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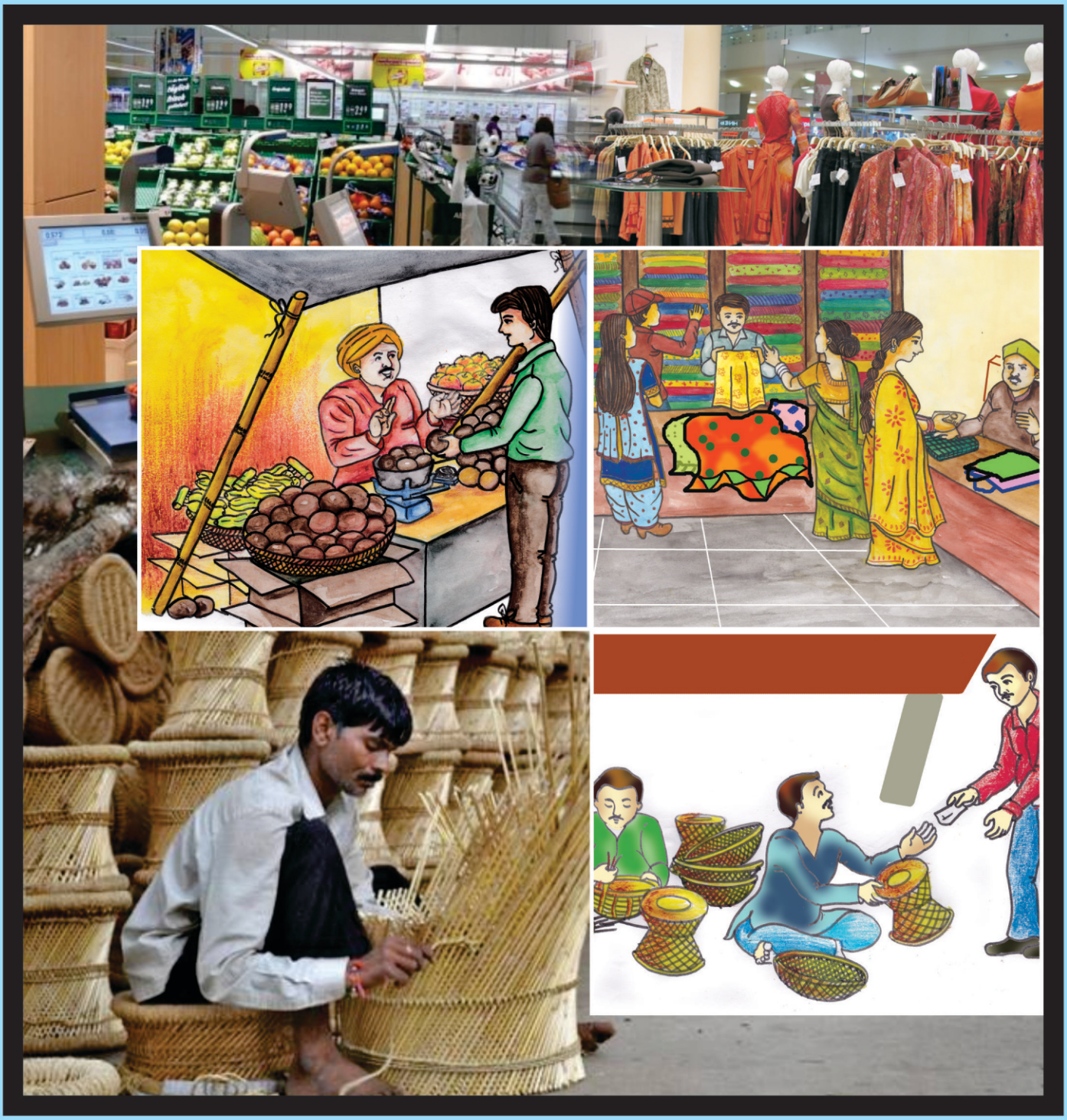
School of Social Sciences

BECC-131
PRINCIPLES OF MICROECONOMICS-I



''शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतन्त्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।''

– इन्दिरा गाँधी

''Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances.''

– Indira Gandhi

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PRINCIPLES OF MICROECONOMICS-I

School of Social Sciences
Indira Gandhi National Open University

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Unit 3	Supply and Elasticity of Supply	
Unit 4	Demand and Supply in Practice	
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Unit 9	Returns to Scale	
Unit 10	The Cost of Production	

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INTRODUCTION TO PRINCIPLES OF MICROECONOMICS-I

Economics is a live subject and helps the economic agents in their decision making like: Which commodities to produce? How to produce? Which techniques to use? Which factors or resources to use, in which combinations to produce and what quantity of a commodity? How consumers make purchasing decisions and how their choices are affected by changing prices and incomes? How firms decide how many workers to hire and how workers decide where to work and how much work to do? In other words, economics has moved away from financing the activities of State to helping the common man in the street to make many a crucial decisions impinging on their day-to-day life.

We, today incorporate a wide spectrum of activities in the domain of economics. These activities include: (a) consumer's behaviour or choice process; (b) producers' behaviour or how is the production organised and carried on, what is the special role of cost functions therein and also the different forms of market organisations; (c) different individuals co-operate in the process of production to contribute factors owned by them. The present course on principles of Micro Economics aims to expose the learners to each of these aspects. The course is divided into three blocks.

Introducing the nature of Economics, **Block 1** throws light on the basics of demand and supply and how the demand and supply curves are used to describe market mechanism. The block comprises 4 units. Unit 1 on Introduction to Economics and Economy covers the essential nature of economics and the basic concepts and methodology used in the discipline. Unit 2 deals with the Principles of Demand, Concept and Measurement of Elasticity of Demand and its Determinants. Unit 3 discusses Law of Supply, Elasticity of Supply and its determinants and Measurement. Unit 4 discusses the Market Mechanism by putting the Supply curve and Demand curve together.

Block 2 deals with the theory of consumer behaviour and consists of two units. Unit 5 discusses Cardinal Utility Approach for measurement of utility and how a consumer attains equilibrium with the help of equi-marginal utility. Unit 6 analyse the Consumer Behaviour under Ordinal Approach.

Block 3 covers production function and theory of cost. It consists of four units. Unit 7 throws light on production function with one variable input, Unit 8 deals with the nature of production function with two variable inputs. Unit 9 covers the production function in the event of all inputs vary and hence application of returns to scale. Unit 10 discusses the cost side of production considering different types of costs.

UNIT 1 INTRODUCTION TO ECONOMICS AND ECONOMY

Structure

1.0 Objectives

1.1 Introduction

1.2 Concept of Scarcity

1.3 Meaning of Production

1.4 Central Problems of an Economy

- 1.4.1 What to Produce?
- 1.4.2 How to Produce?
- 1.4.3 For Whom to Produce?
- 1.4.4 The Problem of Growth
- 1.4.5 Choice between Public and Private Goods
- 1.4.6 The Problem of 'Merit Goods' Production

1.5 Production Possibility Curve

1.6 Allocation of Resources: Solution of Central Problems

- 1.6.1 Resource Allocation in a Mixed Economy

1.7 Economic Methodology and Economic Laws

- 1.7.1 Inductive and Deductive Reasoning
- 1.7.2 Equilibrium

1.8 Positive versus Normative Economics

1.9 Microeconomics and Macroeconomics

1.10 Stocks and Flows

1.11 Statics and Dynamics

1.12 Let Us Sum Up

1.13 References

1.14 Answers or Hints to Check Your Progress Exercises

1.15 Terminal Questions

*Shri I.C. Dhingra, Rtd., Associate Professor, Shaheed Bhagat Singh College (University of Delhi), Delhi.

1.0 OBJECTIVES

After studying this unit, you will be able to:

- explain the problem of scarcity of resources for satisfying ever-increasing wants of society;
- state the meaning and nature of an economy;
- describe the concept of economic entities;
- discuss the concept of production possibility curve;
- state the issues relating to allocation of resources between investment and consumption, and between private and public goods;
- explain the methods of resource allocation in a market economy in a socialist economy and in a mixed economy;
- clearly describe the basic concepts and methodology of Economics;
- state the nature of economic laws; and
- explain some of the analytical concepts associated with economic reasoning.

1.1 INTRODUCTION

Let us begin with defining the discipline of Economics.

Definition of Economics

Economics has been variously defined. As summarised by Samuelson, some of the definitions seek to explain that economics:

- analyses how a society's institutions and technology affect prices and the allocation of resources among different uses.
- explores the behaviour of the financial markets, including interest rates and stock prices.
- examines the distribution of income and suggests ways that the poor can be helped without harming the performance of the economy.
- studies the business cycle and examines how monetary policy can be used to moderate the swings in unemployment and inflation.
- studies the patterns of trade among nations and analyses the impact of trade barriers.
- looks at growth in developing countries and proposes ways to encourage the efficient use of resources.
- asks how government policies can be used to pursue important goals such as rapid economic growth, efficient use of resources, full employment, price stability, and a fair distribution of income.

A common theme running through all these definitions is that scarcity is a fact of life and that an efficient use of these scarce resources is to be found. That is how we define economics as a science that deals with scarcity.

It explains the behaviour of different economic units, households, firms, government and the economy as a whole, when they are faced with scarcity.

1.2 CONCEPT OF SCARCITY

"Scarcity" lies at the root of all economic activities. The concept of scarcity finds an expression in two basic facts of economic life:

A. Unlimited wants or ends, and

B. Scarce resources or means.

A. Unlimited wants or ends

Every person has some wants. Different persons have generally different wants, and wants of even the same person keep changing with the passage of time, change of place and status.

Human **wants are unlimited and keep on increasing.** Different wants differ in their intensity. Subject to the availability of resources, higher order wants need be satisfied first and if the resources are still available these may be used to satisfy lower order wants.

B. Scarce resources or means

Satisfaction of wants requires resources (or the means to satisfy wants). Availability of resources is limited in relation to requirements.

However, scarce means have alternative uses.

The resources therefore need be allocated among different uses in a systematic coordinated manner. Every individual and economy has to devise a mechanism for this.

Different societies try to solve these issues in different ways and in the process each society creates a set-up called 'an economy'. The term 'economy' or 'economic system' is a comprehensive one. It covers the entire set of institutions and arrangements, (including rules and regulations which facilitate their interactions) for resolving the basic and permanent problem of an imbalance between means and wants.

The human society has evolved several sets of such institutional arrangements each is termed an economic system and they have their own distinguishing features and nomenclatures. These systems try to adopt their own means and methodologies for solving the basic problems.

For example, take the case of a capitalist economy. In this case the means of production are owned and inherited by individuals, and various economic decisions are guided by prices of goods and services in the market. The income of an individual is determined by means of production supplied by him to the market and the price which they are paid for their service. On the other hand, in a strict socialist economy all the means of production are owned by the state. The state takes all the decisions regarding the use of available resources.

However, whatever its nature, every economy has to solve the basic problem of scarcity of means in relation to the ever-increasing and varied wants. The means and wants can be combined in alternative ways. The problem of scarcity exists in every society, irrespective of the levels of its development. Hence it has to address itself to two issues:

1) increasing the availability of means of satisfaction, and

2) laying down the priorities of the wants to be satisfied.

Check Your Progress 1

1) State two important characteristics of wants which make them unlimited in number.

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2) What is an economy?

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3) Pick up the correct option among the following:

Which of the following can be called scarce:

a) Stock of rotten vegetables

b) Useless plants in a jungle

c) Number of flowers in a nursery

d) Water in a dirty pit.

1.3 MEANING OF PRODUCTION

The term **'Production' implies the transformation of various inputs into output thereby increasing the want-satisfying capacity of the inputs.** The process of production transforms the things occurring in nature into goods and services which are capable of satisfying human wants. The things which are so transformed are called inputs while output is nothing but the transformed form of inputs, that is, the goods and services. This involves some human effort, both physical and intellectual. The transformation may be physical (a different appearance which enhances want satisfying capacity), spatial (relocate or transfer the things from one place to another to make them available to the end users) or inter-temporal (saving/preserving things which arise/grow/made today for use at a later date-storage and warehousing). A particular transformation is production if the want-satisfying capacity of the output (also called 'product') is more than that of inputs used. To put it differently production is nothing but the creation of utility.

1.4 CENTRAL PROBLEMS OF AN ECONOMY

Because of the scarcity of resources every economy is faced with certain basic or fundamental problems which it must try to solve within its socio-economic framework. These central problems are:

1.4.1 What to Produce?

An economy does not have enough resources to produce everything required by it. So, it must be selective and decide what to produce and what not to produce. When some goods are not produced, some wants of the society remain unsatisfied. The decisions regarding the wants to be satisfied and the goods and services to be produced are interrelated and are taken in a coordinated manner. This is called allocation of productive resources. If some factors of production are employed in the production of product X, to that extent, these will no longer be available for production of product Y. The problems can be illustrated by Production Possibility Curve which we will introduce shortly.

1.4.2 How to Produce?

This is a problem which covers the details of the allocation of productive resources in the production of various goods and services. More precisely, we can say that when an economy decides to produce X , it has also to work out exactly how much of labour, capital, land, etc., would go into its production. The exact proportion of factor-inputs used in the production of goods needs to be decided, irrespective of the size and nature of an economy. This is called the technique of production of that item. For example, we may think of goods which are produced by using more of labour than capital. In such cases labour intensive techniques of production are said to be in use. On the other hand, if more of capital goes into the production of an item, then we say that it is being produced by a capital-intensive technique.

When an individual producer is to decide about the technique of producing any particular product, he considers the prices and productivities of alternative inputs, say labour and capital, since frequently their relative usage can be varied. He tries to use those inputs in such a combination which costs him the least and will yields him the maximum output.

His decision is based on consideration of following two factors:

i) the relative price of labour and capital, and

ii) the relative efficiency of the two inputs

1.4.3 For Whom to Produce?

A society comprises a large number of individuals and households. All the output of consumption goods and services is ultimately meant for their use. Therefore, all goods and services produced are to be distributed amongst the individuals and households. The share of each individual and household has to be determined and also the quantities of specific goods and services which comprise that share.

We can see that it is possible to propose different principles whereby this distribution may be carried out. In an economic system organised on market

principles, the income shares of individual members of the society are determined in the following manner:

In a market economy, productive resources are privately owned. They are sold, bought and hired like any other goods or services. The price of a productive resource is determined by the market forces of demand and supply. Whenever it is to be employed by a producer, he has to pay its market price to its owner. It is for the owner to supply it to the market or withhold it. The income of each individual under these conditions, is determined by the amounts of different productive resources owned and supplied by him to the market and their respective price.

1.4.4 The Problem of Growth

Every economy seeks to increase its stock of capital to increase its production capacity and thereby generate more income. The generated income in an economy has two alternative uses, viz. consumption expenditure (C) and saving (S). Thus, Y = C + S. Saving is source of finance for investment in an economy. Investment adds to the capital stock of an economy. And therefore, there is a need to reduce the share of consumption expenditure (and thereby increase investment); this helps in capital formation.

1.4.5 Choice between Public and Private Goods

1) **Private Goods:** There are certain goods (the term goods here includes services also) whose availability can be restricted to selected individuals only. For example, a product may be priced in the market and only those who pay its price may be allowed to have it. This characteristic of a product by which some people can be prevented from its use is referred to as the **'principle of exclusion'**. Accordingly, those persons who cannot pay for it or who are not ready to pay, are not allowed to use it. The use of the goods is thus divisible between different persons. **Any goods which can be priced and whose use can be restricted to selected persons is termed** as private goods.

2) **Public Goods:** When it is not possible to restrict the availability of a product to selected individuals, they are termed as public goods or social goods. Such goods cannot be so priced as to deprive some persons from using it. That way, it is indivisible. Defence service is a typical example of a public service. When a country is protected against foreign aggression, every citizen is protected.

With its limited resources, an economy cannot have enough of both public and private goods. It must try to achieve an optimum combination of both.

1.4.6 The Problem of 'Merit Goods' Production

Those goods whose consumption is considered highly desirable for the members of the society are termed as merit goods. The important feature of the merit goods is that their consumption benefits both the user and non-users. For example, if a person is educated and healthy, it not only helps him but also the society as a whole. Health and education, therefore, are called a merit product/service and it is desirable that every member of the society gets education. Consumption of merit goods benefits the society as a whole and raises the level of its efficiency and well-being. Therefore, every society has to decide the extent it can and should produce and consume merit goods.

Check Your Progress 2

1) State the central problems of an economy?

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2) What is capital formation?

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3) What is a technique of production?

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4) What are merit goods?

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5) Differentiate between public and private goods.

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1.5 PRODUCTION POSSIBILITY CURVE

The economy has to choose between alternative combinations of various goods and services. This problem of choice can be illustrated by a simple graph known as **Production Possibility Curve or a Product Transformation Curve.** A typical Production Possibility Curve (PPC) is drawn on the following assumptions:

i) The country has to choose between alternative combinations of only two goods, say. LED (L) and computer monitor (M).

ii) All productive resources of the country are taken as given and so is the state of technology, no changes are made in them.

iii) All productive resources of the economy are fully employed. There is no wastage or under utilisation.

iv) The productive resources are suitable for the production of both goods (L) and (M). They can, therefore, be shifted from the production of one to the other goods. However, such a shift would reduce the production of the first good and increase that of the other.

v) No factor of production is considered to be specific in the production of one good alone and inappropriate for the production of the other.

vi) We consider the productive efficiency of the productive resources only in physical terms, i.e., the units of LED (L) and Computer Monitor which they can produce.

Based upon these assumptions, we can illustrate the set of production possibilities available to a country by a hypothetical example. Look at Table 1.1. The figures in the table show that all the productive resources of the country put together can produce a maximum of either 30 L or 30 M or some other combinations thereof. The production possibilities illustrated in Table 1.1 are also represented in Fig. 1.1 in the form of a production possibility curve (PPC).

Quantity of M is measured along X-axis and the numbers of L are measured along Y-axis. The respective pairs of the quantities of L and M are plotted and joined with each other to yield a curve which is called the Production Possibility Curve. Thus, the PPC represents all the possible combinations of L and M which can be produced by using all the productive resources of the economy, efficiently. In that sense, each point on the curve represents the maximum possible output and, for that reason, it is also termed as the production frontier of the economy.

Table 1.1: Production Possibilities Available to a Country

Combination	LED (Numbers) (L)	Computer Monitor (M)	Loss of M for each Additional L Produced (Tones)	Loss of L for each Additional M Produced (Numbers)
1	30	0	2.8	
2	25	14	1.2	0.357
3	20	20	0.8	0.833
4	15	24	0.6	1.250
5	10	27	0.4	1.667
6	5	29	0.2	2.500
7	0	30		5.000

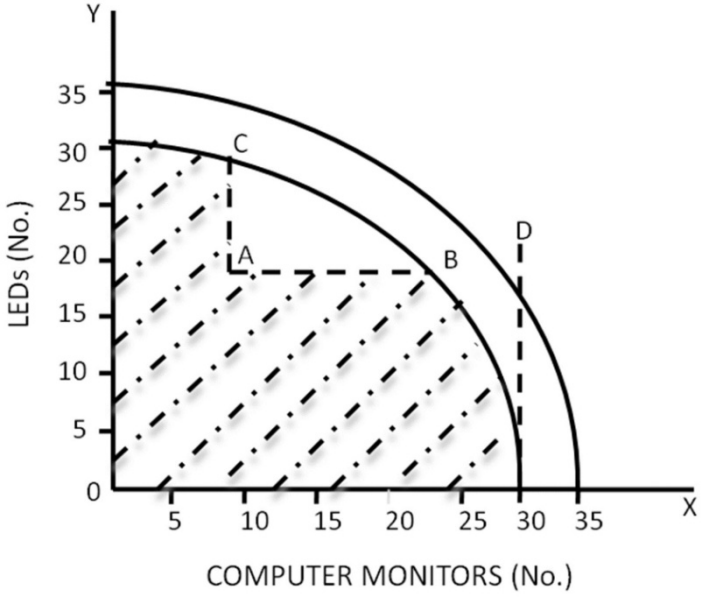

Fig. 1.1

The economy can produce any combination of L and M represented by a point either on the PPC or in the shaded area of the diagram. Production combinations represented by the shaded area imply that the economy can produce either L or M or both. For example, combinations represented by points A, B and C are feasible, as these lie either on the PPC or in the shaded area. But the combination represented by A is feasible but not efficient. Combination represented by points B and C are both feasible and efficient. If it produces at Point A it is not utilising some of its productive resources and let them go waste. Thus consider point A which represents a combination of 10 tonnes of M and 14 L. The PPC, however, shows that with this much of M, the economy can produce 27 L (as shown by point C on PPC). Alternatively, with 14 L, the quantity of M can be increased to 25 tonnes (see point B).

Any point beyond the PPC, which is in the non-shaded area of the diagram, shows a combination of L and M which the economy cannot produce. For example, point D represents a combination of 30 M and 20 L. However, when 30 M is produced, no resources are left for the production of L. On the other hand, if 20 L are produced, then the quantity of M has to be reduced to 20.

Characteristics of PPC

A typical PP curve has two characteristics:

1) **Downward sloping from left to right**

It implies that in order to produce more units of one good, some units of the other good must be sacrificed (because of limited resources).

2) **Concave to the origin**

A concave downward sloping curve has an increasing slope. The slope is the same as MRT. So, concavity implies increasing MRT, an assumption on which the PP curve is based.

Can PP curve be a straight line?

Yes, if we assume that MRT is constant, i.e. slope is constant. When the slope is constant the curve must be a straight line. But when is MRT constant? It is constant if we assume that all the resources are equally efficient in production of all goods.

Note that a typical PP curve is taken to be a concave curve because it is based on a more realistic assumption that all resources are not equally efficient in production of all goods. (Fig. 1.2)

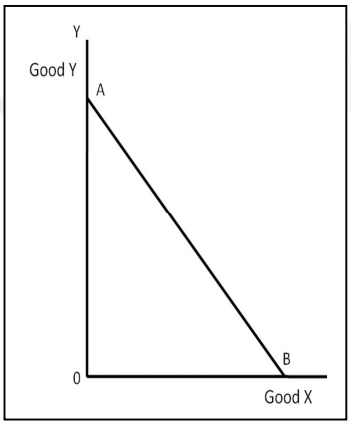

Fig. 1.2

Does production take place only on the PP curve?

Yes and no, both. Yes, if the given resources are fully and efficiently utilised. No, if the resources are under-utilised or inefficiently utilised or both. Refer to the Fig. 1.3.

On point F, and for that matter on any point on the PP curve AB, the resources are fully and efficiently employed. On point U, below the curve or any other

point but below the PP curve, the resources are either under-utilised or inefficiently utilised or both. Any point below the PP curve thus highlights the problem of unemployment and inefficiency in the economy.

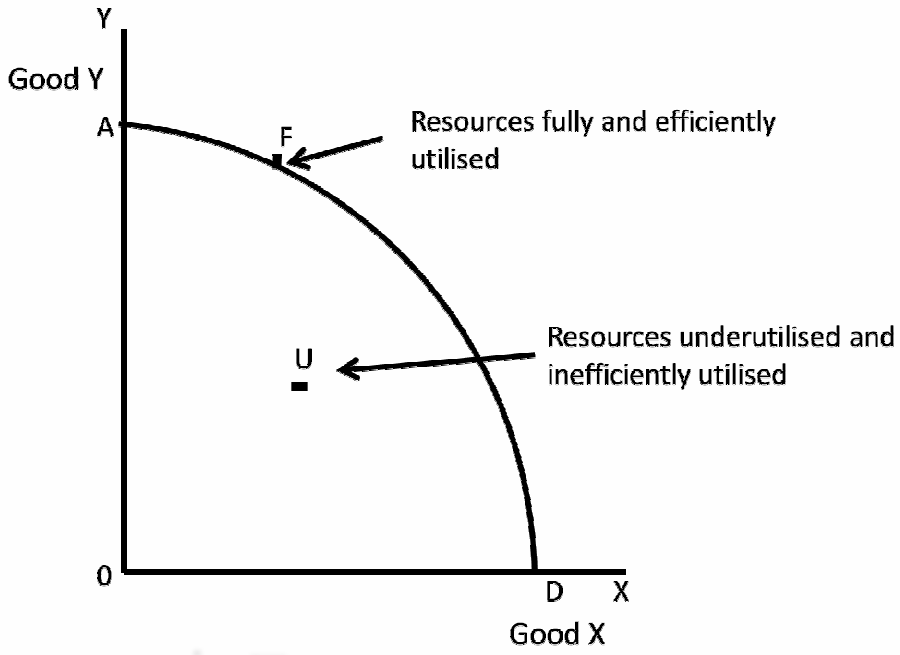

Fig. 1.3

Can the PP curve shift?

Yes, if resources increase. More labour, more capital goods, better technology, all means more production of both the goods. A PP curve is based on the assumption that resources remain unchanged. If resources increase, the assumption breaks down, and the existing PP curve is no longer valid. With increased resources, there is new PP curve to the right of the existing PP curve.

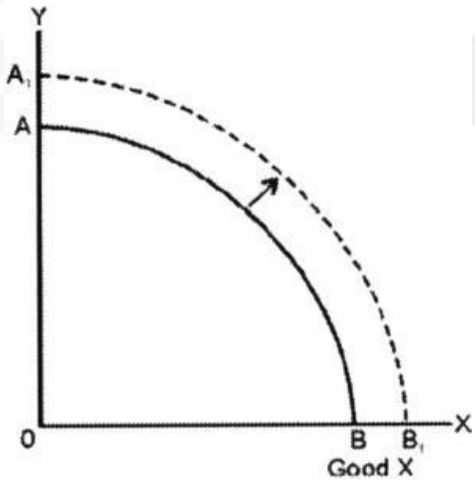

Fig. 1.4

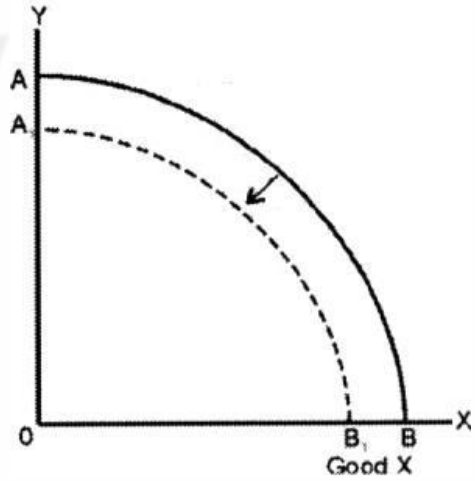

Fig. 1.5

It can also shift to the left, if the resources decrease. It is a rare possibility but sometimes it may happen due to fall in population, and due to destruction of capital stock caused by large scale natural calamities, war, etc.

1.6 ALLOCATION OF RESOURCES: SOLUTION OF CENTRAL PROBLEMS

Theoretically, there are two types of economic systems, viz.. Capitalistic economy and socialistic economy. In practice, all the countries have adopted a system which is broadly identified as mixed economy.

The problem of resources allocation may be tackled in several ways and each economy tries to solve it in line with its own chosen objectives.

1.6.1 Resource Allocation in a Mixed Economy

A mixed economy is one in which some decisions are left to the market forces while others are taken under direct government regulation or even ownership.

Some selected areas of economic activities are reserved for the government sector. The government acquires the necessary productive resources for these activities and employ them in conformity with its priorities. The production pattern of the public sector, the prices of items produced by the public sector and other measures are used to regulate the allocation of resources in private sector as well. These other measures include price controls, licensing, taxation, subsidies and others. Additionally, various labour welfare measures are implemented and enforced by the government. Similar steps are taken to encourage the use of productive resources for encouraging the development of backward areas of the country for removing specific shortages, and for bringing about a balanced development of the economy as a whole.

1.7 ECONOMIC METHODOLOGY AND ECONOMIC LAWS

Economic methodology investigates the nature of economics as a science. It investigates the nature of assumptions, types of reasoning and forms of explanations used in economic science. Various practices such as classification, description, explanation, measurement, prediction, prescription and testing are associated with economic methodology. Economic methodology examines the basis and groups for the explanations. Economists give answer why questions about the economy. For example, economists use the shifting of demand and supply curves to answer the question of why prices change.

Economics being a social science, economic laws are, therefore, a part of social laws. In the words of Alfred Marshall, we should separate that part of behaviour of members of the society where the main motive happens to be an economic one, where the main motive can be expressed in terms of money price. The corresponding activities are then economic activities. However, such a dividing line between economic laws and other social laws is not always clear. Very often an activity happens to be motivated by a combination of both economic and non-economic considerations. As a result, it is often quite difficult to formulate pure economic laws which have full validity also.

1.7.1 Inductive and Deductive Reasoning

Economists have followed two traditions in formulating economic laws. According to one tradition, the causes (also called conditions or assumptions)

are specified and different economic units are expected to behave in a 'rational' manner. The outcome in this case is predictable, provided the assumptions made are satisfied. The assumptions themselves may be totally unrealistic or may be very close to reality but they are stated in a precise manner. In any case, this type of reasoning is called deductive reasoning. In this method, the generalisation or law is stated and the individual activities are expected to conform to it. A typical example of deductive reasoning is the law of demand which states that, other things being equal, the quantity of a product demanded varies inversely with its price. When price falls, demand expands and when price rises, demand contracts.

As against this deductive reasoning, some thinkers try to discover economic laws the other way round. Instead of laying down causes or conditions on a hypothetical basis, they collect the actual information regarding the behaviour of economic units under different conditions. In other words, empirical information is collected and generalisations regarding the behaviour of economic units under different conditions are worked out. This is called the method of inductive reasoning. A well-known example of the use of this method is the Engel's Law. Through a study of family budgets, Engel concluded that as the income of a family increases, the proportion of its expenditure on necessities decreases while that on comforts and luxuries goes up. Most business firms prefer this line of approach.

In economics, both inductive and deductive methods of reasoning are used to supplement our understanding of an economy and its working.

1.7.2 Equilibrium

The concept of equilibrium is an important tool of analysis in economics. It is very frequently used and one should become familiar with it. Usually, an economic variable (such as the price of a commodity) is subject to various forces trying to pull it in different directions. When these forces are in balance, the value of variable stops changing and it is said to be in equilibrium.

Concept of Equilibrium

Equilibrium means a state of rest, the attainment of a position from which there is no incentive nor opportunity to move.

- A consumer is in equilibrium when his expenditure on different goods and services yield maximum satisfaction. No move on his part can increase his satisfaction but, rather, will decrease it.
- A business firm is in equilibrium when its resource purchases and its output are such that it maximises its profits, if profit maximisation is its objective, any change on its part will cause profits to decrease.
- A resource owner is in equilibrium when the resources which he owns are placed in their highest paying employments and the income of the resource owners is maximised. Any transfer of resource units from one employment to another will cause his income to decrease.
- An economy is in equilibrium at the level of income (and employment) where aggregate demand equals aggregate supply.

Equilibrium concepts are important, not because equilibrium is ever in fact attained but because they show us the directions in which economic changes

proceed. Economic units in disequilibrium usually move toward equilibrium positions.

Equilibrium can be analysed in two forms:

1) **Partial:** In partial equilibrium analysis we concentrate on a single market in isolation from the rest of the economy.

2) **General:** In general equilibrium analysis, we analyse simultaneously all the markets in the economy on the basic premise that everything depends on everything else.

1.8 POSITIVE VERSUS NORMATIVE ECONOMICS

The term **positive economics is concerned with only formulating economic laws and describing reality.** The economic laws may be derived from theoretical assumptions or from recorded facts. Either way, they only tell us what exists. They do not pass any judgement as to whether the findings of economic analysis are desirable or need a modification.

As against this, **normative economics realises the fact that an economy is never perfect. The outcome of its working can always be improved upon.** It is quite normal to find an economy faced with many problems requiring immediate attention. Such problems can be related to price changes, employment, scarcity of certain inputs, inequalities of Income and wealth, and so on. In normative economics, the knowledge gained is put to use for improving the working of the economy. Targets of improvement are laid down and policy measures are formulated by which the targets are to be achieved. Thus, normative economics is concerned with what ought to be.

A positive statement:

"An increase in price of petrol leads to a fall in its quantity demanded."

A normative statement:

Government should take steps to cut the consumption of Petrol.

More generally, normative statement uses the verb "should".

1.9 MICROECONOMICS AND MACROECONOMICS

The terms microeconomics and macroeconomics are used in connection with the level of aggregation, that is the extent to which economic units and variables are covered in economic analysis. At one end, the analysis may cover the behaviour and responses of a single economic unit and at the other extreme it may cover the entire economy. These two terms (micro and macro) are derived from Greece words **mikros** and **makros** which mean small and large respectively.

Microeconomics deals with the behaviour of individual elements in an economy such as the determination of the price of a single product or the behaviour of a single consumer or business firm.

As against this, macroeconomics covers large aggregates or collection of economic units which may extend to the entire economy. In the words of Kenneth Boulding, **macroeconomics covers the great aggregates and averages of the economic system rather than individual items.** Here we study collections of variables and economic units (i.e., macro variables) such as national income, employment, level of prices in general, intersectoral flows of goods and services, total savings and investment, and the like. **While the study of an individual firm or an industry lies within the scope of microeconomics, an entire sector falls within the scope of macroeconomics.**

To use a metaphor, macroeconomics studies elephant as one object; microeconomics (like five blind men in a flok tale) studies individual parts of a whole body. Each study leads to different results. Or, to use another metaphor, one enjoys the macro-view of a cricket test match while one enjoys a ball-by-ball description when sitting in before a TV.

1.10 STOCKS AND FLOWS

Economic variables are of two kinds: 1) stocks and 2) flows. **A stock variable is the one which can be measured only with reference to a point of time and not over a period of time. As against this, a flow variable is the one which can be measured only with reference to a period of time and not a point of time.** We come across numerous economic variables which belong to one category or the other. Take the examples of the supply of money and magnitude of wealth. They have reference to point of time. They are, therefore, 'stock' concepts. Correspondingly, examples of flow variables are production, saving, expenditure, income, sales, purchases, etc. All these variables can be measured only over a period of time. A factory can produce so much during, say, a month and not at a given moment of time. A person does not have an income at a point of time. But he has it only for a period of time. A flow concept can assume some value only with the passage of time, not otherwise. One should observe that **stock and flow variables are often used together in economic analysis.**

1.11 STATICS AND DYNAMICS

Economic analysis can be conducted either by using a static framework or a dynamic setting. Static and dynamic modes of analysis can be differentiated in more than one ways. According to one definition, in a static model (theory) the variables (cause effect) are not dated. The demand-supply model of market behaviour is a static model. The model that demand depends on own price, supply depends on own price, with an equilibrium condition that demand must equal supply, time does not enter into the picture at all and the variables are all undated. According to this definition, a dynamic model would be one where the relevant variables are dated. If the demand-supply model is restructured as follows, then the model would become dynamic according to this criterion.

$$D_t = f(P_t)$$

$$S_t = g(P_t)$$

$$D_t = S_t$$

where‘t’ is the relevant time unit.

However, according to some economists, even if the variables are dated the model does not become dynamic. A dynamic model according to this definition would be one where the variables must be dated and a time lag must exist in their relationships. According to this criterion the following would be a dynamic model.

$$D_t = f(P_t)$$

$$S_t = g(P_{t-1})$$

$$D_t = S_t$$

There is **no lag** in the demand relationship. Demand in period ‘t’ depends on own price of the same period. However, in the supply relationship a gestation lag exists which makes the model dynamic. Supply in period ‘t’ depends on price prevailing in the previous period (t–1). The price level in previous period (t–1) would have induced the producers to increase or decrease the supply, full impact of such decisions are visible in time period ‘t’ only. For market to attain equilibrium, demand in period ‘t’ must equal supply in period ‘t’.

Check Your Progress 3

1) State whether the following statements are True or False:

   i) Positive economics is concerned with what ought to be.

   ii) Normative economics requires a system of value judgement for recommending policy steps.

   iii) Every economist prescribes the same remedies for a particular economic problem.

   iv) Positive economies always depict reality.

   v) We can always extend the conclusions of microeconomics to the field of macroeconomics.

   vi) Demand and supply are both stock variables.

   vii) In comparative statics, a comparison of two equilibrium positions is made.

2) Match the item in Column A with those in Column B.

Column A	Column B
i) Study of individual firm and industry	a) Barter
ii) A variable which can be measured at a point of time	b) Macroeconomics
iii) Study of an entire sector of an economy	c) Marginal utility
iv) A variable which can be measured over a period of time	d) Ceteris paribus
v) Want satisfying capacity of a good	e) Flow variable
vi) Satisfaction yielded from consuming one additional unit	f) Microeconomics
vii) Other things being equal	g) Utility
viii) Exchange of apples with eggs	h) Stock variable

3) Which of the following will be the new production possibility frontier, if new technology is developed that enables higher productivity in agricultural (A) only? Industrial output (I) is not impacted.

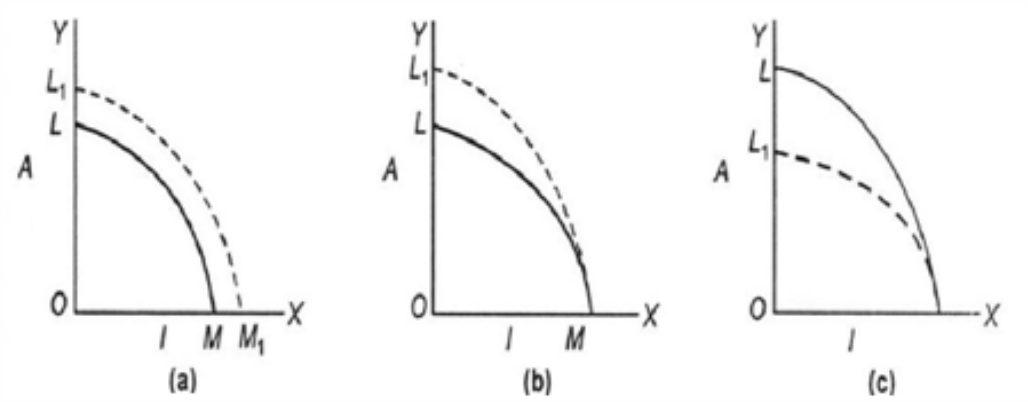

Fig. 1.6

1.12 LET US SUM UP

Economics explains the behaviour of different economic units like consumer, producer, households, firms, governments and the economy as a whole when they are faced with the problem of scarcity. Scarcity is observed in terms of unlimited wants in relation to available scarce resources. Scarcity gives birth to three central problems: What to produce, how to produce and for whom to produce. The other problems aligned with these three problems are the problems growth, choice between public and private goods and the problem of merit goods production. The central problem of an individual as well as for the society is therefore the allocation of scarce means among competing ends. A production possibility curve shows, given scarcity of resources and given technology, the maximum output produced of one good, given the output of other good. It shows how one good can be transformed into another good not physically but via the transfer or shifting of the resources from one line of use to another.

Economic methodology investigates the nature of economics as a science. Economic laws enable us to provide explanation of an event or phenomena in terms of cause and effect relationship. Two types of logics are followed in formulation of economic laws – induction and deduction.

Equilibrium is an important tool of analysis in economics. When the different forces pulling a variable in different directions are in balance, its value stops changing and is said to be in equilibrium.

The term positive economics denotes that part of economic analysis which just describes reality (or theoretical reasoning) without stating the desirability or otherwise of the findings. Normative economics, on the other hand, is concerned with what ought to be. It views reality in the light of chosen goals of society and suggests ways and means of achieving them.

Microeconomics studies the economic activities and responses of individual economic units and their small groups. **Macroeconomics** covers large collections of economic units, their aggregates and averages and macro-variables like national income, employment, and so on.

Economic variables can further be classified into stocks and flows. A **stock variable** is the one which can be measured only with reference to a point of time. A **flow variable**, on the other hand, is measurable only over a period of time.

Static economic or comparative statics is a technique of analysis in which the parameters of the economy are taken to be given. The assumption of ceteris paribus is made and the initial and final equilibrium positions arc compared. In dynamic-economics or dynamic analysis, parameters of the economy are allowed to change.

1.13 REFERENCES

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3) Hal R. Varian, *Intermediate Microeconomics: a Modern Approach, 8th edition*, W.W.Norton and Company/ Affiliated East-West Press (India), 2010.

1.14 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Unlimited, ever increasing

2) Economy refers to the setup created for meeting the basic and permanent problem of an imbalance between means and wants.

3) c)

Check Your Progress 2

1) The central problems of an economy are (i) what to produce, (ii) how to produce, (iii) for whom to produce, (iv) the problems of growth, (v) choice between public and private goods (vi) the problem of merit goods production.

2) Addition in its stock of capital is capital formation.

3) Technique of production refers to exact proportion of factor inputs used in the production of goods.

4) The goods whose consumption benefits both user and non-users are merit goods.

5) Private goods are the goods whose availability is restricted to selected individuals whereas in case of public goods nobody is excluded in the availability of such goods.

Check Your Progress 3

1) i) False ii) True iii) False iv) False – It will depict reality only if its assumptions are realistic. Otherwise it would have only correct reasoning without applicable conclusions. v) False vi) False vii) True

2) i) f ii) h iii) b iv) e v) g vi) c vii) d viii) a

3) b

1.15 TERMINAL QUESTIONS

1) What is an economic system? Explain the central problems of an economy.

2) What are the main characteristics of human wants?

3) Scarcity lies at the root of every economy. Explain.

4) What do you understand by factors of production? Briefly explain each of the four main factors.

5) Write short notes on the following:

   a) Public goods and private goods

   b) Merit goods

   c) Human wants

6) Explain how the solutions to the fundamental problems of an economy are interlinked with each other.

7) Explain the concept of a production possibility curve. Enumerate its assumptions. Illustrate it with the help of an example.

8) Briefly explain how resource allocation takes place in the following systems:

   a) Market economy

   b) Socialist economy

   c) Mixed economy

9) Giving reasons state which of the following statements are true or false:

   i) All human wants cannot be satisfied. It is a universal truth. Why to make a serious effort to satisfy them?

   ii) Only a resource rich economy like Dubai is not faced with the problem of choice.

   iii) The difference between labour force and work force of an economy indicates the size of unemployed persons.

   iv) National Library at Kolkata is a right example of a public good.

   v) MTNL/BSNL produce a private good.

10) Distinguish between positive and normative economics. Which one should be preferred and why?

11) Write short notes on the following :

    a) Concept of Equilibrium

    b) Limitations of Economic Laws

    c) Ceteris Paribus

    d) Tracing the Path of Change

12) Distinguish between :

    a) Microeconomics and Macroeconomics

    b) Static Economics and Dynamic Economics

13) State the reasons on account of which almost every modern economy is a dynamic one.

14) In what forms opportunity costs manifest themselves for the consumer, the producer, the investor, and a factor of production?

UNIT 2 DEMAND AND ELASTICITY OF DEMAND

Structure

2.0 Objectives

2.1 Introduction

2.2 The Nature of Demand

2.3 Demand Function or Determinants of Demand
- 2.3.1 Determinants of Demand for a Consumer
- 2.3.2 Determinants of Demand in a Market

2.4 Law of Demand
- 2.4.1 The Demand Schedule
- 2.4.2 The Demand Curve
- 2.4.3 Why does a Demand Curve Slope Downwards?

2.5 Change in Quantity Demanded and Change in Demand

2.6 Concept of Elasticity of Demand
- 2.6.1 Price Elasticity of Demand
- 2.6.2 Income Elasticity of Demand
- 2.6.3 Price Cross-Elasticity of Demand

2.7 Measurement of Price Elasticity of Demand

2.8 Determinants of Price Elasticity of Demand

2.9 Importance of Price Elasticity of Demand

2.10 Let Us Sum Up

2.11 References

2.12 Answers or Hints to Check Your Progress Exercises

2.13 Terminal Questions

2.0 OBJECTIVES

After studying this unit, you will be able to:

- distinguish between want and demand;
- explain the law of demand with the help of a demand schedule and a demand curve;
- identify the movement along a demand curve and a shift of the demand curve;
- state the various types of elasticity of demand and various methods of measurement; and
- explain the importance of the concept of elasticity of demand.

*Shri I.C. Dhingra, Rtd., Associate Professor, Shaheed Bhagat Singh College (University of Delhi), Delhi.

2.1 INTRODUCTION

Satisfaction of human needs is the basic end and goal of all production activities in an economy. As we have learnt in Unit 1, human wants are unlimited and recurring in nature, whereas means available to satisfy them are limited. Therefore, a rational consumer has to make an optimal use of available resources. The demand theory provides a framework within which these decisions have to be made. Hence, in this unit we shall discuss the various issues related to the theory of demand.

2.2 THE NATURE OF DEMAND

At first, let us understand the meaning of the terms like desire, want, and demand. Desire is just a wish on the part of the consumer to possess a commodity. If the desire to posses a commodity is backed by the purchasing power and the consumer is also willing to buy that commodity, it becomes want. The demand, on the other hand is the wish of the consumer to get a definite quantity of a commodity **at a given price in the market** backed by a sufficient purchasing power.

There are three important points about the quantity demanded which should always be kept in mind. **First,** it is the quantity demanded, which is desired to be purchased by the consumers that we consider rather than the quantity which the consumers actually succeed in purchasing. Thus, quantity demanded is the desired purchase and the quantity actually bought is referred to as actual purchase.

Secondly, quantity demanded is always considered as a flow variable which is measurable over a period of time. Thus, for instance, when we say that demand or quantity demanded of oranges is 10, it must be per day or per week, etc.

Thirdly, the quantity demanded of a commodity has an economic meaning only at a given price. For example, to say that the quantity demanded of oranges is 10 units over a week has no meaning unless we specify the price of oranges per dozen or per unit. In short, the demand for oranges equal to 10 units per week at a price of Rs. 100 per dozen is a full and meaningful statement, as used in microeconomic theory.

2.3 DEMAND FUNCTION OR DETERMINANTS OF DEMAND

The demand of a product is determined by a number of factors. Let us discuss them in detail.

2.3.1 Determinants of Demand for a Consumer

The demand for commodity or the quantity demanded of a commodity on the part of the consumer is dependent on a number of factors. These are mentioned as follows:

i) Price of the commodity in question

ii) Prices of other related commodities

iii) Income of the consumers, and

iv) Taste of the consumers.

Introduction

Demand function refers to the rule that shows how the quantity demanded depends upon above factors. A demand function can be shown as:

$$D_x = f(P_x, P_y, P_z, M, T)$$

where, D_x is quantity demanded of X commodity, P_x is the price of X commodity, P_y is the price of substitute commodity, P_z is price of a complement good, M stands for income, and T is the taste of the consumer.

If all the factors influencing the demand for the commodity X are allowed to vary simultaneously, the picture would look highly complicated. Therefore, normally what we do is to allow one of the factors to change on the assumption that all other factors remain unchanged, or, as an economist will state it by using the term, 'ceteris paribus' (other things remaining equal).

Demand Relationship: Relationship of quantity demanded of a commodity to its various determinants can be stated as follows:

1) **Price of the commodity:** The price of the commodity has an important influence on the quantity demanded by a consumer. Normally, the higher the price of the commodity, the lower the demand of the commodity. This, as will be explained latter, is referred to as the operation of the law of demand. The law of demand is always stated on the assumption that the other factors influencing demand remain constant.

2) **Size of the consumer's income:** The demand for a commodity is also influenced by the size of the income of the consumer. In cases where the increase in income of the consumer leads to an increase in the quantity demanded of the commodity it is referred to a case of a 'normal commodity'. At times an increase in the size of the income leads to a fall in the quantity demanded of the commodity. Such a situation is possible when the commodity in question is what is referred to as an 'inferior commodity'.

3) **Prices of other commodities:** A consumer's demand for a commodity is equally influenced by the prices of the commodities other than the commodity in question.

> Complementary goods are those goods whose utility depends upon the availability of both the goods together. The demand for a commodity bears an inverse relationship with the price of the complementary goods.
>
> Substitute goods are those goods which can be used with equal ease in place of one another. Demand for a good will bear a direct relationship to the price of its substitute good.

In some cases, the demand for the commodity in question will increase as the price of the other commodities increases while in other cases, the demand for the commodity will decrease as the price of the other commodity increases. The first case is a situation of what is called a 'substitute' and the later case is a situation of what is called a 'complement'. Tea and coffee are examples of substitutes while car and petrol or ink pen and ink are examples of complements.

4) **Tastes of consumer:** The demand for a commodity is also influenced by the tastes of the consumer. If a consumer has developed a taste for a particular commodity, he/she will demand more of that commodity. Similarly, if a consumer has changed his taste against a particular commodity, less of it will be demanded at a particular price.

The change of tastes can be illustrated with the help of an example. The consumers have developed taste for coloured T.V. so that even if its price rises consumers will still buy more of it. Taste for coloured T.V. has developed at the cost of black and white T.Vs.

2.3.2 Determinants of Demand in a Market

The factors determining the demand for a commodity in a market are the same as those which determine the demand for the commodity on the part of a consumer. Besides that two additional factors are also to be included. These two factors are:

1) **Size of the population:** All other factors remaining unchanged, the greater is the size of the population, more of a commodity will be demanded. Size of the population itself is dependent on so many other factors.

2) **Income distribution:** It is a little difficult concept to explain. In simple terms, it implies how the National Income (the factor income of the nationals of an economy over a year) is distributed among lower and higher income groups of people.

More unequal is distribution of income, more will be the demand for the commodities which are purchased by the rich. Such commodities may be cars, refrigerators, air conditioners etc. Less unequal is distribution of income, more will be the demand for the commodities which is purchased by relatively poorer people. Such commodities may be food items like wheat and rice, fans, bicycles etc.

It may be observed that if all the variables that influence demand are not included in the demand function or if the parameters are not correctly estimated, the demand equation will not predict demand accurately, sales forecasts will be in error, and incorrect expansion and operating decisions will be made.

Check Your Progress 1

1) Distinguish between want and demand of a commodity.

.....

.....

.....

2) What are the determinants of demand of a commodity by an individual consumer?

.....

.....

.....

3) Explain the factors influencing the market demand of a commodity.

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.....

.....

4) Which of the following curves shows the income demand for inferior goods?

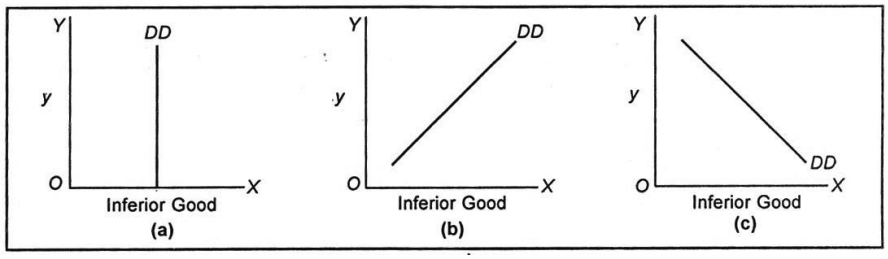


Fig. 2.1

5) If the air travel fare between Bengaluru and Delhi falls significantly, how will it affect (i) demand for rail travel and (ii) demand for air travel. Show graphically.

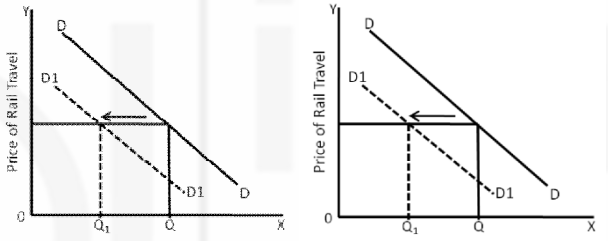


Fig. 2.2

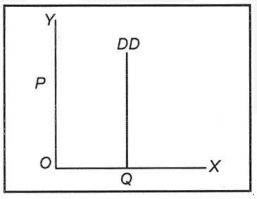
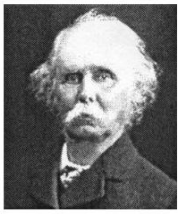


Fig. 2.3

2.4 LAW OF DEMAND



Alfred Marshall

Among the factors influencing demand for a commodity explained above, the most important factor is price of the commodity in question. Generally speaking, in almost all commodities, the quantity demanded of a commodity increases as the price of the commodity falls and vice versa, where price of other commodities, income of the consumer and tastes of the consumer remaining unchanged. The reason of this tendency will be explained below. This inverse relation between the quantity of the commodity and amount of money demanded is called the. 'Law of Demand'. In short, the law of demand can thus be stated as follows: Other things remaining equal, there obtains inverse relationship between the price of a commodity and its quantity demanded.

2.4.1 The Demand Schedule

Let us use imaginary figures to show the application of the law of demand. Table 2.1 given below, showing the application of the law of demand, is called the 'Demand Schedule'.

Table 2.1 : The Demand Schedule of a Consumer for Apples

Price of Apple per Kg. (in Rs.)	Quantity Demanded of Apples (in Kg. per week)
100	15
200	12
300	8
400	3

There are four combinations of price and quantity demanded shown in the Table 2.1. If we study this table, we can easily infer that as price of an apple is rising quantity demanded of apples on the part of the consumer is falling. Thus, the figures chosen are such that the law of demand is applicable.

2.4.2 The Demand Curve

The demand curve states the relationship between the quantity of a good that consumers are willing to buy and the price of the good. Let us understand the demand curve with the help of the Fig. 2.4. In this figure, on the Y-axis, price of an apple in rupees in measured and on the X-axis the quantity demanded of apples per week on the part of a consumer is measured. The first combination of Table 2.1 is shown by point a where at Rs. 100 per kg 15 units of apples are demanded. Similarly points b, c, d represent combinations of Rs. 200 price – 12 quantity demanded, Rs. 300 price – 8 quantity demanded and Rs. 400 price – 3 quantity demanded, respectively. The joining together of points a, b, c, and d give us what is called the demand curve. Thus DD is the demand curve.

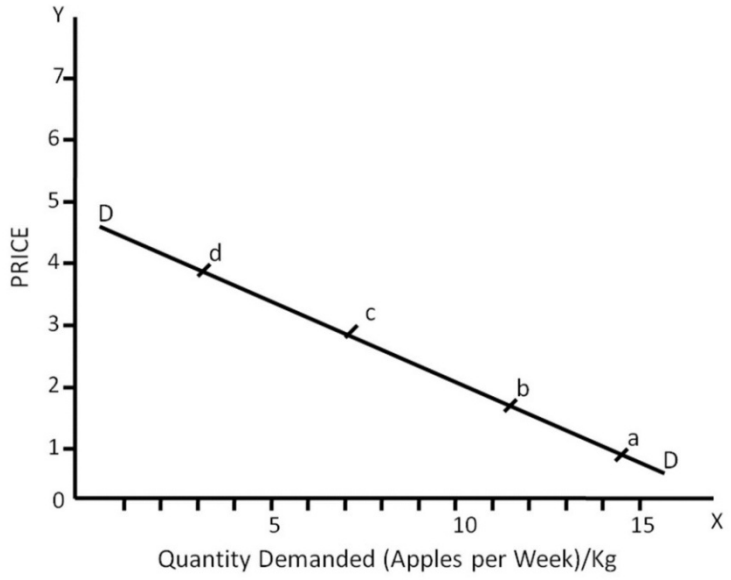


Fig. 2.4

The most important feature of a demand curve is that it slopes downward from left to right. In Fig. 2.4 the demand curve has been shown as a straight line. But the demand curve need not always be a straight line. It can also be in the form of a curve as shown in Fig. 2.5.

Whether a demand curve is a straight line or a curve depends on how much quantity demanded rises with the fall of its price or how much quantity

demanded falls with the rise in the price of the commodity. Whether we take Fig. 2.4 or 2.5, in both the cases the law of demand is applicable.

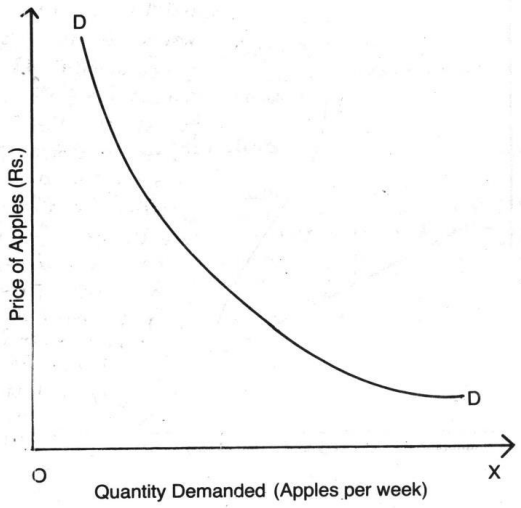


Fig. 2.5

Example : The demand schedules for ice cream for two individual households in a given period are given below. Suppose, there are only two households that demand ice cream. Draw market demand schedule and curve for ice creams.

We will estimate the market demand schedule as follows:

Price (Rs)	Quantity Demanded by			Market Demand
	Household A		Household B	
3	4	+	5	=9
4	3	+	4	=7
5	2	+	3	=5
6	1	+	2	=3

Market demand curve is a horizontal summation of individual demand curves, as illustrated below

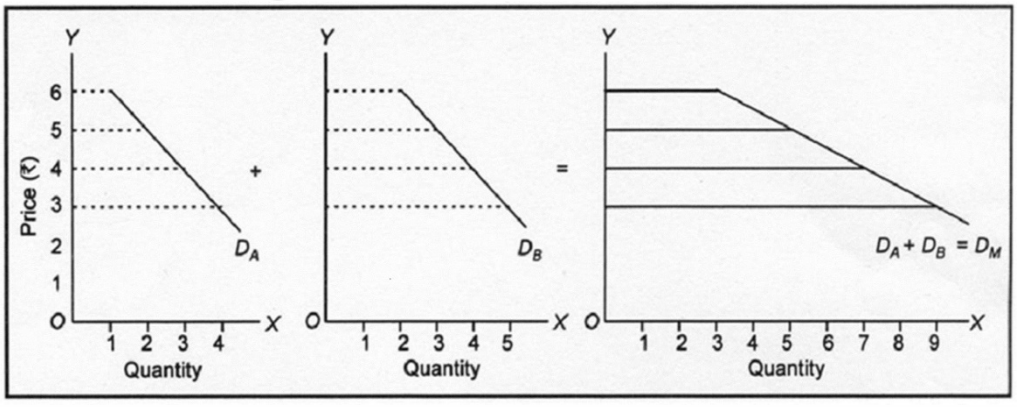


Fig. 2.6

2.4.3 Why does a Demand Curve Slope Downwards?

Law of demand states that there is an inverse relationship between the price of a commodity and its quantity demanded. Traditional demand Theory explained

this relationship with the help of cardinal utility analysis. Modern demand Theory explained it with the help of three concepts as explained below:

1) Substitution Effect

Substitution effect results from a change in the relative price of a commodity. Suppose a Pepsi Can and a Coke Can both are priced at Rs. 20 each. If the price of Coke is raised to Rs. 25, and the price of Pepsi is not changed, Pepsi will become relatively cheaper to Coke, i.e. although the absolute price of Pepsi has not changed, the relative price of Pepsi has gone down. The change, in the relative price of commodity causes substitution effect.

When the price of a commodity say mango falls, prices of other fruits remaining constant, the consumer buys more mangoes by buying less of other fruits. This happens because mango starts looking relatively cheaper to him. This can also be stated by saying that the consumer substitutes mango for other fruits when the price of mango drops. This effect is called 'substitution effect'. This is the main reason for the consumer to buy more of mango, when the price of mango falls, provided prices of other fruits remain unchanged.

2) Income Effect

Given the money income of the consumer, as price of mango falls the purchasing power of that given money income rises. In other words, as price of mango falls, given money income of the consumer, his real income rises. Thus, he can buy more of the mangoes with the same money income and consequently, there is tendency for the demand for mangoes to rise.

This rise in real income with the fall in price of the commodity is called the **'income effect'**. The rise in money income has the same impact on the quantity demanded of a commodity as the rise in real income. Such a commodity whose quantity demanded rises with the rise in money or real income is called a 'normal commodity'. The income effect in such a case is called **positive income effect**. It is positive because there is a direct relationship between the income and the quantity demanded. In a case when rise in money or real income leads to a fall in the quantity demanded of a commodity, we have a case of **negative income effect**. The negative income effect operates in the case of an **'inferior commodity'**. An unbranded cardigan is an inferior commodity in comparison to a branded cardigan.

3) Price Effect

Price Effect is the sum total of the substitution effect and income effect, i.e.

$$PE = SE + IE$$

Where PE = Price Effect

SE = Substitution Effect

IE = Income Effect

Substitution effect and income effect are combined together to get what is called **'price effect'** which relates the quantity demanded of a commodity to the price of the commodity. It is important to note that substitution effect and

income effect do not operate in a sequence, when the price of a commodity changes. In fact, **both substitution and income effects operate simultaneously** with the change in the price of the commodity. **'Substitution effect',** and **'income effect'** taken together give 'price effect.' We can identify three cases.

1) Substitution effect always operates in a manner such that as price falls, quantity demanded of this commodity increases. If along with substitution effect, we take income effect and if that happens to be positive (a case of normal commodity) the law of demand will necessarily apply.

