PGCM S1 02

MANAGERIAL ECONOMICS

SEMESTER - 1

MASTER OF COMMERCE

BLOCK - 1



KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

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MASTER OF COMMERCE
MANAGERIAL ECONOMICS

Block 1

DETAILED SYLLABUS

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Introduction, Meaning, Scope of Managerial Economics, Importance of the Study of Managerial Economics, Major Functions of a Managerial Economist.

UNIT 2 : Demand Analysis **Page 17- 41**

Introduction, Meaning and Law of Demand, Nature and Types of Demand, Exceptions to the Law of Demand, Elasticity of Demand – Price Elasticity, Income Elasticity and Cross Elasticity.

UNIT 3 : Demand Forecasting **Page 42 - 56**

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UNIT 4 : Supply and Market Equilibrium **Page 57 - 77**

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Unit 7 : Cost Analysis **Page 133–150**

Introduction, Types of Costs, Cost Function, Nature of Cost Curves in the Short Run, Long Run Cost Curves of a Firm.

COURSE INTRODUCTION

This is the second course of M. Com. Programme. This course introduces us to the subject- Managerial Economics. This course is designed as an introduction to economics in the field of management. The course has 15 units and is divided into two blocks; Block 1 and Block 2.

Block 1 deals with the introductory concepts of managerial economics, demand analysis, demand forecasting, supply and market equilibrium and consumer behaviour, theory of Production and cost analysis.

Block 2 concentrates on objectives of a firm, revenue analysis and pricing policies and market structure under perfect competition, imperfect competition, macro economic and selected macro economic aggregates, consumption function and investment function, business cycle and inflation, deflation and stagflation.

Each unit of these blocks includes some along-side boxes to help you know some of the difficult, unseen terms. Some “EXERCISES” have been included to help you apply your own thoughts. You may find some boxes marked with: “LET US KNOW”. These boxes will provide you with some additional interesting and relevant information. Again, you will get “CHECK YOUR PROGRESS” questions. These have been designed to self-check your progress of study. It will be helpful for you if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with “ANSWERS TO CHECK YOUR PROGRESS” given at the end of each unit.

BLOCK INTRODUCTION

This is the first block of the course “Managerial Economics”. This block provides you the basic idea of managerial economics. After complition of this block, which consists of seven units, you will be able to get a fair idea on the different concepts of economics, such as managerial economics, demand analysis and forecasting, supply and market equilibrium, and consumer behaviour, theory of production and cost analysis.

The block consists of the following units :

UNIT 1 : Introduction to Managerial Economics

UNIT 2 : Demand Analysis

UNIT 3 : Demand Forecasting

UNIT 4 : Supply and Market Equilibrium

UNIT 5 : Consumer Behaviour-Cardinal and Ordinal Approach

Unit 6 : Theory of Production

Unit 7 : Cost Analysis

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UNIT 1: INTRODUCTION TO MANAGERIAL ECONOMICS

UNIT STRUCTURE

1.1 Learning Objectives

1.2 Introduction

1.3 Introduction to Managerial Economics

1.4 Nature and Scope of Managerial Economics

1.5 Importance of the Study of Managerial Economics

1.6 Major Functions of a Managerial Economist

1.7 Let Us Sum Up

1.8 Further Reading

1.9 Answers to Check Your Progress

1.10 Model Questions

1.1 LEARNING OBJECTIVES

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

- describe managerial economics
- explain the nature and scope of managerial economics
- discuss the basic principles in economics
- learn the economic laws and principles
- learn about a managerial economist and his role and responsibilities.

1.2 INTRODUCTION

In this unit we will discuss about managerial Economics. In management studies, the term “Business economics”and “Managerial Economics” are often used synonymously. Both these terms involve “economics” as a basic discipline.

Economics is the study of how society manages its scarce resources. It is a study of how people make decisions, how much they work , what they buy , how much they save and how they invest their savings and so on. It is thus a study of want satisfying activities of men. Economics

as a social science, studies human behaviour as a relationship between numerous wants and scare means having alternative uses.

Economics has a great application in Management. The Manager of a business firm should have sound knowledge of Economics. The knowledge of economics helps the manager to take business decision efficiently resorting how to allocate the scarce resources, how to determine the price, how to plan the future project etc.

Thus, managerial economics is mainly concerned with the art of making rational choices to yeild maximum return out of minimum resources and efforts, by making the best selection among alternative courses of action.

1.3 INTRODUCTION TO MANAGERIAL ECONOMICS

Business or managerial economics can be seen as applied microeconomics. It is mostly application of micro-economics and some part of macro economics. The manager of a business enterprise has to make a lot of decisions. While making a business decision, he has to ensure the best use of the scarce resources.

The goal of a manager is either maximization of production with the available resources or minimization of cost for a given level of output. A study of the business or managerial economics helps managers in decision-making process. Since the resources of firms are scarce, they have to be used wisely. A greater degree of efficiency in their use will enable them to make either maximum profits or reasonably satisfactory profits. Now, the manager of a firm has a number of alternatives. Business or managerial economics helps in analyzing alternatives and the selecting the one which would achieve the optimal result. The following are some of the definitions of managerial or business economics.

E Mansfield defines managerial economics as-

'Managerial economics is concerned with the application of economic concepts and economic analysis to the problem of formulating material managerial decisions'.

Spencer and Siegelman defines Managerial economics as -

'The integration of economic theory with business practice for the purpose of facilitating decision making and forward planning by management'.

Prof. Evans J. Douglas defines managerial economics in these words:

'Managerial economics is concerned with the application of economic principles and methodologies to the decision making process within the firm or organization under condition of uncertainty. It seeks to establish rules and principles to facilitate the attainment of the desired economic goals of the management. These economic goals relating to costs, revenues and profits are important within both the business and non-business institutions'.

1.4 NATURE OF MANAGERIAL ECONOMICS

Nature of Managerial Economics:

A close interrelationship between management and economics has led to the emergence of managerial economics. Economics is concerned with the problem of allocation of scarce resources among competing ends by individuals, households, firms, etc. and has a number of analytical tools to understand and analyse such problems. Managerial economics applies economics to problems of choise of alternatives and allocation of scarce resources by firms.

Managerial Economics has both descriptive and prescriptive roles. It not only explains how various economic forces affect the working of a firm but also predicts the consequences of the decisions made by it. This is its descriptive (or positive) role. Managerial Economics also prescribes rules for the firms or their managers so that they can achieve their objectives effectively. This is its prescriptive role.

Scope of Managerial Economics:

As regards the scope of business economics, no uniformity of views exists among various authors. However, the following aspects are said to generally fall under managerial economics.

1. Demand Analysis and Forecasting
2. Cost and production Analysis.
3. Pricing Decisions, policies and practices.
4. Profit Management.
5. Capital Management.

The scope of managerial economics are discussed as follows:

1. Demand analysis and forecasting: The foremost aspect regarding scope is demand analysis and forecasting. A business firm is an economic unit which transforms productive resources into saleable goods. Since all output is meant to be sold, accurate estimates of demand help a firm in minimising its costs of production and storage. A firm must decide its total output before preparing its production schedule and deciding on the resources to be employed. Demand forecasts serves as a guide to the management for maintaining its market share in competition with its rivals, thereby securing its profit.

2. Cost and production analysis: A firm's profitability depends much on its costs of production. A wise manager would prepare cost estimates of a range of output, identify the factors causing variations in costs and choose the cost-minimising output level, taking also into consideration the degree of uncertainty in production and cost calculations. Production processes are under the charge of engineers but the business manager works to carry out the production function analysis in order to avoid wastages of materials and time. Sound pricing policies depend much on cost control. The main topics discussed under cost and production analysis are: Cost concepts, cost-output relationships, Economies and Diseconomies of scale and cost control.

3. Pricing decisions, policies and practices: Another task before a manager is the pricing of a product. Since a firm's income and profit depend mainly on the price decision, the pricing policies and all such decisions are to be taken after careful analysis of the nature of the market in which the firm operates. The important issues studied in this topic are Market Structure Analysis, Pricing Practices and Price Forecasting.

4. Profit management: Each and every business firms are tended for earning profit; it is profit which provides the chief measure of success of a firm in the long period. Profits are the reward for uncertainity bearing and risk taking. A successful business manager is one who can form more or less correct estimates of costs and revenues at different levels of output. The more successful a manager is in reducing uncertainty, the higher are the profits earned by him. It is therefore, profit-planning and profit measurement constitutes the most challenging area of business economics.

5. Capital management: Still another most challenging problem for a modern business manager is of planning capital investment. Investments are made in the plant and machinery and buildings which are very high. Therefore, capital management requires top-level decisions. It means capital management i.e., planning and control of capital expenditure. It deals with Cost of capital, Rate of Return and Selection of projects.

6. Inventory management: A firm should always keep an ideal quantity of stock. If the stock is too much, the capital is unnecessarily locked up in inventories At the same time

if the level of inventory is low, production will be interrupted due to non-availability of materials. Hence, a firm always prefers to have an optimum quantity of stock. Therefore, business economics will use some methods such as ABC analysis, inventory models with a view to minimizing the inventory cost.

7. Environmental issues: There are certain issues of macroeconomics which also form a part of business economics. These issues relate to general business, social and political environment in which a business enterprise operates.

8. **Business cycles:** Business cycles affect business decisions. They refer to regular fluctuations in economic activities in the country. The different phases of business cycle are depression, recovery, prosperity, boom and recession. Thus, managerial economics comprises both micro and macro-economic theories.

The subject matter of managerial economics consists of all those economic concepts, theories and tools of analysis which can be used to analyze the business environment and to find out solution to practical business problems

1.5 IMPORTANCE OF THE STUDY OF MANAGERIAL ECONOMICS

As mentionnned earlier, managerial economics is the application of economic theories to solving business problems. In fact managerial economics is a combination of economic theory and business management. Managerial economics deals with those aspects of traditional economics which are used in decision making in real life. These are adopted or modified to enable the manager to take correct decision. Thus , managerial economics helps in taking business decisions' like what products and services should be used, what production techniques should be used, how much output should be produced and at what prices, what should be the locations of new plants, how the available capital be allotted and so on.

A managerial economist is not only involved in decision making but also in planning for the future. Management and decision making are inseparable. Decision making involves plannig, organising, staffing, directing and controlling. It thus involves the process where an executive, by taking into consideration several alternative choices, ultimately comes to a best possible conclusion. Decision making is a continious activity which arises due to unforseen contingencies. The survival and growth of business in such situations is directly determined through decision making process. Since a business organisation has the available resources, such as capital, land and labour, a manager has to select the best alternative amongst them and employ it in the most efficient manner to attain the desired result. After the decision on the use of resources, plans about production, pricing and materials need to be implemented. In this way, decision making and forward plannig go co- jointly. As the future is uncertain, decisions need to be made on the basis of past data as well as the approximations being forecasted. For decision making process to be carried out in an efficient way, economic theory has great relevance as it deals with the concept of production,

demand, cost, pricing etc. This makes the understanding of concepts of managerial economics important for a manager so that he may apply the economic principles to business and appraise the relevance and impact of external factors in relation to business.

1.6 MAJOR FUNCTIONS OF A MANAGERIAL ECONOMIST

The main function of a managerial economist is the application of economic concepts and economic analysis to the problem of formulating rational managerial decisions.

The following are the responsibilities to be performed by a managerial economist:

- The managerial economist has to play a major role in the use of firm's scarce resources efficiently to get the optimal result. The business economist is responsible for maximization of production with available resources or ensure minimization of cost to produce a given amount of output.
- Investing in new plants, how much to invest , expansion programme for the future sources of funds, whether to go for new ventures or to continue with existing product pattern are some crucial investment problems. Managerial economist should have the capability of solving these kinds of problem.
- Fixing prices for the products of the firm is also an important decision-making problem. A managerial economist has to take decision on about pricing method –whether prices should be related to demand or cost or both and whether to follow marginal pricing, mark-up pricing, etc.
- A managerial economist has to solve inventory problems efficiently. Inventory problem is about holding optimal level of stocks of raw materials, semi-finished and finished goods over a period of time.
- The business economist has to acquire full knowledge about the behavior of the economy as a whole. The macro economic policies such as monetary, fiscal and industrial have an impact on the firm's prospect of profit. The business economist should have the ability to gauge the changes and should take timely decisions. Along with that,

he should have the knowledge of balance of payment, exchange rate, export and import policies.

- These days the world economy has been changing at a very fast rate. There is a rapid change of technology and production techniques. To remain competitive with the changing technology, there should be innovation of new products, and improvement of quality of the product. Managerial economist should have the knowledge about the technological changes and keep himself up-to-date with the latest technology.
- Business firms need finance from financial institutions. The profit of a firm depends on the ways of managing the financial matters such as financial needs and the alternative arrangement of business finance. The business economist has to ensure that there is proper arrangement of finance and that finance brings a fair return on capital employed.



CHECK YOUR PROGRESS

Q1: Define managerial economics.

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Q2: State two point indicating scope of managerial economics.

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Q3: State one function of managerial economist.

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1.7 LET US SUM UP

In this unit unit we have discussed the following:

- Managerial economics is the application of economic theories and principles in business management.

- The knowledge of economics is necessary for a manager to take managerial decisions.
- Like other subjects Economics has its principles. Each of the principles has its own implication.
- There is inter-link between economics and management.
- A managerial economist is one who gives advice to the manager in taking certain crucial decision regarding the firm. The business economist has its role and responsibilities.



1.8 FURTHER READING

1. H.L.Ahuja (2010), "*Business Economics* ", 11th Editon ,S. Chand & Company Ltd., India.
2. D. D. Chaturvedi, S. L. Gupta (2012), "*Business Economics*", 3rd Edition, International Book House, India.
3. Mankar V G, (1999), "*Business Economics*", 1st Edition,Macmillan India
4. Koutsoyiannis (2008), "*Modern Economics*", 2nd Edition, Macmillan Press Ltd



1.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q1: Managerial economics is concerned with the application of economic principles and methodologies to the decision making process within the firm or organization under condition of uncertainty. It seeks to establish rules and principles to facilitate the attainment of the desired economic goals of the management. These economic goals relating to costs, revenues and profits are important within both the business and non-business institutions.

Ans to Q2: Two point which indicate scope of managerial economics are:

1. Demand analysis and forecasting
2. Cost and production analysis.

Ans to Q3: The main function of a managerial economist is the application of economic concepts and economic analysis to the problem of formulating rational managerial decisions.



1.10 MODEL QUESTIONS

1) Define Managrial Economics. Is there any inter-link between economics and management? Discuss.

2) Discuss the principles of economics and its application

3) What are the role and responsibilities of a managerial economist?

4) In what way economics helps a manager in a business firm?

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UNIT 2: DEMAND ANALYSIS

UNIT STRUCTURE

2.1 Learning objectives

2.2 Introduction

2.3 Concept of Demand

2.4 The Idea of Demand and the Demand Curve

2.5 Types of Demand

2.6 Determinants of Demand

2.7 Demand Function

2.8 Movement Along a Demand Curve

2.9 Shift in the Demand Curve

2.10 Exceptions to the Law of Demand

2.11 Elasticity of Demand

- 2.11.1 Price Elasticity of Demand
- 2.11.2 Income Elasticity of Demand
- 2.11.3 Cross Elasticity of Demand

2.12 Let Us Sum Up

2.13 Further Readings

2.14 Answers to Check Your Progress

2.15 Model Questions

2.1 LEARNING OBJECTIVES

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

- give the definition of demand
- derive a demand curve
- Know about the different types of Demand
- explain the movement along a demand curve
- illustrate the shift in the demand curve
- state the three variants of elasticity of demand, i.e. price elasticity, income elasticity, and cross elasticity

2.2 INTRODUCTION

The theory of demand studies the various factors that determine demand. It is traditionally accepted that four factors affect the demand for a commodity, namely:

- its own price
- consumer's income
- prices of other commodities, and
- taste of the consumers.

The basic idea of demand is the willingness to buy a commodity or to enjoy a service. But to be effective, it should be backed by purchasing power. Other things remaining constant, there exists an inverse relationship between price and quantity demanded which is stated as law of demand.

The degree of responsiveness of quantity demanded of a good due to a change in its price/income of the consumer/prices of related commodities are indicated by price/income/cross elasticity of demand respectiveiy.

2.3 CONCEPT OF DEMAND

A large number of goods and services are required to satisfy human wants and desires. Some of these basic wants are : air to breathe to make life possible; food and water to sustain; clothing and housing to provide shelter from elements of nature; and a whole lot of things needed to make life comfortable. Some of these wants are satisfied without much efforts made to get the thing satisfying the wants. For instance oxygen is very important for life but it is freely available in nature and absolutely no conscious effort is required to obtain it. It is the gift of nature and there is no scarcity of it. Consequently, even though it is vital to make life possible, it is not the subject matter of Economics. But other things are not so easily available. An effort has to be made to get them, that is, they have to be consciously produced. This means that scarce resources have to be used in order to make them available, and those who wish to consume them have to pay a price which covers the cost of the resources used to produce them. The

fact that something is available only on payment of its price makes it a commodity or economic good.

A mere desire for a commodity is not a demand for that commodity. It is the desire to consume a certain quantity of a particular commodity backed by the ability and willingness to pay the price for it that constitutes a demand for that commodity at that price. If a person is willing to pay, but has no ability to pay, there is only desire and no demand. Demand for a commodity thus implies three things

a) Desire to acquire it
b) Willingness to pay for it, and
c) Ability to pay for it.

A person's demand for a commodity becomes effective only when he supports his desire with adequate purchasing power. The term 'demand' becomes meaningful only when it has reference to 'a price', 'a place', and 'a period'.

Demand is also expressed as a rate. For example, a household demand for rice may be expressed as 20 kg rice per week at a price of Rs.25 per kg rice. It will be meaningless if it is expressed as demand for rice is 20 kg at a price of Rs. 25 per kg. This is because such a statement does not tell us whether this household demand of 20 kg rice is for a day or a week or a month or a year or a decade. Therefore demand is always referred to particular time, particular price and particular place. "In Guwahati demand for rice in last month was 2000 quintals at Rs. 2500 per quintal" will be a meaningful sentence.

2.4 THE IDEA OF DEMAND AND THE DEMAND CURVE

Demand is the amount of particular goods or services that a consumer or group of consumers will want to purchase at a given price. But as said above, merely the want of something will not constitute demand. It should be backed by purchasing power to be effective demand. Usually demand in Economics means 'effective demand'. For example, you may dream of having an aeroplane of your own; but if you don't have the purchasing power to buy it, it will not be considered as demand. On the other hand, if

you have 100 rupees is your hand than you can demand the goods and services worth 100 rupees.

Demand is invariably related to price. There is an inverse relationship between price and quantity demanded known as law of demand. The law of demand expresses the functional relationship between quantity demanded of a commodity and its price. According to the law of demand, other things being equal, the quantity demanded will rise with a fall in its price. This implies that there is an *inverse* relationship between the quantity demanded and the price, given that other things remain the same. The other things that are assumed to remain unchanged consist of income of the consumer, prices of related goods, and the taste of the consumer.

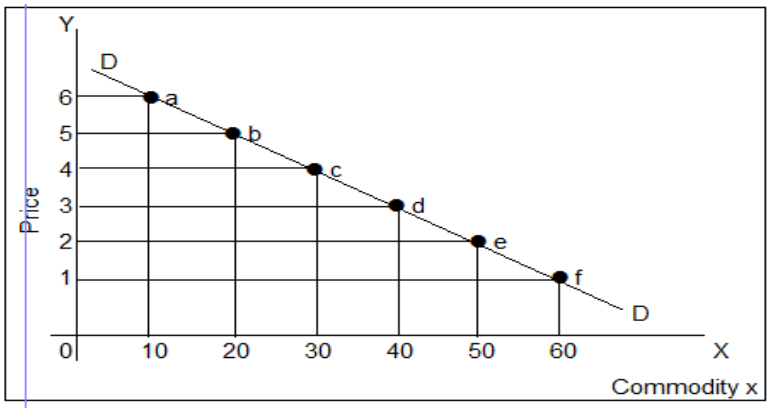
The law of demand can be illustrated by a demand schedule. And the demand schedules constitute the basis on which the demand curve is constructed. Table 2.1 shows a hypothetical demand schedule of a consumer. The table shows the various quantities demanded at different prices by the consumer. Thus, at price Rs.6, the quantity demanded is 10 units. As the price falls successively by Re.1, the quantity demanded correspondingly increases by 10 units for every decrease in the price.

Table 2.1: A Hypothetical Demand Schedule

Price (Rs)	Quantity Demanded	Price/Demane Combinations
(1)	**(2)**	**(3)**
6	10	a
5	20	b
4	30	c
3	40	d
2	50	e
1	60	f

Now, let us plot the various price and quantity demanded combinations of table 2.1 in the following figure 2.1.

Figure 2.1: Demand Curve of a Comsumer



By plotting the various price-quantity demanded combinations from table 2.1, we derive the demand curve DD in figure 2.1. Thus, the demand curve is a graphic representation of the demand schedule and it indicates the various quantities demanded for a commodity at various prices.

The demand curve slopes downward towards the right. This is because as prices fall, the quantity demanded goes on increasing. Thus, it shows that there exists an inverse relationship between the price of a commodity and the quantity demanded for it.

Individual Demand and Market Demand: It is to be noted that demand may be distinguished as **individual consumer's demand** and **market demand**. Market demand for a good is the sum total of the demands of the individual consumers who purchase the commodity in the market.

By definition, individual demand indicates the quantities of a good or service which the household is willing and able to purchase at various prices, holding other things constant. Although for some purposes it is useful to examine an individual consumer's demand, it is frequently necessary to analyse demand for an entire market made up of many consumers. We will now show how we derive the market demand curve from individual demand curves. Let us assume that there are only two consumers in the market. Their demands and the market demand are given below and the individual demand curves and the market demand curve are shown in figure 2.2 (a), (b) and (c).

Table 2.2: Demand Schedules for two Customers and the Market Demand Schedule

Price	Quantity Demanded (in Kgs)		
(In Rs)	**Consumer 1**	**Consumer 2**	**Market Demand**
(1)	**(2)**	**(3)**	**(4)**
12	4	6	4+6=10
10	5	8	5+8=13
8	6	10	6+10=16
6	7	12	7+12=19
4	8	14	8+14=22
2	9	16	9+16=25

The market demand is in fact the summation of the demand schedules of the two individual consumers. These demand schedules have been shown with the help of the figures 2.2 (a), (b) and (c)

Figure 2.2 (a): Demand Curve of Customer 1

Figure 2.2 (b): Demand Curve of Customer 2

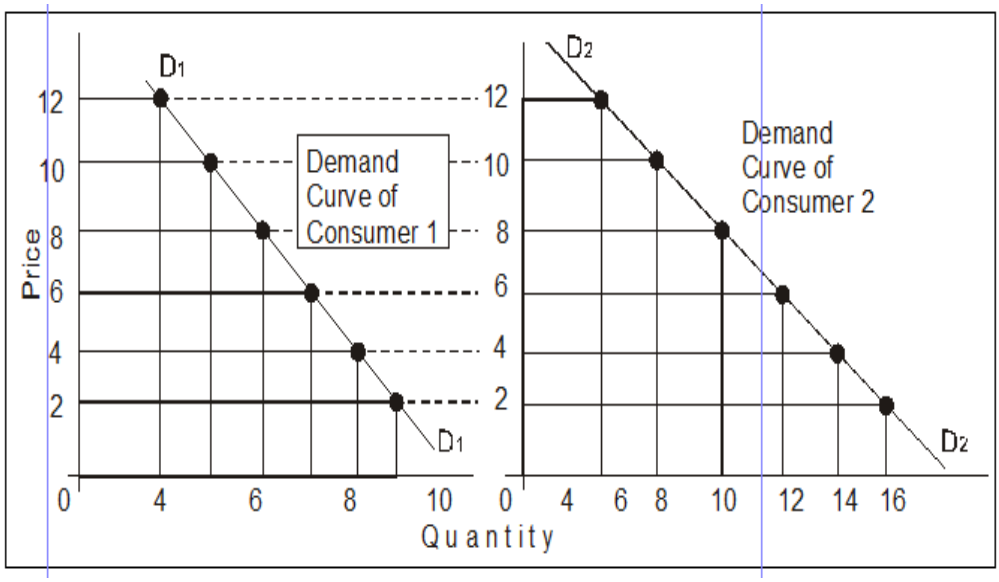
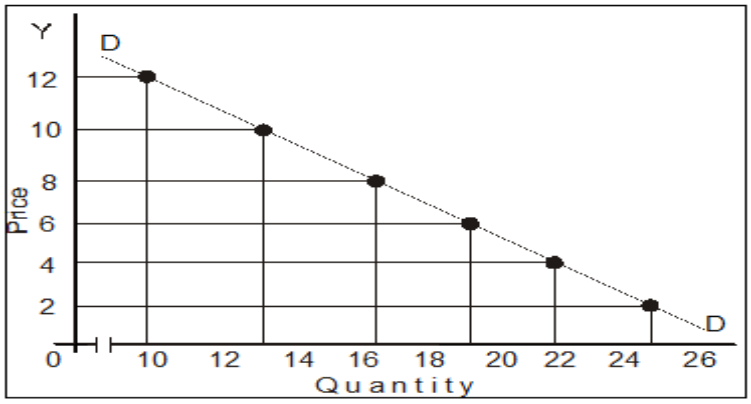


Figure 2.2 (c): Market Demand Curve



In the above, figure 2.2 (a) represents the individual demand schedule of consumer 1, figure 2.2 (b) represents the individual demand schedule of consumer 2, while figure 2.2 (c) represents the market demand schedule. Thus, D_1D_1 represents the demand curve of consumer 1, D_2D_2 represents the demand curve of consumer 2 and DD represents the market demand curve.

