation is another feature of imperfect competion.

(iii) There is no perfect information about market conditions.

(iv) Selling costs play an important role in imperfect competition.

(v) Generally in imperfect competition each firm is a price - maker and it can determine the price of its own brand of the product.

(vi) In imperfect competition the transport costs are included in price level.

KINDS OF IMPERFECT COMPETITION: Theare are different kinds of imperfect competition.

(i) Monopoly -In this market there is only one seller or firm.

(ii) Duopoly - Two sellers are there in this market.

(iii) Monopolistic Competition - There are large number of sellers but producing differential products.

(iv) Oligopoly - There are only few sellers in this market.

2. **ON THE BASIS OF AREA:** On the basis of area, markets can be classified into local, national and international markets.

   (a) LOCAL MARKET: If a commodity is sold within a small or local area, then it is said to have a local market.

   (b) NATIONAL MARKET: In the case of national market the buying and selling transactions are under taken with in the country. The entire nation may be regarded as one market.

   (c) INTERNATIONAL MARKET: When the commodities are sold all over the world, then it is said to be international market.

3. **ON THE BASIS OF TIME:** On the basis of time the markets can be classified into four types.

   (a) VERY SHORT PERIOD MARKET: This is also known as market period. In this market, time is very short for firms to increase the supply.

   (b) SHORT PERIOD MARKET: In this market supply of goods can be changed to only some extent. The price which prevails in the short run market is called short run price.

   (c) LONG PERIOD MARKET: In this period the firms can install new capital equipment and new firms can enter the market. Supply of the goods can be changed to a great extent due to changes in the fixed cost and variable cost.

   (d) VERY LONG PERIOD MARKET: There are tremendous changes in supply and demand in this very long period and it is difficult to identify those changes in this market. This period is also known as secular period.

1.3 FACTORS DETERMINING THE EXTENT OF MARKET:

The extent of market may be different in the case of different goods. A market may be local, confined to a village, or it can cover a whole country or even the world. There are different factors which determine the extent of market. They are as follows.

1. **SIZE OF PRODUCTION:** Large scale production leads to widening of the market. The commodities can have a wider market provided the product can fully meet the market demand. Markets have been expanded after the industrial revolution.

2. **NATURE OF DEMAND:** Generally the goods which have world wide demand will have wider market. For example gold has a world wide market. If the demand for the product is relating to only particular area, then there is a local market for that product.

3. **NATURE OF THE COMMODITY:** Durable goods have wider market. For example, market for gold is wider because it is more durable and its value is very high in relation to its size.

4. **TRANSPORT AND COMMUNICATION:** The development of transport and communication facilities will increase the extent of market. In modern days air crafts and other communication facilities are contributing a lot for expansion of market.

5. **CURRENCY AND CREDIT SYSTEM:** A well developed currency and credit system will promote the extent of market. For example, after the establishment of International Monetary Fund, World Bank and other international institutions, world trade has expanded.

6. **TRADE POLICIES OF THE GOVERNMENT:** This is the most important factor influencing the extent of market for a domestic product in foreign countries. If the government imposes more restrictions on exports and imports, then the market will be narrow.

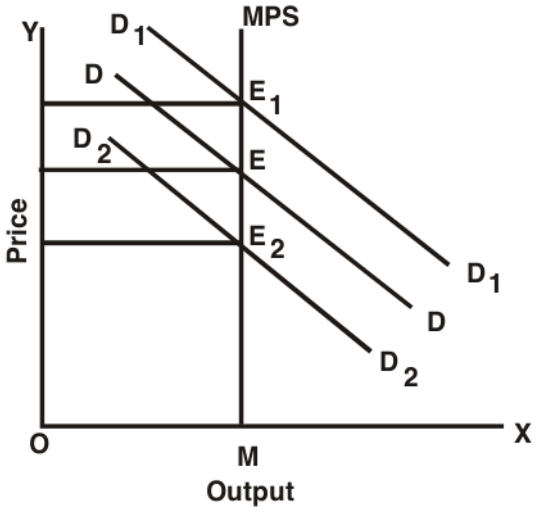
7. **PEACE AND SECURITY:** International peace and security provide better and favourable conditions for the expansion of world market. At the time of war, the extent of market will be limited.

8. **POSSIBILITY OF SAMPLING AND GRADING:** Availability of more samplying and grading facilities will increase the extent of market.

1.4 IMPORTANCE OF TIME ELEMENT IN FORCES OF DETERMINATION:

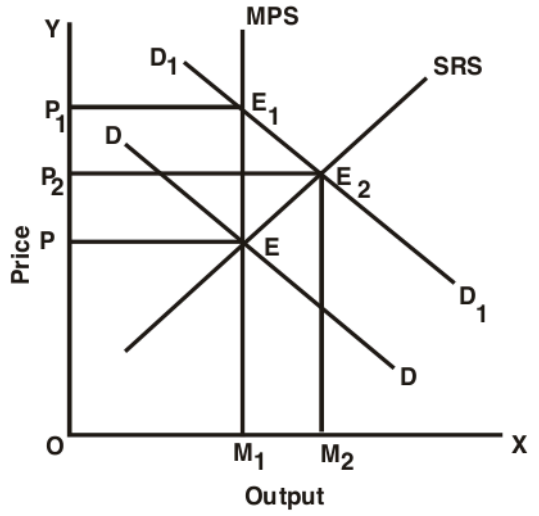
Generally prices are determined with the help of demand and supply. But according to Marshall time element also plays an important role in the price determination along with demand and supply forces. Marshall broadly divided the markets on the basis of time into four 1. Very Short Period, 2. Short Period, 3. Long Period, 4. Very Long Period.

1. **VERY SHORT PERIOD:** Very short period is also known as market period. In this period supply does not change in accordance with the demand. The supply more or less remains constant due to no changes in both fixed cost and variable cost. Market period depends on the nature of commodities. the supply and demand curves are as follows in the very short period.



In the above diagram on the X - axis output and on the Y - axis price are shown. In this diagram MPS is the market supply curve and DD is the demand curve. Both intersect at point E. E is the equilibrium point and OP equilibrium price and OM is the equilibrium output. The market period supply curve i.e. MPS is constant. The demand curve is shifted from DD to D_1D_1. Therefore, the price increases from OP to OP_1 and later decreases from OP to OP_2 with the decrease of demand from DD to D_2D_2.

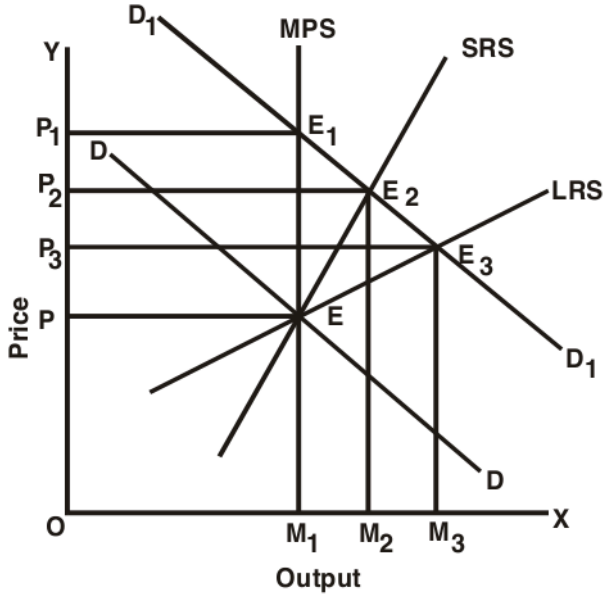
2. **SHORT PERIOD:** In this period due to change in the variable cost, the supply of goods can be adjusted to some extent. We can know this with the help of following diagram.



In the diagram SRS is the short run supply curve. The market period supply curve (MPS) and the increased demand curve (D_1D_1) are equal at point E_1. So the price is determined as OP_1. In the short period the supply curve is changed from MPS to SRS. Now the short run supply curve and increased demand curve D_1D_1 are equal at point E_2. Therefore, the output increases from OM_1 to OM_2 and the price decreases from OP_1 to OP_2. Short period price (OP_2) is less than the price of very short period (OP_1) and the short period output (OM_2) is more than the output of very short period (OM_1).

3. **LONG PERIOD:** Long Period price is also known as normal price. In this long period both fixed cost and variable cost can be changed. Therefore it is possible to increase the supply of goods to a great extent. We can not analyse the price determination in the long period under different cost conditions.

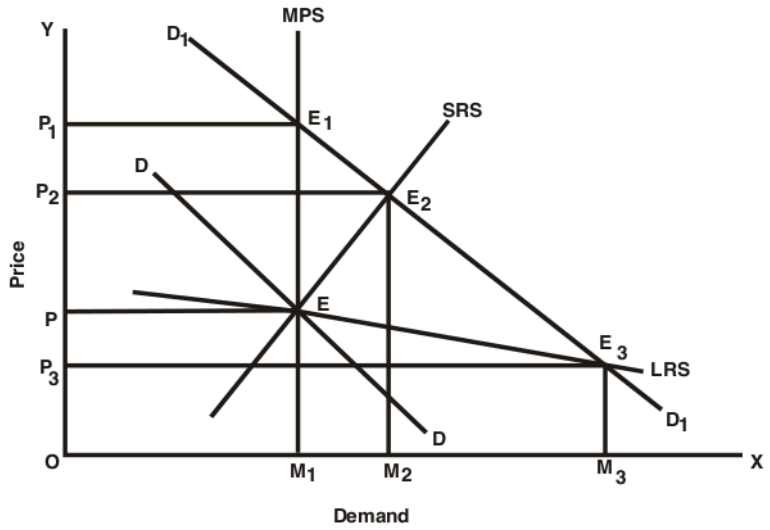
(a) LONG PERIOD PRICE AND INCREASING COSTS: When all the firms in the industry are experiencing diminishing returns to scale, then the additional output is secured only at the increasing costs. This can be explained in the following way with the help of the following diagram.