2) Given substitution effect, if income effect is negative (a case of an 'inferior commodity') the law of demand can still apply provided the substitution effect outweighs or is more powerful than the negative income effect, and

3) Given substitution effect, if income effect is negative (a case of an 'inferior commodity') the law of demand will not apply provided negative income effect outweighs or is more powerful than the substitution effect.

Each of these concepts have been explained in great details in Unit 5 and 6.

GIFFEN GOOD

A case where negative income effect outweighs substitution effect is possible when we have 'Giffen good' named after the Robert Giffen who first talked of such paradox. In case of a Giffen Good the fall in price of a commodity need not lead to an increase in the quantity demanded of the commodity. On the contrary, a fall in the price of a Giffen good may result in a fall in demand for this good.

2.5 CHANGE IN QUANTITY DEMANDED AND CHANGE IN DEMAND

Whenever the demand for a commodity changes because of the change in the price of the commodity, it is called 'change in quantity demanded'. On the other hand, when the demand of the commodity changes because of change in factors other than the price of the commodity it is called 'change in demand'.

Expansion and Contraction in Demand

The change in quantity demanded of a commodity may take the form of expansion or contraction in demand. Expansion in demand takes place when with a fall in the price of a commodity, quantity demanded rises. Conversely, with a rise in the price of a commodity, its quantity demanded falls.

Expansion and contraction in demand can be represented in the form of a movement on a demand curve, as shown in Fig. 2.7.

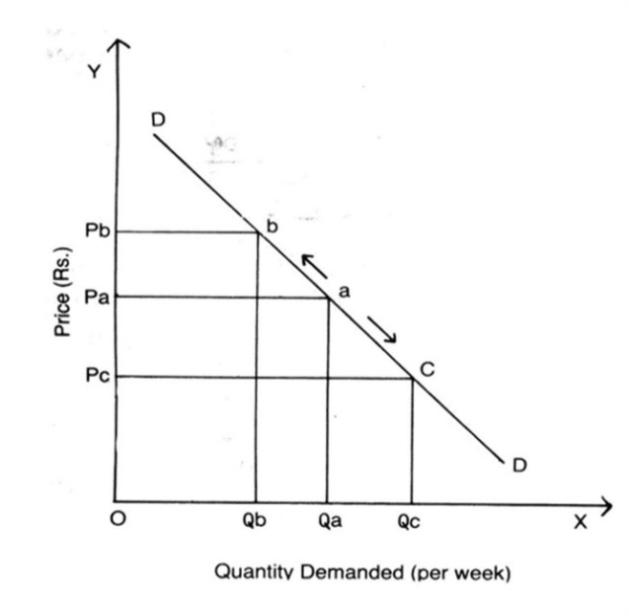


Fig. 2.7

On X-axis quantity demanded of a commodity is measured and on Y-axis price of the commodity is measured in rupees. DD is the demand curve. At point 'a' on the demand curve we find that at price OP_a, OQ_a of a commodity is demanded. As price falls to OP_c, demand becomes OQ_c. This movement from point a to point c on the demand curve DD is referred to as 'extension in demand'. It is also indicated by the arrow from a to c. Similarly when price of a commodity rises to OP_b, demand falls to OQ_b. Thus the movement from a to b on the demand curve DD is known as 'contraction in demand'.

Change in Demand

Change in demand takes place when the whole demand condition undergoes a change. This change occurs due to a change in any determinant of demand, except the price of that commodity.

Change in demand may take two forms:

(i) Increase in demand, and (ii) Decrease in demand

Increase in demand takes place when;

a) at a given price, higher quantity is demanded, or

b) at a higher price, the same quantity is demanded

Decrease in demand takes place when:

a) at a given price, lower quantity is demanded, or

b) at a lower price, the same quantity is demanded

Graphically, increase in demand results in rightward shift of the whole demand curve. Likewise, decrease in demand results in leftward shift of the demand curve. This is shown in the Fig. 2.8

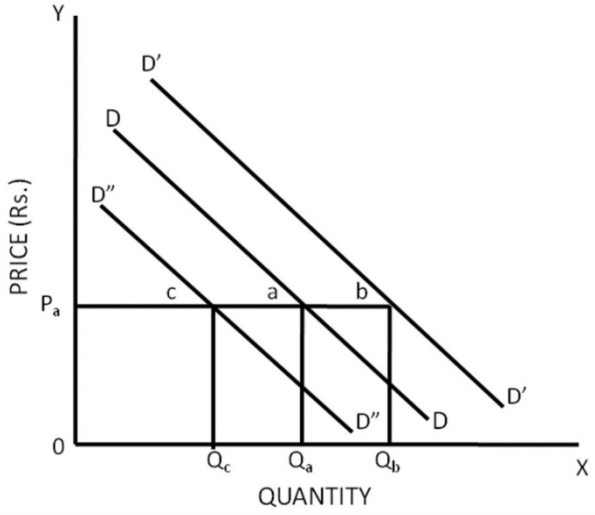


Fig. 2.8

As usual, quantity demanded of a commodity is measured on X-axis. On Y-axis price of a commodity is measured in rupees. At price Pa, on the demand curve DD at point 'a', quantity demanded is OQa and at the same price OPa 'quantity demanded rises to OQb at point c on the demand curve D'D'. This rise in demand is called 'increase in demand'. Similarly, at price OPa the quantity demanded comes down to OQc on point b of demand curve D"D". This change in quantity demanded form OQa to OQc is 'decrease in demand'. The shift of the demand curve to the right of the initial demand curve is called 'increase in quantity demanded' and a movement of the demand curve to the left of the initial demand curve is called 'decrease in demand'.

There can be a number of factors responsible for the shift of the demand curve. Some of the factors are given below:

1) Increase in quantity demanded or shift in the demand curve to the right can be because of increase in money income of the consumer. An increase in money income of the consumer enables him to demand more of a commodity at a given price. Similarly, decrease in quantity or shift in the demand curve to the left can be because of decrease in money income of the consumer.

2) A rightward shift in the demand curve can also take place because of increase in price of a substitute or decrease in price of a complement good. Similarly, a leftward shift in the demand curve can be because of decrease in price of a substitute or increase in price of a complement good.

3) If the consumer has developed a taste for a commodity, he can start demanding more of that commodity even if the price remains unchanged. Thus, a rightward shift in the demand curve can be caused by the fact that the consumer has developed a taste for the commodity in question. Similarly, a leftward shift in the demand curve can be the result of the fact that the consumer has started disliking the commodity. It may be remembered that we have been considering movements of only the demand curve of an individual consumer. The market demand curve and its movements are not been discussed here.

Check Your Progress 2

1) Given the demand function

$q = 90 - 3P$

i) at what price, no one will be will be willing to buy any commodity

.....

ii) what will be the quantity demanded, if the commodity is given free.

.....

2) State whether the following statements are True or False:

i) The law of demand states that there is an inverse relationship between the price of a commodity and its quantity demanded.

ii) The demand curve is always straight line sloping downwards from left to right.

iii) If substitution effect outweighs positive income effect, the law of demand does not operate.

iv) Substitution effect + Price effect = Income effect.

v) If the price of a substitute falls, the quantity demanded of a commodity falls.

vi) Change in taste leads to a movement along the demand curve.

vii) If increase in consumer's surplus is less than the amount of subsidy given by the government, subsidy needs to be given to an industry.

viii) If quantity produced is more than the quantity demanded at a particular price, the government should reduce the price of the commodity.

2.6 CONCEPT OF ELASTICITY OF DEMAND

The elasticity of demand is the responsiveness of a dependent variable (demand) to a given change in an independent variable (price of a commodity, income of the consumer or prices of a commodity other than the commodity in question). An elasticity measures the sensitivity of one variable to another. Elasticity is therefore worked out in terms of a percentage or proportionate change in the dependent variable to a given percentage or proportionate change in the independent variable.

Corresponding to the three important determinants of demand we can talk about three important concepts of elasticity of demand. They are (i) Price elasticity of demand, (ii) Income elasticity of demand, and (iii) Cross elasticity of demand.

2.6.1 Price Elasticity of Demand

Price elasticity of demand is a measure of responsiveness of quantity demanded of a commodity to a change in the price of the commodity. This can be measured as the proportional (or percentage change) change in quantity demanded of a commodity divided by the proportional or percentage change in the price of the commodity. The result is called the price elasticity coefficient of demand. It can be estimated as follows:

Let price elasticity coefficient be represented by E_p where P stands for price and E for elasticity of demand. Then

$$E_p = \frac{\text{Proportional change in quantity demanded of a commodity}}{\text{Proportional change in price of the commodity}}$$

Symbols can be used to express proportional changes. Let the difference between the new quantity demanded and the old quantity demanded be represented by ΔQ and the original demand be represented by Q, then proportional change in quantity demanded of commodity is $\frac{\Delta Q}{Q}$. Similarly let us represent the difference between the new price and the old price by ΔP and the original price be represented by P, then the proportional change in price is $\frac{\Delta P}{P}$.

If proportional change in quantity demanded of a commodity is divided by proportional change in price, then price elasticity of demand E_p is:

$$E_p = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$$

The above expression can also be represented as:

$$E_p = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$$

Since the price of a commodity and its quantity demanded are inversely related, minus sign will appear either in the denominator or in the numerator. Therefore, in the final form, price elasticity of demand (E_p) would always be negative:

$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Interpretation of price elasticity coefficient

The value of E_p may vary from Zero ($E_p = 0$) to infinity ($E_P = \infty$). For sake of convenience we can classify these in following five groups.

1) $E_P = 0$. This happens when the quantify demanded does not change at all with a change in the price of the commodity. This situation is called perfectly inelastic demand. Graphically it can be represented in the form of a vertical straight line demand curve as shown in Fig. 2.9. This would be seen that the quantity demanded of commodity remains unchanged at OQ, irrespective of the change in the price of the commodity.

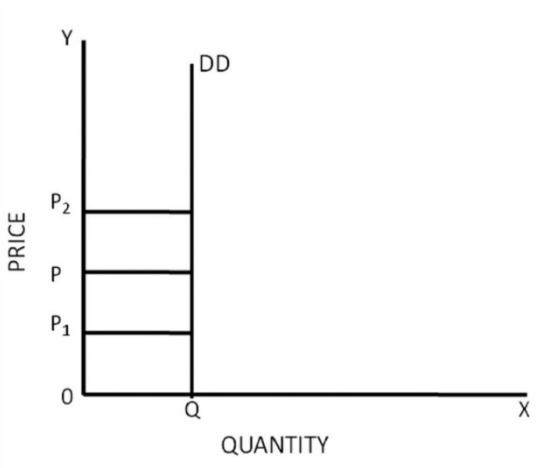


Fig. 2.9

2) E_p greater than zero but less than one – ($E_p > 0 < 1$). This value is obtained when the percentage change in quantity demanded is less than the percentage change in price. For example, a 10 per cent fall in price may induce 8 per cent rise in quantity demanded. This type of demand is known as less than unit elastic.

3) E_p equal to one ($E_p = 1$). This value is obtained when the percentage change in quantity demanded equals the percentage change in price. A 10 per cent fall in price induces a 10 per cent increase in quantity demanded. This type of demand is said to be equal to unit elastic.

4) E_p more than one ($E_p > 1$). This type of elasticity of demand is obtained when the percentage change in quantity demanded is more than the percentage change in the price of a commodity. For example, a 10 per cent reduction in the price of quality chocolate may result in a 30 per cent increase in the quantity demanded of chocolates. In this case, $E_p = \frac{30\%}{10\%} = 3$. This type of demand is called more than unit elastic demand.

5) E_p equal to infinity ($E_p = \infty$). This type of elasticity of demand obtains when a small change in price results in infinite changes in quantity demanded. Alternatively, it can be represented as a situation in which it is not possible to determine the quantity that would be demanded at a given price. This type of demand is also called perfectly elastic demand. Perfectly elastic demand can be represented graphically with the help of a horizontal straight line, as shown in Fig. 2.10.

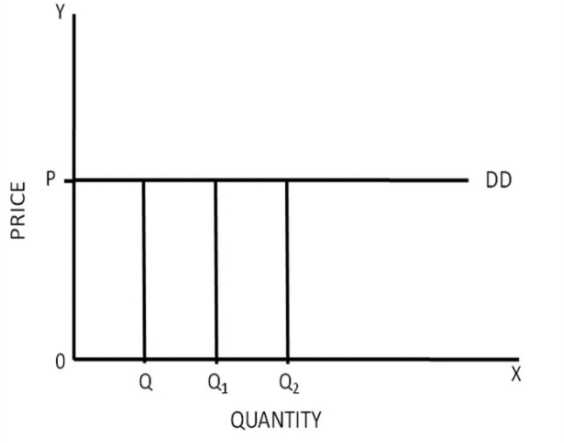


Fig. 2.10

Interpretation of Price elasticity of demand (E_p)

The value of E_p is of significant use, especially in business decision-making. What does $E_p = 1.2$, for example, mean?

The answer is: If the price of a commodity it raised by 1 per cent, quantity demanded of this commodity will fall by 1.2 per cent. Similarly, if the price of a commodity is reduced by 10 per cent, the quantity demanded of this commodity may increase by 12 per cent.

2.6.2 Income Elasticity of Demand

Income elasticity of demand refers to percentage change in the quantity demanded resulting from percentage increase in income. In other words income elasticity of demand is the responsiveness of quantity demanded of a commodity to a change in income of the consumer. It can be measured as the proportional (or percentage) change in quantity demanded of a commodity divided by the proportional change in income of the consumer. The resultant coefficient is called the income elasticity coefficient. Let us use symbols to represent income elasticity of demand (E_i) where i stands for income and E for elasticity of demand. Thus, E_i is:

$$E_i = \frac{\text{Proportinal change in Quantity Demanded}}{\text{Proportional change in income}} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta Y}{Y}}$$

$$= \frac{\Delta Q}{Q} \times \frac{Y}{\Delta Y}$$

$$= \frac{\Delta Q}{\Delta Y} \times \frac{Y}{Q}$$

Where ΔY is the change in income of the consumer, Y is the original income, ΔQ is the change in quantity demanded of a commodity and Q is the original demand.

Income elasticity coefficient may have a positive value (>0) or a negative value (<0). The plus and minus sign alongwith E_i assume great significance. If we are told that:

i) $E_i = +1.8$, we can assume that the commodity in question is a normal good.

ii) $E_i = -1.8$, we can assume that the commodity in question is an inferior good.

iii) $E_i = 0$, we can assume that there is no relationship between the income of the consumer and the quantity demanded of the commodity (.. Bare necessities of life).

2.6.3 Price Cross-Elasticity of Demand

Price cross-elasticity of demand refers to percentage change in the quantity demanded of one good resulting from some per cent increase in the price of another. In other words, the cross-elasticity of demand is the responsiveness of quantity demanded of the given commodity to a change in the price of a related good (it may be a substitute or a complementary good). It can be measured as proportional or percentage change in the quantity demanded of a commodity

say X divided by the proportional or percentage change in the price of related commodity say Y. Let us use symbol ($E_{Q_x P_y}$) to represent price cross-elasticity of demand. Thus, $E_{Q_x P_y}$ is:

$$E_{Q_x P_y} = \frac{\text{Proportional change in quantity demanded of the commodity X}}{\text{Proportional change in price of commodity Y}}$$

Cross-elasticity of demand can be illustrated with the help of a numerical example. Look at Illustration 3 for the calculation of cross-elasticity of demand.

Illustration 3	Price of Tea in Rs.	Quantity Demanded of Coffee (in Grams)
	20	200
	19	150

The given price of tea is Rs. 20 per 100 grams, suppose further that its price falls to Rs. 19; quantity demanded of tea may rise from 500 grams to 600 grams a week. Now coffee is a substitute, of tea. If price of coffee remains unchanged, quantity demanded of coffee may fall from 200 grams to 150 grams. It has happened because quantity demanded of tea has increased. We can easily realise that the fall in the price of tea from Rs. 20 to Rs. 19 has reduced the quantity demanded of coffee from 200 grams to 150 grams.

The change in quantity demanded of coffee is 150 – 200 = –50; the change in price of tea is 19 – 20 = – 1, original quantity demanded of coffee is 200 grams and the original price of tea is Rs. 20. Thus, price cross-elasticity of demand is:

$$E_{Q_x P_y} = \frac{\Delta Q_X}{\Delta P_Y} \times \frac{P_Y}{Q_X}$$

where X is coffee and Y is tea. Thus

$$E_{Q_x P_y} = \frac{-50}{-1} \times \frac{20}{200} = 5$$

It is worth noting that in the given case, the co-efficient of cross-elasticity of demand is positive or there is a positive relationship between the price of tea and quantity demanded of coffee. Whenever the co-efficient of cross-elasticity of demand is positive, it is a case of what is called substitutes; in the above case, tea and coffee are substitute commodities.

Let us now consider the case of complements. Petrol is a complementary good for motorbikes. Price cross-elasticity of demand for petrol in response to change in price of motorbike can be estimated as follows:

Illustration 4	Price of Motorbike in Rs.	Quantity Demanded of Petrol in Litres
	80,000	5,000
	75,000	5,500

The change in quantity demanded of petrol is 5,500 – 5,000 = 500 litres. The change in price of motorbike is Rs. 75,000 – Rs. 80,000 = Rs.(–)5,000, the original quantity demanded of petrol is 5,000 litres, original price of motorbike is Rs. 80,000. Thus, cross-elasticity of demand ($E_{Q_x P_y}$) is:

$$E_{Q_x P_y} = \frac{\Delta Q_X}{\Delta P_Y} \times \frac{P_Y}{Q_X}$$

Where X is petrol and Y is motorbike

$$E_{Q_x P_y} = \frac{500}{5000} \times \frac{80000}{-5000} = -1.6$$

In this case the cross-elasticity co-efficient is negative or there is an inverse relationship between the price of motorbike and quantity demanded of petrol. Whenever the co-efficient of cross-elasticity of demand is negative, it is a case of complements. In the above case, car and petrol are complementary commodities.

In short:

i) If cross elasticity coefficient between two commodities is positive, the two commodities are substitutes (as Pepsi and Coke, or Samsung and Apple Tablets), and

ii) If cross elasticity coefficient between two commodities is negative, the two commodities are complementary goods (as motorbike and petrol, cell phone and sim card, heir die and shampoo, etc.)

2.7 MEASUREMENT OF PRICE ELASTICITY OF DEMAND

There are a number of methods to measure price elasticity of demand. Some of the important methods are as follows:

1) **Point Method:** Also known as the percentage method (as discussed above), the main point to remember about this method is that it is employed only when the changes in price and quantity demanded are very small.

2) **Total Expenditure Method:** The outlay method to measure price elasticity of demand is used whenever the changes in price and demand are not small. Another point to remember about the outlay method is that it cannot help us to find out the co-efficient of price elasticity of demand. It only helps us to distinguish three situations (i) whether the price elasticity of demand is one or unity, (ii) whether the price elasticity of demand is more than one or more than unity and (iii) whether the price elasticity of demand is less than one or less than unity. This method can be explained with the help of numerical example. Study Illustration 1, 2 and 3 for this purpose.

Illustration 1

Price in Rs.	Quantity Demanded of a Commodity (Units)	Outlay in Rs.
5	20	5 × 20 = 100
4	25	4 × 25 = 100

Illustration 2

Price in Rs.	Quantity Demanded of a Commodity (Units)	Outlay in Rs.
5	20	5 × 20 = 100
4	22	4 × 22 = 88

Illustration 3

Price in Rs.	Quantity Demanded of a Commodity (Units)	Outlay in Rs.
5	20	5 × 20 = 100
4	30	4 × 30 = 120

In the above illustrations, we can see that as price of a commodity falls, the quantity demanded of the commodity rises.

In illustration (1) with fall in price of the commodity from Rs. 5 to Rs. 4, the total money spent on the commodity or outlay remains at Rs. 100. It is a situation of what is called unit price elasticity of demand.

In illustration 2, with fall in price of the commodity from Rs. 5 to Rs. 4 the total money spent on commodity or outlay falls from Rs. 100 to Rs. 88. It is a situation of less than unit price elasticity of demand.

Finally, in illustration 3 with the fall in price of the commodity from Rs. 5 to Rs. 4, the total money spent on the commodity or outlay rises from Rs. 100 to Rs. 120. It is a case in which price elasticity of demand is more than unit.

3) **Geometrical Method:** According to this method, elasticity of demand is different at different points on a given demand curve, and is measured as follows on any point of a straight line curve.

$$E_p = \frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$$

In Fig. 2.11 E_p at point K = KB/AK

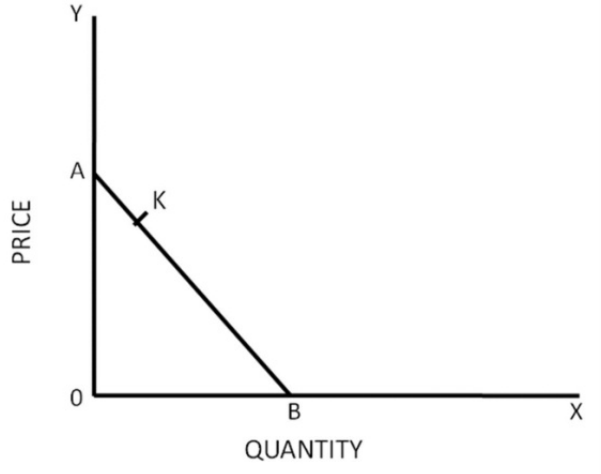


Fig. 2.11

And since KB > KA, the result will be more than 1. We will say E_p at Point K is more than unit elastic. We can use the same method to estimate price elasticity at different points, as shown in Fig. 2.12.

We have marked E at a few selected points in Fig. 2.12. E at the mid-point of a linear demand curve would be equal to unit; it would be zero where the demand curve touches the X-axis, and infinite where the demand curve touches the Y-axis. On any point between A to C, $E_p > 1$; on any point between B and C, $E_p < 1$.

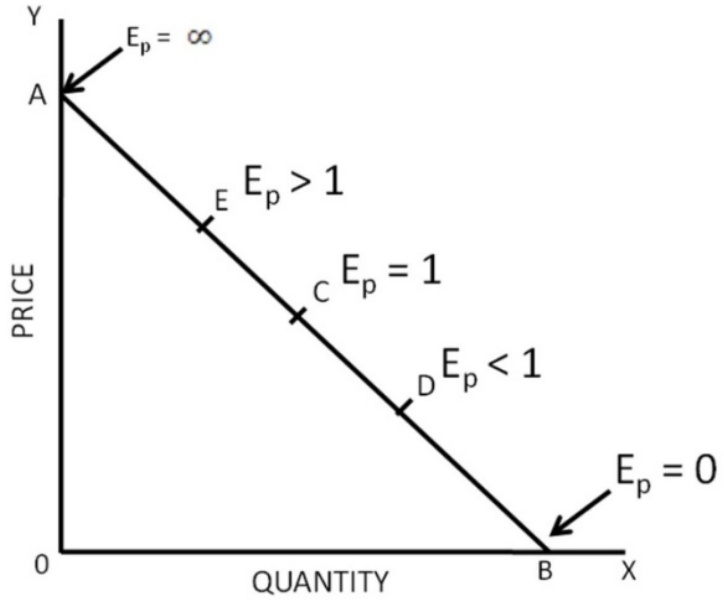


Fig. 2.12

A Case of Unit Price Elastic Demand Curve

Using the outlay method discussed above, we can analyse the case of unitary price elastic demand curve. Look at Fig. 2.13.

On X-axis quantity demanded of the commodity is measured and at the Y-axis it is the price of the commodity which is measured. DD is the demand curve. At point a on the demand curve at OP_0 price OQ_0 quantity is demanded. The total money spent on the commodity or outlay is $OP_0 \times OQ_0$ which is geometrically equal to the area of the rectangle which has sides equal to OP_0 and OQ_0. This area is given by $OQ_0 aP_0$. Now, if price of the commodity falls to OP_1 at which quantity demanded is OQ_1, which is given by point b on the demand curve, then outlay is given by OQ_1bP_1. If the outlay at a which is OQ_0aP_0 is equal to outlay at b which is OQ_1bP_1 then price elasticity of demand at point a and b is unit elastic. If all such rectangles are constructed whose area is equal to each other, then the curve drawn joining all such points give us a demand curve which has the same price elasticity of demand throughout the curve. Such a curve is known as a demand curve which has unitary price elasticity of demand. Such a demand curve is also referred to as 'Rectangular Hyberbola'.

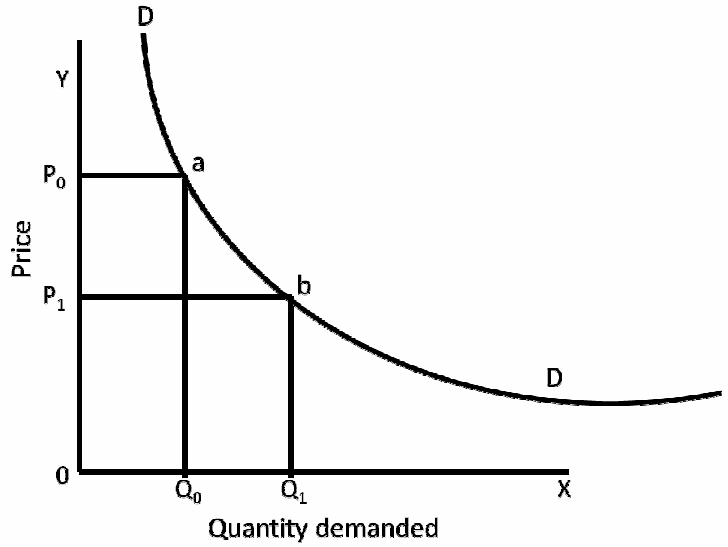


Fig. 2.13: Unit Price Elasticity of Demand

2.8 DETERMINANTS OF PRICE ELASTICITY OF DEMAND

There are a number of factors on which the price elasticity of commodity depends. Some of the important factors affecting price elasticity of demand are discussed below:

1) **Nature of the Commodity:** The commodities are normally divided into three categories (i) necessities, (ii) comforts, and (iii) luxuries. If the commodity happens to be a necessity, price elasticity of demand will be less. Take the case of wheat. Even if the price of wheat rises people will not be able to reduce much the quantity demanded of wheat and therefore, the demand for wheat is relatively less elastic. In the case of comforts, the change in price makes the consumer change the quantity demanded relatively more and so it is more elastic. As regards luxuries, since they are purchased by people who have higher income the demand does not change much with change in price and thus tend to be less price elastic.

2) **Number of Substitutes:** Commodities with few and poor substitutes – wheat and salt, for example, will always tend to have low price elasticity of demand. Commodities with many substitutes – wool, for which cotton and synthetics can be substituted for example, will have relatively high price elasticity of demand.

3) **Number of uses of a commodity:** The greater the number of possible uses of a commodity, the greater its price elasticity of demand will be. Thus a commodity, such as coal – which can be used in producing power generation, domestic purposes and industrial purposes – will have higher price elasticity of demand than a commodity with only one or a very few uses – butter, for instance.

4) **Price level of a commodity:** The level of price will also have an impact on price elasticity of demand. A commodity like a box of matches which has a very low price will have less price elasticity of demand. A commodity like car which has a very high price will also tend to have less price elasticity of demand since it is demanded by persons who have very

high incomes. A medium price commodity like exhaust fan will have relatively more price elasticity of demand. (This idea becomes clear when you revisit Fig. 2.12 at higher price, elasticity is higher)

There can be so many other factors which can also be incorporated in the list. The most important point to remember is that the factors affecting price elasticity of demand are to be taken together before judging the price elasticity of demand of a commodity.

Tabulation of the Different Factors that Affect Elasticity of Demand

S.No.	Tend Towards Elasticity	Tend Towards Inelasticity
1	Long period	Short Period
2	Availability of substitutes	Lack of substitutes
3	Luxuries, comforts	Necessitites
4	Large proportion of expenditure	Small proportion of expenditure
5	Perishable goods	Durable goods
6	Multi-purpose goods	Single-use goods
7	Substitute goods	Complementary goods
8	Low income	High income
9	Normal price range	Extremely high or low price
10	Normality	Habit
11	Urgent want	Postponable want
12	Recurring Demand	Non-recurring demand

2.9 IMPORTANCE OF PRICE ELASTICITY OF DEMAND

The price elasticity of demand is very important in a number of policy decisions. It is especially useful for government policies relating to individual commodity markets. Some of the important fields where price elasticity of demand is important are listed below:

1) **Price fixation by a monopolist:** The monopolist is always interested in charging a higher price from the consumer. If he comes to know that the price elasticity of demand of a commodity is low, he would fix up a higher price for the commodity. He would not be able to charge a very high price for a commodity whose price elasticity of demand is relatively higher.

2) **Price support programme of the government:** Normally, the price elasticity of demand of agricultural commodities like wheat, rice etc, is relatively less. This implies that a given increase in supply say because of better monsoon will lead to a relatively more fall in price. This would reduce the income of the farmer. The government in order to protect the interest of the farmers can announce what is called price support programme such that the price of the commodity will not be allowed to fall below a particular level. Obviously, this would lead to a situation

where the quantity supplied will be more than the quantity demanded of a commodity at the price announced by the government.

Therefore, the government has to be prepared to procure the excess supply of the commodity from the farmers. Similarly, if for some reasons the quantity supplied of a commodity falls which has low price elasticity of demand, the price will tend to be higher and the consumer will be forced to pay relatively higher price. In order to protect the interest of the consumer, the government can announce what is called 'ceiling price' which is a price beyond which the farmer will not be allowed to charge. Whenever the government fixes a price less than what would have prevailed in the market otherwise, the quantity demanded of the commodity will be more than the quantity supplied at the price fixed by the government. The government in order to meet the excess demand of the commodity will either have to release stocks from its godowns or will have to import the commodity from other countries.

3) **Incidence of indirect taxes:** A government imposes indirect taxes on the commodities. Whenever an indirect tax is imposed, the burden of this tax is borne partly by the consumer and partly by the producer himself. The share of burden of an indirect tax borne by the consumer and the producer depends upon the elasticity of demand. Take for example, a situation where the demand curve is perfectly inelastic, irrespective of the shape of the supply curve, the whole burden of the indirect tax will be borne by the consumer. On the other hand, if the demand curve is perfectly elastic the whole burden of the indirect tax will be borne by the producer or the supplier. The situations between two will be decided by the ratio of price elasticity of supply to price elasticity of demand.

Check Your Progress 3

1) State whether the following statements are True or False:

   i) The income elasticity of demand is always positive.

   ii) The co-efficient of cross-elasticity of demand is always negative.

   iii) When price elasticity of demand is determined, income of the consumer is assumed to be changing.

   iv) In the case of complementary commodities the co-efficient of price cross-elasticity of demand is positive.

   v) In the case of 'inferior commodities' the co-efficient of price elasticity of demand is positive.

   vi) In the case of 'normal commodities' the co-efficient of price elasticity of demand is positive.

   vii) When income elasticity of demand is found out, price of the commodities is also allowed to change.

2.10 LET US SUM UP

The demand refers to the wish on the part of the consumer to buy a commodity in the market at a given price backed by the sufficient purchasing power. The price of the commodity in question, prices of other related commodities,

income and taste of the consumers determine the demand for consumer. Demand function refers to the rule that shows how quantity demanded depends upon these determinants. The demand curve states the relationship between the quantity of a good that consumers are willing to buy and the price of the good. Law of demand states inverse relationship between the price of a commodity and its quantity demanded. If the demand for a commodity changes due to change in the price of the commodity, it is termed as 'change in quantity demanded'. Change in the quantity demanded because of change in other factors (other than its own price), it is called 'change in demand'.

Elasticity of demand is the responsiveness of quantity demanded to given changes in price, income or prices of other related goods. It can be of three types- price elasticity of demand, Income elasticity of demand, and cross elasticity of demand. Elasticity of demand can be measured by way of point method, outlay method or geometrical method. Nature of the commodity, number of substitutes, number of uses of a commodity, price level of commodity are among important determinants of price elasticity of demand. Elasticity of demand play an important role in price fixation by a monopolist, price support programme of the government and in determination of incidence of indirect tax.

2.11 REFERENCES

1) Case, Karl E. and Ray C. Fair, *Principles of Economics*, Pearson Education, New Delhi, 2015.

2) Stiglitz, J.E. and Carl E. Walsh, *Economics, viva Books*, New Delhi, 2014.

3) Hal R. Varian, *Intermediate Microeconomics: a Modern Approach, 8th edition*, W.W.Norton and Company/ Affiliated East-West Press (India), 2010.

2.12 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) See Section 2.2

2) See Sub-section 2.3.1

3) Size of the population, Income distribution.

4) (c)

5) (i) Demand for rail travel will decrease (as shown in Fig. 2.2 (a)).

(ii) Demand for air travel will expand (as shown in Fig. 2.2 (b)).

Check Your Progress 2

1) (i) Rs. 30

(ii) q = 90

2) i) True ii) False iii) False iv)False v) True
vi) False vii) False viii) True

Check Your Progress 3

1) i) False ii) False iii) True iv) False v) False
vi) True vii) False

2.13 TERMINAL QUESTIONS

1) Explain the main determinants of demand for a commodity in the market.

2) Explain the law of demand with the help of a demand schedule and a demand curve.

3) Distinguish between substitution and income effects of a price rise.

4) Explain the exceptions to the law of demand using the distinction between substitution and income effects.

5) Distinguish between an inferior good (commodity) and a Giffen good.

6) What uses can be made by the government of the law of demand in deciding about the price policy and tax cum subsidy policy.

UNIT 3 SUPPLY AND ELASTICITY OF SUPPLY

Structure

3.0 Objectives

3.1 Introduction

3.2 The Concept of Supply

3.3 The Law of Supply
- 3.3.1 The Supply Function
- 3.3.2 The Supply Schedule
- 3.3.3 The Supply Curve
- 3.3.4 Exceptions to the Law of Supply

3.4 Changes in Supply versus Changes in Quantity Supplied
- 3.4.1 Changes in Quantity Supplied
- 3.4.2 Change in Supply
- 3.4.3 Why Supply Curve Shifts?

3.5 Elasticity of Supply
- 3.5.1 Concept and Measurement
- 3.5.2 Supply Curves with different Elasticities of Supply
- 3.5.3 Determinants of Elasticity of Supply

3.6 Let Us Sum Up

3.7 References

3.8 Answers or Hints to Check Your Progress Exercises

3.8 Terminal Questions

3.0 OBJECTIVES

After studying this unit, you should be able to:

- explain the meaning of the term supply of a commodity;
- list the determinants of supply of a commodity;
- describe the concepts of supply function;
- state the concepts of supply schedule and supply curve;
- distinguish between change in supply and quantity supplied;
- explain the concept of elasticity of supply; and
- distinguish between different types of supply curves based on elasticity of supply.

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3.1 INTRODUCTION

Demand-supply analysis is a fundamental and powerful tool to understand and predict how changing economic conditions affect market price and production. This tool also enables us to evaluate the impact of government price control, minimum wages, price supports and production incentives. The demand and supply curves are used to describe the market mechanism. In Unit 2, we discussed the concept of demand and its determinants, demand curve, elasticity of demand, its various types and importance.

In this unit we shall talk about the law of supply, supply function, supply schedule and supply curve. We will also get acquainted with the various determinants of supply of a commodity and the concept of elasticity of supply and its determinants.

3.2 THE CONCEPT OF SUPPLY

Supply refers to the quantity of a commodity that producers are willing to produce and sell at different prices per unit of time. The word 'supply' has the following features:

1) The supply of a commodity is stated in quantitative terms as the offered quantities.

2) The supply of a commodity is always with reference to the price at which that quantity is supplied. For example, to say that producers of blankets are supplying one thousand blankets does not carry any economic meaning. At the same time, if it is stated that producers supply one thousand blankets at a price of Rs. 500 per blanket, "supply" will start conveying economic meaning.

3) The supply is always measured as a flow or expressed with reference to a unit of time which may be a day, a week, a fortnight, a month, or a year or any other period of time.

Let us take an example. Consider the statement: "Producers supplied 1,000 blankets at a rate of Rs. 500 per blanket during January 2017." This statement mentions the quantity supplied, the price per unit at which the quantity is supplied and also the period during which the quantity is supplied. So, it is a complete statement about the supply of a commodity.

Formally, supply of a commodity refers to the quantity that a producer is willing to sell at different prices.

It will be better to have a look at distinctions between the 'stock' and the supply:

Differences between Concept of 'Stock' and 'Supply'

Stock	Supply
It implies the volume of a commodity which can be brought into the market for sale at short notice (i.e. 'Stock' is a potential supply).	It implies the quantity of a commodity which is actually brought into the market for sale.

The stock or inventories of a commodity include: Unsold quantity from the previous period, Excess of present production of the commodity over its present sale.	Market sale of the commodity is only a part of the total stock.
The stock of a commodity depends mainly upon: The production of the commodity The procurement and price of the commodity The storage and transport costs, etc.	The supply of a commodity depends mainly upon the market price of that commodity.
The concept of 'stock' has time dimension in a different sense (i.e. we do not say: stock of any commodity per week or month, etc.) We show the stocks at a date or moment of time.	The concept of 'supply' has a time dimension, (i.e. we usually say, the supply of a commodity per day, per week, per month, etc.)
In the case of highly perishable commodities, the 'stock' and 'supply' would almost be the same (since these items cannot be stored for a long period)	In the case of durable commodities, supply consists of only a part of the total stock.
The stock or inventories enable a firm to meet (temporary) an unexpected rise in market demand for the product or a sudden fall in its production.	The supply or the actual market sale enables the firm to earn sales revenue.
The stock of any commodity helps in checking severe fluctuations of market price (say, a steep fall in the price of potatoes during bumper crop, or a steep rise in its price during crop-failure)	The changes in quantity supplied during any particular period, however, depend on the fluctuations in the market price of that commodity.

Determinants of Supply

There are a number of factors which influence the supply of a commodity. Some of the important factors influencing supply or quantity supplied of a commodity can be identified as follows:

1) **Price of the commodity supplied:** The price of a commodity is determined by the forces of demand and supply. Any change in the price of a commodity exerts an influence on the supply of that commodity. Generally speaking, the higher the price of a commodity, the more profitable will it be to produce or supply that commodity, other things

remaining unchanged. The direct relationship between price and supply of a commodity is also referred to as the 'Law of Supply'.

2) **The prices of factors of production or cost of production:** A rise in the prices of factors of production raises its cost of production which, in turn, lowers profits, assuming that receipts from sales remain unchanged. A rise in cost of production of a commodity discourages the production or supply of that commodity. Similarly, a fall in cost of production of a commodity encourages its production or supply.

   A change in the price of one factor of production will cause changes in the relative profitability of producing different commodities. This will cause producers to shift from the production of one commodity to another, and thus cause changes in the supplies of different commodities. For example, a fall in the price of land will have a larger effect on cost of production of an agricultural product and only a very small effect on the cost of producing, say televisions.

3) **Prices of other goods:** Other things remaining unchanged, the supply and production of a commodity will fall as the prices of other commodities rise and vice versa. This happens because normally a producer chooses that commodity for production which earns him the highest profit.

4) **The state of technology:** The state of knowledge changes over time and along with that the methods employed to produce a commodity also undergo a change. The increase in the knowledge about the means of production and the methods of production lead to lower costs of production of goods already being produced and to a large variety of new products.

5) **Goals of the producer:** The objective with which the producer undertakes production also influences the supply of the commodity. The goal of the producer may be to maximise total profits or to maximise sales or to capture the market in the long ran.

6) **Other factors:** There can be many other factors influencing supply. Some of other factors are expected changes in government policy, fear of war, unexpected climatic conditions, expected change in prices, growing inequalities of income influencing the demand of particular types of goods and hence making them more profitable to produce.

It is difficult for us to analyse the effect of a simultaneous change in all the factors which influence the supply of a commodity. Therefore, normally, we think of a situation where one of the factors influencing supply changes, assuming other factors as unchanged, and then work out the effect of a change in that factor on the quantity of the commodity supplied by a producer or a group of producers.

3.3 THE LAW OF SUPPLY

Let us assume that the overall objective of a producer is to maximise profits which is the difference between total revenue and total cost. Total revenue is the price of the product multiplied by the quantity sold. Total cost is the average cost of production multiplied by the quantity produced.

PROFIT = TR–TC (where TR stands for total revenue and tC for total cost)

$$TR = Q.P$$

$$TC = Q.AC$$

A higher price would mean more profits, provided there is no change in other factors influencing the supply. Therefore, a producer will be willing to supply more if he expects to get a higher price for his product. Similarly, a producer will be ready to supply smaller quantity only if he expects to get a lower price for his product. So, we observe a direct relationship between the price and the quantity supplied of a commodity. This direct relationship between price and supply of a product is referred to as the 'Law of Supply'.

The law of supply states that as the price of a commodity increases, the quantity supplied, per unit of time, of that commodity also increases and vice versa, assuming all other factors influencing supply remain constant.

The law holds good only on the assumption that other factors remain constant.

In this direct relationship between the price and the supply of a commodity, the change in supply is caused by the change in price such that change in price is the cause and change in supply is the effect. We can express this relationship in functional form treating supply as dependant variable and price as independent variable.

$$S = f(P)$$

It is important to understand that the statement "Price rise leads to supply rise" is true and the statement that "Supply rise leads to price rise" is false. Price is the independent variable whereas quantity supplied is a dependent variable.

3.3.1 The Supply Function

The supply function is a shorthand expression of the various factors affecting quantity supplied of a commodity. Thus, the supply of a commodity can be put as a function of price of that commodity, the price of all other commodities, the prices of factors of production, technology, the objectives of producers and other factors. This relationship can be expressed with the help of following symbols.

$$q_s = f(P_1, P_2, P_3 \ldots P_n, F_1 \ldots F_n, T, G, E_i)$$

Where q_s stands for the supply of commodity 1;

P_1 is the price of that commodity, P_2, $P_3 \ldots P_n$ are the prices of all other commodities;

$F_1 \ldots\ldots F_n$ are the prices of all factors of production;

T is the state of technology;

G is the goal of the producer;

and E_i Indicates other factors influencing supply.

In the Law of Supply we are only concerned with the relation between q_s and $f(P_1)$, other things remaining constant. In specific terms what we state in the law of supply is that the quantity of a commodity produced and offered for sale will increase as the price of the commodity rises and decreases as the price falls, other things remaining constant.

3.3.2 The Supply Schedule

A supply schedule shows different prices of a commodity and the quantities which a producer is willing to supply, per unit of time, at each price, assuming other factors influencing the supply to be constant. A supply schedule of a product based on imaginary data is given in Table 3.1 illustrating the relationship between price and quantity supplied as given by the law of supply.

Table 3.1: A supply schedule of a pen producer

Price (in Rs) per Pen	Quantity Supplied (in thousand) per Month
2	25
3	40
4	50
5	60
6	70

The schedule presented in Table 3.1 shows that at a price of Rs. 2 per pen the producer is willing to supply 25 thousand pens per month. And at a higher price of Rs. 3 per pen he is willing to supply 40 thousand pens per month. As price of pens keep rising, he is willing to supply more and more quantity of pens per month. This supply schedule has been so drawn as to depict a direct relationship between price per pen and quantity supplied of pens per month.

3.3.3 The Supply Curve

Look at Fig. 3.1 where the data from Table 3.1 has been plotted. Here price is plotted on the Y-axis and quantity supplied on X-axis.

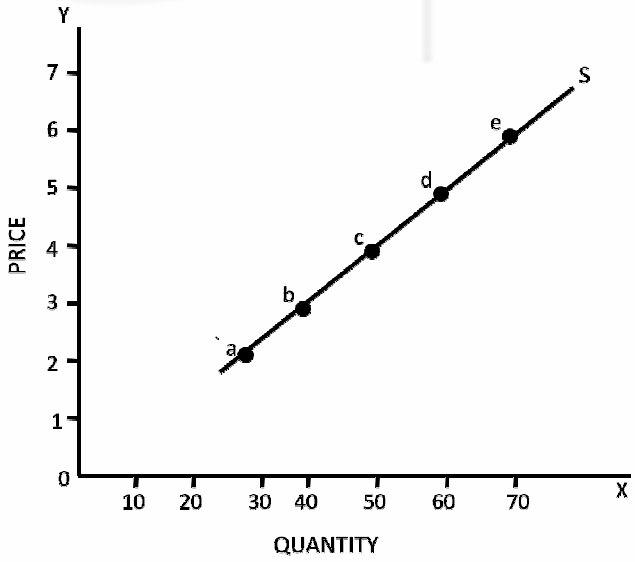


Fig. 3.1: Supply Curve

Fig. 3.1 shows that point labelled a, for example, gives the same information that is given on the first row of the table; when the price of pens is Rs. 2 per pen, 25,000 pens will be produced and offered for sale per month. Similarly, points b, c, d, and e on the graph correspond to row 3rd, 4th, 5th and 6th of Table 3.2 respectively.

The supply curve S is a smooth curve drawn through the five points a, b, c, d and e. This curve shows the quantity of pens that will be produced and offered for sale at each price.

The supply curve (just like a demand curve) can be linear straight line, or in the shape of a upward slopping convex curve.

In short, the supply curve for a product depicts the direct relation between the price of that commodity and the quantity producers wish to produce or sell at that price. This curve is drawn on the assumption that all other factors that influence supply are constant (i.e. they remain unchanged). The upward slope of the supply curve indicates that higher the price, the greater the quantity producers will supply. If the supply curve is extended to the Y-axis, it may or may not pass through O. If it passes through O, it shows that the quantity supplied is zero at zero price; if it does not pass through zero, it shows that unless the price rises upto a point, (indicated by a point not shown in the Fig. 3.1 at which supply curve cuts the Y-axis) quantity supplied will remain zero. Re. 1 can be known as Reserve Price. A producer will not offer any quantity for sale if price is Re. 1 or less. The upward sloping supply curve is just a diagrammatic representation of the law of supply.

3.3.4 Exceptions to the Law of Supply

Generally speaking, the law of supply indicates a direct relation between the price and the quantity supplied. There are some exceptions to the law of supply which are given below:

Non-maximisation of profits: In some cases, the enterprise may not be pursuing the goal of maximisation of profits. In that case, the quantity supplied may increase even when price does not rise. For example, if the firm wants to maximise sales even if price remains unchanged, it may like to increase sales so that total revenue can be increased.

> Sometimes, the firm may be interested to maximise profits in the long run; in the short run it may pursue some other goals.

Similarly, if a firm is controlling a number of companies, it is the profits taken together which may be sought to be maximised so that for different products produced, the law of supply may not apply for each product.

Factors other than price not remaining constant: The law of supply was stated on the assumption that factors other than the price of the commodity remain constant. In reality, we notice that factors other than the price of the product may not remain constant. For example, the quantity supplied of a commodity may fall at a given price if prices of other commodities show a tendency to rise. The change in the state of technology can also bring about a change in the quantity supplied of a commodity even if the price of that commodity does not undergo a change.

Check Your Progress 1

1) Fill in the blanks:

   i) Producers supply more at a …… price than at a …… price.

   ii) A supply curve is …… sloping.

   iii) A supply curve relates …… of a commodity to the …… offered for sale during a particular period of time.

   iv) If price of a commodity …… the profit from its sale will fall, other things remaining unchanged.

   v) The law of supply states that the price of a commodity and its quantity supplied are……. related, other things remaining unchanged.

2) State whether the following statements are True or False:

   i) The law of supply states that there exists a relationship between supply of a commodity and its price.

   ii) The law of supply states that there exists direct relationship between the price of a commodity and its quantity supplied per unit of time, other things remaining constant.

   iii) Supply refers to the quantity of a commodity offered for sale.

   iv) Supply refers to the quantity of a commodity offered for sale at a price during a specific period of time.

   v) Technological development in a particular field of production is likely to increase cost of production.

   vi) New method of organising an existing productive activity is not a technological development.

   vii) The supply is a stock concept.

   viii) Profit maximisation can be the only objective of every firm.

3.4 CHANGES IN SUPPLY VERSUS CHANGES IN QUANTITY SUPPLIED

3.4.1 Changes in Quantity Supplied

Changes in the quantity offered for sale on account of a change in the price of the commodity only, assuming all other factors to be constant, is termed as change in quantity supplied. The change in quantity supplied can be of two types:

1) When the price of a commodity falls and its quantity supplied falls provided the law of supply applies, it is termed as ‘contraction of supply’.

2) With the rise in the price of a commodity, its quantity supplied rises, provided the law of supply applies, it is termed as “extension of supply”.

The contraction, and 'extension' of supply has been shown in Fig. 3.2 below.

On X-axis quantity of pens supplied are measured and on Y-axis price per pen is measured. S curve is the required supply curve. Start with point b on the supply curve at which price per pen is Rs. 3 and quantity supplied is 30,000 pens. As price per pen falls to Rs. 2 the quantity supplied falls to 20,000 and when price of pen rises to Rs. 4, the quantity supplied rises to 40,000. The fall in quantity supplied from 30,000 to 20,000 with the fall in price, from Rs. 3 to Rs. 2 is termed as 'contraction in supply'.

On the graph it is the movement from b to a on the supply curve which represents 'contraction of supply'. Similarly, the movement from b to c on the S curve represents 'extension of supply' since it implies that the quantity supplied rises from 30,000 to 40,000 with the rise in price from Rs. 3 to Rs. 4.

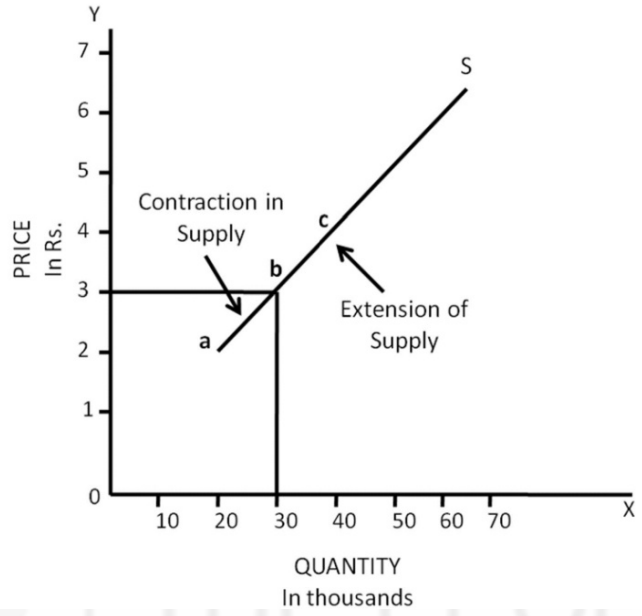


Fig. 3.2 : Supply Curve

3.4.2 Change in Supply

If production of a commodity undergoes a change because of factors other than the price of the commodity, we call this change in supply.

Change in supply can be of two types:

A decrease in supply: When the quantity of a commodity supplied falls, at the same price it is referred to as a 'decrease in supply'. If represented in the form of a curve, it implies a leftward shift of the supply curve.

An increase in supply: When the quantity of a commodity supplied increases, at the same price, it is known as an increase in supply. This amounts to a rightward shift in the supply curve.

In short, a rise in supply implies a rightward shift of the supply curve showing that producers are willing to supply more at each price. A fall in supply, on the other hand, implies a leftward shift of the supply curve indicating that producers are willing to supply less at each price.

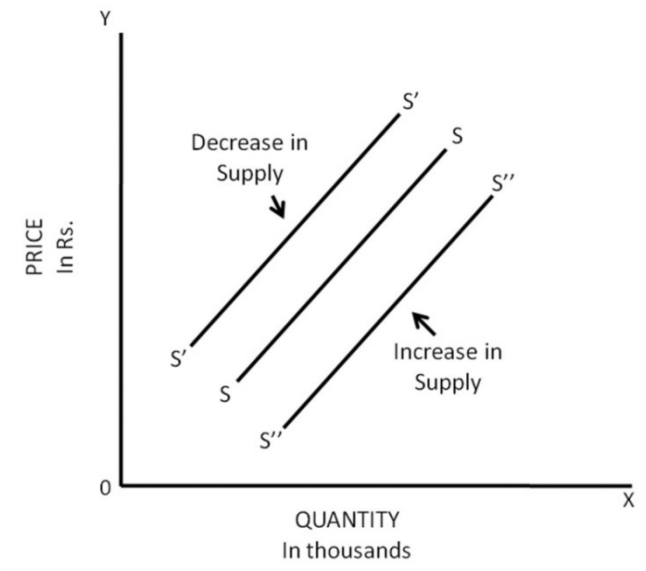


Fig. 3.3 : Shifts in Supply Curve

3.4.3 Why Supply Curve Shifts?

The reasons for 'contraction' and 'extension' of supply have already been explained in section 3.2.

The reasons for the change in supply (both increase and decrease in supply) can be stated as follows:

1) **Change in the prices of other commodities:** A decrease in the prices of other commodities increases the supply of the commodity in question at each price because relative profits from supplying other products fall. An increase in the prices of other commodities decreases the supply of the commodity in question at each price.

2) **Change in the prices of factors of production:** An increase in the prices of factors of production used in producing the commodity tends to reduce the supply of the commodity at each price. Since the cost of production rises at the given price, profits fall. Conversely, a decrease in the price of factors of production used in making a commodity leads to an increase in supply, at each price.

3) **Change in technology:** An improvement in technology normally leads to a fall in cost of production and given the price of the product, a producer tends to produce more of that commodity, at each price. Conversely, loss in technical knowledge (the chances of which are meagre) will lead to a fall in supply, at each price.

4) **Change or expectation of change in other factors:** Sometimes, supply of a commodity may change because of the change in government policies relating to taxes or rate of interest or because of fear of war or because of changing inequalities of income and wealth which influence the demand of particular types of goods and hence making it more or less profitable to produce that commodity. Accordingly, if producers expect more profits because of change in other factors, supply increases at each price. Conversely, if producers expect less profits because of change in other factors, supply decreases at each price.

Check Your Progress 2

1) State whether the following statements are True or False:

   i) An 'extension of supply' means that at a given price, more is supplied.

   ii) An 'increase' and 'extension'of supply are one and the same thing.

   iii) The quantity supplied changes because of change in technology.

   iv) The supply increases because of a fall in price of the commodity.

   v) A movement along the supply curve shows the operation of the law of supply.

   vi) A shift in the supply curve leftwards indicates an increase in supply.

   vii) A supply curve shifts because of factors other than the price of a commodity.

2) Distinguish between extension of supply and an increase of supply.

   .....

   .....

   .....

3.5 ELASTICITY OF SUPPLY

The Law of Supply tells us that there is a direct relation between the price of a commodity and its quantity supplied, other things remaining unchanged. Elasticity of supply measures the degree to which the quantity supplied responds to price changes.

3.5.1 Concept and Measurement

Elasticity of supply can be defined as the percentage change in quantity supplied divided by the percentage change in price of the commodity or we can say that Elasticity of Supply (E_s) is :

$$E_s = \frac{\frac{\Delta Q_s}{Q_s} \times 100}{\frac{\Delta P}{P} \times 100} \quad \text{or}$$

$$E_s = \frac{\Delta Q_s}{\Delta P} \cdot \frac{P}{Q_s}$$

Where S and P are the original quantity supplied and price respectively and ΔS and ΔP are the change in quantity supplied and change in price.

The method of measurement of the elasticity of supply can be illustrated with the help of an example from Table 3.1. The price of pen rises from Rs. 2 to Rs. 3 and the quantity supplied of pens rises from 25,000 to 40,000. Using the formula to measure elasticity of supply, we can work out the elasticity of supply:

$$E_s = \frac{\Delta Q_s}{\Delta P} \cdot \frac{P}{Q_s}$$

$$= \frac{40{,}000 - 25{,}000}{3-2} \times \frac{2}{25{,}000}$$

$$= \frac{15{,}000 \times 2}{25{,}000}$$

$$= 1.2$$

It can be interpreted as a situation where the price of pens going up by say one per cent leads to an increase in quantity supplied of pens by 1.2 per cent or we can say that the situation is of elastic supply. If the co-efficient was less than 1, it would mean that we have inelastic supply. $E_s = 1$ is a case of unit elasticity of supply. $E_s = 0$ is a case of perfectly inelastic supply and finally, $E_s = \infty$ is a case of perfectly elastic supply.

3.5.2 Supply Curves with Different Elasticities

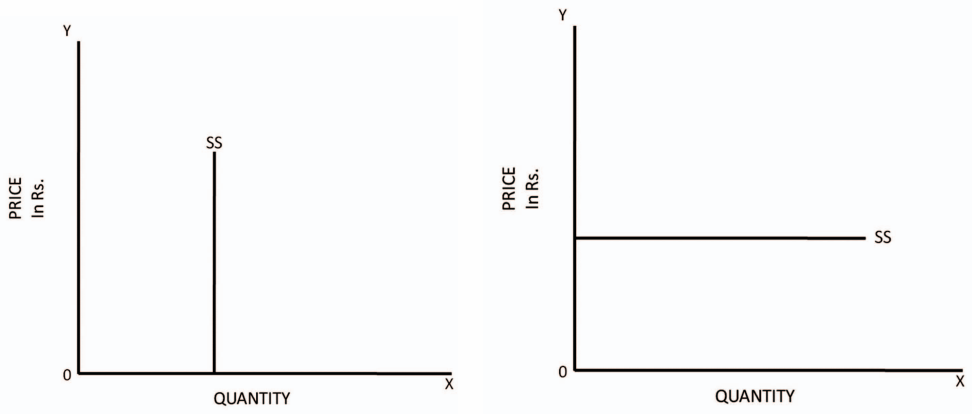
Fig. 3.4 shows five cases of elasticity of supply. The case of zero elasticity or perfectly inelastic supply is represented in Fig. 3.4 (i) in which the quantity supplied does not change as price changes. This happens when producers insist on producing a given quantity irrespective of the price prevailing in the market. The case of infinity elasticity or $E_s = \infty$ is illustrated in Fig. 3.4 (ii) where at price P the producers are prepared to supply as much as the market demands and nothing at all is supplied at a price less than OP. A small increase in price to OP leads to supply rising from zero to an infinity.

The Fig. 3.4 (iii) shows supply curve with unit elasticity.

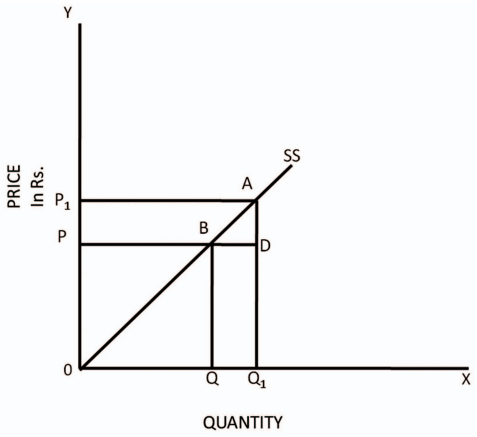
The price rises from P to P_1. As a response quantity supplied is increased from Q to Q_1. We define elasticity as $\frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$. Here, $\Delta Q = QQ_1 = BD$. $\Delta P = PP_1 = AD$. Now, compare right triangles ADB and BQO. Angle ABD = angle BOQ as they are corresponding angles. Therefore, the triangles are similar and their corresponding sides will have same ratios.

Therefore, $E_s = \frac{BD}{AD} \times \frac{BQ}{OQ}$. But $\frac{AD}{BD} = \frac{BQ}{OQ}$

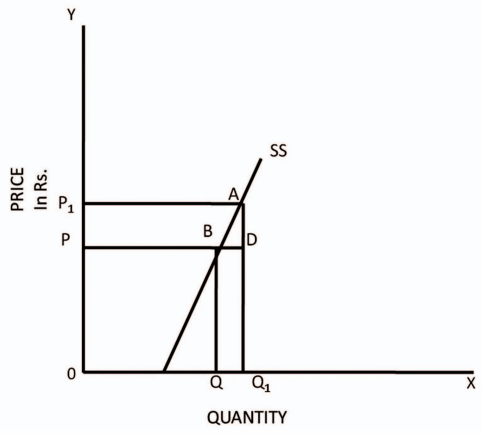
Using this information we get $E_s = \frac{OQ}{BQ} \times \frac{BQ}{OQ} = 1$ hence, elasticity of supply is unity.



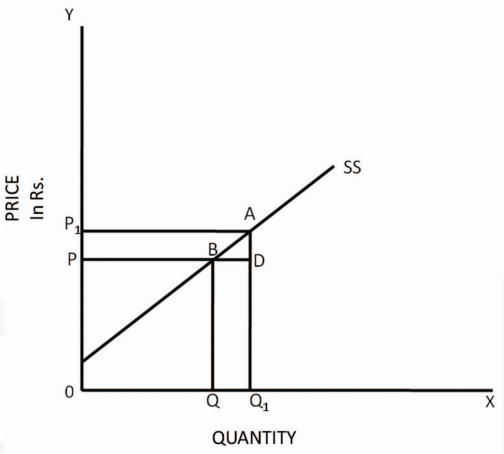
(i) **(ii)**



(iii)



(iv)



(v)

Fig. 3.4 : Supply Curves with Different Elasticities

$E_s = 1$ implies that if the price of a commodity rises by a given per cent, say 5, then the quantity supplied also rises by the same percentage i.e. 5.