Assumptions of the Law of Demand: The working of the law of demand rests on the following assumptions:

- The habits and tastes of the consumer remain the same.
- There is no change in income of the consumer.
- The prices of other related goods remain the same.

It is to be noted that while the law of demand is universally applicable, it may not hold good in certain cases. We shall discuss this in the next section.



CHECK YOUR PROGRESS

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

(a) Other things remaining the same, there exists an inverse relationship between the quantity demanded and its price.

(b) Change in demand occurs due to a change in the price of a commodity.

(c) Market demand is the summation of individual demands of all the consumers in the market.

Q 2: Fill in the blanks.

(a) By definition, other things remaining the same, ... indicates the quantities of goods or services which the household is willing to and able to purchase at various prices.

(b) The demand curve slopes ..... towards the right.

(c) ..... for a good is the sum total of the demand of the individual consumers who purchase the commodity in the market.

Q 3: How would you derive a market demand curve from individual demand curves? (Answer in about 30 words)

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2.5 TYPES OF DEMAND

The different ways of classifying demand are as follows :

Individual demand and market demand :

The quantity of a commodity that an individual demands at a particular price and time is known as individual demand of a commodity. The total quantity that all the consumers buy at a particular price during particular period is known as market demand of the commodity.

In other words, the sum total of the individual demands is the market demand of a commodity. Say, there are three buyers of a commodity namely– A, B and C. Their individual demand at different prices is given in Table 2.3. The last column represents the market demand.

Table 2.3 : Price and Quantity Demanded

Price of the Commodity (Rs. Per Unit)	Quantity Demanded by			Market Demand
	A	B	C	
20	5	2	2	8
9	7	3	4	24
8	8	4	6	28
7	9	5	7	22
6	22	7	9	27

Demand for consumer goods and producer goods :

Consumer goods are meant for final consumption e.g. food items. Producer goods are those which are used for production of other goods. The demand for consumer good is also known as direct demand, for they are used for final consumption. The demand for producer goods (labour, raw material, machinery etc) is a derived demand as the demand of the same depends on the demand for consumer good. If the demand for bread increases the demand for labour to be used in making bread will also increase.

Demand for durables and perishable goods :

Durable goods are those which can be used over a period of time and can be stored. The utility is not destroyed in single use. For example cloth, furniture, electronic gadgets etc.

Perishable goods can not be stored for a long time. They get spoilt. Examples of perishable goods are milk, green vegetables, fruits etc.

2.6 DETERMINANTS OF DEMAND

There are various determinants or factors on which demand for a commodity depends. These determinants may be economic and non-economic. Some of the important determinants of demand are follows:

- **Price of the Commodity :** Price of the commodity is the main determinant of demand for a commodity. The law of demandstates that if other variables remain constant or unchanged, there is a definite relationship between the price of the commodity and its

demand. The relation is inverse. When price of the commodity falls demand for it increases and when the price of the commodity rises demand for it decreases.

- **Consumer's Income :** There is a positive relationship between consumer's income and the demand for a commodity. When income of the consumer increases the demand for the commodity also increases. When income increases capacity of the consumer to purchase the commodity increases and therefore the demand also increases.
- **Price of the Related Commodity :** The demand for a commodity is also affected by the price of its related commodity. For example, if the price of coffee falls demand for tea will be affected, if the price of petrol increases the demand for the car will be affected.
- **Consumer's Tastes and Preferences :** Consumer's tastes and preferences are important determinants of demand for a commodity. The demand for a commodity changes when the taste and preference of the consumer changes. If the taste for a particular commodity changes positively, the demand for that commodity will increase. Advertisement, improved knowledge etc. cause a change in the taste and preference.
- **Consumer Expectations :** If consumers expect a fall in the future price, demand for the commodity will be affected. If the commodity is durable in nature, now consumers will postpone their purchasing. On the other hand if the consumers hear that the price of a particular commodity is going to rise and the commodity is essential, then the consumers will try to purchase more at the going price. Similar is the case of expectation about future income. If a consumer is certain about rise in future income, he will try to purchase more even at a high price and vice versa.
- **Population of the Country :** When population of the country increases, demand for cloth, house, rice, medicine, school, college etc increases.

- **Credit Facility :** When the credit facility is available, demand for commodities particularly of durable commodities and commodities of status symbol increases. If banks offer easy credit facility on installment basis, demand for two wheelers and four wheelers will definitely increase.
- **Weather :** Weather is another determinant which affects the demand for a commodity. Demand for cold drinks increases when it is very hot. Similarly, demand for tea and coffee will increase in a cold rainy day.

2.7 DEMAND FUNCTION

The demand function describes the relationship between demand for a commodity and its determinants. In mathematical term the demand function for a commodity can be expressed as follows : $D_X = f (P_X, Y, Pr, T, E, D, C, W, \ldots\ldots, Z)$

where, D_X = demand for commodity X

Y = income of the consumer

P_X = price of the commodity X

P_r = price of related goods

T = taste and preference of the consumer

E = expectation about future price and income

D = demography

C = credit facility

W = weather

Z = all other determinants not discussed

The popular form of demand function is:

$D_X = f (P_X)$

Here, other variables are assumed to be constant.

The demand function postulates the law of demand. The law of demand explains the inverse relationship between demand and price. According to the law of demand if price falls, demand increases and if price rises, demand decreases, other thing remaining constant.

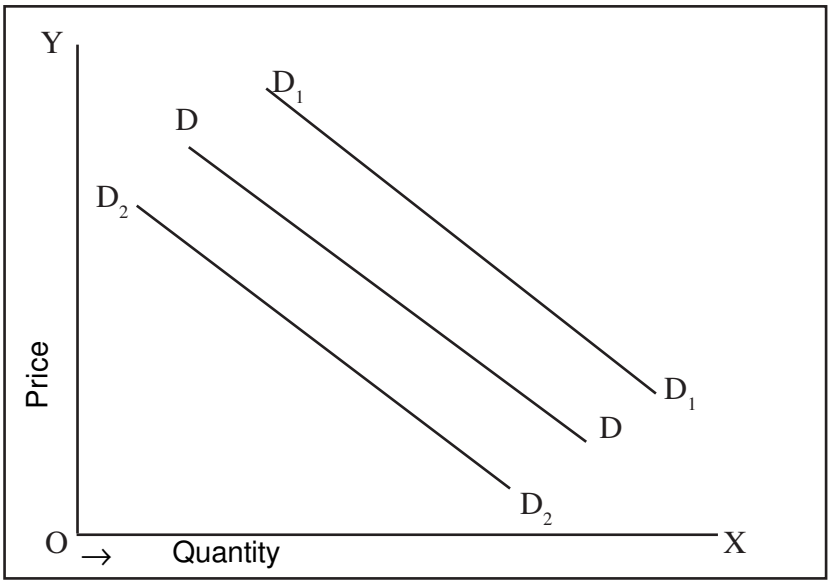
2.8 MOVEMENT ALONG A DEMAND CURVE

Movement along a demand curve means change in the quantity demanded in response to the change in price. This movement is in the same demand curve. This situation can be illustrated with the same diagram of 2.1 or 2.2(c) where the general demand curve and market demand curve has been portrayed. Here movement along different points of the demand curve corresponding to the different combination of price and quantity demanded will clearly show you the movement along a demand curve.

2.9 SHIFT IN THE DEMAND CURVE

Movement along a demand curve can show changes in quantity demanded corresponding to various price level of a particular good or service. But for change in demand, we have to show the shift in demand curve. A shift to the left of the original demand curve will show decrease in demand and shift to the right will show increase in demand. This can be shown with the help of the following diagram-

Figure 2.3: Shift in the Demand Curve



In the above figure 2.3, shift in the demand curve has been shown. DD is the original demand curve. A decrease in demand is shown by downward shift in the demand curve to the left (D_2D_2), and an increase in

demand is shown by an upward shift in demand curve to D_1D_1. This shift in demand may be caused by some factors other than price. This change can be due to the taste and preference of the consumer, new innovation and technology etc.

2.10 EXCEPTIONS TO THE LAW OF DEMAND

For certain commodities the law of demand does not hold, and they exhibit a direct relationship between the price and quantity demanded.

The commodities that violates the 'law of demand' are mentioned below:

- **Giffen Goods:** Giffen Goods are special categories of inferior goods which do not follow the 'law of demand'. Thus, a fall in the price of such a good will result in a decrease in the quantity demanded and vice versa. Robert Giffen studied this paradox. This happens because the income effect of the price change of a Giffen good is positive and is greater than the negative substitution effect. This results in a price effect which is positive, resulting in the price and quantity demanded changing in the same direction.

Besides Giffen Goods, the law of demand may not operate in the case of the following goods:

- **'Status Symbol' Goods:** These goods are bought because they confer a social prestige to the buyer. According to ***Torstein Veblen***, a fall in their prices will result in the curtailment in the quantity demanded, resulting in the violation of the law of demand. This generally happens in case of luxury goods.
- **Speculative Consumption:** Speculation of further rise in prices of the very essential products may induce consumers to purchase more of a commodity as its price increases, resulting in a temporary failure of the law of demand. Suppose, the price of a very important drug/ medicine has started to increase very sharply. In such a situation, in anticipation of further increase in prices in the coming days, the consumers may find it more beneficial to purchase more quantity of the drug than actually required.



CHECK YOUR PROGRESS

Q 4: State whether the following statements are True or False.

(a) According to the law of demand, there exists an inverse relationship between the price of a commodity and its demand.

(b) The law of demand does not hold good in case of Giffen goods.

Q 5: Fill in the blanks.

(a) Price effect in the summation of substitution effect and the .....

(b) The relative strength of the two components of the price effect determines the relationship between the price of a commodity and ..... for it.

Q 6: Define the term Giffen Good? (Answer in about 40 words)

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Q 7: Why is the law of demand violated in case of specultive consumption? (Answer in about 50 words).

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Q 8: Distinguish between change in quantity demanded and change in demand. (Answer in about 50 words)

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2.11 ELASTICITY OF DEMAND

Elasticity of demand relates to the degree of responsiveness of quantity demanded of a good to a change in :

- its price, or
- the consumer's income, or
- the prices of related goods.

Thus, change in quantity demanded as a response to the the above three variable gives us three different concepts of elasticity of demand, namely:

- price elasticity of demand (resulting due to a change in price)
- income elasticity of demand (resulting due to a change in income)
- cross elasticity of demand (resulting due to a change in the prices of related goods).

2.11.1 Price Elasticity of Demand

Price elasticity of demand measures the responsiveness of quantity demanded of a good to changes in its price, other things remaining the same. Price elasticity of demand can be expressed by two related measures, viz:.

- Point Elasticity of Demand, and
- Arc Elasticity of Demand.

Now, let us explain these two concepts in some detail.

- **Point Elasticity of Demand:** Point elasticity of demand technique is used to measure the price elasticity of demand of a good if the change in its price is very small.

Hence, the point elasticity of demand is defined as the proportionate change in the quantity demanded of the product due to a very small proportionate change in price. Thus,

$$\text{Point Elasticity of demand} = \frac{\text{Proportion ate change in quantity demanded}}{\text{Proportion ate change in price}}$$

$$\text{Thus, } e_p = \frac{\Delta Q / Q}{\Delta P / P} = \frac{P}{Q} \times \frac{\Delta Q}{\Delta P}$$

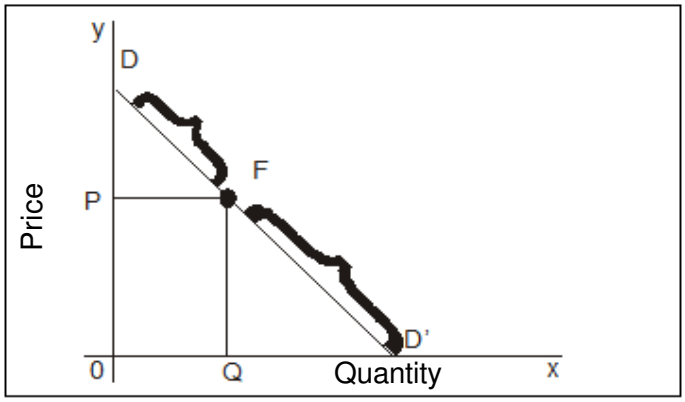
wheres, e_p means price elesticity, P means price, Q means

quantity, and Δ means infinitesimal (very very small) change in the variable concerned.

The price elasticity of demand is always negative due to the inverse relationship between price and quantity demanded. However, in general the negative sign is ignored in the formula.

Graphically, the point elasticity of demand in a linear demand curve is shown by the ratio of segments of the line to the right and to the left of any particular point. This has been shown in figure 2.4.

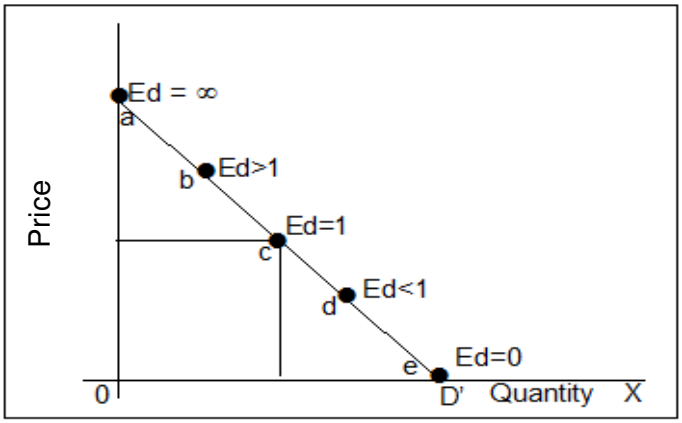
Figure 2.4: Point Elasticity in a Linear Demand Curve



Thus, in figure 2.4 point elasticity of demand on point F of the linear demand curve DD' is measured as :

Now given this graphical measurement of point elasticity, it is obvious that a linear demand curve like the one in figure 2.4, the mid-point will represent unitary elasticity of demand. This has been shown in figure 2.5.

Figure 2.5 : Elasticities on Different Points of a Linear Demand Curve



From figure 2.5, it can be seen that at point c of the demand curve DD/, DC = D/C (i.e. the lower segment of the demand curve equals the upper segment). Thus, elasticity of demand at this point c is 1. Above this point and below point' a of the demand curve where it touches the vertical axis, the elasticities at various points (say, at point 'b') will be greater than 1. Similarly, below the point 'c' and above point 'e' where the demand curve touches the horizontal axis, elasticities at various points (say at point 'd') will be less than 1. Elasticities at two extreme points of the demand curve, i.e., at points a and e will be infinite and zero respectively.

Thus, we find that the point elasticity of demand ranges between 0 and 1,i,e,

$0 < e_p < 1$

Now,

a) If $e_p=0$, the demand is perfectly inelastic.

b) If $e_p=1$, the demand is perfectly elastic.

c) If $e_p<1$, the demand is relatively elastic.

Now, let us explain these situations in some detail.

a) If $e_p=0$, the demand is perfectly inelastic. This implies that any proportionate change in price will have no effect on the quantity demanded. A perfectly inelastic demand is indicated in figure 2.6, which is a straight perpendicular on the horizontal axis.

Figure 2.6: Vertical Demand Curve : Perfectly Inelastic



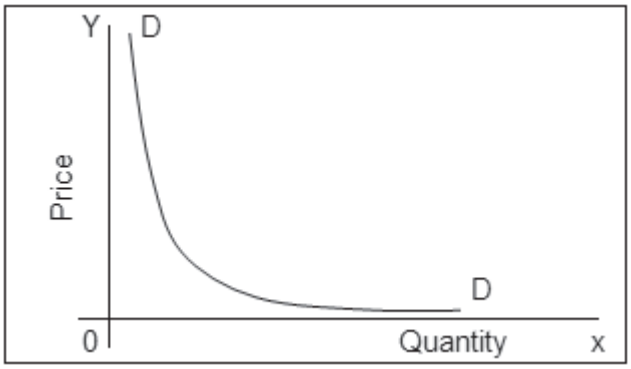
b) If $e_p=\infty$ the demand is perfectly elastic. this implies that for a small change in price there would be a infinitely large change in quantity demanded. This gives us a demand curve which is parallel

to the horizontal axis as has been shown in the following figure 2.7.

Figure 2.7: Horizontal Demand Curve : Perfectly Elastic

c) If e_p=1, the demand is unitarily elastic. Here, a proportionate change in the price will result in the same proportionate change in the quantity demanded. The demand curve having unitary elasticity is a hyperbola as has been shown in figure 2.8.

Figure 2.8: Horizontal Demand Curve : Unitary Elastic



➢ **Arc Elasticity of Demand:** The arc elasticity of demand measures the price elasticity of demand when the change in price is somewhat large. In terms of demand curve, the arc elasticity measures the price elasticity of demand over an arc between two points on the demand curve. In fact, it is a measure of the average elasticity, and represents the elasticity of the mid-point of the chord that joins the two points (say, A and B) on the demand curve. The two points are defined by the initial and the final prices.

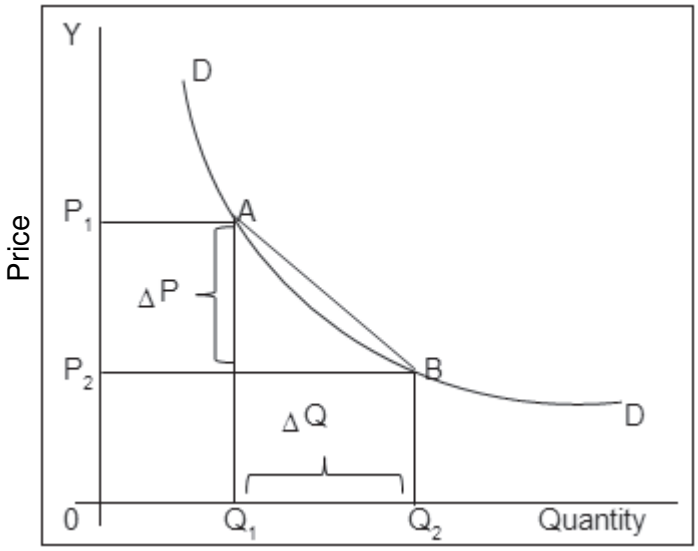
Thus, the arc elasticity of demand is:

$$e_1 = \frac{Q}{P} \times \frac{P_1 + P_2}{Q_1 + Q_2}$$

Where, e_p=arc elasticity, $Q=Q_1-Q_2$, $P = P_1 - P_2$, Q_1 and Q_2 are the two quantities at the two prices P_1 and P_2 respectively.

The concept of Arc elasticity of demand has been explained with the help of figure 2.9.

Figure 2.9: Arc Elasticity of Demand



In figure 2.9, the elasticity of demand in the AB segment of the demand curve DD is indicated by the arc elasticity of demand. Thus, the arc elasticity of demand is average elasticity of the segment AB and is represented by the midpoint of the chord AB joining the two points A and B of the demand curve DD.

Δ

2.11.2 The Income Elasticity of Demand

The income elasticity of demand is defined as the proportionate change in the quantity demanded due to a proportionate change in income. Thus,

$$\text{Thus, } e_y = \frac{Q/Q}{Y/Y} = \frac{Y}{Q} \times \frac{Q}{Y}$$

Where e_y means income elasticity, Y means income, Q means quantity, means infinitesimal change.

For example, suppose income of Mr. X has increased from Rs.5000 to Rs.6000 per month, i.e., by 20 percent. As a result, expenditure of consumption of his fruit basket increases from 10 kg to 12 kg, i.e., by 20 percent. Thus, income elasticity of demand in this case will be 20/20 or 1.

The income elasticity of demand had been used by some economists to classify goods as luxuries, necessities and inferior goods. Thus :

$e_y = 0$ means : the commodity is a necessity

$0 < e_y$ means : the commodity is luxury, and

$e_y < 0$ means : the commodity is inferior.



ACTIVITY 3.1

Calculate the income elasticity of demand and indicate the range of income over which a commodity x is a luxury, a necessity or an inferior goods.

Income (in Rs.)	Quantity (Q_x) (y)	$\Delta Q/Q$ (in %)	$\Delta y/y$ (in %)	e_y	Types of Goods
8000	5				
12000	10	100	50	2	luxury
16000	15	—	—	—	—
20000	18	—	—	—	—
24000	20	—	—	—	—
28000	19	—	—	—	—
32000	18	—	—	—	—

2.1

2.11.3 The Cross Elasticity of Demand

When two goods are related to each other, then the change in demand for one good in response to a change in the price of the second good is indicated by the cross elasticity of demand. The cross elasticity of demand is defined as the proportionate change in the quantity demanded of x in response to a proportionate change in the price of y.

$$\text{Thus, } e_{xy} = \frac{\Delta Q_x / Q_x}{\Delta P_y / P_y} = \frac{P_y}{Q_x} \times \frac{\Delta Q}{\Delta P_y}$$

where, e_{xy} means cross elasticity of demand, Qx means Quantity of the commodity x, Qy means change in quantity y, P_y meansPrice of the commodity y, and ΔP_y means Change in price of y.

Now,

e_{xy} <0 means : x and y are complimentary goods, and

e_{xy} > 0 means : x and y are substitutes.



CHECK YOUR PROGRESS

Q 9: What do you mean by elasticity of demand? (Answer in about 40 words)

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Q 10: How will you graphically measure the point elasticity of demand of a linear demand curve? (Answer in about 40 words)

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Q 11: Mention some of the applications of the concept of income elasticity of demand. (Answer in about 40 words)

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2.12 LET US SUM UP

- The theory of demand studies the various factors that determine demand.
- The law of demand states that, other things remaining same, there exists an inverse relationship between quantity demanded and the price.
- "Change in Demand" and the "Change in Quantity Demanded" are not the same thing.
- Demand may be distinguished as individual consumer's demand and market demand. Market demand for a good is the sum total of the demands of the individual consumers who purchase the commodity in the market.
- For certain commodities, the law of demand does not hold good.
- Income effect of a price change of a Giffen good is positive and is greater than the negative substitution effect.
- Besides Giffen Goods, the law of demand may also not operate in the case of status symbol goods and in case of speculative consumption.
- Elasticity of demand relates to the degree of responsiveness of quantity demanded of a good to a change in
  - Its price (price elasticity)
  - The consumer's income (income elasticity)
  - The prices of related goods (cross elasticity)
- Price Elasticity of demand can be further classified as point elasticity of demand and arc elasticity of demand.