In the above diagram the long run supply curve LRS and the increased demand curve D_1D_1 are equal at point E_3. So the price is determined as OP_3 and the

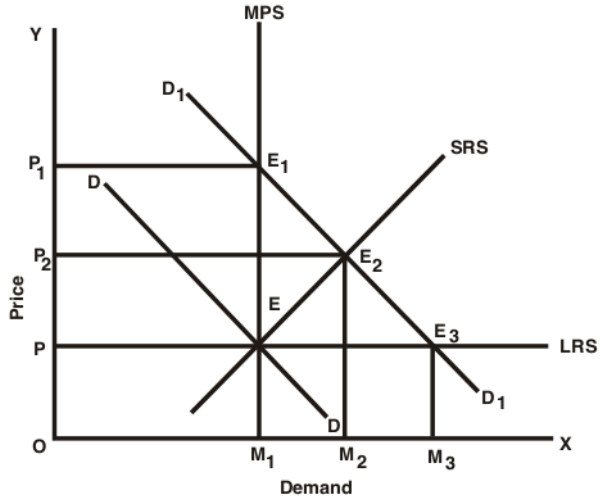
output is OM_3. The long period price (OP_3) is less than the short period price (OP_2) and the very short period price (OP_1). The long period output (OM_3) is more than the short period output (OM_2) and very short period output (OM_1).

(b) LONG PERIOD PRICE AND DIMINISHING COSTS: At the time of diminishing costs, the net external economies are so powerful therefore, the normal price will be less than the original market price. This can be explained with the help of following diagram.



In the diagram OP is the original market price and OM_1 is the output. In the long period the price falls to OP_3. Since the industry is subject to increasing returns to scale, the net external economies cause results in the decline in the cost per unit. As a result the long run normal price i.e. OP_3 is lower than even te original market price i.e. OP.

(c) LONG PERIOD PRICE AND CONSTANT COST: The industry which experiences constant returns to scale is called constant cost industry. The price determination under constant cost is explained with the following diagram.



In the diagram at OP original market price the output is OM_1. In the long period the of output is increased to OM_3 and the price falls from OP_2 to OP. Therefore, the long period normal price is equal to the original market price i.e. OP.

4. **VERY LONG PERIOD:** In very long period, the economic factors like size of population, supply of raw materials, general conditions of capital supply etc. have been changed very rapidly. The demand supply of the goods will be changed rapidly and frequently in this period. Therefore, it is not possible to determine the price and output. We can call this very long period as secular period.

1.5 MARKET PRICE AND NORMAL PRICE:

In the study of micro economics the concept of price plays an important role. The value of the commodity is expressed in terms of money is known as price. The concept of price can be analysed in two ways - 1. Market price, 2. Normal price. The differences between market price and normal price can be analysed in the following way.

1. Market price is related to short run and normal price is related to long run. Therefore, market price is a short run equilibrium price and normal price is a long run equilibrium price.
2. The demand plays an important role in the determination of market price. Supply cannot be increased or decreased in a market period. Market price is increases with the increase of demand and decreses with the decrease of demand. Supply plays are important role in the determination of normal price. Some times the normal price falls even below the original previous price level due to the increase of supply to a greater extent.

3. Market price may be less or more than the cost of production. Therefore, the market price is not influenced by the cost of production on the other hand normal price always remains equal to the average cost of production. so, normal price is influenced by the cost of production.

4. Market price is actually established andtherefore it is an actual price. But in actual life, the normal price does not exist. It is only an imaginary one.

5. Market price is a temporary price and it is determined by temporary equilibrium between the forces of demand and supply at a particylar time. Normal price is a permanent price and it is the result of long run equilibrium between demand and supply. Market price may change continuously from time to time. But the normal price is stable in the long period.

6. The producer may enjoy abnormal profits if the market price is more than the average cost. Some times he may bear losses if the market price is less than the average cost. But in the long period the producer always gets only normal profits. Normal price is always equal to the average cost of prodution and therefore the producer gets nromal profits in the long run.

7. All the commodities have market price. The goods which are reproducible are have normal price. There is no normal price in the case of non - reproducible goods. For example diamonds are not reproducible goods and therefore, these goods do not have normal price.

1.6 CONCLUSION:

Market is a situation where the buying and selling transactions are under taken. On the basis of competition, time and area, markets are classified into different ways. In economics, the classification of markets on the basis of competition is the most important one. There are some fundamental differences between market price and normal price.

1.7 POINTS TO REMEMBER:

1. In economics market is a situation where buying and selling transactions are under taken.

2. On the basis of competition, markets are classified into perfect competition and imperfect competition.

3. On the basis of area, markets can be classified into local national and international markets.

4. On the basis of time the markets are brodly classified into very short period market, short period market, long period market and very long period market.

5. There are various factors which determine the extent of market.

6. According to Marshall the time element is also plays an importnat role in the determination of price.

7. The concept of price plays an importaant role in the study of micro economics. There are some differences between market price and normal price.

1.8 KEY CONCEPTS:

1. **Market** : In economics market is a situation where the buying and selling transactions are under taken.
2. **Local Market** : If a commodity is sold with in a small or local area, then it is said to have a local market.
3. **National Market** : In the case of national market, the buying and selling transactions are undertaken with in the country.
4. **International Market** : When the commodities are sold all over the world, then it is said to be international market.
5. **Price** : If the value of commodity is expressed in terms of money it is known as price.
6. **Fixed Cost** : Fixed Cost is that cost which is not changed with the change of output and it remains constant.
7. **Variable Cost** : Variabale cost is that cost which is changed wit the change of output. There is a direct relationship between output and variable cost.

1.9 MODEL QUESTIONS:

I. Essay Questions:

1. Write about the importance of time element in price determination.

II. Short Essay Questions:

1. What is market and explain the clasification of markets.
2. What are the factors influencing the extent of market.

III. Very Short Questions:

1. Classification of the markets on the basis of competition.
2. Classification of the markets on the basis of area.
3. Classification of the markets on the basis of time.

1.10 REFERENCE BOOKS:

1. R.A. Bilas : Micro Economic Theory
2. K.K. Dewet : Modern Economic Theory
3. H.C. Ahuja : Principle of Micro Economics
4. M.L. Jhingon : Micro Economic Theory

MODULE :5 Lesson : 2

PERFECT COMPETITION

2.0 AIMS AND OBJECTIVES:

The main aim of this chapter is to study the features and determination of price under perfect competition. We will also observe the equilibrium of the firm in the short run and long run under perfect competition. We can also observe the equilibrium of the industry in perfect competition in this chapter.

CONTENTS:

2.1 INTRODUCTION:

The concept of market is playing an important role in study of economics. The determination of price of any commodity is mainly depending on the market. more over, the decisions with regard to production and purchase are also mainly dependent on the nature of market. On the basis of competition the markets can be classified into two - 1. Perfect Competition, 2. Imperfect Competition.

DEFINITIONS: There are various definitions with regard to perfect competition.

According to Left witch "Perfect competition is a market in which there are many firms selling identical products with no firm is large enough relative to the entire market to be able to influence market price."

According to Bilas, "The perfect competition is characterised by the presence of many firms; they all sell identically the same product. the seller is a price - taker."

Mrs. Joan Robinson has defined perfect competition as "it prevails when the demand for the output of the each product is perfectly elastic."

2.2 FEATURES OF PERFECT COMPETITION:

The following are the main features of perfect competition.

1. **LARGE NUMBER OF BUYERS AND SELLERS:** There are large number of buyers and sellers in perfect competition. the activity of one buyer or seller may not influence the market price. The output of single firm and demand of a single buyer are very much less in the total output and demand respectively.
2. **HOMOGENEOUS PRODUCTS:** Under perfect competition the goods produced by different firms are homogeneous or identical. The commodities are uniform in respects of quantity and quality. There is no product differentiation in this market. Therefore, the customers prefer all commodities equally.
3. **FREE ENTRY AND EXIT:** There is a free entry and exit of the firms in perfect competition. Every firm has the freedom to enter the market and exit from the market. If the firms are getting abnormal profits then the new firms may enter the market. If the firms are getting losses, then the firms have the freedom to leave the industry. So, in the long run under perfect competition all the firms gets normal profits.
4. **PERFECT INFORMATION ABOUT MARKET CONDITIONS:** In perfect competition the buyers and sellers must have the perfect knowledge with regard to the prices of various commodities and different supply and demand forces. Therefore, it is possible to avoid price discrimination in this market.
5. **PERFECT MOBILITY OF FACTORS OF PRODUCTION:** There is a perfect mobility of factors of production with in the country. This situation leads to uniform cost of production in the whole economy. It implies that different factors of production are free to seek employment in any industry they may like to do.

6. **UNIFORM PRICE LEVEL:** All commodities under perfect competition are uniform in respect of quantity and quality. Therefore, the prices of the commodities are also same.

7. **NO TRANSPORT COSTS:** In perfect competition in order to maintain uniform price level, the transport costs should not be included in the price level.

8. **DIFFERENCE BETWEEN FIRM AND INDUSTRY:** Under perfect competition there is a difference between firm and industry. Firm is a production unit and industry is a group of firms producing some commodities.

.3 PRICE DETERMINATION:

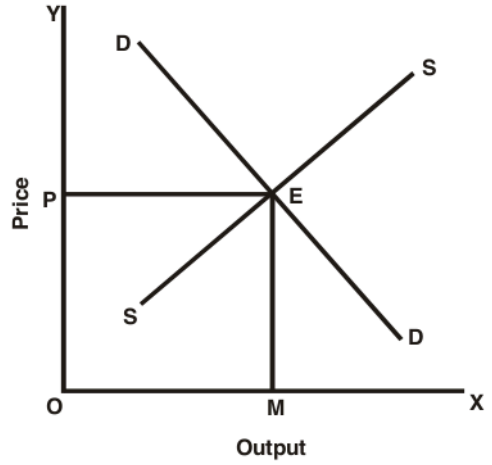
Generally prices are determined with the help of supply and demand forces. In perfect competition the price and output are determined at that point where the demand and supply both are equal. The following table explain the price determination under perfect competition.

Price (Rs.)	Demand	Supply
5	200	600
4	300	500
3	400	400
2	500	300
1	600	200

In the table above when the price of the commodity is Rs. 5 then this is a demand for 200 commodities and the supply is 600 commodities. If the price is decreases from Five rupees to One rupee, then the demand is increases to 600 commodities and the supply in decreased to 200 commodities. There is an inverse relationship between price and demand and there is a positive or direct relationship between price and supply. In the above table at Rs. 3 price level, there is demand for 400 commodities and the supply is also 400 commodities. Therefore, the price is determined as Rs. 3 in the above example.