Fig. 3.4 (iv) illustrates the case of elasticity of supply as being inelastic or less than unity. At point P, as we move to P_1 quantity changes from Q to Q_1. But change in quantity demanded to original does not bear the same ratio as is between price change and original price. Ratio of AB to BQ is much higher compared to the ratio of change in quantity to the original quantity. Hence, E_s is lesser than unity.

Fig. 3.4 (v) illustrates the case of elasticity of supply as being elastic or more than unity. At point P, here the ratio in change of quantity to original quantity is higher than the ratio of change in price to original price. Therefore, $E_s >$ unity.

PRACTICAL EXERCISES

Practical Exercise 1

Prove that the elasticity of supply on the entire range of a straight line supply curve that originates at the point of origin will be unity.

Solution

The situation is depicted in Fig. 3.5. The curve SS originates from the point O. The elasticity of supply on the entire range of this curve is equal to unity (E_s = 1).

Proof

Look at two triangles. One has sides P, Q and the SS curve; the other has sides OP, OB and SS curve BP.

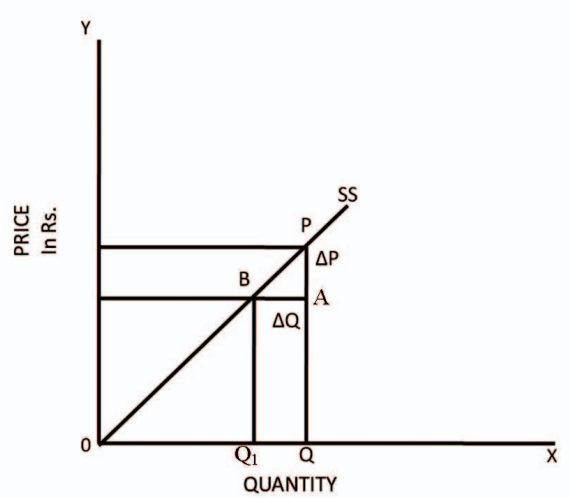


Fig. 3.5

Clearly, they are similar ΔS. It follows that the ratios of their sides are equal,

$$\frac{P}{Q} = AP/AB = \frac{\Delta P}{\Delta Q} \qquad (1)$$

Elasticity of supply is:

$$E_s = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} \qquad (2)$$

Substituting P/Q = ΔP/ΔQ (since these two are equal) into (1), we get

$$\frac{\Delta Q}{\Delta P} \times \frac{\Delta P}{\Delta Q} = 1 \text{ or unity}$$

Practical Exercise 2

Show that the elasticity of supply of a straight line supply curve cutting Y-axis has greater than unit elasticity.

Solution

In order to prove the above mentioned result we draw a straight line supply curve AB cutting Y-axis at the point A as shown in Fig. 3.6. We extend this AB supply curve to meet X-axis at point R. Take two points L and K on the supply curve which correspond to OP and OP_1 prices respectively.

$$(E_s) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{QQ_1}{PP_1} \times \frac{OP}{OQ}$$

$$= \frac{LZ}{KZ} \times \frac{LQ}{OQ}$$

Take two right angled triangle KZL and LQR. In these two triangles

$\angle Q = \angle Z$ (right angles)

$\angle LRQ = \angle KLZ$ (corresponding angles)

$\angle RLQ = \angle LKZ$ (corresponding angles)

Thus the two triangles are similar. Therefore, the ratio of the two sides must be equal, i.e.,

$$\frac{LZ}{KZ} = \frac{RQ}{LQ}$$

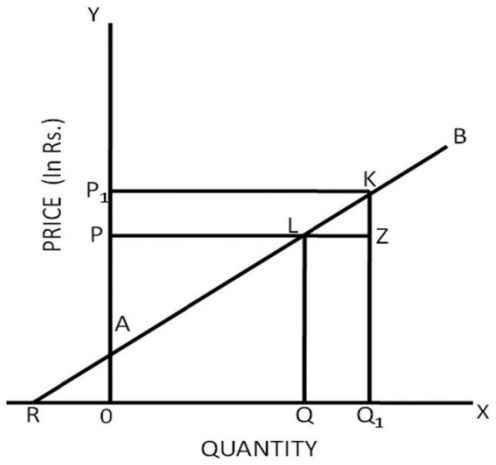


Fig. 3.6

Putting $\frac{RQ}{LQ}$ for $\frac{LZ}{KZ}$ in the above measure of elasticity of supply, we get

$$(E_s) = \frac{LZ}{KZ} \times \frac{LQ}{OQ} = \frac{RQ}{LQ} \times \frac{LQ}{OQ} = \frac{RQ}{OQ}$$

Since RQ distance is greater than OQ distance, the elasticity of supply is greater than unity.

Practical Exercise 3

Show that the elasticity of supply of a straight line supply curve cutting X-axis has less than unit elasticity.

Solution:

In order to prove the above mentioned result we take a straight line supply curve AB which cuts X-axis at the point A. Also, we take two points L and K corresponding to two prices OP and OP_1 respectively.

$$(E_s) = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

$$= \frac{QQ_1}{PP_1} \times \frac{OP}{OQ} = \frac{LZ}{KZ} \times \frac{LQ}{OQ}$$

Take two right angled triangles, KZL and LQA. In these triangles

$\angle Q = \angle Z$ (right angles)

$\angle LAQ = \angle KLZ$ (corresponding angles)

$\angle ALQ = \angle LKZ$ (corresponding angles)

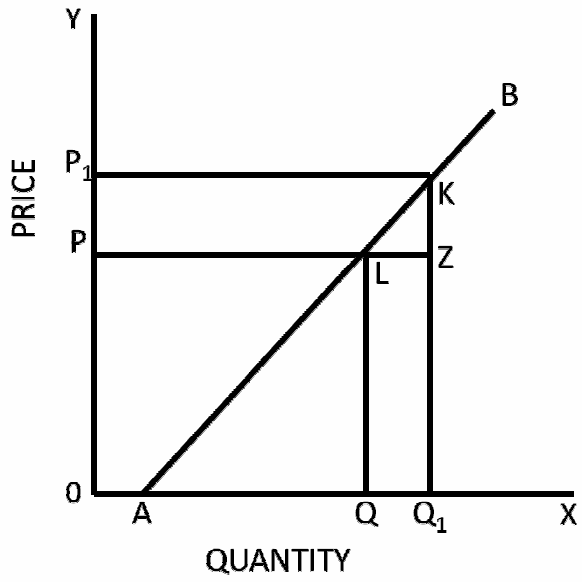


Fig. 3.7

Hence the two triangles are similar. Therefore, the ratio of two sides must be equal,

$$\frac{LZ}{KZ} = \frac{AQ}{LQ}$$

Putting $\frac{AQ}{LQ}$ for $\frac{LZ}{KZ}$ in the above given measure of elasticity of supply, we get

$$(E_S) = \frac{LZ}{KZ} \times \frac{LQ}{OQ} = \frac{AQ}{LQ} \times \frac{LQ}{OQ} = \frac{AQ}{OQ}$$

Since AQ distance is less than OQ distance, the elasticity of supply is less than unity.

3.5.3 Determinants of Elasticity of Supply

Elasticity of supply depends on a number of factors and all these factors are to be taken together before one can comment on the elasticity of supply of a commodity. Some of the important determinants of elasticity of supply are given as follows:

1) **Behaviour of costs as output varies:** As output of a commodity rises, total cost does show a tendency to rise but it does not rise at a uniform rate. Normally, total cost rises at a falling rate in the beginning, then at a constant rate and finally at a rising rate. If cost of production rises rapidly as output rises, then there is less stimulus to expand production in response to rise in price and accordingly supply will tend to be less elastic. If, on the other hand, total costs rise but rather slowly as production increases, a rise in price will bring about a large increase in quantity supplied and so the supply will be more elastic.

2) **Nature of the commodity:** Commodities may be classified, based on their nature, into (i) perishable and (ii) durable. Perishable products cannot be stored for long and thus, their supply does not respond very much to the change in their prices. Supply of perishable products is inelastic. Durable products, on the other hand, can be stored and their

supply responds to the change in their prices. The supply elasticity of durable products is relatively higher.

3) **Time:** Supply of a commodity comes from its production which involves a time lag. If the size of the plant is given and other adjustments in terms of technology etc., are not allowed, a producer cannot effectively respond to the change in price. Under such a situation, i.e., in the short-run supply of a commodity is less elastic. In the long run, when the size of the plant can be changed and technological changes are also allowed, supply responds to the change in price and hence, elasticity of supply is more elastic or the supply curve becomes flatter.

4) **Price expectations:** Expectation of future prices also influences elasticity of supply. If the producers expect that prices in the future will not be allowed to fall below a particular level, they would not mind producing more. Further, if producers expect prices to rise in the future they may hold more stocks and may supply less quantities in the market. Supply in such a case will be inelastic. If the prices are expected to fall in the future, supply will be more elastic.

5) **Nature of techniques of production:** If techniques of production required to produce a commodity are simple, the producer responds to a rise in price and supplies more which makes supply more elastic. More the complex and cumbersome techniques of production required to produce a commodity, more difficult it will be for the supply to respond to rising price and, therefore, less elastic will be the supply.

Check Your Progress 3

1) List three important determinants of elasticity of supply?

.....

.....

.....

2) State whether the following statements' are True or false:

i) Elasticity of supply explains the reasons for the law of supply to apply.

ii) Elasticity of supply can be found out even if the law of supply does not apply.

iii) Elasticity of supply is the responsiveness of price to a given per cent change in quantity supplied.

iv) A case of elastic supply implies when a given per cent rise in price leads to the same percent rise in quantity supplied.

v) Perfectly elastic supply curve is parallel to Y-axis.

vi) Inelastic supply curve passes through the quantity axis.

vii) Elasticity of supply of a curvilinear supply curve is unity throughout the curve.

viii) Short run supply curve of a commodity is generally less elastic than the long run supply curve.

3.6 LET US SUM UP

The law of supply shows a direct relationship between price of the commodity and the quantity supplied of that commodity per unit of time; other things remaining unchanged. A supply schedule shows different prices and the quantities of the product supplied at each price. A supply curve is upward sloping from left to right.

Supply of a commodity is always with reference to: (a) price of the commodity, (b) quantity supplied at that price, and (c) quantity supplied over a period of time. Supply of a commodity is determined by (a) price of the commodity, (b) prices of other commodities, (c) cost of production of the commodity, (d) technical knowledge available with the producer, (e) goal of the producers, and (f) other factors like government policies, fear of war, growing inequalities of income and wealth, etc.

A supply curve shifts when there is a change in supply due to the influence of one or more factors other than the price of the commodity. A movement along the supply curve means change in quantity supplied due to the change in the price of the commodity only, other factors influencing supply remaining constant. A rightward shift of the supply curve represents a situation of 'increase in supply' and a leftward shift of the supply curve shows a situation of 'decrease in supply'. A rightward expansion movement along a supply curve is a case of expansion of supply' and a leftward movement along a supply curve is a case of "contraction in supply".

Elasticity of supply is the percentage change in amount supplied in response to a given percentage change in price of the commodity. Elasticity of supply can be unity, more than unity or less than unity. In the case of perfectly inelastic supply, elasticity of supply is zero; in the case of perfectly elastic supply, elasticity of supply is infinity.

The determinants of elasticity of supply are the behaviour of costs as output varies, nature of the commodity, time, price expectations and nature of techniques of production.

3.7 REFERENCES

1) Case, Karl E. and Ray C. Fair, *Principles of Economics*, Pearson Education, New Delhi, 2015.

2) Stiglitz, J.E. and Carl E. Walsh, *Economics, viva Books*, New Delhi, 2014.

3) Hal R. Varian, *Intermediate Microeconomics: a Modern Approach, 8th edition*, W.W.Norton and Company/ Affiliated East-West Press (India), 2010.

3.8 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) i) higher, lower ii) upward iii) price, quantity iv) falls v) directly

2) i) False ii) True iii) False iv) True
v) False vi) False vii) False viii) False

Check Your Progress 2

1) i) False ii) False iii) False iv) False v) True
vi) False vii) True

2) Rise in the quantity supplied in response to rise in the price of that commodity is extension of supply where as rise in the quantity supplied due to the factors other than the price of the commodity is increase in supply.

Check Your Progress 3

1) Three important determinants of elasticity of supply are:

   i) Nature of the commodity

   ii) Price expectation

   iii) Nature of technique of production

2) i) False ii) True iii) False iv)False
v) False vi) True vii) False viii) True

3.9 TERMINAL QUESTIONS

1) What is the meaning of the term "supply"? Answer with the help of an example.

2) Explain the various determinants of supply of a commodity.

3) Explain the law of supply. Point out its exceptions.

4) Distinguish between 'extension in supply' and 'increase in supply'. Give examples.

5) Explain the significance of 'movement along the supply curve', as distinguished from 'shift of the supply curve'.

6) Distinguish between perfectly elastic, perfectly inelastic, unit elastic, inelastic and elastic supply curves with the help of diagrams.

7) What are the main determinants of elasticity of supply of a commodity?

UNIT 4 DEMAND AND SUPPLY IN PRACTICE

Structure

4.0 Objectives

4.1 Introduction

4.2 Determination of Equilibrium

4.3 Effects of Shift in Demand and Supply on Equilibrium
- 4.3.1 Determination of Equilibrium: A Mathematical Presentation
- 4.3.2 Uniqueness of Equilibrium and Multiple Equilibria

4.4 Applications
- 4.4.1 Rationing and the Allocation of Scarce Goods
- 4.4.2 Price Support Measures
- 4.4.3 Minimum Wage Legislation
- 4.4.4 Arbitrage
- 4.4.5 Sharing of Tax Burden

4.5 Let Us Sum UP

4.6 References

4.7 Answers or Hints to Check Your Progress Exercises

4.8 Terminal Questions

4.0 OBJECTIVES

After going through this unit, you will be able to :

- appreciate how market price and quantity are determined;
- evaluate the impact of price controls, minimum wages, price support and arbitrage on price and quantity;
- determine how the taxes and subsidies affect consumers and producers; and
- appreciate the usefulness of economic theory in our day to day life.

4.1 INTRODUCTION

Demand and supply curves are used to describe the market mechanisms. These two market forces by way of equilibrium determine both the market price of a good and the total quantity produced/supplied. The level of price and the quantity depend on the particular characteristics of Demand and Supply. Variations in price and quantity over time depend on the ways in which supply and demand respond to other economic variables.

In this unit we will try to acquaint you with the usefulness of this analysis.

*Shri I.C. Dhingra, Rtd., Associate Professor, Shaheed Bhagat Singh College (University of Delhi), Delhi.

4.2 DETERMINATION OF EQUILIBRIUM

Equilibrium price is defined as the price at which the quantity demanded and quantity supplied are equal. Quantity demanded is an inverse function of price, while quantity supplied is a direct function of price. The two functions can be stated as follows:

$$q^d = 10 - 1P$$

and

$$q^s = 1P$$

Equilibrium price is the one at which the quantity demanded equals quantity supplied, i.e.,

$$q^d = q^s$$

or

$$10 - 1P = 1P$$

$$\therefore \quad P = 5$$

Equilibrium price is Rs. 5. At this price $q^d = q^s$ and $q^d = 5$ units. Thus, 5 units would be sold and purchased in the market at price Rs. 5.

Similarly, if we graphically represent these two functions as in Fig. 4.1, we find that the downward sloping demand curve intersects the upward sloping supply curve at E, forming what is known as the **Marshallian cross.**

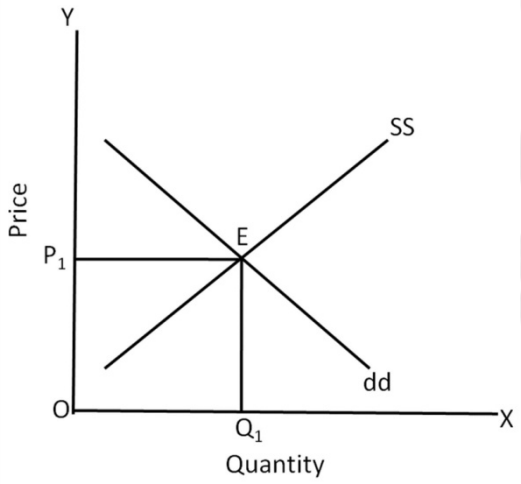


Fig. 4.1

In the equilibrium, OQ_1 quantity is sold and purchased at OP_1 price.

If, for any reason, the market price were to be less than the equilibrium price, say at OP_1, quantity demanded will be more than the quantity supplied, resulting in excess demand in the market, TW in Fig. 4.2. This will push the market price upwards, till the market price equals the equilibrium price.

Similarly, if the market price is more than the equilibrium price, the resultant excess supply, RS, will push the price downwards to OP_2. In short, we reach the following conclusions:

- All demand curves have negative slopes throughout their entire range.

- All supply curves have positive slopes throughout their entire range.
- Prices change if and only if, there is excess demand or excess supply.
- Prices rise, if there is excess demand and fall if there is excess supply.

In short, market price has a tendency to be equal to the equilibrium price. This is called **stable equilibrium.**

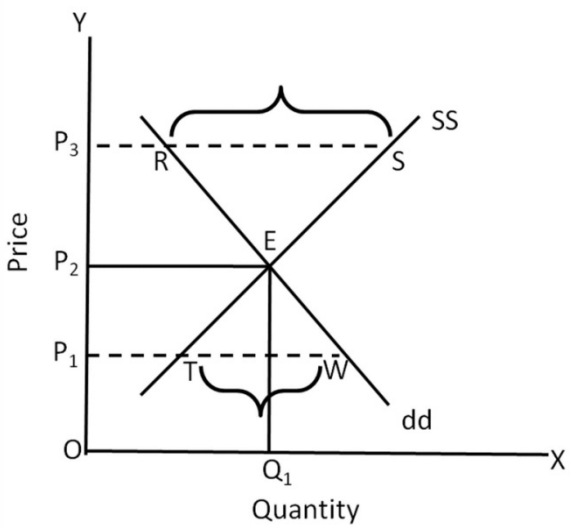


Fig. 4.2

The essential condition for stable equilibrium is that the demand curve should have a negative slope and the supply curve a positive slope. Otherwise, it will not be a stable equilibrium, this would be what can be called **unstable equilibrium.**

Let us illustrate the situation of unstable equilibrium with the help of Fig. 4.3.

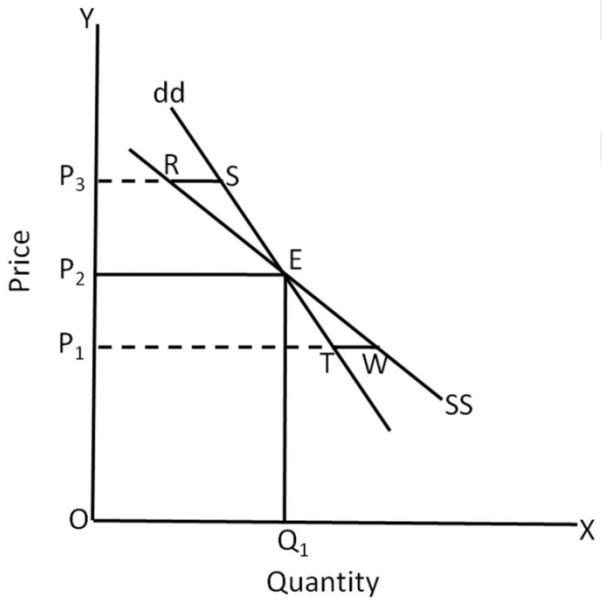


Fig. 4.3

We have plotted a negatively sloped demand curve and a negatively sloped supply curve. Equilibrium is determined at point E. If the market price were to fall to Op_1 quantity supplied > quantity demanded, and therefore the market price should fall further (rather than rise).

Similarly, if market price were to be Op_3, quantity supplied < quantity demanded, and hence the price should still rise further (rather than fall to back to equilibrium).

Thus, in this situation there is unstable equilibrium. The condition for stable equilibrium is that above the equilibrium point surplus must exist ($Q^s > Q^d$) and below the equilibrium point shortage must exist (Q^d, > Q^s). In case this condition is not fulfilled, we get unstable equilibrium.

Can there be a stable equilibrium when supply curve is downward sloping?

Yes, there can be a stable equilibrium even if supply curve is downward sloping. This is illustrated with the help of Fig. 4.4. At price Op_2, which is more than the equilibrium price Op_1 there exists surplus to the extent of SR, which creates competition among sellers, as such price falls to Op_1.

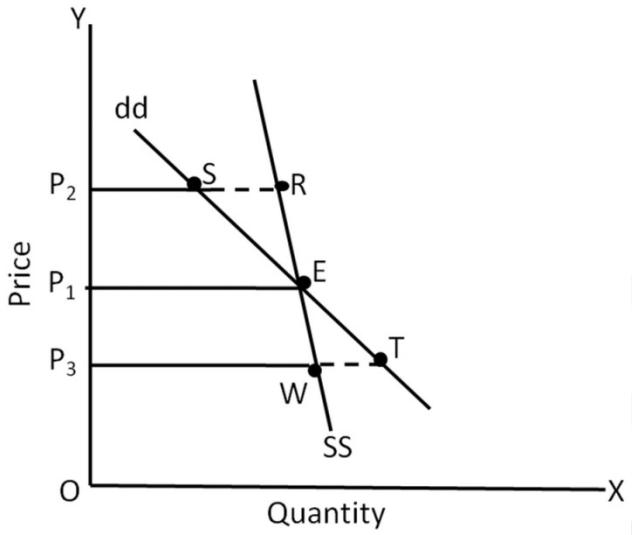


Fig. 4.4

At price Op_3, which is less than equilibrium price Op_1 there exists shortage to the tune of WT, which creates competition among buyers, this causes the price to increase to Op_1 Thus, we get stable equilibrium.

This is also known as the **Walrasian Equilibrium.** The Walrasian stability condition can be stated as follows:

Above the equilibrium price, the supply curve must be to the right of the demand curve; and below the equilibrium price, the supply curve must be to the left of the demand curve.

It would be seen that whereas the Marshallian adjustment process works through a change in quantities, the Walrasian adjustment process works through a change in price.

4.3 EFFECTS OF SHIFT IN DEMAND AND SUPPLY ON EQUILIBRIUM

In the method of comparative statics we start from a position of equilibrium and then introduce the change to be studied. The new equilibrium position is determined and compared with the original one. The differences between the

two positions of equilibrium must result from the change that was introduced, by keeping everything else as constant.

1) **Shift in Demand Curve**

A shift in demand curve (the supply curve remaining unchanged) will affect the equilibrium price and equilibrium quantity, as shown in Fig. 4.5.

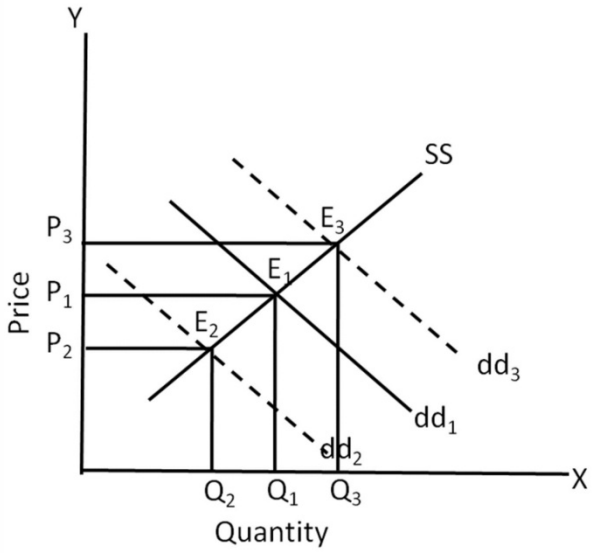


Fig. 4.5

An increase in demand would result in:

- an increase in the equilibrium price
- an increase in the equilibrium quantity.

Conversely, a decrease in demand would result in:

- a decrease in the equilibrium price
- a decrease in the equilibrium quantity.

2) **Shift in Supply Curve**

A shift in supply curve (the demand curve remaining unchanged) will also affect both, the equilibrium price and equilibrium quantity, as shown in Fig. 4.6.

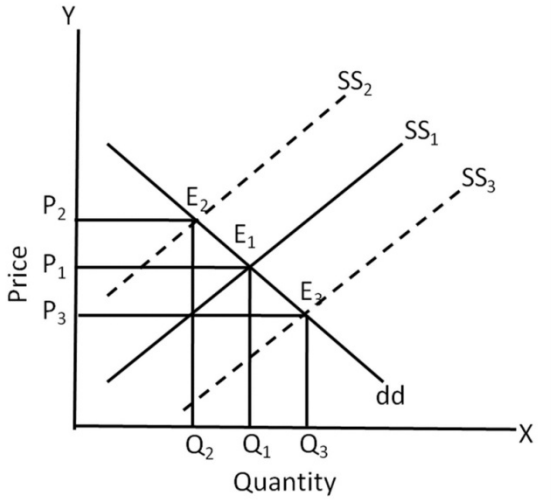


Fig. 4.6

An increase in supply would result in:

- a fall in the equilibrium price
- an increase in the equilibrium quantity.

A decrease in supply would result in:

- a rise in the equilibrium price
- a fall in the equilibrium quantity.

3) **Simultaneous Shift**

We may also examine if both demand and supply curves shift simultaneously. The combined result would be determined as we have analysed above.

The net result would depend upon the relative change in demand and supply.

The various results can be briefly summarised as follows:

When one of the demand or supply curves shifts, the effect on both the price (P) and quantity (Q) can be determined:

- An increase in demand (a shift rightward in the demand curve) raises P and increases Q.
- A decrease in demand (a shift leftward in the demand curve) lowers P and decreases Q.
- An increase in supply (a shift rightward in the supply curve) lowers P and increases Q.

When both the demand and supply curves shift the effect on the price or the quantity can be determined but without information about the relativity of the shifts, the effect on the other variable is ambiguous.

- If both the demand and supply curves increase (shift rightward), the quantity increases but the price may rise, fall or remain the same.
- If the demand decreases (shifts leftward) and the supply increases (shifts rightward) the price falls but the quantity may increase, decrease, or not change.

4.3.1 Determination of Equilibrium: A Mathematical Presentation

We begin with a simple numerical example:

$$q^d = 100 - 2p \quad (1)$$

$$q^s = 3p \quad (2)$$

$$q^d = q^s \quad (3)$$

We solve the system by substituting (1) and (2) into (3):

$$100 - 2p = 3p = 100 = 3P + 2P$$

or $5p = 100$

or $p = 20$

by putting P value in equation (1) we get,

$$q^d = 100 - 2(20)$$

$$q^d = 60$$

and $q^s = q^d = 60$

If we let the demand curve shift to the right so that 60 more units are bought at each price, (I) becomes

$$q^d = 160 - 2p \quad (1')$$

Substituting (1') and (2) into (3) yields $p = 32$ and $q^d = q^s = 96$.

In this manner we could solve the equations every time.

Algebra allows us, however, to find the solution to any linear demand supply system. To do this, we substitute letters, called **parameters**, for the numbers in the above system:

$$q^d = a + bp,\ a > 0,\ b < 0 \quad (4)$$

$$q^s = c + dp,\ c < a,\ d > 0 \quad (5)$$

$$q^d = q^s \quad (6)$$

The restrictions on the parameters ensure that a positive amount is demanded at a zero price ($a > 0$), that the demand curve has a negative slope ($b < 0$), and the supply curve has a positive slope ($d > 0$). The restriction on c is a little more complex. If c is less than zero a positive price is required to call forth any supply. If c exceeds zero, some amount is supplied at a zero price. In that case, we need less to be supplied than demanded at a zero price ($a > c$) if we are to get a positive equilibrium price. If $c > a$, supply exceeds demand at a zero price and the linear model solves for a negative price.

To avoid this, we need the added condition that $p = 0$ whenever $c > a$.

Once again, we solve by substituting the equations (4) and (5) into (6). This gives

$$a + bp = c + dp$$

Simple manipulation produces

$$p = \frac{a-c}{d-b} \quad (7)$$

Now, whenever we encounter a numerical example, we can substitute the numbers directly into (7) and obtain the answer.

4.3.2 Uniqueness of Equilibrium and Multiple Equilibria

So far, we have examined the situations in which a unique equilibrium is established, i.e., a single price (or single quantity) corresponding to a single quantity (or single price).

We can also conceive of a situation in which there is no such unique price or unique quantity. This is illustrated with the help of Fig. 4.7 and Fig. 4.8.

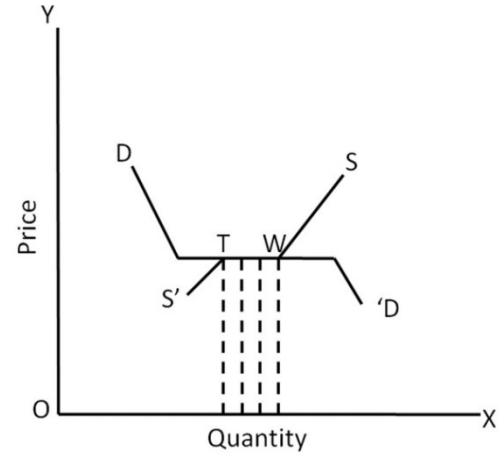


Fig. 4.7

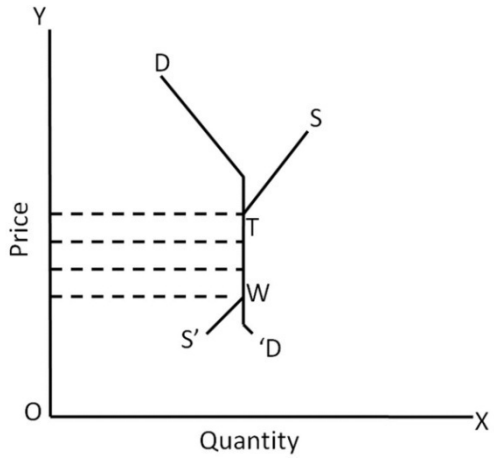


Fig. 4.8

In Fig. 4.7, both the demand curve and the supply curve have horizontal segments.

As a result of this, though the equilibrium price is uniquely determined, there is no unique quantity. It lies in the range TW.

In Fig. 4.8 similarly, both the demand curve and the supply curve have vertical segments. Though a unique quantity is determined, there is no unique price. The equilibrium price lies in the range TW.

This is also known as **multiple equilibria.**

Check Your Progress 1

1) Given the following demand and supply functions, find the equilibrium price and quantity in the market

$$q^s = -5 + 3P,\ q^d = 10 - 2P$$

2) From the following equation find the equilibrium price and output $q^d = 6 - P$, $q^s = 3P - 2$

3) State whether following statements are true or false:

   i) All demand curves have positive slopes

   ii) Prices change if and only if there is excess demand or excess supply

   iii) Prices fall if there is excess demand

   iv) The Walrasian equilibrium adjustment process works through change in quantity

   v) The quantity increases in case of both demand and supply curve shift rightwards.

4) There are 1000 identical individuals in the market for commodity X given the individual demand function $q^d = 12 - 2P$ and 100 identical producers of commodity given the individual producer supply function $q^s = 20P$. Find the equilibrium price and quantity.

4.4 APPLICATIONS

4.4.1 Rationing and the Allocation of Scarce Goods

Rationing implies fixation of price controls. Price control means that a ceiling has been imposed on the prices of such commodities as are covered under the price-control measures. Fixation of ceiling on prices means that the free operation of the forces of demand and supply is not being permitted.

Let us see what will happen in such a situation. This can be illustrated with the help of Fig. 4.9. DD and SS are the original demand and supply curves respectively for a commodity. R is the equilibrium point, corresponding to which OQ quantity is being demanded and supplied at the price OP per unit. Suppose the Government decides to interfere with the free operation of the market forces, i.e., it decides to impose price controls. Price controls, as already stated, take the form of ceiling on prices. Ceiling could be fixed at a price (a) higher than the equilibrium price, say at OK, (b) equal to the equilibrium price, i.e., OP, and (c) less than the equilibrium price, say at OH.

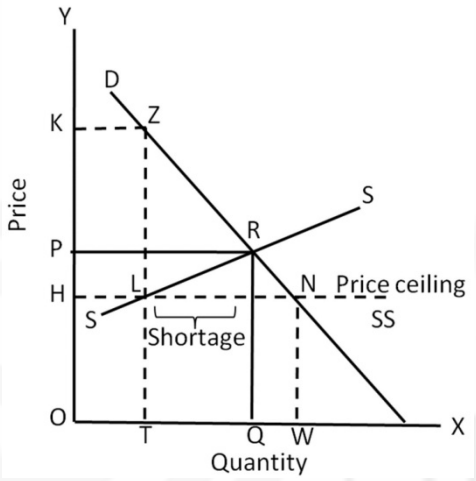


Fig. 4.9

- Ceiling price more than the equilibrium price will have no effect on the market. At a higher price say OK, OT quantity of the commodity will be demanded. The suppliers, on the other hand, would be waiting in their wings to supply more than the quantity being presently demanded. There will be a tendency for the price to fall down to the equilibrium level.

- If ceiling price equals the equilibrium price, OP, it will leave the market unaffected.

- If ceiling price is less than the equilibrium price, it will create conditions which need our further attention. Suppose, in Fig. 4.9, the Government imposes ceiling at OH per unit. The equilibrium price, OP, would no longer be legally obtainable. Prices must be reduced from OP to OH. At the lower price, OH, quantity demanded will expand to HN or OW. But at this reduced price, suppliers will be ready to supply only HL or OT quantity of goods. As a result, a shortage of this commodity (equal to quantity demanded minus quantity supplied) will emerge. This shortage is being represented by the line segment LN.

We reach the following conclusion about the effect of price control in free market: The setting of minimum prices will either have no effect (maximum price set at or below the equilibrium) or it will cause a shortage of the commodity and reduce both the price and the quantity actually bought and sold below their equilibrium values.

Consequences of Price Controls (ceiling below the equilibrium price). Imposition of ceiling below the equilibrium price will have the following major implications:

1) **Shortages:** The quantity actually sold and bought in the market will shrink. As a result, a large chunk of consumer's demand will go unsatisfied. The situation, as it arises, has been explained in Fig. 4.9.

2) **Problem of allocation of limited supplies among large number of consumers:** As already observed, shortage of a commodity means that all those consumers who demand the commodity at the ruling price cannot be satisfied. In other words, a large number of potential consumers of the commodity will be denied its use.

Here question arises how to allocate the limited supplies among large numbers of consumers?

One general way is that it is left at the retail shops to arrange for the distribution of the scarce product. For example, in our country, we have often witnessed such products as kerosene, edible oils, sugar, onions, etc., going scarce in the market. More generally, the consumer is left at the mercy of the local retailer, who more often than not chooses I: serve his regular customers in preference to others.

Among all others, the scarce product may be distributed on the basis of first-come-first-served. The latter situation often develops in the formation of long unmanageable queues at the retail centres, so that the persons lining up at the tail of the queue have only a little chance of getting the desired good. To avoid these problems which may often arise from the free marketing of the scarce product, Governments generally couple price controls with distribution controls. The most effective form of distribution control is rationing.

Rationing implies that a ceiling is imposed on the quantity which can be bought and consumed by a consumer. A consumer with less utility may choose not to purchase the rationed product. But those consumers for whom the rationed product has fairly large marginal utility are assured of some quantity at least, which possibly might not have been available to them in free marketing conditions. Rationing thus will increase the aggregate utility derived by the community from the consumption of the commodity. In such a situation, in all probabilities, rationing will replace first-come-first-served method of distribution.

We reach the conclusion:

Where there is a feeling against allocation on the basis of first-come-first-served and seller's preferences, effective price ceiling will give rise to strong pressure for a central (administered) system of rationing.

3) **Black Marketing:** It is a direct consequence of price controls. Black marketing implies a situation in which the controlled commodity is sold unlawfully, below the desk, at a price higher than the lawfully enforced ceiling price.

This situation arises largely because of the fact that (i) the number of potential consumers of the commodity is more than what can be served by the available supplies of the commodity, and, (ii) there are consumers who are willing to pay more than the ceiling price. This latter phenomenon is more important in creating black market and sustaining it.

In Fig. 4.9, OH is the ceiling price. At this price only OT quantity is being supplied and therefore actually bought in the market. We can see from DD curve in Fig. 4.9 that OT quantity would be demanded even at the price TZ or OK, which is substantially higher than the ceiling and the equilibrium price. Those buyers, who are willing to pay more than the ceiling price, will prefer to indulge in underhand transactions rather than go without the commodity since none of the free market methods of distribution can assure these consumers that the desired supplies would be coming.

Thus, we reach the interesting conclusion:

Black marketing in a commodity whose price has been controlled by the authorities will invariably arise since there are consumers who are willing to pay more than the controlled price.

4.4.2 Price Support Measures

Price support means a floor has been fixed on the prices of such commodities as are covered under the price-support measures.

Producers of these commodities need not sell at prices lower than the floor prices (i.e., the minimum prices) fixed by the Government. Fixation of floor on prices means that the free operation of the forces of demand and supply is being interfered with. Let us see what will happen in such a situation.

In Fig. 4.10; R is the equilibrium point determined by the intersection of demand and supply curves, OQ quantity is being supplied and demanded at OP price. Suppose, the Government decides to impose price supports. Price supports mean that the Government imposes a floor on prices. Floors could be fixed at a price (a) lower than the equilibrium price, say at OH; (b) equal to the equilibrium price, OP; and (c) more than the equilibrium price, say at OK.

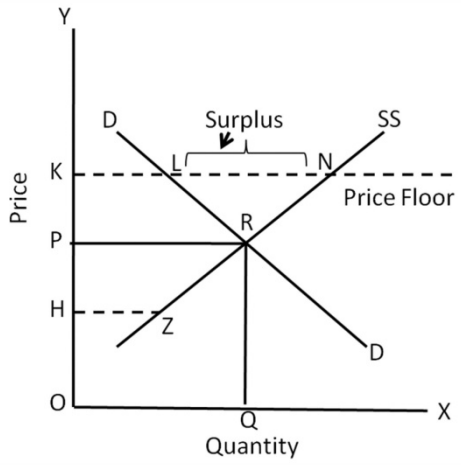


Fig. 4.10

Floor Price Lower than the Equilibrium Price: If floor price is less than the equilibrium, it will have no effect on the market. At a lower price, say OH, HZ quantity will be supplied. The consumers, on the other hand, would be willing to pay a higher price. The price will move upwards towards the equilibrium level.

Floor Price Equal to the Equilibrium Price: If floor price equals the equilibrium price, OP, it will leave the market unaffected.

Floor Price Higher than the Equilibrium Price: If floor price is more than the equilibrium price, it will need our further attention. Suppose, in Fig. 4.10, the Government imposes the price floor at OK per unit. The equilibrium price OP would no longer be legally obtainable. Price must be raised to OK. At the higher price, OK, quantity demanded will contract to KL. But at this price suppliers will be ready to supply KN quantity. As a result, a surplus will emerge; surplus is shown by the line segment LN.

We reach the following conclusion about the effect of price support in a free market:

The setting of minimum prices will either have no effect (minimum price set below the equilibrium) or it will cause surplus of the commodity to develop with the actual price being above its equilibrium level but the actual quantity bought and sold being below its equilibrium level.

Consequences of Price Support (Floor above equilibrium price): Imposition of floor prices above equilibrium price will have the following major implications:

1) **Surpluses:** The quantity actually bought and supplied will shrink as a direct consequence of price support. As a result, large chunk of producer's stocks will remain unutilised. The situation, as it arises, has been explained in Fig. 4.10 where the surplus has been shown equal to LN.

2) **Buffer Stocks:** In order to maintain the support price, the Government would have to design some such programme as to enable producers to dispose of their surplus stocks. One such programme can take the form of buffer stocks. The Government purchases the surplus stocks available with the producers, these stocks are released if and when the production of the supported commodity suffers. The buffer stock operations benefit the producers as a group. But who bears this cost? First, consumer who has to pay higher prices for the product. Second, the people in general who have to pay taxes to support this programme.

3) **Subsidies:** To offset the loss to the consumers, the Government may undertake to subsidise the product. By subsidy we mean that the Government purchases the product at the support price and sells the product to consumers below its cost of procurement. The difference between cost and price is borne by the Government.

Before we leave this discussion of price floors and ceilings, the reader should note that such terms as surplus and shortage are defined with reference to a specific price.

4.4.3 Minimum Wage Legislation

Minimum wage legislation is similar to fixing of floor prices. Governments, at times, are known to have interfered in the factor markets also. Legislation may be enacted whereby in the market, employers may be prohibited from paying less than the minimum wage fixed by the Government. The effect of fixing the minimum wage would be the same as that of fixing the minimum price of a commodity. Let us illustrate this effect diagrammatically, as in Fig. 4.11.

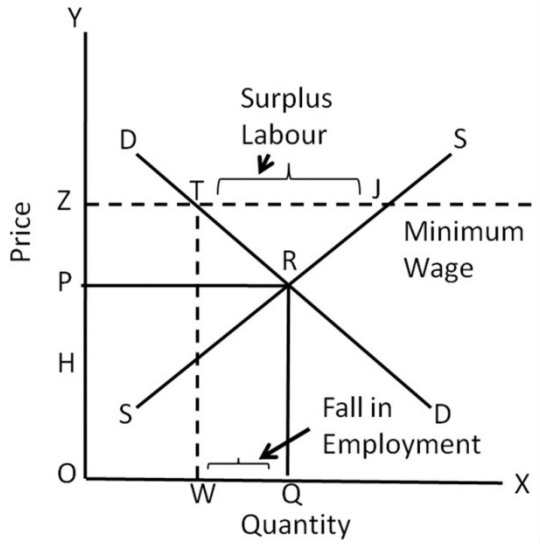


Fig. 4.11

In Fig. 4.11, OQ quantity of labour is being demanded and supplied at the equilibrium wage rate OP. If the wage rate is fixed at OZ by Government legislation, or by trade union agreement, the following consequences will follow:

1) Where the law or the agreement is effective, it will raise the wages of that labour which remains in employment, from OP to OZ.

2) Minimum wage will lower the actual amount of employment; at the new minimum wage rate only ZT or OW labour would be demanded, whereas at the equilibrium wage OQ labour was being supplied and demanded. Employment will fall by WQ.

3) Minimum wage will create a surplus of labour which would like to work, but cannot find a job. The surplus labour would equal TJ.

4) Some of the unemployed workers may be tempted or forced to offer themselves for work at the wage rate below the floor rate. Some sort of clandestine transaction in the labour market will begin to take place.

4.4.4 Arbitrage

Arbitrage is an operation involving simultaneous purchase and sale of a commodity in two or more markets between which there are price differentials or discrepancies. The arbitrageur aims to profit from the price difference; the effect of his action is to lessen or eliminate it.

Suppose fresh mushrooms are being sold in New Delhi and Noida. Geographically separate markets are illustrated in Fig. 4.12.

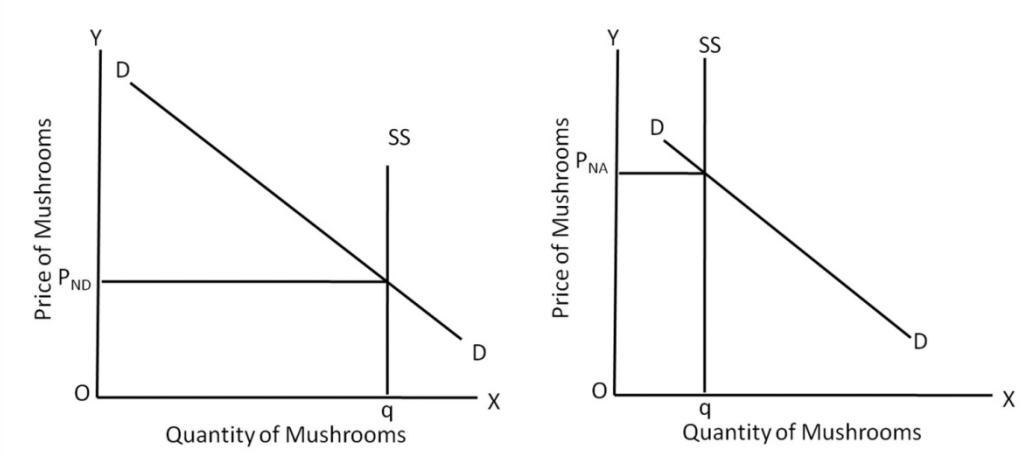


Fig. 4.12

New Delhi (ND) and Noida (NA) are separate markets with separate demand curves. The vertical supply curve in each city represents the quantity of mushrooms now available in each place. The equilibrium price in New Delhi is labelled P_{ND} and in Noida, P_{NA}.

If the equilibrium price in New Delhi is much less than that in Noida, a trucker might buy a load in New Delhi and sell them in Noida. As long as the price differential is greater than the cost of transporting the mushrooms, it will pay truckers to buy and sell in this way. As mushrooms are bought in New Delhi for sale in Noida, the price in New Delhi will increase, while that in Noida will fall. Thus the transport of mushrooms from New Delhi to Noida tends to narrow the price gap between the two cities. This process is called arbitrage.

Arbitrage will stop when the price differential becomes equal to or less than the cost of transportation between the two points. If transportation costs are small relative to the price of the good, the price differentials between cities will remain small.

Arbitrage narrows the dispersion of prices. If commodities are easily transported, geographic variations in price are small. If a commodity is easily stored, seasonal variations in price are insignificant. When markets are well-organised, with information about prices in different places and times readily available, arbitrage works easily. Any dealer can act as an arbitrageur by deciding when and where to buy. If, however, information about prices in different times and places is expensive to get, the dispersion of prices will then be greater.

Case Study

A few years ago The New York Times carried a dramatic front page picture of the President of Kenya setting fire to a large pile of elephant tusks that had been confiscated from poachers. The accompanying statement explained that the burning was intended as a symbolic act to persuade the world to halt the ivory trade. One may well doubt whether the burning really touched the hearts of criminal poachers. However, one economic effect was clear. By reducing the supply of ivory in the world markets, the burning of tusks forced up the price of ivory which raised the illicit rewards reaped by those who slaughter elephants. They could only encourage more poaching – precisely the opposite of what the Kenyan government sought to accomplish!

4.4.5 Sharing of Tax Burden

Who bears the tax burden under following situations:

a) When demand is perfectly elastic and supply is of normal shape.

b) When demand is perfectly inelastic and supply is of normal shape.

c) When supply is perfectly elastic and demand is of normal shape.

d) When supply is perfectly inelastic and demand is of normal shape.

a) When demand is perfectly elastic, the whole tax burden is borne by the producer himself as is illustrated in the Fig. 4.13. Before imposition of tax, equilibrium point is E which gives equilibrium price as OP. After the imposition of per unit tax, the equilibrium point shifts to giving equilibrium price as OP which is same as before the imposition of tax. Hence the whole tax burden is borne by the producer.

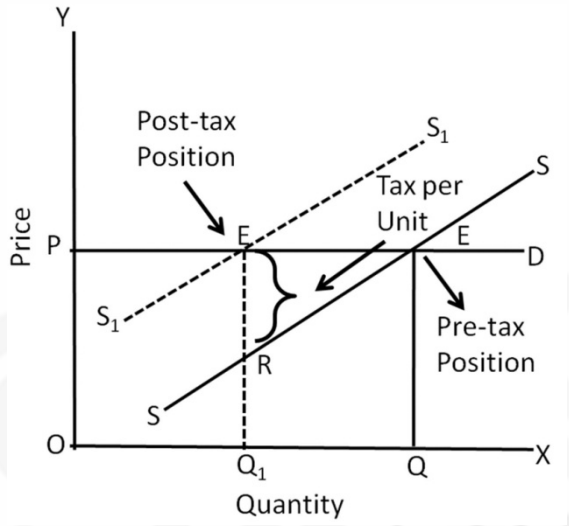


Fig. 4.13

b) When demand is perfectly inelastic, the whole tax burden is borne by the consumer because in this case the price rises by the full amount of tax as shown in the Fig. 4.14. The equilibrium point before imposition of tax is E which gives the equilibrium price as OP. After the imposition of tax per unit, the equilibrium point shifts to E_1 which gives equilibrium price as OP_1 Thus, price rises by the full amount of tax.

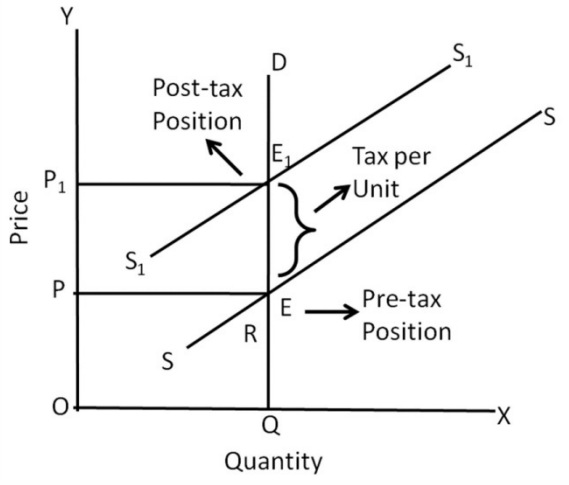


Fig. 4.14

c) When supply is perfectly elastic, the whole tax burden is borne by the consumer as illustrated in the Fig. 4.15. Before imposition of tax, the equilibrium point is E giving equilibrium price as OP. After the imposition of tax, the equilibrium point shifts to E_1 showing equilibrium price as OP_1. Thus the whole tax burden is borne by the consumer.

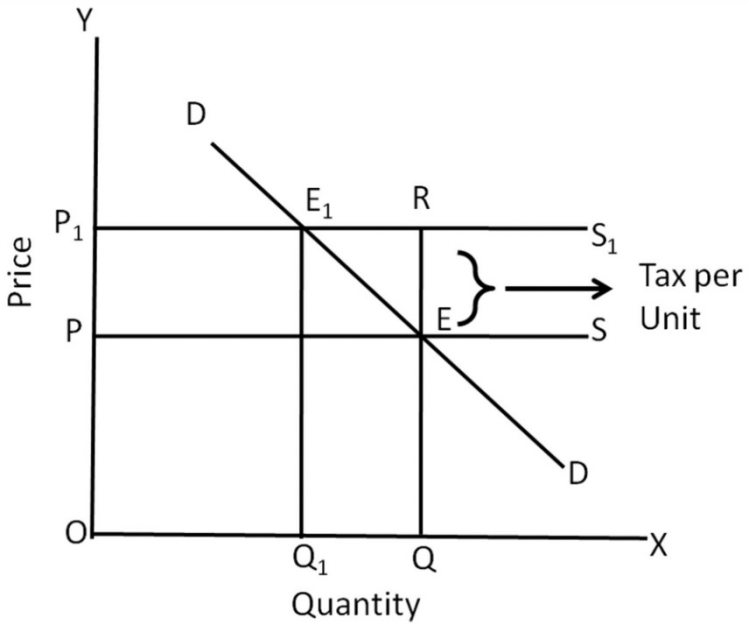


Fig. 4.15

d) When supply is perfectly inelastic, the whole tax burden is borne by the seller as the pre-tax equilibrium position and post-tax equilibrium remains unchanged, as shown in Fig. 6.16. Since supply is perfectly inelastic, with the imposition of tax the supply curve remains unchanged as such equilibrium price remains unchanged. So the tax burden falls on producer.

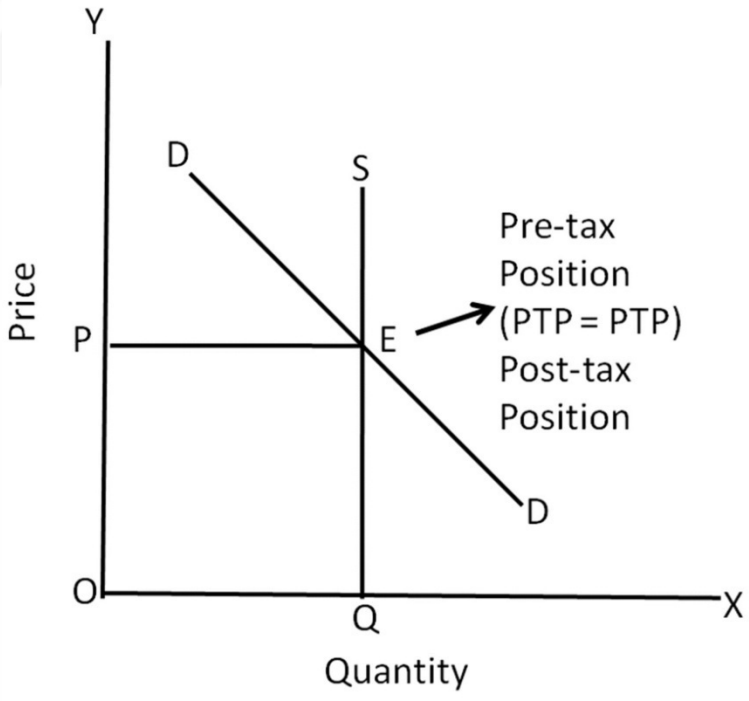


Fig. 4.16

- Show that as the demand curve becomes steep (arid hence inelastic) as greater amount of the tax is passed on to the consumer.

We take three different demand curves with different elasticities as shown in Fig. 4.17.

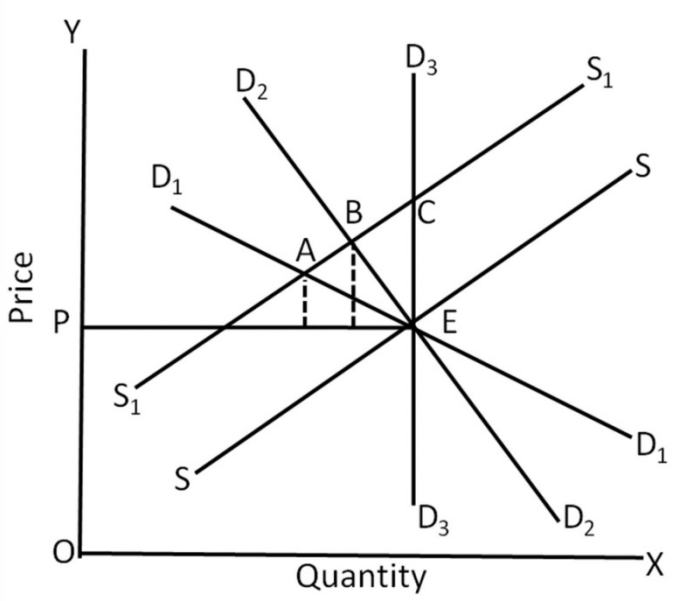


Fig. 4.17

All the three curves are drawn through the point E in order to facilitate comparison. Let the imposition of tax shift the supply curve to S_1S_1. The post-tax equilibrium position is shown by three points, A, B or C depending upon whether the relevant demand curve is D_1D_1, D_2D_2 or D_3D_3 respectively. The length of vertical line segment from points A, B or C to the line PE shows the amount of increase in the consumer price that will occur, given the respective demand curves. Examining the relationship between the amount of the price increase and the slope of the demand curve, we note that as the demand curve becomes steep (and hence elastic) a greater amount of the tax is passed onward to the consumer.

Check Your Progress 2

1) The price of a personal computer has continued to fall in the face of increasing demand. Explain.

2) New cars are normal goods. Suppose that the economy enters a period of strong economic expansion so that people's incomes increase substantially. Determine what happens to the equilibrium price and quantity of new cars.

3) State whether following statements are true or false:

   i) If ceiling price equals the equilibrium price, it will affect the market.

   ii) The minimum wage Act lowers the actual employment of workers.

   iii) Arbitrage widens the dispersion of prices.

   iv) When the demand is perfectly elastic, the whole burden is born by the consumer.

4) Suppose that the policy makers decide that the price of a pizza is too high and that not enough people can afford to buy pizza. As a result, they impose a price ceiling on pizza that is below the current equilibrium price. Are consumers able to buy more pizza: before the price ceiling or after?

5) Suppose that demand for a good is subject to unpredictable fluctuations. Explain how speculators help reduce the price variability of the good.

4.5 LET US SUM UP

Basics of demand and supply enables us to appreciate the relevance of economics in day to day life. Market price is determined at a point where quantity demanded is equal to quantity supplied. The characteristics of demand and supply may differ from one situation to another and from one market to another. These market forces influence the prices and quantity over a period of time. Marshalian equilibrium is attained through the process of change in quantity whereas Walrasian adjustment process works through a change in price.

Imposition of ceiling below the equilibrium price have implications of shortage of supply, black marketing and hence the need for central administered system of rationing. The imposition of floor prices may cause the surpluses of the commodity, hence need for buffer stocks and selling of the product to the consumers at subsidised prices.

The impact of minimum wage legislative is similar to fixing of floor prices.

The Arbitrage narrows the dispersion of prices.

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3) Hal R. Varian, *Intermediate Microeconomics: a Modern Approach, 8th edition*, W.W.Norton and Company/ Affiliated East-West Press (India), 2010.

4.7 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) $P = 3$, $q^d = 4$

2) $p = 2$, $q = 4$

3) (i) False (ii) True (iii) False (iv) false (v) True

4) $P = 3$, $q = 6000$

Check Your Progress 2

1) Personal computers have fallen in price although the demand for them has increased because the supply has increased more rapidly.

2) Because new cars are a normal good, an increase in income increases the demand for them. Hence the demand curve shifts rightward. As a result, the equilibrium price rises and the equilibrium quantity also rises.

3) (i) False (ii) True (iii) False (iv) False

4) As a result of a price ceiling, the sellers would offer less quantity for sale in the market. The consumers would end up consuming less of the pizzas. There would be a large unmet demand.

5) Speculators buy the product to exploit any potential profit opportunities. In particular, speculator- aim to sell the good from their inventories if the current price is higher than the expected future price and they strive to buy the good to be added to their inventories if the current price is below the expected future price.

The first profit opportunity – selling when the current price is higher than the expected future price – reduces the current price. The second profit opportunity – buying when the current price is lower than the expected future price – raises the current price.

Selling, if the price is higher than, or buying, if the price is lower than the expected future price, means that the price will not deviate much from the expected future price.

Thus, speculators help reduce price fluctuations and make the price less variable.

4.8 TERMINAL QUESTIONS

1) Given the following supply and demand equations

$$Q^u - 100 - 5P$$

$$Q^s - 10 + 5P$$

a) Determine the equilibrium price and quantity.

b) If the government sets a minimum price of Rs. 10 per unit, how many units would be supplied and how many would be demanded?

c) If the government sets a maximum price of Rs. 5 per unit, how many units would be supplied and how many would be demanded?

d) If demand increases to

$$Q^{d1} = 200 - 5P$$

determine the new equilibrium price and quantity.

2) Discuss the likely effects of the following:

a) Rent ceilings on the market for apartments.

b) Floors under wheat prices on the market for wheat.

Use supply-demand diagrams to show what may happen in each case.

3) The demand and supply curves for T-shirts in the tourist town, Bengaluru, are given by the following equations:

$$Q^d = 24{,}000 - 500\ P$$

$$Q^s = 6{,}000 + 1{,}000\ P$$

a) Find the equilibrium price and quantity algebraically.

b) If tourists decide they do not really like T-shirts that much, which of the following might be then demand curve?

$$Q^d = 21{,}000 - 500\ P$$

$$Q^d = 27{,}000 - 500\ P$$

Find the equilibrium price and quantity after the shift of the demand curve.

c) If, instead, two more new stores that sell T-shirts open up in town, which of the following might be the new supply curve?

$$Q^s = 3{,}000 + 1{,}000\ P$$

$$Q = 9{,}000 + 1{,}000\ P$$

Find the equilibrium price and quantity after the shift of the supply curve.

4) Under which condition will a shift in the demand curve result mainly in a change in quantity? In price?

5) Under which condition will a shift in the supply curve result mainly in a change in price? In quantity?

6) Suppose the market demand for pizza is given by $Q^d = 300 - 20\ P$ and the market supply for pizza is given by $Q^s = 20\ P - 100$, where P = price (per pizza).

a) Graph the supply and demand schedules for pizza using Rs. 5 through Rs. 15 as the value of P.

b) In equilibrium, how many pizzas would be sold and at what price?

c) What would happen if suppliers set the price of pizza at Rs 15? Explain the market adjustment process.

d) Suppose the price of hamburgers, a substitute for pizza, doubles. This leads to a doubling of the demand for pizza (at each price consumers demand twice as much pizza as before). Write the equation for the new market demand for pizza.

e) Find the new equilibrium price and quantity of pizza.

BLOCK 2 THEORY OF CONSUMER BEHAVIOUR

BLOCK 2 THEORY OF CONSUMER BEHAVIOUR

Microeconomics essentially describes how prices are determined. In a market economy prices are determined by the interaction of consumers, firms and workers. Demand is made by the consumers. Hence this block explains the principles underlying consumer behaviour. The block comprises of two units. **Unit 5** explains Consumer behaviour under cardinal approach wherein utility is measured in quantitative scale. Law of diminishing marginal utility, consumer equilibrium with the help of equi-marginal utility, derivation of demand curve, consumer surplus and critical evaluation of the cardinal utility analyses constitute the core contents of this unit. **Unit 6** discusses the consumer behaviour under Ordinal approach where utility is perceived in terms of preferences and ranking. Properties of indifference curves, consumer equilibrium through indifference curve analysis, law of diminishing marginal rate of substitution, separation of price effect into income effect and substitution effect, derivation of demand curve from indifference curve etc have been covered in this unit.