2.13 FURTHER READINGS

1) Ahuja, H.L. (2003). *Advanced Economic Theory;* New Delhi: S.Chand & Co.

2) Koutsoyiannis, A (1979). *Modern Microeconomics;* New Delhi: Macmillan.

3) Jhingan, M.L. (1986). *Micro Economic Theory;* New Delhi: Konark Publications.



2.14 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: a) True b) False c) True

Ans to Q No 2: a) By definition, other things remaining same, the individual demand schedule indicates the quantities of goods and services which the household is willing to and able to purchase at various prices.

b) The demand curve slopes downward towards the right.

c) Market demand for a good is the sum total of the demand of the individual consumers who purchase the commodity in the market.

Ans to Q No 3: The market demand curve can be derived from the demand curves of the individual. This is done by adding the quantities demanded by all the consumers, at each price. Thus, we get the aggregate demand curve for the market as a whole.

Ans to Q No 4: a) True b) True

Ans to Q No 5: a) Price effect is the summation of substitution effect and the income effect.

b) The relative strength of the two components of the price effect determines the relationship between the price of a commodity and the demand for it.

Ans to Q No 6: A Giffen Good is a special type of inferior good which does not follow the “law of demand”. Thus, a fall in the price of such a good will result in a decrease in the quantity demanded whereas a rise in its price would induce an increase in the quantity demanded.

Ans to Q No 7: The law of demand is violated in case of speculative consumption because, speculation of further rise in pricces may induce consumers to consume more of a commodity as its price increases, resulting in a temporary failure of the law of demand.

Ans to Q No 8: A change in "quantity demanded" is an out come of a change in price, as other things remain constant. On the other hand, a change in "demand" may occur with prices remaining constant, while other factors such as income of the consumer, prices of related goods and taste of the consumer changes.

Thus, change in quantity demanded is represented by a movement along the same demand curve, while the change in demand results in an upward or downward shift in the demand curve.

Ans to Q No 9: Elasticity of demand means the degree of responsiveness of quantity demanded of a good to a change in :

- its price, or
- the consumer's income, or
- the price of related goods.

Ans to Q No 10: Point elasticity of demand in a linear demand curve can be shown graphically by taking the ratio of segments of the line to the right and to the left of any particular point. Thus, point elasticity of demand on a linear demand curve can be measured by lower segment, upper segment on any point of the demand curve.

Ans to Q No 11: The income elasticity of demand can be used to classify goods as luxuries, necessities and inferior goods. Thus,

e_y=0 means: the commodity is a necessity.

$e_y > 0$ means : the commodity is luxury, and

$e_y < 0$ means : the commodity is inferior.



2.15 MODEL QUESTIONS

Q 1: Define the term elasticity of demand. What are the different types of the price elasticity of demand?

Q 2: Deduce the demand curve when the price elasticity of demand of product is zero.

Q 3: What is Point elasticity of demand? Derive the elasticities of demand on the different parts of demand curve.

Q 4: Differentiate between individual demand and market demand. How can you derive the market demand curve from individual demand schedules of two consumers?

Q5: Briefly explain how the relationship between the substitution effect and the income effect help us to derive the relationship between the price of a commodity and its demand?

Q 6: Define “price elasticity of demand”. Distinguish between “price elasticity” and “arc elasticity”. How would you measure the two?

Q 7: State the law of demand? On its basis construct a demand schedule and derive the demand curve.

Q 8: Discuss under what conditions, the law of demand is violated. What is the consequences?.

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UNIT 3: DEMAND FORECASTING

UNIT STRUCTURE

3.1 Learning Objectives

3.2 Introduction

3.3 Meaning of Demand Forecasting

3.4 Level of Demand Forecasting

3.5 Creteria for Good Demand Forecasting

3.6 Methods or Techniques of Demand Forecasting

- 3.6.1 Subjective Methods of Demand Forecasting
- 3.6.2 Statistical Methods of Demand Forecasting

3.7 Demand Forecasting for New Products

3.8 Let Us Sum Up

3.9 Further Readings

3.10 Answers to Check Your Progress

3.12 Model Questions

3.1 LEARNING OBJECTIVES

After going through this unit, you will be able to

- explain the meaning of Demand Forecasting
- define level of Demand Forecasting
- discuss the criteria for good demand forecasting
- explain the method or technique of demand forecasting
- describe Survey Method of Demand Forecasting
- explain Statistical Method of Demand Forecasting
- discuss Demand Forecasting for new Product

3.2 INTRODUCTION

This unit will familiarize you with concepts such as demand forecasting, level of demand forecasting, criteria for good demand forecasting and method of demand forecasting, survey method of demand forecasting, statistical method of demand forecasting and demand forecasting for new product etc.

Demand forecasting is predicting future demand for products. In other words, it refers to the prediction of probable demand for a product or a service on the basis of the past events and prevailing trends in the present. The level of demand forecasting is the method of estimating probable demand for their products or services by each individual production or service organisation. Good forecasting of future demand is important for calculating the rate of return on capital invested. There is no particular method that enables organisations to anticipate risks and uncertainties in future; however certain criteria used for demand forecasting are accuracy, durability, flexibility, affectivity, plausibility, acceptability, availability and economy etc.

There are different approaches to demand forecasting: survey methods and statistical method of demand forecasting.

The first approach involves forecasting demand by collecting information regarding the buying behavior of consumers from experts or through conducting surveys. The second approach is to forecast demand by using past data through statistical techniques. It includes time series analysis, barometric technique, regression analysis and simultaneous equation model. The survey method is generally for short term forecasting, whereas statistical methods are used to forecast demand in the long run.

Demand forecasting may be used in production planning, inventory management, and at times in assessing future capacity requirements, or in making decisions on whether to enter a new market.

3.3 MEANING OF DEMAND FORECASTING

A forecast is a prediction or estimation of future situation. Demand forecasting means prediction of future demand. It is the method of forecasting customer demand to drive holistic execution of such demand by corporate supply chain and business management. To reduce the uncertainty in planning for future production level, demand forecasting is essential. Demand forecasting techniques involve both informal methods, such as educated guesses, and quantitative methods, such as the use of historical sales data and statistical techniques or current data from test markets. The more realistic the forecasts, more effective decisions can be taken for the future.

3.4 LEVEL OF DEMAND FORECASTING

The demand forecast for a product may be of different level. It may be in respect of aggregate demand or macro level demand forecasting, industrial level and at a micro or individual level.

As regards aggregate demand, it is usually measured by the level of gross national product. As future is uncertain and unknown, the managers have to make plans for future level of production. The changes in aggregate demand have repercussion on individual demand. However, an individual firm is more interested in forecasting demand for its own product or its market share rather than gross national product. Demand forecast of an industry's product usually depends on level of overall economic activity or performance of the major sectors of the economy. Demand forecasting by an individual firm depends on industry's demand forecast or its sales estimates. When each individual production or service organization estimate demand for their products or services, it is called micro level demand forecasting. Generally, an individual firm estimates the future demand by considering industry's demand forecast and its market share.

3.5 CRITERIA FOR GOOD DEMAND FORECASTING

There are different criteria for assessing the quality of demand forecasting. As discussed in the introductory section of the chapter, good forecasting of the future demand is essential for calculating rate of return on capital. Capital investment yields returns over number of years in future. It is by comparing rate of return on capital investment with the current rate of interest that decision regarding investment is made. Generally, forecast is said to be successful when the excepted demand is equal to the actual demand. But it is very difficult to make correct forecasting. This can only be possible only if the correct method of demand forecasting is adopted. Selecting the right criteria for good demand forecasting is not an easy task. But there are some general acceptable criteria on the basis of which we can differentiate a good demand forecast from a bad demand forecast. The criteria that need to be considered before forecasting the demand for a product are as follows:

(a) Accuracy of Demand Forecasting:

Accuracy of demand forecasting implies that an organization should make forecasts close to real figures, so that the real picture of demand can be determined. It should be specific and close to real figures. For example, there would be an increase in sales in the coming years is an inaccurate forecast. On the other hand, there would be an increase in sales by 20% in the next year is an accurate forecast.

(b) Durability of Forecasting:

Durability is a criterion for good demand forecasting. It implies that forecasts should be done in such a way that they can be used for long periods as forecasts involves a lot of time, money, and efforts.

(c) Flexibility of Demand Forecasting:

This criterion of demand forecasting demands that forecasts should be adjustable and adaptable to changing business environment. In today's uncertain business environment, there is a rapid change in the tastes and preferences of consumers, which affect the demand for products. Therefore, the demand forecasts made by an organization should reflect those changes. Apart from this, an organization, while making forecasts, should consider various business risks that may take place in the future.

(d) Acceptability of Demand Forecasting:

Acceptability is one of the most important criterion of demand forecasting. An organization should forecast its demand by using simple and easy methods. In addition, the methods should be such that organizations do not face any complexities. However, organizations generally prefer advanced statistical methods.

(e) Availability:

This criterion of demand forecasting demands that adequate and up-to-date data should be available for forecast. Lack of sufficient data may lead to incorrect forecasting. The forecasts should be done in timely manner so that necessary arrangements can be made related to the market demand.

(f) Plausibility:

This criterion of demand forecasting implies that the demand forecasts should be reasonable, so that they are easily understood by individuals who are using it.

(g) Economy:

Another other important requirement for demand forecasting is that it should be economically viable. The planning for forecasting should be done in such a manner that the costs should be minimized and benefits should be maximized.



CHECK YOUR PROGRESS

Q1. Define demand forecasting.

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Q2. Mention two criteria for demand forecasting.

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3.6 METHODS OR TECHNIQUE OF DEMAND FORECASTING

Accurate demand forcasting is essential for a firm/industry to enable it to produce the required quanities at the right time and arrange well in advance for the various factors of production, e.g., raw materials, equipment, machine accessories, etc. Forecasting helps a firm/industry to access the problem demand for its products and plan its production accordingly.

However, there is no essay method or a simple formula which enables a manager to predict the future. The main challenge to forecast demand is to select an effective technique. There is a wide variety of techniques to forecast demand and it is very important that the most suitable technique is selected. This requires an understanding of all popular techniques.

Broadly speaking, the techniques of demand forecasting depends upon information on only three questions –

(i) What do people say? This involves the method/techniques of surveys and opinion

(ii) What do people do? This involves test marketing

(iii) What people have done? This involves analysis of past data.

The choice of a specific technique depends on the following factors :

(i) the immediate objectives of forecast-whether it is for a new product or an extension of an existing one or to study the impact of a new advertisement;

(ii) the time frame – the cost of forecasting should not be more than its benefits;

(iii) the time frame – whether the forecast is for the short period or the long period;

(iv) the nature and quality of data available-whether the data exhibits a clear trend or is unstable.

There are several methods which can be used forecast future demand for the products. For the sake of convenience, we can categories the various techniques under two broad heads – subjective and quatitative.

3.6.1 Subjective Methods of Demand Forecasting

Subjective methods of forecasting deals with the first two questions – what do people say and what do they do. These methods are more useful in forecasting in cases where no past data are available. Some of the common subjectives methods are -

1. Consumer Survey Method : A direct method to obtain information about future demand for goods is to conduct a survey. Surveys are important techniques for short – term forecasts. This technique is normally used when a firm is planning to introduce a new product or make substantial changes in the existing product.

There are two types of survey –

(i) Complete Enumeration and

(ii) Sample survey

1. Complete Enumeration Method: Complete enumeration method is just like population census method. In this method, all consumers of the product are asked questions about quantity of a product they plan to buy in future if there is a change in the price of

the product, changes in income, advertisement expenditure etc. With this information, the total future demand for the product can be estimated. For analytical purpose, the gathered information is classified and tabulated. Now if D is the total quantity demanded of a product by each consumer, and N is the number of consumers, then total demand forecast for the product is given by

Total forecasted Demand = $\sum_{i=1}^{N} Di$

The main advantage of this method is that it is free from any bias or value judgment of the investigator. The task of the investigation is to just record the data or information. In this method, there is higher degree of accuracy of the data. Another advantage of this method is that it is suitable for heterogeneous units and indispensible in some cases such as where completed population is required. The problem with this method is that it is more costly and time consuming. It is very difficult to study the whole universe as it requires more finance. The complete enumeration method is suitable only in the following cases.

(a) Where the population is not so vast.
(b) Where there is enough time to collect data.
(c) Where higher degree of accuracy is required
(d) Where there is sufficient availably of fund

2. Sample Survey Method: As it is clear from the above discussion that complete enumeration method is highly expensive and time consuming, therefore an alternative method of consumer survey, namely, sample survey is adopted. In this method only few consumers are selected at random or on a stratified basis. Questions are asked from them through personal interviews or mailed questionnaire about their intended demand for a product and their response to changes in price of the product, their incomes, prices of competing products etc. The data so collected are classified and tabulated for analysis of consumers demand. Compared to the method of complete enumeration, sample survey technique is less costly and less cumbersome. But for getting reliable result, the

investigator has be very careful regarding the adoption of the sampling technique. Therefore for getting correct result, the sample size should be sufficiently large and it should be selected at random so that it is free from any kind of bias.

Consumer survey method is one of the popular sample survey methods of demand forecasting. This is a very transparent method of gathering the information. The targeting parameter in this method is the buyers' intention. Consumers are either targeted to the broadened limit or narrowed considering specific categories like location, gender, age etc. The responses of the targeted sample groups are analysed properly to make an accurate prediction about the future demand.

1. Expert Opinion Method : Another method of demand forecasting is to obtain views of specialists (either internal or external to the firm) who are well - informed about the market possiblities of a product. Though these predictions of demand by experts are not always based on any hard data, but they can provide useful information about demand for the product. There are various methods of confirming the opinion regarding future demand by experts. Two such methods are

(i) Group Discussion and

(ii) Delphi Technique

Group Discussion : In this method, experts meet as a group to find out future demand level and the decisions may be takemn with the help of brainstorming sessions or by structured discussions. These discussions may be physical or through electronic media bike video conferencing.

Delphi Technique : In the Delphi technique, opinion of a number of experts about future demand is first obtained without their face to face interaction. Then, each expert is given a summary of the opinions of other experts. This offers scope for revision of previous replies and the group eventually converges towards the "correct" answer.

3. Market Experiments : Business firms make market experiments to forecast demand for their product when they make changes in price, advertising expenditure, or want to introduce a new product. There are two types of market experiments – (i) Test Marketing and (ii) Controlled Experiments.

(i) Test Marketing : In this technique, initially a test area is selected which is representative of the market where the new product is to be launched. This test are may, thus, consist of several towns and cities, or a particular region of a country, or a particular region of a country, or a sample of consumers. By introducing a new product in the test market, consumer response can be studied. The major advantage of this method is that forecast can made based on actual consumer behaviour.

(ii) Controlled Experiments : In this technique of demand forecasting, a sample of some consumers of a product which are representative of the target market is selected. They are then asked to visit a shopping store where various brands of a product are available. Their preferences are recorded. After that they are provided advertising materials of the different brands and a certain amount of money to make purchases of the products of different brands. The quantity of the product purchased by them is then recorded.

3.6.2 Statistical Methods of Demand Forecasting

The basic limitation of subjective methods of demand forecasting is the presence of bias in the technique, high cost and time of collecting information and uncertainty of accuracy. Thus these techniques should be used only when past data is not available, as in case of new products, new price and new market. When past data is available, firms are seen to use statistical tools as they are more scientific and cost effective. The different statistical techniques of demand forecasting are –

Time series Analysis or Trend Method:

Trend is a general pattern of change in the long run. Trend method or Trend Projection is a powerful statistical tool that is used to predict

future values of a variable based on time series data. Under this method, the time series data are used to fit a trend line or curve either graphically or through statistical method of Least Squares. The trend line is worked out by fitting a trend equation to time series data with the aid of an estimation method. The trend equation could take either a linear or any kind of non-linear form. The trend method outlined above often yields a dependable forecast. The advantage in this method is that it does not require the formal knowledge of economic theory and the market; it only needs the time series data. In some situations, if the time series analysis does not show any trend, the moving average method or exponentially weighted moving average method is used to smoothen the time series. The main shortcoming of this method is that it assumes that the past events are repeated in future. Another limitation of this method is that it is not appropriate method for long-run forecasts.



Activity 3.1

Identify different methods of finding Trend. You may take the help of books given in further readings.

2) Barometric techniques or lead or lag methods:

The barometric method consists in discovering a set of series of some variables which exhibit a close association in their movement over a period or time. For example, it shows the movement of personal disposable income and the sale of luxury items. The movement of personal disposable income is similar to that of sale of luxury items, but the movement in the sale of luxury items takes place after a week's time lag compared to the movement in personal disposable income. Thus if one knows the direction of the movement of personal disposable income, one can predict the direction of movement of sale of luxury items in the next week. Thus movement of personal disposable income may be used as a barometer to help the short-term forecast for the sale of luxury items. Usually, this

barometric method of prediction has been used extensively for predicting business cycles situation. For this purpose, some countries construct what are known as 'diffusion indices' by combining the movement of a number of leading series in the economy so that turning points in business activity could be discovered well in advance. Some of the limitations of this method may be noted however. The leading indicator method does not tell you anything about the magnitude of the change that can be expected in the lagging series, but only the direction of change. Also, the lead period itself may change overtime. Through our estimation we may find out the best-fitted lag period on the past data, but the same may not be true for the future. Finally, it may not be always possible to find out the leading, lagging or coincident indicators of the variable for which a demand forecast is being attempted.

3) Econometric method of Demand Forecasting

Another important demand forecasting method as widely by the managerial economist is the econometric model of demand forecasting. Econometrics may be defined as the social science in which the tools of economic theory, mathematics and statistical inferences are applied to analysis of economic phenomena. With the help of appropriate econometric technique, the future value of the forecast variable can be predicted on the basis of the predictor or explanatory variable. One of the popular econometric methods for demand analysis is the regression analysis. Regression analysis estimates the casual relationship between the economic variables. On the basis of the economic theory, a statistical model describing the relationship between economic variables is established. Now, with the help of regression analysis, estimate of the parameter are made. Forecasting of the demand can be made with the help of the estimated parameter. Another important econometric method of demand forecasting is the simultaneous equation model. It is also known as the 'complete system approach' or 'econometric model building'. This method is normally used in macro-level forecasting

for the economy as a whole. For a corporate manager, this method is useful for macro level forecasting. This method is indeed quite complicated. However, in the days of computer, when different software packages are available, this method can be used to derive meaningful forecasts. The principle advantage in this method is that the forecaster needs to estimate the future values of only the exogenous variables unlike the regression method where he has to predict the future values of all, endogenous and exogenous variables affecting the variable under forecast. The values of exogenous variables are easier to predict than those of the endogenous variables. However, such econometric models have limitations, similar to that of regression method.



CHECK YOUR PROGRESS

Q3. Mention two statistical methods of demand forecasting.

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3.7 DEMAND FORECASTING FOR NEW PRODUCTS

In the above section of the unit, we have discussed about different methods of demand forecasting. In this section an analysis is carried out regarding demand forecasting for new product. Forecasting the demand for new products is always a complicated task. Very often it happens that misjudged demand for a particular product is an important cause of the decline in profit and some times the company has to incur losses. Forecasting the demand for new products is difficult. The assessment of sales and product marketing is often taken as a starting point which can be termed as *judgmental forecast*. The method of historical sales by using the predecessor-successor relation is used to forecast the demand of the new product. This process of forecasting the future demand for the product by using historical data is found to be partially successful in most of the cases.

The main problem is that historical data is only useful to a certain extent. The extrapolation of the past does not work well in new and innovative products. In addition, predecessor-successor relations are ambiguous. Another problem is that the estimates are often found to be too optimistic which is likely to be *biased.* This is due to the fact that every product manager, after all, has a firm belief in his own products.

The solution of the problem is that is that product manager has to explore the alternative methods as each method has its advantages and limitations. For example, in a project for a competitive product, the demand for different colors and designs is forecasted through the use of various inputs. During the process of introducing a new product, different data extracted from different sources are available, each with their own advantages and disadvantages. The different methods available for this job are use of historical data, expert judgment, company internal survey, social forecasting, and pre-order intake etc. Each method has its own importance in terms of predictability of future demand. Therefore, the prediction has to be made considering the above advantages of the each method.



3.8 LET US SUM UP

In this unit we have discussed the following:

- Demand forecasting means prediction of future demand.
- There are different approaches to demand forecasting: survey methods and statistical method of demand forecasting.
- The first approach involves forecasting demand by collecting information regarding the buying behavior of consumers from experts or through conducting surveys.
- The second approach is to forecast demand by using past data through statistical techniques. It includes time series analysis, barometric technique, regression analysis and simultaneous equation model. The survey method is generally for short term forecasting, whereas statistical methods are used to forecast demand in the long run.

- Forecasting the demand for new products is difficult. The assessment of sales and product marketing is often taken as a starting point which can be termed as *judgmental forecast*. The method of historical sales by using the predecessor-successor relation is used to forecast the demand of the new product.



3.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No 1: Demand forecasting means prediction of future demand.

Ans to Q. No 2: i) Flexibility of Demand Forecasting

ii) Durability of Demand Forecasting

Ans to Q. No 3:

i) Time series analysis

ii) Barometric technique



3.10 FURTHER READINGS

1. Ahuja, H.L.(2010), "*Business Economics* ", 11th Editon ,S. Chand & Company Ltd., India.
2. Chaturvedi, D. D. , Gupta, S. L. (2012), "*Business Economics*", 3rd Edition, International Book House, India.



3.11 MODEL QUESTIONS

Q.1: Explain the different statistical methods forecasting of demand.

Q.2: Explain the factors an investigator has to take into consideration for predicting the demand for new products.

Q.3: Discuss the advantages of sample survey method of demand forecasting over complete enumeration method.

Q.4: You are required to forecast the weekly sale of a new brand of mobile phone. What method would you apply and why?

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UNIT 4: SUPPLY AND MARKET EQUILIBRIUM

UNIT STRUCTURE

4.1 Learning Objectives

4.2 Introduction

4.3 Supply: Its Meaning, Types and the Diagrammatic Representation

4.4 Law of Supply, Supply Schedule and the Supply Curve

4.5 Increase and Decrease in Supply

4.6 Exceptions to the Law of Supply

4.7 Elasticity of Supply

4.8 Factors Determining Elasticity of Supply

4.9 Supply: Its Practical Importance

4.10 Market Equilibrium and Changes in Market Equilibrium

4.11 Let Us Sum Up

4.12 Further Reading

4.13 Answers to Check Your Progress

4.14 Model Questions

4.1 LEARNING OBJECTIVES

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

- put forward the concept of supply
- derive a supply schedule and draw a supply curve
- discuss the determinants of supply and discuss the exceptions to the law of supply
- explain the concept of elasticity of supply and calculate it
- discuss the concept of market equilibrium.

4.2 INTRODUCTION

Dear learners, by now, you have known that demand and supply are two fundamental concepts in Economics. In fact, the famous saying goes: “Demand and supply are the two words that can make an economist out of a parrot”. The market mechanism in particular has to depend a lot on

these two concepts. In fact, 'demand' and 'supply' are like two Siamese twins or tools, together which determine equilibrium in the market. The interaction between demand and supply are very important in guiding the market in general and in guiding the behaviour of the consumers and suppliers of the market in particular.

Before we go on discussing the concept of supply in detail, let us pause for a moment to consider what happens to us, to ourselves when we go to the market. We find that sometimes, market is abundant in supply. In a busy market place, we often see the street vendors shouting and attraction customers to sell their products. We also see consumers often get into bargaining with the vendors. Contrary to this, for certain high-priced products like cars, there is no such shouting and pulling of customers. Of course, they also try to attract customers through other means, e.g., advertising, campaigning etc. This means that with respect to the type of market, or the type of product, the behaviour of the consumers and sellers differ. While all sellers try to sell their products, it is the interaction of demand and supply in the marketplace that basically sets the behaviour of the consumers and also the sellers.