DIAGRAMMATIC EXPLANATION:

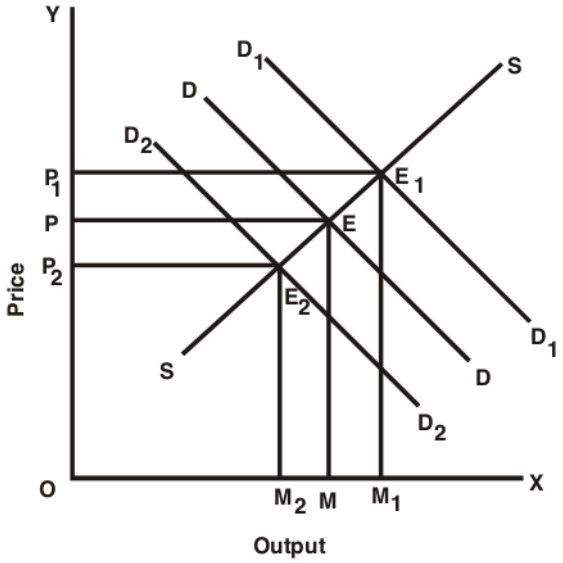
The price and output determination under perfect competition can be explained with the help of following diagram.



In the above diagram on the X axis output and on the Y axis price are shown. DD is the demand curve and it is falling down from left to right due to inverse relationship between price and demand. SS is the supply curve and it is increasing from left to right due direct relationship between price and supply. Both demand and supply curves are equal at point E. Therefore, the price is determined as OP and output is OM.

2.4 PRICE DETERMINATION WHEN DEMAND CHANGES AND SUPPLY REMAINS CONSTANT:

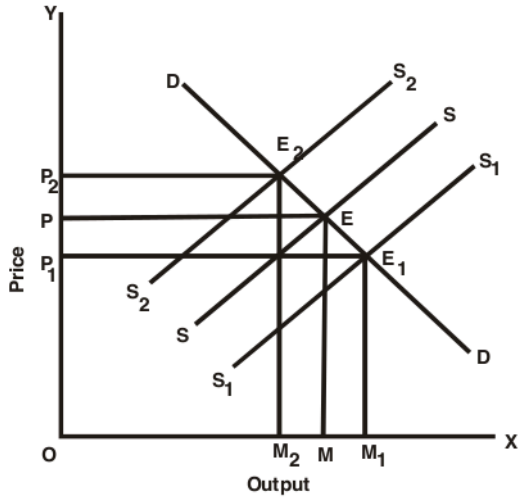
Under perfect competition supply being constant the equlibrium price rises with the increase in demand and price decreases demand with the decrease in Demand. This can be explained with the help of following diagram.



In the diagram output is shown on X axis and price is shown on Y axis. DD is the demand curve and SS is the supply curve. In this diagram we can find how the price determined when demand changes and supply remains constant. The demand is increased from DD to DD_1 and this increased demand curve and constant supply curve intersect each other at point E_1. Therefore, the equilibrium price is increased from OP to OP_1 and later the output is increased from OM to OM_1. when the demand is decreased from DD to D_2D_2, then this decreased demand curve and constant supply curve both are equal at point E_2 and therefore, the price is decreased from OP to P_2 and output is decreased from OM to OM_2.

2.5 PRICE DETERMINATION WHEN DEMAND REMAINS CONSTANT AND SUPPLY CHANGES:

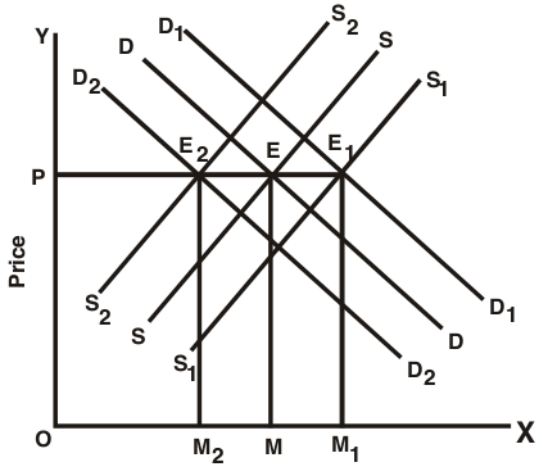
Under perfect competition the demand being constant, the equilibrium price will rise when the supply decreases and price falls when supply increases. This can be explained with the help of following diagram.



In the diagram on the X - axis output and on the Y axis price are shown. DD is the demand curve and SS is the supply curve. When the supply is increased from SS to S_1S_1, then the constant demand curve and the increased supply curve both are equal at point E_1. So the output is increased from OM to OM_1 and the price is decreased from OP to OP_1. when the supply is decreased from SS to S_2S_2, then the decreased supply curve S_2S_2 and the constant demand curve DD both are equal at point E_2. Therefore, the output is decreased from OM to OM_2 and the price is increased from OP to OP_2.

2.6 PRICE DETERMINATION WHEN BOTH DEMAND AND SUPPLY ARE CHANGED:

In perfect competition when the demand and supply both are changed in the same direction and in the same rate, then the equilibrium price may not be changed. This can be explained with the help of following diagram.



In the diagram on the X - axis is output and on the Y - axis the price are shown. DD is the demand curve and SS is the supply curve both are equal at point E and therefore, the price is determined as OP and the output is determined as OM. Suppose the demand and supply both are increases from DD to D_1D_1 and from SS to S_1S_1 respectively. The increased demand and supply curves are equal at point E_1. At this point even though the output is increased from OM to OM_1 the price remains constant as OP. In the same way if the demand and supply both decreases from DD to D_2D_2 and from SS to S_2S_2 respectively, then also the price remains constant as OP even though the output is decreased from OM to OM_2. Therefore, under perfect competition, there will be no change in price if demand and supply both are changed in the same direction.

2.7 EQUILIBRIUM OF THE FIRM AND INDUSTRY UNDER PERFECT COMPITION:

Market is a condition where buying and selling transactions are undertaken. On the basis of competition the markets are classified into perfect competition and imperfect competition. According to Liftwitch, perfect competition is a market in which there are many firms selling identical

products with no firm in large enough relative to the entire market to be able to influence the market price. According to Mrs. Joan Robinson perfect competition prevails when the demand for the output of the each product is perfectly elastic.

In perfect competition there are large number of buyers and sellers. All the products are homogeneous in the quantity and quality. In this market there is free entry and exit of the firms and perfect availability of information. There is a perfect mobility of factors of production. There is a uniform price and the transport costs are not included in the price level in perfect competition.

There is a difference between firm and industry under perfect competition. Firm is a production unit and where as industry is a group of firms. Equilibrium is a balancing position or resting point. A firm can get an equilibrium where it has no desire to increse or decrease its output. A consumer is in equilibrium position where he gets maximum satisfaction with the help of his limited income. The producer gets an equilibrium if he gets maximum production with the available resources. According to Bilas, "where profits are maximised we say the firm is in equilibrium."

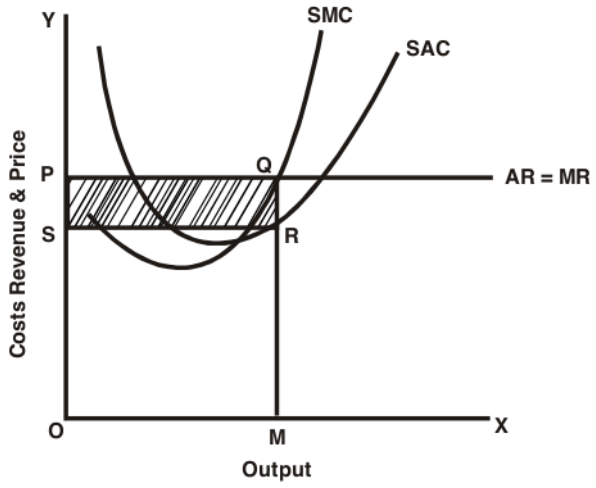
2.8 EQUILIBRIUM OF THE FIRM UNDER PERFECT COMPETITION:

The following conditions are necessary for the attainment of equilibrium of the firm under perfect competition.

1. The firm must try to get maximum profits.
2. Marginal cost must be equal to marginal revenue and at that equilibrium point price price & output are determined.
3. The marginal cost curve must cut the marginal revenue curve from below or from left side. At that equilibrium point the MC curve is at rising stage.

2.9 EQUILIBRIUM OF THE FIRM IN SHORT PERIOD WITH ABNORMAL PROFITS:

Under perfect competition the firm can get abnormal profits or losses in the short period. The following diagram explains how the firm can get abnormal profits and reaches the equilibrium position in the short run.

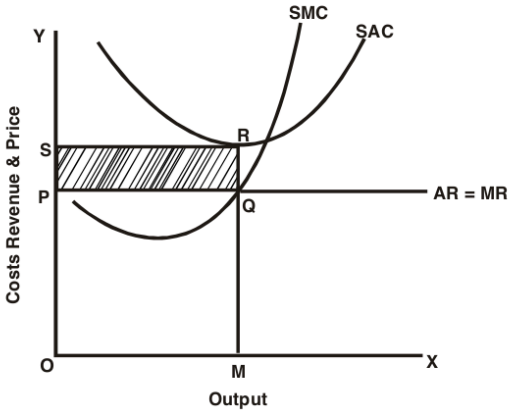


In the above diagram on the X - axis output and on the Y - axis cost, revenue and price are shown. In perfect competition the average revenue and marginal revenue curves are equal and therefore, AR and MR curves are equal and parallel to X axis due to uniform price level. In this diagram SMC curve is equal to MR curve at point Q. So, at that equilibrium point the output is determined as OM and the price is OP. Moreover at that equilibrium marginal cost curve is at rising stage. OPQM is the total revenue and OSRM is the total cost. IF we deduct the total cost from the total revenue, then we can get the total profits. Therefore -

OPQM - OSRM = PQRS = Profits.

2.10 EQUILIBRIUM OF THE FIRM IN SHORT PERIOD WITH LOSSES:

Under perfect competition in the short run some firms may get losses. We can know this with the help of following diagram.

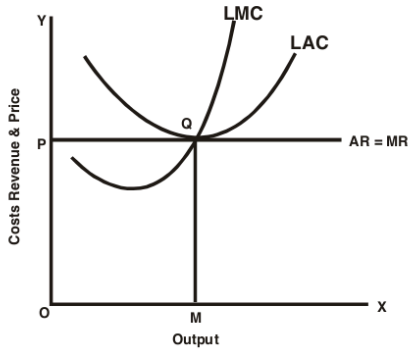


In the diagram on the X - axis output and on the Y - axis costs, revenue and price are shown. The marginal cost and marginal revenue are equal at point Q and therefore it is an equlibrium point. At this point average cost (SAC) is more than average revenue (AR). In the diagram OM is the output OP is the price. OPQM is the total revenue and OSRM is the total cost. In this diagram total cost is more than total revenue and therefore, the firm is getting losses. In this diagram -

OSRM - OPQM = PQRS = Losses

2.11 EQULIBRIUM OF THE FIRM IN THE LONG RUN:

Under perfect competiton in the long run the firm does not get abnormal profits or losses because of free entry and exit of the firms. In the long run all the firms get only normal profits. In this period both AC and AR become equal and therefore, thefirms get only normal profits. This can be explained with the help of following diagram.