UNIT 5 CONSUMER BEHAVIOUR: CARDINAL APPROACH

Structure

5.0 Objectives

5.1 Introduction

5.2 Concept of Utility
- 5.2.1 What is Utility?
- 5.2.2 Relationship between Want, Utility, Consumption and Satisfaction
- 5.2.3 Measurement of Utility

5.3 Some Basic Assumptions about Preferences
- 5.3.1 Assumptions about Consumer Preferences

5.4 Cardinal Utility Analysis

5.5 Law of Diminishing Marginal Utility
- 5.5.1 Exceptions to the Law/Limitations of the Law
- 5.5.2 Criticism of the Law

5.6 Consumer Equilibrium through Utility Analysis
- 5.6.1 Determination of Consumer Equilibrium

5.7 Derivation of Demand Curve with the Help of Law of Diminishing Marginal Utility

5.8 Consumer Surplus

5.9 Critical Evaluation of Cardinal Utility Analysis

5.10 Let Us Sum Up

5.11 References

5.12 Answers or Hints to Check Your Progress Exercises

5.0 OBJECTIVES

After completion of this unit, you will be able to:

- explain the concept of utility;
- analyse and use cardinal utility approach for measurement of utility;
- explain Law of Diminishing Marginal utility;
- describe consumer equilibrium with the help of law of equi-marginal utility;
- distinguish between cardinal and ordinal utility approaches; and
- list the assumptions of consumer preferences.

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5.1 INTRODUCTION

In previous units, we have understood the concept of demand and supply, their determinants, and elasticity of demand and supply etc. We have also applied the concepts of demand and supply in practice i.e. equilibrium, determination of price and quantity, rationing and allocation of scarce goods, minimum wage legislation and arbitrage etc. In this and subsequent unit, we shall examine the theory of consumer behaviour. Consumer behaviour has always been a subject of curiosity and research. Researchers have been trying to understand and predict consumer behaviour ever since the commencement of trade. However, relevance of this subject has increased over the time. With global markets and more informed customers today, success of business is entirely dependent on its understanding of consumer behaviour. Traditional businesses are getting obsolete every day and new businesses based on needs of consumers (or utility) are evolving. Increased internet penetration has changed the concept of market. Businesses are increasingly talking about value creation rather than mere product creation.

The concept of value creation is based on the concept of utility. Consumer values a product only if it has 'utility' for him. Thus, the concept of utility has become extremely relevant today. It is guiding marketing team across the globe in designing business and marketing the company in a way that is likely to attract the maximum number of customers and maximise sales revenues.

Let us begin to state the concept of utility and how has it evolved.

5.2 CONCEPT OF UTILITY

Utility is the basis of consumer demand. The consumers demand a commodity because they desire or expect to derive utility from that commodity. As discussed above, the concept of market, interaction between consumer and producer has evolved in present times. Today, a consumer is more informed about the choices available to him and someone somewhere is trying to produce a good/service in order to provide utility to the customer. New businesses, like an app to book a cab, maid, grocery, medicine, beauty service etc. which have evolved in present time are successful because they provide high utility to their customers.

5.2.1 What is Utility?

Utility is a psychological phenomenon. It is a feeling of satisfaction, pleasure or well-being experienced by the consumer from the consumption or possession of the commodity or availing of a service. In this sense, it is a subjective or relative concept i.e. level of utility derived from a product differs from person to person. For example, meat has no utility for vegetarians.

Utility of a product can be 'absolute' in the sense that the want satisfying power is ingrained or embeded in it. For example, pen has its own utility whether a person can write or not. However, utility is considered as 'subjective' in consumer analysis because a consumer will demand a good only if that good holds utility for her. Utility not only varies from person to person but also from time to time, at different level of consumption and at different moods of a consumer. The most basic example to understand this concept is food. If a person is not hungry, even her favourite food will not have any utility for her at that point of time.

Based on this understanding, marketing concepts have also evolved over the time. Advertisers target now consumers on the basis of their past purchases, interests, likes/dislikes, sites they visit. Customers are often offered customised coupons for the product/service that might hold 'utility' for them.

5.2.2 Relationship between Want, Utility, Consumption and Satisfaction

Want of the consumer is the basis of understanding her behaviour. A consumer selects a commodity based on its want satisfying power. Consumption of the commodity leads to satisfaction of wants. Thus want, utility, consumption and satisfaction are related in following manner:

Want → Selection of commodity → Consumption of the commodity → Getting utility in the sense of satisfaction of the want

Following points can be noted about utility:

a) Utility is a want satisfying power of a commodity

b) Utility varies from person to person

c) It varies from time to time, at different level of consumption and at different moods of a consumer.

There are three concepts related to utility:

1) **Initial Utility-** The utility derived from the first unit of a commodity is called initial utility. For example: utility obtained from consumption of first roti is called initial utility.

2) **Total Utility-** The utility derived by a person from the total number of units of a commodity consumed by her is called total utility.

$$\text{i.e. } TU_n = U_1 + U_2 = U_3 = \ldots U_n$$

3) **Marginal Utility-** It means addition made to total utility by consuming an additional unit.

It can be measured with the help of following formula:

$$\mathbf{MU_n = TU_n - TU_{n-1}}$$

Where: MU_n = Marginal utility of nth unit

TU_n = Total utility of n units

TU_{n-1} = Total utility of n – 1 units or one unit less than the total no. of units

Let us understand the concept with the help of Table 5.1 and Fig. 5.1.

Table 5.1: Relationship between Total utility (TU) and Marginal utility (MU)

Units of a Good Consumed	Total Utility (TU)	Marginal Utility (MU)
1	6	6
2	10	4
3	12	2
4	12	0
5	10	-2
6	6	-4

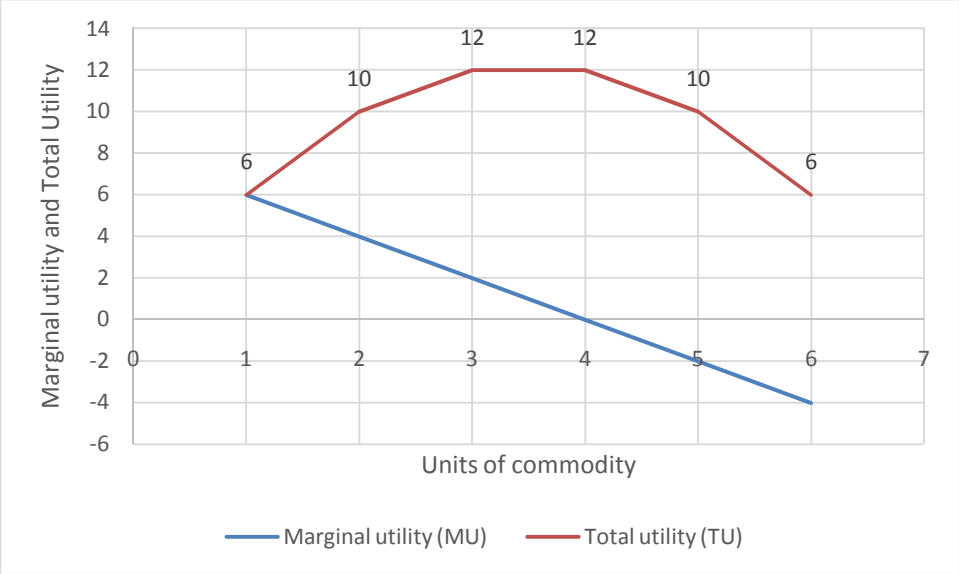

Fig. 5.1: Relationship between Total utility (TU) and Marginal utility (MU)

In Fig. 5.1, units of commodity are measured along x axis and utility is measured along y axis. Upto 3rd unit the total utility is increasing but marginal utility is diminishing but is positive. When a consumer consumes 4th roti, the total utility is maximum and the marginal utility is zero. Consumer is getting maximum satisfaction at this point. If a consumer consumes more than 4 units, total utility will diminish and the marginal utility will be negative. This is also called Law of diminishing Marginal Utility, which is discussed in detail in Section 5.4.

5.2.3 Measurement of Utility

The concept of measurement of utility has evolved over the time. The classical economists viz Jeremy Bentham, Menger, Walras etc. and neoclassical economists like Marshall believed that utility is cardinally or quantitatively measurable like height, weight etc. The belief resulted in **Cardinal Utility Approach**. The exponents of cardinal utility analysis regard utility to be a cardinal concept. According to them, a person can express utility or satisfaction he derives from the goods in the quantitative cardinal terms. Jeremy Bentham (1748–1832), the founder of Utilitarian school of ethics coined a psychological unit of measurement called 'utils'. Thus, a person can say that he derives utility equal to 10 utils from the consumption of a unit of good A, and 20 utils from the consumption of a unit of good B. Moreover, the cardinal measurement of utility implies that a person can compare utilities derived from goods in respect

of size, that is, how much one level of utility is greater than another. According to Marshall, marginal utility is actually measurable in terms of money and money is the measuring rod of utility. This approach will be discussed in detail in Section 5.4. The modern economists like J.R Hicks, Allen are of view that utility is not quantitatively measurable but can be compared or ranked. This is known as **Ordinal concept of utility**. Modern Economists hold that utility being a psychological phenomenon, cannot be measured quantitatively, theoretically and conceptually. However, a person can introspectively express whether a good or service provides more, less or equal satisfaction when compared to one another. In this way, the measurement of utility is ordinal, i.e. qualitative, based on the ranking of preferences for commodities. For example, Suppose a person prefers tea to coffee and coffee to milk. Hence, he or she can tell subjectively, his/her preferences, i.e. tea > coffee > milk. Ordinal Utility approach of measurement of utility is discussed in detail in the next unit.

Check Your Progress 1

1) Explain the relationship between total utility and marginal utility.

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2) Calculate Marginal utility in following table:

Ice Creams Consumed	Total Utility	Marginal Utility
1	20	
2	36	
3	46	
4	50	
5	50	
6	44	

5.3 SOME BASIC ASSUMPTIONS ABOUT PREFERENCES

One of the basic questions addressed in microeconomics is how a consumer with limited income takes decision about which good/service to buy. As discussed above, consumer behaviour has gained great relevance today and companies are spending huge amount to understand consumer preferences. Success of business has always been dependent on its understanding of consumer behaviour. But now since the world is more connected than ever through internet, consumers have large number of options. It has become imperative for companies to analyse consumer choices, preferences and design their goods/services accordingly.

Economists have identified three basic steps to understand consumer behaviour:

1) **Consumer Preferences:** First step is to identify consumer preferences. This can be done graphically or algebraically also. Behaviour is based on preferences i.e. likes, dislikes of the consumers. Thus, it is important to identify 'what gives value to the consumer'. We live in an information age and today. Companies follow their customers online, keep a track of sites they visit, products they buy etc. in order to identify their preferences. Social networking sites have become popular data source to identify preferences.

2) **Budget Constraints:** This is next important aspect. Prices of goods and paying capacity of consumer has strong influence on his behaviour. Through online tracking, companies today are not only able to identify consumer preferences alone, but also their paying capacity and budget constraints. Additional discounts, cash back schemes, EMI options etc. are offered to the customer these days in order to ease their budget constraint.

3) **Consumer choices:** Final step to understand consumer behaviour is consumer choices. Given preferences and limited income, consumer chooses the combination of goods which maximise their satisfaction. With markets becoming global, consumers have large number of choices available these days. But final demand for a good will be dependent on combination of factors: their preferences, value offered by the product and budget constraint.

5.3.1 Assumptions about Consumer Preferences

As discussed above, the theory of consumer behaviour is based on consumer preferences. For better understanding of consumer behaviour with the help of consumer preferences, economists usually make following assumptions about consumer preferences:

a) **Completeness:** Preferences are assumed to be complete i.e. any two different bundles of goods can be compared. A consumer either prefers one basket over other or is indifferent between two baskets.

Mathematically, $(a1, a2) \geq (b1, b2)$ or

$(a1, a2) \leq (b1, b2)$ or

Both

b) **Transitivity:** Transitivity means that if a consumer prefers X over Y and Y over Z then the consumer also prefers X over Z. Transitivity is a necessary assumption to ensure consumer consistency.

c) **More is always preferred over less:** Consumer is rational and knows that greater utility can be derived by consuming more quantity of a commodity. Thus, he always prefers more quantity over less.

Check Your Progress 2

1) What are the basic assumptions about consumer preferences?

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2) How does consumer preferences affect consumer behaviour?

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5.4 CARDINAL UTILITY ANALYSIS

Cardinal utility Analysis was mainly given by neoclassical economists like Jevons, Dupuit, Menger, Walras and Pigou etc. The exponents of this approach regards utility as cardinal concept. In other words, they hold that utility is a measurable and quantifiable entity. For example, According to cardinal utility approach, if a person is drinking a glass of water, it will be possible for him to assign some numerical value say 10 utils or 20 utils to the utility derived from it.

This approach is based on following assumptions:

1) The cardinal measurement of utility- Utility of any commodity can be measured in units called 'utils'.

2) Utilities are additive i.e. total utility can be calculated by measuring utility derived from all the units of a commodity consumed.

3) Utility is independent i.e. not related to the amounts of other commodities purchased by the consumer. Further, it is also assumed that it is not affected by utilities of other individuals.

4) Marginal utility of money remains constant: When a person purchases more of a good, the amount of money diminishes and marginal utility of remaining money may increase. But in this approach, marginal utility of money is treated constant. This assumption is important as cardinalists have used money as a measure of utility and it is necessary to keep the measuring rod of utility as fixed.

5.5 LAW OF DIMINISHING MARGINAL UTILITY

Law of Diminishing Marginal Utility is one of the most fundamental law of utility analysis. It explains the relationship between utility and quantity of a commodity. This law states that after sufficient quantity of a commodity is consumed, the utility derived from each successive unit decreases, consumption of all other commodities remaining same. Let us take an example to illustrate this law. For example, If a person is hungry, the first roti he consumes will have high utility for him as it will give him high level of satisfaction. As he keeps on consuming more and more roties, utility derived from each successive unit will go on decreasing. After a point of time, when person is satisfied, he will not be able to eat more. The utility will drop to zero here. If the consumption of roti is continued further, a person would get negative utility or disutility. This can be illustrated with the help of following table:

Table 5.2: Diminishing Marginal Utility

No. of Roti	Marginal Utility (MU)
1	10
2	8
3	5
4	3
5	0
6	-2

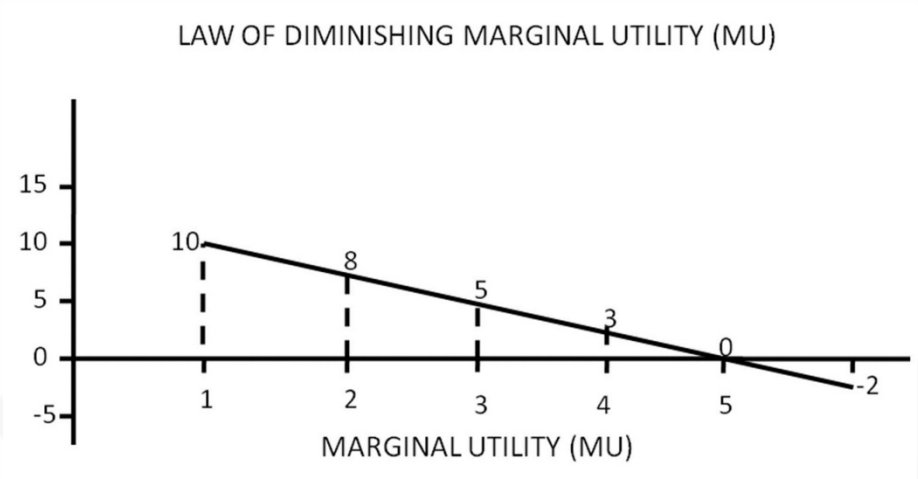

Fig. 5.2: Diminishing Marginal Utility

It can be noted from the above table and diagram, that the utility of first roti is very high i.e. 10 utils. The utilities of 2nd, 3rd, 4th roti falls to 8, 5 and 3 utils respectively. 5th roti gives zero utility, after which each successive roties starts giving negative utility.

5.5.1 Exceptions to the Law/ Limitations of the Law

The law of Diminishing Marginal utility does not apply in following cases:

1) **Small initial unit:** The law is not applicable when the initial units of commodity are of very small size. For example, drinking water with a spoon. In such cases, initially utility derived from additional units will go on increasing and the law may not operate for sometime. It is only after a stage in consumption is reached that marginal utility begins to diminish.

2) **Rare and curious things like rare paintings, gold and diamond jewellery:** The law does not apply in such cases because collection of more and more units usually give more satisfaction to the collector/consumer.

5.5.2 Criticism of the Law

Law of Diminishing Marginal utility has been criticised by modern economists on following grounds:

1) **Measurement of utility is not possible:** The major criticism of this approach is that it is not possible to measure utility in cardinal numbers.

Utility is a psychological phenomenon and thus it is not possible to measure it in quantifiable terms. In real life, we can only describe utility of a product in words.

2) **Marginal utility of money does not remain constant:** Cardinal economists believe that marginal utility of money remains constant throughout. However, when a person uses money, stock of money reduces leading to increase in utility of remaining stock.

3) **Utility is not always independent:** Sometimes utility of one commodity is affected by other commodities. Many times, consumer prefers to consume series of related goods. For example, A consumer may prefer to consume biscuits or pakoda along with tea.

4) **Unrealistic assumptions:** The law is based on various unrealistic assumptions. It assumes no change in fashion, taste, income, preferences of a customer. But in real life, environment is extremely dynamic and so are taste, fashion etc. With new products having advanced features being launched so frequently, taste and preferences of customers are also changing frequently. Thus, this law may not operate in present dynamic times, at least not in the same form it was believed to operate, say one century ago.

Check Your Progress 3

1) Why does marginal utility diminished?

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2) What does happen to marginal utility at a point when total utility is maximum?

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5.6 CONSUMER EQUILIBRIUM THROUGH UTILITY ANALYSIS

Consumer Equilibrium is a situation wherein a consumer gets maximum satisfaction out of his limited income and has no tendency to change his existing expenditure pattern. A consumer is considered to be extremely satisfied when he allocates his income in such a way that the last rupee spent on each commodity yields the same level of utility. The concept of consumer equilibrium can be examined under **one-commodity model** and **multi-commodity model**.

Consumer equilibrium through utility analysis is based on following set of assumptions:

1) **Consumer is rational:** This is one of the basic assumption of the law. Consumer is rational i.e. he measures, compares and chooses the best option in order to maximise his utility.

2) **Cardinal measurement of utility:** Utility can be measured in quantifiable terms.

3) **Marginal utility of money is constant:** It is assumed that utility is measured in terms of money and utility of money does not change.

4) **Fixed income and prices:** It is assumed that income of the consumer and prices of goods remain constant.

5) **Constant tastes and preferences:** It is assumed that taste and preferences of the consumer remain same.

5.6.1 Determination of Consumer Equilibrium

As discussed above, Consumer equilibrium can be examined under two cases:

1) **Consumer equilibrium-One commodity case**

Suppose a consumer with fixed income consumes a single commodity x. He will continue his consumption till a point where marginal utility that he derived from consumption of a unit of commodity is greater than marginal utility of money spent on purchasing that unit. If the marginal utility of commodity x (MU_x) is greater than the marginal utility of money (MU_m), then a consumer will exchange his money for a commodity. Consumer will keep on consuming and spending his money so long as $(MU_x)>P_x(MU_m)$ where P_x is the Price of commodity x and MU_m is 1(constant), Thus a utility maximising consumer will be in equilibrium where

$MU_x=P_x$

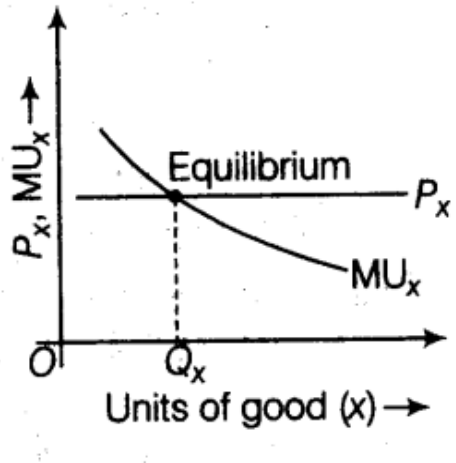

Fig. 5.3: Consumer equilibrium in case of single commodity

Let us understand the concept with the help of an example. Suppose, the consumer wants to buy a good x costing Rs. 10 per unit. Marginal utility derived from each successive unit (in utils is determined and is given in Table 5.3 (It is assumed that 1 util = Re. 1, i.e. MU_m = Re. 1).

Table 5.3: Consumer Equilibrium in case of Single Commodity

Unit of 'x'	Price of 'x' (P_x)	Marginal Utility (MU) in Utils	Difference between MU and P_x	Remarks
1	10	18	8	Since $MU_x > P_x$ Consumer will increase consumption
2	10	16	6	
3	10	12	2	
4	10	10	0	Consumer equilibrium $MU_x = P_x$
5	10	8	-2	Since $MU_x < P_x$ Consumer will not buy any more units
6	10	0	-10	
7	10	-2	-12	

2) **Consumer equilibrium in Multi-commodity case:**

Consumer equilibrium in single commodity is unrealistic model in the sense that in real life, consumer consumes a large number of commodities. This model deals with the equilibrium in case of many commodities. This model works under the assumption of limited income of the consumer and diminishing marginal utility of commodities. Thus, utility maximising consumer will first spend money on commodity which yield highest utility, then the second highest and so on. Finally, a consumer will reach equilibrium when the last rupee he spent on different commodities will yield equal level of utility.

This case of multi-commodities is known as **Law of Equi-Marginal Utility**, a consumer having choices of multiple goods distribute their limited income in such a way that the last rupee spent on each commodity yields equal marginal utility. Suppose a customer consumes only two goods x (with price P_x) and y (with price P_y). Thus he will try to maximise his utility by equating his marginal utility and prices.

$$MU_x = P_x\ (MU_m)$$

$$MU_y = P_y\ (MU_m)$$

Given these conditions, a consumer will be in equilibrium when:

$$MU_x / P_x\ (MU_m) = MU_y / P_y\ (MU_m)$$

Or

$MU_x / P_x = MU_y / P_y$ (because MU of each unit of money is assumed to be constant at 1)

Two commodity case can be generalised for multi-commodity case. Suppose a customer consumes various goods, he will be in equilibrium when:

$$MU_x / P_x = MU_y / P_y = MU_c / P_c = \ldots\ldots MU_z / P_z$$

Diagrammatically, equilibrium is achieved at a point when $MU_x/P_x = MU_y/P_y$

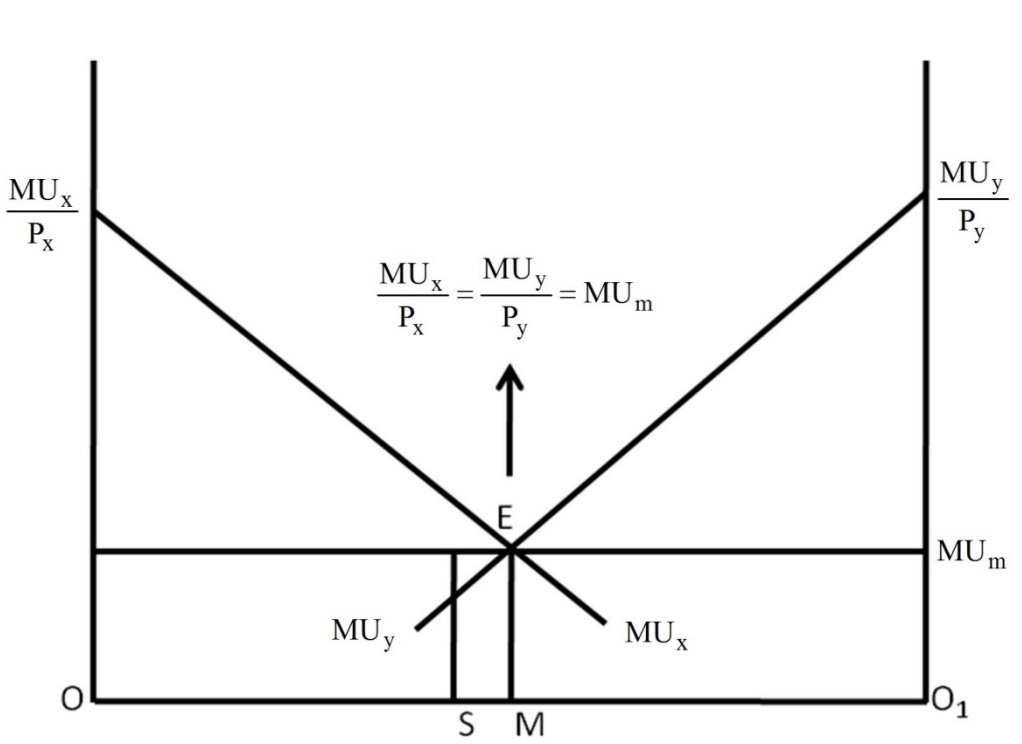

Fig. 5.4: Consumer equilibrium in multi commodity case

Let us understand the law with the help of an example: Suppose, total money income of a consumer is 5 which he wants to spend on two goods 'x' and 'y'. Both these commodities are priced at Re. 1 per unit. Table 5.4 presents marginal utility which consumer derives from various units of the two commodities.

Table 5.4: Consumer Equilibrium in case of multi-commodity

Unit	MU Derived from Good X (in Utils)	MU Derived from Good Y (in Utils)
1	12	9
2	10	8
3	8	6
4	6	4
5	4	2

It can be noted from Table 5.4 that the consumer will spend first and second rupee on commodity 'x', which will provide him utility of 12 and 10 utils respectively. The third rupee will be spent on commodity 'y' to get utility of 9 utils. Fourth and fifth rupee will be spent on X and Y respectively. To reach the equilibrium, consumer should purchase that combination of both the goods, when:

a) MU of last rupee spent on each commodity is same; and

b) MU falls as consumption increases.

It happens when consumer buys 3 units of 'x' and 2 units of 'y' because:

a) MU from last rupee (i.e. 5th rupee) spent on commodity y gives the same satisfaction of 8 utils as given by last rupee (i.e. 4th rupee) spent on commodity x; and

b) MU of each commodity falls as consumption increases.

The total satisfaction of 47 utils will be obtained when consumer buys 3 units of 'x' and 2 units of 'y'. It reflects the state of consumer's equilibrium. If the consumer spends his income in any other order, total satisfaction will be less than 47 utils.

Check Your Progress 4

1) Given the price of good, how will a consumer decide as to how much quantity of the good to buy? Use utility analysis.

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2) A consumer consumes only two goods – x and y. State and explain the conditions of consumer equilibrium using utility analysis.

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5.7 DERIVATION OF DEMAND CURVE WITH THE HELP OF LAW OF DIMINISHING MARGINAL UTILITY

We have learned in Unit 2 that the demand curve or law of demand shows the relationship between price of a good and its quantity demanded. Marshall derived the demand curves for goods from their utility functions.

Marshall assumed the utility functions of different goods to be independent of each other. In other words, Marshallian technique of deriving demand curves for goods from their utility functions rests on the hypothesis of additive utility functions.

Dr. Alfred Marshall derived the demand curve with the help of law of diminishing marginal utility. The law of diminishing marginal utility states that as the consumer purchases more and more units of a commodity, utility that he derives from successive units goes on decreasing.

A rational consumer, while purchasing a commodity compares the price of the commodity which he has to pay with the utility he receives from it. So long as the marginal utility of a commodity is higher than its price ($MU_x > P_x$), the consumer would demand more and more units of it till its marginal utility is equal to its price $MU_x = P_x$ or the equilibrium condition is established.

In other words, as the consumer consumes more and more units of a commodity, its marginal utility goes on diminishing. So it is only at a diminishing price at which the consumer would like to demand more and more units of a commodity. Derivation of demand curve with the help of law of diminishing marginal utility is presented in Fig. 5.5.

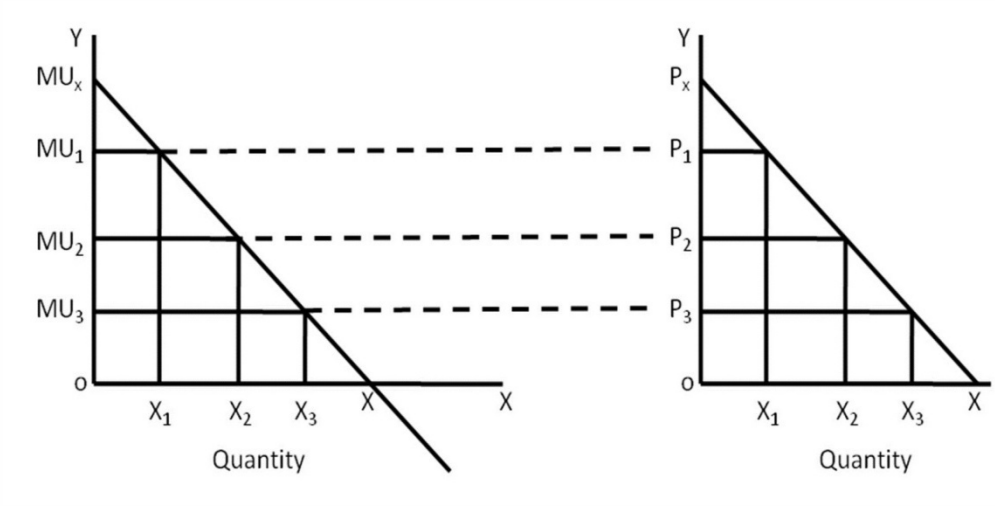

Fig. 5.5: Derivation of demand curve with the help of law of diminishing marginal utility

In Fig. 5.5, the MU_x is negatively slopped. It shows that as the consumer acquires larger quantities of good X, its marginal utility diminishes. Consequently at diminishing price, the quantity demanded of the good X increases as is shown in the second Fig. of 5.5.

At X_1, quantity of the marginal utility of a good is MU_1. This is equal to P_1 by definition. Thus, consumer demands OX_1 quantity of the commodity at P_1 price. In the same way X_2 quantity of the good is equal to P_2. Here at P_2 price, the consumer will buy OX_2 quantity of commodity. At X_3 quantity the marginal utility is MU_3, which is equal to P_3. At P_3, the consumer will buy OX_3 quantity and so on.

It can be concluded that as the purchase of the units of commodity X are increased, its marginal utility diminishes. So at diminishing price, the quantity demanded of good X increases. The rational supports the notion of down slopping demand curve that when price falls, other things remaining the same, the quantity demanded of a good increases and vice versa.

5.8 CONSUMER SURPLUS

The concept of consumer surplus was first formulated by Dupuit in 1844 to measure social benefits of public goods such as canals, bridges, national highways. Marshall further refined and played a significant role in providing it a theoretical structure in his book 'Principles of Economics' published in 1890.

Marshall's concept of consumer's surplus was based on the cardinal measurability and interpersonal comparisons of utility. According to him, consumer's surplus is the difference between what 'one is willing to pay' and 'what one actually pays' to acquire a particular good. Concept of consumer's surplus is a very important concept in economic theory, especially in theory of demand and welfare economics. It is also very useful in formulation of economic policies such as taxation by the Government.

The quintessence of the concept of consumer's surplus is that people generally get more utility from the consumption of goods than the price they actually pay

for them. This extra satisfaction, which the consumers obtain, from buying a good has been called consumer's surplus.

The concept of consumer's surplus is derived from the law of diminishing marginal utility. As we purchase more units of a good, its marginal utility goes on diminishing. It is because of the diminishing marginal utility that consumer's willingness to pay for additional units of a commodity declines as he has more units of the commodity.

The measurement of consumer surplus from a commodity from the demand or marginal utility curve is illustrated in Fig. 5.6. In the figure, quantity of a commodity is measured along the X-axis, the marginal utility (or willingness to pay for the commodity) and the price of the commodity are measured on the Y-axis.

DD' is the demand or marginal utility curve which is sloping downward, indicating that as the consumer buys more units of the commodity, marginal utility derived from the additional units of the commodity falls.

If OP is the price that prevails in the market, then the consumer will be in equilibrium when he buys OM units of the commodity, since at OM units, marginal utility from a unit of the commodity is equal to the given price OP.

The Mth unit of the commodity does not yield any consumer's surplus to the consumer since this is the last unit purchased and for this price paid is equal to the marginal utility which indicates the price that he is prepared to pay rather than go without it. But for the units before Mth unit, marginal utility is greater than the price and therefore, these units yield consumer's surplus to the consumer. The total utility of a certain quantity of a commodity to a consumer can be known by summing up the marginal utilities of the various units purchased.

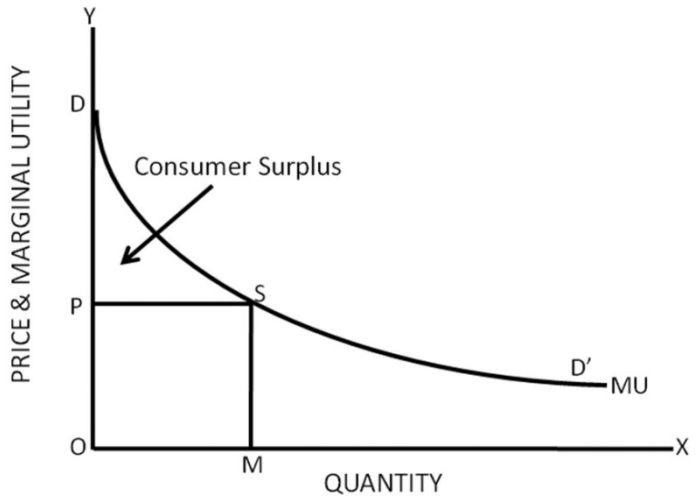

Fig. 5.6: Consumer Surplus

In Fig. 5.6, the total utility derived by the consumer from OM units of the commodity will be equal to the area under the demand or marginal utility curve up to point M. That is, the total utility of OM units in Fig. 5.6 is equal to ODSM.

In other words, for OM units of the good the consumer will be prepared to pay the sum equal to Rs. ODSM. But given the price equal to OP, the consumer will actually pay the sum equal to Rs. OPSM for OM units of the good. It is thus clear that the consumer derives extra utility equal to ODSM minus OPSM

= DPS, which has been shaded in Fig. 5.6. If market price of the commodity rises above OP, the consumer will buy fewer units of the commodity than OM. As a result, consumer's surplus obtained by him from his purchase will decline. On the other hand, if price falls below OP, the consumer will be in equilibrium when he is purchasing more units of the commodity than OM. As a result of this, the consumer's surplus will increase. Thus, given the marginal utility curve of the consumer, the higher the price, the smaller the consumer's surplus and the lower the price, the greater the consumer's surplus.

5.9 CRITICAL EVALUATION OF CARDINAL UTILITY ANALYSIS

Cardinal utility analysis of demand has been criticised by modern economists on following grounds:

1) **Cardinal measurability of utility is impractical:**

Cardinal utility analysis of demand is based on the assumption that utility can be measured in absolute, objective and quantitative terms. But in actual practice utility cannot be measured in such quantitative or cardinal terms. Since utility is a psychological phenomenon and subjective feeling, it cannot be measured in quantitative terms. In reality, consumers are only able to compare the satisfactions derived from various goods or various combinations of the goods. In other words, in the real life consumer can state only whether a good or a combination of goods gives him more or less, or equal satisfaction as compared to another. Thus, economists like J.R. Hicks are of the opinion that the assumption of cardinal measurability of utility is unrealistic and therefore it should be given up.

2) **Wrong assumption of independent utilities:**

Cardinal Utility analysis also assumes that utilities derived from various goods are independent. This means that the utility which a consumer derives from a good is the function of the quantity of that good only. In other words, the assumption of independent utilities implies that the utility which a consumer obtains from a good does not depend upon the quantity consumed of other goods. On this assumption, the total utility which a person gets from the whole collection of goods purchased by him can be calculated as sum of the separate utilities of various goods. In other words, utility functions are additive. But in the real life this is not so. In actual life the utility or satisfaction derived from a good depends upon the availability of some other goods which may be either substitutes for or complementary with each other. For example, the utility derived from a pen depends upon whether ink is available or not. Similarly, utility of tea may increase if accompanied by biscuits. It is, thus, clear that the utilities derived from various goods are interdependent, that is, they depend upon each other.

3) **Assumption of constant marginal utility of money is not true:**

An important assumption of cardinal utility analysis is that when a consumer spends varying amount on a good or various goods or when the price of a good changes, marginal utility of money remains constant. But in actual practice, this is not correct. As a consumer spends his money income on the goods, money income left with him declines.

With the decline in money available to the consumer, the marginal utility of remaining money rises. Further, when price of a commodity changes, the real income of the consumer also changes. With this change in real income, marginal utility of money will change and this would have an effect on the demand for the good in question, even though the total money income available with the consumer remains the same.

Cardinal utility analysis ignores the changes in real income and its effect on demand for goods following the change in price of a good. Further, it is because of the constant marginal utility of money and therefore the neglect of the income effect by Marshall that he could not explain Giffen Paradox.

Marginal utility of money also varies from a poor man to a rich one. For example, a person having just Rs. 80/- with him will place much higher valuation as each of these 10 rupees. But, someone who has thousands of rupees with him may not place that much value on a Rs. 10 note.

4) **Cardinal utility analysis does not split up the Price effect into Substitution and Income effects:**

Another shortcoming of the cardinal utility analysis is that it does not distinguish between the income effect and the substitution effect of the price change. Marshall and other exponents of cardinal utility analysis ignored income effect of the price change by assuming the constancy of marginal utility of money.

In real life, when the price of a good falls, the consumer becomes better off than before, that is, a fall in price of a good brings about an increase in the real income of the consumer. With this income he would be in a position to purchase more of this good as well as other goods. This is the income effect of the fall in price on the quantity demanded of a good. Besides, when the price of a good falls, it becomes relatively cheaper than other goods and as a result the consumer is induced to substitute that good for others. This results is increase in quantity demanded of that good. This is the substitution effect of the price change on the quantity demanded of the good. Thus total effect of price can be decomposed into substitution effect and income effect.

5) **Marshall could not explain Giffen Paradox:**

By not visualising the price effect as a combination of substitution and income effects and ignoring the income effect of the price change, Marshall could not explain the Giffen Paradox. He treated it merely as an exception to his law of demand. In contrast to it, indifference curve analysis has been able to explain satisfactorily the Giffen good case.

According to indifference curve analysis, in case of a Giffen Paradox or the Giffen good, negative income effect of the price change is more powerful than substitution effect so that when the price of a Giffen good falls, the negative income effect outweighs the substitution effect with the result that quantity demanded of it falls.

Check Your Progress 5

1) If price of good is Rs. 10 and marginal utility of a consumer is Rs. 12, how much will be the consumer surplus? Use utility analysis.

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2) Critically examine Cardinal utility approach.

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5.10 LET US SUM UP

Utility is a psychological phenomenon. It is a feeling of satisfaction, pleasure or well-being experienced by the consumer from the consumption or possession of the commodity or a service. In this sense, it is a subjective or relative concept i.e. level of utility derived from a product differs from person to person. We also examined the relationship between want, utility, consumption and satisfaction i.e. how want leads to selection of commodity having utility which in turn leads to consumption and finally satisfaction of want. We further analysed the relationship between Marginal utility and Total utility and the law of diminishing marginal utility. We also explained consumer equilibrium using utility approach in case of single commodity and multiple commodity. We also discussed the basic assumptions of consumer preferences.

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5.12 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Study Section 5.2 and answer

2) 1. 20 2. 16 3. 10 4. 4 5. 0 6. -6

Check Your Progress 2

1) Completeness, Transitivity and more is preferred to less.

2) Consumer preference are the first step for determining consumer behaviour. Consumer behaves according to his preferences and budget constraint.

Check Your Progress 3

1) Study Section 5.5 and answer

   Marginal utility is zero when total utility is maximum

Check Your Progress 4

1) A consumer buys a quantity of commodity when Marginal utility is equal to price of that good.

2) Study Sub-section 5.6.1 and answer

Check Your Progress 5

1) Consumer Equilibrium is the difference between what customer is willing to pay and what he actually pays. So consumer surplus is Rs. 2

2) Study Section 5.9 and answer

UNIT 6 CONSUMER BEHAVIOUR: ORDINAL APPROACH

Structure

6.0 Objectives

6.1 Introduction

6.2 Ordinal Utility Approach

6.3 Indifference Curve Analysis

- 6.3.1 Indifference Schedule
- 6.3.2 Indifference Curve
- 6.3.3 Indifference Map
- 6.3.4 Law of Diminishing Marginal Rate of Substitution
- 6.3.5 Properties of Indifference Curve

6.4 Some Exceptional Shapes of Indifference Curve

6.5 Budget Line

6.6 Shift in Budget Line

6.7 Consumer Equilibrium through Indifference Curve Analysis

6.8 Some Exceptional Shapes of Indifference Curve and Corner Equilibrium

6.9 Price Effect as Combination of Income Effect and Substitution Effect

- 6.9.1 Income Effect
- 6.9.2 Substitution Effect
- 6.9.3 Price Effect

6.10 Measuring Income and Substitution Effects of Price Change

6.11 Derivation of Demand Curve from Indifference Curves

6.12 Let Us Sum Up

6.13 References

6.14 Answers or Hints to Check Your Progress Exercises

6.0 OBJECTIVES

After completion of this unit, you will be able to:

- state ordinal utility approach for measurement of utility;
- use Indifference curve analysis to explain consumer behaviour;
- identify shape of Indifference curve in case of perfect substitutes and complementary goods;
- explain the concept of Budget line;

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- identify the factors causing shift in Budget line;
- describe consumer equilibrium through Indifference curve approach;
- decompose price effect into income effect and substitution effect using Hicksian and Slutsky approach; and
- derive demand curve from Price Consumption curve (PCC).

6.1 INTRODUCTION

In Unit 5, we have learnt the concept of cardinal and ordinal utility in order to understand the concept of consumer preferences. We also examined consumer equilibrium through cardinal utility analysis. As discussed in previous unit, study of consumer behaviour has been a focus point for researchers as well as business houses. Consumer behaviour directly affects the sales and thus profits of the companies. In order to understand consumer's buying pattern, it is also important to understand how consumer equilibrium is attained. A rational consumer wants to maximise his satisfaction derived from consumption of various goods but is subject to his budget constraint. In this unit, we will examine the concept of consumer equilibrium using ordinal utility approach.

6.2 ORDINAL UTILITY APPROACH

Cardinal Utility approach was criticised for being restrictive in nature. English economist Edgeworth criticised cardinal approach for its Unrealistic assumptions. He was of opinion that measurement of utility in quantitative scale is neither possible nor necessary. This idea gave birth to ordinal approach. Edgeworth also believed that all consumer behaviour can be measured in terms of preferences and rankings and can be understood using Indifference curve approach. Though this approach was originally propounded by Edgeworth, it became popular because of Vilfred Pareto (1906), Slutsky (1915) and finally because of RGD Allen and J.R Hicks. However, this approach is also based on some assumptions.

Assumptions of Ordinal Utility Approach

1) **Rationality:** The basic assumption is that consumer is a rational being, i.e., he prefers more to less and tries to maximise his satisfaction.

2) Indifference curve analysis assumes that **utility is only ordinally expressible** i.e. utility derived from two goods can be compared, as more, less, or equal, but not how much more or less.

3) **Transitivity:** Consumer choices are assumed to be transitive. Transitivity of choices means that if a consumer prefers A to B and B to C, then he prefers A to C, or if she treats A>B and B>C, then she also treats A>C.

4) **Consistency:** Consistency of choice means that if a person prefers A over B in one period, he/she will not prefer B over A in another period.

5) **Non satiety:** This assumption means that a consumer prefers a larger quantity of all the goods over smaller quantities of the same.

6) **Diminishing Marginal Rate of Substitution (MRS):** MRS is that rate at which a consumer is willing to substitute one commodity (say X) for

another (say Y) while maintaining the same utility or level of satisfaction to the consumer. The concept of diminishing MRS will be discussed in greater detail in next section.

6.3 INDIFFERENCE CURVE ANALYSIS

J.R Hicks used the concept of Indifference curve to analyse consumer behaviour. A consumer facing choice between large number of bundles of two goods tries to maximise his satisfaction by choosing a combination which gives him maximum utility. In the course of decision making, consumer finds out that goods can be substituted for each other and identifies various combinations of commodities that give him equal level of satisfaction. When all these combinations are plotted graphically, it produces a curve called Indifference curve.

6.3.1 Indifference Schedule

An indifference schedule is a table which represents various combinations of two goods, which yield equal satisfaction to consumer. Since all the combinations give equal level of satisfaction, consumer is indifferent between them.

Table 6.1 presents an imaginary indifference schedule representing the various combinations of two goods X and Y.

Table 6.1: Indifference schedule of two commodities 'X' and 'Y'

Combinations	Units of 'X' Goods (Cup of Tea)	Units of 'Y' Goods (Biscuits)	Satisfaction
A	1 +	12	K
B	2+	8	K
C	3+	5	K
D	4+	3	K
E	5+	2	K

In above table, five different combinations of Tea and Biscuits are depicted. All these combinations give equal level of satisfaction i.e. K. The consumer is indifferent whether he buys 1 cup of tea and 12 biscuits or 2 cups of tea and 8 biscuits. Different schedules can be formed showing different levels of satisfaction.

6.3.2 Indifference Curve

The graphical presentation of Indifference schedule is known as Indifference curve. The indifference curve is locus of all the combinations of two commodities which give same level of satisfaction to the consumer.

Fig. 6.1 is graphical representation of Table 6.1. It shows all the combinations of good X and good Y i.e. A, B, C, D and E which yield equal level of satisfaction to the consumer. The curve is downward sloping, convex to the point of origin.

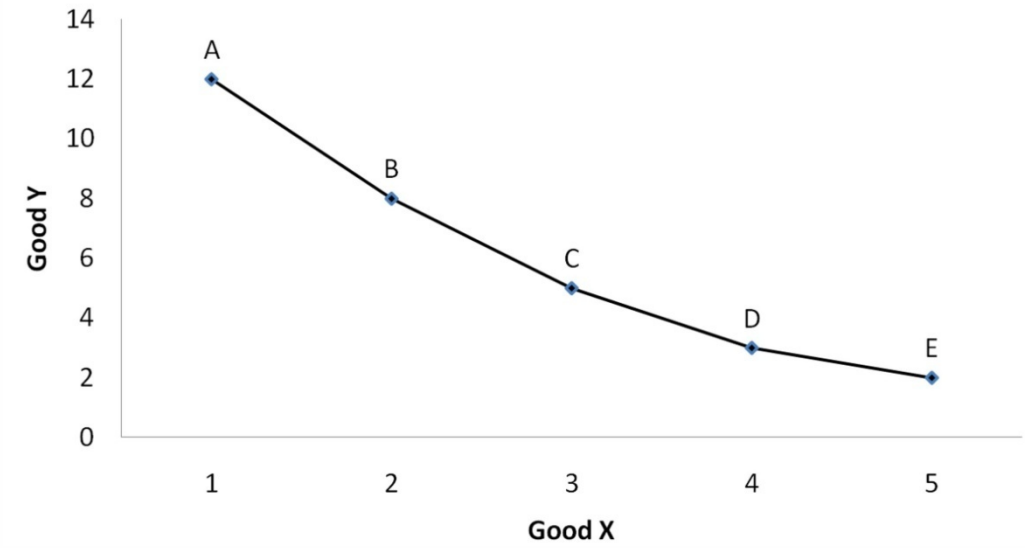

Fig. 6.1: Indifference curve

6.3.3 Indifference Map

The combinations of two commodities X and Y given in the Indifference schedule are not the only possible combinations for these commodities. The consumer may make any other combinations with less of one or both of the goods, each yielding the same level of satisfaction but less than the one shown in schedule. IC curve of this schedule will be above IC_1. Similarly, the consumer may make other combinations with more of one or both of the goods, each combination yielding the same satisfaction but greater than the satisfaction indicated.

A diagram showing different indifference curves corresponding to different indifference schedules of the consumer is indifference map. In other words, a set or family of indifference curves is an indifference map.

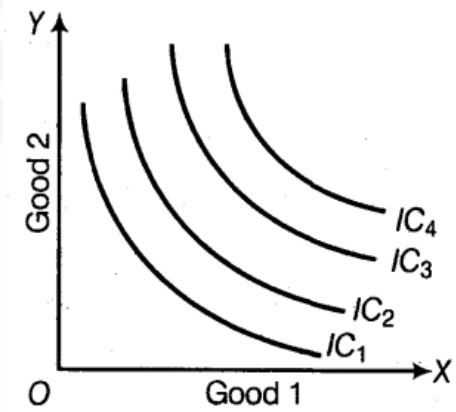

Fig. 6.2: Indifference map

Fig. 6.2 shows four indifference curves: IC_1, IC_2, IC_3 and IC_4. All the points on IC_2 will yield higher satisfaction than the points on IC_1 and all the points on IC_3 will yield lesser satisfaction than the points on IC_4.

6.3.4 Law of Diminishing Marginal Rate of Substitution

What is Marginal Rate of Substitution?

Marginal rate of substitution may be defined as the rate at which a consumer will exchange successive units of a commodity for another. In other words, Marginal rate of substitution is the rate at which, in order to get the additional units of a commodity, the consumer is willing to sacrifice or give up to get one additional unit of another commodity.

The Marginal Rate of Substitution can symbolically be represented as under:

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

Where MRS_{xy}= Marginal rate of substitution of X for Y

ΔY= Change in 'Y' commodity

ΔX= Change in 'X' commodity.

Diminishing Marginal rate of Substitution

One of the basic postulates of ordinal utility theory is that Marginal rate of substitution (MRS_{xy} or MRS_{yx}) decreases. It means that the quantity of a commodity that a consumer is willing to sacrifice for an additional unit of another commodity goes on decreasing. Law of diminishing Marginal rate of substitution is an extensive form of the law of diminishing Marginal Utility. As discussed in previous section, Law of diminishing marginal Utility states that as a consumer increases the consumption of a good, his marginal utility goes on diminishing. Similarly as consumer gets more and more unit of good X, he is willing to sacrifice less and less units of good Y for each extra unit of X. The significance of good X in terms of good Y goes on diminishing with each addition of good X. The law can be understood with the help of following Table 6.2.

Table 6.2: Marginal rate of Substitution

Units of 'X' Good	Units of 'Y' Good	MRS of 'X' for 'Y'
1	10	-
2	7	3:1
3	5	2:1
4	4	1:1

To have the second combination and yet to be at the same level of satisfaction, the consumer is ready to forgo 3 units of Y for obtaining an extra unit of X. The marginal rate of substitution of X for Y is 3:1. The rate of substitution is units of Y for which one unit of X is a substitute. As the consumer desires to have additional unit of X, he is willing to give away less and less units of Y so that the marginal rate of substitution falls from 3:1 to 1:1 in the fourth combination.

In Fig. 6.3 given below at point M on the Indifference curve I, the consumer is willing to give up 3 units of Y to get an additional unit of X. Hence, MRS_{xy} =3. As he moves along the curve from M to N, MRS_{xy}, = 2. When the consumer moves downwards along the indifference curve, he acquires more of X and less

of Y. The amount of Y he is prepared to give up to get additional units of X becomes smaller and smaller.

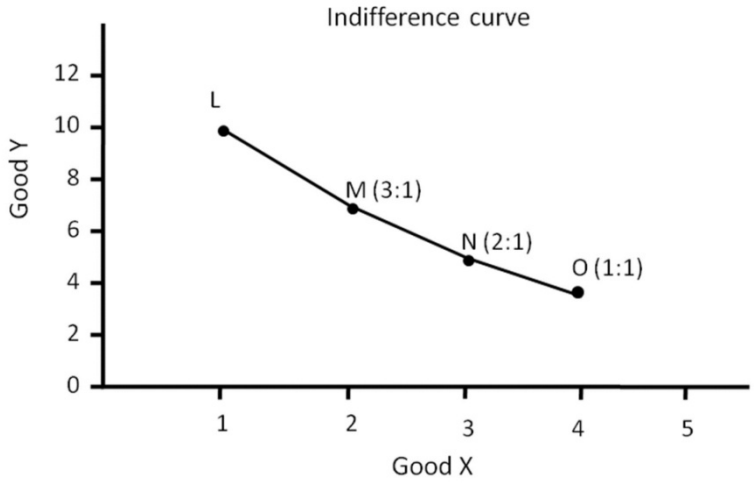

Fig. 6.3: Indifference curve and Marginal rate of Substitution

The marginal rate of substitution of X for Y (MRS_{xy}) is, in fact, the slope of the curve at a point on the indifference curve, such as points M, N or P in Fig. 6.3. Thus $MRS_{xy} = \Delta Y/\Delta X$

6.3.5 Properties of Indifference Curve

1) **Indifference curve slopes downwards from left to right:** It implies that Indifference curve has a negative slope. This attribute is based on the assumption that if a consumer uses more quantity of one good, he has to reduce the consumption of the other good in order to stay at the same level of satisfaction.

2) **Indifference curves are generally convex to the origin 'O':** This property is based on the principle of Diminishing Marginal Rate of Substitution. It means that as the units of 'X' are increased by equal amounts, the 'Y' diminishes by smaller and smaller amounts. This happens because as a consumer gets more and more units of 'X' good, he is willing to give up less and less units of good Y for each extra unit of X.

3) **Indifference curves cannot intersect each other:** This is because of the fact that each indifference curve represents different level of satisfaction. If two indifference curves intersect, it will lead to self-contradictory result. In Fig. 6.4, two Indifference curve IC_1 and IC_2 are shown intersecting each other at point C. But this is not possible.

Point 'A' and point 'C' on Indifference curve IC_1 represents combination yielding equal satisfaction. That is satisfaction from A combination = the satisfaction from C combination, therefore,

i) Pt. A = Pt. C (Because both lie on same IC curve IC_1)

ii) Pt. B = Pt. C (Because both lie on same IC curve IC_2)

Thus Pt. B = Pt. A in terms of satisfaction. But this is impossible because at combination 'B' quantities of both X and Y are more than in combination 'A', hence this is self-contradictory.

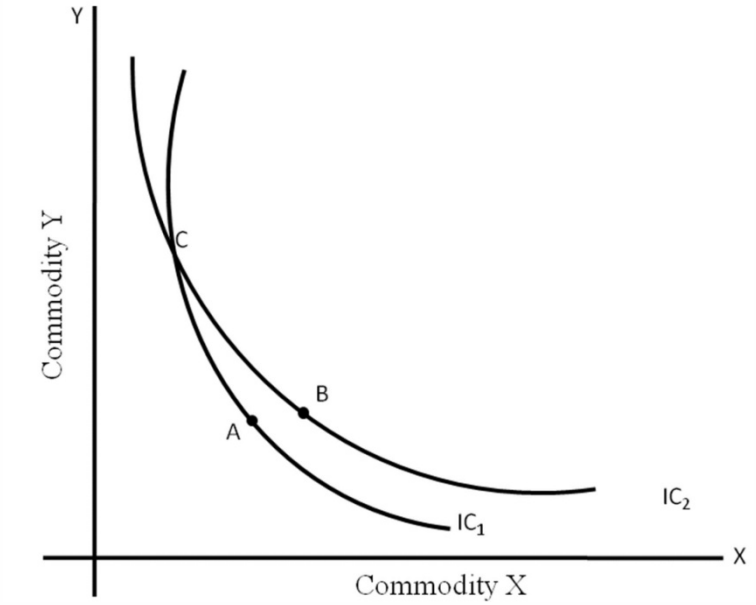

Fig. 6.4: Two Indifference curves cannot intersect

Thus, two Indifference curves cannot intersect with each other. The Indifference curves cannot be tangent to each other.

4) **Higher Indifference curve represents higher level of satisfaction:** In Fig. 6.5, the indifference curve IC_2 lies above and to the right of the IC_1. Point C on IC_2 represents more units of 'x' than point A on IC_1. Similarly, Point B on IC_2 represents more units of 'y' than point A on IC_1. It is thus evident that higher the indifference curve, the higher the satisfaction it represents because our consumer prefers more of a good to less of it. Also note that all the points between B and C on IC_2 show larger amounts of both X and Y compared to point A on IC_1.

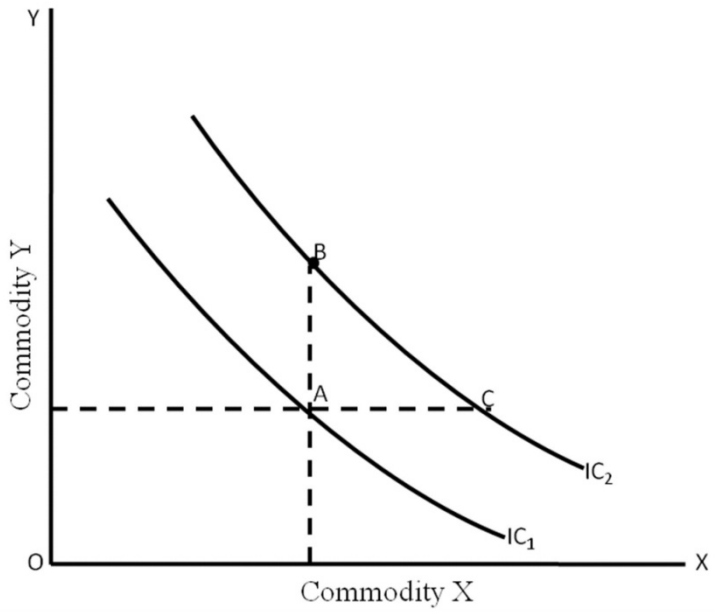

Fig. 6.5: Higher Indifference curve means higher level of satisfaction

5) Indifference curves do not touch either of the axes X or Y . This is because of the assumption that the consumer purchases combination of different commodities. In case, an indifference curve touches either axis, it means the consumer wants only one commodity and his demand for the second commodity is zero. Purchasing one commodity means

monomania, i.e. consumer's lack of interest in the other commodity. This is against the assumption of Indifference curve which is a two good model.

6) **No Indifference curve cuts either of axes:** If it were to happen, the consumer will be consuming negative quantity of that commodity which makes no sense.

6.4 SOME EXCEPTIONAL SHAPES OF INDIFFERENCE CURVE

Indifference curve may take a different shape in case of perfect substitutes and perfect complements. Some exceptional shapes of Indifference curve are discussed as follows:

Perfect Substitutes

We have examined the concept of perfect substitutes in previous units. Two goods are perfect substitutes if the utility consumers get from one good is the same as another.

When two goods are perfect substitutes of each other, their indifference curve will be a straight diagonal line sloping downwards from left to right. It is because of the fact that MRS in such cases is constant i.e. 1.

For example: Suppose good A and good B are perfect substitutes, consumer will be indifferent between them and will be ready to sacrifice equal quantity of good A to achieve good B. But, even here, the ICs will not cross the axes.

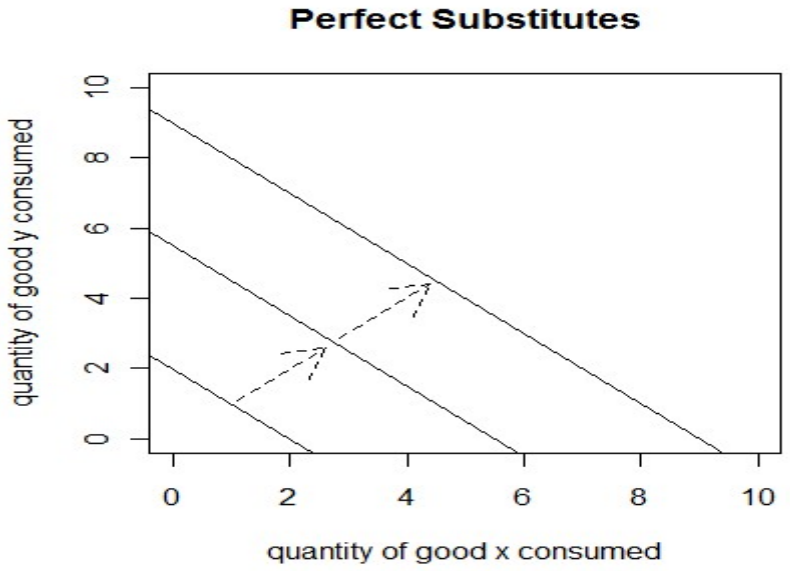

Fig. 6.6: Indifference curve in case of Perfect Substitutes

Perfect Complements

Two goods may be perfect complementary to each other. Just as left and right shoes, cups and saucers of a tea set etc. In such case, the indifference curve will be parallel to each other and bent at 90 degree angle or L shaped. Perfect complementary goods are those goods which are used in fixed ratio i.e. 1:1or 2:2. They cannot be substituted for each other, thus putting MRS as zero. This

case is shown in Fig. 6.7. It is clear that IC_1 and IC_2 are right angled curves, meaning thereby that the consumer buys piece of each right shoe. This will be useless. The consumer will be no better off and he will remain at point 'A' on IC_1. In case, he buys 2 pieces of left shoe and only one piece of right shoe, it will be useless, the consumer will be no better off and he will remain at point C of IC_1. It means that having one more pair of shoe will not add to his satisfaction. But if he buys one more shoe, his satisfaction will immensely increase and he will move to point B on higher Indifference curve IC_2.