This unit lays its primary focus on discussing the concept of supply from the theoretical underpinnings of Economics. We shall begin with defining the concept supply and its different types and deriving its diagrammatic representation. Then we shall derive the law of supply, the graphical shape of a supply curve and also discuss how we can derive the market supply. Then we shall examine the factors that determine supply, followed by the concepts of increase and decrease in supply. Finally, we shall discuss the different exceptions to the law of supply.

4.3 SUPPLY: ITS MEANING AND TYPES

Supply refers to quantity of a product offered for sale at a given price at a given point of time. In this statement, three issues are very important. First, supply refers to *the quantity of a product offered for sale*. This means that all the quantity produced by a firm does not necessarily mean supply. The seller/producer may have huge quantity of a produces

kept in his warehouse. But only the amount released to the market for sale constitutes supply. Thus, a firm may have 1000 tonnes of rice is his warehouse. But he has released only 10 tonnes of rice for sale in the market. Thus, only 10 tonnes of rice will be considered as supply. The rest constitutes stock. Secondly, *supply has a given price* tag attached to it. Everything brought to the market has a price tag, which serves as one of the issues of interaction with its prospective buyer, i.e., the consumers. Third, supply has a reference to a *given point of time*. Whenever we talk about supply, we must remember, we are talking in reference to a particular point of time. This also means that supply is a ***stock concept***, rather than a ***flow concept***.

We may distinguish supply into different categories basically as individual supply and market supply and fixed and flexible supply. *Individual supply* refers to the quantity of a product made available by an individual firm for sale at the market at a given price at a given point of time. *Market supply* refers to aggregate of quantities of the product offered by all the suppliers of the product at a given price at a particular point of time. Thus, market supply is the lateral summation of the supplies of all the individual sellers in the market.

Supply may also be categorised as fixed supply and flexible supply. Supply of certain goods cannot be changed i.e., they cannot be increased. For example, we cannot increase the supply of the antique items. Can we increase the supply of the picture *Monailsha* painted by Leonardo da Vinci, or can we increase the supply of the pictures drawn by Van Gough? Similarly, can we increase the supply of the hand-written letters of the Father of the Nation, Mahatma Gandhi? We cannot. And that is why, the supply of such items remain fixed. Flexible supply on the other hand refers to the case of generally traded goods and commodities, whose supply are flexible. The supply of the general commodities is, on the other hand, prone to react to the general price mechanism. That means, like demand that we have discussed in the previous unit, supply of a commodity also reacts to price movement in the market. Now, the question remains: how does supply of a commodity react to the change in prices in the market? Does supply increase with increase in the price of the product in the market; or does it

decrease with fall in its prices? The law of supply explains this phenomenon of movement of price of a commodity and the quantity of its supply in the market.

4.4 LAW OF SUPPLY, SUPPLY SCHEDULE AND THE SUPPLY CURVE

As we have already mentioned, Supply refers to the quantity of a commodity that producers/sellers are willing and able to offer for sale in the market at a certain price at a particular point of time. Again, we have also mentioned that the entire amount of the commodity produced, though marketable, may not be brought to the market for sale at a particular point of time. Thus, supply means the total amount of a commodity that are brought to the market for sale at a particular price at a particular point of time. Hence, we can not say that increased production will essentially lead to increased supply, as the entire addition to output may not be brought to the market, part of it may be hoarded. Given the total production of a commodity, the smaller is the amount hoarded, the larger will be the supply of the commodity and vice versa. Therefore, it follows that there are differences between total output, supply, stocks (also called as inventories) and hoarding.

Now, let us discuss the law of supply. The law of supply states that, other things remaining the same, as price of a commodity rises, the supply of the commodity rises and as price of the commodity falls, the supply of the commodity also falls. Thus, the main idea behind law of supply is that higher the price greater the supply, and lower the price, lower the supply, other things remaining constant. We can express this statement In a symbolic form as follows:

$S_X = S (P_x, P_S, P_C, F_j, C, T, G)$.

In the above statement, S_X is quantity of the commodity supplied, P_X is its price, P_S represents prices of ***substitute goods***, P_C represents prices of ***complementary goods***, F_j represents prices of ***factors of production***, C is total expenditure of the producer, T represents the state of technology, G represents goal of the producer.

When we mentioned 'other things remaining the same', we assumed that the variables other than price remain constant/unchanged during the concerned period of our discussion. It also implies that the supply of commodity X (S_X) and price of X (P_X) is directly related. The concept of law of supply will be easy to understand if we relate it with supply schedule and supply curve as have been shown in the next section.

Supply Schedule: Supply schedule exhibits the functional relationship between quantities of a commodity that the producers/sellers are willing to produce/sell and its different prices at a particular point of time. Thus, the list showing the quantities of the commodity that the producers or sellers are willing to sell in the market at different prices is known as supply schedule. The law of supply as discussed in the previous section can be explained with the help of the supply schedule and supply curve. The table 4.1 shown below represents a hypothetical supply schedule, showing the various price combinations of a commodity (rice per kg) and quantity supplied (in tonnes) at the corresponding prices.

Table 4.1: Supply Schedule of a Commodity

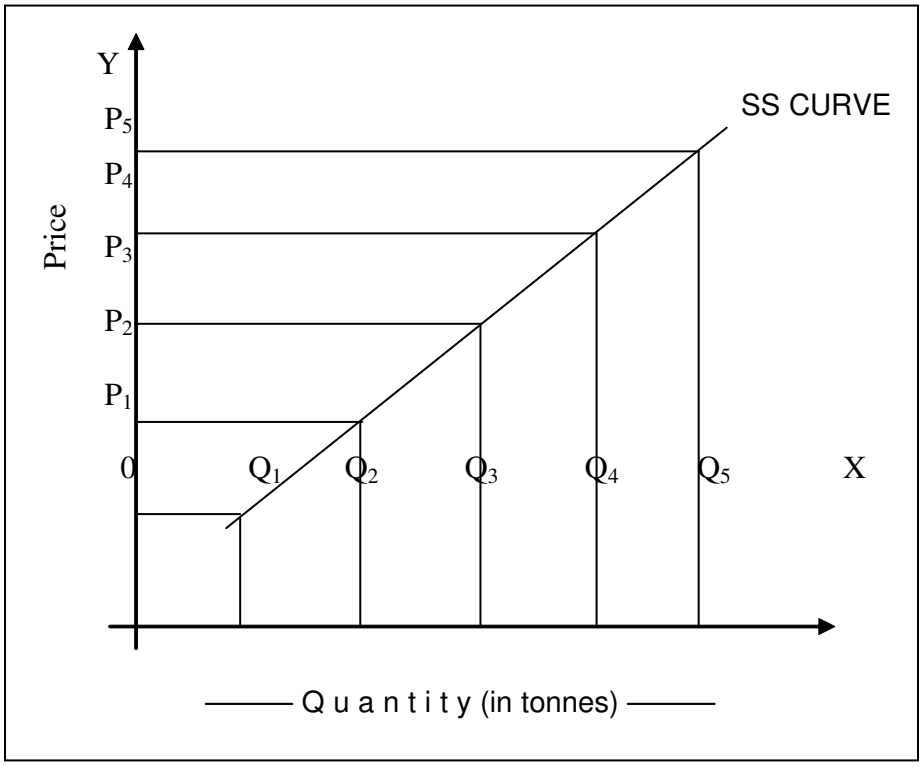
Price per kg of rice (in Rs.)	**Number of Units Supplied (in tonnes)**
22 (P_1	5 (Q_1)
24 (P_2)	10 (Q_2)
26 (P_3)	15 (Q_3)
28 (P_4)	20 (Q_4)
30 (P_5)	25 (Q_5)

From Table 4.1 it can be seen that when price of rice per kg has increased from Rs. 22 (P_1) to 24 (P_2), the quantity supplied has increased from 5 tonnes (Q_1) to 10 tonnes (Q_2). Similarly, when the price of rice per kg increases from 24 (P_2) to 26 (P_3), the quantity supplied also increases from 10 tonnes (Q_2) to 15 tonnes (Q_3), and so on. This means that with the rise in prices, there is a corresponding increase in the quantity supplied. To

make our discussion more meaningful, a supply curve is drawn on the basis of the above schedule.

Supply Curve: In figure 4.1, SS represents the supply curve. As may be seen from the figure, the SS curve is rising upward from left to right. This means that as prices of the commodity increases, volume of supply also increases. This implies that price and supply of a commodity are directly and positively related. As the suppliers of a commodity are guided by the profit motive, they are willing to offer more units of a commodity for sale in the market at a higher price.

Figure 4.1: Supply Curve





CHECK YOUR PROGRESS

Q 1: State the law of supply. (Answer in about 30 words)

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Q 2: Why does the supply curve rise upward from left to right? (Answer in about 50 words).

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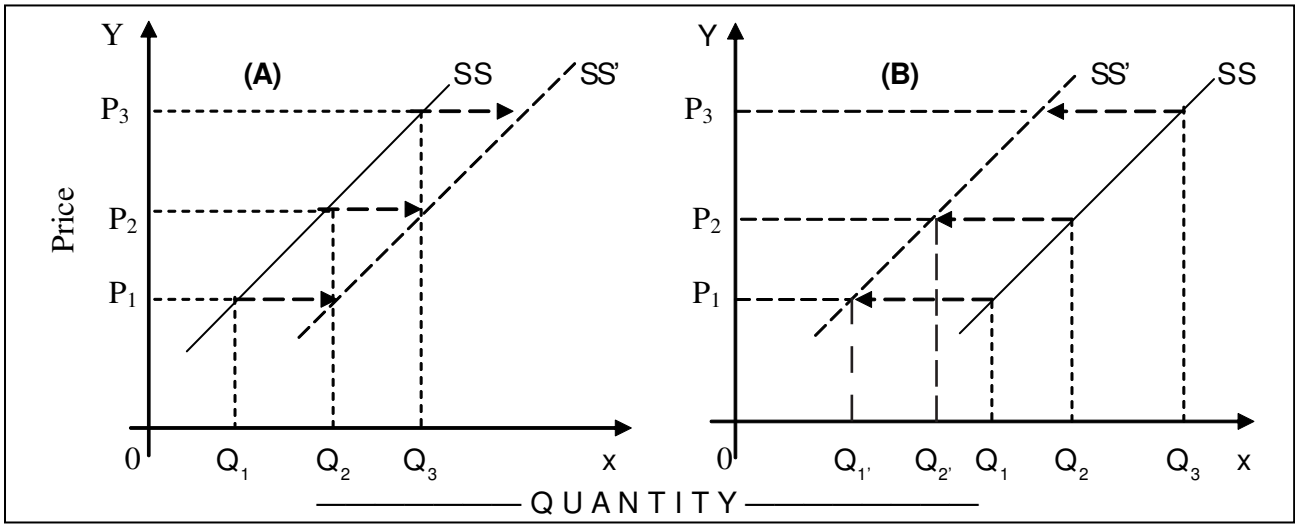
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4.5 INCREASE AND DECREASE IN SUPPLY

While explaining the law of supply, we mentioned that, other things remaining the same, as price of a commodity rises, the supply of the commodity rises and as price of the commodity falls, the supply of the commodity also falls. The other things, that we assumed remains constant includes prices of substitute goods, prices of complementary goods, prices of factors of production, total expenditure of the producer, state of technology and the goal of the producer. On the basis of this assumption, we had discussed the supply schedule and the supply curve as shown in Figure 4.1.

Now, let us suppose, the price of the commodity remains constant, but there occurs a change in the 'other factors', say, the cost of labour and raw materials (factors of production). Now if the cost of labour and raw materials decline, the cost of production will also decline. This will enable the supplier to produce more and also to increase supply in the market at each of the price points. This has been shown in panel (A) of the Figure 4.2.

Figure 4.2: Increase and Decrease in Supply



In panel (A) of Figure 4.2, it has been seen that as a result of decline in the prices of labour and raw materials, the entire SS curve shifts right to SS' exhibiting a higher level of supply in each of the price points. For example, at price P_1, the quantity supplied in case of the new supply curve SS' is higher: $0Q_2 > 0Q_1$ of SS curve. Similarly, at price P_2, the quantity supplied in SS' is higher than SS: $0Q_3 > 0Q_2$. Such increase in supply may also be the result of change in the state of technology used in production, or any other such factors as have been already mentioned.

Panel (B) of Figure 4.2 shows decrease in supply. If the cost of labour and raw materials increases, this would result in lowering the production volume, and subsequently leading to less supply than before. As a result of increased cost of production, the supply curve SS moves to the left. SS' is the new supply curve which shows lower levels of supply at each price point. For example, at P_1 price, the quantity supplied in the new SS' curve $0Q_{1'} < 0Q_1$ of the SS curve. Similarly, at P_2 price, the quantity supplied in the new SS' curve $0Q_{2'} < 0Q_2$ of the SS curve. Another factor that may result in decrease in supply is the increase in the prices of other commodities. For example, if the price of rice increases, the farmer would be interested to engage more factors in the production of rice by withdrawing the factors from the production of other commodities.

4.6 EXCEPTIONS TO THE LAW OF SUPPLY

Although the price of a commodity and supply are directly related, there are various exceptions to the law of supply. Exception to the law of supply implies that there may be situations, in which in spite of increase in price of a commodity, there is no simultaneous increase in its supply. Various exceptions of the law of supply are

- Supply of the commodity may rise instead of falling when the supplier expects an even bigger fall in its price in the near future. In such a situation the supplier seeks to sell more of the commodity in the present before the price falls further in the future.
- The taste and preferences of the consumers must remain constant for supply to increase. Otherwise the law of supply will not be valid.
- Weather conditions affect the supply of commodities, particularly agricultural commodities. When the monsoon fails, the supply of agricultural commodities may not rise when the prices go up.
- The cost of production of the commodity determines the supply of the commodity. When the cost of production rises because of a fall in the productivity of workers or additional taxes on raw materials or rise in wages, supply of the commodity may fall with the price of the commodity remaining unchanged.
- In case of substitute goods, the law of supply is not applicable. If the prices of the substitute goods for a commodity increase, when other factors are constant, the willingness of supplying the commodity decreases.
- With regard to the supply of labour, it is seen that the supply falls with the rise in wages beyond a certain level.



ACTIVITY 4.1

You may notice that in the post-harvesting period, the abundance of supply in the market reduces the prices of the product. This adversely affects the farmers, as they do not receive their due income. What factors do you think are

responsible for such situations? What measures may be adopted to tackle such situations?

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CHECK YOUR PROGRESS

Q 3: What happens to the supply curve when there is an increase in price? (Answer in about 30 words)

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Q 4: Mention any two situations in which the law of supply may not operate. (Answer in about 60 words).

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4.7 ELASTICITY OF SUPPLY

The concept of elasticity of supply is actually derived from the law of supply itself. According to the law of supply, if price of a commodity goes up, its supply will also increase. But by how much? To put it more precisely, how much the supply of a commodity will change (increase or decrease) with a change (increase or decrease) in its price? The concept of elasticity of supply seeks to answer that, or rather to say, it measures that change. Thus, elasticity of supply measures the degree of responsiveness of quantity supplied to a change in own price of the commodity. Like the concept of elasticity of demand, elasticity of supply is also defined as the percentage change in quantity supplied divided by the percentage change in price.

Thus, it can be put as:

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

$$\text{Symbolically, } ES = \frac{\Delta Q}{Q} / \frac{\Delta P}{P} \qquad \text{(i)}$$

Or, ES = Δ Q/ P x P/Q. Where, Q = Quantity, P = Price, = Change in

,

The price elasticity of supply equals the slope of supply curve. Since the supply curve has a positive slope, therefore, the price elasticity of supply is always positive. This is opposite to the price elasticity of demand, which is negative.

Calculation of Elasticity of Supply: A trick is involved in calculating elasticity in Economics, be it elasticity of demand or elasticity of supply or others. This is unlike conventional mathematical calculation of measuring elasticity. Let us explain this trick in some detail.

When we use the above formula (i) in the calculation of elasticity of supply (defined as the percentage change in quantity supplied divided by the percentage change in price), we land ourselves into some problems, though, conceptually we are not wrong! Why? Let us consider this example. Suppose, the price of a bread in the market goes up from Rs. 10 to Rs 12 and the corresponding supply in a particular market goes up from 100 breads per week to 120 breads per week. Now, let us consider the changes in prices first. The change in price here in absolute term is Rs. 2 (Rs 12-10), and in percentage terms it is Rs 2/ Rs12 = 16.7%. But if we consider the changes in price of breads in the opposite direction: i.e., if we consider that prices has reduced from Rs. 12 to Rs. 10, we would find the same absolute change (Rs 2), but in percentage terms it becomes Rs.2/Rs 10 = 20%. The same logic is applicable while we consider the changes in supply (quantity) as well. So, ultimately, we would get to different elasticities in those two situations. This results in confusion! This is because, whether price moves from Rs 10 to Rs 12 or from Rs 12 to Rs 10, we are considering the same supply curve. How can the slope of the supply curve be different when we move from up to down or from down to up? It has to be the same.

To avoid this problem, in Economics, we use a refined formula. What we do is we consider mid-points (or average) of the variables concerned. In our case, to calculate price elasticity, we can take help of the modified formula as given below:

$$ES = \frac{\text{Change in Quantity Supplied}}{(Q_i + Q_f) \div 2} \div \frac{\text{Change in Price}}{(P_i + P_f) \div 2}$$

$$\text{Or, } ES = \frac{\text{Change in Quantity Supplied}}{\text{Change in Price}} \times \frac{(P_i + P_f) \div 2}{(Q_i + Q_f) \div 2}$$

Where Q_i is the initial quantity supplied, Q_f is final quantity supplied, P_i is the initial price and P_f is the final price.

Please note that the same logic and methods should be applied in the calculation of other elasticity in Economics, for example, the price elasticity of demand.

Numerical Example: Calculate the price elasticity of supply using the mid-point formula when the price of tomatoes changes from Rs. 5 to Rs. 6 and the quantity supplied changes from 20 kgs per supplier per week to 30 kgs per supplier per week.

Solution: Here,

Percentage change in quantity supplied

= (30 kg – 20 kg) ÷ {(30kg + 20 kg) ÷ 2} = 40%

Percentage change in price

= (Rs. 6 – Rs. 5) ÷ {(Rs 6 + Rs 5) ÷ 2} H” 18%

Price elasticity of supply H” 40% ÷ 18% = 2.22



ACTIVITY 4.2

Calculate Elasticity of supply if the price of breads in the market goes up from Rs. 5 to Rs 6 and the corresponding supply in a particular market goes up from 100 units per week to 120 units per week. Use both formula (i) and formula (ii) and derive the logical conclusion.

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4.8 FACTORS AFFECTING ELASTICITY OF SUPPLY

In this section, we shall discuss the various factors that determine the slope of supply curve, and hence, elasticity of supply. These factors are:

- **Objective of the firm:** The objective of the firm also affects the volume of supply of the commodity. If the firm aims to increase the sales volume, the firm would offer more volume of the product for sale.
- **Nature of the Industry:** Price elasticity of supply is affected by the nature of the particular industry. In fact, nature of the industry explains the flexibility of the suppliers to increase supply of the product as a response to the increase in its price. For example, it is much easier to increase the supply of electronic products as compared to the gold ornaments. This is because supply of raw materials in case of electronic products is relatively more elastic as compared to gold. Because of inelastic supply, production of gold cannot be easily increased.
- **Influence of nature cannot be over ruled:** Sometimes, nature may impose restrictions on supply of a product. For example, it takes at least 7-8 years for coconut trees to bear fruits. So, the supply of coconuts cannot be increased overnight. As a result, supply of certain coconut-based products, for example, coconut oil cannot be increased in a very short period.
- **Price of the commodity:** We have already discussed the role price plays in determining the volume of supply of the commodity. As the price of the commodity increases, its supply also increases and vice versa.
- **Prices of related commodities:** While deriving the supply schedule, and drawing the supply curve, we assume that the prices of other related

commodities remains unchanged. If the prices of the related commodities change, the supply of the commodity may also change. For example, when there is a rise in the market price of rice, farmers will be encouraged to produce more amount of rice. As such, the farmers may reduce the cultivation of other crops and make more and more land available for rice. Thus, this would affect the supply of rice, its prices as well as of other crops in the market.

- **Prices of factors of production:** Any price change in the factors of production affects the production cost of the commodity. This would further affect the price of the commodity and its supply. For example, if the wages of labour increase, this would increase the cost of production. Ultimately, this would affect the cost of production and the volume of supply would be lower, making it shift towards left.
- **State of production technology:** The business firms always try to bring in new technologies to the production process with an attempt to improve quality and/or reduce the production cost. Thus, with changes in technology, the firms may be able to bring down the production cost. This would help the firms to increase the volume of supply. Consequently, this would shift the supply curve towards the right.
- **Future price expectations:** Expectations regarding the future prices of the product also affects its supply. During inflation, the business firms expect prices to increase in the near future. This may encourage the firms to reduce the supply of the product with an aim to earn larger profit as price increases. The opposite happens during deflation. During deflation there is the tendency of the price to decrease in the near future. As such, farmers want to sell more and more volume of the product at the current price. Thus, supply increases during deflation.

4.9 SUPPLY: ITS PRACTICAL IMPORTANCE

In the theoretical framework of studying consumer or producer behaviour, both the concepts of demand and supply occupies equally important roles. Demand is more directly related to the consumers, while supply is more directly related to the producers. As a result, the supply side

economic agents, e.g., the industrialist often manipulate, or rather regulate supply in the market to create 'supply shortage' in the economy, and thereby drive up prices in the market. This becomes possible in certain industries where there are very less number of producers. For example, a ***monopolist firm*** (being a monopolist, the monopolist firm itself function as an industry) may raise the price in the market, as there is no alternative good/service available in the market. Similarly, in a ***oligopoly market*** the producers may form agreement to regulate supply in the market and thereby raise prices. Of course, being very few in numbers in the industry, it is possible to drive up prices even in normal market situations. However, in most of the countries of the world, we do not have ***free market economy*** in its purest form. As a result, Government interventions often act as a deterrent to such trade malpractices.

The increasing importance attached to the supply side has led to the emergence of Supply Side Economics as a distinct branch of study. In the discipline of managerial economics, supply plays a very important role. This is because, as a manager in an organisation, you would be often responsible for organizing and ordering inventory, you would also need to be vigilant when it comes to popularity versus availability of products and services. As a managerial economist in an organisation, the theoretical knowledge of supply would help you in the following ways:

- **Evaluation of Supply Risks:** An organisation often has to rely on external suppliers for raw materials. As a manager, it is important to understand how the conditions of the market supply and demand can affect your suppliers, and finally, your organisations as well. You would need to keep a track record of your suppliers, so that you can meet your own deadlines of supplying goods and services to the consumers.
- **Pricing Decision:** The pricing decision of a product mostly depends on its market demand and supply. One has to understand where the lines of supply and demand intersect, known as the equilibrium point. We shall discuss this in detail in the later units of the course. The basic issue here is you must match the pricing to your competitors in the

market. Consumers are unlikely to buy your product if it is overpriced. Over pricing may reduce your sales in the market. You cannot charge a very low price in the market as well. However, the pricing decision of your product depends on the market structure as well. We shall discuss the different market structure and price determination in the later units, viz., Unit 9 and Unit 10 of this course.

- **Shortage and Surplus:** As a manager in an organisation, you would also need to assess the supply and demand conditions in the markets. You would need to assess the sales volume, inventory status and market trend of your product market. At the same time, you may also need to assess the supply of the raw materials, its present inventory and future needs, if they are in shortage or in surplus. Like shortage, surplus is also a problem, because surplus lying idle would only add to cost of storage, electricity etc.
- **To align to business strategies of the firm:** As a manager, you must also keep track of the change in the business environment of the firm. You must supply up-to-date product in the market, especially if you are dealing with technological products, for example mobile phones, audio-video, or other computing devices. Only then you would be able to take the bull with the horns.