In the diagram on the X axis output and on the Y axis costs, revenue and price are shown. Both marginal cost and marginal revenue are equal at point Q and it is an equilibrium point. At this equilibrium point average cost (LAC) and average revenue (AR) both are equal. OPQM is the total revenue and also total cost. Therefore, the firm is getting only normal profits in the long run. These normal profits are included in the cost of production.

2.12 Equilibrium of The Industry Under Perfect Competition:

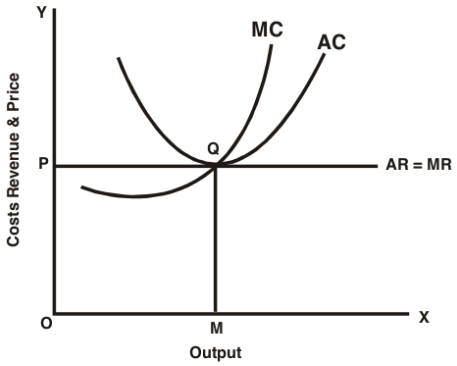
Industry is a group of firms producing similar products. In fact the concept of industry exists only under perfect competition. The industry is in equilibrium where it has no tendency to increase or decrease its level of output. Therefore, equilibrium of the industry means that firms are neither moving in or nor moving out.

Under perfect competition the industry will be in equilibrium when the following conditions are satisfied.

1. All firms in the industry get only normal profits.
2. The industry gets an equilibrium position where the marginal cost is equal to marginal revenue.
3. When the industry is in equilibrium the marginal cost, average cost, marginal revenue and average revenue are equal.

DIAGRAMMATIC EXPLANATION:

Under perfect competition in the short run the firm short run can get either abnormal profits or losses. But in the case of industry, there is no possibility of getting of abnormal profits or losses. The industry gets only normal profits. Thiscan be explained with the help of following diagram.



In the diagram on the X axis output and on the Y axis costs, revenue and price are shown. In this diagram MC and MR are equal at point Q. At this point the MC, MR, AC and AR are equal. The output is determined as OM and theprice is OP. OPQM is the total revenue and also total cost. So, there are no abnormal profits or losses. The industry is getting only normal profits. These normal profits are included in the cost of production.

2.13 CONCLUSION:

In perfect competition the price, average revenue and marginal revenue are the same. There is a uniform price in perfect competition. Actiually the concept of perfect competition is only a myth. It is not a realistic concept. the most important essential condition for equilibrium of the firm or industing under perfect competition is the marginal cost must become equal to marginal revenue.

2.14 POINTS TO REMEMBER:

1. There are various definitions with regard to perfect competition.
2. Perfect competition is having some features.
3. In perfect competition the price is determined at that point where demand and supply are equal.
4. Equilibrium is a resting point or balancing position.
5. Certain conditions are necessary for the attainment of equilibrium of the firm under perfect competition.
6. In the short period under perfect competition some firms may get abnormal rofits and some firms may get losses also.
7. In the long run all firms get only normal profits.

8. For the attainment of equilibrium of the industry certain conditions are to be satisfied.
9. All the firms in the industry get only normal profits.

2.15 KEY CONCEPTS:

1. **Firm** : Firm is a production unit. Goods produced by a single unit of production unit is known as firm.
2. **Industry** : Industry is a group of similar firms. The group of firms which are producing similar products is known as industry.
3. **Equilibrium** : Equilibrium is a balancing position or resting point.
4. **Marginal Cost** : Marginal cost is the additional cost due to production of one more unit of output.
5. **Average Cost** : Average Cost is the cost per unit. If we divide the total cost by the total quantity of output, then we get average cost.
6. **Marginal Revenue** : Marginal revenue is the additional revenue which we get selling an additional commodity.
7. **Average Revenue** : Average Revenue is the revenue per unit. If we divide the total revenue by the total number of goods sold, then we get average revenue.

2.16 MODEL QUESTIONS:

I. Essay Questions:

1. What is perfect competition and how the price is determined under it.
2. Explain the equilibrium of the firm and industry under perfect competition.

II. Short Essay Questions:

1. Write about the features of perfect competition.
2. Explain the equilibrium of the firm under perfect competition.
3. Write about the equilibrium of the industry under perfect competition.

III. Very Short Questions:

1. Conditions for the equilibrium ofthe firm under perfect competition.
2. Condition for the equilibrium of the industry under perfect competition.
3. Features of perfect competition.

2.17 REFERENCE BOOKS:

1.	R.A. Bilas	:	Micro Economic Theory
2.	Stonier & Hague	:	A Text Book of Economic Theory
3.	H.L. Ahuja	:	Principles of Micro Economics
4.	M.L. Jhingan	:	Micro Economic Theory

MODULE : 5 Lesson : 3

MONOPOLY AND DISCIMINATING MONOPOLY

3.0 AIMS AND OBJECTIVES:

The main aim of this chapter is to study the price and output determination under monopoly and disciminating monopoly. We also observe the main differences between perfect competition and monopoly market in this chapter.

CONTENTS:

3.1 INTRODUCTION:

The word monopoly has been derived from the conbination of two words like 'mono' and 'poly'. Mono means 'single' and 'poly' means 'seller'. Therefore, monopoly means single seller. It is the ordinary meaning of monopoly. In economics monopoly is said to exist when there is a single seller or producer of a product where there are no close substitutes for it.

DEFINITIONS:

According to Ferguson, "pure monopoly exists when there is only one producer in the market. There are no dire competitions."

According to Mc. Connel, "pure or absolute monopoly exists when a single firm is the sole producer of a product for which there are no lose substitutes."

3.2 FEATURES:

The following are the main features of monopoly market.

1. **SINGLE PRODUCER:** Under monopoly there is only one seller or producer. He controls the entire supply of the commodities. Monopoly may be an individual or firm or a partnership or a joint stock company or a state. There is no competition in monopoly market.
2. **NO CLOSE SUBSTITUTES:** In monopoly market there are no close substitute products. There are no other firms producting the similar or near commodities for the product of monopoly.
3. **NO FREE ENTRY:** The new firms under monopoly have no freedom to enter the market. Therefore, the monopoly firm can get abnormal profits in both short run long run.
4. **NO DIFFERENCE BETWEEN FIRM AND INDUSTRY:** In monopoly market there is no differernce between firm and industry. There is only one firm in this market and the other firms do not produce the similar products which are produced by the monopoly firm. Therefore, in monopoly market, the firm and industry are same.
5. **REVENUE CURVES FALLDOWN FROM LEFT TO RIGHT:** The revenue curves down from left to right in monopoly market. The monopolist can control either price or output. If the monopolist wants to sell more, he must reduce the price level and if he wants to fix high price, he must reduce the output.
6. **PRICE MAKER:** In monopoly market, the monopolist has complete control over the supply of the commodity. Due to large number of buyers, demand of any one buyer constitutes a small part of the total demand. Therefore, buyers have to pay

the price fixed by the monopolist.

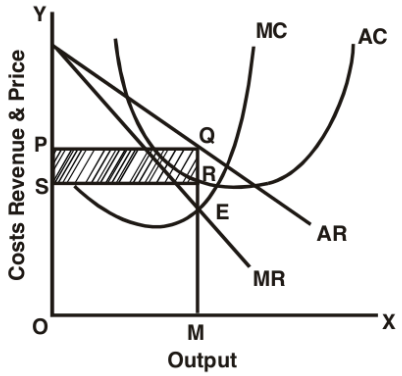
3.3 DETERMINATION OF PRICE AND OUTPUT UNDER MONOPOLY:

The following conditions are necessary for the determination of price and output under monopoly market.

1. The aim of the monopolist is to get maximum profits. He must produce the goods to that extent where the marginal cost becomes equal to marginal revenue. At that level he will get an equilibrium position and gets maximum profits.
2. The average revenue and marginal revenue curves fall down from left to right with the increase of output in monopoly market. If the monopolist wants to sell more, he must reduce the price level and therefore, the revenue curves fall down from left to right with the increase of output.
3. In monopoly the average revenue is equal to price and therefore, the AR curve is the demand curve.
4. Under monopoly market the MR falls more rapidly than the AR with the increase of the output. Hence MR lies below AR.
5. In monopoly market, the monopolist fixes the output at that point where the marginal cost is equal to marginal revenue. On the basis of this, he will fix the price on the average revenue line and this is more than MR and AC. The difference between AR and AC is the amount of profit.

DIAGRAMMATIC EXPLANATION:

In monopoly market the output is determined at that point where MC and MR are equal and on the basis of this the price is determined on AR line. This can be explained with the help of following diagram.



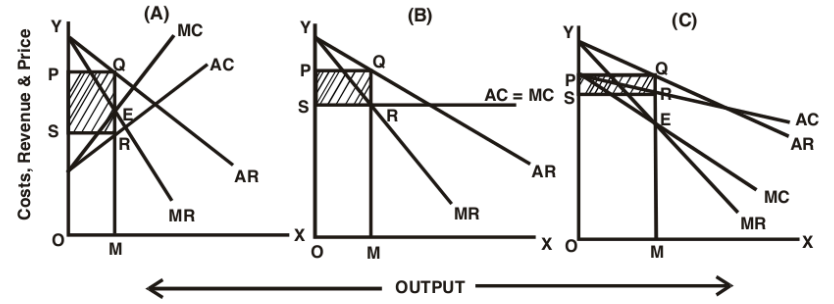
In the above diagram on the X - axis the output and on the Y - axis the costs, revenue and price are shown. In this diagram AR is the average revenue, MR is the marginal revenue, AC is the average cost and MC is the marginal cost. In monopoly market where MC and MR are equal and at that point only the output is determined. On the basis of this equilibrium point the price is determined on AR line. In the above diagram the MC and MR are equal at point 'E'. Therefore, the output is determined as OM. on the basis of this the price is determined on AR line at point Q. Therefore, the price is OP or QM. The difference bwetween AR and AC is the amount of abnormal profit per one unit. Therefore, QR is the profit per unit. If we deduct the total revenue from the total cost, we can get the total amount of profit. Therefore -

OPQM - OSRM = PQRS = Profit

In the above manner the monopoly firm may get abnormal profits in the short run. In the short run the monopoly may get normal profits or losses. In the long run also the monopoly firm may get abnormal profits because of no free entry of new firms in the market.