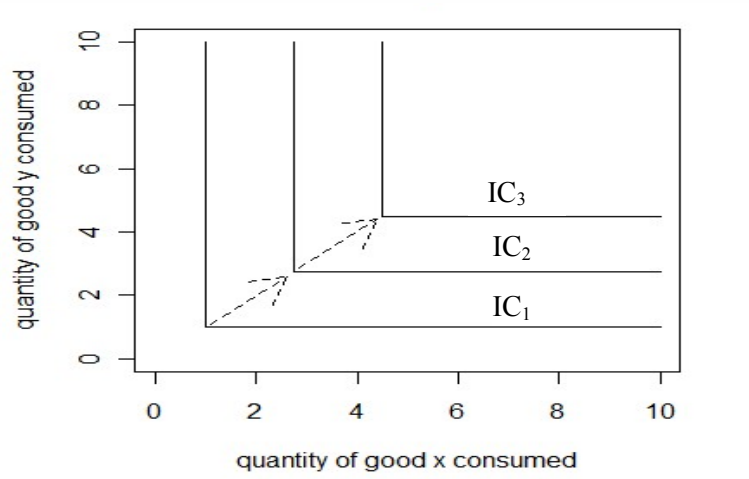

Fig. 6.7: Indifference curve in case of Perfect Complements

Check Your Progress 1

1) Suppose that goods A and B are perfect compliments. Draw a set of indifference curves for perfect compliments, and explain why the curves look the way they do. Do the same for perfect substitutes**?**

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2) Explain the concept of Marginal Rate of Substitution (MRS). What happens to MRS when consumer moves downward along the Indifference curve?

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3) Why is Indifference curve convex to origin?

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6.5 BUDGET LINE

As discussed above, a rational consumer always acts according to his budget constraint and tries to maximise his level of satisfaction. Thus, the knowledge of the concept of budget line or what is also called budget constraint is essential for understanding the theory of consumer's equilibrium.

A consumer in his attempt to maximise his satisfaction will try to reach the highest possible indifference curve. But in his pursuit of maximising satisfaction by buying more and more goods, he has to consider two constraints: first, he has to pay the prices for the goods and, secondly, he has a limited money income to purchase the goods. Thus, how much a person is capable to buy, depends upon the prices of the goods and the money income which he has at his disposal.

Price line or budget line represents all possible combinations of two goods that a consumer can purchase with his given income and the given prices of two goods. Let us try to understand the concept with the help of an example:

Suppose a consumer has an income of Rs. 100 to spend on Oranges and Apples which cost Rs. 10 each. He can either spend his limited income only on one good or both the goods. All the possible alternative combinations of two goods are presented in Table 6.3.

Table 6.3: Alternative consumption possibilities

Income	Apples (Rs. 10/piece)	Oranges (Rs. 10/piece)
Rs. 100	10	0
Rs. 100	9	1
Rs. 100	8	2
Rs. 100	7	3
Rs. 100	6	4
Rs. 100	5	5
Rs. 100	4	6
Rs. 100	3	7
Rs. 100	2	8
Rs. 100	1	9
Rs. 100	0	10

It can be observed from the above table that if the consumer spends his total income of Rs. 100 on Apples, he is able to buy 10 Apples. On the other hand, if he buys Oranges alone, he can get 10 Oranges by spending his total income. Further, a consumer can also buy both the goods in different combinations.

The budget line can be written algebraically as follows:

Algebraic Expression for Budget Set: The consumer can buy any bundle (A, B), such that:

$$M \geq (P_X * Q_X) + (P_Y * Q_Y)$$

Where P_X and P_Y denote prices of goods X and Y respectively and M stands for money income

We can rewrite the budget line as: $P_Y Q_Y = M - P_X Q_X$

dividing both sides by P_Y yields: $Q_Y = \frac{M}{P_Y} - \frac{P_X}{P_Y} Q_X$

This is the budget line plotted in Fig. 6.8.

SLOPE OF BUDGET LINE

As we know that the slope of a curve is calculated as a change in variable on the Y-axis divided by change in variable on the X-axis, slope of the budget line in given example will be number of units of Oranges, that the consumer is willing to sacrifice for an additional unit of Apple.

Slope of Budget Line = Units of Oranges (Y) willing to Sacrifice/ Units of Apples (X) willing to Gain = $\Delta Y/\Delta X$

In above example, 1 Apple need to be sacrificed each time to gain 1 Orange.

So, Slope of Budget Line = –1/1 = –1

This slope of budget line is equal to 'Price Ratio' of two goods.

Price Ratio = Price of X (P_X)/Price of Y (P_Y) = $-P_X/P_Y$

Budget line is presented in Fig. 6.8.

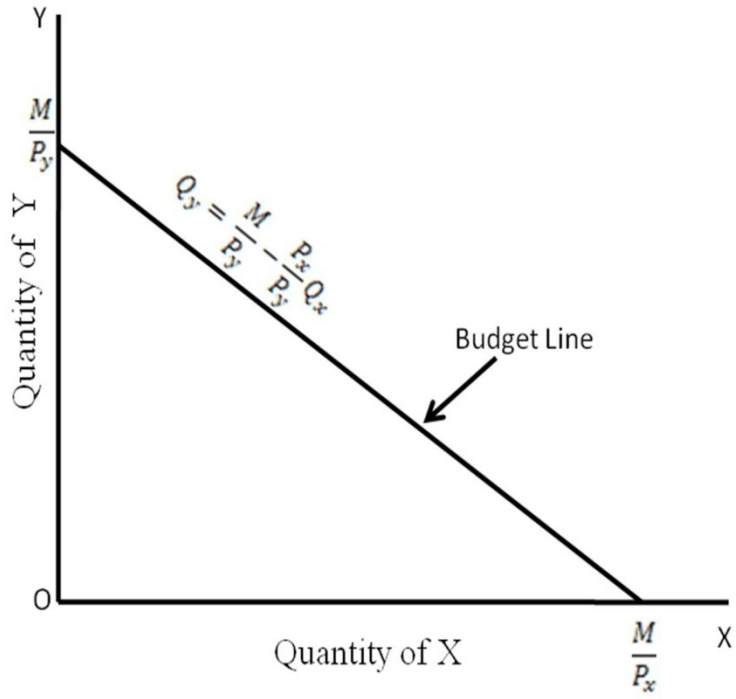

Fig. 6.8: Budget Line

6.6 SHIFT IN BUDGET LINE

Budget line is drawn on the basis of assumption of constant prices of the goods and constant income of the consumer. Thus, if there is any change in either of the two variables, budget line shifts.

Thus, there are two variables that causes shift in Budget Line:

1) Change in Income of the consumer

2) Change in equal proportion of Prices of both the goods.

Change in Income of the consumer

If income changes while the prices of goods remain the same, Budget line will shift rightwards or leftwards. Since the prices of two goods are constant, slope

of budget line will remain constant. The effect of changes in income on the budget line is shown in Fig. 6.9. If consumer's income increases while prices of both goods X and Y remain unaltered, the price line shifts upward and is parallel to the original budget line.

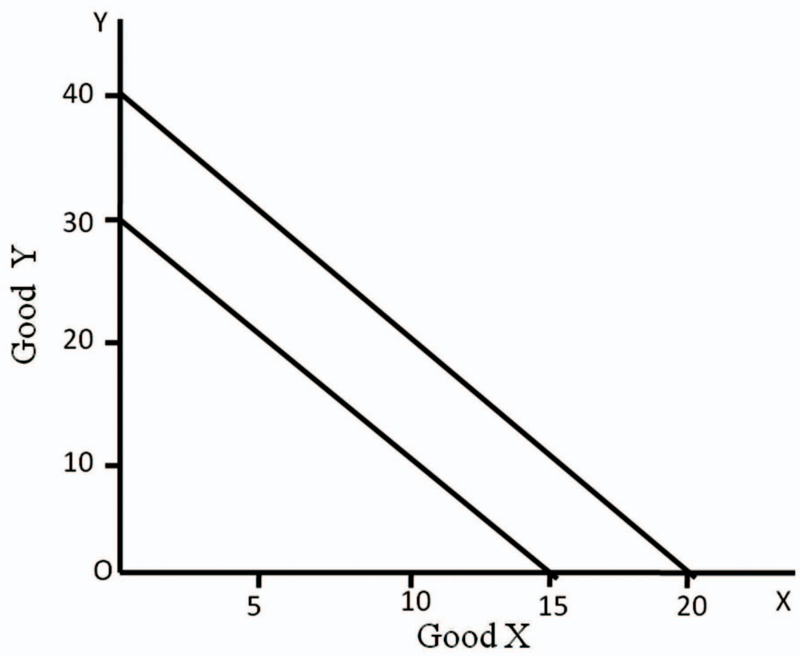

Fig. 6.9: Effect of change in Income on Budget Line

This is because with the increased income the consumer is able to purchase proportionately larger quantity of both goods than before.

On the other hand, if income of the consumer decreases, prices of both goods X and Y remaining unchanged, the budget line shifts downward but remains parallel to the original price line. This is because a lower income will leave the consumer in a position to buy proportionately smaller quantities of both goods.

Changes in Price of either of the two goods:

Budget Line also shifts when there is change in price of either of the two goods. Increase in price of any commodity reduces the purchasing power of the consumer, in turn reducing the quantity demanded. Shift of Budget line due to change in prices of either good x or good y is presented below:

Changes in Budget Line as a Result of Changes in Price of Good X

Suppose, price of good X rises, the price of good Y and income remaining unaltered. With higher price of good X, the consumer can purchase smaller quantity of X.

In Fig. 6.10, original price line is AB. With increase in Price of good X, budget line will shift to AB_2 i.e. consumer will be able to buy less quantity of good X, quantity of good Y remaining same. Similarly when there is fall in price of good X, keeping prices of good Y constant, budget line shifts from AB to AB_1 i.e. consumer will be able to buy more quantity of good X, quantity of good Y remaining same.

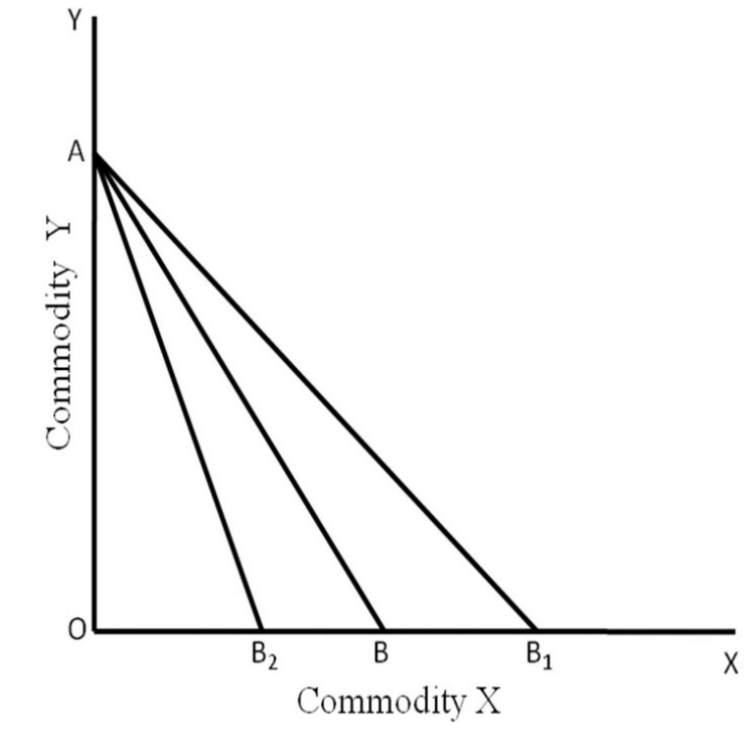

Fig. 6.10: Shift in Budget line due to change in price of good X

Change in Price of good Y

Fig. 6.11 shows the changes in the budget line when price of good Y falls or rises, with the price of X and income remaining the same. It can be observed from Fig. 6.11 that the initial budget line is AB. With fall in price of good Y, other things remaining unchanged, the consumer could buy more of Y with the given money income and therefore budget line will shift above to EB. Similarly, with the rise in price of Y, other things being constant, and the budget line will shift below to DB.

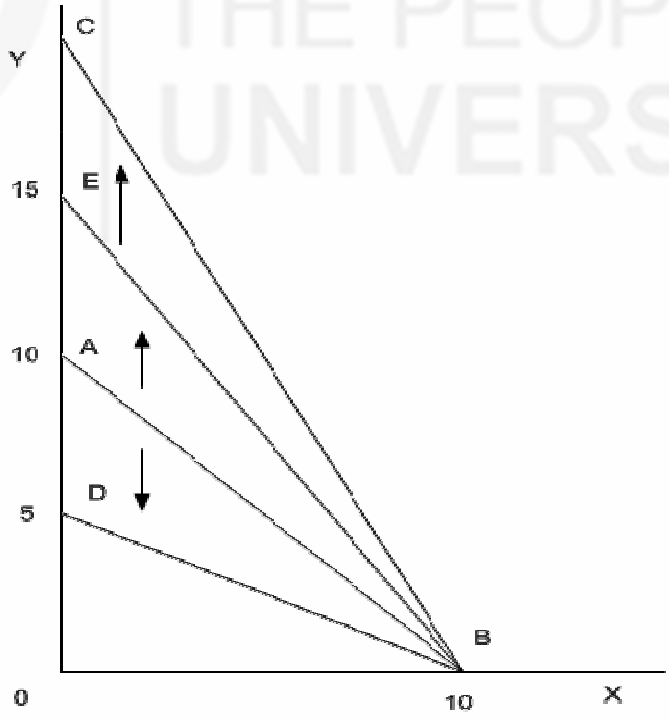

Fig. 6.11: Shift in Budget line due to change in price of good Y

Check Your Progress 2

1) What is budget line? Calculate slope of Budget line if prices of good X and good Y are 8 and 10 respectively?

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2) What will happen to budget line if:

Case A: Price of good X increases

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Case B: Price of good Y decreases

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Case C: Income of consumer increases

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6.7 CONSUMER EQUILIBRIUM THROUGH INDIFFERENCE CURVE ANALYSIS

Assumptions

As discussed above, consumer equilibrium is a point of maximum satisfaction for the consumer. It is a state of rest for the consumer. Study of Consumer equilibrium requires some assumptions to be made about the consumer behaviour. These are:

i) Rationality: The consumer is rational. He wants to obtain maximum satisfaction given his income and prices.

ii) Consumer has an indifference map, showing his scale of preference for various combinations of good x and y.

iii) Utility is ordinal: It is assumed that the consumer can rank his preference according to the satisfaction of each combination of goods.

iv) Consistency of choice: It is also assumed that the consumer is consistent in the choice of combination of goods.

v) Consumer has a given and fixed amount of money income to spend on the goods. Thus, consumer has to choose to spend his income on either of the two goods or a combination thereof.

vi) All the units of the goods are homogeneous.

vii) The goods are divisible i.e. they can be divided into small units.

viii) Total utility: The total utility of the consumer depends on the quantities of the good consumed.

Conditions of Consumer's Equilibrium

There are two fundamental conditions of consumer's equilibrium through Indifference curve approach:

1) The price line should be tangent to the Indifference curve. It means that at the point of equilibrium the slope of the indifference curve and of the price line should be same. The slope of Indifference curve indicates MRS_{xy} i.e. $-\Delta Y/\Delta X$. The slope of the price line indicates the ratio between price of two goods X and Y i.e. P_x/P_y.

2) Indifference curve should be convex to the point of origin: Marginal rate of substitution of X for Y (MRS_{xy} i.e. $\Delta y/\Delta x$) is equal to the slope of the price line that indicates the ratio between prices of two goods.

Condition 1: MRS_{XY} = Ratio of prices or P_X/P_Y

Let the two goods be X and Y. The first condition for consumer's equilibrium is that

$$MRS_{xy} = P_x/P_y$$

- If $MRS_{xy} > P_x/P_y$, it means that the consumer is willing to pay more for X than the price prevailing in the market. As a result, the consumer buys more of X. As a result, MRS falls till it becomes equal to the ratio of prices and the equilibrium is established.
- If $MRS_{xy} < P_x/P_y$, it means that the consumer is willing to pay less for X than the price prevailing in the market. It induces the consumer to buys less of X and more of Y. As a result, MRS rises till it becomes equal to the ratio of prices and the equilibrium is established.

Condition 2: MRS continuously falls

The second condition for consumer's equilibrium is that MRS must be diminishing at the point of equilibrium, i.e. the indifference curve must be convex to the origin at the point of equilibrium. Unless MRS continuously falls, the equilibrium cannot be established.

Thus, both the conditions need to be fulfilled for a consumer to be in equilibrium.

Let us now understand this with the help of a diagram:

In Fig. 6.12, IC_1, IC_2 and IC_3 are the three indifference curves and MM is the budget line. With the constraint of budget line, the highest indifference curve, which a consumer can reach, is IC_2. The budget line is tangent to indifference curve IC_2 at point 'P'. This is the point of consumer equilibrium.

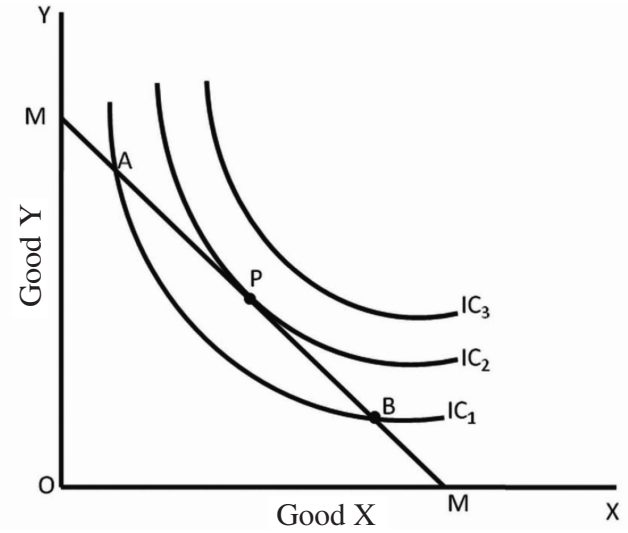

Fig. 6.12: Consumer equilibrium through indifference curve

All other points on the budget line to the left or right of point 'P' will lie on lower indifference curves and thus indicate a lower level of satisfaction. As budget line can be tangent to one and only one indifference curve, consumer maximises his satisfaction at point P, when both the conditions of consumer's equilibrium are satisfied:

i) MRS = Ratio of prices or P_X/P_Y:

At tangency point P, the absolute value of the slope of the indifference curve (MRS between X and Y) and that of the budget line (price ratio) are same. Equilibrium cannot be established at any other point such as $MRS_{XY} > P_X/P_Y$ at all points to the left of point P or $MRS_{XY} < P_X/P_Y$ at all points to the right of point P. So, equilibrium is established at point P, when $MRS_{XY} = P_X/P_Y$.

ii) MRS continuously falls:

The second condition is also satisfied at point P as MRS is diminishing at point P, i.e. IC_2 is convex to the origin at point P.

6.8 SOME EXCEPTIONAL SHAPES OF INDIFFERENCE CURVE AND CORNER EQUILIBRIUM

As hinted earlier, indifference curve may take different shape in exceptional cases like perfect complements, perfect substitutes. Also if an assumption of 'two goods' is dropped, indifference curve may touch X axis or Y axis also. In case of an exceptional shape of an indifference curve, equilibrium may be called as corner solution. This section deals with such cases.

Normally, an equilibrium is achieved at the point of tangency between the budget line and his indifference curve. At this point, consumer's preferences are such that he likes to consume some amount of both the goods. This equilibrium position at the point of tangency which lies within commodity space between the two axes is often called interior solution. Interior solution implies that consumers' pattern of consumption is diversified and they prefer basket or bundle of several different goods instead of spending their entire income on a single commodity.

However, this may not be true in real life scenario and a customer may prefer small number of goods and service rather than buying all goods and services available. There may be various reasons for such behaviour – price, taste and preference etc.

Corner solution when only Commodity Y is purchased

Fig. 6.13 presents a case where indifference map between two goods X and Y and budget line BL are such that the interior solution is not possible and consumer in its equilibrium position at point B will not consume any quantity of commodity X. The reason behind such indifference map is high price of commodity X. As we already know that the slope of budget line is ratio of price of two goods, high price of good X makes the budget curve is steeper than the indifference curves between the two commodities i.e. price or opportunity cost of commodity X in the market is greater than the marginal rate of substitution of X for Y which indicates willingness to pay for the commodity X ($P_x/P_y > MRS_{xy}$). The price of good X is so high that the consumer does not purchase even one unit of the commodity X. Thus the consumer maximises his satisfaction or is in equilibrium at the corner point B where he buys only commodity Y. Thus, consumer's equilibrium in this case is a corner solution.

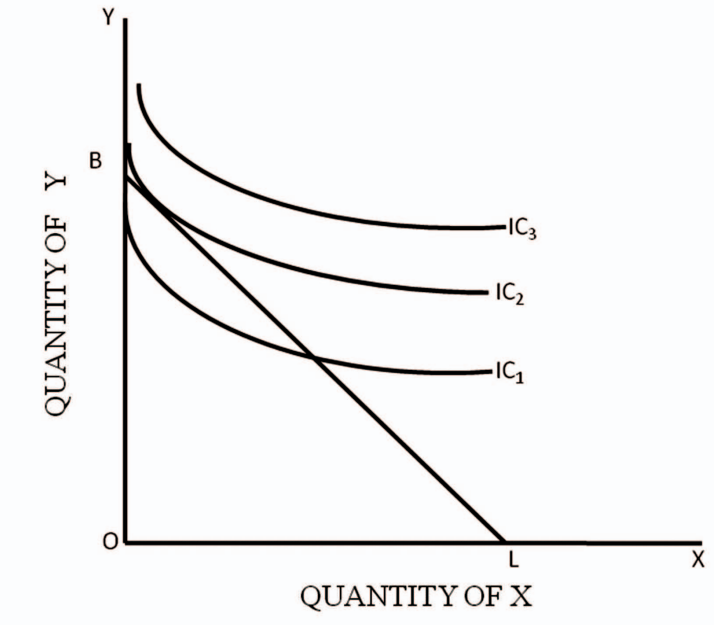

Fig. 6.13: Corner solution when only Commodity Y is bought

Corner solution when only Commodity X is purchased

On the other hand, when the indifference map between the two goods is such that the budget line BL is less steep than the indifference curves between the two goods so that the $MRS_{xy} > P_x/P_y$ for all levels of consumption along the budget line BL. Therefore, he maximises his satisfaction at the corner point L where he buys only commodity X and none of Y. In this case price of commodity Y and willingness to pay (i.e. MRS) for it are low that he does not consider it worthwhile to purchase even one unit of it. Fig. 6.14 presents the corner solution when only commodity X is purchased.

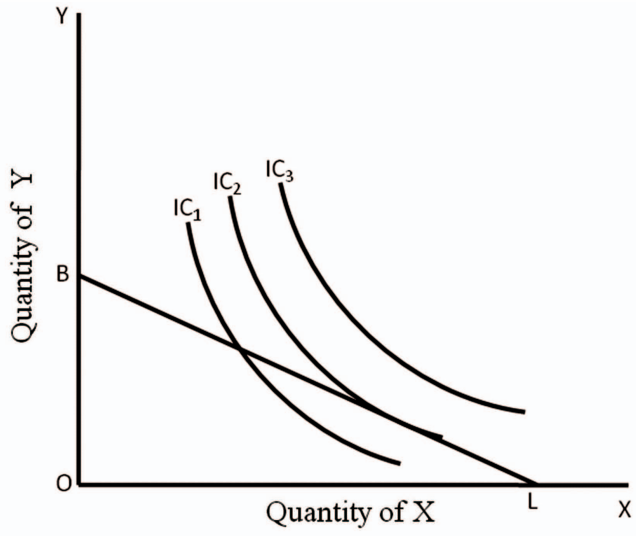

Fig. 6.14: Corner solution when only Commodity X is purchased

Corner Equilibrium and Concave Indifference Curves:

The indifference curves are usually convex to the origin. Convexity of indifference curves is due to the reason that marginal rate of substitution of X for Y falls as more of X is substituted for Y. However, indifference curves are concave to the origin in some exceptional cases. Concavity of the indifference curves implies that the marginal rate of substitution of X for Y increases when more of X is substituted for Y. Thus, in case of concave indifference curve, consumer will choose or buy only one good. It implies that the customer prefers to buy only one good and does not prefer diversification in his buying pattern.

In case of concave indifference curves, the consumer will not be in equilibrium at the point of tangency between budget line and indifference curve, that is, in this case interior solution will not exist. Instead, we would have corner solution for consumer's equilibrium. Corner solution in case of concave indifference curve is presented in Fig. 6.15.

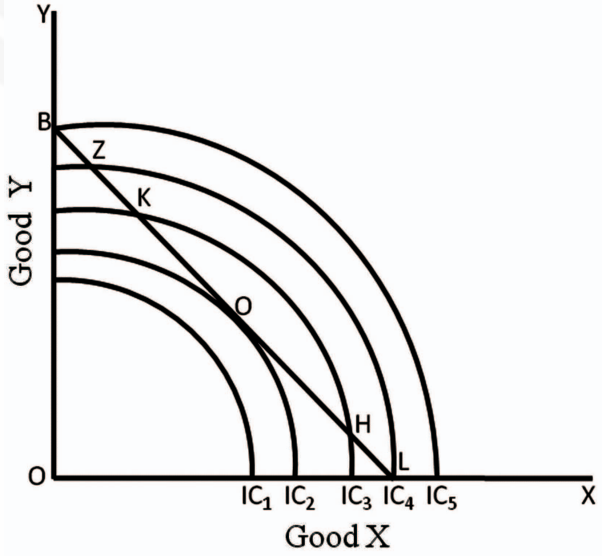

Fig. 6.15: Consumer equilibrium in case of concave indifference curves

It can be observed from Fig. 6.15 that the given budget line BL is tangent to the indifference curve IC_2 at point Q. However, consumer cannot be in equilibrium at Q since by moving along the given budget line BL he can get on

to higher indifference curves and obtain greater satisfaction than at Q. Thus, by moving on higher indifference curve he will reach at extreme point B or point L. In Fig. 6.15, point B is on higher indifference curve. Thus, consumer will be satisfied at point B where he will buy OB units of commodity Y. It should be noted that at B the budget line is not tangent to the indifference curve IC_5, even though the consumer is here in equilibrium. It is clear that when a consumer has concave indifference curves, he will consume only one good.

Corner solution in case of Perfect Substitutes and Perfect Complements:

Another case of corner solution to the consumer's equilibrium occurs in case of perfect substitutes. As seen above, indifference curves for perfect substitutes are linear. In their case tangency or interior solution for consumer's equilibrium is not possible since the budget line cannot be tangent to a point of the straight-line indifference curve of substitutes.

In this case budget line would cut the straight-line indifference curves. Fig. 6.16A presents a case where slope of the budget line BL is greater than the slope of indifference curves. If the slope of the budget line is greater than the slope of indifference curves, B would lie on a higher indifference curve than L and the consumer will buy only Y.

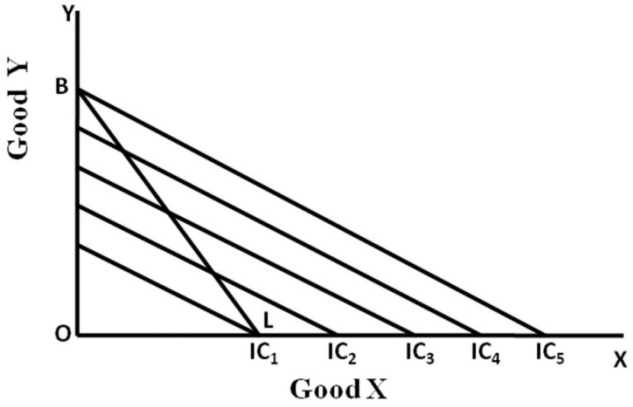

Fig. 6.16 A: Corner equilibrium in case of Perfect Substitutes

Fig. 6.16 B presents a case the slope of the budget line can be less than the slope of indifference curve. If the slope of the budget line is less than the slope of indifference curves, L would lie on a higher indifference curve than B and the consumer will buy only X.

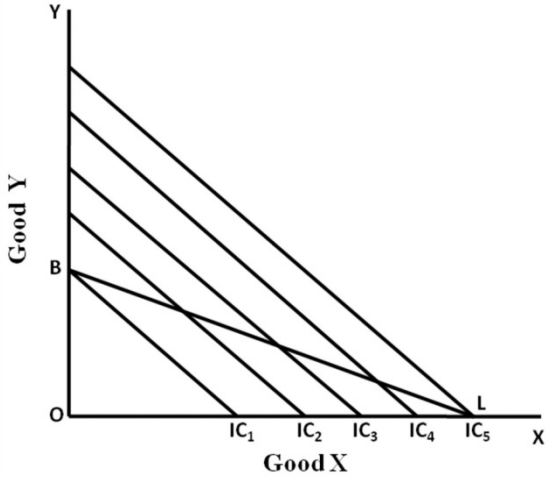

Fig. 6.16 B: Corner equilibrium in case of Perfect Substitutes

Perfect complements

Another exceptional case of perfect complementary goods is presented in Fig. 6.17. Indifference curves of perfect complementary goods have a right-angled

shape. In such a case the equilibrium of the consumer will be determined at the corner of indifference curve which just touches the budget line. It can be noted from Fig. 6.17 that in case of perfect complements equilibrium point will be point C and will be consuming OM of X and ON of Y.

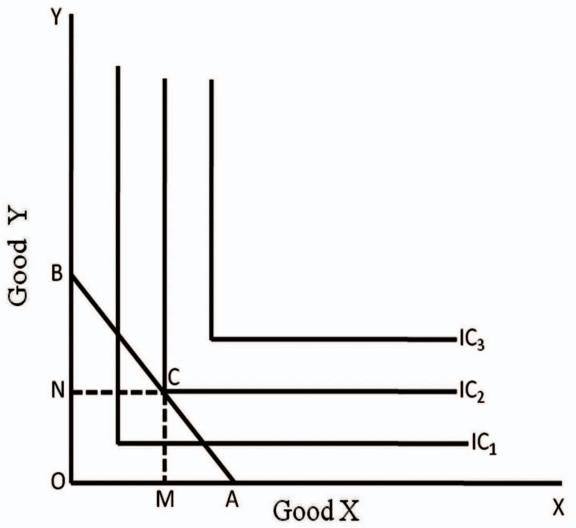

Fig. 6.17: Corner solution in case of Perfect Complements

6.9 PRICE EFFECT AS COMBINATION OF INCOME EFFECT AND SUBSTITUTION EFFECT

As discussed above, a consumer's equilibrium position is affected by the changes in his income, prices of substitute and changes in the price of goods consumed. These effects are known as:

1) Income effect,

2) Substitution effect, and

3) Price effect

6.9.1 Income Effect

In the analysis of the consumer's equilibrium it is assumed that the income of the consumer remains constant, and the prices of the goods X and Y are given. Thus, given the tastes and preferences of the consumer and the prices of the two goods, if the income of the consumer changes, the effect it will have on his purchases is known as the Income effect.

The Income effect may be defined as the effect on the purchases of consumer caused by the changes in income, if the prices of goods remain constant. If the income of the consumer increases his budget line will shift upward to the right, parallel to the original budget line. On the contrary, a fall in his income will shift the budget line inward to the left. The budget lines are parallel to each other because relative prices remain unchanged.

Assumptions of Income Effect

1) The prices of both the commodities X and Y remain constant

2) Taste and preferences remain constant

3) There is no change in fashion and market condition

Kinds of Income Effect

Income effect may be of three types:

1) Positive Income effect
2) Negative Income effect
3) Zero Income effect

1) **Positive Income effect:** When an increase in income leads to an increase in demand for a commodity or for both the commodities the income effect is positive. In case of Normal goods, income effect is positive and Income consumption curve slopes upwards to the right.
2) **Negative Income effect:** Income effect is negative, when with the increase in his income, the consumer reduces his consumption of the good. Income effect is negative in case of inferior goods.
3) **Zero Income effect:** If with the change in income, there is no change in the quantity purchased of a commodity, than the income effect is said to be zero. Zero income effect is in case of goods like medicines, necessities like salt etc.

All the three effects are explained diagrammatically.

In Fig. 6.18, when the budget line is B_1, the equilibrium point is X* where it touches the indifference curve I_1. If now the income of the consumer increases, B_1 will move to the right as the budget line B_2, I_1, and the new equilibrium point is X_1 where it touches the indifference curve I_2. As income increases further, B_3 becomes the budget line with X_2 as its equilibrium point.

The locus of these equilibrium points X*, X_1 and X_2 traces out a curve which is called the income-consumption curve (ICC). The ICC curve shows the income effect of changes in consumer's income on the purchases of the two goods, given their relative prices.

Normally, when the income of the consumer increases, he purchases larger quantities of two goods. Usually, the income consumption curve slopes upwards to the right as shown in Fig. 6.18. Here the income effect is also positive and both X and Y are normal goods.

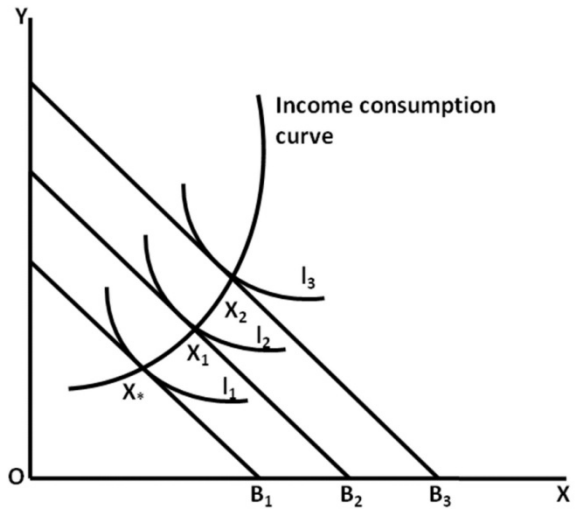

Fig. 6.18: Income Consumption curve-Normal goods

But an Income-consumption curve can have any shape provided it does not intersect an Indifference curve more than once.

The second type of ICC curve may have a positive slope in the beginning but become and stay horizontal beyond a certain point when the income of the consumer continues to increase. In case where X is a superior good and Y is a necessity, shape of ICC curve will be as shown in Fig. 6.19.

In Fig. 6.19, the ICC curve slopes upwards with the increase in income up to the equilibrium point R at the budget line P_1Q_1 on the indifference cure I_2. Beyond this point it becomes horizontal which means that the consumer has reached the saturation point regarding consumption of good Y. He buys the same amount of Y (RA) as before despite further increases in his income. It often happens in the case of a necessity (like salt) whose demand remains the same even when the income of the consumer continues to increase further. Here Y is a necessity.

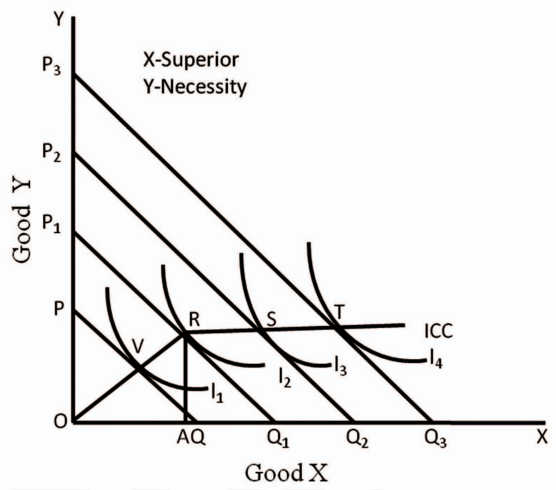

Fig. 6.19: Income Consumption curve (X is a superior good and Y is a necessity)

Further, the demand of inferior goods falls, when the income of the consumer increases beyond a certain level, and he replaces them by superior substitutes. For example, he may replace coarse grains by wheat or rice, and coarse cloth by a fine variety. In Fig. 6.20, good X is inferior and Y is a normal good.

It can be observed from the Fig. 6.20, that up to point R the ICC curve has a positive slope and beyond that it is negatively inclined. The consumer's purchases of X fall with the increase in his income.

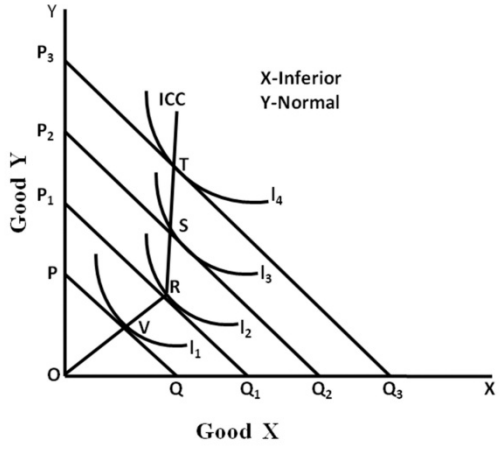

Fig. 6.20: Income Consumption curve (Y is normal good and X is inferior)

The different types of income-consumption curves are also shown in Fig. 6.21 where: (1) ICC_1, has a positive slope and relates to normal goods; (2) ICC_2 is horizontal from point A, X is a normal good while Y is a necessity of which the consumer does not want to have more than the usual quantity as his income increases further: (3) ICC_3 is vertical from A, y is a normal good here and X is satiated necessity; (4) ICC_4 is negatively inclined downwards, Y becomes an inferior good form A onwards and X is a superior good; and (5) ICC_5 shows X as an inferior good.

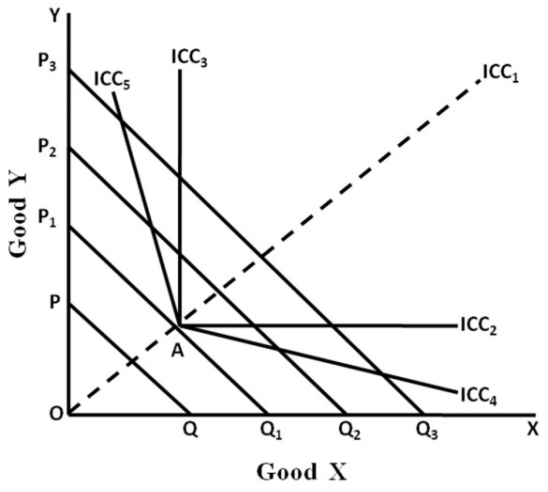

Fig. 6.21: Possible shapes of Income Consumption curve (ICC)

6.9.2 Substitution Effect

The substitution effect relates to the change in the quantity demanded resulting from a change in the price of one good it prompts the substitution of relatively cheaper good for a dearer one, while keeping the price of the other good, real income and tastes of the consumer as constant. Prof. Hicks has explained the substitution effect independent of the income effect through compensating variation in income. "The substitution effect is the increase in the quantity bought as the price of a commodity falls, after adjusting income so as to keep the real purchasing power of the consumer the same as before. This adjustment in income is called compensating variations and is shown graphically by a parallel shift of the new budget line until it become tangent to the initial indifference curve."

Thus, on the basis of the methods of compensating variation, the substitution effect measures the effect of change in the relative price of a good. The increase in the real income of the consumer as a result of fall in the price of, say good X, is so withdrawn that he is neither better off nor worse off than before.

The substitution effect is explained in Fig. 6.22 where the original budget line is PQ with equilibrium at point R on the indifference curve I_1. At R, the consumer is buying OB of X and BR of Y. Suppose the price of X falls so that his new budget line is PQ_1. With the fall in the price of X, the real income of the consumer increases. To make the compensating variation in income or to keep the consumer's real income constant, take away the increase in his income equal to PM of good Y or Q_1N of good X so that his budget line PQ_1 shifts to the left as MN and is parallel to it so that new budget line tangent to I_1 at point H.

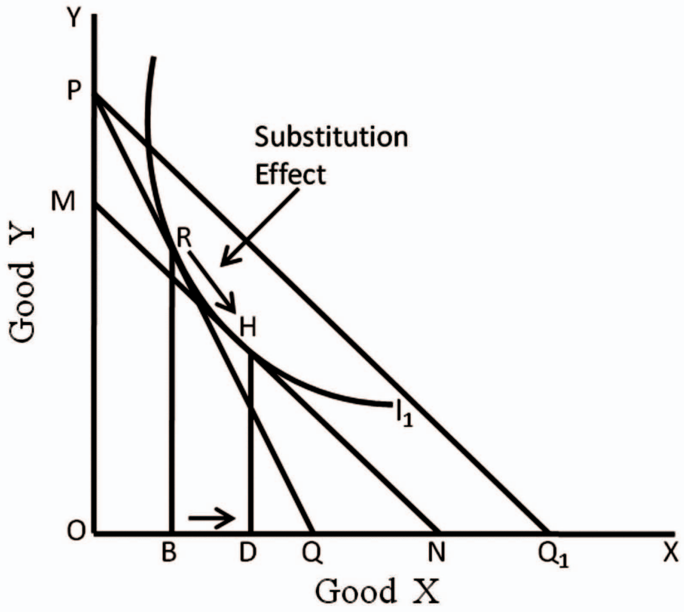

Fig. 6.22: Substitution effect (Hicksian Analysis)

As MN is tangent to the original indifference curve I_1, at point H, the consumer buys OD of X and DH of Y. Thus PM of Y or Q_1N of X represents the compensating variation in income, as shown by the line MN being tangent to the curve I_1 at point H. Now the consumer substitutes X for Y and moves from point R to H or the horizontal distance from B to D. This movement is called the substitution effect. The substitution affect is always negative because when the price of a good falls (or rises), more (or less) of it would be purchased, the real income of the consumer and price of the other good remaining constant. In other words, the relation between price and quantity demanded being inverse, the substitution effect is negative.

6.9.3 Price Effect

The price effect indicates the way the consumer's purchases of good X change, when its price changes, given his income, tastes and preferences and the price of good Y. This is shown in Fig. 6.23. Suppose the price of X falls. The budget line PQ will extend further out to the right as PQ_1, showing that the consumer will buy more X than before as X has become cheaper. The budget line PQ_2 shows a further fall in the price of X. Any rise in the price of X will be represented by the budget line being drawn inward to the left of the original budget line towards the origin.

If we regard PQ_2, as the original budget line, a two time rise in the price of X will lead to the shifting of the budget line to PQ_1, and PQ_2 – PQ. Each of the budget lines fanning out from P is a tangent to an indifference curve I_1, I_2, and I_3 at R, S and T respectively. The curve PCC connecting the locus of these equilibrium points is called the price-consumption curve (PCC). The price-consumption curve indicates the price effect of a change in the price of X on the consumer's purchases of the two goods X and Y, given his income, tastes, preferences and the price of good Y.

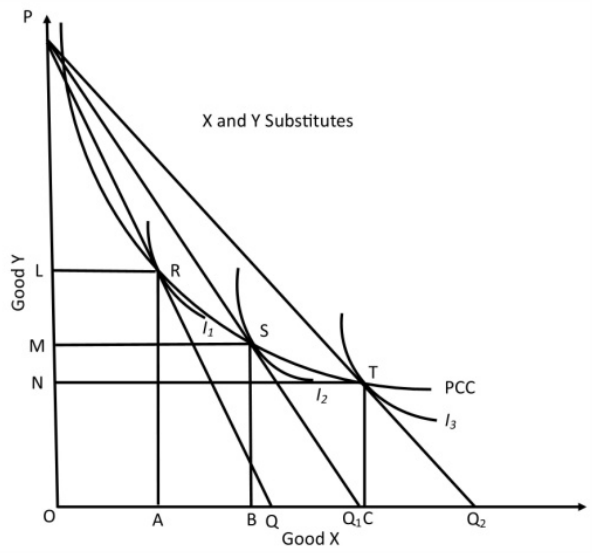

Fig. 6.23: Price effect through Indifference curve analysis

Check Your Progress 3

1) Differentiate between Income effect, price effect and substitution effect.

.....

.....

.....

2) What will be the shape of Income consumption curve (ICC):

Case A: X is an inferior good, Y is superior good

.....

.....

Case B: Y is an inferior good, X is superior good

.....

.....

6.10 MEASURING INCOME AND SUBSTITUTION EFFECTS OF PRICE CHANGE

As noted above, the change in consumption basket due to change in the prices of consumer goods is called price effect. Price effects combines two effects: Income effect and substitution effect. Income effect is the result of increase in real income due to decrease in price of a commodity. Substitution effect arises due to substitution of costly good by cheaper good. This section presents the decomposition of Income and substitution effect from the price effect. There are two approaches for the decomposition: a) Hicksian approach, and b) Slutsky approach.

Hicksian approach uses two methods of splitting the price effect, namely

i) Compensating variation in income

ii) Equivalent variation in income.

Slutsky uses cost-difference method to decompose price effect into its two component parts.

Hicksian or Compensating Variation approach

In this method of decomposition of price effect into income and substitution effects by compensating variation, income of the consumer is adjusted so as to offset the change in satisfaction and bring the consumer back to his original indifference curve, that is, his initial level of satisfaction before the change in price.

For instance, with the fall in price of a commodity, a consumer moves to a new equilibrium position at a higher indifference curve i.e. at a higher level of satisfaction. To offset this increase in satisfaction resulting from a fall in price of the good, one part of income is taken back to force him to come back at his original indifference curve. This requires reduction in income (say, through levying a lump sum tax) to cancel out the gain in satisfaction or welfare on account of by reduction in price of a good. It is called compensating variation in income.

The effect is called compensating variation in income because it compensates (in a negative way) for the gain in satisfaction resulting from a price reduction of the commodity. Process of decomposition of price effect into substitution effect and income effect through the method of compensating variation in income is presented in Fig. 6.24.

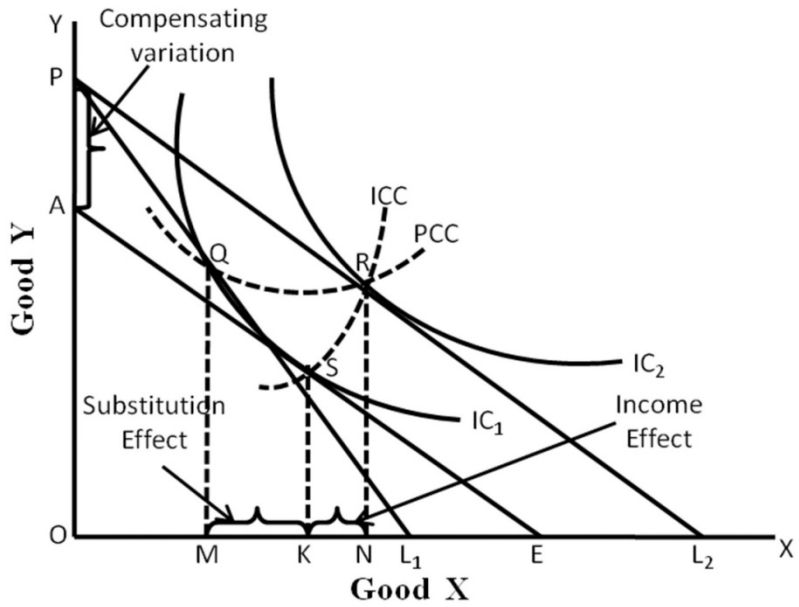

Fig. 6.24: Decomposition of price effect into income effect and substitution effect through Compensating variation in Income

It can be observed from Fig. 6.24, that when price of good X falls, budget line shifts to PL_2 i.e. real income of the consumer i.e. he can buy more of both the goods with his increased income. With the new budget line PL_2, consumer is in equilibrium at point R on a higher indifference curve IC_2 and enjoy increased satisfaction as a result of fall in price of good X.

Suppose, money income of the consumer is reduced by the compensating variation in income so that he is forced to come back to the original indifference curve IC_1 he would buy more of X since X has now become

relatively cheaper than before. In Fig. 6.24, with the reduction in income by compensating variation, budget line will shift to AB which has been drawn parallel to PL_2 so that it just touches the indifference curve IC_1 on which he was before the fall in price of X.

Since the price line AB has got the same slope as PL_2, it represents the changed relative prices with X being relatively cheaper than before. Now, X being relatively cheaper than before, the consumer, in order to maximise his satisfaction, in the new price income situation substitutes X for Y.

Thus, when the consumer's money income is reduced by the compensating variation in income (which is equal to PA in terms of Y or L_2B in terms of X), the consumer moves along the same indifference curve IC_1 and substitutes X for Y. At price line AB, consumer is in equilibrium at S at indifference curve IC_1 and is buying MK more of X in place of Y. This movement from Q to S on the same indifference curve IC_1 represents the substitution effect since it occurs due to the change in relative prices alone, real income remaining constant.

If the amount of money income which was taken away from him is now given back to him, he would move from S at indifference curve IC_1 to R on a higher indifference curve IC_2. The movement from S at lower indifference curve to R on a higher in difference curve is the result of income effect. Thus the movement from Q to R due to price effect can be regarded as having taken place into two steps first from Q to S as a result of substitution effect and second from S to R as a result of income effect. Thus, price effect is the combined result of a substitution effect and an income effect.

In Fig. 6.24 the various effects on the purchases of good X are:

- Price effect = MN
- Substitution effect = MK
- Income effect = KN
- MN = MK+KN or

Price effect = Substitution effect + Income effect

Slusky's Cost difference approach

In Slutsky's approach, when the price of good changes and consumer's real income or purchasing power increases, the income of the consumer is changed by the amount equal to the change in its purchasing power which occurs as a result of the price change. His purchasing power changes by the amount equal to the change in the price multiplied by the number of units of the good which the individual used to buy at the old price.

In other words, in Slutsky's approach, income is reduced or increased (as the case may be), by the amount which leaves the consumer to be just able to purchase the same combination of goods, if he so desires, which he was having at the old price.

That is, the income is changed by the difference between the cost of the amount of good X purchased at the old price and the cost of purchasing the same quantity of X at the new price. Income is then said to be changed by the cost difference. Thus, in Slutsky substitution effect, income is reduced or

increased not by compensating variation as in case of the Hicksian substitution effect, but, by the cost difference.

Slutsky substitution effect is explained in Fig. 6.25.

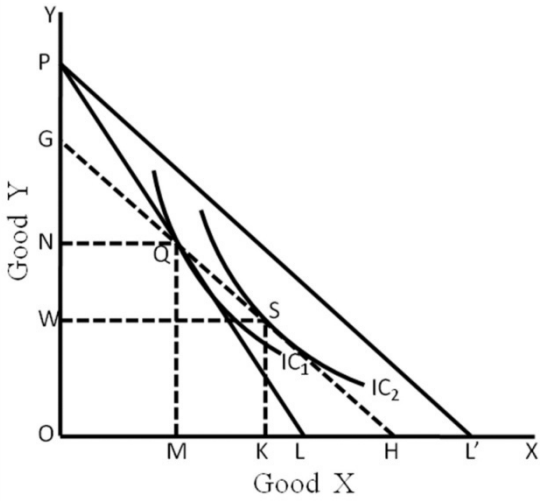

Fig. 6.25: Slutsky's Substitution Effect (For a Fall in Price)

Initially, with a given money income and the given prices of two goods as represented by the price line PL, the consumer is in equilibrium at point Q on the indifference curve IC_1 where consumer is buying OM units of good X and ON units of good Y. Suppose that price of X falls, price of Y and money income of the consumer remaining constant. As a result of this fall in price of X, the price line will shift to PL' and the real income or the purchasing power of the consumer will increase.

In order to identify Slutsky's substitution effect, consumer's money income must be reduced by the cost difference or, in other words, by the amount which will leave him to be just able to purchase the old combination Q, if he so desires.

For this, a price line GH parallel to PL' has been drawn which passes through the point Q. It means that income equal to PG in terms of Y or LH in terms of X has been taken away from the consumer and as a result he can buy the combination Q, if he so desires, since Q also lies on the price line GH.

Consumer will not now buy the combination Q since X has now become relatively cheaper and Y has become relatively dearer than before. The change in relative prices will induce the consumer to rearrange his purchases of X and Y. He will substitute X for Y. But in this Slutsky substitution effect, he will not move along the same indifference curve IC_1, since the price line GH, on which the consumer has to remain due to the new price-income circumstances is nowhere tangent to the indifference curve IC_1.

The price line GH is tangent to the indifference curve IC_2 at point S. Therefore, the consumer will now be in equilibrium at a point S on a higher indifference curve IC_2. This movement from Q to S represents Slutsky substitution effect according to which the consumer moves not on the same indifference curve, but from one indifference curve to another.

It is important to note that movement from Q to S as a result of Slutsky substitution effect is due to the change in relative prices alone, since the effect

due to the gain in the purchasing power has been eliminated by making a reduction in money income equal to the cost-difference.

At S, the consumer is buying OK of X and OW of Y; MK of X has been substituted for NW of Y. Therefore, Slutsky substitution effect on X is the increase in its quantity purchased by MK and Slutsky substitution effect on Y is the decrease in its quantity purchased by NW.

6.11 DERIVATION OF DEMAND CURVE FROM INDIFFERENCE CURVES

A demand curve shows quantity of a good purchased or demanded at various prices, assuming that tastes and preferences of a consumer, his income, and prices of all related goods remain constant. Demand curve showing relationship between price and quantity demanded can be derived from price consumption curve (PCC) of indifference curve analysis.

In Marshallian utility analysis, demand curve was derived on the assumptions that utility was cardinally measurable and marginal utility of money remained constant with the change in price of the good. In the indifference curve analysis, demand curve is derived without making such assumptions.

Let us suppose that a consumer has got income of Rs. 300 to spend on goods. In Fig. 6.26 money is measured on the Y-axis, while the quantity of the good X whose demand curve is to be derived is measured on the X-axis. An indifference map of a consumer is drawn along with the various budget lines showing different prices of the good X. Budget line PL_1 shows that price of the good X is Rs. 15 per unit.

As price of good X falls from Rs. 15 to Rs. 10, the budget line shifts to PL_2. Budget line PL_2 shows that price of good X is Rs. 10. With a further fall in price to Rs. 7.5 the budget line takes the position PL_3. Thus PL_3 shows that price of good X is Rs. 7.5. When price of good X falls to Rs. 6, PL_4 is the relevant budget line.

Tangency points between the various budget lines and indifference curves, which when joined together by a line constitute the price consumption curve shows the amounts of good X purchased or demanded at various prices. With the budget line PL_1 the consumer is in equilibrium at point Q_1 on the price consumption curve (PCC) at which the budget line PL_1 is tangent to indifference curve IC_1. In his equilibrium position at Q_1 the consumer is buying OA units of the good X. In other words, it means that the consumer demands OA units of good X at price Rs. 15. When price falls to Rs. 10 and thereby the budget line shifts to PL_2, the consumer comes to be in equilibrium at point Q_2 the price-consumption curve PCC where the budget line PL_2 is tangent to indifference curve IC_2. At Q_2, the consumer is buying OB units of good X.

In other words, the consumer demands OB units of the good X at price Rs. 10. Likewise, with budget lines PL_3 and PL_4, the consumer is in equilibrium at points Q_3 and Q_4 of price consumption curve and is demanding OC units and OD units of good X at price Rs. 7.5 and Rs. 6 respectively. Thus, price consumption curve shows the quantity demanded of the good X against various prices.

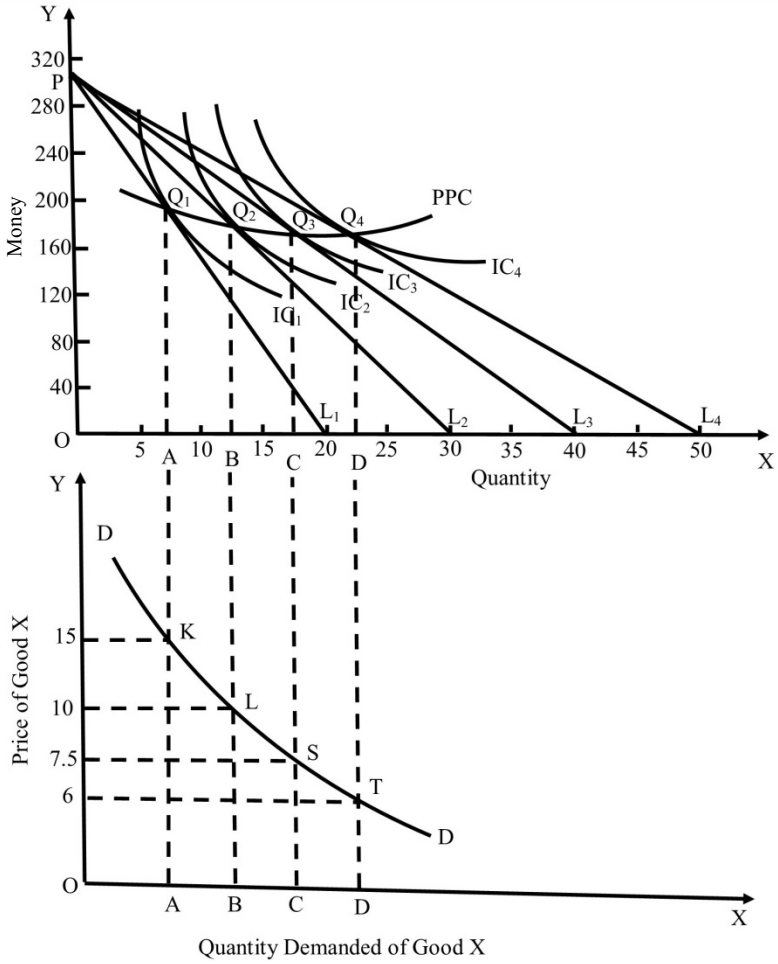

Fig. 6.26: Derivation of demand curve from indifference curve

In most cases, the demand curve of individuals will slope downward to the right, because as the price of a good falls both the substitution effect and income effect pull together in increasing the quantity demanded of the good. Even when the income effect is negative, the demanded curve will slope downward to the right if the substitution effect is strong enough to overcome the negative income effect. Only when the negative income effect is powerful enough to outweigh the substitution effect can the demand curve slope upward to the right instead of sloping downward to the left.

Deriving Demand Curve for a Giffen Good:

Giffen good is a good where higher price causes an increase in demand (reversing the usual law of demand). The increase in demand is due to the income effect of the higher price outweighing the substitution effect. In this section we will derive the demand curve of a Giffen good.

In Fig. 6.26, demand curve DD in case of a normal good is downward sloping. There are two reasons behind downward slope: a) income effect b) substitution effect.

Both the income effect and substitution effect usually work towards increasing the quantity demanded of the good when its price falls and this makes the demand curve slope downward. But in case of Giffen good, the demand curve slopes upward from left to right. This is because in case of a Giffen good, income effect, which is negative and works in opposite direction to the substitution effect, outweighs the substitution effect. This results in the fall in

quantity demanded of the Giffen good when its price falls and therefore the demand curve of a Giffen good slopes upward from left to right. Fig. 6.27 presents the Indifference curves of a Giffen good along with the various budget lines showing various prices of the good. Price consumption curve of a Giffen good slopes backward.

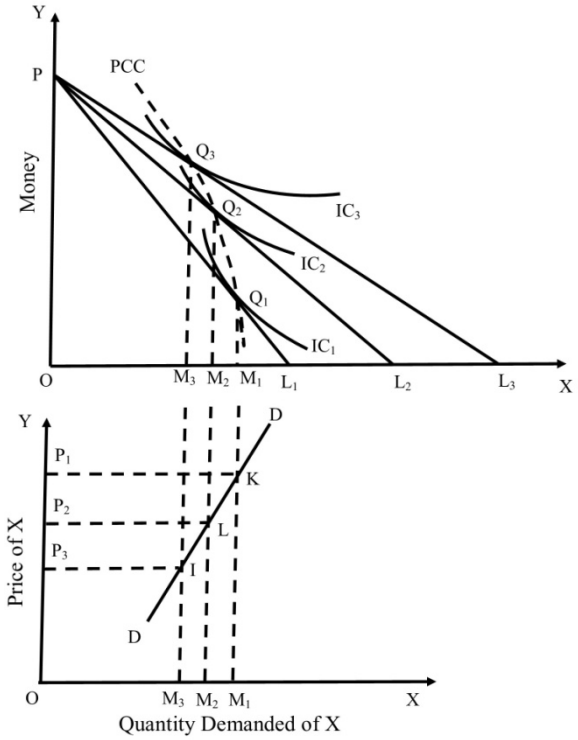

Fig. 6.27: Upward Sloping Demand Curve for a Giffen Good

It is evident from Fig. 6.27 (the upper portion) that with budget line PL_1 (or price P_1) the consumer is in equilibrium at Q_1 on the price consumption curve PCC and is purchasing OM) amount of the good. With the fall in price from P_1 to P_2 and shifting of budget line from PL_1 to PL_2, the consumer goes to the equilibrium position Q_3 at which he buys OM_2 amount of the good. OM_2 is less than OM_1.

Thus, with the fall in price from P_1 to P_2 the quantity demanded of the good falls. Likewise, the consumer is in equilibrium at Q_3 with price line PL_3 and is purchasing OM at price P_3. With this information we can draw the demand curve, as is done in the lower portion of Fig. 6.26. It can be seen from Fig. 6.27 (lower part) that the demand curve of a Giffen good slopes upward to the right indicating that the quantity demanded varies directly with the changes in price. With the rise in price, quantity demanded increases and with the fall in price quantity demanded decreases.