CHECK YOUR PROGRESS

Q 5: Define elasticity of supply. (Answer in about 30 words)

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Q 6: Why is the study of supply important to a manager? (Answer in about 60 words).

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4.10 MARKET EQUILIBRIUM AND CHANGES IN MARKET EQUILIBRIUM

At every moment, some people are buying while others are selling. Foreign companies are opening production units in India while Indian companies are selling their products abroad. In the midst of all this turmoil, markets are constantly solving the problems of what to produce, how much to produce, how to produce and for whom to produce. As they balance all the forces operating in the economy, there is also a market equilibrium of supply and demand.

Thus, the term 'market equilibrium' represents a baiance among the different buyers and sellers, i.e., the demand and supply in the market are in a balance. According to ***G. J. Stigler,*** "An equilibrium is a position from which there is no tendency to move." Equilibrium describes a situation where economic agents or aggregates of economic agents such as markets have no incentive to change their economic behaviour.

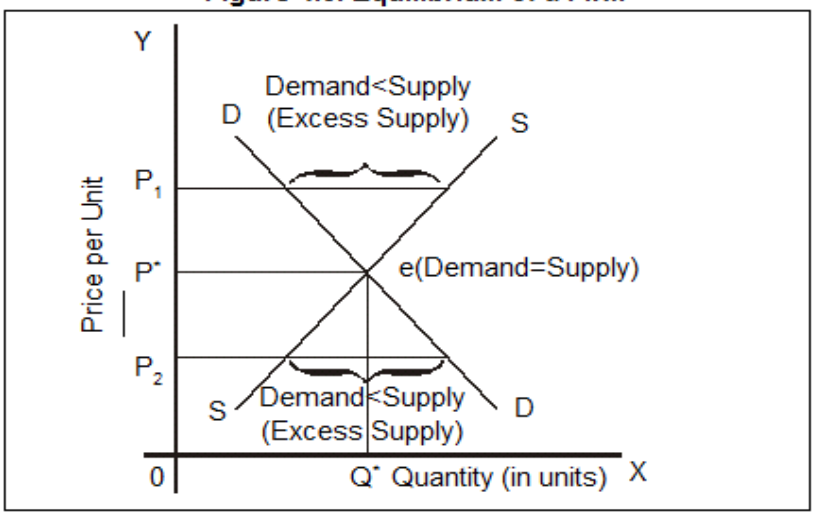
Depending upon the price, households and firms all want to sell or buy different quantities. The market finds the equilibrium price that simultaneously meets the desires of buyers and sellers. Too high a price would mean a ***glut*** of goods with too much output; too low a price will on the other hand lead to a deficiency of goods. That price for which buyers desire to buy exactly the quantity that sellers desire to sell yields an equilibrium of supply and demand.

Thus, we have discussed that the word "equilibrium" denotes a state of rest from where there is no tendency to change. In Figure 4.3 the point 'e' describes a position of equilibrium because this is a point where all buyers and all sellers are satisfied.

From figure 4.3 it can be seen that the price P* is determined by the intersection of the market demand (DD) and market supply curve (SS) and

is called the equilibrium price. Corresponding to this equilibrium price, the quantity transacted Q* is called the equilibrium quantity.

Figure 4.3: Equilibrium of a Firm



If the price is higher than P* say P_1, then the buyers can buy what they want to buy at that price, but the seller cannot sell all they want to sell. Demand will be low. This is a situation of excess supply or surplus in the market. The suppliers are dissatisfied. This situation cannot be sustained and the market price has to come down.

Again, If the price is lower than P*, say P_2, then the sellers can sell what they want to sell at that price, but buyers cannot buy all they want to buy because supply of the good will be low. This is a situation of excess demand or shortage of supply in the market. The buyers are dissatisfied. This situation cannot, be sustained and the market price has to go up.

Thus, we have seen that when prices are above or below P*, the market is in disequilibrium. The market is in equilibrium when demand is equal to supply and in the figure given above the point of equilibrium is at where equilibrium price is OP* and equilibrium quantity is 0Q*.

The laws of supply and demand state that the equilibrium market price and quantity of a commodity is the intersection point of consumer's demand and producer's supply. Here the quantity supplied equals the quantity demanded; that is, equilibrium is reached. Equilibrium implies that price and quantity will be steady.

Changes in Market Equilibrium: According to the law of supply and the law of demand, a market will move from a disequilibrium point where the quantity demanded is not equal to the quantity supplied, to an equilibrium point. This is called *stable equilibrium.* Not all economic equilibria are stable. For an equilibrium to be stable, a small deviation from equilibrium leads to economic forces that returns an economic sub-system toward the original equillibrium. When the price is above the equilibrium point there is a surplus of supply; and when the price is below the equilibrium point there is a shortage in supply. Different supply curves and different demand curves have different points of economic equilibrium. In most simple microeconomic analysis of supply and demand in a market, *a static equilibrium* is observed. Static equilibrium occurs in a stationary economy where population, technology, resources, tastes and preferences do not change. When changes take place in such a system, the rate of change remains the same. However, economic equilibrium can be *dynamic* when the factors mentioned above such as population, technology and so on change over time. Equilibrium may also be multi-market or general, as opposed to the partial equilibrium of a single market.



CHECK YOUR PROGRESS

Q 7: What does market equilibrium mean? (Answer in about 20 words)

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Q 8: When can we say that market equilibrium is stable? (Answer in about 60 words).

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4.11 LET US SUM UP

- Supply refers to quantity of a product offered for sale at a given price at a given point of time. In this statement, three issues are very important.
- Supply is a stock concept, rather than a flow concept.
- We may distinguish supply into different categories basically as (i) individual supply and market supply and (ii) fixed and flexible supply.
- The law of supply states that, other things remaining the same, as price of a commodity rises, the supply of the commodity rises and as price of the commodity falls, the supply of the commodity also falls.
- Supply schedule exhibits the functional relationship between quantities of a commodity that the producers/sellers are willing to produce/sell and its different prices at a particular point of time.
- Although the price of a commodity and supply are directly related, there are various exceptions to the law of supply.
- Like the concept of elasticity of demand, elasticity of supply is also defined as the percentage change in quantity supplied divided by the percentage change in price.
- The increasing importance attached to the supply side has led to the emergence of Supply Side Economics as a distinct branch of study. In the discipline of managerial economics, supply plays a very important role.
- Market equilibrium' represents a baiance among the different buyers and sellers. Not all economic equilibria are stable. For an equilibrium to be stable, a small deviation from equilibrium leads to economic forces that returns an economic sub-system toward the original equillibrium.



4.12 FURTHER READING

1) Ahuja, H.L. (2003). *Advanced Economic Theory;* New Delhi: S.Chand & Co.

2) Koutsoyiannis, A (1979). *Modern Microeconomics;* New Delhi: Macmillan.

3) Jhingan, M.L. (1986). *Micro Economic Theory;* New Delhi: Konark Publications.



4.13 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: According to the law of supply, other things remaining the same, as price of a commodity rises, the supply of the commodity rises and as price of the commodity falls, the supply of the commodity also falls.

Ans to Q No 2: As prices of the commodity increases, volume of supply also increases, and as the price of the commodity falls, supply of the commodity also falls. This means that price and supply of a commodity are directly and positively related. This is the reason for the supply curve rising upwards from left to right.

Ans to Q No 3: In case of increase in supply, the supply curve shifts to the right. This means that at each of the price points, the supply of the commodity increases with the increase in supply.

Ans to Q No 4: Although the price of a commodity and supply are directly related, there are various exceptions to the law of supply. For example, supply of the commodity may rise instead of falling when the supplier expects an even bigger fall in its price in the near future. Secondly, if the taste and preferences of the consumers change, the law of supply will not be valid

Ans to Q No 5: Elasticity of supply is defined as the percentage change in quantity supplied divided by the percentage change in price.

Thus, it can be put as:

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

Ans to Q No 6: The theoretical knowledge of supply can help a manager to evaluate supply risks, to undertake pricing decisions of the products, to assess shortage of and excess of supply and demand conditions in the market and also to align business strategies of the firm to its competitors.

Ans to Q No 7: Market equilibrium represents a baiance among the different buyers and sellers. This implies that the demand and supply in the market are in a balance.

Ans to Q No 8: According to the law of supply and the law of demand, a market will move from a disequilibrium point to an equilibrium point. This is called *stable equilibrium.* Not all economic equilibria are stable. We can say a market equilibrium to be stable, if a small deviation from equilibrium leads to economic forces that returns an economic sub-system toward the original equillibrium.



4.14 MODEL QUESTIONS

Q 1: What is meant by Supply? Distinguish between flows and stocks.

Q 2: State the law of supply. Draw a supply curve from a hypothetical schedule.

Q 3: Discuss the various determinants of supply. What are the different exceptions of law of supply? Explain

Q 4: Why should a managerial economist should have knowledge of the concept of supply? Explain

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UNIT 5: CONSUMER BEHAVIOUR-CARDINAL AND ORDINAL APPROACH

UNIT STRUCTURE

5.1 Learning Objectives

5.2 Introduction

5.3 Cardinal and Ordinal Approach to Utility: Basic Concepts

- 5.3.1 Measurement of Utility
- 5.3.2 Concepts of Total Utility and Marginal Utility
- 5.3.3 Law of Diminishing Marginal Utility

5.4 Consumer's Equillibrium: Law of Equi- marginal Utility

5.5 The Indiference Curve Technique: Basic Concepts

- 5.5.1 Assumptions of the Indifference Curve Technique
- 5.5.2 Indifference Schedule and Indifference Curve
- 5.5.3 Indifference Map
- 5.5.4 Properties of Indifference Curves

5.6 Consumer Equilibrium through Indifference Curve Approach

5.7 Let Us Sum Up

5.8 Further Readings

5.9 Answers to Check your Progress

5.10 Model Questions

5.1 LEARNING OBJECTIVES

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

- appreciate the diffecence between cardinal and ordinal utility
- describe the concepts of total utility and marginal utility
- illustrate the law of diminishing marginal utility
- describe the law of equi-marginal utility
- explain the basic concepts of indifference curve and the budget line
- derive the equilibrium of the consumer using the ordinal/indifference curve approach

5.2 INTRODUCTION

This unit deliberates on the study of consumer behaviour through ordinal approach. This approach states that utility is not measureable in a cardinal way. A consumer can only give rank to his preferences or order them. In this unit the attainment of a consumer's equilibrium ordinally through the use of indifference curve approach has been discussed. At first, the basic concepts related to indifference curve approach has been given. Finally, the concept of price effect and its breaking up into the substitution effect and income effect have also been discussed along with the idea of Giffen Goods.

5.3 CARDINAL AND ORDINAL APPROACHES TO UTILITY : BASIC CONCEPTS

Let us ponder for a few minutes over this question : why do we buy goods and services from the market? Well, the answer is obvious : they satisfy our wants. Thus, in this sense, goods and services have want-satisfying power. In Economics, we name this want-sarisfying power as 'utility'. Thus, utility may be defined as the power of a commodity or a service to satisfy the wants of a consumer. Alternatively, utility may also be defined as the satisfaction that a consumer derives by consuming a commodity or a service. Utility is a subjective concept and it is formed in the mind of a consumer. It is important to note that the concept of utility is not related to the concepts of morality or ethics. Let us take an example : a drug addict person consumes drugs. In Economics paralance, the drug addict is a consumer of drugs and drugs have utility for the person. While dealing with the issue of utility, It is not considered if consumption of drugs will have any harmful effects on the health of the drug addict. Another important aspect of utility is that being a subjective concept, the level of satisfaction from the consumption of goods and services varies among different individuals. Suppose, you and one of your friends have gone to a tea stall. You may be like to take a hot samosa and tea, while your friend may not like them so much. Thus, the satisfaction you will derive from the hot samosa and the

cup of tea will differ from what your friend will derive from the items. In fact, the extent of desire for a commodity by an individual depends on the utility that he associates it with.

5.3.1 Measurement of Utility

Having said that utility is an important concept, the next obvious question that comes to one's mind is how to measure it. In the study of utility, two prominent schools of thought exist, viz., the cardinal and the ordinal school. The cardinal utility theory was developed over the years with significant contributions from *Gossen, Jevons, Walras* and finally *Marshall*. The cardinali school of thought assumed that utility can be measured and quantified. It means, it is possible to express utility that an individual derives from consuming a commodity or service in quantitative terms. Thus, a person may express the utility he derives from consuming an apple as 10 ***utils*** or 20 ***utils***. Moreover, it allows consumers to compare and define the difference in utilities perceived in two commodities. Thus, it allows an individual to state that commodity A (accruing an utility of 20 utils) gives double the utility of commodity B (accuring an utility of 10 utils). Another assumption of the cardinalist school of thought is that total utility is a function of the individual utilities derived from each individual unit of the commodity. In an earlier version of the theory, it was assumed that utilities were additive. This meant that an individual was able to add the utilities he/she derived from the consumption of the successive units of a commodity to derive the total utility of consumption. However, additivity of utility was later on relaxed.

The assumption of the cardinalist school of thought on measurement of utilities was challanged later by ordinalist school of thought. Rather, they pointed out that utility actually should be arranged in an order of preference. Thus, according to them, utility is ordinal, and not cardinal. We begin our discussion on the cardinal approach, then will move towards the ordinal approach to utility in the next unit.

5.3.2 Concepts of Total Utility and Marginal Utility

Let us now take a hypothetical example to derive the relationship between total utility and marginal utility as discussed in the cardinal approach. Our hypothetical consumer likes to consume mangoes. Thus, the Total utility (TU) from the consumption of mangoes is the aggregate utility derived by the consumer after consuming all the available units of the commodity, i.e. mangoes. Thus, it is the sum of all the utilities accruing from each individual unit of the commodity.

Marginal utility (MU), on the other hand, is the utility derived from an aditional unit of the commodity, over and above what had been consumed. This relation can be better understood from the following table 5.1 and the figure 5.1.

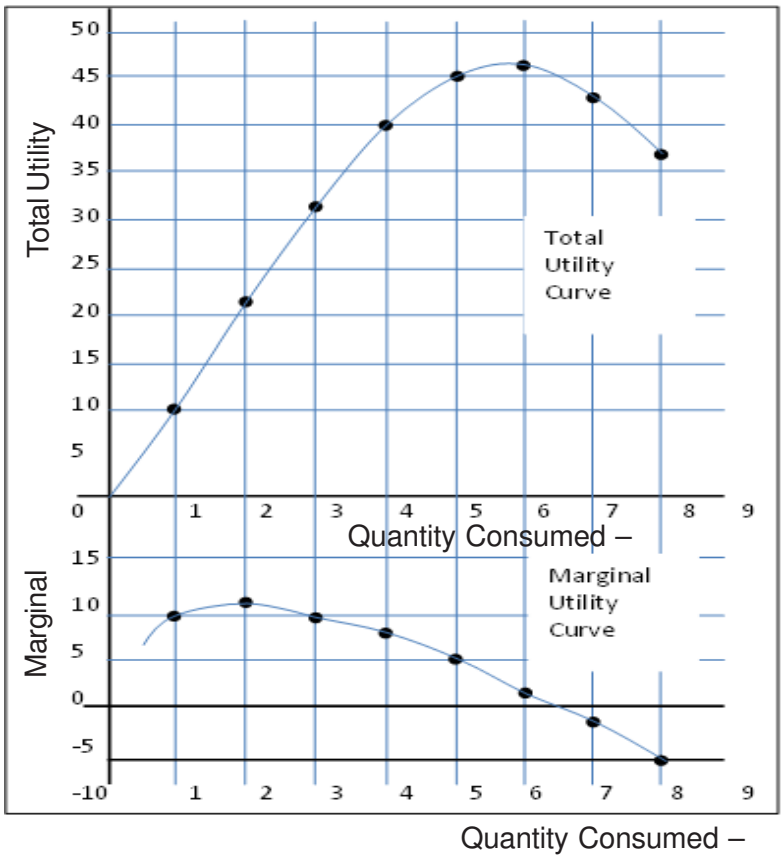
Table 5.1 : A Hypothetical Utility Schedule

Number of Mangoes	Total Utility	Marginal Utility
1	10	10
2	22	12
3	32	10
4	40	8
5	45	5
6	46	1
7	43	-3
8	38	-5

Graphically, this relation between marginal utility and total utility has been shown in figure 5.1.

Now, from the table 5.1 and the figure 5.1, we can see that total utility rises upto a certain limit (upto consumption of the 6^{th} mango). Then it tends to diminish. The marginal utility, on the other hand first increases till second unit and then keeps on declining. And after the consumption of the 6^{th} apple, the marginal utility of the consumer in fact becomes negative.

Fingure 5.1 : Total Utility & Marginal Utility Curves



5.3.3 Law of Diminishing Marginal Utility

An important aspect of the law of marginal utility as discussed in the cardinal utility approach is its nature. According to the cardinal utility approach, marginal utility of a good diminishes as more and more units of the good is consumed. Marshall has described this law in these words, "The additional benefit which a person derives from a given increase of his stock of a thing diminishes with every increase in the stock that he already has."

The law of diminishing marginal utility may be illustrated with the help of the above hypothetical utility schedule 4.1. From the schedule it can be seen that from the consumption of the first unit of the good, the consumer derives 10 utils of utility. From the next unit, he derives 12 utils. Again, from the consumption of the third unit of the good, the consumer derives 10 utils of utility. Similarly, from the

consumption of the fourth and the fifth unit, the consumer attains 8 and 5 utils of marginal utility respectively. Thus, the marginal utility derived from each successive unit of the good though initially increases exhibits a declining trend as the consumer goes on to consume the successive units of the good. Total utility, on the other hand, keeps on increasing. However, the rate of increase in total utility decreases with the consumption of successive units of the good.

This law of diminishing marginal utility rests on an important practical fact. Even when a consumer may have unlimited wants, but after a certain stage each particular want is satiable. Therefore, as the consumer consumes successive units of the same good, intensity of satisfaction from each additional unit goes on diminishing, and a point is reached when the consumer is no more interested in the consumption of the same good. Let us take an example. How many sweets can a person continuously take? It can be easily said that after a few initial units (one or two), the person will not derive the same satisfaction. However, after the consumption of a few units of the same variety of sweets, the consumer may become disinterested to consumer any more sweets. Thus, the level of zero utility or even negative utility is reached.

The theory of diminishing marginal utility works under the following conditions : *first,* there is no time-gap in the consumption process. This means that consumption is a continuous process and no leisure is there in the consumption of the successive units. *Secondly,* tastes and preferences of the consumer remain unchanged during the period. And *third,* all the units of consumption are homogeneous in terms of size, quality and other attributes.

The principle of diminishing marginal utility however fails to work under certain circumstances. Exceptions are there when the law fails to operate. For example, the law tends to fail in case of consumption of liquor. A drinker may tend to drink more and more (at least as compared to the consumption of sweets or any other

thing), and thus exhibit a case of positive relationship between marginal utlity and the quantity of liquor consumed. However, even when a drinker of liquor exhibits such a positive relationship between quantity of liquor and the level of satisfaction, there is however, a limit to this habit as well. After a certain stage, the drinker of liquor has to stop consuming more liquor. Another example frequently cited as an exception to the law of diminishing marginal utility is in case of habits like ***philately or numismatics***. People with such habits will like to own/study about more and more items. As such, it seems that the law of diminishing marginal utility does not operate. However, it should be noted that the person with such habits tends to collect/ study varieties of such items, rather than a number of copies of the same item. The person, thus, finds it more pleasurable to own different varieties of the product at their kitty. The law seems to fail to operate in case of luxury and esteemed goods as well. For example, rich and affluent people tend to prefer a diamond jewellery of higher prices, rather than the lower one.

5.4 CONSUMER'S EQUILIBRIUM : THE LAW OF EQUI MARGINAL UTILITY

Before discussing how the consumer attains equilibrium, let us discuss the assumptions on which the theory rests. The assumptions of the theory are :

- The consumer is rational in the sense that given his income constraints, he would always attempt to maximise his utility.
- Utility is a cardinal concept and it can be measured and expressed in quantitative terms. For convenience, it is expressed in terms of the monetary units that a consumer is willing to pay for the marginal unit of the commodity.
- The law of diminishing marginal utility operates. This implies that as a consumer increases his/her consumption of a commodity, the utility accruing from successive units of the commodity decreases. In other

words, the marginal utility of a commodity will keep on falling as a consumer goes on increasing its consumption (this is what we have already discussed in Table 4.1 and the subsequent figure 4.1).

- Marginal utility of Money is constant. That is, as one acquires more and more money, the marginal utility of money will remain unchanged. This assumption is critical because money is used as a standard unit of measurement of utility, and, hence, cannot be elastic.
- The total utility of a 'bundle' of goods depends on the quantities of the individual commodities. Thus : $U=f(x_1, x, ..., x_n)$ where U means total utility $x_1, x_2, ..., x_n$ are the quantities of n number of commodities.

It is to be noted that in the earlier version of the theory, utilities were considered to be additive. However, in the later version of the theory, this assumption has been dropped, without any effect on its basic argument.

Now, let us discuss how the consumer attains equilibrium. Consumer's equilibrium in the cardinal approach to utility may be derived with the help of the law of equi-marginal utility. Initially we derive the equilibrium of the consumer when he/she spends his/her money income M on a single commodity x. Here, the consumer will be at equilibrium when the marginal utility of x is equal to its market price.

Symbolically: $MU_x = P_x$, where MU_x stands for marginal utility of the commodity x and P_x stands for price of the concerned commodity x.

Now: if

(i) $MU_x > P_x$, then the consumer can increase his/her welfare by consuming more of x. He/she will continue to do that until his/her marginal utility for x falls sufficiently, to be equal with its price.

(ii) $MU_x < P_x$, then the consumer can enhance his/her welfare by cutting down on his/her consumption of x. He/she will be persisting on doing this, until for x falls sufficiently, to be equal with its price P_x.

If more commodities are introduced into the model, then the consumer will attain equalibrium when the ratios of the marginal utilities of the individual commodities to their respective price are equal for all commodities. That is .

$$\frac{M_x}{P_x}=\frac{M_y}{P_y}=---=\frac{MU_z}{P_z}=MU_M$$

where, x,y, ... z are different commodities; and MU_m= marginal utility of money income.

This state is defined by the "law of equi-marginal utility", which states that a consumer will distribute his/her money income among different commodities in such a way that the utility derived from the last rupee spent on each commodity is equal.

Now if :

(i) $\frac{MU_x}{Px} > \frac{MU_y}{P_y}$, then the consumer will start substituting commodity y with commodity x, causing MU_x to fall and MU_y to rise. This he/she will continue untill $\frac{MU_y}{P_y}$ equals

(ii) Conversely, if $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$, then the consumer will substitute commodity x with commodity y until the equilibrium is restored.

Limitations of the theory : The theory of equi marginal utility has been criticised on the ground of the following basic limitations :

- Utility cannot be cardinally measured. Hence, the assumption that utility derived from the consumption of various commodities can be measured and expressed in quantitative terms is very unrealistic.
- As income increases the marginal utility of money changes. Hence the assumption of constant marginal utility of money is not realistic. Once we consider that trhe marginal utility of money changes, the whole theory breaks down, as the unit of measurement itself changes.
- Finally, the law of diminishing marginal utility is a psychological law, which cannot be empirically established and has to be taken for granted.

5.5 THE INDIFFERENCE CURVE TECHNIQUE : BASIC CONCEPTS

The indifference curve technique was conceived as an alternative to the cardinal utility approach of the theory of consumer behaviour. A number of economist have contributed to this techique as it has evolved over the years, with the latest reflnements attributed to Slutsky, J.R. Hicks and R.G.D. Allen.