3.4 PRICE DETERMINATION WHEN COSTS ARE INCREASING OR CONSTANT OR FALLING:

Regarding price and output determination, there is a difference between perfect competition and monopoly. In perfect competition at equilibrium point the cost curves especially the marginal cost curve is at rising stage. But in monopoly market the cost curves may be increasing or constant or decreasing at equilibrium point. We can know these things with the help of following diagrams.



In the above diagrams on X axis the output and on Y axis the costs, revenue and price are shown. In diagram A the cost curves are increasing MC and MR are equal at point E and therefore, the output is determinedas OM and on the basis of this the price is determined on AR line at point Q. Therefore, OPQM is the total revenue and OSRM isthe total cost. So, PQRS is the total amount of profit.

In diagram (B) the marginal cost and marginal revenue (MC and MR) are equal at point R. OPQM isthe total revenue and OSRM is the total cost and therefore PQRS is the total amount of profit. In this diagram AC and MC are constant and therefore, they are parallel to X axis.

In the diagram C the cost curves ar e falling. Marginal cost (MC) and marginal rvenue (MR) are equal at point E and therefore it is equilibrium point. In this diagram OPQM is the total revenue and OSRM is the total cost and therefore PQRS is the total amount of profit.

3.5 MONOPOLY PRICE AND ELASTICITY OF DEMAND:

There is a relationship between monopoly price and elasticity of demand. The concept of elasticity of demand is more helpful to monopolist determining. The main motive of monopolist is to get maximum profits. In order to get maximum profits the monopolist fixes more price in the case of those goods for which the demand is inelastic and fixes less price in the case of goods those which demand is elastic. If the monopolist fixes the price on the basis of elasticity of demand, then only he will get maximum profits.

3.6 PRICE DISCRIMINATION UNDER MONOPOLY:

Price discrimination refers to the changing of different prices from different buyers by the monopolist for the same type of products. Therefore, the practice of selling the same commodities at different prices to different buyers is known as price discrimination. Price discrimintion is possible only in monopoly market.

DEFINITIONS:

Mrs. Joan Robinson has defined the price discrimination as "the act of selling the same

article produced under single control at different prices to different buyers."

According to Stigler, " price discrimination refers to the sale of technically similar products at prices which are not proportional to their marginal cost."

3.7 KINDS OF PRICE DISCRIMINATION:

1. **PERSONAL DISCRIMINATION:** In personal discrimination the monopolist charges different prices from different customers for the same type of product on the basis of ability to pay. For exmple a doctor may charge more fee from a rich patient and less fee from a poor patient for the same services rendered.
2. **PLACE OR LOCAL DISCRIMINATION:** The monopolist charges different prices in different markets for the same product under plae discrimination. Dumping is the best example for place discrimination. According t o this the producer may sell the same commodity at one price at home market and at the other price abroad. Place discrimination is also known as local discrimination or geographical discrimination.
3. **TRADE OR USE DISCRIMINATION:** In this trade discrimination the monopolist will charge different prices for different types of uses of same commodity. For example, electricity will be sold at the lower price for agriculture purpose and at higher price for domestic purpose.

3.8 CONDITIONS FOR PRICE DISCRIMINATION:

The price discrimination is possible when the following conditions are prevailing.

1. **MORE THAN ONE MARKET:** There must be two or more than two seperate markets, otherwise theprice discrimination is not possible. For charging different prices from different persons, different markets must exist.
2. **DIFFERENT ELASTICITIES:** The elasticity of demand in each market must be different. It means if one market is less elastic then the other market must be more elastic. This condition is very important condition for price discrimination. There will be no scope for price discrimination if the elasticity of demand is equal in all markets.

3.9 PRICE AND OUTPUT DETERMINATION UNDER DISCRIMINATING MONOPOLY:

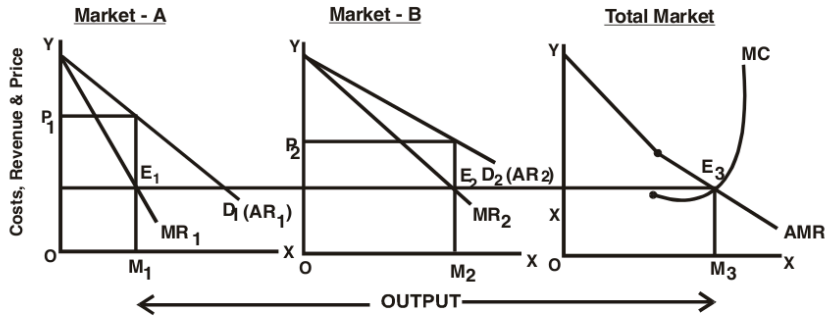
The main aim of price discrimination under monopoly is to get maximum profits. The following conditions must be observed for getting of maximum profits and for price and output determination under discriminating monopoly.

1. The monopolist must fix more price in the case of inelastic demand and less price in the case of elastic demand.

2. All the marginal revenues in different markets must be equal to the marginal cost.

DIAGRAMMATIC EXPLANATION:

The following diagrams explain the price and output determination under discriminating monopoly where there are two markets.



In the above diagrams on X axis output and on Y axis costs, revenue and price are shown. In market A, MR_1 is the marginal revenue and D_1 is thedemand or average revenue curves. In this market the demand is inelastic. In market B, MR_2 and D_2 are the marginal revenue and demand curves respectively. The demand curve is also known as average revenue curve. In this market the demand is elastic. If we combine the marginal revenue curves of these two markets $(MR_1 + MR_2)$, then we can get the aggregate marginal revenue curve (AMR) in the total market. At point E_3 the marginal revenue is equal to marginal cost. Therefore, the output is OM_3. This equilibrium point is extended to market A and market B. The price in market A i.e. OP_1 is more than the price in market B i.e. OP_2.

3.10 DEGREES OF PRICE DISCRIMINATION:

A.C. Pigon hs distinguised the degrees of price discrimination into three on the basis of the degree or extent of price discrimination. He charges maximum that each buyer is able and willing to pay leaving him and consumers surplus. Under first type of price discrimination the monopolist will fix different prices to different buyers. This type of price discrimination is called perfect price discrimination.

In thesecond type of price discrimination the monopolistic fixies different prices to different buyers that he allows a part of consumeri surplus but not the complete consumer's surplus.

In third degree of price discrimination the monopolist divides the buyers into two or more classes or groups or markets and charges different prices in different markets. In this type the markets are divided on the basis of the elasticity of demand. This degree of price discrimination isthe most common one.

3.11 IMPORTANCE OF PRICE DISCRIMINATION:

1. There are several services such as rail transportation etc.. which cannot be worked profitably unless the price discrimination is allowed. Uniform price for such services will lead to low income or losses to entrepreneur. In order to avoid those losses the price discrimination must be implemented.
2. Some times, for promoting the welfare of the community the price discrimination is compulsory. For example, if the doctor charges more fee from rich and low fee from the poor, then the public welfare can be promoted.
3. The government can reduce the economic inequalities to some extent with the help of price discrimination.
4. Price discrimination enables the monopolist to obtain a higher total revenue and larger output. Here the output would be identical with the perfectly competient output. Therefore, the society at large is benifitted, since output under discriminating monopoly is larger than with a single price.
5. When the monopolist fixes higher price in the case of inelastic goods which is demand and lower price for those goods and then the demand and output will not be badly effected for which demand is elastic.

3.12 DIFFERENCES BETWEEN PERFECT COMPETITION AND MONOPOLY:

Perfect competition and monopoly are the two concepts. There are some difference between perfect competition and monopoly. Perfect competition is that type of market where there are large number of sellers selling similar products and where the activity of single seller or buyer cannot influence the market price, monopoly is said to be existed when the firm is the sole producer or seller of the product where there are no close substitutes for this product.

In perfect competition there are large number of buyers and sellers and all products are homogeneous. In this market there is a free entry and exit of the firms and also there is perfect information about market conditions. There is also perfect of mobility of factors of production. In perfect competition, there is a uniform price level. In this competition the transport costs should not be included in the price level. There is a difference between firm and industry under perfect competition.

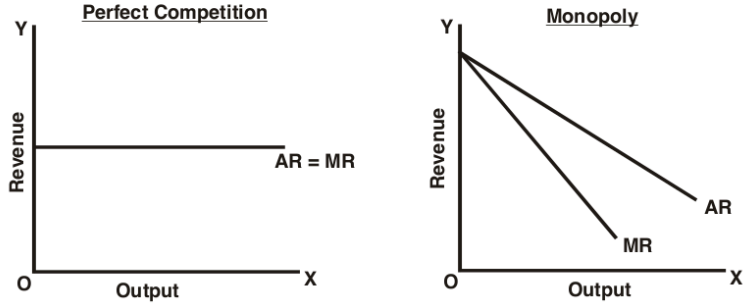
In monopoly market there is only one seller or producer. There are no close substitute products for monopoly products. In this market there is no difference between firm and industry. The new firms have no right to enter the market. The monopolist can control the price either output. In this market the revenue curves fall down from left to right with the increase of output.

DIFFERENCES:

The following are the main differences between perfect competition and monopoly.

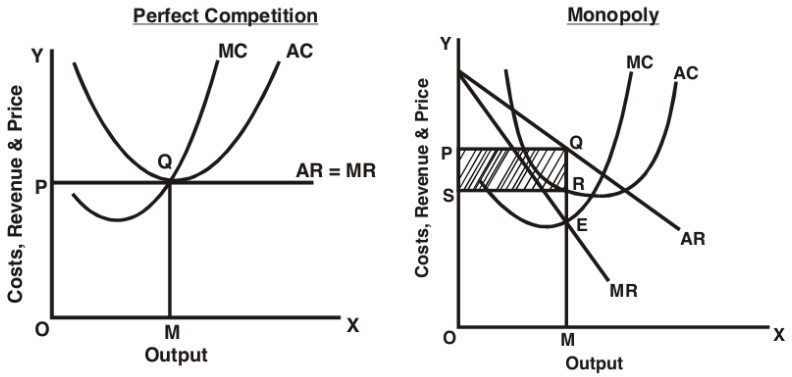
1. **NUMBER OF SELLERS:** In perfect competition there are large number of sellers who are producing homogeneous products. Therefore, the activity of single seller may not influence the market price. But in monopoly there is a single seller. He controls entire supply of the commodities. In this market there is no competition.