Check Your Progress 4

1) Differentiate between Hicksian or Compensating Variation approach and Slutsky Cost difference approach.

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2) How can demand curve be derived from Indifference curve?

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6.12 LET US SUM UP

In this unit, we have learnt consumer equilibrium through Indifference curve analysis. Consumer equilibrium is a situation, in which a consumer derives maximum satisfaction, with no intention to change it and subject to given prices and his given income. In indifference curve analysis, the point of maximum satisfaction is achieved by studying indifference map and budget line together. We have discussed the concept of budget line to identify consumer equilibrium. Price line or budget line represents all possible combinations of two goods that a consumer can purchase with his given income and the given prices of two goods. Budget line may shift due to change in income or change in prices of either of the two commodities. We further examined the two conditions of consumer equilibrium i.e. MRS_{XY} = Ratio of prices or P_X/P_Y and continuous fall of MRS. We have also learnt how is Price effect combination of income effect and substitution effect using Hicksian and Slutsky's analysis. Demand curve has been derived from price consumption curve.

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6.14 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Study Section 6.4 and answer

2) Study Sub-section 6.3.4 and answer

3) Indifference curve is convex to origin because of diminishing marginal rate of substitution.

Check Your Progress 2

1) Study Section 6.5 and answer

2) Study Section 6.6 and answer

Check Your Progress 3

1) Study Section 6.9 and answer

2) Study Section 6.9 and answer

Check Your Progress 4

1) Study Section 6.10 and answer

2) Study Section 6.11 and answer

BLOCK 3 PRODUCTION AND COSTS

BLOCK 3 PRODUCTION AND COSTS

Block 3 develops the theory of the firm and explains the laws that are observed in course of production. This will enable you to know how firms combined inputs such as capital, labour and raw materials to produce goods and services in a way that minimise costs of production. In this process various concepts like production function, Iso product curves, Iso-cost lines etc have been explained.

The block comprises four units. **Unit 7** throws light on production function with one variable input, and discusses the law of variable proportions. **Unit 8** deals with the Properties of isoquants and optimal combination of factors and producer's equilibrium. The economic region of production and ridge lines and the expansion path have also been discussed. **Unit 9** covers the production function in the event all the inputs vary and hence application of returns to scale. **Unit 10** discusses the cost side of production considering different types of costs.

UNIT 7 PRODUCTION WITH ONE VARIABLE INPUT

Structure

7.0 Objectives

7.1 Introduction

7.2 Total, Average and Marginal Products

7.3 Total, Average and Marginal Product Curves

7.4 The Law of Variable Proportions: Returns to a Factor

- 7.4.1 The Three Stages of Production
- 7.4.2 Explanation of Increasing Returns
- 7.4.3 Explanation of Constant Returns
- 7.4.4 Explanation of Diminishing Returns

7.5 Let Us Sum Up

7.6 References

7.7 Answers or Hints to Check Your Progress Exercises

7.0 OBJECTIVES

After going through this unit, you will be able to :

- state the concept of total product, average product and marginal product;
- explain the nature and relationship of total, average and marginal product curves;
- analyse the operation of the law of variable proportions; and
- identify the three stages of production.

7.1 INTRODUCTION

For the purpose of production, we require a combination of various inputs or factors of productions. It is only with the joint efforts of these inputs (like labour, machines, land, raw materials etc.) that output is produced. Normally, production is carried out under conditions of variable proportions which implies that the rate of input quantities may vary. Fixed proportions production means that there is only one ratio of inputs that can be used to produce a good. For example, only one driver can work one truck. In this case, the ratio of driver and truck is technologically determined and is fixed. It is beyond the capabilities of the producer to change it. However, the ratio of land and labour in agriculture can be changed and is thus regarded as variable. In the short run, not all inputs are variable. In the long run, however, all inputs are variable and the ratio of inputs may also vary. This is the case of technological Progress. In this unit, we shall focus only on short run production. In the short run, for the

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purpose of analysis, it is often assumed that only one input is variable and all other inputs are fixed. We shall follow this convention.

7.2 TOTAL, AVERAGE AND MARGINAL PRODUCTS

At the outset we shall explain the concept of total, average and marginal products. The short run production function, whether it is shown as a table, a graph or as a mathematical equation, gives the total output obtainable from different quantities of the variable inputs given a specified amount of the fixed input. Let us now consider the case in which capital is fixed, but labour is variable, so that the firm can produce more output by increasing the labour input. For example, consider a firm manufacturing garments. It has a fixed amount of equipment, but it can hire more or less labour to operate the machines. For decision making, the firm's manager (or owner) must know how the amount of total output or product (Q) increases (if at all) as the labour input (L) increases. Table 7.1 provides this information about the production function.

Table 7.1 shows the output that can be produced with different amounts of labour and with capital fixed at 5 units. The first column shows the fixed amount of capital, the second shows the amounts of labour from zero to 10 units and the third shows total product or output. From the table, it is clear that when labour input is zero, output is zero because capital alone cannot produce anything. Then, upto a labour input of seven units output increases first at an increasing rate and then at a decreasing rate in response to increased use of labour. The eighth unit of labour input does not raise output. Whether firm applies 7 or 8 units of labour input to a fixed amount of capital input, total output remains 224 units. Beyond this point using more units of labour input is counter productive because output declines as use of labour is increased.

Table 7.1: Production with One Variable Input

Amount of Capital (K)	Amount of Labour (L)	Total Product or Output (Q)	Average Product (Q/L)	Marginal Product ($\Delta Q/\Delta L$)
5	0	0	--	--
5	1	20	20	20
5	2	60	30	40
5	3	120	40	60
5	4	160	40	40
5	5	190	38	30
5	6	216	36	26
5	7	224	32	8
5	8	224	28	0
5	9	216	24	-8
5	10	200	20	-16

Although the figures provided in Table 7.1 are hypothetical, the general relationship they indicate is common. To examine the relationship further, we introduce the concepts of average product and marginal product of an input.

The average product (or average physical product) of an input can be defined as total output (or total product) divided by the amount of input used to produce that output. For example, 4 units of labour input produce 160 units of output, so the average product of labour is 40 units of output per worker at that level of employment. In a more general way, we may express

$$AP_L = \frac{Q}{L}$$

where, AP_L = average product of labour

Q = total output or total product

L = amount of labour

The fourth column in Table 7.1 shows the average product of labour (AP_L). The average product for each quantity of labour is derived by dividing total output shown in column 3 by corresponding amount of labour in column 2 that produces each output level. In our illustration, the average product of labour increases initially but when labour input exceeds 4 units, it tends to fall.

The marginal product (or marginal physical product) of an input is defined as the change in total output due to a unit change in the use of an input while quantities of other inputs are held constant. For example, with capital fixed at 5 units when the amount of labour increase from 3 to 4 units, total output rises from 120 to 160 units or by 40 units. So the marginal product of labour, when fourth unit of labour input is employed, is 40 units of output. We may thus generalise,

$$MP_L = \frac{\Delta Q}{\Delta L}$$

where, MP_L = Marginal product of labour

ΔQ = Change in output

ΔL = Change in labour input

In Table 7.1, the fifth column shows the marginal product of labour. It may be noted that like the average product, the marginal product increases initially and then falls and finally becomes negative. In the present example, the marginal product of labour becomes negative when labour input exceeds 8 units. This happens when the variable input is used too intensively with the fixed input.

The marginal product is greater than average product when average product is rising, equals average product when average product is at maximum, and is less than average product when average product is falling.

This proposition is, in fact, true of all marginal and average relationships.

7.3 TOTAL, AVERAGE AND MARGINAL PRODUCT CURVES

Fig. 7.1 plots the information provided in Table 7.1 (it has been assumed in drawing the graphs that both labour input and the product are divisible into smaller units and thus the relationships are smooth curves rather than discrete points). The total product curve shown in Fig. 7.1 indicates how the total

product varies with the quantity of labour input used. As indicated in Table 7.1, Fig. 7.1 a also shows that first the total output increases at an increasing rate upto point E as more labour is used. The point E where total product stops increasing at an increasing rate and begins increasing at a decreasing rate is called the **point of inflexion**. Total product reaches a maximum at 224 units when 7 units of labour input are used. The use of an additional unit of labour input at this stage does not lead to any increase in total product. Beyond this point, further use of labour input results in a fall in total product.

That portion of total product curve (TP) is shown by dashed segment which indicates a decline in output as a result of increased employment of labour. In Fig. 7.1 a when labour input is expanded beyond eighth unit, output falls which means that production is not technically efficient and is thus not a part of the production function.

Fig. 7.1 b shows the average and marginal product curves for labour. (The units of the vertical axis have been changed from output per period of time to output per unit of labour). Hence, average product and marginal product curves measure the output per unit of labour. It may be noted that as the use of labour input increases, initially the marginal product of labour increases, reaches a maximum at 3 units of labour, and then declines. The marginal product of labour in our example becomes zero at 8 units of labour and thereafter turns negative. However, technical efficiency rules out the possibility of negative marginal products and is, therefore, not a part of the production function. The average product of labour also increases initially, reaches a maximum at 4 units of labour input, and then declines.

Relationship between MP and AP Curves:

Let us now consider the relationship between the marginal and average product curves. As is true of all marginal and average curves, there are definite relationships between the marginal and average product curves.

i) When marginal product increases, average product also increases though at a rate lower than that of the marginal product. It is important to note in this context that even when marginal product starts declining but remains greater than the average product, the latter shows a tendency to increase.

ii) When the average product is maximum, the marginal product is equal to it. This is the reason why the marginal product curve intersects the average product curve at its highest point.

iii) Beyond this point, when the marginal product declines, it also pulls down the average product. However, the rate of decline in the average product is less than that of the marginal product.

Relationship between TP and MP Curves

The relationship between the total product curve and the marginal product curve can be stated as under:

i) As long as marginal product is positive, total product curve will continue to rise.

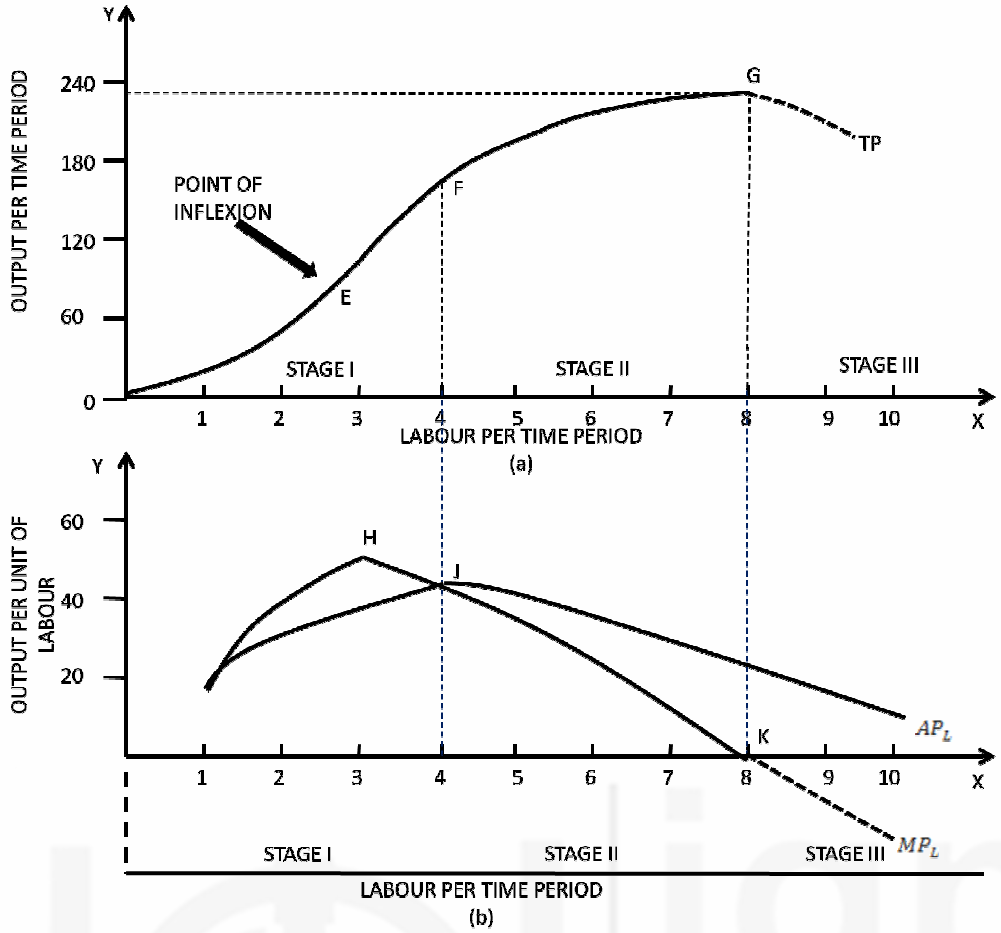

Fig 7.1: Production with one variable input (labour). In the upper part of the figure, the total product curve (TP) of labour is shown. The lower part of the figure shows how average product curve (AP) of labour and marginal product curve (MP) of labour are obtained with the help of information contained in the upper part

ii) When marginal product is zero, total product curve reaches its highest point. It may be noted that when eighth unit of labour input is employed, marginal product of labour becomes zero and total product is at the maximum.

iii) Thereafter, marginal product of labour is negative and total product curve has a downward slope which means that total product falls.

Check Your Progress 1

1) Indicate the following statement as true (T) or false (F):

   i) The marginal product is greater than average product when average product is falling.

   ii) As long as marginal product is rising, total product curve will continue to rise.

2) Discuss the relationship between the marginal and average product curves.

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   .....

7.4 THE LAW OF VARIABLE PROPORTIONS: RETURNS TO A FACTOR

Knowledge regarding the conditions of production reveals that as more and more of some input is employed, all other input quantities being held constant, normally marginal and average product (of the variable input) increase upto a point. Thereafter, marginal product starts declining and this pulls down the average product also. In the production process generally land, capital equipment and buildings remain fixed in the short run while quantities of labour and raw materials can be conveniently varied. However, we may consider a case where amount of capital is fixed and the quantity of labour is increased.

i) In this case, initially the marginal product of labour will increase as its amount is increased and the marginal product will also pull up average product with it. In this situation, total product increases at an increasing rate.

ii) If the variable input, say, labour is further increased, marginal product stops increasing after a point. Therefore, the rate of increase of total product also shows a tendency to fall.

iii) Ultimately marginal product turns negative and this causes a fall in total product itself.

Since in the short run, changes in technology are ruled out, the tendency of marginal product to decline after a point is inevitable. This statement of trends in marginal product in response to changes in the quantities of a variable factor applied to a given quantity of a fixed factor is called the **law of diminishing returns**. It is also called the law of variable proportions because it predicts the consequences of varying the proportions in which factors of production are used. we can sum up the law of variable proportions as follows:

> **"As equal increments of one input are added, the inputs of other productive services being held constant, beyond a certain point the resulting increments of product will decrease, i.e, the marginal product will diminish."**

The law of variable proportions can be easily followed with the help of Table 7.1 and Fig. 7.1 which has been drawn on the basis of illustration given in Table 7.1. In Table 7.1, it has been assumed that capital is a fixed factor and its quantity remains unchanged at 5 units. Labour is the variable factor and its quantity increases from 1 to 10. It can be seen from Table 7.1.

i) As the amount of labour employed increases, the total output also increases until the seventh unit of labour is employed. Initially the increase in output takes place at an increasing rate because marginal product rises. This tendency is observed upto the point E where marginal product reaches a maximum. At point E, which is the point of inflexion, the rate of increase in total product switches from increasing to decreasing because marginal product begins to diminish. However, average product continues to increase until it reaches a maximum at point F on total product curve (point J on average product curve).

ii) When the amount of labour is further expanded, total product continues to increase though at a diminishing rate. Both marginal product and

average product remain positive, but both continue to diminish. Eventually, total product reaches a maximum at point G and the marginal product becomes zero (note point K in Fig. 7.1 b). The average product, however, remains positive but continues to diminish.

iii) Any attempt to increase output beyond this point by employing more units of labour will not be fruitful. In fact, it will be counter-productive because marginal product is negative which implies that total product diminishes.

Product curves such as the one shown in Fig. 7.1 are general representations of production function with fixed and variable inputs. To illustrate particular instances, similar product curves could be drawn, though each different from others in some way. The stage of increasing marginal product may be long or brief or can be totally absent. Moreover, when marginal product diminishes, the rate at which it happens may be different in each case. Table 7.2 sums up the law of variable proportions.

Table 7.2: Properties of Product Curves

Total Product	Marginal Product	Average Product	Figure 7.1
Stage I first increases at increasing rate	Increases	Increases	to point E
then rate of increase changes from increasing to diminishing	reaches a maximum, and then starts diminishing	continues increasing	at points E and H
Stage II continues to increase at diminishing rate	continues diminishing	reaches a maximum where it equals MP and then starts diminishing	at points F and J
reaches a maximum and then starts diminishing	becomes zero	continues diminishing	at points G and K
Stage III diminishes	is negative	continues diminishing	to right of points J and K

7.4.1 The Three Stages of Production

Normally when the amount of a variable input is expanded, the marginal product first rises and then falls and the product curves have the shapes shown in Fig. 7.1. Conventionally, these product curves are partitioned into three regions, shown as Stages I, II and III in Fig. 7.1.

Stage I is characterised particularly by the rising average product. In our example, Stage I occurs when labour is employed from 1 to 4 units. In Stage 1, total product first increases at an increasing rate and thus marginal product rises. It reaches a maximum at labour input of 3 units. When fourth unit of labour input is employed, diminishing returns set in implying that total product increases at a diminishing rate and the marginal product falls.

In **Stage II**, total product increases at a diminishing rate and thus both marginal product and average product decline. Marginal product being below the average product, pulls the latter down. The right-hand boundary of Stage II is at maximum total product where marginal product reaches zero. In our example, Stage II ranges from 4 to 8 units of labour.

In **Stage III**, total product falls and marginal product is negative. In our example, stage III occurs when labour is employed in excess of 8 units.

Actual Stage of Operation

The rational producer will operate in Stage II. It is not difficult to follow why production will not be done in Stage III. In Stage III, less output is produced by using more of the variable input which means that production costs would be higher in Stage III than they were in Stage II. Obviously, any rational producer will always avoid such inefficiencies in the use of production inputs.

In Stage I, average product of the variable input is increasing. Therefore, if the amount of variable input is doubled, the output more than doubles and the unit cost of producing output decreases. If a firm is operating in a competitive market, it would avoid producing in this stage because by expanding output it reduces the unit costs while the price it receives remains same for each additional unit sold. This means that total profits increase if production is expanded beyond the region of rising average product.

To sum up we can say: Initially, the variable factor-labour is not able to use all the capacities of the fixed factor, hence MP and AP remain low. For instance, one worker may not be able to make full use of the potential of a one hectare plot of land. But two workers, together are is a better position to work on that field. Hence rise in MP as Labour increases from 1 to 2.

Thus, any rational producer will operate in the second stage only when the law of diminishing marginal return operates. This is why the law of variable proportions is also called the Law of Diminishing Marginal Returns to a factor.

7.4.2 Explanation of Increasing Returns

According to modern economists, when in the initial stage of production quantity of the variable factor is increased, the tendency of increasing returns in production operates. The classical economists had also observed this tendency and had termed it as the Law of Increasing Returns. However, they felt that this law operated only in manufacturing industries. As against this, the modern economists believe that this law can operate in any area of economic activity. Below we give the views of Marshall (representing the former position) and Joan Robinson (representing the latter position) in this regard.

Marshall opined that the tendency of increasing returns operates only in the manufacturing industries. He believed that when the quantity of labour and capital employed in the manufacturing industries is increased, the scale of

production expands and this leads to a better organisation of production. In Marshall's own words:

> **"An increase in labour and capital leads generally to improved organisation, which increases the efficiency of the work of labour and capital... Therefore, in those industries which are not engaged in raising raw produce, an increase in labour and capital generally gives a return increased more than in proportion."**

Joan Robinson's explanation of the tendency of increasing returns is more scientific. She states:

> **"When an increased amount of any factor of production is devoted to a certain use, it is often the case that improvements in organisation can be introduced which will make natural units of the factor (men, acres or money capital) more efficient, so that an increase in output does not require a proportionate increase in the physical amount of the factors."**

1) The tendency of increasing returns operates not only in manufacturing industries but in all productive activities. Limiting the application of this tendency to manufacturing industries alone is wrong.

2) The tendency of increasing returns comes into operation because the efficiency of the factors of production is improved.

Let us now examine in detail why the tendency of increasing returns operates.

1) **Optimum combination of factors of production:** According to Joan Robinson, full exploitation of some indivisible factors of production is not possible until increased quantities of some other factors of production are employed. Therefore, when the producer engages a small quantity of different factors of production, an optimum proportion among them is not established and the level of production remains low. When he increases the quantities of those factors of production, which were employed less (in relation to the requirements of optimum production), marginal product increases till the point is reached where the factors are combined in optimum proportion. Naturally, at this point, output level is the maximum.

2) **Large size of fixed factors:** When the size of the fixed factors used for producing a given good is very large while the quantity of the variable factor used is very small, the level of efficiency remains very low. As more and more quantities of the variable factors are employed, marginal productivity increases (since the level of efficiency increases). For example, if only one person is working on a ten hectare plot of land, his productivity will be very low. As the number of workers increases, division of labour and specialisation will lead to increasing returns as marginal product will rise rapidly.

7.4.3 Explanation of Constant Returns

If even on continuously increasing the quantity of variable factors of production in a firm, the marginal product neither increases nor decreases but

remains constant, the tendency of constant returns is in operation. In fact, there is no industry in which increase in the quantity of variable factors of production yields constant returns permanently. According to Marshall, "if the actions of the law of increasing and diminishing returns are balanced, we have the law of constant returns."

Marshall feels that the operation of the law of constant returns is very limited. According to him, this law can operate only when there is a balance between the tendencies of increasing returns and diminishing returns. However, modern economists regard the area of operation of constant returns as fairly large. According to them, tendency of constant returns is generally found to operate before the tendency of diminishing returns sets in. In no field of productive activity increasing returns are obtained forever. Whether it is agriculture, manufacturing, industry or any other productive activity, the tendency of increasing returns can operate only up to a certain limit. After this limit is reached, constant returns operate for some time. From the point of view of the producer, this is an important stage because it exhibits an optimum combination of the factors of production. In this stage, marginal cost is the minimum. This is due to two reasons. First, the stage of constant returns is reached only when the tendency of increasing returns comes to an end so that there is no possibility of a further decline in marginal cost. Second, after the stage of constant returns, the stage of diminishing returns sets in. Therefore, the stage of constant returns is very significant from the point of view of the producers.

7.4.4 Explanation of Diminishing Returns

The diminishing returns stage is the most important of the three stages of the law of variable proportions. In Economics, the explanation of the law of diminishing returns is presented in two ways. The classical economists believed that this law applies only to agriculture. Basically accepting this position of the classical economists, the neo-classical economist Marshall had stated, "We say broadly that while the part which nature plays in production shows a tendency of diminishing returns, that part which man plays shows a tendency of increasing returns."

Modern economists like Joan Robinson, Stigler, etc. constitute the second category of economists. These economists regard the law of diminishing returns of far greater applicability than the classical economists. According to them, this law operates in all areas of productive activity.

Marshall had argued that this law operated only in agriculture. Therefore, he discussed it only in reference to agriculture. According to him,

> **"An increase in the capital and labour applied in the cultivation of land causes in general a less than proportionate increase in the amount of produce raised unless it happens to coincide with an improvement in the arts of agriculture."**

The implication is that when land is kept fixed in agriculture while the quantity of labour and capital applied on that land is increased, total production increases but not in the same proportion as the factors of production are increased. It increases by a lesser proportion. For example, if an agriculturist doubles the amount of labour and capital employed on a fixed plot of land, the total production will undoubtedly increase but it will not double itself. Due to

this reason agriculturists do not consider it profitable to continuously increase the application of other factors of production on their fixed plots of land. They know from their experience that unless there is some improvement in agricultural techniques, increased application of labour and capital on a fixed quantity of land leads to a situation of continuously declining marginal product.

Marshall has accepted two limitations of the law of diminishing returns as applied to agriculture:

1) **The law generally operates in agriculture:** Marshall was aware of the fact that the law of diminishing returns does not always operate in agriculture (hence the qualification that it generally operates in agriculture). In some cases when the agriculturist applies the first unit of labour and capital on his fixed plot of land, the fertility of the soil is not properly exploited. Accordingly, the level of production remains low. When the second unit of labour and capital is applied, output increases in a greater proportion. However, this tendency does not remain for long because the agriculturist soon finds that additional units of labour and capital start yielding a lower and lower marginal product. On account of the above reasons, Marshall was careful in pointing out that the law of diminishing returns operates generally in agriculture. However, in certain exceptional cases, it may not operate.

2) **There should be no improvement in agricultural techniques:** The law of diminishing returns operates only if there is no improvement in agricultural techniques. It is a law of static agriculture. If the agriculturist is able to expand irrigation facilities on his land, or make use of better seeds, better agricultural implements, more fertilisers, etc. or use new scientific methods in production, he can stall the operation of this law. Generally, an improvement in agricultural techniques leads to a more than proportionate increase in output corresponding to an increase in labour and capital.

As against the view of Marshall, modern economists like Joan Robinson, Stigler and Boulding regard the law of diminishing returns as more pervasive and universal. According to these economists, this law operates in all branches of productive activity. Accordingly, they have presented this law in a general fashion as would be clear from the definition of this law presented by Joan Robinson:

> **"The Law of Diminishing Returns, as it is usually formulated, states that, with fixed amount of any one factor of production, successive increases in the amount of other factors will after a point yield a diminishing increment of the product."**

From the above definition of the law by Joan Robinson, it is clear that she regards this law as of universal value and does not restrict its application to agriculture alone. According to her, this law operates in all branches of productive activity and the principal reason behind the operation of this law is that the optimum proportion between different factors of production breaks down sooner or later.

The law of diminishing returns is a logical necessity. When in any productive activity, the quantity of the variable factors of production employed with given

quantity of fixed factor of production is increased, the law of diminishing returns sets in after the point of optimum proportion has been reached. Initially, application of variable factors was sub-optional, given the size of fixed factor. Later, the expansion in use of variable factors leads to sub-optimality of a different kind: each doze or unit of variable factors have sub-optional quantity of fixed factor to work on.

Another important reason for the operation of the law of diminishing returns is that one factor of production (out of the various factors of production) is used in a fixed quantity. Had all the factors of production been available in abundance and had it been possible to increase their use in production to all conceivable limits, the law of diminishing returns would not operate. However, all factors of production land, labour, capital, enterprise, organisation, etc. are scarce and often the supply of one of these is taken to be fixed. It is this factor that results in diminishing returns.

Check Your Progress 2

1) Indicate the following statement as true (T) or false (F):

   i) In statge II of production, both marginal product and average product decline.

   ii) In stage III of production, marginal product is negative.

   iii) The law of diminishing returns operates only in agriculture.

2) State the law of diminishing marginal returns. There is a provision to the law that other things be held constant. What are these things?

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3) Explain the three stages of production. Why should a rational producer under competitive conditions produce in stage II?

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4) Explain the (i) law of increasing returns, (ii) law of constant returns.

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7.5 LET US SUM UP

In this unit we have focused on short run production assuming that only one input is variable and all other inputs are fixed. We then define total product, average product of an input and the marginal product of an input. We note that

total product in the case of production with one variable input first increases at an increasing rate as the amount of variable input expands and then switches to increasing with decreasing rate. Having reached a maximum, it eventually declines. We then explain the law of variable proportions. Conventionally the product curves drawn to depict the law of variable proportion are partitioned into three stages. In stage I, average product increase throughout, in stage II marginal product from the point where it equals average product falls throughout but remains positive; and in stage III total product fall and marginal product is negative. The diminishing returns stage is the most important of the three stages of the law of variable proportions.

7.6 REFERENCES

1) Robert S.P rindyck, Daniel L. Rubinfeld and Prem L. Mehta, *Microeconomics* (Pearson Education, Seventh edition, 2009), Chapter 5, Section 5.1.

2) Dominick Salvatore, *Principles of Microeconomics* (Oxford University Press, Fifth edition, 2010), Chapter 7, Section 7.2.

3) A.Kontsoyianmis, *Modern Microeconomics* (The Macmillan Press Ltd., Second Edition, 1982/, Chapter 3.

4) John P Gould and Edward P Lazar, *Microeconomic Theory* (All India Traveller Bookseller, Sixth edition, 1996), Chapter 6.

7.7 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) (i) (F); (ii) (T)

2) See Section 7.3

Check Your Progress 2

1) (i) F; (ii) (T); (iii) (F)

2) See Sub-section 7.4.4

3) See Sub-section 7.4.1

4) See Sub-section 7.4.2. for law of increasing returns and Sub-section 7.4.3 for law of constant returns.

UNIT 8 PRODUCTION WITH TWO VARIABLE INPUTS

Structure

8.0 Objectives

8.1 Introduction

8.2 Production Function

8.3 What are Isoquants?
- 8.3.1 Definition
- 8.3.2 Types of Isoquants
- 8.3.3 Isoquants Map
- 8.3.4 Assumptions of Isoquants

8.4 Characteristics or Properties of Isoquants

8.5 Economic Region of Production and Ridge Lines

8.6 The Optimum Combination of Factors and Producer's Equilibrium
- 8.6.1 Input Prices and Isocost Lines
- 8.6.2 Maximisation of Output for a Given Cost
- 8.6.3 Minimisation of Cost for a Given Level of Output

8.7 The Expansion Path
- 8.7.1 Optimal Expansion Path in the Long Run
- 8.7.2 Optimal Expansion Path in the Short Run

8.8 Let Us Sum Up

8.9 References

8.10 Answers or Hints to Check Your Progress Exercises

8.0 OBJECTIVES

After going through this unit, you should be able to:

- know the meaning and nature of isoquants;
- identify the economic region in which production is bound to take place;
- find out the level at which output will be maximised subject to a given cost;
- find the point on the isoquant where cost will be minimised; and
- describe the nature of optimal expansion path both in long run and short run.

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8.1 INTRODUCTION

As stated in Unit 7, production requires the use of certain resources often called factors of productions or inputs. When resources are broadly defined, they are known as factors of production and classified as labour, land and capital. The relationship between the inputs to the production process and the resulting output is described by a production function. In this unit we shall start with a definition of production function and then proceed to discuss the concept of isoquants. This will be followed by a discussion on the economic region of production and then, finally, on how the optimum combination of factors and producer's equilibrium is obtained.

8.2 PRODUCTION FUNCTION

The theory of production begins with some prior knowledge of the technical and/or engineering information. For instance, if a firm has a given quantity of labour, land and machinery, the level of production will be determined by the technical and engineering conditions and cannot be predicted by the economist. The level of production depends on technical conditions. If there is an improvement in the technique of production, increased output can be obtained even with the same (fixed) quantity of factors. However, at a given point of time, there is only one maximum level of output that can be obtained with a given combination of factors of production. This technical law which expresses the relationship between factor inputs is termed as production function.

> The production function describes the laws of production, that is, the transformation of factor inputs into products (outputs) at any particular period of time. Further, the production function includes only the technically efficient methods of production. This is because no rational entrepreneur will use inefficient methods.

For the sake of simplicity, we may assume that there are two inputs, labour (L) and capital (K). We can, then, write the production function as

$$Q = F(L,K)$$

This equation relates the quantity of output Q to the quantities of the two inputs, labour and capital.

A popular production function in economics is Cobb Douglas production function which is given as

$$Q = AL^{\alpha}K^{\beta}$$

A special class of production functions is linear homogenous production function. In this case, *when all inputs are expanded in the same proportion, output expands in that proportion.* In this case, Cobb Douglas production function becomes

$$Q = AL^{\alpha}K^{1-\alpha}$$

i.e. $$\beta = 1 - \alpha$$

Here we can see that when labour and capital are increased λ times, output Q also increased λ times as

$$A(\lambda L)^{\alpha}(\lambda K)^{1-\alpha} = A[\lambda^{\alpha+(1-\alpha)} L^{\alpha}K^{1-\alpha}] = \lambda[AL^{\alpha}K^{1-\alpha}] = \lambda Q$$

8.3 WHAT ARE ISOQUANTS?

8.3.1 Definition

An isoquant is the locus of all the combinations of two factors of production that yield the same level of output.

It is easy to understand the concept of an isoquant with the help of an example. Let us suppose that a firm wants to produce 100 units of commodity X and for that purpose can use any one of the six processes indicated in Table 8.1.

Table 8.1: Isoquant table showing combinations of Labour and Capital Producing 100 Units of X

Process	Units of Labour	Units of Capital
1	2	7
2	4	4
3	6	3

From Table 8.1, it is clear that all the three processes yield the same level of output, that is, 100 units of X. The first process is clearly capital-intensive. Since we assume possibilities of factor substitution, we find that there are two more processes available to the firm and in each of them factor intensities differ. The third process is the most labour-intensive or the least capital-intensive. Graphically, we can construct an isoquant conveniently for two factors of production, say labour and capital. One such isoquant is shown in Fig. 8.1. It has been constructed on the basis of information provided in Table 8.1.

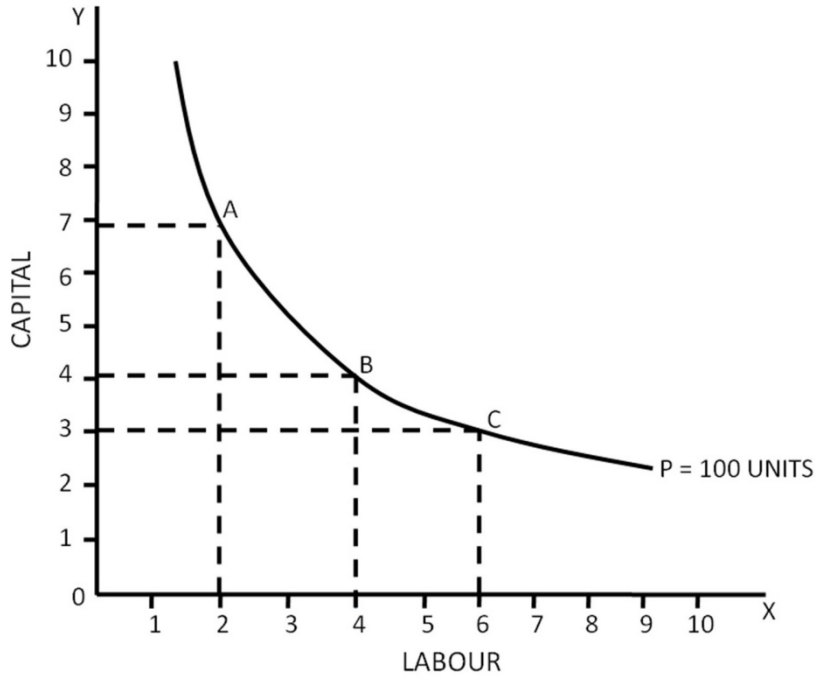

Fig. 8.1: This figure shows that at point A, B and C same level of output (=100 units) is obtained by using different combinations of labour and capital. Curve p is known as isoquant

8.3.2 Types of Isoquants

1) Convex isoquant

2) Linear isoquant

3) Input-output isoquant

The traditional economic theory has mostly used the convex isoquant as shown in Fig. 8.1. However, the isoquant can assume some other shapes depending on the degree of the substitutability of factors. The two other possible production isoquants are linear isoquant and input-output isoquant.

Linear Isoquant: In case of perfect substitutability of the factors of production, the isoquant will assume the shape of a straight line sloping downwards from left to right as in Fig. 8.2. In Fig. 8.2 it is shown that when quantity of labour is increased by RS, the quantity of capital can be reduced by JK to produce a constant output level, i.e., 50 units of X. Likewise, on increasing the quantity of labour by ST, it is possible to reduce the quantity of capital by KL, and on increasing the quantity of labour by TU, quantity of capital can be reduced by LM for producing 50 units of X. Since in respect of labour RS = ST = TU and in respect of capital JK = KL = LM, it is clear that a constant quantity of labour substitutes a constant quantity of capital. It implies that a given commodity can be produced by using only labour or only capital or by infinite combinations of labour and capital. In the real world of production, this seldom happens. Therefore, a linear downward sloping isoquant can be taken only as an exception.

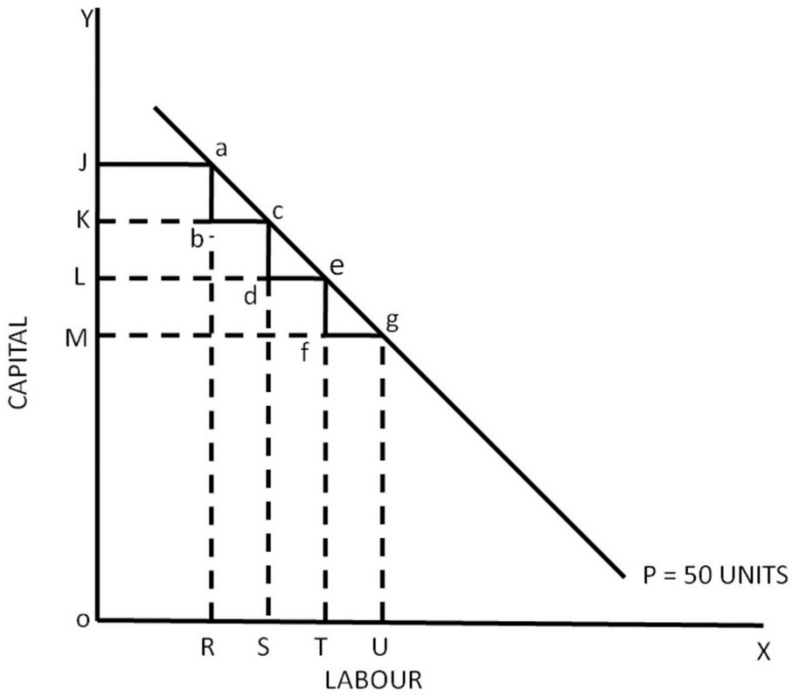

Fig. 8.2: In the case of perfect substitutability of factors of production, the isoquant becomes a straight line and is, therefore, known as linear isoquant

Input-Output Isoquant: When factors of production are not substitutes but complementary, technical coefficients are fixed. The meaning of this statement is that optimum output is obtained only when the factors of production are used in a fixed proportion. In this situation, if a producer uses one factor of

production in excess of what is required by fixed proportion, there will be no increase in output. In the case of complementarily of factors of production, the shape of the isoquant is right angled or like the letter 'L' as shown in Fig. 8 .3. As would be clear from the figure, the isoquant is formed by two straight lines, one vertical and the other horizontal, and these two lines are perpendicular to each other. The common point of these lines is convex to the origin.

This type of isoquant is also called Leontief isoquant after Wassily Leontief who did pioneer work in the field of input-output analysis. Input-output isoquant does not imply that by increasing the quantities of the two factors of production, viz., labour and capital the output will increase proportionately; it implies only that for producing any quantity of a commodity, capital and labour must be used in a fixed proportion. Fig. 8.3, slope of Isoquant P_1 and P_2 indicates the capital-labour ratio has to be maintained for ensuring efficiency in production.

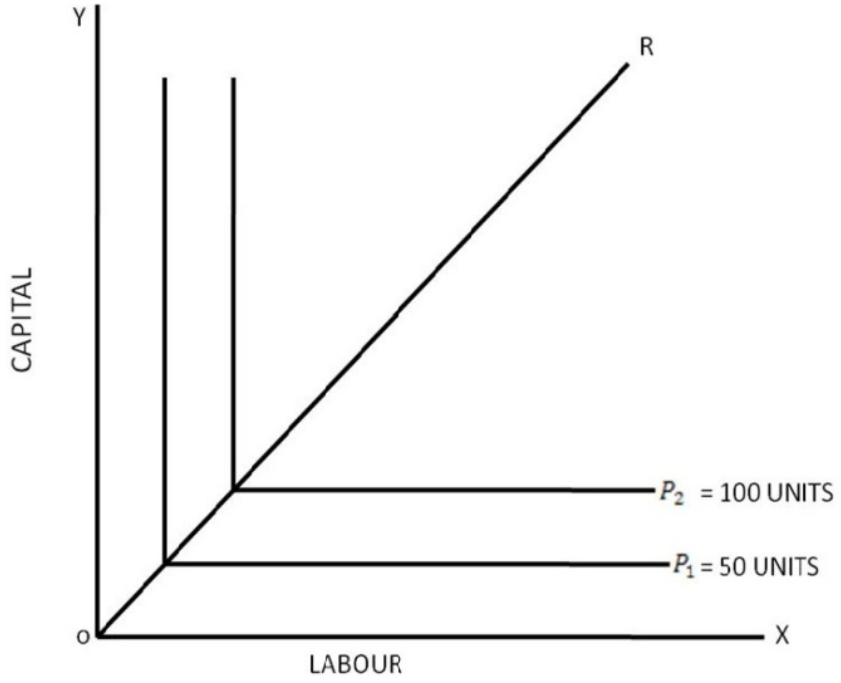

Fig. 8.3: If factors of production can be used only in a fixed proportion, the isoquant is 'L' shaped and is known as an input-output isoquant

8.3.3 Isoquants Map

The production function shows how output varies as the factor inputs change. Therefore, there are always a number of isoquants for a producer depicting levels of production (one isoquant depicting one particular level of production). Isoquants nearer the point of origin represent relatively lower level of production. The level of production increases as one moves away from the origin and goes to higher isoquants. A complete set of isoquants for the producer is called an isoquant map. One such isoquant map showing four isoquants is shown in Fig. 8.4.

In Fig. 8.4, P_4 is the highest isoquant and it represents the highest level of output, i.e., 400 units. P_3, P_2 and P_1 represent lower output levels in that order.

It may, however, be noted that the distance between two isoquants on an isoquant map does not measure the absolute difference between output levels.

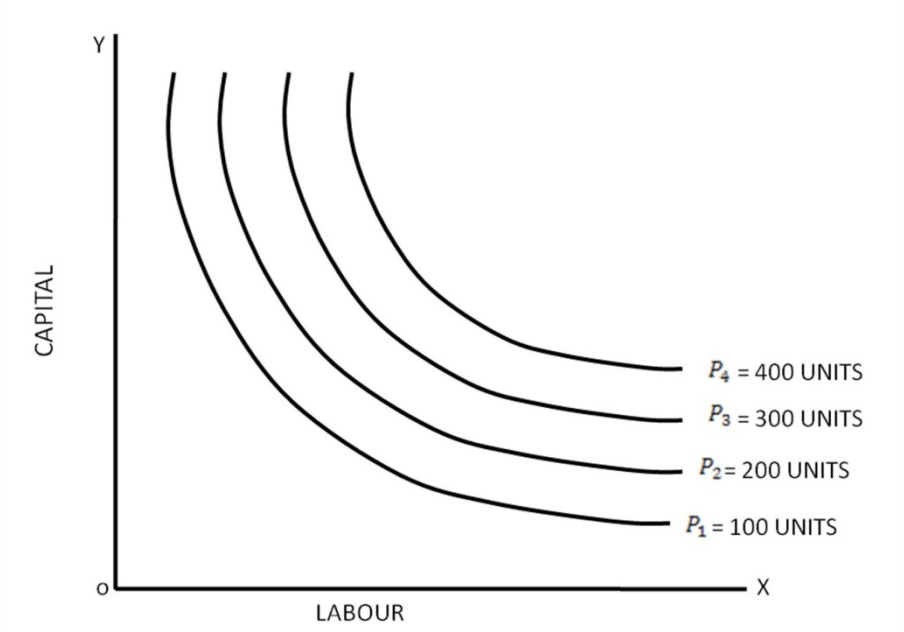

Fig. 8.4: When a number of isoquants are depicted together, we get an isoquant map

8.3.4 Assumptions of lsoquants

Isoquant analysis is normally based on the following assumptions:

1) It is generally assumed that there are only two factors or inputs of production. This makes the geometric exhibition of the concept easy since we can easily draw a diagram. If we abandon this assumption and consider four or five factors of production (in keeping with the reality) we would not be able to make use of the diagrammatic representation and would have to resort to the algebraic method.

2) The second assumption of the isoquant analysis is that the factors of production are divisible into small units and can be used in various proportions.

3) Technical conditions of production are given and it is not possible to change them at any point of time.

4) Given the technical conditions of production, different factors of production are used in the most efficient way. If this assumption is abandoned, then any one combination of the factors of production will yield a number of different levels of production of which the highest level obtained would be efficient (and all lower levels of production inefficient).

8.4 CHARACTERISTICS OR PROPERTIES OF ISOQUANTS

A smooth continuous isoquant that has been adopted in the traditional economic theory possesses the following characteristics:

1) lsoquants are negatively sloped

2) A higher isoquant represents a larger output

3) No two isoquants intersect or touch each other

4) lsoquants are convex to the origin.

1) **lsoquants are negatively sloped**

Normally, isoquants slope downwards from left to right implying that they are negatively sloped. The reason for this characteristic of the isoquant is that when the quantity of one factor is reduced, the same level of output can be achieved only when the quantity of the other is increased. This characteristic of the isoquant, however, assumes that in no case marginal productivity of a factor will be negative. In a more realistic case when this assumption is dropped, one may find an isoquant which bends back upon itself or has a positively sloped segment. in Fig. 8.5, such an isoquant is shown. AB and CD segments of this isoquant are positively sloped.

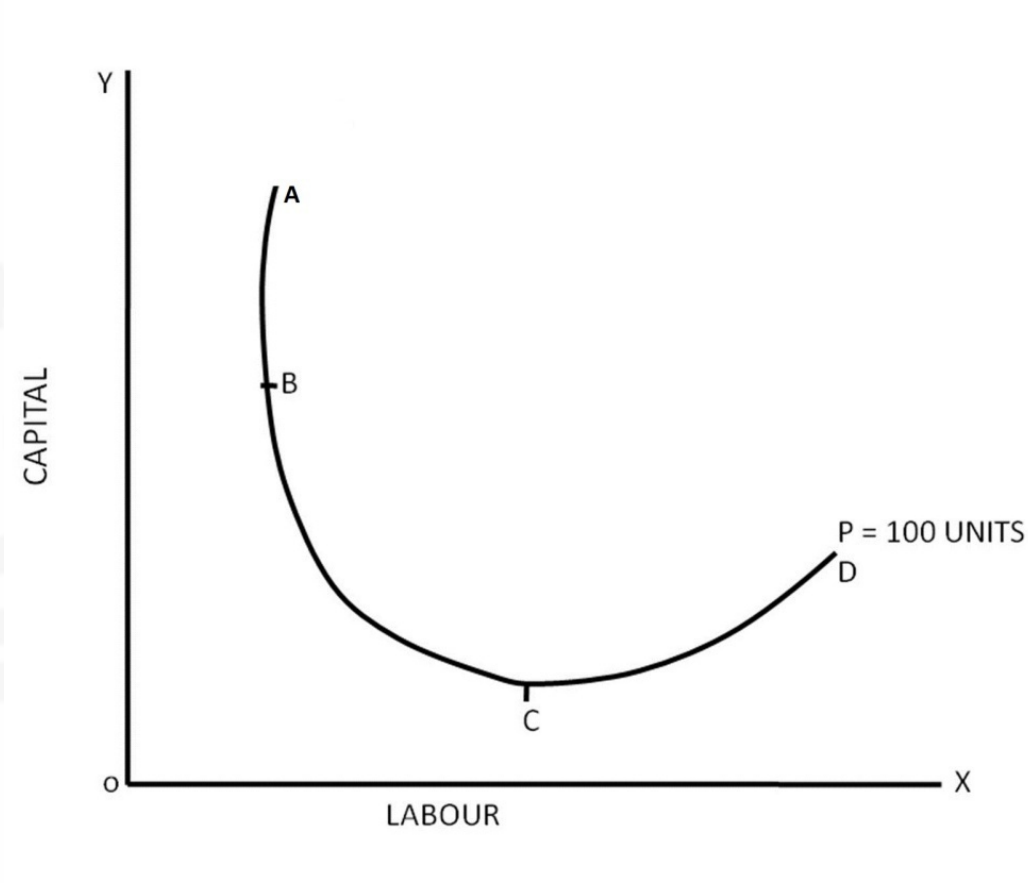

Fig. 8.5: Isoquant having positively sloped segments

2) **A higher isoquant represents a larger output**

A higher isoquant is one that is farther from the point of origin. It represents a larger output that is obtained by using either the same amount of one factor and the greater amount of the other factor or the greater amounts of both the factors. Two isoquants P_1 and P_2 have been shown in Fig. 8.6. They depict output levels of 100 units and 200 units. Obviously, the output level represented by isoquant P_2 can be reached only by using more of factor inputs as compared to the amount of factor inputs required to reach output level represented by isoquant P_1.

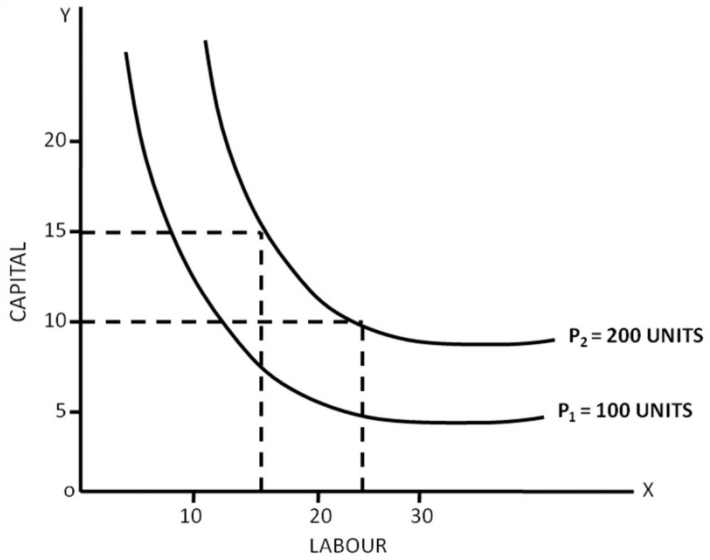

Fig. 8.6: Two Isoquants representing different output levels. A higher isoquant depicts a higher amount of output

3) No two isoquants intersect or touch each other

Isoquants do not intersect or touch each other because they represent different levels of output. If, for example, isoquants P_1 and P_2 (Fig. 8.7) represent output levels of 100 and 200 units respectively, their intersection at some point, say A would mean that two output levels (i.e, 100 and 200 units) will be reached by using the same amount of capital and labour which is not likely to happen. For the same reason, no two isoquants will touch each other.

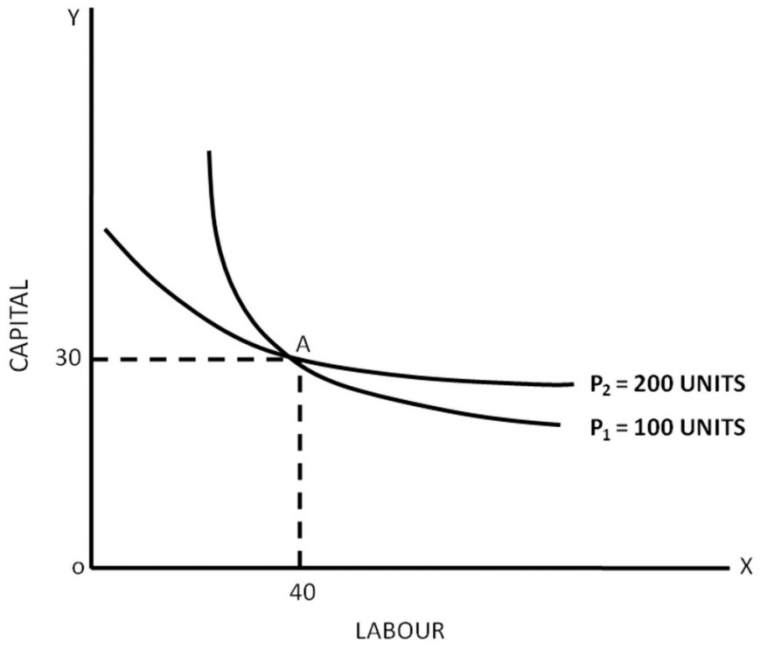

Fig. 8.7: No two isoquants intersect one another because each isoquant depicts a different level of output

4) Isoquants are convex to the origin

In most production processes, the factors of production have substitutability. Often, labour can be substituted for capital and vice versa. However, the rate at which one factor of production is substituted for the other in a production process, that is, the marginal rate of technical substitution **(MRTS)** often tends to fall.

Marginal rate of technical substitution of factor L for factor K ($MRTS_{L,K}$) is the quantity of K that is to be reduced on increasing the quantity of L by one unit for keeping the output level unchanged.

The isoquants are convex to the origin precisely because the marginal rate of technical substitution tends to fall. Let us explain why this happens with the help of Fig. 8 8. Here, the isoquant is curve P. Let us suppose that the producer is at point 'a' of the curve. The meaning of this is that he uses OJ units of capital and OR units of labour to produce 100 units of output. We shall assume that one unit of labour is OR = RS = ST = TU = UV. Now, if he wants to increase the amount of labour by RS, and keep the output at 100 units, he must reduce the use of capital by JK. Similarly, when he increases the amount of labour by ST, TU and UV, he must reduce the application of capital by KL, LM and MN respectively if output has to be kept at the same level (i.e., 100 units). It is clear from the figure that JK > KL > LM > MV. In other words, as additional units of labour are employed it becomes progressively more and more difficult to substitute labour in place of capital so that lesser and lesser units of capital can be replaced by additional units of labour. This means that the marginal rate of technical substitution tends to fall. This is due to the reason that factors of production are not perfect substitutes for one another. When the quantity of one factor is reduced, it becomes necessary to increase the quantity of the other at an increasing rate. For example, let us suppose that in a particular productive activity two factors of production – labour and capital– are employed. When the quantity of labour employed is reduced by one unit, it is possible to undertake the activity by employing one more unit of capital initially. However, when one more unit of labour is reduced, it might become necessary to compensate this by employing, say, two units of capital. As the quantity of labour employed is reduced successively at each stage, we would require more and more units of capital to compensate for the loss of each additional unit of labour.

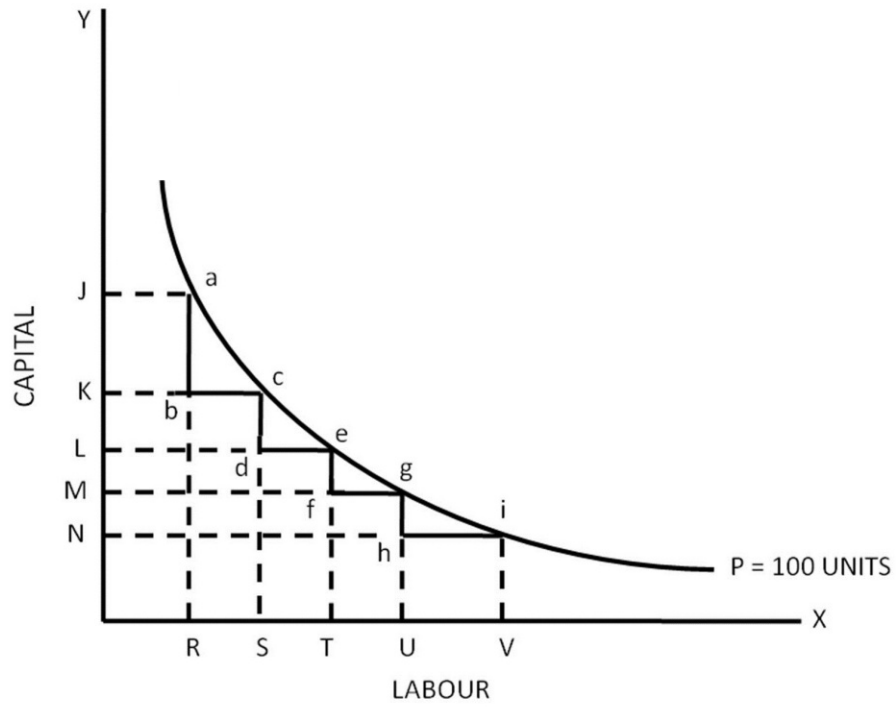

Fig. 8.8: An isoquant is covex from below because the marginal rates of technical substitution tends to fall

If the factors of production are perfect substitutes, the marginal rate of technical substitution between them would be constant and the isoquant will be linear and sloping downwards from left, to right as in Fig. 8.2. In the case of strict complementarity, that is, zero substitutability of the factors of production the isoquant will be right angled or we may say that it will assume the shape of 'L' as in Fig. 8.3. However, the linear and right angled isoquants are the limiting cases in the production processes.

Check Your Progress 1

1) Indicate the following statements as true (T) or false (F):

   i) In case of perfect substitability of the factors of production, the isoquant is convex from below.

   ii) Isoquants are positively sloped.

   iii) A higher isoquant represents a larger output.

   iv) No two isoquants intersect each other.

2) Define isoquant. Discuss its properties.

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3) Discuss the possible shapes which the isoquants may assume depending on the degree of substitutability.

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8.5 ECONOMIC REGION OF PRODUCTION AND RIDGE LINES

Generally, production functions generate isoquants which are convex to the origin, negatively sloped throughout, do not intersect each other and the higher the isoquants, greater the level of output. However, there are some production functions which yield isoquants having all the properties of a normal isoquant except that they are not negatively sloped throughout. In other words, they have positively sloped segments. In Fig. 8.9, the production function is depicted in the form of a set of isoquants which have positively sloped segments.

Let us consider isoquant P_3. AB segment of this isoquant has a negative slope. Beyond points A and B, this isoquant is positively sloped. Similarly, other isoquants have the points where they bend back upon themselves implying that they become positively sloped. The lines OK and OL joining these points are called ridge lines. They form the boundaries for the economic region of production. A careful interpretation of any of the isquants in Fig. 8 .9 will make this point clear.

Suppose the output represented by isoquant P_3 is to be produced. For producing this quantity, a minimum of OK_2 amount of capital is required because any smaller amount will not allow the producer to attain the P_3 level of output. With OK_2 amount of capital, OL_2 amount of labour must be employed. In case the producer uses an amount of labour less than OL_2 together with OK_2 amount of capital, his output level would be lower than the one represented by isoquant P_3. This is quite normal, because use of inputs in smaller amounts would yield a smaller output. But combining labour input in an amount larger than OL_2 with OK_2 amount of capital would also result in output smaller than that is represented by the isoquant P_3. In order to maintain the P_3 level of output with a larger labour input, capital input also in a larger amount has to be used. Obviously, this is something which no rational producer would attempt because it involves uneconomic use of resources.

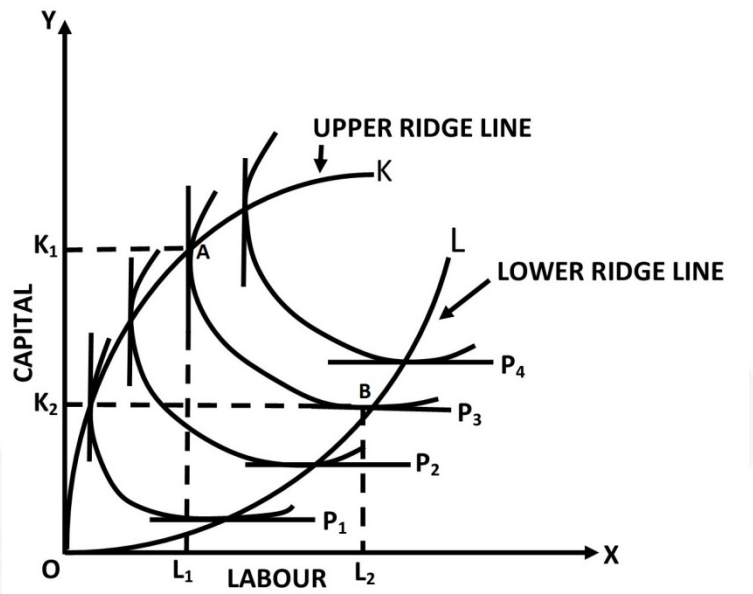

Fig. 8.9: Area enclosed within the upper side line OK and the lower side lint OL indicates the economic region of production

Point B on isoquant P_3 represents the intensive margin for labour because an increase in the amount of labour input beyond OL_2 with a fixed amount of capital input OK_2 does not increase the output level. At this point, marginal product of labour is zero and thus the marginal rate of technical substitution of labour for capital ($MRTS_{LK}$) is zero. This implies that at point B labour has been substituted for capital to the maximum extent. Thus, to the right of ridge line OL in Fig. 8.9, we have Stage III for labour.

Similarly, for producing P_3 level of output, a minimum of OL_1 amount of labour input is required. A smaller amount of labour input will not allow the producer to attain P_3 level of output. With OL_1 amount of labour, OK_1 amount of capital must be used and any additions to capital input beyond OK_1would not increase output. This point represents intensive margin for capital because an increase in the amount of capital input beyond OK_1 with a fixed labour input of OL_1 does not augment output. At point A on P_3, capital has been substituted for labour to the maximum extent. Thus, above ridge line OK in Fig. 8.9, we have Stage III for capital. The marginal rate of technical substitution of capital for labour (MRTSKL) is zero, which means that the marginal rate of technical substitution of labour for capital (MRTSKL) is infinite or undefined.