The indifference curve technique rejects the concept of cardinal utility and asserts that utility cannot be measured in quantitative terms. Instead, it adopts the principle of ordinal utility which states that, while the consumer may not be able to indicate exactly the amount of utility that he derives from the consumption of a commodity or a combination of commodities, he is perfectly capable of comparing and ranking the different levels of satisfactions that he derives from them. For example, in case of different varieties of rice, Mrs Saikia may prefer (in terms of satisfaction derived from) to consume a *joha* variety of rice over *aijung* variety of rice, and *aijung* variety of rice over *parimal* variety of rice. Interestingly, this much of information(i.e., information about the order of ranking among the different varieties of rice) is sufficient to derive the demand schedule and hence the demand curve of an individual consumer. Therefore, the questionnable assumption that consumers possess a cardinal measure of satisfaction can be dropped. Thus, the basic distinction between the two schools of thought is that the cardinal approach to the measurement of utility believes that the utility derived from the consumption of commodity can be expressed in quantitative terms. The ordinalist approach, on the other hand, rejects this and states that the consumer at best can rank the various commodities (or combination of them) in accordance with the satisfaction that he/she expects from their consumption.

Now, let us discuss some of the key concepts used in the indifference curve analysis, viz. indifference curve, indifference map and the budget line. Let us begin with the assumptions on which the theory of indifference curve rests.

5.5.1 Assumptions of the IC Technique

The indiference curve technique is based on the following assumptions.

- **Utility can be ordinally measured:** The consumer can rank various commodities or combination of commodities in accordance with the satisfaction that the consumer derives from them.
- **The consumer is rational:** Given the market prices and the money income, a consumer will attempt to maximise his/her satisfaction when he/she undertakes consumption.
- **Additive Utilities:** The quantities of the commodities that is consumed determines the total utility of the consumer.
- **Consistency of choices:** The choice of the consumer is consistent in the sense that if he/she chooses combination A over B in one peried, he/she will not choose B over A in another period. Symbolically : If A>B , then B<A.
- **Transitivity of consumer choice :** If a consumer prefers combination A to B, and prefers B to C, then, it can be concluded that he/she prefers A to C.

  Symbolically : If A>Bs, and B>C, then A>C.

5.5.2 Indifference Schedule and Indifference Curve

An indfference curve is defined as the locus of the various combinations of two commodities that yield the same satisfaction to the consumer, so that the consumer is indifferent to any one particular combination. In other words, all combinations of the two commodities in the indifference curve are equally desired by the consumer.

An indifference curve is based on the indifference schedule, which represents the various combinations of two commodities that give the consumer the same level of satisfaction. Given below is an indifference schedule representing various combination of commodity x and y that gives the consumer the same amount of satisfaction.

Table 5.1 : Indifference Curve Schedule

Combination	x	y	MRS_{xy}
1st	1	20	...
2nd	2	15	5
3rd	3	11	4
4th	4	8	3
5th	5	6	2
6th	6	5	1

Putting the various combinations of the indifference schedule from the above table 5.1, we obtain the IC, indifference curve as shown infigure 5.2

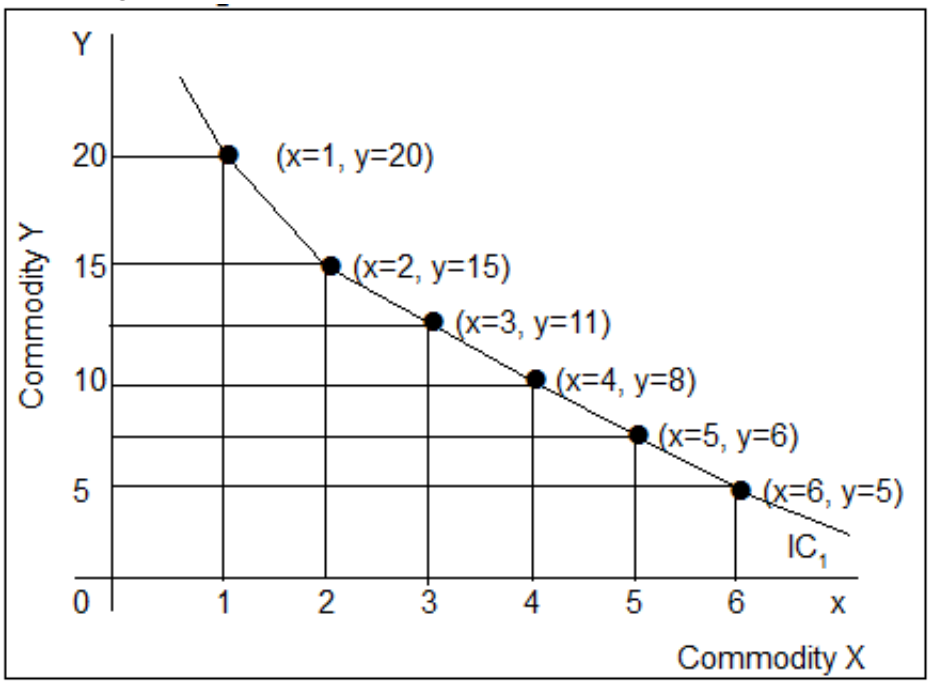


Figure 5.2 : Indifference Curve

In figure 5.2, the slope of the indifference curve is indicated by the "marginal rate of substitution'. The marginal rate of substitution of X for Y is defined as the numbers of y that has to be given up by the consumer to get an additional unit of x, so that his/her satisfaction remains unchanged. Thus, [slope of the indifference curve]=MRS_{xy}.

It can be seen from table 5.1 that as the consumer gets more and more of X, the number of Y he is willing to give up for an additional unit of X successively falls. This is known as the "principle of diminishing marginal rate of substitution" which states that the

marginal rate of X for Y falls as more and more of X is substituted for Y. This implies that the indifference curve always slopes downwards to the left and is convex to the origin.

5.5.3 Indifference Map

An indifference map, on the other hand, shows all the indifference curves which rank the preference of the consumer. While the combinations of commodities on the same indifference curve yield the same satisfaction, combinations on a higher indifference curve yield higher levels of satisfaction and combinations on a lower curve yield lower levels of satisfaction. In figure 5.3, an indifference map has been shown.

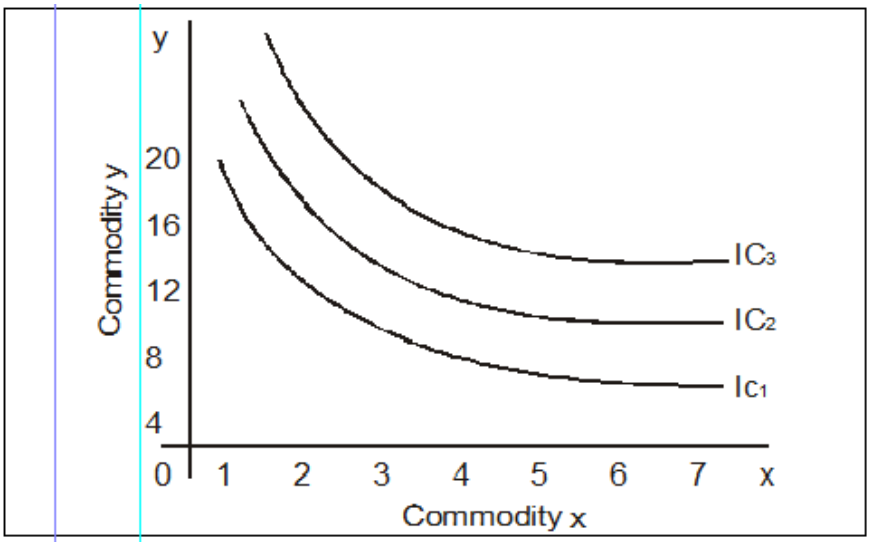


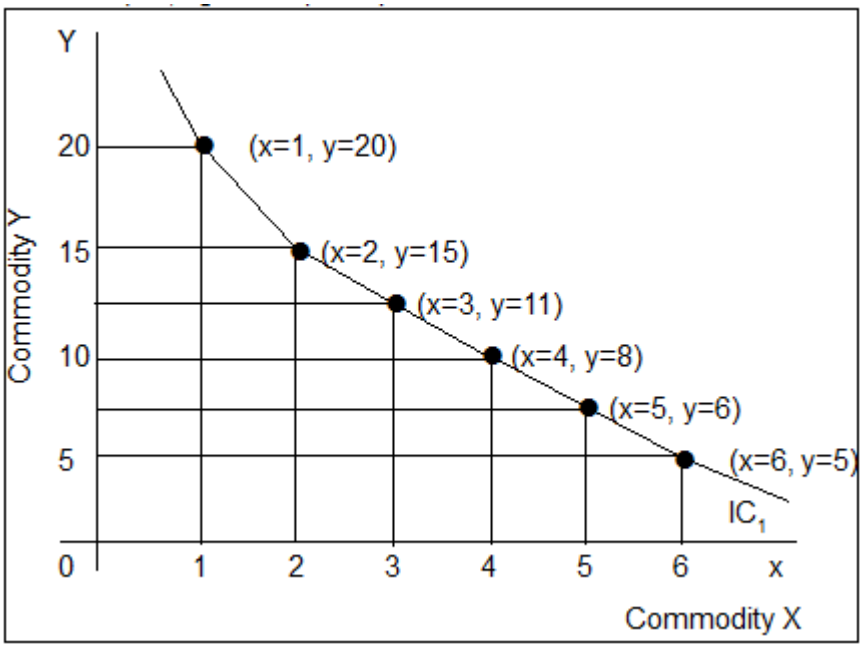
Figure 5.3: An Indifference Map

In the above figure, we see an indifference map of a consumer. It is needless to say that the rational consumer would prefer to be on a higher indifference curve (i.e. he would prefer to be on IC_2 than being IC_1 and on IC_3 than on IC_1 and IC_2) rather than on the indifference cure which is positioned lower (IC_2 or IC_1).

5.5.4 Properties of Indifference Curves

Let us now discuss the properties of the indifference curves. The important properties of the indifference curves are as follows :

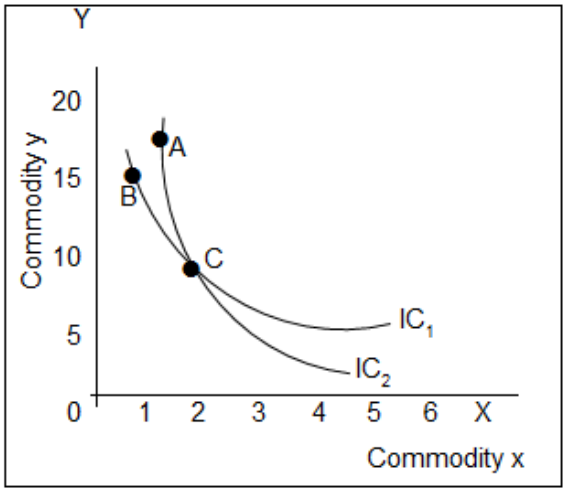
- **Indifference curves are downward sloping towards the right :** The first important property of an indifference curve is that it slopes downward from left to right. This is also called as indifference curves are negatively sloped towards right. The basic reason for the downward slope is that as the consumer chooses to move along an indifference curve, he/she has to sacrifice some units of one good to obtain an additional unit of the other good. The sacrifices of a few units of one good for obtaining an additional unit of the other good becomes necessary so that the consumer remains in the same level of satisfaction as he/she moves along an indifference curve. Thus, we get the indifference curve of the shape as has been shown in the previous figure 5.2 or 5.3.
- **Indifference curves are convex to the origin :** Another important property of an indifference curve is that an indifference curves is convex to the origin. The convexity of an indifference curve is basically due to the working of the principle of diminishing marginal rate of substitution. While discussing the concept of an indifferene curve, we have mentioned that as the consumer consumes more and more units of X, the number of units of Y he is willing to give up for an additonal unit of X begins to fall. A relook at the table 5.1 as has already been discussed would clarify this point. From the table, it can be seen that as the consumer increases consumption of X by an additional unit, he tends to give up smaller units of Y for each additional unit of X. The indifference curve representing the table 5.1 (i.e., figure 5.2) is reprodued here



- **Indifference curves cannot intersect :** Another important property of an indifference curve is that no two indifference curves can intersect. This means that only one indifference curve can pass through a point in an indifference map. Figure 5.4 will make this point clear.

  From the figure shown in the next page it can be seen that the indifference curve IC_2 allows the consumer to choose the combination A. Again IC_1 is another indifference curuve in his indifference map. Now, let us suppose that the consumer chooses combination B in the indifference cuve IC_1. It is obvious from the above figure that combination A would give the consumer higher level of satisfaction as it offers the consumer

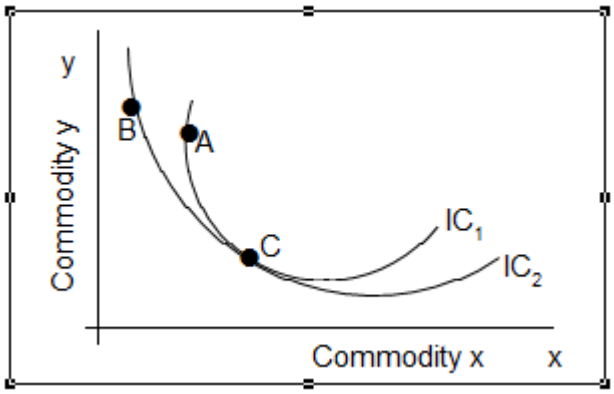
Figure 5.4 : No two Indifference Curves can intersect



higher quantities of both the goods X and Y. Now, let us consider point C. This point is common to both the indifference curves. Thus, combinations A and C would give the consumer the same level of satisfaction, as both the points lie on the same indifference curve IC_2. Again for combinations B and C also the consumer will derive the same level of satisfaction as both of them are on the same indifference curve IC_1. What it means is that combinations A and B will derive the same level of satisfaction. This is not at all logical to accept. Thus, two indifference curves can never intersect.

The same thing may happen if two indifference cuves touch a single common point in an indifference map as has been shown in the next figure 5.5.

Figure 5.5 : No two Indifference Curves can touch each other





CHECK YOUR PROGRESS

Q 1: State whether the following statements are True (T) or False (F).

(a) According to the indifference curve analysis, consistency of consumer choices states that if a consumer prefers combination A to B, and prefers B to C, then it implies that the consumer prefers A to C.

(b) According to the indifference curve approach, utility cannot be cardinally measured, they can only be ordinally arranged.

Q 2: Fill in the blanks :

(a) The slope of the indifference curve is indicated by .....

(b) Two ..... cannot intersect.

(c) An indifference curve is defined as the ..... of various combinations of two commodities that yield the ..... level of satisfaction to the consumer.

Q 3: What do you mean by 'consistency of consumer choices' and 'transitivity of consumer choices' as discussed in the indifference curve analysis? (Answer in about 50 words).

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Q 4: What does an indifference schedule exhibit? (Answer in about 30 words)

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Q 5: Can an indifference curve be upward rising? Justify your view in about 60 words.

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5.6 CONSUMER EQUILIBRIUM USING THE INDIFFERENCE CURVE APPROACH

The equilibrium of a consumer under the indifference curve approach can be derived using the budget line and the indifference curve of the consumer. Therefore, before discussing the equilibrium of the consumer, let us first discuss the concept of the budget line.

Concept of the Budget Line : The budget line is an important concept in the indifference curve technique. It is defined as the various combination of the two commodities (X and Y) that a consumer can consume, given his income(M) and the price of the two commodities (P_x and P_y).

The Budget line can be algebraically expressed as : $M=P_xX + P_yY$.

where X and Y indicate the quantities of X and Y respectively.

Now, let us suppose, M=100, P_x=10 and P_y=20, then

(a) If the consumer spends all his income on x, then he can consume

$$X = \frac{M}{Px} = \frac{100}{10} = 10$$

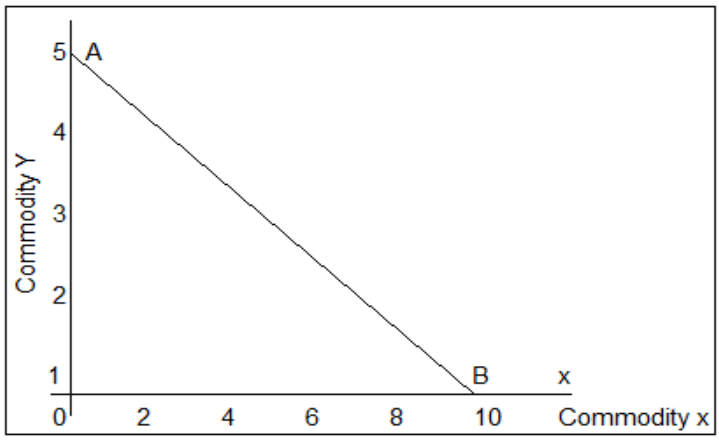
(b) and if he spends all his income on y, then the number of units of y that he can consume is :

$$Y = \frac{M}{Py} = \frac{100}{20} = 5$$

Thus, 10 X and 5Y are the two extreme limits of the consumer's expenditures. However, he usually prefers a combination of the two commodities within these two limits. In fact, the budget line joins the two extreme consumption limits of the consumer, and the points within those two limits indicate the combinations available to the consumer, given his income and the prices of the two commodities.

The concept of budget line has been shown with the help of figure 5.6.

Figure 5.6 : Budget Line



In the above figure 5.6, AB indicates the budget line. In this budget line AB, the consumer has the option of consuming 10X (0B) or 5Y (0A) or some combination of the two.

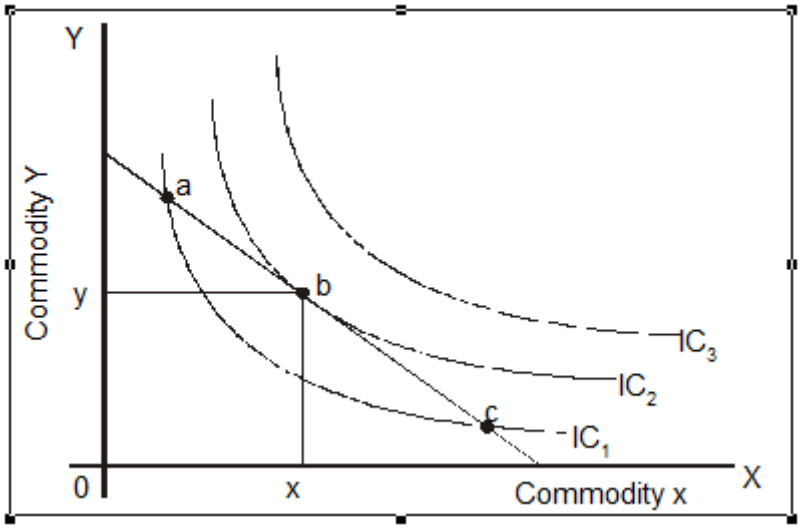
The slope of the budget line is the ratio of the prices of the two commodities. Geometrically,

$$[\text{Slope of the Budget Line}] = \frac{M/P_y}{M/P_x} = \frac{P_x}{P_y}$$

Consumer's Equilibrium: Given his budget line, a consumer would like to maximise his satisfaction by climbing on to the highest indifference curve. This has been shown in the following figure 5.7.

From the above figure 5.7 it can be seen that the consumer is at equilibrium at point b, where his budget line is ***tangent*** to the indifference curve IC_2. He has the option of consuming at 'a' and 'c', but those combinations are rejected as they would place him on a lower indifference

Figure 5.7 : Equilibrium of the Consumer



Curve IC_1. The consumer would like to be on the indifference curve IC_3, but his budget line does not allow him to do that. From figure 5.7, it can be seen that at equilibrium the consumer consumes 0x amount of x and 0y amount of y.

Thus, at equlibrium,

[slope of the indifference curve] = [slope of the budget line]

Symbolically, it can be expressed as :

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

Indifference Curve Technique vs Cardinal UtilityAnalysis:

The indifference curve technique is considered to be surperior to the cardinal utility approach on the following grounds:

- It avoids the unrealistic assumption of cardinal utility and instead adopts the concept of ordinal utility.
- It can be used to split the price effect into substitution effect and income effect.
- It is not based on the unrealistic assumption of constant marginal utility of money.

Limitations of the Indiference Curve Technique : The indifference curve technique has been crticised on the following grounds :

- The indifference curve technique does not tell us anything new, and it is only "old wine in new bottle".
- It assumes that the consumer is very familiar with his entire preference schedule, which is not the case in actual life.
- The technique can be efficiently applied only to two commodities. Once more than two commodities are introduced, the analyais become very complicated to illustrate.



CHECK YOUR PROGRESS

Q 6: State whether the following statements are True (T) or False (F).

(a) The indifference curve approach avoids the unrealistic assumption of constant marginal utility of money.

(b) The budget line of the consumers are the same (T/F)

Q 7: Mention any two superiorities of the ordinal approach over the cardinal aproach. (Answer in about 50 words).

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Q 8: What is a budget line? Derive the algebraic expression of the budget line. (Answer in about 50 words).

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5.7 LET US SUM UP

Theory of consumer behaviour studies how a consumer spends his income so as to attain the highest satisfaction or utility.

- Utility is a subjective concept and its perception varies among different individuals.
- The cardinalist school asserts that utility can be measured and quantified, while the ordinalist school asserts that utility cannot be measured in quantitative terms.
- The law of equi-marginal utility states that a consumer will attain equilibrium when the ratios of the marginal utilities of the individual commodities to their respective prices are equal for all commodities.
- The theory has been criticised on the ground that utility cannot be measured cardinally and utility of money does not remain constant. The law of diminishing marginal utility is also unrealistic as this is a psychological law, and cannot be established empirically.
- Theory of consumer behaviour studies how a consumer spends his income so as to attain the highest satisfaction or utility.
- An indifference curve is the locus of the various combination of two commodities that yield the same satisfaction to the consumer, so that he is indifferent to any one particular combination.
- An indifference map shows all the indifference curves which rank the preference of the consumer. While combinations of commodities on the same indifference curve yield the same satisfaction, combinations on a higher indifference curve yield greater satisfaction and combinations on a lower curve yield less satisfaction.
- A consumer is in equilibrium at the point where his budget line is tangent to the indifference curve. Symbolically :

  $$MRS_{xy} = P_x / P_y$$

- The substitution effect and the income effect are the two components of the price effect.
- These two components can be derived using either the Hicksian compensating variation method or the Slutsky's cost - difference method.



5.8 FURTHER READINGS

1) Dewett, K.K. (2005). *Modern Economic Theory;* New Delhi: S Chand & Sons.

2) Chopra, P.N. (2008). *Micro Economics;* New Delhi: Kalyani Publishers.

3) Ahuja, H.L. (2006). *Modern Economics;* New Delhi: S. Chand & Sons.

4) Sundharam, K.P.M. & Valish, M.C. (1997). *Microeconomic Theory;* New Delhi: S. Chand & Sons.

5) Koutsoyiannis, A(1979). *Modern Microeconomics*; New Delhi: Macmillan.



5.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: a) False b)True

Ans to Q No 2: a) The slope of the indifference curve is indicated by marginal rate of substitution.

b) Two indifference curves cannot intersect.

c) An indifference curve is defined as the locus of various combinations of two commodities that yield the same level of satisfaction to the consumer.

Ans to Q No 3: Consistency of choices means that the choice of the consumer is consistent in the sense that if he chooses combination A over B in one period, he will not choose B over A in another period.

Again, transitivity of consumer choice means that if a consumer prefers combination A to B, and prefers B to C, then, it can be concluded that he prefers A to C.

Ans to Q No 4: An indifference schedule represents the various combinations of two commodities that give the consumer the same level of satisfaction. An indifference curve is drawn based on an indifference schedule.

Ans to Q No 5: An indifference curve cannot be upward rising, because in such an indifference curve, as the counsumer will move upward the curve, he will be able to choose more quantities of both the goods. As such, he will not remain indifferent among the different bundles of goods available to him. This is clearly a violation of the very definition of an indiffernce curve.

Ans to Q No 6 : a) True b) True

Ans to Q No 7 : Two important superiorities of the indifference curve approach over the cardinal utility approach are :

- Indifference curve approach avoids the unrealistic assumption of cardinal utility and instead adopts the concept of ordinal utility.
- It can be used to split the price effect into substitution effect and income effect.