2. **NATURE OF REVENUE CURVES:** In perfect competition because of uniform price the average revenue and marginal revenue are equal. They are parallel to X axis. But in monopoly the average and marginal revenue curves falldown from left to right. We can know these things with the help of following diagrams.



In perfect competition AR and MR both are the same and they are parallel to X axis. In monopoly market AR and MR both are falling down from left to right. If the monopolist wants to sell more, he must reduce the price level and if he wants to fix more price he must reduce the output.

3. **PRICE AND OUTPUT DETERMINATION:** In perfect competition the price and output are determined at that point where MC and MR are equal. But in monopoly where MC and MR both are equal and at that equilibrium point the price is determined on AR line. We can know these things with the help of following diagrams.



In the case of perfect competition MC and MR bothe are equal at point Q and therefore at that point output is determined as OM and prices OP. In monopoly market where MC and MR both are equal and at that equilibrium point only the output in determined and on the basis of this price is determined on AR line at point Q. So, the price is determined as OP.

4. **ENTRY AND EXIT OF THE FIRMS:** In perfect competition there is free entry and exit of firms. The new firms may enter the market when the firms are getting abnormal profits and leave the market when they are getting losses. But in monopoly the other firms have no freedom to enter the market.

5. **NATURE OF COST CURVES:** In perfect competition the firm gets an equilibrium position where the marginal cost is rising. If the marginal cost curve falls down, then there is no possibility of equilibrium between MC and MR Under monopoly the firm may get equilibrium position where the MC is at a rising stage or constant or falling stage.

6. **DIFFERENCE BETWEEN FIRM AND INDUSTRY:** There is a difference between firm and industry under perfect competition. Firm is a production unit and industry is a group of similar firms. But in monopoly market, there is no difference between firm and industry and both are same.

7. **NORMAL PROFITS AND ABNORMAL PROFITS:** Under perfect competition in the short period the firm may get abnormal profits. But in the long run because of free entry and exit, the firm gets only normal profits. But in monopoly the firm may get abnormal profit in the short period as well as in the long period becuase of no free entry of new firms.

8. **NATURE OF AVERAGE COST AT EQUILIBRIUM POINT:** Under perfect

competition the average cost becomes minimum at equilibrium point. In the above diagram in the case of perfect competition the average cost becomes minimum at point Q. But in monopoly market the firm attains equilibrium where the average cost is falling. In the diagram in the case of monopoly the average cost curve i.e. AC is falling at the equilibrium point i.e. at point E.

9. **PRICE AND OUTPUT:** In perfect competition the output is more and the price is less where as in monopoly the output is less andthe price is more.

10. **UNIFORM PRICE AND PRICE DISCRIMINATION:** In perfect competition there is a uniform price and there is no price discrimination. Fixing of different prices to different customers for the same commodity is said to be price discrimination. But in monopoly, there is a possibility for price discrimination. Monopolist can fix different prices to different customers for the same commodities.

11. **PRICE TAKER AND PRICE MAKER:** In perfect competition the firm is a price - taker where as in monopoly the firm is a price maker. In perfect competition the firms must follow and take the existing price. Under monopoly, the monopolist has full control over the supply of the commodity and therefore, the monopolist is price - maker.

12. **EQUILIBRIUM :** Under the perfect competition at the equilibrium point MC = MR = AR = AC = P under monopoly at the equilibrium point MC = MR < AR = P.

3.13 MONOPSONY:

Monopsony is a market condition were there is only one buyer for a product or service from a large number of sellers. In other words, there is only one customer for a company's products. It is also called as buyer's monopoly. So monopsony may be defined as a market of one buyer and many sellers.

The word Monopsony is derived from two Greek words namely - monos means single and opsonia means purchase. Therefore the literarly meaning of monopsonly is single purchaser. In the imperfect competitive market monopsonly is a typlical type of market which is not much in discussion.This market is an important idea in economics but not discussed very often.

The term was first introduced by Joan robinson in her book "The Economics of Imperfection Competition", which was published in 1933. In fact monopsonly is a state in which demand comes from only one source. If there is only ne customer for a good that customer has a monopsonly in the market for that good.

The concept can be explained with an example. In Bangladesh, a dozen of power generating companies have been established in the private sector since 2009. It is only the Government of Bangladesh who purchaes from these companies, power. So in this case the government of Bangladesh is monopsonly in the market as it is the only buyer for the power which is been produced by many private producers in the country. A monopsonist has buying power in the market. This buying power means that a monopsonist can exploit their bargaining power with a supplier to negotiate lower prices. The reduced cost of purchasing inputs increases their profits margins.

3.14 CONCLUSION:

In this chapter we discussed the price and output determination under monopoly and discrimination monopoly. Monopoly is said to exist when a firm is the single seller or producer of a product where there are no close substituter for it. The practice of selling the same commodities at different prices to different buyers is known a s price discrimination. the monopolist will get maximum profits if he will fix prices on the basis of elasticity of demand.

3.15 POINTS TO REMEMBER:

1. Monopoly is a mrket where there is a single seller in which there are no clsoe substitutes.
2. There are some features with regard to monopoly.
3. Certain conditions are necessary for price and output determination under monopoly.
4. Price and output are determined in monopoly at the time of increasing costs, constant cost and diminishing costs.
5. There is a relationship between monopoly price and elasticity of demand.
6. The practice of selling the same type commodities at different prices to different buyers is known as price discrimination.
7. There are various kinds of price discrimination.
8. The price discrimination under monopoly is possible when certain conditions are prevailing.
9. According to A.C. Pigou there are three degrees of price discrimination.
10. Price discrimination is supported on varius grounds.
11. There are some differences between perfect competition and monopoly.

3.16 KEY CONCEPTS:

1. **Monopoly** : Monopoly is that type of market where there is a single firm producing the goods for which there are no close substitutes.
2. **Price Discrimination** : The practice of selling the same commodities at different prices to differnt buyers is known as price discrimination.
3. **Personal Discrimination** : If the monopolist charges different prices from different customers for the smae type of product on the basis of ability to pay, then it is known as personal discrimination.

4. **Place or Local Discrimination** : In this monopolist charges different prices in different places for the same product. It is also known as geographical discrimination.

5. **Trade or Use Discrimination** : The monopolist will charge different prices for different types of uses of the same commodity.

3.17 Model Questions:

I. Essay Questions:

1. What is monopoly and how the price and output are determined under it.
2. What is menat by price discrimination and howthe price and output are determined under discriminating monopoly.
3. Expalin the main differences between perfect competition and monopoly.

II. Short Essay Questions:

1. Write about the features of monopoly.
2. Explain the price and output determination under monopoly under different costs.
3. Write about the importance of price discrimination.

III. Very Short Questions:

1. Monopoly price and elasticity of demand.
2. Types of price discrimination.
3. Condititions for price discrimination under monopoly.

3.18 Reference Books:

1. R.A. Bilas : Micro Economic Theory
2. Stonier & Hegue : A Text Book of Economic Theory
3. M.L. Jhingan : Micro Economic Theory
4. K.K. Dewett : Moderen Economic Theory

MODULE :5 Lesson : 4

MONOPOLISTIC COMPETITION

4.0 AIMS AND OBJECTIVES:

The main aim of this chapter is to analyse the equilibriumm of he firm and industry in monopolistic competition.

CONTENTS:

4.1 INTRODUCTION:

Prof. E.H. Chamberlin developed the concept of "Monopolistic Competition" in his book "The Theory of Monopolistic Competition" published in 1933. Monopolistic Competition refers to a market situation where there are many sellers of a commodity, but the product of each seller differs from one another. It in one type of imperfect competition. It is also some times referred as 'group equilibrium'. There are some features of perfect competition and some features of monopoly in this monopolistic competition. Therefore, it is the midway of perfect competition and monopoly.

DEFINITIONS:

According to lieftwitch, "Monopolistic Competition is a market situation in which there are many sellers of a particular product, but the product of each seller is in some way differentiated in the minds of consumers from the product of every other seller."

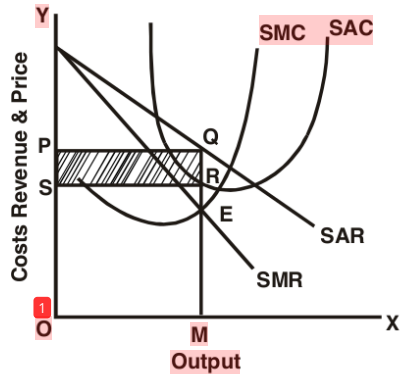
According to Joe S. Bain "Monopolistic Competition" is found in the industry where there are a large number of small sellers selling differentiated but close substitute products."

4.2 FEATURES:

1. **EXISTENCE OF LARGE NUMBER OF FIRMS:** There are large number of firms in monopolistic competition. The output of each firm is very small in the total output. Each firm acts independently without bothering about the reactions ofthe rivals because of existence of large number of firms.
2. **PRODUCT DIFFERENTIATION:** Under monopolistic competition there is a product differentiation. In this competition products are not homogeneous as in perfect competition and they are not remote substitutes as in monopoly. These products may be close substitutes. For example, colgate tooth paste, promise tooth paste, close-up tooth paste etc... are close substitutes. Product differenciation can be brought about in so many ways.
3. **FREE ENTRY AND EXIT:** In monopolistic competition there is a free entry and exit of the firms. There are no restrictions for a new firm to enter the market or to leave the market under monopolistic competition. Because of existence of large number of firms there is a free entry and exit.
4. **LACK OF PERFECT KNOWLEDGE:** There is no perfect knowledge with regard to prices, quality ofthe products and quantity of the product produced in the market. The buyers do not know about all these products. The sellers do not know the exact preferences of buyers and unableto get advantage out of the situation.
5. **EXCESS CAPACITY:** In monopolistic competition the firms produce the goods upto that level where the average cost is at falling stage. The firms do not produce the output upto that point where the long run average cost is minimum. In monopolistic competition the amount of output that is produced by the firm is less than the ideal output. This is called excess capacity.
6. **SELLING COSTS:** Generally the costs on advertisements are commonly known as selling costs. According to chamberlin selling cost is that cost which shifts the demand curve towards the right side. Therefore, the selling costs are useful to the increase the demand for the product. The producer spends on selling costs until the additional revenue becomes zero. In real sense the selling cost will not promote the welfare of the consumers with the help of advertisements the firms may change the tastes and preferences of the consumers.