The line OK in Fig. 8.9 connects the point of zero marginal product of capital. We have designated it as the **upper ridge line.** Similarly, the line OL designated as the **lower ridge line** joins the points of zero marginal product of labour.

The combinations of labour and capital inputs comprising the area between ridge lines OK and OL constitute the generalised Stage II of production for both resources. These are the combinations that are relevant for production decisions.

8.6 THE OPTIMUM COMBINATION OF FACTORS AND PRODUCER'S EQUILIBRIUM

So far, we have explained as to how different combinations of inputs allow a producer to attain a certain level of output. The producer is free to choose any of these input combinations. However, his choice cannot be arbitrary if he wishes to minimise cost of producing a stipulated output. Our task now is to explain how the producer selects a particular input combination.

8.6.1 Input Prices and Isocost Lines

A producer may attempt maximisation of output subject to a given cost or alternatively, he may seek to minimise cost subject to a given level of output. In both cases, for choosing optimum quantities of two inputs, viz., labour and capital, he must consider their physical productivities as well as their prices. While isoquants represent the productivities of the inputs, their prices are shown by isocost lines.

An isocost line represents various combinations of inputs that may be purchased for a given amount of expenditure; that is, the producer's budget.

The firm or the producer has to purchase factors or inputs from the market. How the prices of labour and capital are determined in the market is not our present concern. Moreover, the firm is in no position to influesence the input prices unless it is a monopsonist or oligopsonist. In other words, prices of labour and capital have to be taken as given by the firm operating in a competitive factor market. Let us now suppose that the firm's total cost outlay on labour and capital is Rs. 1000. The firm is free to spend this entire amount on labour or capital or it may spend it on a combination of both labour and capital. In Fig. 8.10, we have shown that if the firm chooses to spent the entire amount of Rs. 1,000 on labour input, it can employ OL_2 amount of labour, and if the entire amount is to be spent on capital, it can get OK_2 amount of capital. The straight line $K_2 L_2$ is an isocost line representing all the combinations of capital and labour which the firm can obtain for Rs. 1,000. In the figure, the length of OL_2 is twice the length of OK_2 which means that the price of a unit of labour is half that of a unit of capital. The slope of the line $K_2 L_2$ shows the ratio of input prices. Hence, the slope of an isocost line is (w/r), which is the ratio of the price of labour (w) to the price of capital (r) when X-axis denotes labour input and Y-axis denotes capital input. We can thus generalise that for any isocost line which is always linear because the firm has no control over the

prices of inputs and the prices remain the same, no matter how much quantity of these inputs, the firm buys,

$$\text{Slope} = \frac{\Delta K}{\Delta L} = \frac{K}{L} = \frac{\text{expenditure}}{r} / \frac{\text{expenditure}}{w} = \frac{w}{r}$$

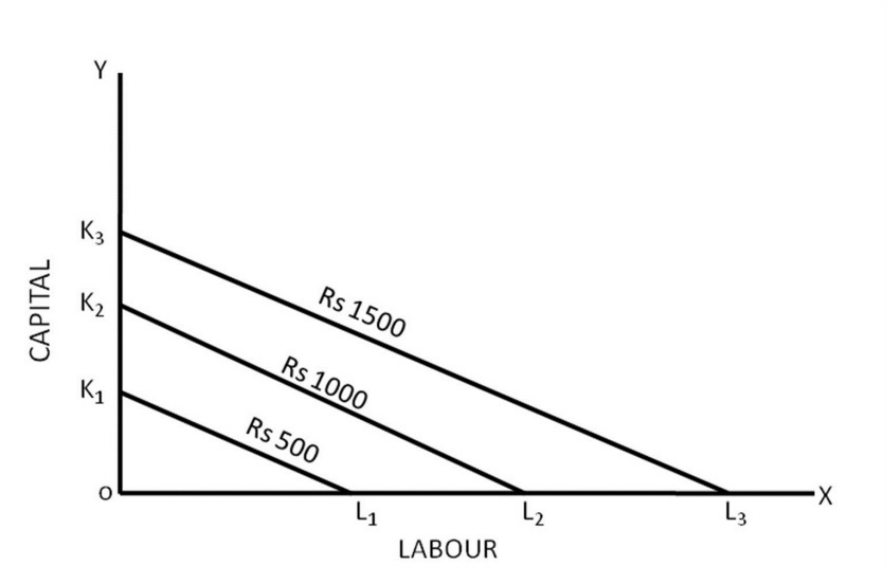

Fig. 8.10: Isocost Lines - A higher cost line indicates a higher cost

This property of an isocost line is similar to that of the budget line of the consumer. However, there is an important difference between the two lines. Since the consumer's budget is invariably fixed, he has a single budget line. The firm generally has no such constraint and thus has more than one isocost lines. In Fig. 8.10, we have shown three isocost lines. There can be many more of them corresponding to firm's cost outlay plans to attain various output levels.

An isocost line farther to the right reflects higher costs; the one closer to the origin reflects lower costs.

8.6.2 Maximisation of Output for a Given Cost

A rational producer is expected to maximise output for a given cost. Alternatively, he may attempt to minimise cost subject to a given level of output.

In this section, we shall explain how a producer maximises his output for a given cost. Suppose the producer's cost outlay is C and the prices of capital and labour are r and w respectively. Subject to these cost conditions, the producer would attempt to attain the maximum output level.

Let KL isocost line in Fig. 8.11 represent the given cost outlay at input prices r and w. P_1, P_2 and P_3, are isoquants representing three different levels of output. It may be noted that P_3 level of output is not attainable because the available factor resources (various labour-capital combinations represented by isocost line KL) are insufficient to reach that output level. In fact, any output level beyond isocost line KL is not attainable. The producer, however, can attain any output level in the region OKL, but that would not require all the resources (labour and capital inputs) that are available to the producer for his cost outlay.

Therefore, in the case of a given cost, the producer's attempt would be to reach the isoquant which represents the maximum output level. The producer can operate at points such as R and T. At these two points, the combinations of labour and capital to produce P_1 level of output are available for a given cost represented by isocost line KL. In contrast, at point S, the combination of labour and capital available for the same cost (as it is also on isocost line KL) enables the producer to reach isoquant P_2 which represents an output level higher than that represented by P_1. Since at point S on isoquant P_2 is jus tangent to isocost line, a greater output than P_2 is not obtainable for the given level of cost. A lesser output is not efficient because production can be raised without incurring additional cost. Hence, the optimal combination of factors of production, viz., capital and labour is $OK_2$of capital plus OL_2 of labour as it enables the producer to reach the highest level of production possible given the cost conditions.

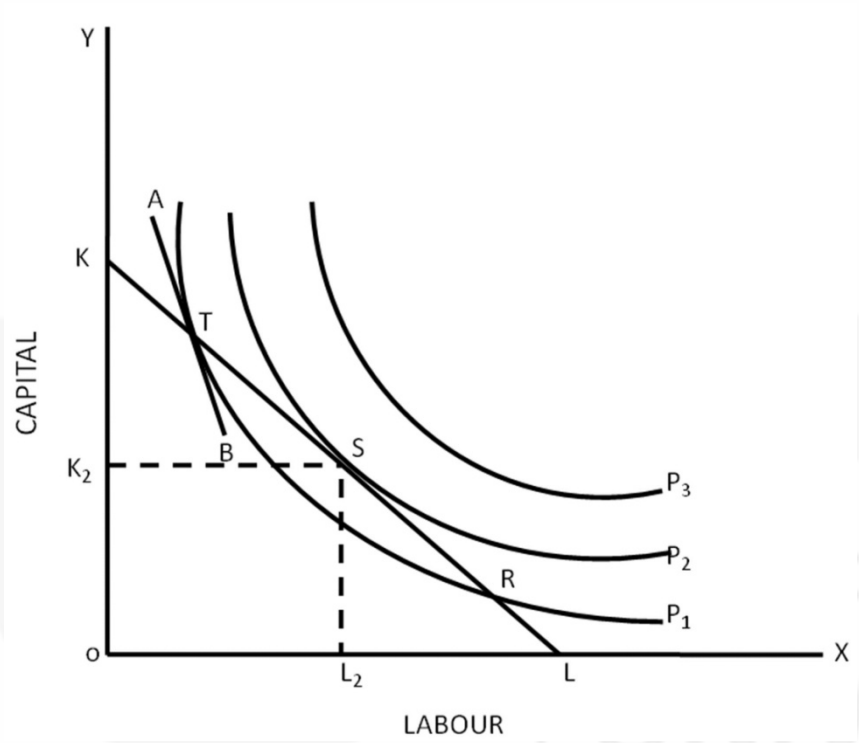

Fig. 8.11: With the given cost line KL, the highest isoquant that a producer can reach is P_2. Point S on this isoquant, therefore, indicates producer's equilibrium

The above proposition should be obvious to those who have studied the theory of consumer behaviour. At the same time, the reason that lies behind it must be followed carefully. Let us suppose that the producer wishes to produce at point T. The marginal rate of technical substitution of labour for capital indicated by the slope of tangent AB at point T is relatively high. Suppose ΔK is equal to 3 and ΔL is equal to 1. Thus, the slope of tangent AB is 3:1 which implies that at point T one unit of labour can replace 3 units of capital. However, the relative factor price indicated by the slope of KL is less, say, 0.7:1 which means that the cost of 1 unit of labour is the same as the cost of 0.7 unit of capital. Therefore, it would be rational on the part of the producer that he substitutes labour for capital so long as the marginal rate of substitution of labour for capital is not equal to the factor price ratio, that is, the ratio of the price of labour to the price of capital. At point R, the opposite situation prevails because the marginal rate of technical substitution is less than the factor price ratio.

The producer maximises output for a given cost (reaches equilibrium) only when the marginal rate of technical substitution of labour for capital is equal to the ratio of the price of labour to the price of capital.

Thus,

$$MRTS_{LK} = \frac{w}{r} = \frac{MP_L}{MP_K}$$

8.6.3 Minimisation of Cost for a Given Level of Output

If a producer seeks to minimise the cost of producing a given amount of output rather than maximising output for a stipulated cost, the condition of his equilibrium remains formally the same. That is, the marginal rate of technical substitution must be equal to the factor price ratio.

This can be easily followed graphically. In Fig. 8.12, we have a single isoquant P which denotes the desired level of output, but there is a set of isocost lines representing various levels of total cost outlay. An isocost line closer to origin indicates a lower total cost outlay. The isocost lines are parallel and thus have the same slope w/r because they have been drawn on the assumption of constant prices of factors.

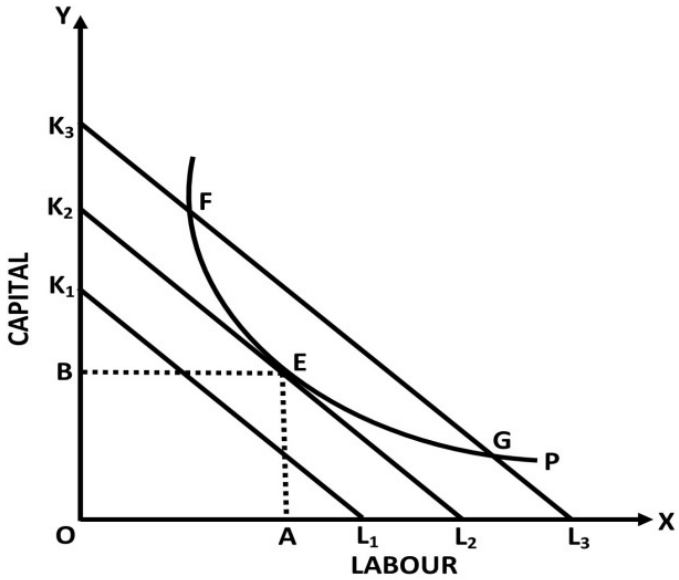

Fig. 8.12: To obtain a level of production indicated by isoquant P, the minimum cost that must be incurred is given by point E on the isocost line K_2L_2. Therefore, point E indicates the point of producer's equilibrium

It may be noted that isocost line $K_1 L_1$ is just not relevant because the output level represented by the isoquant P is not producible by any factor combination available on this isocost line. However, the P level output can be produced by the factor combinations represented by the points F and G which are on isocost line $K_3 L_3$. Alternatively, the producer can attain the P level output by the

factor combination represented by the point E which is on isocost line $K_2 L_2$. Since the isocost line $K_2 L_2$ is closer to the origin as compared to the isocost line $K_3 L_3$, it represents relatively lower cost. Therefore, by moving either from F to E or from G to E, the producer attains the same output level at a lower cost. The producer thus minimises his costs by employing OB amount of capital plus OA amount of labour determined by the tangency of the isoquant P with the isocost line $K_2 L_2$. Points representing factor combinations below E are certainly preferable because they represent lower costs but they cannot be considered as they cannot help in producing the output level represented by the isoquant P. Points above E represent higher costs. Hence, point E denotes the least cost combination of the factors, viz., labour and capital for producing output shown by isoquant P. This discussion thus leads us to the principle that in the case of producer's equilibrium, the marginal rate of technical substitution of labour for capital must be equal to the ratio of the price of labour to the price of capital. We can now sum up the whole discussion as follows:

1) **The optimal combination of factors, whether the producer seeks to maximise output for a given cost or he wishes to minimise cost for a stipulated output, is that where marginal rate of technical substitution and the factor price ratio are equal.**

2) **The producer is in equilibrium when there is optimal combination of factors.**

8.7 THE EXPANSION PATH

Producers expand their outputs both in the long run and in the short run. In the long run, output expands with all factors variable, while in the short run, expansion of output is possible with some factor(s) constant and some others variable. We shall consider both cases.

8.7.1 Optimal Expansion Path in the Long Run

In the long run, there is no limitation to the expansion of output as all the factors of production are variable. The firm's goal being maximisation of its profits, it seeks to expand outputs in the optimal way. With given factor prices, the optimal expansion path is the locus of the points of tangency of successive isocost lines and successive isoquants.

Consider now Fig. 8.13. Given the factor prices, the output corresponding to isoquant P_1 is producible at the lowest cost at point A where isocost line $K_1 L_1$ is tangent to the isoquant P_1. This is the initial position of producer equilibrium. Assuming that factor prices remain constant, suppose the producer desires to expand output to the level indicated by the isoquant P_2. This will cause a shift in the isocost line from $K_1 L_1$ to $K_2 L_2$. The new equilibrium is found at point B where isocost line $K_2 L_2$ is tangent to the isoquant P_2. Further expansion in output to the level corresponding to the isoquant P_3 will shift equilibrium to point C where isocost line $K_3 L_3$ is tangent to the isoquant P_3.

On connecting all points of producer equilibrium, such as A B and C, we get the curve OE which is called the expansion path. **Since every point of the expansion path denotes an equilibrium point of the producer, it indicates the optimum combination of factors of production of some particular level**

of output. It may be recalled that each point of producer equilibrium is defined by equality between the marginal rate of technical substitution and the factor price ratio. Since the latter has been assumed to remain constant, the former also remains constant. Hence, OE is an isocline along which output expands when factor prices remain constant.

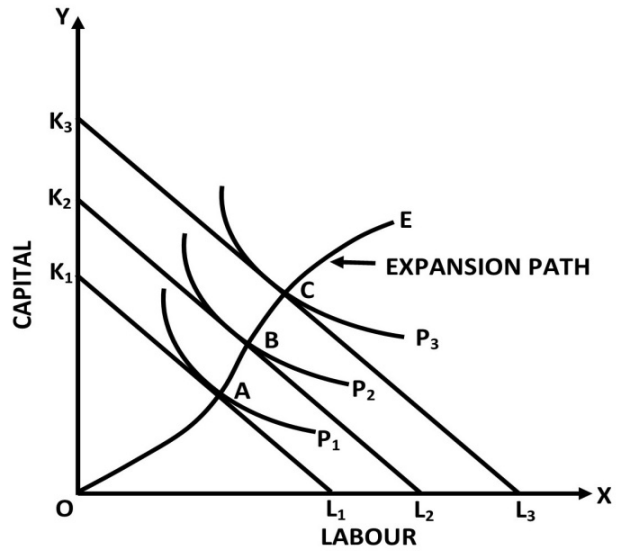

Fig. 8.13: Expansion path in the case of non-linear production function

In the case of linear homogeneous production function, the isoclines are straight lines through the origin. Therefore, the expansion path will also be a straight line as shown in Fig. 8.14. This means that given the prices of the factors of production, the optimal proportion of the inputs of the firm will not change with the size of the firm's output or input budget.

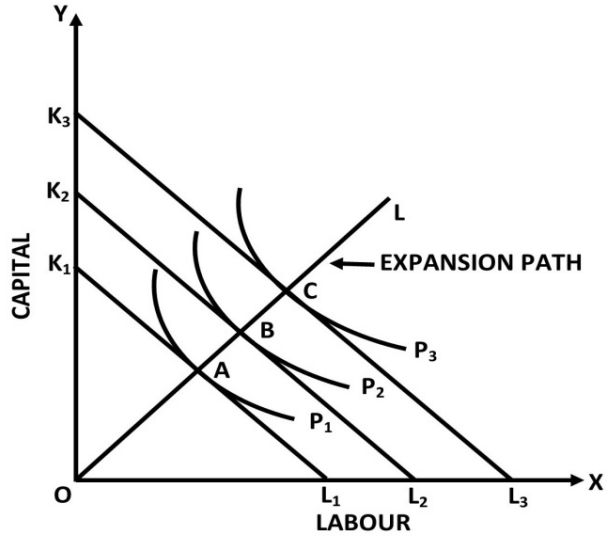

Fig. 8.14: Expansion path in the case of linear homogeneous production function is a straight line

The line formed by connecting the points determined by the tangency between the successive isoquants and the successive isocost lines is the firm's expansion path. It identifies the least costly input combination for each level of output and will slope upward in the long-run setting. This means that the firm will expand use of both inputs as it expands its output.

8.7.2 Optimal Expansion Path in the Short Run

In the short run, capital is a fixed factor and thus its amount remains constant. Labour is, however, variable and the producer can expand his output by increasing the amount of labour along a straight line parallel to the axis on which this factor is measured. In Fig. 8.15, the straight line AB indicates the expansion path as the total amount of capital is fixed at OA in the short run.

With the prices of the factors of production remaining constant, the firm cannot maximise its profits while it expands its output in the short run, on account of the constraint of the fixed amount of capital. This can be followed from Fig. 8.15. The firm's initial equilibrium is at point E where isocost line K_1L_1 is tangent to the isoquant P_1. If the firm wishes to raise its output level corresponding to the isoquant P_2, it reaches the point F which, given the factor prices, is not the least cost situation. Further expansion of output to the level corresponding to the isoquant P_3 leads the firm to reach the point G which again does not represent the least cost situation. The optimal expansion path would be OR, were it possible for the firm to increase the quantity of capital. However, given the amount of capital, the firm has no choice but to expand along the straight line AB in the short run.

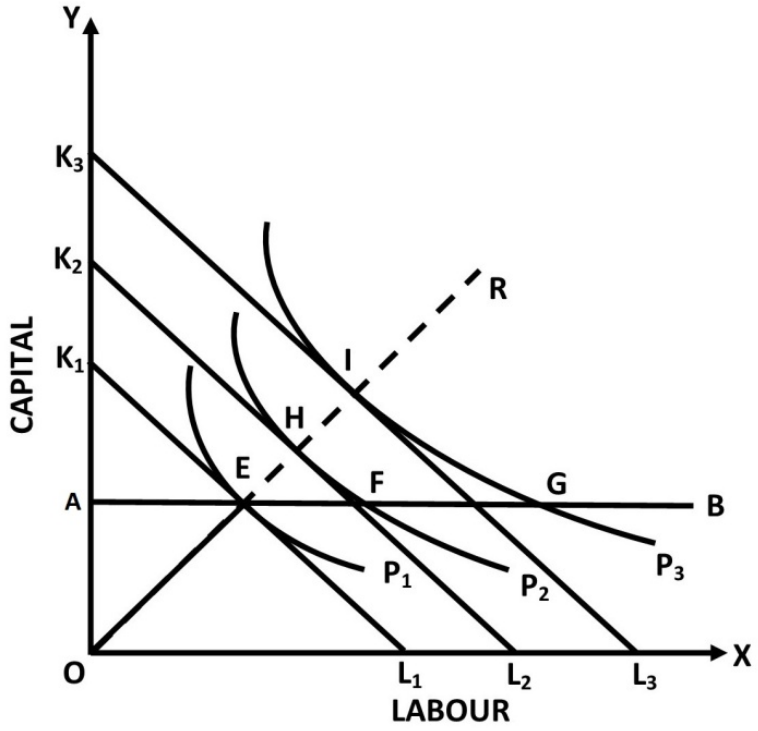

Fig. 8.15: Expansion path in the short run in the case of linear homogeneous production function

Check Your Progress 2

1) Indicate the following statements as True (T) or False (F):

   i) The condition for optimal combination is that marginal rate of technical substitution is greater than factor price ratio.

ii) The area between ridge lines constitutes the Stage II of production for both resources.

iii) An isocost line represents various combinations of input that may be purchased for a given amount of expenditure.

iv) An isocost line farther to the right reflects higher cost.

v) Every point on the expansion path denotes an equilibrium point of the producer.

vi) The line formed by connecting the points determined by the tangancy between the successive isoquants and the successive iocost lines is the firm's expansion path.

2) Explain the condition of a producer's equilibrium.

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3) Suppose that P_K= Rs. 10, P_L = Rs. 20 and TO (total outlay) = Rs. 160.

i) What is the slope of the isocost ?

ii) Write the equation of the isocost?

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4) Explain the significance of tangency between an isoquant and an isocost line.

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5) Explain why, for a least cost combination of inputs, a firm requires that the marginal rate of technical substitution be equal to the input ratio.

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6) What is meant by a firm's expansion path? Distinguish between the expansion path in respect of a linear homogeneous production function from the expansion path in respect of a non-linear production function.

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8.8 LET US SUM UP

The unit begins with the concept of Production function which refers to functional relationship between inputs and output. This is followed by the definition of an isoquant and the explanation of three types of isoquant- (i) convex isoquant, (ii) linear isoquant, and (iii) input-output isoquant. The properties of isoquants are: (i) isoquant are negatively sloped (ii) a higher isoquant represents a larger output, (iii) no two isoquants intersect or touch each other, and (iv) isoquants are convex to the origin. From here we proceed to a discussion of the concept of the economic region of production and ridge lines. The next section is devoted to a discussion of the optimum combination of factors and producer's equilibrium. In this section, we first consider the concept of isocost lines and then consider (i) maxmisation of output for a given cost, and (ii) minimisaton of cost for a given level of output. The last section of the chapter discusses the optimal expansion path for a firm both under long run and short run.

8.9 REFERENCES

1) Robert S Pindyck, Daniel L. Rubinfld and Prem L Mehta, *Microeconomics* (Pearson Education, Seventh Edition, 2009), Chapter 5, Section 5.1 and Section 5.3.
2) Dominick Salvatore, *Principles of Microeconomics* (Oxford University Press, Fifth Edition, 2010), Chapter 7, Section 7.1, Section 7.3 and Section 7.4.
3) A.Koutsoyiannis, *Modern Microeconomics* (The Macmillan Ltd., Second edition, 1982). Chapter 3.
4) John P. Gould and Edward P. Lazear, *Microeconomic Theory* (All India Traveller Bookseller, Sixth edition, 1996), Chapter 7.

8.10 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) i) F) ii) F iii) T iv) T

2) See Sub-section 8.3.1 of Section 8.3 and Section 8.4

3) See Sub-section 8.3.2 of Section 8.3

Check Your Progress 2

1) i) F ii) T iii) T iv) T v) T vi) T

2) See Section 8.6

3) (i) Slope of isocost is $-P_L/P_K = -2$ and the eqution is $160 = 10K + 20L$ or $16 = K + 2L$ or $K = 16 - 2L$

4) See Section 8.6

5) See Sub-section 8.6.3 of Section 8.6

6) See Section 8.7

UNIT 9 RETURNS TO SCALE

Structure

9.0 Objectives

9.1 Introduction

9.2 Concept of Returns to Scale
- 9.2.1 Increasing Returns to Scale
- 9.2.2 Constant Returns to Scale
- 9.2.3 Diminishing Returns to Scale

9.3 Economies and Diseconomies of Scale
- 9.3.1 Internal Economies of Scale
  - 9.3.1.1 Real Internal Economies of Scale
  - 9.3.1.2 Pecuniary Internal Economies if Scale
- 9.3.2 Internal Diseconomies of Scale
- 9.3.3 External Economies
- 9.3.4 External Diseconomies

9.4 Let Us Sum Up

9.5 References

9.6 Answers or Hints to Check Your Progress Exercises

9.0 OBJECTIVES

After going through this unit, you should be able to :

- state the concept of returns to scale;
- distinguish between the stage of increasing, constant and diminishing returns to scale; and
- explain the concepts of economies and diseconomies of scale (both internal and external).

9.1 INTRODUCTION

Sometimes to increase the level of output, all factors are increased simultaneously and factor proportions are held constant. This is known as expansion in scale. In this context, three phases of production are discussed: increasing returns to scale, constant returns to scale, and diminishing returns to scale. Expansion of scale confers a number of economies i.e. advantages on the firm – both internal and external. Internal economies, in turn, can be divided into real internal economies of scale and pecuniary internal economies. If the scale of production is continuously expanded, a stage of internal diseconomies of scale sets in i.e. after a certain point, increase in production is less than proportionate increase in the factors of production. In this unit, we propose to discuss all these issues. We shall also explain the concept of external economies and external diseconomies.

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9.2 CONCEPT OF RETURNS TO SCALE

The concept of returns to scale is associated with the tendency of production that is observed when the ratio between the factors is kept constant but the scale is expanded, that is use of all the factors is changed in same proportion.

When all the factors of production (labour, capital, etc.) are increased in the conditions of constant techniques, three possibilities arise:

1) Output increases in a greater proportion as compared to the increase in the factors of production. This is the case of **increasing returns to scale.**

2) Output increases in the same proportion as the increase in the amount of the factors of production. This is the case of **constant returns to scale.**

3) Output increases in a smaller proportion as compared to the increase in the amounts of the factors of production. This is the case of **diminishing returns to scale.**

We can illustrate these three situations with the help of numerical examples as follows:

OUTPUT SCHEDULE-1				
Input-X	**Input -Y**	**% Change in Inputs**	**Output**	**% Change in Output**
2	4	100	1000	-
4	8	100	3000	200
8	16	100	10000	233
16	32	100	35000	250

It can be observed from the given output schedule that:

1) At all the stages, we are increasing the quantity of inputs by 100%.

2) With increase in the quantity of inputs, the quantity of output is increasing by more than 100% at all stages. In other words output is increasing proportionately more than the increase in input.

Compare this situation with the illustrations given below:

OUTPUT SCHEDULE-2				
Input-X	**Input -Y**	**% Change in Inputs**	**Output**	**% Change in Output**
2	4	100	1000	-
4	8	100	2000	100
8	16	100	4000	100
16	32	100	8000	100

Output shedule-2 indicates that:

1) Inputs increase by 100% at each stage.

2) Output also increased by 100% at each stage.

In this illustration, output increased by the same proportion in which inputs have been increased.

Compare this situation with the one given below:

OUTPUT SCHEDULE-3				
Input-X	**Input -Y**	**% Change in Inputs**	**Output**	**% Change in Output**
2	4	100	1000	-
4	8	100	1800	80
8	16	100	2500	39
16	32	100	3000	20

It would be observed that the total output at all stages increases less proportionately than the increase in inputs.

9.2.1 Increasing Returns to Scale

When the ratio between the factors of production is kept fixed and the scale is expanded, initially output increases in a greater proportion than the increase in the factors of production.

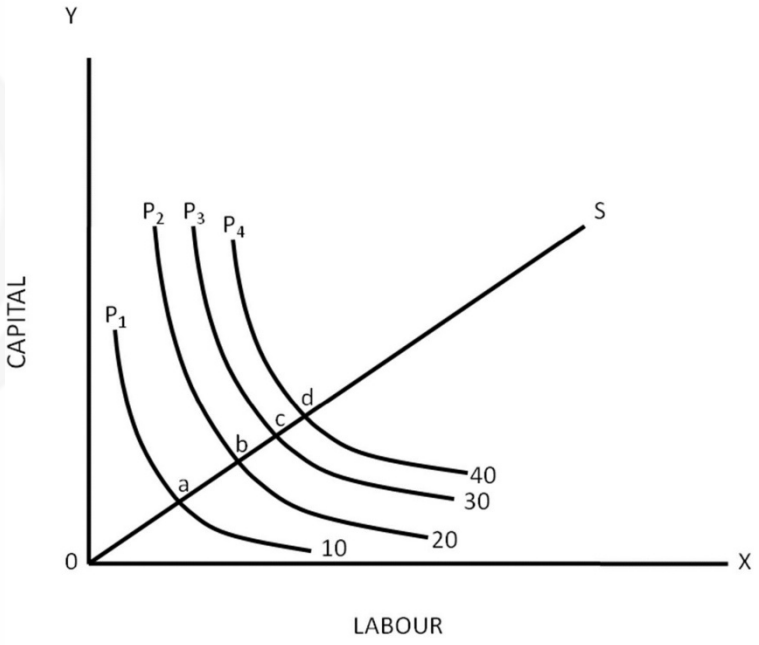

Fig. 9.1: Increasing returns to scale output increases in a greater proportion than the increase in the factors of production

For example, if factors are doubled the output is more than doubled. In other words, to double the quantity of the output, it is not necessary to double the quantity of the factors of production. This can be understood with the help of Fig. 9.1. In this figure P_1, P_2, P_3, P_4 are isoquants. They show 10, 20, 30, 40 units of output respectively. OS is the scale line which is cut by the isoquants at unequal distances. In the figure, it can be seen that cd < bc < ab < oa. This means that to enable the firm to rise from isoquant P_1 to P_2 (so that production increases from 10 to 20 units), the amount of factors of production required is less than the amount required to produce the initial l0 units of output.

Similarly, to increase the output further by 10 units so as to reach isoquant P_3, the amount of factors of production required is less than the amount required to produce the earlier 10 units of output as bc < ab. This position seems to hold true till isoquant P_4. There are three main factors which account for increasing returns to scale:

1) **Indivisibility:** The most important reason of increasing returns to scale is the 'technical and managerial indivisibilities'. The meaning of an indivisible factor of production is that there is a certain minimum size of the factor and even if it is large in relation to the size of the output, it has to be used (i.e., it cannot be divided). For example, even if only 10-15 letters are to be despatched from an office, it would be necessary to keep a typewriter. It is not possible to purchase only half the typewriter since only a small number of letters have to be typed daily. We would, therefore, say that typewriter is not divisible. In a similar way, plants and managerial services in modern factories are not divisible. Accordingly, when the scale of production is enlarged initially, there is no equi-proportionate increase in the demand for the factors of the production.

2) **Specialisation:** Chamberlin does not regard indivisibility as an important cause of 'increasing returns to scale'. According to him, the main reason of increasing returns to scale is specialisation. When due to division of labour, workers are given jobs according to their ability, their productivity increases while cost declines. According to Donald S. Watson, acknowledgement of this fact contradicts the assumption that the ratio of different factors of production remains constant. Accordingly, he casts doubts whether specialisation can be regarded as leading to increasing returns to scale. The importance of specialisation can be accepted only if we assume that although an increase by an equal amount in quantity of labour and capital employed is necessary for an expansion in scale, this increase does not mean the doubling or trebling their units employed but it does mean an increase in their fixed money cost. But this can lead to technical changes and it is very much possible that increasing returns emerge not due to an expansion in scale but due to technical reasons.

9.2.2 Constant Returns to Scale

Increasing returns to scale can be obtained only upto a point. After this point is reached, expansion of scale only leads to equal proportionate change in output.

Empirical evidence suggests that the phase of constant returns is a fairly long one and is observed in the case of a number of commodities. In a scientific sense, constant returns to scale implies that when the quantity of the factors of production is increased in such a way that the ratio of the factors remains unchanged, output increases in the same proportion in which the factors are increased. In other words, when the quantity of the factors is doubled, the output also doubles. Such a production function is often called linear homogeneous production function or homogeneous production function of the first degree. The phase of constant returns to scale can be understood with the help of Fig. 9.2. In this figure, when the firm goes from isoquant P_3 to P_4, or

from isoquant P_4 to P_5 or from isoquant P_5 to P_6, constant returns to scale are obtained. The fact cd = de = ef on the scale line indicates this phenomenon.

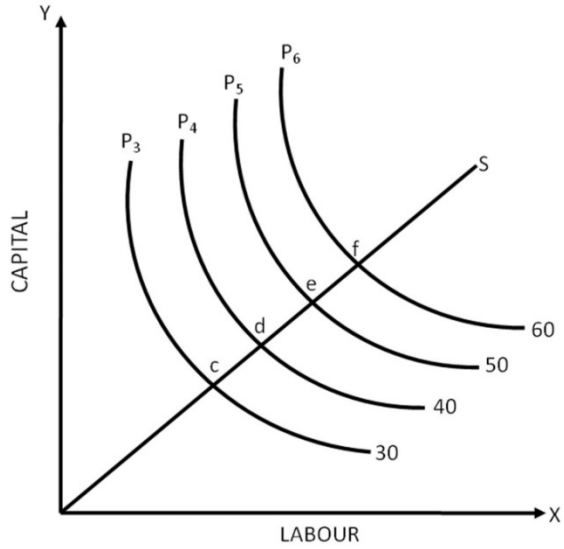

Fig. 9.2: Constant returns to scale-output increases in the same proportion in which inputs are increased

The question that now arises is what are the reasons which account for constant returns to scale. Generally when inefficiencies of production on a small scale are overcome and no problems regarding technical and managerial indivisibilities remain, expansion in scale leads to a situation where returns increase in the same proportion as the factors of production. Some economists are of the view that when benefits of specialisation of a factor in the unit of production are small or when such benefits have already been reaped at a small level of production, then for a considerable period of time, production increases according to the law of constant returns to scale.

Economists have argued that if the factors of production are perfectly divisible, the production function must exhibit constant returns to scale. In their opinion, if constant returns to scale does not prevail in some industries, it is because in these industries either due to scarcity or indivisibility of some factors, it is not possible to vary all them in the same proportion. Indivisibility of a factor often results in its under-utilisation at lower levels of output. When a producer for obtaining a larger output increases quantities of other factors, the amount of the lumpy factor which had not been fully utilised at lower levels of output, will not be increased. These economists do not think that economies of scale will be available when the factors of production are perfectly divisible. They however, stress the role of optimum factor proportionality in production. When factors of production are perfectly divisible, they can be increased or decreased in such amounts that an optimum proportion between factors is achieved. The output can be increased or decreased by increasing, or decreasing the amounts of the factors in the optimum proportion without any economies or diseconomies of scale which means that constant returns to scale will necessarily prevail.

9.2.3 Diminishing Returns to Scale

Diminishing returns to scale ensure that the size of the productive firms cannot be infinitely large. Generally after a limit when the quantity of the factors of production is increased in such a way that the proportion of the factors remains unchanged, output increases in a smaller proportion as compared to increases

in the amounts of the factors of production. For example, it may happen that an increase in amount of labour and capital by 100 per cent leads to an increase in output by only 75 per cent. In other words, if output has to be doubled, the factors of production will have to be more than doubled. We can understand this phenomenon with the help of Fig. 9.3. In this figure, when the firm is at isoquant P_6, the tendency of constant returns to scale has come to an end. From here, the increasing distance between two consecutive isoquants is an indication that to obtain the same increase in output, factors of production will have to be increased at a higher and higher rate. On the scale line OS, ij > hi > gh >fg > ef indicate this phenomenon very explicitly.

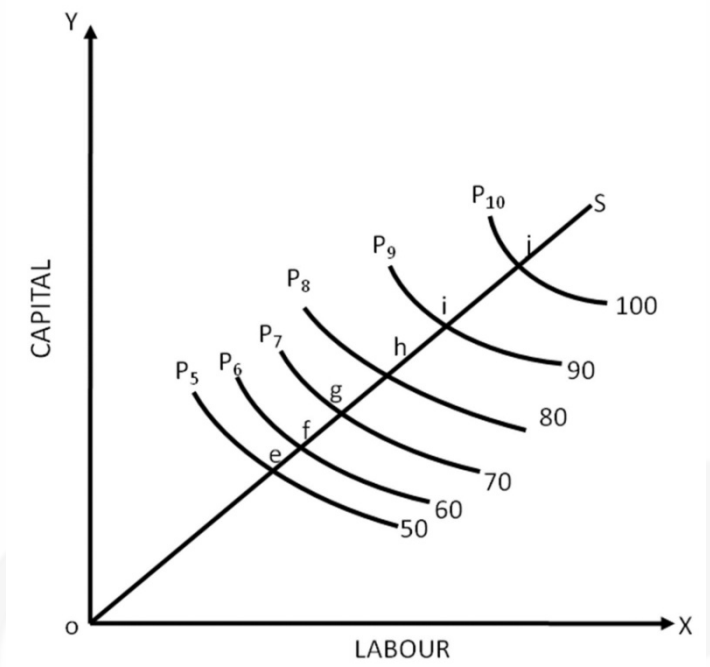

Fig. 9.3: Diminishing returns to scale – output increases proportionally less than inputs

Economists do not agree on the causes which leads to operation of diminishing returns to scale. Nevertheless, the two causes that are often mentioned are as follows:

1) **Enterprise:** Some economists emphasise that enterprise is a constant and indivisible factor of production and its supply cannot be increased even in the long run. Accordingly, when the quantity of other factors is increased and the scale of production expanded in a bid to boost up production, the proportion of other factors in relation to enterprise increases. Beyond a certain point, this results in diminishing returns as enterprise becomes scarce in relation to other factors.

2) **Managerial difficulties:** According to some other economists, the main reason for the operation of diminishing returns to scale is managerial difficulties. When the scale of production expands, the co-ordination and control on different factors of production tend to become weak and therefore output fails to increase in the same proportion as the factors of production increase. This results in diminishing returns to scale.

9.3 ECONOMIES AND DISECONOMIES OF SCALE

Expansion of the scale confers a number of economies on the firm. Some of these are in 'real terms' while others are in 'pecuniary terms'. Economies that are obtained in production work, marketing, management, transport, etc. are in real terms, while economies that are obtained in terms of, say, purchase of inputs at wholesale rate, availability of finance at lower rate of interest, saving on advertisement costs, etc. are in money terms. Then, there are certain economies that do not accrue to the firm whose scale of operation is large but accrue to certain other firms which benefit from the large scale of this firm.

In Economics, those economies which accrue to a firm on expansion of its own size are known as internal economies. As against this, those economies which accrue to a firm not due to its own operations but due to the operations of other firms are termed external economies.

9.3.1 Internal Economies of Scale

Generally, when the scale of production is sought to be enlarged, the firm replaces its small plant by a larger plant. This increases the efficiency of production. However, it is not always necessary to change the plant for expanding the scale of production. The firm can keep the old plant in a running condition and either establish a new plant of the same type or a new plant of some new type. In all these alternatives, the firm obtains many different kinds of economies. The fact is that it is the economies of scale that determine the nature of the long-run average cost curve.

9.3.1.1 Real Internal Economies of Scale

When expansion in the scale of production takes place, the firm obtains some real internal economies. These economies accrue in the form of saving in the physical quantities of raw materials, labour, fixed and variable capital, and other inputs. Broadly speaking, real internal economies are of the following four types: (i) production economies, (ii) selling or marketing economies, (iii) managerial economies, and (iv) economies in transport and storage.

1) **Production economies:** When the scale of production expands, a number of economies accrue to the firm in the production process itself. First, opportunities for obtaining various types of economies emerge in the workshop of the factory. Production on a large scale enables the firm to carry out extensive division of labour and employ large automatic machines. The capacity of the machines is also fully used on account of the large volume of production. Instead of depending on others for carrying out repairs of machines and machine tools, the firm can itself employ technicians and workmen for the purpose. Techniques of production are changing so rapidly in the modern world that every producer has to remain ever alert. Large size of the firm and large-scale of operations is distinctly better in this regard since a larger firm can easily make use of its big financial resources to conduct research in its laboratories and/or adapt technology discovered elsewhere to suit its own requirements. The firm is, thus, able to discover better and less expensive techniques of production.

Whatever be the scale of operations, some waste material is invariably left out in each factory. If the scale of operations is small, a relatively larger quantity of this material goes unutilised. However, if the scale of operations is large, some useful goods can be prepared even from the waste material. For example, from the syrup left out in the sugar factory, liquor can be prepared. Similarly, in bangles factory, a number of small glass goods can be prepared out of the broken bangles.

When the scale of production is small, the producer generally cannot afford a packaging department. Therefore, he has to depend on others for obtaining packaging material like boxes, labels, etc. This leads to a substantial expenditure on packaging. However, if the scale of production is large, the firm can setup its own packaging department which is economical and also leads to lower per unit packaging costs.

2) **Selling or marketing economies:** Every producer produces with the purpose of selling. Therefore, he has to incur some expenditure in making his goods available to the consumer. When the scale of production is large, the per unit expenditure of the producer on marketing of goods is reduced substantially due to a number of reasons. All firms advertise their products in a number of ways. Even very small firms have to spend a certain minimum amount on advertising, though this expenditure of the small firms is considerably less than the expenditure of the large firms, yet the per unit cost of the large firms is smaller due to the fact that advertising cost is not required to be increased proportionately as the volume of production increases. Also, when the scale of production is large, the firm can economise on the expenditure on salesmen, agents, etc. The large firms can also enter into such contracts with the wholesalers and distributors that they take more interest in selling the products of the firm. Naturally, a small firm is deprived of this benefit.

3) **Managerial economies:** Managerial costs are partially production costs and partially selling costs. However, they are generally considered separately since it is convenient to do so. Managerial economies are obtained on account of the following two basic reasons: First, benefits of specialisation in the field of management can be obtained only when the scale of operations is considerably large. When the scale of production is small, all managerial responsibilities regarding production, marketing, finance, etc. will have to be borne by one person only. However, as the scale of operations expands, separate managers are appointed to look after these tasks. This raises the level and quality of management. At the same time, cost does not increase in proportion to the increase in the scale of operations. Large firms are in a position to use a number of machines for purposes of management. The use of computers, telephone, fax, etc. can be made only by a sufficiently large firm. If small firms use these machines, the total costs incurred on them would be very much higher in relation to the level of production attained.

The economists are, however, not in complete agreement on the managerial economies. Some economists argue that with the expansion of scale, managerial economies are obtained only upto a limit. After this limit, costs on management increase in a greater proportion. This is due to two reasons. First, the managerial structure in large companies is bureaucratic and when the scale of production expands, delays in decision making creep in. This weakens managerial efficiency. Second,

the degree of uncertainty increases as the size of the firm increases. On account of this reason, various difficulties have to be encountered in decision making leading to an increase in managerial costs.

4) **Economies in transport and storage:** When the scale of production expands, economies in transport and storage accrue to the firm. Small firms have usually to depend on public transport and therefore their per unit transport cost is higher. As the scale of operation expands, the firm can purchase its own truck, lorry, etc. This will reduce the per unit transport cost for the firm. If the scale of operation expands still further, the firm can go in for larger trucks and lorries. The railways also give siding facilities to large producers and this reduces their loading costs. In reality, the transport cost is partly production cost and partly selling and marketing cost. When the firm purchases raw material, the loading cost is a part of its production cost. On the other hand, when finished goods are transported to the market, it is a part of selling and marketing cost. However, for convenience in analysis, the economists prefer to treat transport costs separately.

Like transport costs, storage costs are also partly production costs and partly selling and marketing costs. For example, expenditure on storing the raw material is a production cost whereas expenditure on finished and semi-finished goods is a part of marketing costs. From the point of view of the size of the warehouse, an important thing to remember is that larger the size of warehouse, larger will be the economies accruing to the firm. The reason is that the cost of construction of the warehouse does not increase in the same proportion as the increase in the storage capacity of the warehouse.

9.3.1.2 Pecuniary Internal Economies of Scale

Some pure pecuniary economies accrue to a firm as its scale of operation expands. The more important ones are the following:

1) A large sized firm can ask the suppliers of raw materials to give specific concessions and discounts. No raw material supplier usually ignores such requests (or pressures) of the large firm.
2) Perfect competition generally does not prevail in the capital market. Since the large companies have greater goodwill in the capital market, they are in a position to obtain loans at lower rates of interest from the banks and financial institutions.
3) Transport companies are also willing to provide discounts and concessions if the cargo is substantially large. This enables the firm to obtain monetary economies in transport costs by expanding its scale of operations.
4) When production is large, the firm is required to spend a large amount on advertising as well. However, advertising on a large scale attracts discounts and concessions from the media in which the advertisements appear.

9.3.2 Internal Diseconomies of Scale

If the scale of production is continuously expanded, is it possible that after a certain point, increase in production is less than proportionate than increase in the factors of production? Many economists believe that such a situation can and does arise if production is pushed beyond the point of optimum scale. The reasons that they advance are as follows:

1) **Limitations on the availability of factors of production:** The factors of production are always available in limited supply at the place of production. When the scale of production is increased beyond a certain point, it no longer remains possible to meet the requirements of some factors from local sources and, accordingly, factors have to be transported from other regions. This is generally possible only at higher prices. Let us suppose that an engineering factory is to be set up at Rudrapur in the Terai region. When the scale of production is small, it would be possible to meet the demand for some materials from local sources. As the scale of production expands, it will become more and more difficult to get even the labour from local sources and after a certain point, workers will have to be attracted from other regions by offering them higher wages.

2) **Problems in management:** When the scale of production is very large, the task of management at the top level becomes increasingly more and more burdensome and some inefficiency is bound to creep in. At times, information vital for taking a decision does not reach the top managers of the company in time. This delay, in turn, leads to a delay in decision making and increases the per unit cost.

3) **Technical factors:** When the scale of production is expanded, per unit cost increases due to a number of technical reasons. The establishment cost of large and sophisticated plants and machinery is generally high. The buildings of large factories should also have stronger foundations and the factory itself must be equipped with coolers, air-conditioners, etc. All these factors lead to an increase in per unit cost.

9.3.3 External Economies

External economies were discussed first of all by Alfred Marshall. According to him, when a firm enters production, it obtains a number of economics for which the firm's own production strategy, managerial arrangements, etc. are not responsible. In fact, these are economies external to the firm. For example, let us suppose that a firm is established at a place where transport, advertising facilities, etc. are not available. If the size of the firm remains small, it is possible that these facilities are not locally available in the future as well. However, if the size of the firm increases significantly, these facilities will themselves start coming to the firm. These are, in fact, external economies.

When a firm expands its scale of production, other firms also earn many economies. For example, when a large factory attracts various factors of production fairly regularly, many other factories set up in the neighbourhood, that could not have attracted these factors on their own, also stand to gain. They obtain these factors at practically the same prices at which the large factory obtained them.

Because of external economies of large-scale production, there is a gap between private and social returns. When a firm expands its scale of production, it becomes possible for the other firms to reduce their cost of production. However, there is no method available in the prevalent price mechanism to the firm expanding its scale of operations to charge for the benefits it confers on the other firms.

9.3.4 External Diseconomies

When the scale of operations is expanded, many such diseconomies emerge that have no particular ill-effect on the firm itself. In fact, their burden falls on

the other firms. On account of this reason, they are termed external diseconomies. The smoke rising from the chimney of a factory pollutes the atmosphere. When the firm is of a small size, the pollution is less and its ill-effects on the people living in colony nearby is limited. However, if the scale of the firm is large, the smoke will be very dense and can cause serious health hazard to the people. Similarly, as the scale of production of the factories increases, employment rises sharply. This creates problems of traffic congestion and overcrowding in the city where these factories are located. In agriculture, increase in the scale of production leads to problems of soil erosion and this reduces the fertility of the adjoining fields as well. From the above illustrations, it is clear that external economies and diseconomies can be both pecuniary and technological.

Check Your Progress 1

1) Indicate the following statements as true (T) or false (F):

   i) When output increases in a greater proportion as compared to the increase in the amount of the factors of productions, we have the stage of increasing returns to scale.

   ii) Those economies which accrue to a firm an account of the other firms are known as external economies.

   iii) Production economies are a part of pecuniary internal economies.

   iv) In the case of linear homogenous production function, we have constant returns to scale.

2) Discuss the factors which account for increasing returns to scale.

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3) Explains how decreasing returns to scale arise.

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4) Discuss the internal economies of scale.

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5) What do you mean by external economies and external diseconomies?

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9.4 LET US SUM UP

In this unit, the concept of returns to scale has been explained. As noted in the beginning itself, this concept is associated with the tendency of production that is observed when the ratio between the factors is kept constant but the scale is expanded. This, in turn, can give rise to three possibilities – increasing returns to scale, constant returns to scale, and diminishing returns to scale. After

discussing all these possibilities, we shift our focus to a discussion of economies and diseconomies of scale. Economies of scale, in turn, are divided into two parts – internal economies of scale and external economies of scale. Economies which accrue to a firm on expansion of its own size are known as internal economies while economies which accrue to a firm not due to its own operations but due to operations of other firms are termed as external economies. We have discussed in detail all the causes which can result in the generation of such economies. In the end, we have focussed our attention on diseconomies of scale – both internal and external.

9.5 REFERENCES

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4) John P. Gould and Edward P Lazear, *Microeconomic Theory* (All India Traveller Bookseller, Sixth edition, 1996), Chapter 8, Section 8.6.

9.6 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) (i) (T), (ii) (T), (iii) (F), (iv) (T)

2) See Sub-section 9.2.1 of Section 9.2

3) See Sub-section 9.2.3 of Section 9.2

4) See Sub-section 9.3.1 of Section 9.3

5) See Sub-section 9.3.3 and 9.3.4 of Section 9.3.

UNIT 10 THE COST OF PORDUCTION

Structure

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10.7 Let Us Sum Up

10.8 References

10.9 Answers or Hints to Check Your Progress Exercises

10.0 OBJECTIVES

After going through this unit, you should be able to:

- state the various concepts of costs like private cost, social cost, money cost, sunk cost, economic cost, accounting cost etc.;

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- differentiate between short-run and long-run cost functions;
- know the difference between fixed cost and variable cost and the nature of total cost curve;
- explain the concept of average fixed cost, average variable cost, average total cost and marginal cost and nature of these curves;
- discuss the relationship between marginal cost curve and average cost curve;
- appreciate the difference between short-run and long-run cost curves; and
- describe the relationship between long-run marginal cost and short marginal cost.

10.1 INTRODUCTION

The decision of a firm regarding production of a good depends on two factors: First, the demand for the good, and second, the cost of production of the good. Accordingly, the concept of cost of production is basic to the understanding of the price theory and requires a thorough discussion. A price taker firm wishes to maximise its profits will be able to do so if it is able to minimise its costs. Obviously a firm is interested in minimising what economists call the *private cost*. The concept of *social cost* that is being often referred to in the context of social welfare is not relevant for the theory of firm. However, it is necessary to understand the distinction between the concepts of the private cost and the social cost. In economic analysis, we often distinguish between *money cost* and the *opportunity cost*. From analytical point of view both the concepts are relevant and thus must be understood carefully. The concept of money cost may be interpreted from the point of view of an accountant or an economist. The two approaches differ on the treatment of implicit costs.

After settling these conceptual issues in the theory of costs, one has to analyse the nature of costs in both the short-run and the long-run. In the short-run since we have some fixed inputs and some other inputs are variable, one has to draw the distinction between the *fixed costs* and the *variable costs*. However, in the long-run because the amounts of all the inputs can be varied, all costs are considered together. Finally, the theory of costs attempts to explain as to how cost changes occur in response to changes in the size of production. In the last two units we have discussed the theory of production at some length. This discussion should help us to understand that the cost changes depend largely on how changes in production take place as a result of changes in the amounts of inputs.

10.2 THE CONCEPTS OF COSTS

10.2.1 Private Costs and Social Costs

In microeconomic theory, the concepts of both private cost and social cost are used. The firm, in its attempt to attain the goal of profit maximisation, is guided entirely by the private cost considerations. In its decision making, it ignores all those costs which it may be imposing on others while carrying out its production programme. However, in welfare studies, together with the

firm's both explicit and implicit costs, all such costs are taken into account which are external to the 'narrow economy' of the firm.

Private costs: Every firm requires various inputs to produce a good. In order to secure a command over these inputs, the firm has to pay some price for each of these inputs. In common parlance, the amount of money so paid is known as cost. Economists, however, include in the private cost not only the expenditure incurred by the producer on purchasing (or hiring) of factors of production (or inputs) from the market, but also the imputed cost of all those services which the producer himself provides. The private cost of production of any output may thus be defined as either the purchase or the imputed value of all productive services used in producing the output and is equivalent to the total monetary sacrifice of the firm made to secure it.

Generally, economists include the following expenditures in the cost: (i) cost of the raw materials, (ii) wages of the labourers, (iii) interest payments on capital loans, (iv) rent of the land and the buildings, (v) repairing costs of machines and depreciation, (vi) tax payments to the government and local bodies, (vii) imputed wage payment to the producer for the work performed by him, (viii) imputed interest payment for the capital invested by the producer himself, (ix) rent of land and buildings owned by the producer himself and (x) normal profits of the firm.

This shows that three types of expenditures are included in the private cost: (i) the purchase price of the factors of production employed in the production process, (ii) imputed price of the resources provided by the producer himself, and (iii) normal profits.

Social costs: Social costs differ from private costs on account of two reasons:

First, externalities are not included in private costs. For example, a factory located in the residential area by polluting the atmosphere will expose the residents of the colony to various ailments and will thereby raise their medical expenditures. Though these costs are quite relevant from the point of view of the society, they will never be considered by the firm as part of its costs.

Secondly, market prices of goods may not reflect their social value and thus there may be divergence between private and social costs. The imposition of government taxes, subsidies, and controls of various kinds distort free market prices. Further, prices of factors of production may overstate or understate the opportunity cost of using those factors. In heavily populated countries where widespread disguised unemployment is to be found in the agricultural sector, the industrial wage often exceeds the opportunity cost of the labour which is drawn from the agricultural sector. In computing the social costs, adjusted market prices for goods and factors of production are used. While the adjusted prices for factors of production are called shadow prices, the adjusted prices for goods are termed as social prices.

10.2.2 Money Cost: Explicit and Implicit Costs

The concept of the money cost in contrast to the concept of opportunity cost is simple.

The money cost of production of any output is considered to be equivalent to the total monetary sacrifice made to obtain that output.

Thus, costs are not sacrificed alternatives but monetary payments. This conception of money cost is rather narrow and is used for accounting purposes. From the point of view of the economists, this concept of cost is not very relevant. Since economists wish to study as to how costs affect output choices, employment decisions, and the like, costs should include imputed value of all the inputs provided by the producer himself in addition to outright money expenses. Hence, costs can be classified as explicit costs and implicit costs. Explicit costs arise from transactions between the firm and other parties in which the former purchases inputs or services of inputs for carrying out the production. These costs are usually the costs shown in the accounting statements and include wage payments, raw materials costs, interest on loans, payments for insurance, electricity and so on. Implicit costs are the costs associated with the use of the firm's own resources. Since these resources will bring return if employed elsewhere, their imputed values constitute the implicit costs. Implicit costs are however difficult to measure. Economists nonetheless assert that they must be taken into account in analysing the activities of a firm.

10.2.3 Real Costs

The concept of real cost was developed by Alfred Marshall. In his opinion, a worker suffers discomfort while he renders his services for productive purposes. Similarly, a person makes some sacrifice when he saves his income and lends it to investors who use it for carrying out production. These discomforts and sacrifices are in the nature of real costs of production. In Marshall's own words, "The exertions of all the different kinds of labour that are directly or indirectly involved in making it; together with the abstinences or rather the waitings required, for saving the capital used in making it; all these efforts and sacrifices together will be called the real costs of the production of the commodity."

The concept of real cost is, however, based on subjectivity and cannot be used for precise measurement of production cost. It is this reason why modern economists do not consider it to be of much relevance in the price theory. They admit that most of the labour involves hard work and is definitely unpleasant. It, therefore, has a heavy real cost. In contrast, the real cost of simple and less arduous work is generally low. But this fact is not at all relevant from the point of view of price determination in a free enterprise economy. Moreover, to modern economists, savings do not involve any sacrifice. Hence, these economists regard the concept of real cost as inappropriate.

10.2.4 Sunk Cost and Incremental Cost

In economics and business decision-making, a sunk cost is a cost that has already been incurred and cannot be recovered. Sunk costs (also known as retrospective costs) are sometimes contrasted with prospective costs, which are future costs that may be incurred or changed if an action is taken. In traditional microeconomic theory, only prospective (future) costs are relevant for decision making. Since sunk costs have already been incurred and cannot be recovered, therefore they should not influence the rational decision-maker's choices.

An incremental cost is the increase in total costs resulting from an increase in production or other activity. For instance, if a company's total costs increase from Rs. 5.6 lakh to Rs. 6.0 lakh as a result of increasing its machine hours from 7,000 to 8,000, the incremental cost of the 1,000 machine hours is Rs. 40,000.

10.2.5 Economic Cost and Accounting Cost

Economists and accountants view costs from different angles. Accountants are concerned with the firm's financial statement and tend to take a retrospective look at the firm's finances because they have to keep track of assets and liabilities and evaluate past performance. Accounting cost includes depreciation expenses for capital equipment at rates allowed by the tax authorities.

Economists, on the other hand, are concerned with what cost is expected to be in the future, and with how the firm might be able to rearrange its resources to lower its cost and improve its profitability. Thus, they take a forward looking view and must therefore be concerned with opportunity costs.

As stated earlier, there is a difference regarding the treatment of explicit and implicit costs as well. Both, the economists and the accountants consider explicit costs (like payment of wages and salaries, cost of raw material, property rentals, etc.) because these involve direct payments by a company to other firms and individuals that it does business with. However, while economists also take into account the implicit costs, accountants ignore them. For example, consider the owner of a retail store who manages his own retail store but does not pay any salary to himself. Since no monetary transaction has taken place, accountant will not include it in the accounting cost. However, the economist will include this implicit cost in total cost as the retail store owner could have earned a competitive salary by working elsewhere (that is, the implicit cost of the owner will be his opportunity cost).

The treatment of depreciation is also different. When estimating the future profitability of a business, an economist is concerned with the capital cost of plant and machinery. This involves not only the explicit cost of buying and the running of the machinery, but also the cost associated with wear and tear. On the other hand, accountants use depreciation rates on different assets as allowed under the tax laws in their cost and profit calculations. These depreciation rates need not reflect the actual wear and tear of the equipment, which is likely to vary asset by asset.

The above discussion shows that there are some important differences in the methods of calculating costs as used by the economists and the accountants. Accordingly, the calculation of profit will also differ. To illustrate, consider a retail store owner who has invested Rs. 1,00,000 as equity in a store and inventory. His monthly sales revenue is Rs. 2,60,000. After deduction of cost of goods sold, salaries of hired labour, and depreciation of equipment and buildings, the accounting profit to the store owner is Rs. 25,000 (see Table 10.1).

Table 10.1: Accounting income statement for the Retail-Store Owner

Sales		Rs. 2,60,000
Cost of goods sold	Rs. 1,80,000	
Salaries	30,000	
Depreciation expense	25,000	Rs. 2,35,000
Accounting profit		Rs. 25,000

In Table 10.2 we consider the economic statement of profit of the same store. The cost of goods sold and salaries remain the same. Let us suppose that the market values of the equipment and building in fact declined by Rs. 25,000 over the current year and that the depreciation charge, therefore, reflects the opportunity costs of these resources. Thus, depreciation expense is taken to be Rs. 25,000 as in Table 10.1. However, the economist will add two items relating to the implicit cost in the cost of production. Suppose that the owner-manager could earn Rs. 25,000 per month as a departmental manager in a large store and that this is his best opportunity for salary. Then we would add Rs. 25,000 as the imputed salary of the owner-manager to the cost of production. Similarly, the owner-manager has Rs.1,00,000 equity in the store and inventory – a sum he could have easily invested elsewhere. Let us suppose that he could have earned 10 per cent interest on this amount had he invested it elsewhere. Thus, imputed interest cost on equity will be Rs. 10,000. Thus, as can be seen from Table 10.2, the total economic costs, or the opportunity costs of all resources used in the production process will add up to Rs. 2,70,000. This implies an economic loss of Rs.11,000 to the owner-manager of the store against the accounting profit of Rs. 25,000 depicted in Table 10.1.

Table 10.2: Economic statement of profit to the Retail-Store Owner

	Rs.	Rs.
Sale		2,60,000
Cost of goods sold	1, 80,000	
Salaries	30,000	
Depreciation expense	25,000	
Imputed salary to owner-manager	25,000	
Imputed interest cost on equity	10,000	2,70,000
Economic Profit		-10,0000

In addition to the above differences in the calculation of profits by the economists and the accountants, it is also important to point out that while for economists, profits and losses are the driving force, business accounting does not stop here. Business accounts also include the balance sheet, which is a picture of financial conditions on a particular date. This statement records what a firm is worth at a given point of time. On one side of the balance sheet are recorded the 'assets' and on the other side are recorded the 'liabilities' and 'net worth'. A balance sheet must always balance because net worth is a residual defined as assets minus liabilities.