Ans to Q No 8: A budget line is defined as the various combinations of two commodities (say, x and y) that a consumer can consume, given his income (M) and the price of the two commodities (Px and Py).

Thus, a Budget line can be algebraically expressed as :

$M=P_xX + P_yY.$

where X and Y indicates the quantities of x and y respectively.



5.10 MODEL QUESTIONS

Q 1: Dislinguish between cardinal and ordinal utility. Which one of these two concepts is more realistic and why?

Q 2: What is cardinal utility?

Q 3: Define the term marginal utility.

Q 4: What do you mean by the term total utility?

Q 5: State any two situations where the law of diminishing marginal utility fails to operate.

Q 6: Write a short note on the concept of diminishing marginal utility. Under what conditions does this law operate?

Q 7: Discuss the assumptions of the cardinalist approach to utility. What criticisms have been raised on the assumptions of this approach?

Q 8: What is an indifference map? Why does an indifference curve take the shape of a downward sloping convex curve?

Q 9: With the help of a suitable figure discuss the concept of a budget line.

Q10: State the law of Equi-marginal utility. How does it explain consumer's equilibrium?

Q11: What is an indifference curve? Discuss the properties of indifference cuves.

Q12: Derive the consumer's equilibrium using the indifference map and the budget line as your tools.

Q13: Derive the "Price Effect" of a price fall. Distintegrate the price effect into substitution effect and income effect.

*** ***** ***

UNIT 6 : THEORY OF PRODUCTION

UNIT STRUCTURE

6.1 Learning Objectives
6.2 Introduction
6.3 Production Decisions
6.4 Law of Variable Proportions
6.5 Returns to Scale
6.6 Concepts in Production
  6.6.1 Production Function
  6.6.2 Iso-quant
  6.6.3 Isoquant Map
  6.6.4 Marginal Rate of Technical Substitution (MRTS) (Factor Substitution)
6.7 Equilibrium of a Firm
6.8 Expansion path
6.9 Economics and Diseconomes of scale
6.10 The Importance of Production Function in Managerial Decision Making
6.11 Let Us Sum Up
6.12 Further Readings
6.13 Answers to Check Your Progress
6.14 Model Questions

6.1 LEARNING OBJECTIVES

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

- know about production and production decisions
- what is iso-quant and how to construct it
- understand what is factor substitution
- explain the law of variable proportions
- compare the laws of returns to scale with law of variable proportions
- determine the equilibrium condition of the firm and derive the expansion path.

6.2 INTRODUCTION

While studying consumer behaviour, we have found that a consumer always tries to maximize his utility given his budget constraint. There are strong similarities between the behaviour of a producer and a consumer. In this unit, we will discuss the behaviour of a producer. With a given production function, a producer always tries to reach the optimum output. The process of transformation of inputs into output is called production and the physical relation between inputs and output is called production function. A particular level of output can be produced by using inputs in various combinations. An iso-quant shows all possible combinations of inputs that yield the same output. Then the behaviour of production function keeping all inputs constant except one is studied with the help of the law of variable proportions. Returns to scale has also been studied by varying all inputs. The condition of equilibrium of a firm to reach the optimum output has also been discussed here. When a firm increases output, it moves from one equilibrium position to another. Finally, we study the expansion path which shows the movement of equilibrium condition from one position to another.

6.3 PRODUCTION DECISIONS

Just as a consumer has to take certain decision regarding the basket of consumption, time, and use of resources etc., a producer or a firm also has to undertaken certain decisions. Production decision of a firm relates to four basic questions the firm faces: what to produce, how to produce, how much to produce and for whom to produce.

- **What to produce?** A firm will produce according to its perception of the customer demand. It can either produce consumer goods like food, clothing etc. (which are for consumption purpose) or it can produce capital goods like machinery etc. (which are for investment purposes).
- **How to produce?** After a firm decides what it will produce, the next question it faces is how to produce. We have already discussed that there are four factors of production, viz., land, labour, capital

and entrepreneurship. Of these four factors, supply of land may be considered given. The role of entreperneurship is undertaken by the firm itself. As such, out of the four factors, labour and capital are of special interest for the firm. Thus, the firm has the option of producing goods by labour intensive technique and capital intensive technique. Labour intensive technique is the one in which manual labour is used to produce goods. Capital intensive technique is the one in which machineries are used to produce goods.

- **How much to produce?** The firm has also to decide its production capacity and its production volume.
- **For whom to produce?** A firm has to decide its target population (i.e. to whom they will serve products and/or services). Example, it will not be viable to produce luxurious goods or middle income or low income group if they can't afford it and produce basic necessity goods for rich class if they don't need it. Therefore, a firm needs to match its produce according to the target population it is serving.

6.4 LAW OF VARIABLE PROPORTIONS

The law of variable proportions occupies an important place in the field of production. This law studies the changes in the quantity of production when one input is variable and all other inputs used in production are kept constant. In other words, it shows how output changes with changes in the quantity of one input while other inputs are kept constant. The law of variable proportions is the new name for the famous "Law of Diminishing Returns" of ***classical economics***.



LET US KNOW

The Law of Diminishing Returns: it is a classical law of economics. But very often the law of variable proportions is also called the law of diminishing returns. But actually the law of diminishing returns exactly refers to production that takes place between the first and the third stage.

This is the only stage where production is feasible and possible. At this stage total product increases but average and marginal products decline. Throughout this stage, marginal product is below average product.

Assumptions: The law of variable proportions is based on the following assumptions :

- There should not be any change in the state of technology.
- Only one input will undergo change in quantity keeping all other inputs constant.
- All the units of the variable factor are homogenous.
- It is possible to change the proportions in which the various inputs are combined.

Let us now go back to our previous example of the producer who uses both labour and capital in the process of production. To study the law of variable proportions let us assume that the producer will keep capital constant and increases the units of labour. From the following table 6.2 it is clear that with the successive increase in the units of labour, the marginal product of labour (MP_L) increases for some time. But with the increase of successive units, MP_L starts declining. In this way when total product is maximum, MP_L becomes zero and AP_L starts declining.

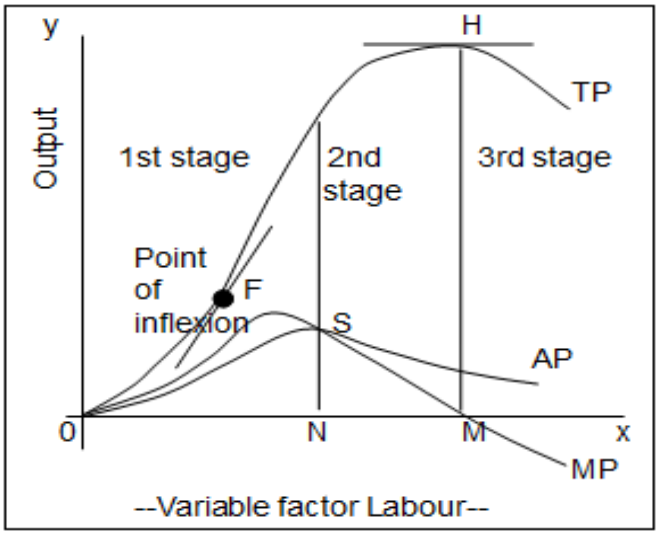
Table 6.1 : Law of Variable Proportions

Units of labour	Total products	Marginal product of Labour (MP_L)	Average product of Labour (AP_L)
1	50	50	50
2	120	70	60
3	190	70	63.3
4	270	80	65
5	345	75	69
6	395	50	65.8
7	**395**	**0**	**56.4**
8	360	–35	45

Again, it can be seen from the above table 6.1 that total product is the highest when marginal productivity of labour is zero. After this point both total and average product fall and marginal product of labour becomes negative. We can study the rise and fall of production with diagrams in three stages.

Three Stages of the Law of Variable Proportions: From the above table 5.1 we see the behaviour of output with varying quantity of labour and fixed quantity of capital. The rise and fall of output can be divided into three stages as has been shown in the following figure 6.1.

Figure 6.1 : The Three Stages of Law of Variable Proportions



Stage One: in the first stage the total output to a point increases at an increasing rate. In the above figure 6.1 it can be seen that the total output increases rapidly up to point F. This point is called **'the point of inflexion'**. From this point onwards in stage one, total output increases but at a slower rate. Therefore, the slope of the curve starts to fall slightly. Stage one ends at the point where average product is the maximum. In this stage, the quantity of the fixed factor (capital) is too much relative to the quantity of the variable factor (labour) so that if some of the fixed factor is withdrawn, the total product will increase. Stage one is known as the stage of *increasing returns*.

Stage Two: in stage two, the total product continues to increase at a diminishing rate until it reaches its maximum point H (figure 6.1) where the second stage ends. At the end of second stage marginal product becomes zero. This stage is known as the stage of *decreasing returns* as both the average and marginal products of the variable factor continuously fall during this stage.

Stage Three: in stage three the marginal product becomes negative. Therefore, both total product and average product decline. In this stage, total product curve and average product curve slope downward and marginal product curve goes below the X-axis. This is the opposite of first stage. In stage three, variable factor (labour) is too much in relation to fixed factor (capital). This stage is called the stage of *negative returns.*

A rational producer will always like to produce in stage two. The producer will not choose stage one where marginal product of fixed factor is negative. If he chooses this stage, he will not be utilizing completely the opportunity of production by increasing variable factor. A rational producer will never choose stage three also. Because, in this stage, he can always increase output by reducing the quantity of variable factor whose quantity is excess in proportion of fixed factor. Even when the variable factor is free, the rational producer will stop at the end of second stage.



Convex Curve: A curve is said to be convex as the slope or gradient of the curve increases as we go down along the curve. But it can not touch any of the axis. (Refer to Appendix A for more detail at the end of block III).

Significance of the Law of Variable Proportions: The law of variable proportions is very important in the field of economics. Till Marshall it was believed that the law was applicable in the field of agriculture only. But the modern economists propound that the law is equally applicable to industries and other productive activities. If the law actually does not occur, we can produce any amount of food grain in a small size of holding by using more and more amount of labour and capital. But in spite of the presence of the law of variable proportions a country like India need not be pessimistic where there is tremendous pressure of population and agricultural production is not sufficient. Productivity in the field of agriculture can be increased by making advancement in technology to avoid food crisis.



CHECK YOUR PROGRESS

Q.1. Mention the assumptions of law of variable proportions. (Answer within 40 words)

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Q.2. What is 'point of inflexion'? (Answer within 40 words)

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Q.3. Which stage is known as the stage of diminishing returns and why? (Answer within 40 words)

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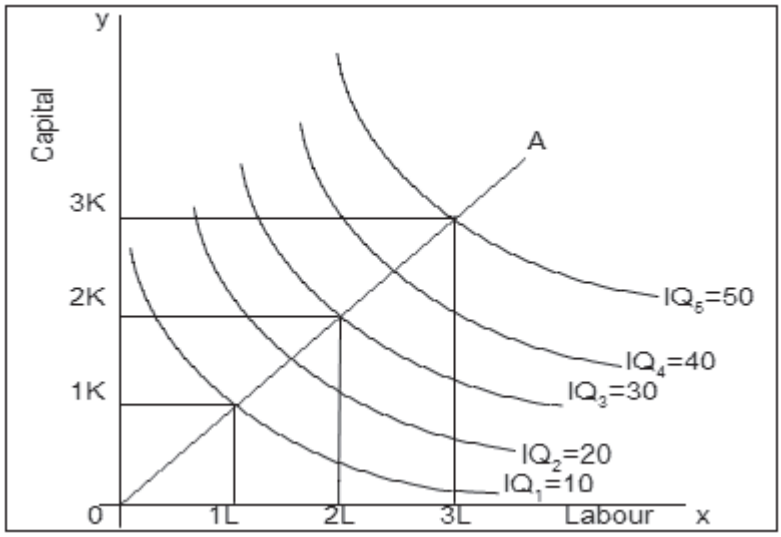
6.5 RETURNS TO SCALE

Under the law of variable proportions we have known that the changes in total output as a result of change in variable factor keeping quantity of other factors of production constant. But when all inputs are changed in a fixed proportion, there is change in the scale of production. The study of changes in output as a consequence of changes in the scale is the subject matter of "returns to scale". Let us make the distinction between 'the law of variable proportions' and 'returns to scale' clearer with the help of the producer who uses both labour and capital in the process of production. When the producer changes the quantity of labour and keeps capital constant, the law of variable proportions or the law of diminishing returns occurs. But if the producer changes both labour and capital in the same proportion and the changes in total production are studied, it refers to returns to scale. It is called so because there is change in the scale of production. In other words, returns to scale is the rate at which output increases as inputs are increased proportionately.

The concept of returns to scale can be explained with the help of iso-quant. Returns to scale may be increasing, decreasing or constant. These concepts have been discussed below.

Increasing Returns to Scale: If output more than doubles when inputs is doubled, there is increasing returns to scale. For example, if inputs are increased by 2 percent and consequent increase in output is 3 percent, then it is a case of increasing returns to scale. This has been shown with the help of the following figure 6.2.

Figure 6.2 : Increasing Returns to Scale



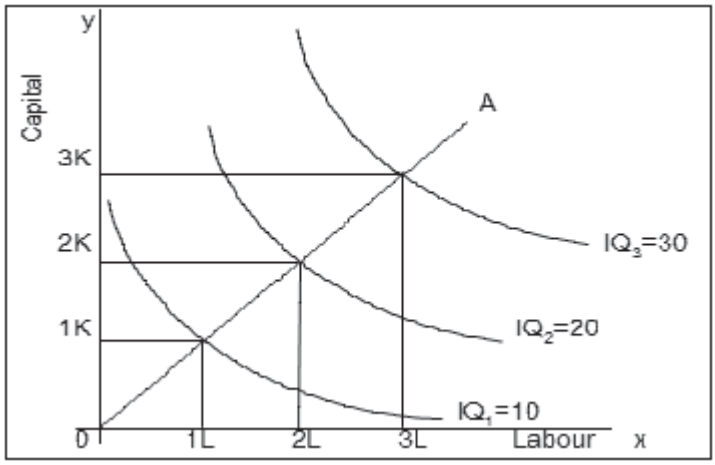
In the above figure 6.2, the firm's production function exhibits increasing returns to scale. The line 0A originating from the origin describes a production process in which labour and capital are used as inputs to produce various levels of output. As the iso-quants move upward along the line 0A, they become closer. As a result, less than twice the amount of both inputs is needed to increase production from 10 to 20 units. When inputs are doubled, output increases to 30 units as shown by IQ_3.

The increasing returns to scale may be due to technical or managerial expertise. Large scale production process cannot be halved and when used for production they are more efficient. Such large scale operation allows managers and workers to specialize in their tasks and uses more sophisticated large scale factories and equipments.

Marginal Physical Productivity of Labour and Capital: it is the additional output obtained from an additional unit of labour or capital i.e. the additional output per unit of labour or capital.

Constant Returns to Scale: If output increases in the same proportion as the increase in inputs, returns to scale is said to be constant. With constant returns to scale, the size of the firm's operation does not affect the productivity of its factors : one firm using a particular production process can easily be duplicated so that two plants produce twice as much output. For example, a large travel agency might provide the same service per client and use the same ratio of capital and labour as a small agency that services fewer clients.

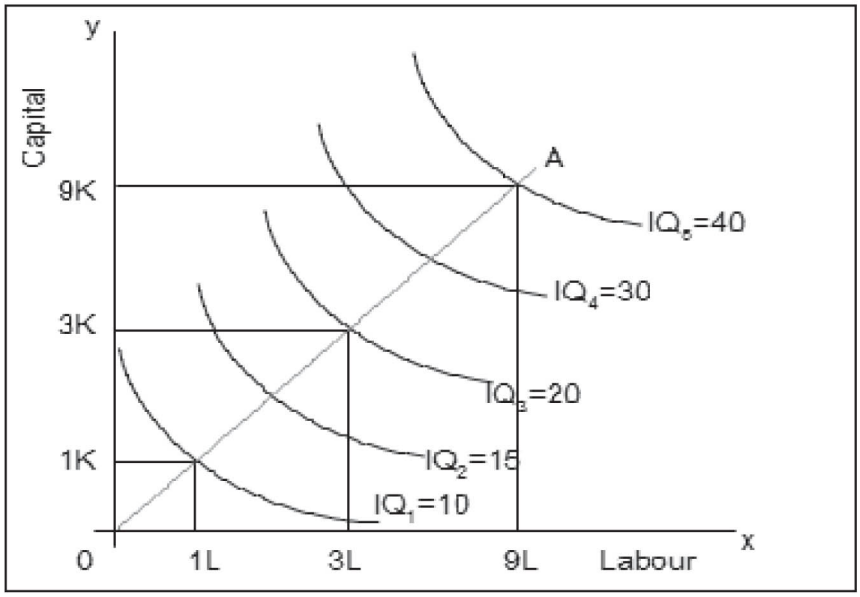
Figure 6.3 : Constant Returns to Scale



In the above figure 6.3, the firm's production function represents constant returns to scale. When 1 unit of labour hour and one hour of machine time are used, an output of 10 units is produced. When both inputs are doubled, output doubles from 10 to 20 units; when both inputs triple, output triples from 10 to 30 units.

Decreasing Returns to Scale: When the rate of increase in output is smaller than the proportion of increase in inputs, decreasing returns to scale is said to exist in the production process. It means that output may be less than double when all inputs are doubled.

Figure 6.4 : Decreasing Returns to Scale



Classical Economics: The economic thought which evolved in UK during the period mid eighteenth century to mid-nineteenth century. Its principal contributors were : Smith, Malthus, Say, Senior and J. S. Mill.

In the above figure 6.4, it can be seen that to increase output from 10 to 20 units inputs need to be increased more than twice. Similarly, to raise the level output by four times from 10 to 40 units, the firm needs to employ nine times of its initial inputs, i.e., 9 units of capital and labour each.The common cause of diminishing returns to scale is diminishing returns to management. As the output grows managers are overburdened and become less efficient in rendering duties. Communication between workers and managers can become difficult to monitor as the work place becomes more and more impersonal. Decreasing returns to scale may also arise due to exhaustible nature of natural resources.



CHECK YOUR PROGRESS

Q.4. What do you mean by returns to scale? (Answer in about 40 words)

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Q.5. Distinguish between returns to scale and law of variable proportions. (Answer in about 40 words)

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6.6 CONCEPTS IN PRODUCTION

We have already mentioned that a firm has to take several decisions while producing a commodity. A commodity may be produced by various methods of production. Among the set of technically efficient processes, the choice of a particular technique is a purely economic decision. The decision is based on price of factors. Another decision to be taken is to determine the range of output where marginal products of factors are positive but declining.

6.6.1 Production Function

A production function is a relation between inputs to the production process and the resulting output. A production function shows the highest output that a firm can produce for every specified combination of inputs. Let us assume that there are two inputs (factors of production) labour and capital. Now the production function can be written as:

$$Q = f(L, K)$$

where, Q is a dependent variable which represents output; and both labour (L) and capital (K) are independent variables.

This relation simply states that output depends on inputs. To get output Q, inputs can be combined in various proportions. But as technology improves the same inputs can give more and more output and the same output can be obtained by less and less input. In our production function, there are only two variables. But there may be other variables in the production function.

6.6.2 Iso-quant

An iso-quant or equal product line is a curve showing all possible combinations of inputs that yield the same level of output. This concept is analogous to consumer's indifference curve. Therefore, it is also known as producer's indifference curve. Let us explain the concept with the help of a production function which uses both labour and capital and produces 50 units.

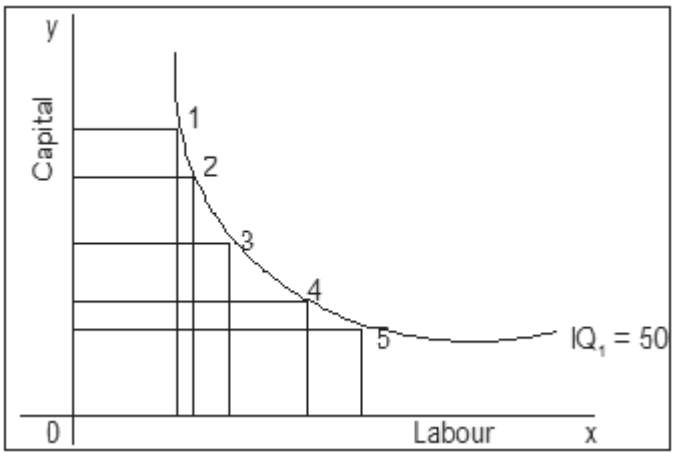
Table 6.2 : Combination of Labour and Capital to Produce Output

Combination of Labour and Capital	Units of Labour	Units of Capital	Output
1	1	13	50
2	2	9	50
3	3	6	50
4	4	4	50
5	5	3	50

In this example, the producer can produce 50 units of output with 1 unit of labour + 13 units of capital, 2 units of labour + 9 units of capital, 3 units of labour+ 6 units of capital, 4 units of labour + 4 units of capital or 5 units of labour + 3 units of capital. When these points are plotted on graph paper and joined, they form an iso-quant. In other words, an iso-quant is a locus of points showing alternative combinations of labour and capital which produce same level of output.

The above table has been shown graphically in the following figure 7.5. In the figure IQ_1 represents the Iso-quant curve. Capital has been depicted in the y-axis while the labour has been shown in the x-axis. Point 1 on the IQ_1 curve represents the capital-labour combination 1, which represents 13 units of capital and 1 unit of labour. Other combinations 2,3,4 and 5 thus represent different units of capital labour of the iso-quant.

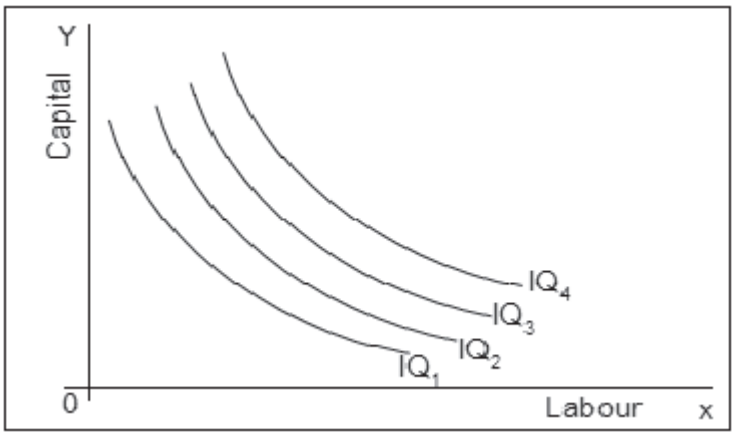
Figure 6.5 : Iso-quant



6.6.3 Iso-Product Map or Isoquant Map

The Iso-Product Map, like the Indifference Curve Map shows a set of iso-product curves. A higher iso product curve shows a higher level of output and a lower iso-product curve represents a lower level of output. Figure 6.6 is an isoquant map. The points on the same IQ shows an equal level of output whereas an IQ to the right represents a larger amount of output.

Figure 6.6: Isoquant Map



6.6.4 Marginal Rate of Technical Substitution

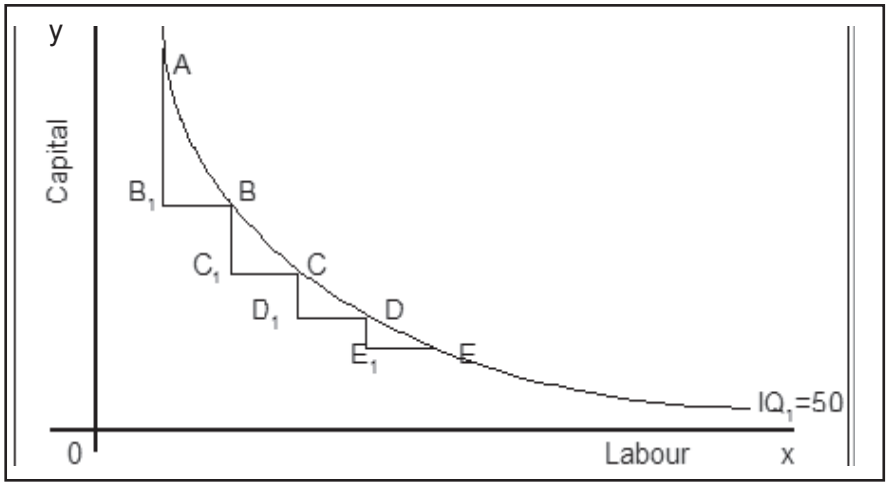
The concept of Marginal Rate of Technical Substitution ($MRTS_{LK}$) between labour and capital can be explained with the help of the following schedule.