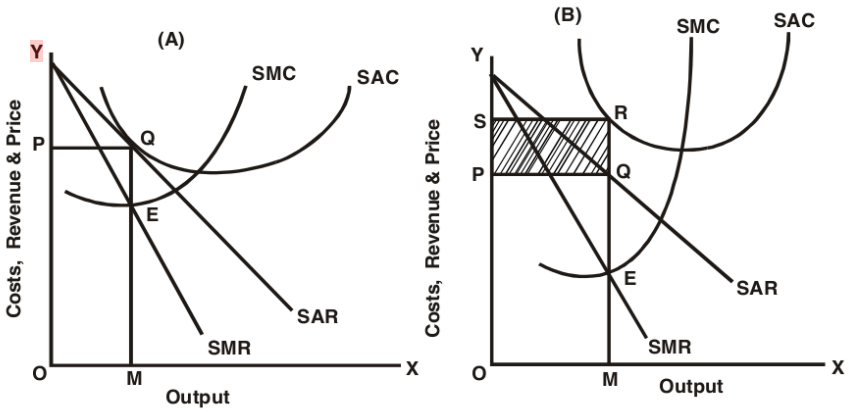
4.3 SHORT RUN EQUILIBRIUM OF THE FIRM UNDER MONOPOLISTIC COMPETITION:

In the short run some firms may get abnormal profits and attains equilibrium position in the following way.



In the diagram on X axis the output and on Y axis the costs, rename and price are shown. SAR is the short run average revenue curve and also demand line. SMR is the short run marginal revenue curve. SAC is the short run average cost curve. Marginal cost revenue curves are equal at point 'E'. Therefore, the output is determined as OM and price is OP. OPQM is the total revenue and OSRM is the total cost. QR is the amount of abnormal profit per unit. PQRS is the total amount of profit.

In the short period it is possible that some firms may get abnormal profits like in the above manner. In the same shortperiod some firms may get normal profits and some other firms may get losses also in the following way.



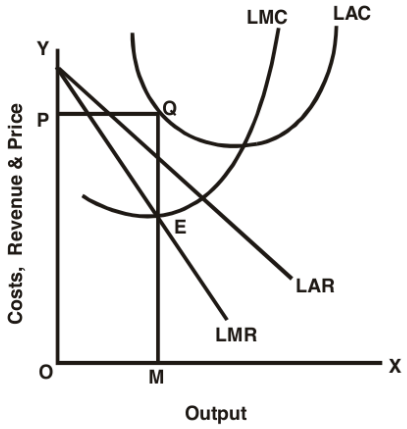
In the diagram 'A' the firm is getting only normal profits which are included in the cost of production. The equilibrium output is OM. At OM output level the price is OP which is also equal to average cost. In the diagram OPQM iste total revenue and also total cost. Therefore the firm gets only normal profits.

In the diagram 'B' the firm is getting losses. In this diagram at OM output level theprice is OP. But the average cost is OS. So the firm is getting SP or QR amount of loss OPQM is thetotal revenue and OSRM is the total cost. So PQRS isthe total amount of loss. Therefore -

OSRM - OPQM = PQRS = Losses

4.4 LONG RUN EQUILIBRIUM:

There is a free entry and exit under monopolistic competition. If the existing firms are getting abnormal profits, then the new firms may enter the market and if the firms are getting losses, then they have freedom to leave the market. Therefore, in the long period the firms get only normal profits. This can be explained with the help of following diagram.



In the above diagram on the X axis output and on Y axis costs revenue and price are shown. LAC isthe long run average cost curve and LMC isthe long run marginal cost curve. LAR isthe long run average revenue curve and LMR isthelong run marginal revenue curve. The LMC and LMR are equal at point E. So the output is determined as OM and price as OP. In the diagram at equilibrium point the average cost is equal to average revenue. so thefirm is getting only normal profits in the long run. These normal profits are included in the cost of production.

4.5 DIFFERENCE BETWEEN PERFECT COMPETITION AND MONOPOLISTIC COMPETITION:

There are some differences between perfect competition and Monopolistic Competition.

1. Under perfect competition in the long run the firm gets an equilibrium position at that level where the AC isthe minimum and where as in monopolistic competition thefirm gets an equilibrium position where the AC is at falling stage. Therefore, in monopolistic competition, there is an excess capacity.
2. In perfect competition the revenue curves are parallel to X axis due to uniform price. In monopolistic competition therevenue curves are falling down from left to right.
3. In perfect competition all products are homogeneous in quantity and quality. But in monopolistic competition there is a product differentiation.
4. There is a perfect information about market conditions in perfect competition. But in monopolistic competition there is no perfect information about market conditions.

4.6 DIFFERENCE BETWEEN MONOPOLY AND MONOPOLISTIC COMPETITION:

Even though there are some similarities between monopoly and monopolistic competition, there are some differences between these two markets.

1. In monopoly there is a single seller and in monopolistic comeptition there are large number of sellers.
2. In monopoly, the firm may get abnormal profits in the short period as well as in the long period. But in the case monopolistic competition, the firm may get abnormal profits or normal profits. In monopoly, there is no free entry of new firms and therefore, the monopoly firm may get abnormal profits in the short run as well as in the long run. In monopolistic competition there is a free entry and exit of new firms and therefore, thefirms in the monopolistic competition can get only normal profits in the long run.
3. The absolute monopoly market is some what not a realistic one in practical life. The monopolistic competition is very nearer to practical and real life.

4.7 POINTS TO REMEMBER:

1. Monopolistic Competition is a midway of both perfect competition and monopoly.
2. Existence of large number of firms, product differentiation importance of selling costs are some of the main features of monopolistic competition.

3. Under monopolitic competition in the short run some firms may get abnormal profits, some others get normal profits and some more firms may get even losses. But in the long run all firms get only normal profits.

4. There are some differences between perfect competition and monopolistic competition and monopoly and monopolistic competition.

4.8 IMPORTANT CONCEPTS:

1. **PRODUCT DIFFERENTIATION:** Product differntiation is the main feature of monopolitic competition. In this market the products are different but close substitutes.

2. **SELLING COSTS:** Generally the costs on advertisement are known as selling costs. Selling costs are useful to increase the demand for the product.

3. **EXCESS CAPACITY:** In monopoly and monopolistic competition the output is not produced upto that level where the average cost is minimum. Therefore, the amount of output that is produced by the firm is lessthan the ideal output. this is called excess capacity.

4.9 MODEL QUESTIONS:

I ESSAY QUESTIONS:

1. Explain the short run and long run equilibrium of the firm under monopolistic competition.

II SHORT ESSAY QUESTIONS:

1. Write about the features of monopolistic competition.

4.10 REFERENCE BOOKS:

1. Stonier & Hague : A Text Book of Economic Theory
2. R.A. Bilas : Micro Economic Theory
3. M.L. Jhingon : Micro Economic Theory
4. K.K. Dewett : Modern Economic Theory

MODULE : 5 Lesson : 5

OLIGOPOLY & DUOPOLY

5.0 AIMS AND OBJECTIVES:

The main aim of this chapter is to analyse the equilibriumm of he firm and industry in monopolistic competition. We can also observe the nature and price determination under duoply market. In this chapter we study the nature, features and types of price determination under Oligopoly market.

CONTENTS:

5.1 INTRODUCTION:

Duoply market is that type of market where we find only two sellers. A brief description of duopoly is explained in this chapter. Further Oligopoly market is also explained. Oligopoly is that kind of market were we find only few sellers.

5.2 DUOPOLY:

Duo means two and poly means sellers. Therefore, duopoly refers to that type of market situation in which there are two sellers. There are two types of price determination under duopoly market - 1. Pricing under duopoly without product differentiation, 2. Pricing with product

differentiation.

1. PRICING WITHOUT PRODUCT DIFFERENTIATION:

A. COLLUSIVE PRICE: when there are two sellers producing or selling idential products, there may be collusion between these two sellers. They may come to an agreement and divide the market between them and fix the price collectively. In such case it will be similar to that of monopoly market.

B. INDEPENDENT PRICING: There may be continuous price-war between the two sellers if there is no agreement between these two sellers. Each firm in its way try to drive out the other seller from the market by reducing the price. Some times te price may be lower than the average cost and it may lead to losses also.

C. LONG RUN PRICE: Under duopoly market if there is no product differentiation, the consumers do not have any special preference for any producer. So in the long run the two producers may charge the same price. Therefore, these two sellers may earn only normal profits.

COURNOT MODEL: A model of Oligopoly, projecting duopoly was first put forth by cournot, a French economist in 1838. This model isdeveloped on the basis of certain assumption -

1. There are two sellers selling idential products.
2. There are large number of buyers.
3. The total output must be sold out.
4. The cost of production is assumed to be zero.
5. Each seller knows the demand curve of his product.
6. Each seller takes the supply of his rival to be constant and ignorant about his rival's plans about it.
7. Each seller wants to acquire maximum net revenue.

On the basis of above assumptions cournot developed his model. Cournot model tells us that each producer will be supplying exactly equal qualities of output and the price charged will be the same.

EDGEWORTH MODEL: Edgeworth also developed his model on the basis of the same assumptions of cournot - except one assumption. Edgeworth did not take the assumption of constant supply of rivals. He has taken the assumption of constant price of his rivals. There will not be any price stability under duopoly, according to Edgeworth. According to this model, the price changes continuously between competitive price and monopolistic price. According to Edgeworth duopoly situation is unstable and indeterminate equilibrium.

CHAMBERLIN MODEL: Prof. Chamberlin advocated a stable equilibrium model. He recognised the mutual interdependence of the two sellers. According to chamberlin each seller is intelligent and recognises the importance of natural agreement between the two sellers. This will lead to a spirti of stable monopoly

equilibrium.

2. **PRICING WITH PRODUCT DIFFERENTIATION:** Under duopoly market, if there is product diffrentitaion, each seller may act as monopoly andis having his own market. Like in monopoly each seller decides his price and output. The seller who sells the superior quality of the product may earn abnormal profits when compared to the other seller.

5.3 OLIGOPOLY MARKET:

The term 'Oligopoly' is derived from two Greek words namely 'Oligoi' which means 'a few' and 'pollein' which means 'to sell'. Therefore, Oligopoly refers to that form of imperfect competition where there will be only few sellers producing either homogeneous products or products which are close substituites. So Oligopoly market prevails when an industry is made up of a few firms producing either identical products or differentiated produts. Oligopoly may also be referred as competition among the few.