The business accounting concepts can be summarised as follows:

1) **The income statement shows the flow of sales, cost, and revenue over the year or accounting period. It measures the flow of money into and out of the firm over a specified period of time.**

2) **The balance sheet indicates an instantaneous financial picture or snapshot. It is like a measure of the stock of water in a lake. The major items are assets, liabilities and net worth**.

10.2.6 Historical Cost and Replacement Cost

The historical cost is the cost that was actually incurred at the time of the purchase of an asset. As against this, replacement cost is the cost that will have to be incurred now to replace that asset (i.e., replacement cost is the current cost of the new asset of the same type).

These two costs differ because of changes in prices over a period of time. Naturally, if prices remain unchanged over time, both the costs will be the same. But this seldom happens. Accordingly, historical cost and replacement cost of an asset always differ. If the price rises over a period of time, replacement cost will be higher than the historical cost. On the other hand, if the price of the asset declines over a period of time, replacement cost will be lower than the historical cost.

Because of the requirements of tax laws and the laws governing financial reporting to shareholders, accountants generally express many costs in terms of the actual or historic costs paid for the resources used in the production process in accordance with the convention of financial accounts. However, both economists and accountants agree on the fact that for decision making purposes, it is not the historical cost that is relevant but the replacement cost. This is due to the reason that for all decision making purposes, it is the 'current' (or the replacement) cost that is important and not the cost that was incurred some years earlier at the time of the purchase of the asset.

Check Your Progress 1

1) Indicate the following statements as true (T) or false (F):

   i) Externalities are not a part of private cost ( )

   ii) Implicit costs are the costs associated with the use of firm's own resource ( )

   iii) Retrospective costs are relevant for decision making ( )

   iv) Accountants tend to take a retrospective look at the firm's finances ( )

   v) Economists are concerned with opportunity costs ( )

   vi) The historical cost is the current cost of the new asset of the same type ( )

2) Explain the difference between explicit cost and implicit cost.

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3) Distinguish between private cost and social cost.

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4) What is the difference between sunk cost and incremental cost?

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5) Explain the difference between economic cost and accounting cost.

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10.3 COST FUNCTIONS: SHORT-RUN AND LONG-RUN

The relationship between product and costs is known as the cost function.

There are two elements in determining the cost function of a firm. First, the production of the firm, and second, the prices paid by the firm for the factors used.

In practice, production functions can be of various types. At times, one factor of production is variable and other factors fixed. It is also possible for some factors to be variable. On account of this reason, cost function can also be of various types. In economics, generally two types of cost functions are considered under the price theory:

i) The short-run cost function, and

ii) The long-run cost function.

Cost functions can be illustrated in diagrammatic forms as cost curves.

10.3.1 Cost Function and the Time Element

To understand the theory of cost, it is necessary to be clear about the meaning of short-run and long-run. In common usage, these terms may be used for weeks, months and years but for the economist they indicate conditions of production and have no reference to the calendar year. Even then, the concept of time does creep in indirectly when the terms short-run and long-run are discussed.

Generally, economists regard that period of time as short-run in which some factors of production are fixed (at least one factor is fixed) and the firm depends only on the variable factors of production to increase the level of output. If the firm does not employ the variable factors at all, the output will be zero in the short-run. However, the maximum quantity of output that can be produced depends upon the quantity of the fixed factors of production. In the long-run, all factors are variable and the quantity of the output can be increased to any limit. For example, in a manufacturing industry the plants, machinery, building of the factory, etc. are fixed resources in the short-run while the raw materials, labour, power, etc. are variable. Therefore, to increase the amount of output in this period, it will become necessary to employ more units of the variable resources in conjunction with the fixed resources. Obviously, the

maximum output that can be obtained in this period will depend to a great extent upon the total quantity of the fixed resources of production.

10.3.2 Long-Run Cost Function

In the long-run, total cost is a multivariable function which implies that total cost is determined by many factors. The long-run cost function may be written as

$$C = f(Q, T, P_f)$$

Where, C = total cost of production

Q = output

T = technology

P_f = prices of the relevant factors of production.

Graphically, the long-run cost function is shown on two dimensional diagram as C=f(Q), ceteris paribus. With the assumption that the technology and the prices of relevant factors of production remain constant, the long-run cost function may be written as

$$C = f(Q, \overline{T}, \overline{P}_f \text{ or } C = f(Q)$$

However, the technology and the factor prices need not remain constant. When these factors change, their effect on cost is shown by a shift of the cost curve. It is this reason why the factors other than output are known as shift factors. Theoretically there is no difference between the various factors which determine the costs, and the distinction we have drawn above between the output level and other factors determining costs can sometimes be misleading. However, for showing costs on two dimensional diagrams this distinction has to be made.

10.3.3 Short-Run Cost Function

In the short-run, in addition to output level, technology and factor prices, the fixed factors such as capital equipment, land, etc. also determine costs of production. Therefore, the short-run cost function is written as

$$C = f(Q, \overline{T}, \overline{P}_f, \overline{K})$$

Where, $\overline{K}$ indicates fixed factors. In the discussion on the production function, it has been stated that in the short-run certain factors like capital equipment, land, factory building and top managerial staff remain constant. $\overline{K}$ underlines the fact of the constancy of the fixed factors. Since the amount of fixed factors does not change in the short-run under any circumstances, $\overline{K}$ is not a shift factor like technology and factor prices.

10.4 THEORY OF COST IN THE SHORT-RUN

The short-run costs of a firm are divided into fixed and variable costs. Therefore,

$$TC = TFC + TVC$$

where, TC = total cost

TFC = total fixed cost

TVC = total variable cost

10.4.1 Fixed Cost

Fixed cost is also known as supplementary cost. While engaging in productive activity, the producer always has to incur some expenditure which remains fixed whatever the level of production, so much so that even if the producer stops production altogether, these costs have to be incurred.

This is known as fixed cost of production. Interest paid by the producer on the capital borrowed for purchasing plant and machinery, rent of the factory building, depreciation of the machinery, the wages of foremen and organisers, etc. are all fixed costs. These costs remain fixed even when the level of output is varied. Even if the producer decides to close down production, he has to bear these costs since the factory rent, wages of managers, interest on capital, etc. have to be paid. This discussion makes it clear that larger the level of production in a firm, the lower will be the per unit fixed cost (or average fixed cost).

10.4.2 Variable Cost

The cost which keeps on changing with the changes in the quantity of output produced is known as variable cost.

For instance, raw material has to be used in the process of production in a manufacturing industry, labour has to be employed for running machines, and energy (electricity) has to be arranged. Generally expenditure on these inputs increases or decreases due to changes in the level of production. It is important to remember in this context that when the producer abandons production in the short run, these costs also vanish completely. In fact, it is due to this direct relationship between expenditure on such inputs and the level of production that these expenditures are known as variable costs.

The concepts of total cost, total variable cost and total fixed cost in the short-run can be easily followed with the help of Table 10.3.

Table 10.3 : Short-Run Costs of a Hypothetical Firm

Output (Unit)	Total Fixed Cost (Rupees)	Total Variable Cost (Rupees)	Total Cost (Rupees)
0	240	0	240
1	240	120	360
2	240	160	400
3	240	180	420
4	240	212	452
5	240	280	520
6	240	420	660

10.4.3 Total Fixed Cost

Total fixed cost is the total expenditure by the firm on fixed inputs.

From Table 10.3, it is clear that the total fixed cost of the firm remains constant at Rs. 240 irrespective of the level of output. In our illustration, output varies from 1 unit to 6 units, but the total fixed cost remains 240 in each case. Even when the firm stops production altogether, implying that output is at zero level, the total fixed cost remains unchanged. The firm's total fixed cost function is shown in Fig. 10.1.

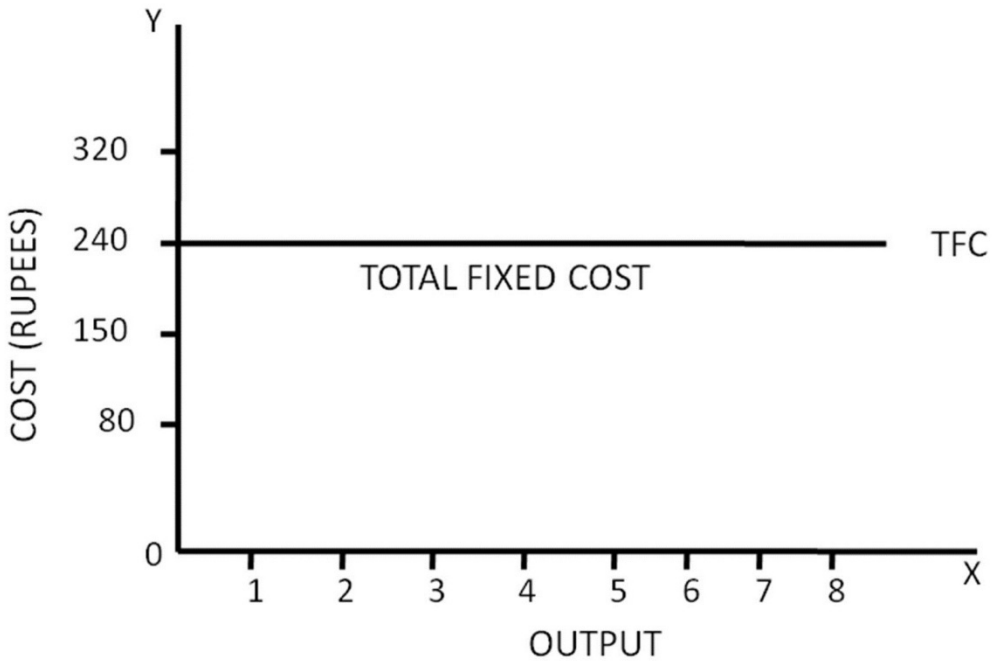

Fig. 10.1 : Total Fixed Cost curve is parallel to X axis as total fixed cost remains the same for all levels of output

10.4.4 Total Variable Cost

Total variable cost is firm's total expenditure on variable inputs used to carry out production.

Since higher output levels require greater utilisation of variable inputs, they mean higher total variable cost. Table 10.3 shows that the total variable cost of the firm increases as its output increases. However, when the firm stops its production altogether, it does not require any variable input and, therefore, its total variable cost is zero. Fig. 10.2 shows the firm's total variable cost function. Notice one peculiar feature of TVC – initially it rises sharply, then, there is a moderation in its rate of rise and ultimately it resumes rising at a faster pace.

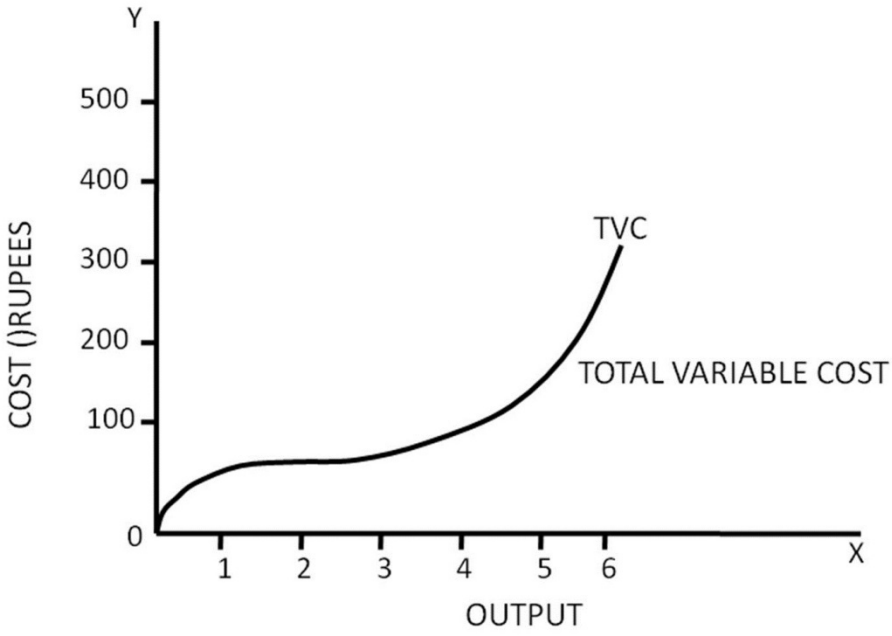

Fig. 10.2 : Total Variable Cost Curve rises from left to right

10.4.5 Total Cost

Total cost is the sum of total fixed cost and total variable cost.

Thus, to obtain the firm's total cost at a given output, we have only to add its total fixed cost and its total variable cost at that output. The result is shown in Table 10.3 and the total cost function is shown in Fig. 10.3. Since the total cost function and the total variable cost function differ by only the amount of total fixed cost which is constant, they have the same shape.

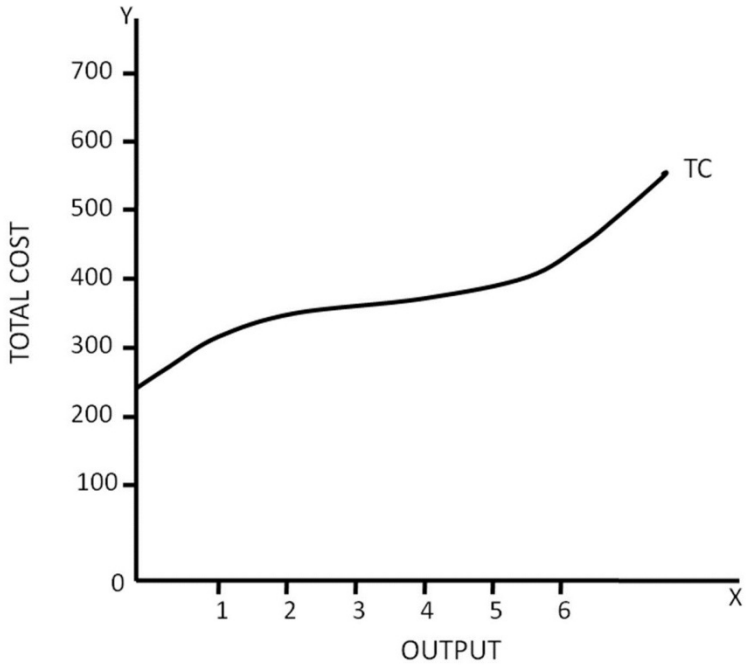

Fig. 10.3: Total Cost curve is obtained by adding the total fixed cost to total variable cost

In Fig. 10.4, all the three cost functions discussed above (total fixed cost function, total variable cost function and total cost function) have been shown together. Cost functions, when depicted graphically, are often called cost curves.

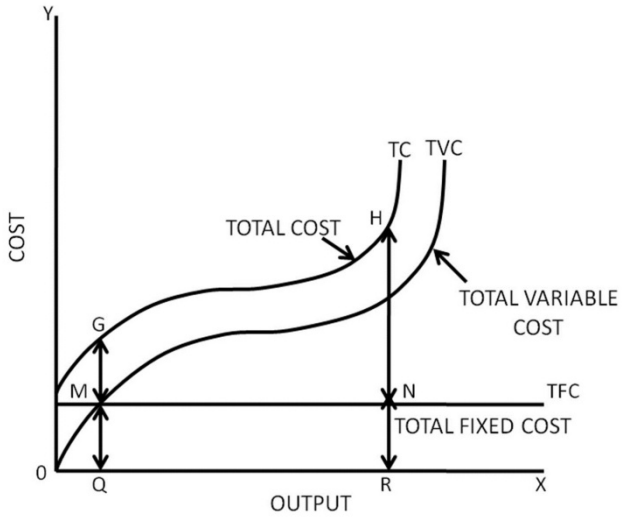

Fig. 10.4 : Total Fixed Cost, Total Variable Cost and Total Cost

In Fig. 10.4, TFC is the total fixed cost curve. Since it is parallel to X-axis, it indicates that whatever be the level of output the total fixed cost remains the same (i.e., it does not change in response to a change in the level of production). TC is total cost curve. It indicates the sum of total fixed cost and total variable cost for the various output levels. If the level of production is to be raised, the use of variable inputs will have to be increased and this will push up the costs. The rising total cost curve TC from left to right (the positive slope of TC curve) indicates this fact. The vertical distance between the total cost curve TC and the total fixed cost curve TFC indicates total variable cost. For example, if the firm wishes to produce OQ units of output, the total variable cost will be GQ – MQ = GM and if the level of output is OR, the total variable cost will be HR – NR = HN. The total variable cost has been depicted by the curve TVC in Fig. 10.4. This is parallel to the total cost curve TC and the vertical distance between the two curves (TC and TVC) indicates total fixed cost.

Check Your Progress 2

1) Indicate the following statements as true (T) or false (F):
   i) Cost function explains the relationship between product and costs ( )
   ii) In the long run all factors are variable ( )
   iii) Fixed cost is also known as supplementary cost ( )
   iv) Total variable cost is the total expenditure by the firm for fixed input ( )

2) Define and distinguish between long run cost function and short run cost function.

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3) Distinguish between fixed cost and variable cost.

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4) Define total fixed cost and total variable cost and trace the nature of the total cost curve.

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10.5 SHORT-RUN COST CURVES

To find out the per unit profit, the firm has to compare the per unit cost (or average cost) with per unit price. Therefore, it is necessary for us to understand the concepts of average fixed cost, average variable cost and average total cost.

10.5.1 Average Fixed Cost

Generally, all those firms whose total costs of production include a significant proportion of fixed costs try to increase the level of production to such an extent that per unit fixed cost which is often known as average fixed cost, is reduced substantially. To find out the average fixed cost, total fixed cost has to be divided by the output.

In the form of a formula,

$$AFC = \frac{TFC}{Q}$$

where, AFC is the average fixed cost

TFC is the total fixed cost

Q is the output

Table 10.4: Average Fixed Cost, Average Variable Cost and Average Total Cost of the Firm

Output (Units)	Average Fixed Cost TFC ÷ Q	Average Variable Cost TVC ÷ Q	Average Total Cost TC ÷ Q
1	240 ÷ 1=240	120 ÷ 1=120	360 ÷ 1=360
2	240 ÷ 2=120	160 ÷ 2=80	400 ÷ 2=200
3	240 ÷ 3=80	180 ÷ 3=60	420 ÷ 3=140
4	240 ÷ 4=60	212 ÷ 4=53	452 ÷ 4=113
5	240 ÷ 5=48	280 ÷ 5=56	520 ÷ 5=104
6	240 ÷ 6=40	420 ÷ 6=70	660 ÷ 6=110

A mere look at Table 10.4 will show how the average fixed cost declines with a rise in the level of output. When the firm produces only 1 unit, average fixed cost is Rs. 240. As the ouput is expanded, there is a sharp decline in average fixed cost and it is as low as Rs. 40 when 6 units of the commodity are produced.

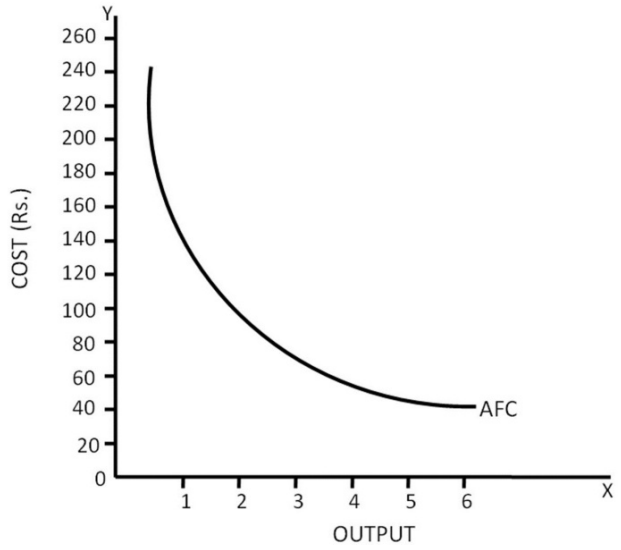

Fig. 10.5: Average Fixed Cost curve is a rectangular hyperbole

The fact that average fixed cost must decline with increases in output can be easily understood with the help of average fixed cost curve in Fig. 10.5. In this figure, when output is 1 unit, the average fixed cost is Rs. 240. When the output is increased to 3 units and then to 6 units, average fixed cost declines first to Rs. 80 and then to Rs. 40.

The average fixed cost curve (AFC) is a rectangular hyperbole because multiplication of average fixed cost with the quantity of output produced always yields a fixed value (the area under the curve is always same and is equal to the total fixed cost).

10.5.2 Average Variable Cost

To obtain the average variable cost, we divide the total variable cost by the output. In the form of formula:

$$AVC = \frac{TVC}{Q}$$

where, AVC = the average variable cost

TVC = the total variable cost

and Q = the output.

In fact, the average variable cost curve (AVC) gives us the same information in money terms that we obtain from the average product curve of the variable factor in physical terms.

With an increase in the amount of variable factor, the efficiency in production increases (resulting in an increase in average product) and the average variable

cost declines. If average productivity remains constant, average variable cost will also remain constant. If it declines, average variable cost increases.

Thus, average variable cost curve is the reciprocal of the average variable (factor) product curve.

After having understood the relationship between average variable factor productivity and average cost, it is easy to understand the nature of the AVC curve. While discussing the laws of production, we had stated that if other factors are kept constant and only the quantity of one factor is increased, then initially the tendency of increasing returns is observed. Later on, it is followed by constant returns and diminishing returns in that order. This means that in the initial stages, average variable cost declines and, after reaching a minimum point, starts increasing. This increase is due to the operation of the law of diminishing returns. From Table 10.4 we learn that at the output level of 1 unit the firm's average variable cost is Rs. 120. It declines when output is increased and is Rs. 53 when 4 units of the commodity are produced. Thereafter, it increases and is Rs. 70 when output level is raised to 6 units. The average variable cost curve is thus U-shaped as in Fig. 10.6.

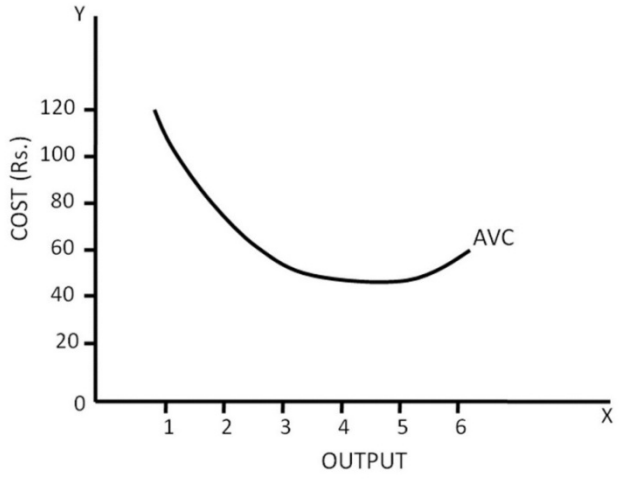

Fig. 10.6: Average variable cost curve is a U-shaped curve

10.5.3 Average Total Cost

The average total cost is also known as average cost. To find out average cost, we divide total cost (which is the sum of total fixed cost and total variable cost) by the output. In the form of a formula:

$$\text{AC or ATC} = \frac{\mathbf{TC}}{\mathbf{Q}} = \frac{\mathbf{TFC}}{\mathbf{Q}} + \frac{\mathbf{TVF}}{\mathbf{Q}}$$

The modern economists are generally agreed that in all areas of economic activity, average total cost declines initially. The reasons are the same which lead to increasing returns in the initial stages. Average cost declines initially because some of the resources are indivisible and there are possibilities of specialisation in the production process. As long as the indivisible factors are not fully utilised, the average total cost falls and when expansion in output leads to a stage where the indivisible resources are fully utilised, an optimum proportion is established between the factors of production. Output obtained at this point is the optimum output. Here, the average total cost is minimum. If the output is expanded beyond this point (which denotes an optimum combination of resources) by increasing the amount of variable inputs, then total production increases at a diminishing rate. This leads to a rise in average

total cost. This shows why the average total cost curve is U-shaped as shown in Fig. 10.7. The illustration given in Table 10.4 also makes this point abundantly clear.

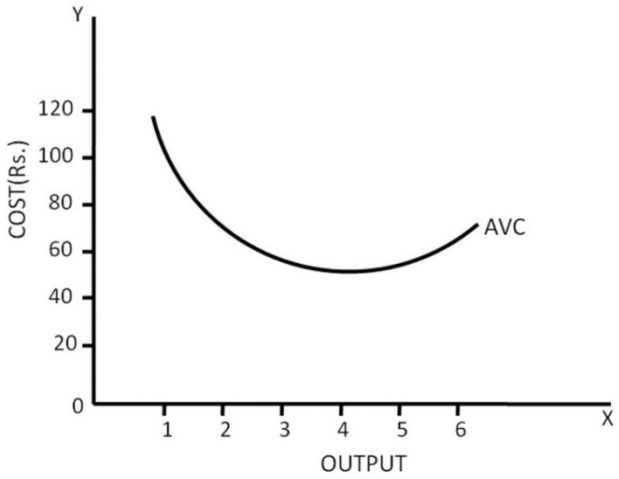

Fig. 10.7: Average Total Cost curve is obtained by dividing total cost by the output

We can understand the shape of average total cost curve ATC better with the help of average variable cost curve AVC and average fixed cost curve AFC drawn in Fig. 10.8. Since the ATC curve is obtained by vertically summing up the AVC and AFC curves, when both AVC and AFC curves slope downward, the ATC curve also slopes downwards. The point R on the AVC curve shows the minimum average variable cost. After this point, the average variable cost starts increasing and thus the AVC curve is sloping upward. However, the fall in the average fixed cost more than compensates for the rise in average variable cost. Hence, the ATC curve slopes downward. Since at point T on the AVC curve the rate of increase of the average variable cost is the same as the rate at which the average fixed cost falls corresponding to this level of output, average total cost is minimum at this output level. As the level of output increases beyond this point, the average variable cost rises far more rapidly than the rate at which average fixed cost falls. Therefore, the ATC curve slopes upward.

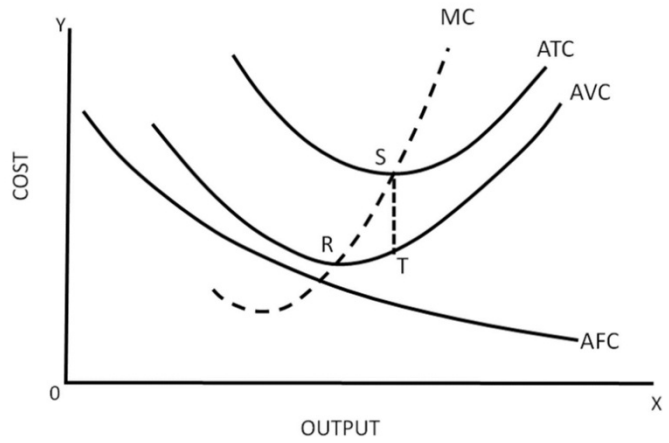

Fig. 10.8: Average total cost is the vertical sum of AFC and AVC

10.5.4 Marginal Cost

The marginal cost is the increase in the total cost owing to a small increase in output.

In symbols,

$$MC = \frac{\Delta TC}{\Delta Q} \text{ or } \frac{\Delta TVC}{\Delta Q}$$

where, MC is marginal cost

ΔTC is change in total cost associated with a small change in output

ΔTVC is change in total variable cost associated with a small change in output

ΔQ is small change in output

The concept of marginal cost can be understood with the help of an example. In Table 10.5, the total cost of producing 2 units of output is Rs. 400 and the total cost of producing 2 + l or 3 units of output is Rs. 420. Therefore, marginal cost is Rs. 20 which is Rs. 420 – Rs. 400.

Table 10.5: Calculation of Marginal Cost

Output Units	Total Cost (Rs.)	Total Variable Cost (Rs.)	Marginal Cost (Rs.)
0	240	0	-
1	360	120	120
2	400	160	40
3	420	180	20
4	452	212	32
5	520	280	68
6	660	420	140

Since fixed cost remains unchanged in the short run, marginal cost can also be defined as the increase in total variable cost consequent upon a small increase in output. From Table 10.5, we learn that the variable cost of producing 2 units is Rs. 160 and that of 3 units Rs. 180. The marginal cost, thus, will be Rs. 180 – Rs. 160 = Rs. 20.

The marginal cost (MC) curve as it would be clear from Fig. 10.9 is U-shaped. This implies that the marginal cost curve MC first slopes downward and then at the point where marginal cost is minimum, it starts sloping upward because marginal cost after decreasing with increases in output at low output levels, increases with further increases in output. The shape of marginal cost curve is in fact attributable to the law of variable proportions. According to the law of variable proportions, the marginal product of the variable input rises at low output levels and then falls with the expansion in output. Hence, the marginal cost curve will first fall and then rise. There are two important points to remember about the marginal cost curve:

i) The MC curve reaches its minimum point before the ATC and the AVC curves reach their minimum points; and

ii) When the MC curves rises, it cuts the AVC and the ATC curves at their minimum points.

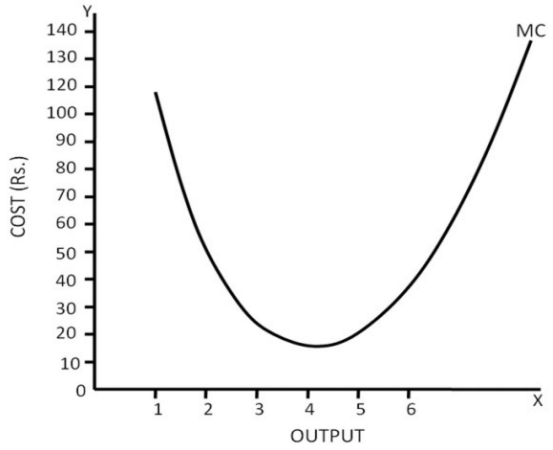

Fig. 10.9 : Marginal Cost Curve is a U-shaped Curve

10.5.5 Relationship between Marginal Cost and Average Cost

There is a close relationship between the marginal cost (MC) curve and the average total cost (ATC) and average variable cost (AVC) curves. We shall explain the relationship only between the MC curve and the ATC curve, but the relationship between the MC curve and the AVC curve can be explained along the same lines of reasoning.

Fig. 10.10 shows the MC curve together with the ATC curve and the AVC curve. The relationship between the ATC curve and the MC curve is as follows:

1) **When the MC curve is below the AC curve (which means marginal cost is less than average cost), the latter falls.**
2) **When the MC curve is above the AC curve (which means marginal cost is more than average cost), the latter rises.**
3) **The MC curve intersects the AC curve at its minimum point.**

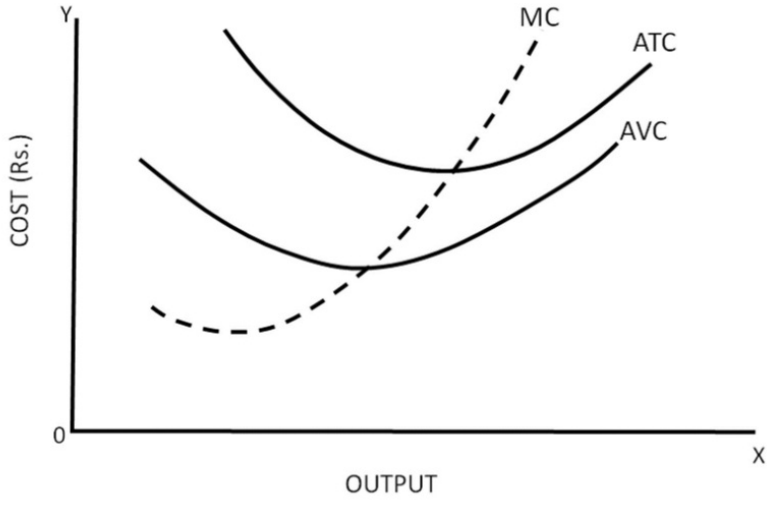

Fig. 10.10: MC curve intersects both AVC curve and ATC curve at their minimum points

The reason for the above stated relationship between the MC curve and the ATC curve is simple. So long as the MC curve lies below the ATC curve, it pulls the latter downwards; when the MC curve rises above the ATC curve, it pulls the latter upwards. Consequently, marginal cost and average total cost are equal where the MC curve intersects the ATC curve. Further when output is small, marginal cost remains lower than average total cost; but when output is expanded, marginal cost exceeds average total cost. Thus, it is natural that the MC curve intersects the ATC curve at its minimum point.

Another important feature of the relationship between MC and AC curves is that MC is affected only by variable costs. Fixed costs do not affect marginal costs. This can be proved algebraically as follows:

$$MC_N = TC_N - TC_{N-1}$$

$$= (TFC_N + TVC_N) - (TFC_{N-1} + TVC_{N-1})$$

Since, TFC_N will always be equal to TFC_{N-1} we can also state as follows:

$$MC_N = TFC_N + TVC_N - TFC_{N-1} - TVC_{N-1}$$

$$= TVC_N - TVC_{N-1}$$

This proves that MC is affected only by TVC and not by TFC.

Check Your Progress 3

1) Indicate the following statement as true (T) or false (F):
   i) Average fixed cost curve is a rectangular hyperbole ( )
   ii) Average variable cost curve is the reciprocal of the average variable factor productivity curve ( )
   iii) The average total cost curve has inverted U shape ( )
   iv) When the MC curve is below the AC curve, the latter rises ( )
2) What is average cost? What is the nature of the average total cost curve?

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3) Define and distinguish between average cost and marginal cost.

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4) Explain the relation between the average cost and the marginal cost. How is it possible that the marginal cost continues to rise while average cost declines?

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5) The following table gives information on total cost, total fixed cost and total variable cost for a firm for different levels of output:

Output ⟶	0	1	2	3	4	5	6
TFC (Rs.)	120	120	120	120	120	120	120
TVC Rs.)	0	60	80	90	105	140	210
TC (Rs.)	120	180	200	210	225	260	330

Find (i) AFC (ii) AVC (iii) AC and (iv) MC.

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10.6 LONG-RUN COST CURVES

In the long-run, all factors are variable. Due to the absence of fixed factors in the production function, all costs of production are variable in the long-run and therefore there is no need to distinguish between fixed and variable costs as is done in the short-run. In the long-run, to increase the level of production, all factors have to be increased and this results in an expansion of scale.

In the short-run, the production capacity of the firm depends upon the size of the plant. Generally, there are many options before a firm. According to the circumstance, it can choose any plant out of the large and small plants available to it. Let us suppose that a firm has three options and corresponding to them, the short-run average total cost (SATC) curves are as given in Fig. 10.11. We shall call the smallest plant as A, the medium size plant as B, and the large size plant as C. The short-run average total cost curves corresponding to these plants are designated $SATC_a$, $SATC_b$ and $SATC_c$.

The firm decides about the size of plant keeping the market considerations in view. If the demand is small, the firm will use plant A for purposes of production but in doing so it will have to incur a higher average total cost. If the firm has to produce OQ_2 quantity of output, it has two options open before it: firstly, it can employ plant A. The optimum level of output that can be produced with the help of this plant is itself OQ_2. Secondly, it can opt for plant B. If it does so, the capacity of plant B will not be fully utilised nevertheless per unit cost of production will be lower than the cost of production the firm will have to incur if it opts for producing OQ_2 amount of output with the help of plant A (even though OQ_2 is the optimum level of output that can be produced on plant A). This is due to the tendency of 'increasing returns to scale'. Not that plant C is larger in size than plant B yet, the curve $SATC_c$ is higher than the $SATC_b$ curve. If the firm opts for plant C in this case, the average total cost will increase due to the operation of 'diminishing returns to scale'.

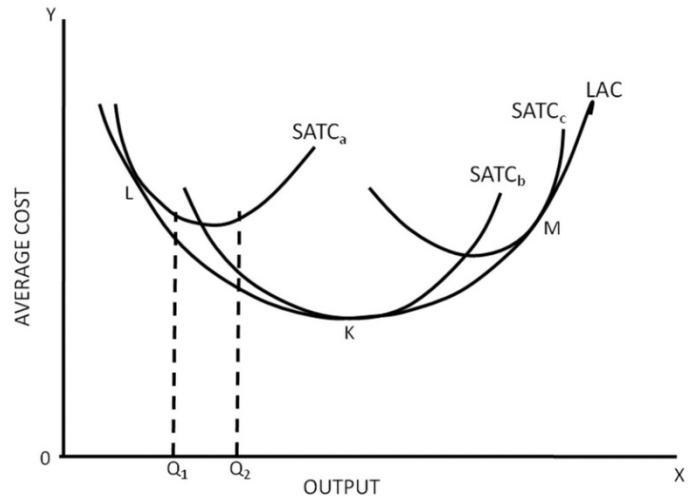

Fig. 10.11 : Long-run average cost curve envelopes short-run average total cost curves

Theoretically speaking, the long-run average cost (LAC) curve touches the short-run average total cost (SATC) curves on their minimum points. Geometrically this is possible only under those circumstances when the tendency of constant returns to scale prevails. It is due to the fact that initially increasing returns to scale and after some time diminishing returns to scale prevail in the production process that the LAC curve touches the lowest SATC curve at its minimum point. In the phase of increasing returns to scale when average total cost is falling, the LAC curve touches the SATC curves to the left of the minimum points of the SATC curves and in the phase of diminishing returns towards the right of minimum points of these curves. In Fig. 10.11, the curve LAC touches the $SATC_b$ curve at its minimum point K, the $SATC_a$ curve towards the left of its minimum point (at L) and the SAT C_c curve towards the right of its minimum point (at M).

In Economics, we say that the long-run average cost curve (LAC) 'envelopes' the short-run average total cost (SATC) curves.

10.6.1 Long Period Economic Efficiency

The behaviour of the firm which seems to be efficient in the short-run may be found to be inefficient in the long-run. To understand this let us consider Fig. 10.12. Let us suppose that the firm is producing OQ_1 quantity of output. If, due to an increase in demand, the firm wishes to increase output by Q_1Q_2, plant cannot be changed in the short-run and only variable factors will be increased. Thus, the firm will advance on the curve $SATC_1$. As a result, the efficiency of the variable resources will improve and per unit production cost will decline from BQ_1 to JQ_2. In the short-run the level of efficiency cannot improve further because this is the optimum level of production that can be achieved with the help of the plant available to the firm. However, in the long-run to produce the level of output OQ_2, the use of plant of such a small size is inefficient. If the firm uses a plant of a larger size, it will benefit from the increasing returns that would thus become available. As a result, the per unit cost will fall and come down to the level KQ_2. Though the full capacity of this plant will not be fully utilised, even then it would be more efficient as compared to the earlier plant.

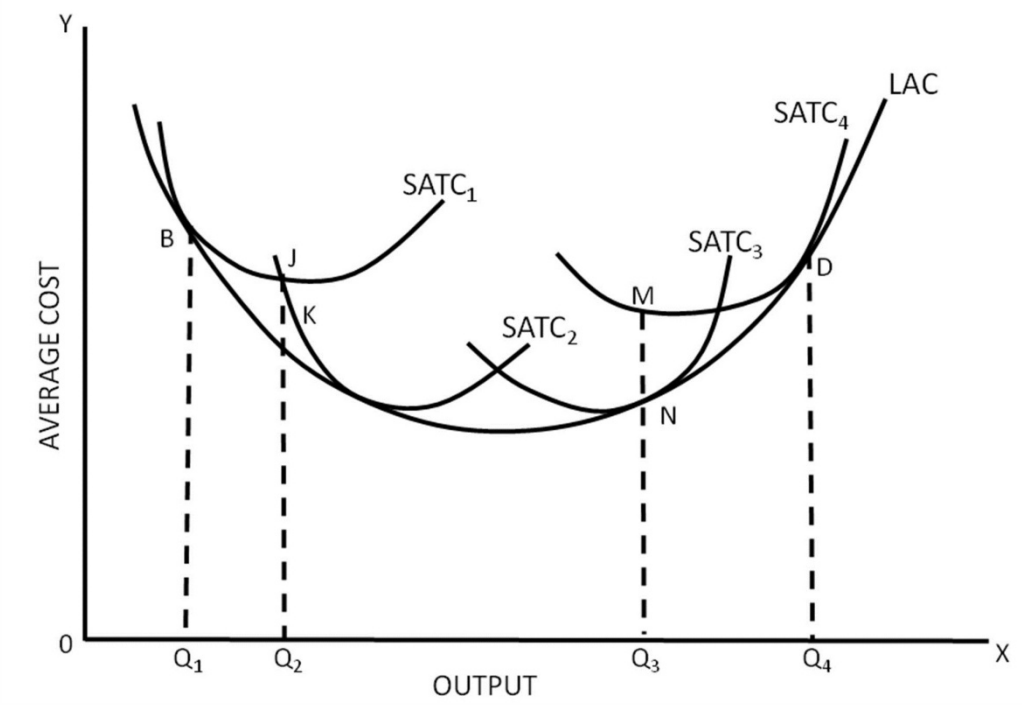

Fig. 10.12: Explanation of long-run economic efficiency

In a similar way when an expansion in scale leads to diseconomies or diminishing returns to scale emerge, it will be in the interest of the firm to reduce the level of production. If the firm is producing the output OQ_4 in Fig. 10.12, it will not be a right strategy from the point of view of maximising profits. The firm can cut down production by Q_3Q_4 in the short-run and this will enable it to reduce the average total cost from DQ_4 to MQ_3. This will result in optimum use of the plant. However, in the long-run, this position will not be satisfactory as the firm can reduce the average cost to the level NQ_3 by reducing the size of the plant. Since $NQ_3 < MQ_3$, the position which was optimum for the firm in the short-run becomes inefficient in the long-run. It is clear that when the firm uses plant of a relatively small size, it produces output much larger than is technologically optimum yet the cost remains low because it becomes possible to reduce the diseconomies of the large plant.

10.6.2 The Long-Run Average Cost Curve

We have explained in detail above that the short-run average total cost curve is U-shaped. Let us now discuss the shape of long-run average cost curve. There is general agreement that the long-run average cost falls initially due to economies of scale. But whether it falls to a certain point and then becomes constant or rises again, cannot be conclusively said.

In traditional analysis, the long-run average cost (LAC) curve is assumed to be U-shaped (as in Fig. 10.12). The shape of the long-run average cost curve is based on the assumption that ultimately the tendency of diminishing returns operates in the production process. If this belief of the economists is correct that every producer wishes to maximise profits and conditions of production are perfectly competitive, then it is true that the LAC curve must ultimately rise to the right.

10.6.3 Long-Run Marginal Cost Curve

After having understood the meaning of short-run marginal cost, it is not difficult to understand what long-run marginal cost is. Long-run marginal cost designates the change in total cost consequent upon a small change in total output when the firm has ample time to accomplish the output changes by making the appropriate adjustments in the quantities of all resources used, including those that constitute its plant. As can be seen, this definition of long-run marginal cost is practically the same as the definition of short-run marginal cost given by us earlier. The only difference between the two is that whereas in the short-run the existing plant will continue to be used for affecting an increase in output, in the long-run the plant itself will be changed.

As far as the relationship between the long-run marginal cost curve and long-run average cost curve is concerned, it is precisely the same as exists between the short-run marginal cost curve and the short-run average total cost curve. This would be clear from a mere glance at Fig. 10.13.

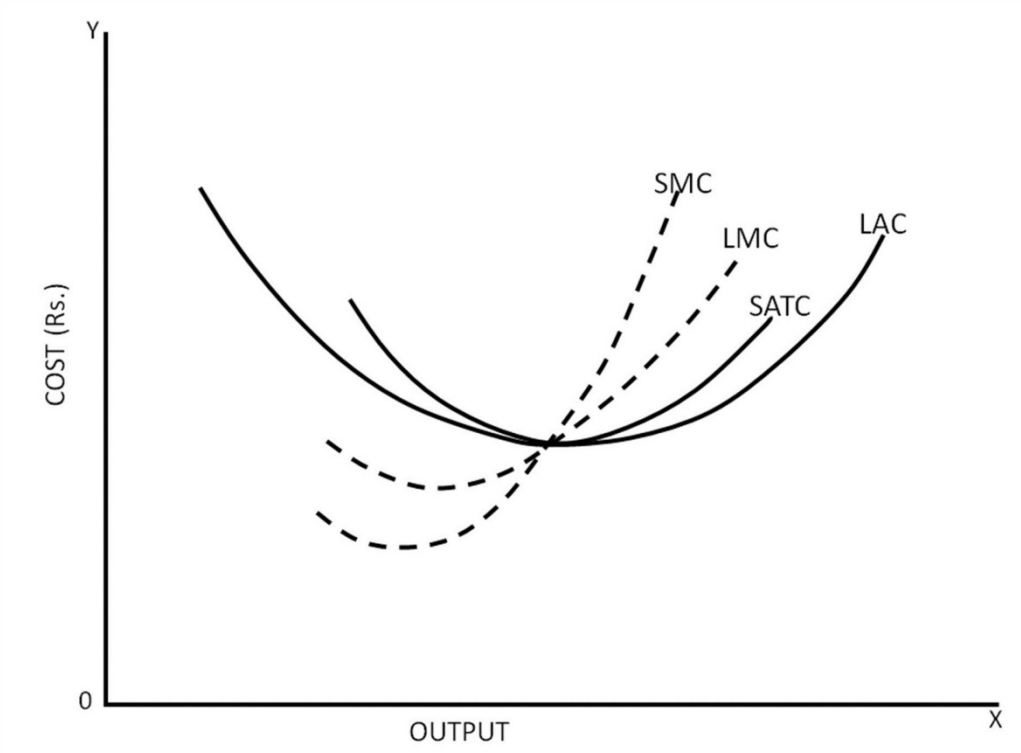

Fig. 10.13: Long-run marginal and average cost curves

10.6.4 Relationship between Long-Run Marginal Cost and Short-Run Marginal Cost

When to produce a certain given level of output, a firm sets up the most efficient plant, its short-run marginal cost (SMC) becomes equal to its long-run marginal cost (LMC). Let us explain this with the help of Fig. 10.14. In this figure, the given quantity of output is OQ_1. This output can be produced at lowest unit cost with the help of plant A. The short-run average cost curve of the firm when it produces with the help of plant A is given by SAC. Short-run average cost curves corresponding to other plants have not been drawn in Fig. 10.14. It is clear from the figure that at OQ_1 level of output, SMC and LMC are equal. However, we must see why they should be equal.

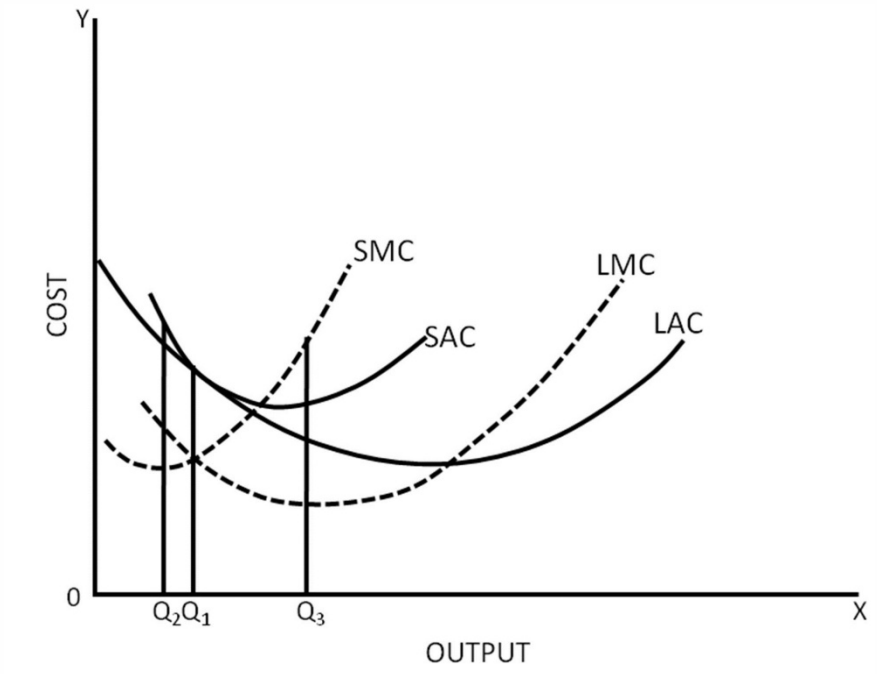

Fig. 10.14: Equality of SMC and LMC on use of an optimum size plant

To find out why SMC and LMC must be equal at the level of output OQ_1, let us consider the implications of a small change in the output by a small amount. For instance, let us take the level of output OQ_2. At this output level, short-run average cost will be greater than long-run average cost (SAC > LAC). In other words, short-run total cost is greater than long-run total cost (STC > LTC). When output rises from the level OQ_2 to the level OQ_1 the short run total cost becomes equal to the long-run total cost. If the level of output is raised to OQ_3 then since SAC is greater than LAC at this output, STC will also be greater than LTC. In other words, when output level is raised beyond OQ_1, we find that SMC exceeds LMC. Actually as we move from OQ_2 to OQ_1, we find that rate of decline in SMC is declining. In fact, beyond OQ_1, it stands rising. On the other hand, LMC keeps falling over the entire range. Therefore, between OQ_1 and OQ_3 SAC is rising and LAC is falling.

On practical considerations, the equality of short-run marginal cost and the long-run marginal cost is very significant for a firm. If the firm has to increase the level of output only by a very small amount whether it continues to employ the existing plant and changes only the quantity of the variable resources or makes a small change in the size of the plant, the results are the same. Therefore, from the point of view of the firm, both the methods are equally correct.

Check Your Progress 4

1) Indicate the following statements as True (T) or False (F):

   i) There is no need to distinguish between fixed costs and variable costs in the long-run. ( )

   ii) Long-run average cost curve envelopes the short-run average total cost curves. ( )

   iii) Long-run marginal cost curve cuts the long-run average cost curve from below at the latter's lowest point. ( )

2) Discuss the nature of the long-run average cost curve.

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3) Discuss the concept of long period economic efficiency.

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4) What is the relationship between long-run marginal cost curve and long-run average cost curve.

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5) Discuss the relationship between long-run marginal cost and short-run marginal cost.

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10.7 LET US SUM UP

In this unit, we start with a discussion of the various concepts of cost like private cost, social cost, and economic cost and accounting cost. This is followed by a discussion of short-run and long-run cost functions. We then proceed to define the distinction between fixed cost and variable cost. We note that total fixed cost curve is a straight line while the total variable cost curve and the total cost curve rise upwards to the right. We then turn to a discussion of short-run cost curves .We note that the nature of the average fixed cost curve is that of a rectangular hyperbola. When average variable cost curve is added to the average fixed cost curve, we get the average cost curve. This is followed by a discussion of the marginal cost and the nature of the marginal cost curve. The marginal cost curve cuts the average cost curve from below at the latter's minimum point.

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10.9 ANSWERS OR HINTS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) (T) ; ii) (T) ; iii) (F) ; iv) (T) ; v) (T) ; vi) (F) .

2) See Sub-section 10.2.2 of Section 10.2.

3) See Sub-section 10.2.1 of Section 10.2.

4) See Sub-section 10.2.4 of Section 10.2.

5) See Sub-section 10.2.5 of Section 10.2.

Check Your Progress 2

1) (T) ; ii) (T) ; iii) (T) ; iv) (F)

2) See Section 10.3

3) See Sub-section 10.4.1 and 10.4.2 of Section 10.4

4) See Sub-section 10.4.3, 10.4.4 and 10.4.5 of Section 10.4

Check Your Progress 3

1) (T) ; ii) (T) ; iii) (F) ; iv) (F)

2) See Sub-section 10.5.3 of Section 10.5

3) See Sub-sections 10.5 .3 and 10.5.4 of Section 10.5

4) See Sub-section 10.5.5 of Section 10.5

5) (I)AFC = $\frac{TFC}{Q}$ (ii) AVC = $\frac{TVC}{Q}$ (iii) AC = $\frac{TC}{Q}$ (iv) MC = $\frac{\Delta(TC)}{\Delta Q}$

Check Your Progress 4

1) (i) T (ii) T (iii) T

2) See section 10.6

3) See Sub-section 10.6.1 of Section 10.6

4) See Sub-sections 10.6.2 and 10.6.3 of Section 10.6

5) See Sub-section 10.6.4 of Section 10.6

GLOSSARY

Average Product : Total product divided by the number of units of the input used is average product.

Accounting Cost : Accounting cost refers to actual expenses of the firm plus depreciation charges for capital equipment.

Barter : Exchange of goods/services against other goods/services.

Budget Line : The Budget Line, also called as Budget Constraint shows all the combinations of two commodities that a consumer can afford at given market prices and within the particular income level.

Comforts : Goods which are used for increasing our productive capacity and for making our lives more comfortable.

Consumption : Using up of Utility of goods in the satisfaction of a want.

Change in Demand : Shift of the entire demand of curve.

Change in Quantity Demanded : Movement on a demand curve itself caused by a changes in the price of the commodity in question.

Contraction in Supply : The decrease in quantity supplied because of a fall in the price of the commodity.

Curvilinear Supply Curve : The supply curve which is not a straight line.

Cardinal Utility : The **Cardinal Utility** approach is propounded by neo-classical economists, who believe that utility is measurable, and the customer can express his satisfaction in cardinal or quantitative numbers, such as 1, 2, 3 and so on.

Consumer Equilibrium : The point at which a consumer reaches optimum utility, or satisfaction, from the goods and services purchased, given the constraints of income and prices.

Constant Returns to Scale : Constant returns to scale implies that when all inputs are increased in a given proportion, output increases in the same proportion.

Complementary Commodity : It is the commodity whose demand is directly related to the demand of the commodity in question.

Demand : The amount of goods which the buyers are ready to buy, per period of time, at a given price per unit.

Dependent Variable : A variable which changes only with the change in the independent variable.

Decrease in Supply : The decrease in quantity supplied at a given price of the commodity.

Diminishing Returns to Scale : Diminishing returns to scale refers to the case when output grows proportionally less than input.

Economic Laws : Statements of tendencies. They depict the standardised or generalised response of economic units to different forces and stimuli.

Exchange Value : The price which an item commands in the market.

Elasticity of Demand : It quantifies the strength relationship between the quantity demanded of commodity and the price of the commodity or income of the consumer or price of another commodity which is related to the commodity in question.

Elasticity of Supply : The responsiveness of quantity supplied to a given percentage change in the price of the commodity.

Extension in Supply : The rise in quantity supplied due to a rise in the price of the commodity.

External Economies : When a firm enters production, it obtains a number of economies for which the firm's own strategies/policies are not responsible. These are economies external to the firm.

External Diseconomies : When the scale of operations is expanded, many such diseconomies accrue that have no particular ill-effect on the firm itself but their burden falls on the other firms. These are known as external diseconomies.

Economic Cost : Economic cost refers to cost to a firm utilising economic resources in production including opportunity cost.

Explicit Cost : Explicit costs arise from transaction between the firm and other parties in which the former purchases inputs or services for carrying out production.

Flow Variable : A variable which can be measured only with reference to a period of time.

Goods : Items which have a utility or can be used for the production of other goods or services.

Giffen Good : A good where higher price causes an increase in demand (reversing the usual law of demand). The increase in demand is due to the income effect of the higher price outweighing the substitution effect.

Historical Cost	:	Historical cost is the cost that was actually incurred at the time of purchase of an asset.
Inductive Reasoning	:	The technique of analysis in which factual information is used to discover the behaviour pattern of different economic units in response to various forces and stimuli.
Inferior Commodity (Good)	:	A commodity in which there is an inverse relationship between the income of the consumer and quantity demanded of a commodity.
Income Elasticity of Demand	:	It is the responsiveness of demand to a given proportional change in the income of the consumer.
Inequalities of Income	:	The distribution of income among different income groups of an economy.
Increase in Supply	:	The rise in quantity supplied at a given price of the commodity.
Income Effect	:	A change in the demand of a good or service, induced by a change in the consumers' real income. Any increase or decrease in price correspondingly decreases or increases consumers' real income which, in turn, causes a lower or higher demand for the same or some other good or service.
Isocost Line	:	An isocost line represents various combinations of inputs that may be purchased for a given amount of expenditure.
Isoquant	:	An isoquant is the of all the combination of two factrors of production that yield the same level of output.
Increasing Returns to Scale	:	Increasing returns to scale refer to the case when output grows proportionally more than inputs.
Internal Economies	:	Those economies that accrue to a firm on expansion of its own size are known as internal economies.
Internal Diseconomies	:	When the scale of production is continuously expanded, a point is reached where the increase in production becomes less than proportionate to the increase in the factors of production. As this point, internal diseconomies set in.
Implicit Cost	:	Implicit costs are the costs associated with the use of firm's own resources. Since these resources will bring returns if employed elsewhere, their imputed values constitute the implicit costs.
Incremental Cost	:	An incremental cost is the increase in total costs resulting from an increase in production or other activity

Luxuries : Goods which are meant for status or social standing.

Law of Supply : It shows the direct relationship between the price of a commodity and its quantity supplied, other factors influencing supply (except price of the commodity) remaining constant.

Law of Diminishing Returns : As more units of an input are used per unit of time with fixed amounts of another input, the marginal product of the variable input declines after a point.

Linear Homogeneous Production Function : When output increases in the same proportion in which inputs are increased, the production function is linear homogeneous. For example, if labour and capital are increased λ by times and, as a result, output also increases by λ times, the production function is linear homogeneous.

Merit Goods : The goods whose consumption is believed to be desirable for the benefit of the society and the consuming individuals.

Macroeconomics : Branch of economic analysis that focuses on the workings of the whole economy or large sectors of it.

Margin : The value of the variable under consideration related to the last unit of an item.

Marginal Utility : The additional or extra satisfaction yielded from consuming one additional unit of a commodity.

Microeconomics : Branch of economic analysis that focuses on individual economic units or their small groups and micro-variables like individual prices of individual commodities, etc.

Money Exchange : Sale of goods/services against money.

Monopolist : A producer who controls the whole supply of a commodity.

Marginal Product : Marginal product of an input is defined as the change in total output due to a unit change in the amount of an input while quantities of other inputs are held constant.

Marginal Rate of Technical Subsitution ($MRTS_{L,K}$) : Marginal rate of technical substitution of factor L for factor K ($MRTS_{L,K}$) is the quantity of K that is to be reduced on increasing the quantity of L by one unit for keeping the output level unchanged.

Necessities : Goods which are used for satisfying basic of existence.

Normative Economics : That part of economic analysis which is concerned with what ought to be, and the way it can be achieved by changing the existing situation.

Ordinal Utility : The Ordinal Utility approach is based on the fact that the utility of a commodity cannot be measured in absolute quantity. However, it will be possible for a consumer to tell subjectively whether the commodity gives more or less or equal satisfaction when compared to another.

Optimality : The point where maximum possible output is being achieved given the use of different factors of production.

Private Goods : Goods whose availability can be restricted to selected users. It is divisible in that sense.

Production Possibility Curve : A graphic representation of the combinations of maximum amounts of goods X and Y which can be produced with the given productive resources of the economy and under certain other simplifying assumptions.

Public Goods : Goods or services whose availability cannot be restricted to selected users only. The benefits of the goods are indivisible and people cannot be excluded.

Positive Economics : That part of economic reasoning which covers what is, without going into its desirability or otherwise, and without suggesting ways for changing the existing state of affairs.

Price Effect : The impact that a change in its price has on the consumer demand for a product or service in the market. The price effect can also refer to the impact that an event has on something's price. The price effect is a resultant effect of the substitution effect and the income effect.

Point of Inflexion : The point where total product stops increasing at an increasing rate and begins increasing at a decreasing rate is called the point of inflexion.

Production Function : The technical law which expresses the relationship between factor inputs and output is termed production function.

Rectangular Hyperbola : It is a curve in which every rectangle drawn with one corner on the curve has the same area.

Ridge Lines : The lines forming the boundaries of the economic region of production are known as the ridge lines.

Replacement Cost : Replacement cost is the cost that will have to be incurred now to replace that asset (i.e., the replacement cost is the current cost of the new asset of the same type).

Stock Variable : A variable which can be measured only with reference to a point of time.

Supply : The quantity of goods which the sellers are ready to sell, per unit of time, at a given price per unit.

Substitution Effect : It shows how with a change in the price of a commodity, prices of other commodities remaining unchanged, a consumer substitutes one commodity for the other.

Substitute Commodity : It is the commodity whose demand is inversely related to the demand of the commodity in question.

Supply Schedule : A table having two columns, one showing different prices of the commodity and the other showing quantities supplied during a given period at each of these prices.

Supply Curve : A curve showing the relationship between price of a commodity and its quantity supplied during a given period, other factors influencing supply remaining unchanged.

Sub-optimality : It is a point where optimality has not been achieved, i.e. output is less than the possible maximum given the use of the resources.

Sunk Cost : Sunk cost is a cost that has already been incurred and can't be recovered.

Technology : The method employed to produce a commodity or service.

Total Utility : The total satisfaction derived from all the units of an item.

Use Value : Utility of goods.

Utility : The want satisfying capacity of goods. It is the service or satisfaction an item yields to the consumer.

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