DEFINITIONS:

According to Mc. Connel, "Oligopoly is a market situation in which number of firms in an industry are so small that each must consider the reaction of rivals in formulating its price policy".

In view of P.C. Dooley, "An Oligopoly is a market of only a few sellers offering whether homogeneous or differentiated products."

5.4 FEATURES OF OLIGOPOLY:

1. **INTERDEPENDECE:** Existence of interdependence of firms in the main feature of Oligopoly market. The price and output decissions of one firm will effect the other firms.

2. **INDETERNINATE DEMAND CURVE:** In Oligopoly market no firm can fore cast with fair degree of certainity about the nature and position of its demand curve. The firm can not make an estimation of sales of its products if it reduces its price.

3. **ELEMENT OF MONOPLOLY:** Monopoly element may be prevailed in the Oligopoly market. In this market there are only few firms andeach firm controls a large share of the market and therefore, we can findout the element of monopoly even in oligopoly to some extent.

4. **IMPORTANCE OF SELLING COSTS:** In Oligopoly market each firm employs various techniques of advertisements. Indeterminate demand leads to making of advertisements to make the average revenue curve more favourable.

5. **PRICE RIGIDITY:** In Oligopoly there is price rigidity. The price will be kept unchanged due to fear of retaliation and the price will tend to be inflexible. Every firm knows the ultimate out come ofthe price change and therefore no firm is willing to change its price. In order to avoid the retaliation among the consumers and to

discourge the entry of new firms the existing firms want to maintain the stable price.

5.5 PRICE DETERMINATION UNDER OLIGOPOLY:

There are mainly three types of price determination under Oligopoly market -

A. Independent Pricing

B. Pricing under collusion

C. Price leadership

A. INDEPENDENT PRICING: In Oligopoly market, the firms may produce either identical products or products with close subtitutes. If there is a product differentiation under Oligopoly each firm can act as a monopoly and fixes the price independently. If these firms produce identical products, it is difficult to know the price determination in an accurate manner. There may be heavy competition among these firms and finally they may fix the common reasonable price which can not be changed. But this policy of independent pricing can not withstand in the market.

B. PRICING UNDER COLLUSION: Most of the firms have the opinion that independent price determination leads to uncertainity. To avoid this defect there is a tendency among the oligopoly firms to act collectively by collusion. In this method these few firms may make 'cartel' arrangements. The firms may agree to share the market even though they are producing identical products. Generally the untralised cartel determines the output produced by different frms and the price is determined which is most accetable by all the firms.

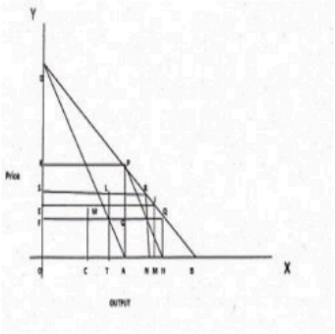
C. PRICE LEADERSHIP: When the other firms follow the price which is determined by one firm in oligopoly then we can say that there is a prie leadership. There are various ways of taking of leadership in price determination in oligopoly market. A dominant firm orthe firm with lowcosts or a well established firm or a old firm may take the leadership and fixes the price. Generally the other firms will follow this price.

5.6 COURNOT'S MODEL:

Augustin Cournot was a French Economists. His model is rival's output model which is assumed by an Oligopolist to remain fixed at the present level, while he contemplates a certain change in his own output. To explain his model Cournot has taken the case of two identical mineral springs operated by two owners who are selling the mineral water in the same market. Their waters are identical. Therefore, his model relates to the duopoly with homogeneous products. It is assumed by Cournot that the owners operate mineral springs and sell water without any cost of production. Thus, is Cournot's model, cost of production is taken as zero; only the demand side of the market is analyzed. The duopolists fully know the market demand for the mineral water; they can see every point on the demand curve.

The market demand for the product is assumed to be linear. Cournot makes another assumption that each duopolist believes that regardless of his actions and their effect upon market price of the product, the other will go on producing the same amount of output which he presently producing. In other words, for determining the output to be produced, he will not take into account the reactions of his rival in response to his variation in output.

Cournot's concept can be explained with the help of a diagram. In the diagram below DB is the demand curve that is confronting to the two producers of the mineral water. Suppose OA = AB is the maximum daily output of each mineral spring. Therefore the total output of both the springs is OA+ AB = OB. The output OB of both the springs is offered for sale in the market, the price will be zero.



Assume that one producer of the mineral water is a monopolist and he starts the business first. He will then produce daily OA output which is his maximum daily output for his profits will be maximum at output OA and will be equal to OAPK. The price which that producer will charge will be AP or OH. Suppose now the owner of the other spring comes into the business and starts his operation. According to Cournot's basic assumption, this new producer believes that the former producer will continue to produce at the old amount of output that is OA, regardless of what output he himself decided to produce. With the demand curve PB, the producer will produce AH or ½ AB amount of output. So the total output will be now OA + AH = OH. The price will fall to HQ per OF unit. The total profits made by the two producers will be only OHQG.

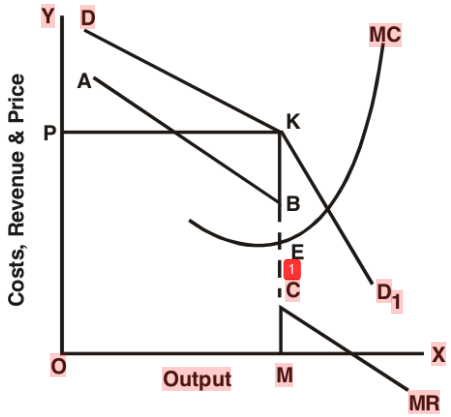
First producer will gain OAGF and the second producer will earn AHQG profits. Now if compared the first producer has reduced his profits from OAPK to OAGF. Now the first producer will reconsider the situation and the second producer producing AH output. But the first producer will assume that the second producer will not change his production level and will continue to produce at Ah level. First producer would now produce OT. He therefore, reduces his output from OA to OT. With output OT of the first producer and AH of the second producer the total output now will be OT + AH = ON and the price of the product will b now NR and the total profits of the two producers will be ONRS. The first producer will have OTLS profits, which is greater than his previous profits of OAGF and the second producer will have TNRL profits which is more than his previous profits of AHQG.

Now seeing the profits of first producer, the second one will realize that his profits are less than the first producer. So he will reappraise his situation. Believing that the first producer will continue producing at OT the second producer will find his maximum profits by producing output equal to ½ of TB which is greater than ½ of AB. With this move of second producer, the first producer will find that his profits are reduced. So he would reconsider his position and will find that he can increase his profits by producing output that is equal to ½ OB-output of the second producer. These adjustments will continue till each produce the same amount of output. In the final position, first producer produces OC amount of output and the second producer will produce CM amount of output and OC = CM.

Through out this process of adjustments and readjustments, each producer assumes that the other ill keep his output constant at the present level and then always finds to his maximum profits by producing output that is equal to ½ i.e. OB – the present output of the other producer. So in this way Cournot has explained his model of oligopoly which is more duopoly in nature.

5.7 DIAGRAMMATIC EXPLANATION - KINKY DEMAND CURVE :

In Oligopoly the popular method with regard to price and output determination is the method of 'Kinky demand curve'. This concept was introduced by Paul M. Sweezy. We can know the price and output determination with the help of following diagram.



In the diagram on X axis output and on the Y axis costs, revenue and price are shown. The demand curve DD_1 has kink at point 'K'. It is the average revenue curve. The point 'K' divides the demand curve into two parts i.e., DK and KD_1. DK part of demand curve is more elastic one and KD_1 part of demand curve is less elastic one. There is a price rigidity at point K because of several reasons. If particular firm rises its price, the other firms do not follow. Therefore, the demand for the particular product will be reduced on the otherhand, if the particular firm cuts its price, its rivals will react and they will also reduce their prices. So, no firm has the desire to increase or decrease the price level. Therefore, there is a price rigidity in Oligopoly market. In the diagram the marginal revenue curve is discontinuous between B and C . AMrginal cost is equal to marginal revenue at point E. Therefore, the output is determined as OM and the price as OP.

In inperfect competition, the monopolistic competition duopoly and oligopoly are the most important concepts. In monopolistic competition there are large number of firms and there is a product differentiation. In this market we can findout somefeatures of perfect competition and some otehr features of monopoly. In duopoly there are only two sellers. In Oligopoly market there

are only few sellers. Price rigidity in the main feature of oligopoly market. Monopolistic competition and oligopoly market situations are very nearer to the real life.

5.8 POINTS TO REMEMBER:

1. In duopoly market there are two sellers. In this market prices are determined without product differentiation and with product differentiation.
2. Oligopoly market refers to that type of imperfect competition where there will be only few sellers producing either homogeneous products or products which are close substitutes.
3. Interdependence, price rigidity etc... are some ofthe features of Oligopoly market.
4. In Oligopoly market the popular method with regard to price and output determination is the method of 'Kinked demand curve'.

5.9 IMPORTANT CONCEPTS:

1. **DUOPOLY:** 'Duo' means 'few' and 'poly' mans 'sellers'. Therefore, duopoly is that type of market where there are only two sellers.
2. **OLIGOPOLY:** Oligopoly refers to that type of imperfect comeptition where there will be only few sellers producing either homogenous products or differential products.
3. **PRICE RIGIDITY:** It is the main feature of Oligopoly market. The price will be kept un changed due to fear of retaliation from rivals. Every firm knows the ultimate out come oftheprice change and therefore, no firm is willing to change its price.
4. **KINKEY DEMAND CURVE:** This concept was introduced by paul M. Sweezy. We can find this Kinked demand curve in Oligopoly market. Knked demand curve method represents the price rigidity.

5.10 MODEL QUESTIONS:

I ESSAY QUESTIONS:

1. Explain the short run and long run equilibrium of the firm under monopolistic competition.
2. Write about the features and price determination under Oligopoly market.
3. Explain Cournot's model

II SHORT ESSAY QUESTIONS:

1. Explain the features of Oligopoly.

2. Write about the features of monopolistic competition.
3. Write about the price determination with help of Kinked demand curve in Oligopoly market.

III **VERY SHORT QUESTIONS:**

1. Duopoly Market
2. Product Differentiation
3. Kinky Demand Curve
4. Price Rigidity

5.11 REFERENCE BOOKS:

1. Stonier & Hague : A Text Book of Economic Theory
2. R.A. Bilas : Micro Economic Theory
3. M.L. Jhingon : Micro Economic Theory
4. K.K. Dewett : Modern Economic Theory

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