Table 6.2

Combinations of labour and capital	Units of labour(L)	Units of capital(K)	Output	$MRTS_{lk}$
A	1	15	50	-
B	2	11	50	4
C	3	8	50	3
D	4	6	50	2
E	5	5	50	1

As can be seen from the table (Table 6.2), 50 units of output can be produced by using 1 unit of labour and 15 units of capital. The same output can be produced by combination of B which uses 2 units of labour and 11 units of capital. Same amount of output can be produced by combination of C, D and E which uses more and more units of labour but lesser and lesser units of capital. That is, in the different combinations of inputs labour can be substituted for capital and yet we have the same amount of output. The rate at which one factor of production can be subsituted for the other to obtain the same amount of output is known as the 'marginal rate of technical substitution' (MRTS). In other words, MRTS of labour for capital is the number of units of capital which can be replaced by one unit of labour, the quantity of output remaining the same. MRTS is the slope of the isoquant or the amount of one input (K) that a firm is able to give up in return for a unit of another input (L) with no change in total output. Another characteristics of $MRTS_{LK}$ is that MRTS has a diminishing tendency. In other words, as the amount of labour units is increasing in the succeeding combinations, less and less units of capital are sacrificed to obtain the same output.

Figure 6.7 : Marginal Rate of Technical Substitution



The above figure 5.7 shows that iso-quant IQ_1 represents output level 50. As we move downward from A to B, AB_1 units of capital is substituted by BB_1 units of labour. Similarly, B to C, BC_1 units of capital is substituted by CC_1. Again if we come down from point C to D, CD_1 units of capital is foregone to obtain EE_1 units of capital. It is clear that for the same quantity of labour (represented by $BB_1 = CC_1 = DD_1 = EE_1$), we are sacrificing less and less of capital (represented by $AB_1 > BC_1 > CD_1 > DE_1$). When more units of labour are used to compensate for the loss of the units of capital to maintain constant output, the ***marginal physical productivity*** of labour diminishes and the marginal physical productivity of capital increases. Therefore, MRTS diminishes as labour is substituted for capital. It makes the iso-quant convex to the origin.

Elasticity of Substitution: The degree of substitutability between two inputs is measured by elasticity of substitution. It is the proportionate change in the ratio of the factors divided by proportionate change in the MRTS.

Therefore :

$$Es = \frac{\text{proportionate change in the ratio of the factors}}{\text{proportionate change in the MRTS}}$$

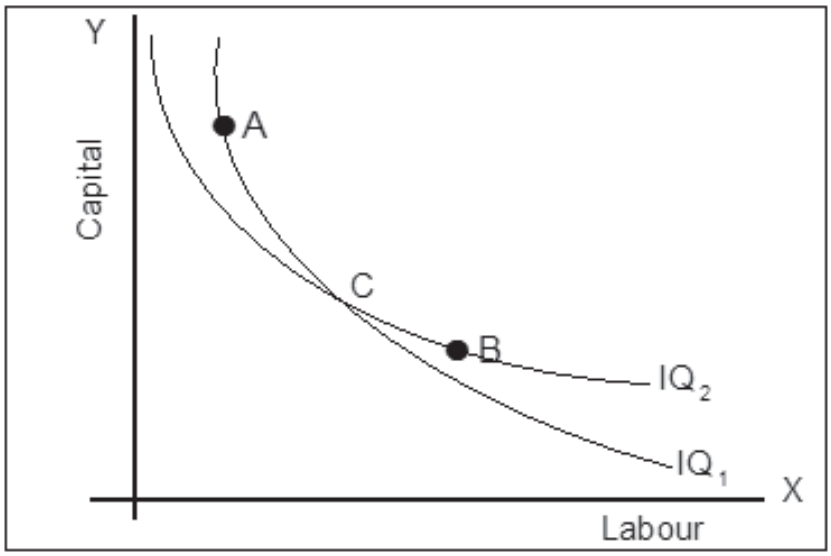
Es (Elasticity of substitution) varies between zero and infinity. When two

factors can not be substituted at all, Es is zero and elasticity of substitution is infinite when the factors are perfect substitutes i. e E_s is 1.

6.6.5 Properties of Iso-quant : An iso-quant has the following properties:

- An iso-quant slopes downward from left to the right. It happens because when quantity of labour is increased, the quantity of capital must be reduced so that there is no change in quantity of output produced.
- Two iso-quants can not intersect each other. If they intersect each other, there will be common factor combination for two different levels of output. This has been explained with the help of the following figure 6.8.

Figure 6.8 : Iso-quants do not intersect each other



In the above figure 6.6, IQ_1 and IQ_2 intersect at point C. Thus, the point C lies on IQ_1. Again, point A also lies on IQ_1. Therefore, it means that at both the points (A and C) the level of output is the same. On the other hand, point C lies on IQ_2 meaning same level of output at point C and point B on the iso-quant.

Thus, we found that:

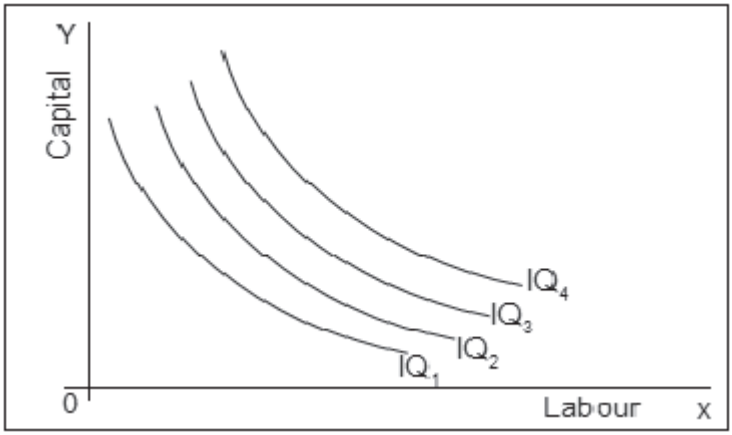
Output level at point A= Output level at point C.

Output level at point B = Output level at point C.

Thus, Output level at point A= Output level at point B. This is completely ridiculous. So, it can be said that two iso-quants can not intersect.

- Every iso-quant is ***convex*** to the origin. The convexity property of an iso-quant means that as we move down on the curve less and less of capital is required to be substituted by a given increament of labour so as to keep the level of output constant. In other words, the convexity is due to the diminishing marginal rate of technical substitution (MRTS). The degree of convexity of the iso-quant depends on the rate at which the MRTS diminishes. If the iso-quants are concave to the origin, it would mean that the marginal rate of technical substitution is increasing and more capital is replaced to get one additional unit of labour.
- As an iso-quant moves upward to the right, it represents higher levels of output. In the following figure 6.9, IQ_2 is higher than IQ_1 and it represents higher level of output. Similarly, IQ_3 is higher than IQ_2 representing higher level of output.

Figure 6.9: Movement of Iso-quants



- There may be a number of iso-quants in between two iso-quants. They show various levels of output that combination of two inputs can produce between any two iso-quants.



Tangent : a tangent is a straight line which touches a curve at a single point. The point where the straight line touches the curve is called the point of tangency.



CHECK YOUR PROGRESS

Q.6. What is an iso-quant? (Answer in about 30 words)

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Q.7. What is elasticity of substitution? (Answer in about 30 words)

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Q.8. What is meant by convexity of an iso-quant? (Answer in about 30 words)

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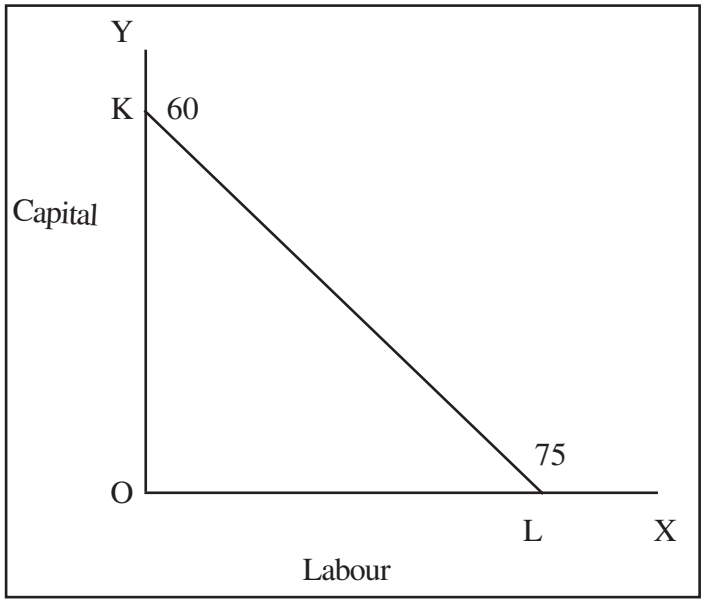
6.7 EQUILIBRIUM OF A FIRM

The concept of equilibrium of a firm can be explained with the help of iso-quants and iso-cost lines. An iso-quant maps represent the various factor combinations which can yield various levels of output.

Let us now introduce the concept of the iso cost line. The prices of factors are represented by the iso-cost line. The iso-cost line determines what combination of factors the firm will choose for production. An iso-cost line shows various combinations of two factors that the firm can buy with a given outlay. Figure 6.10 shows an iso-cost line where units of labour are measured on the X-axis and units of capital are measured on the Y-axis. We assume that the prices of factors are given and constant for the firm. If the firm can spend Rs. 300/- with labour cost at Rs. 4 per labour hour and capital cost at Rs. 5 per machine hour, then the producer can buy 75 units

of labour or 60 units of capital if the entire amount of Rs. 300/- is spent on labour or capital respectively. Let OL represents 75 units of labour and OK represents 60 units of capital. Joining points K and L, we get the iso cost line which passes through all combinations of labour and capital which the firm can buy with Rs. 300/-. Thus, an iso-cost line can be defined as the locus of various combinations of factors which a firm can buy with a constant outlay. The iso- cost line is also called the price line or outlay line.

Figure 6.10 Iso-cost Line

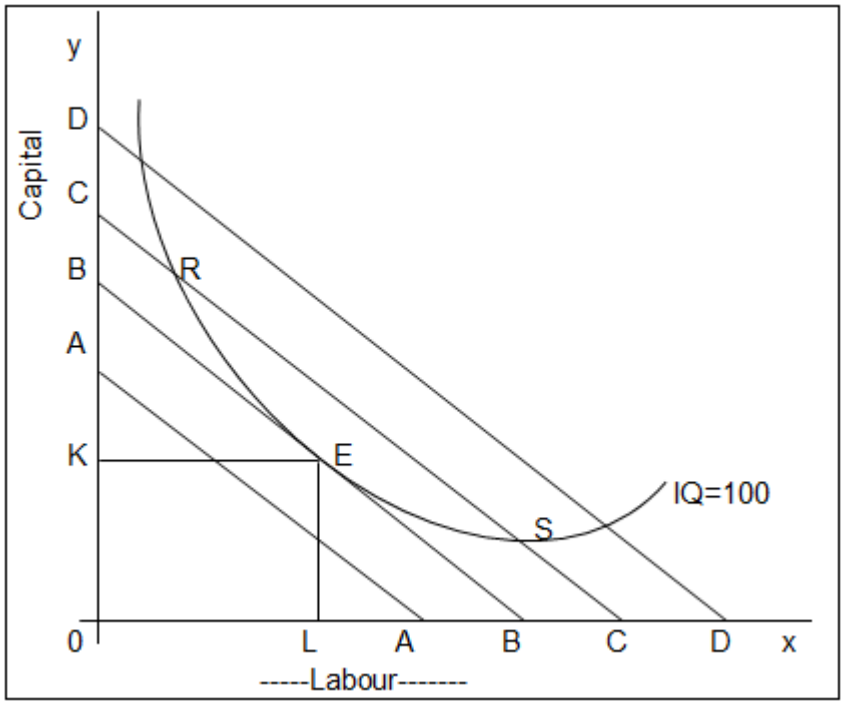


The iso cost line shifts when the total outlay which the firm wants to spend on the factors changes. A greater outlay will cause the iso cost line to shift to the right.

The equilibrium condition of the firm depends on its objectives. As mentioned earlier, an isoquant map given the various factor combinations which can yield various levels of output, every isoquant showing those factor combinations which can produce a specified level of output. A family of iso-cost line represents the various levels of total cost or outlay, given the prices of two factors.

We have already said that the point of least cost combination of factors for any level of output is where the iso-quant is ***tangent*** to an iso-quant. The point of tangency is the point where a straight line touches a curve. This has been explained with the help of the following figure 6.9.

Figure 6.10 : Equilibrium of a Firm



In the above figure 6.9 AA, BB, CC and DD are different iso-cost lines. They show different levels of cost at which production can take place. An important point to note here is that iso-cost lines are always parallel to each other. The producer wants to produce 100 units of output and he has to decide which level of cost will maximize his profit.

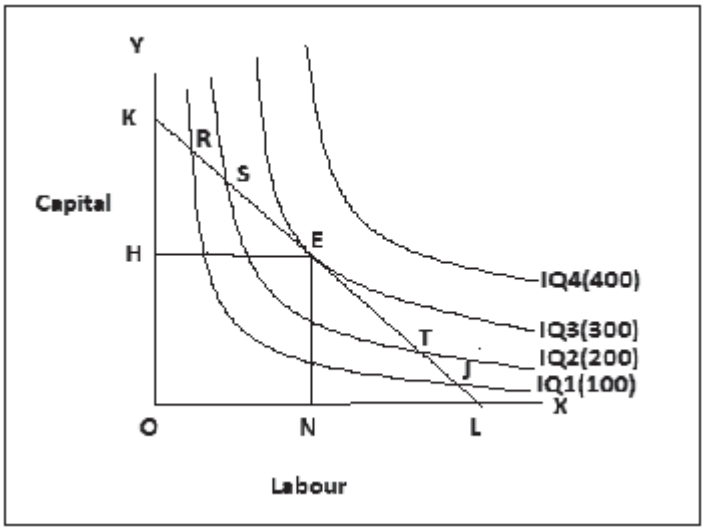
Profit will be maximum at point E where the iso-quant IQ touches the iso-cost line BB. At this point the producer uses 0L amount of labour and 0K amount of capital. Points other than E can not be point of equilibrium as other points cannot fulfil the condition of tangency. If we consider the point R, cost is beyond the reach of the producer. Therefore, the producer will not choose a combination other than E which is the least cost factor combination for producing 100 units of output.

It should be remembered that the point of tangency between the iso-cost and the iso-quant is not a necessary condition for producer's equilibrium. At the point of tangency, the iso-quant must be convex to the

origin. In other words, marginal rate of technical substitution of labour for capital must be diminishing.

The second situation of output maximisation for a given level of cost can be explained with the help of the following diagram.

Figure 6.10 Output Maximisation for a Given Cost



With the given outlay, there will be a single iso-cost line. The firm will have to choose a factor combination lying on the given iso-cost line. The producer will now be in equilibrium at point E where IQ_3 is tangent to KL using ON units of labour and OH units of capital. The firm has the option of producing at R, S, T and J but point E enables the firm to reach the highest possible isoquant IQ_3 producing 300 units of output.



CHECK YOUR PROGRESS

Q.9. State two options of a firm to attain equlibrium.

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Q.10. State the conditions to be fulfilled for the equilibrium of a firm.

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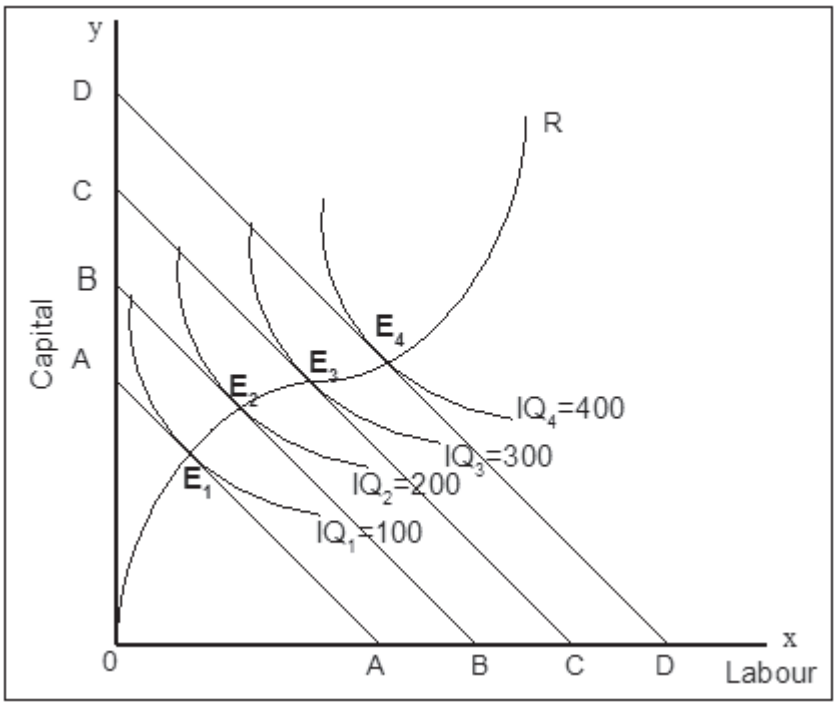
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6.8 EXPANSION PATH

After discussing how a producer reaches equilibrium, we are now in a position to study how a producer will change his factor combination as he expands output with given factor prices. We can study how he will proceed with the help of iso-cost and iso-quant. Suppose, the producer uses labour and capital and their prices are represented by the iso-cost line AA which is shown in the next page.

In figure 6.10, parallel to the iso-cost line AA, there are other three iso-quants BB, CC and DD which show different levels of total cost or outlay. Suppose the producer wants to produce 100 units of output. Then he will produce at point E_1. Suppose he wants to produce 200 units of output, he will choose to produce at E_2 which is a point of tangency between iso-cost curve BB and iso-quant IQ_2. Likewise, for higher level of output 300 and 400, the firm will respectively produce at E_3 and E_4. If we join all the least cost equilibrium points E_1, E_2, E_3 and E_4,

Figure 6.11 : Expansion Path



we get the expansion path. Thus, expansion path may be defined as the locus of the points of tangency between the equal product curves and iso-cost lines as the firm expands output.

The expansion path may have different paths and shape depending upon the relative prices of the productive factors used and the shape of the iso-quant. Since expansion path represents minimum cost combinations for various levels of output, it shows the cheapest way of producing each output given the relative prices of the factors.

6.9 ECONOMICS AND DISECONOMES OF SCALE

Economies of scale :

Economies of scale refers to the advantages or benefits enjoyed by a firm or an industry following an expansion of its scale of production. It is also regarded as the benefits of large scale of production. There are two types of economies of scale-

Scale – (a) internal economies and

(b) external economies

Internal Economies of Scale :

When a particular firm of an industry enjoys certain advantages following an expansion in its scale of production, the advantages will be known as internal economies of scale. Different internal economies are explained below–

(i) **Financial economies :** A big firm with a higher scale of production enjoys financial economies in the sence that the firm can easily secure bank loans as compared to a small firm.

(ii) **Technical economies :** Technical economies arises when a firm uses large machinaries. Large machineries have more productive capacity. Given the productive capacity of the machine and given the fixed cost, the smaller is the output produced, the higher is the cost per-unit and larger is the amount of output prodreced, the lower is the unit cost. A large firm will therefore, have lower production cost per-unit of output produced.

(iii) **Market economies :** A big firm will generate a higher demand for raw

materials compared to a small firm. The supplier of raw-materials may offer rebates to the big firm as it makes a bulk purchase such rebates may not be given to a small firm which makes a small purchase. A big firm may also undertake extensive surveys of market demand for its product.

(iv) **Managerial economies :** A big firm may employ efficient personal to oversee the production plans and programmes. At a large scale production, managerial works are done in a very efficient way which helps to reduce the cost. In a large scale production, the whole unit is grouped into certain divisions, such as production, marketing, export etc. Eact division is leaded by an expert manager. Above all, a general manager is also appointed. Thus managerial economies arises as a result of expert work of the skill managers.

(v) **Labour related economies :** The big firm has a large market for its product. It can go in a big way for division of labour and specialisation. Such a firm can offer various incentives like rapid promotion, provision of pension etc.

(vi) **Risk bearing economies :** Large scale firm can easily bear the risks. A big firm can produce a number of commodities. If the demand for a particular product goes down in the market, the big firm can still fall back upon the other products. They can easily cover the losses incurred by one or more units.

External Economies of Scale

External economies refers to the economies or benefits enjoyed by all the firm which are generated by the industry as a whole. External economies are associated with the benefits of localisation of industries. Sualkuchi is the center of the silk industry of Assam. As and when the number of loom increases, it may be possible to establish a sophisticated colouring and calendening plant at sualkuchi. This will benefit all the weavers. This is an example of external economies of scale. External economies can be analysed in the following way–

(i) **Economies of concentration :** When firms concentrate in a specific area, they can reap the benefits of several aspects. These aspects

may be skilled workers, better transport facilities, credit facilities etc.

(ii) **Economies of information :** When a large scale industry publishes reports, statistics and other informations regarding the products, markets, future prospects and other related matters by its own survey and research, the other firms concentrated nearby can avail these necessary informations.

(iii) **Economies of welfare :** Welfare policy of one firm compels the others to adopt sufficient measures for the welfare of the workers. Besides, all firms can work together to bring welfare of the whole community.

Diseconomies of scale :

Diseconomies of scale refers to disadvantages that a firm or an industry faces following an expansion of its scale of production. There may be internal or external diseconomies of scale.

Internal Diseconomies of scale :

(i) As the firm expands beyond a certain stage the organiser finds it difficult to co-ordinate the activities, efficiency suffers and there arises the problem of mismanagement of large-scale production.

(ii) Every machinery has a maximum productive capacity and when the firm overexpands it becomes difficult to raise output without raising the cost of production.

External Diseconomies of scale :

There are certain external diseconomies of scale. These are–

(i) The disadvantages of localisation of industry will become more prominent as the industry expands. Unplanned urbanisation, environmental pollution and other problem will begin to surface.

(ii) Large scale industry demands more raw materials and as a result, the price of raw materals will begin to rise leading to inflation in the economy.



Division of labour : Division of labour means the breaking up of a job into smaller parts and assigning each part into a particular worker.

Specialisation : Specialisation is a wider sence of division of labour. Division of labour is specialisation only with regard to one factor of production ie. labour. But specialisation implies specialisation of all other factors of production land, capital and organisation.

Localisation of industry : Localisation of industry implies the concentration of the different firm of the industry at a certain place or region.

6.10 THE IMPORTANCE OF PRODUCTION FUNCTIONS IN MANAGERIAL DECISION MAKING

For managers, understanding of the basic concept of production provides a conceptual framework for decisions involving the allocation of a

firm's resources both in the short run and in the long run. We discuss below one such key management principle.

Careful Planning can help a firm to use its Resources in a Rational Manner :

As discussed earlier, a firm has three stages of production and stage II is the only stage for a rational firm to operate. But, the firm may find itself in stage I or stage III depending on how much the consumer wants to buy. This means that, for a firm to operate in stage II only, careful planning is necessary regarding the amount of fixed inputs regarding the amount of fixed inputs that will be used along with the variable ones. If the firm anticipates demand to be in stage II, then the capacity is perfect for its needs. However, if the firm anticipated demand to be in stage III, then it would have to increase its capacity so that stage II includes higher level of output. Similarly, if the firm forecasts demand to be in stage I, it would have to consider decreasing its capacity. Thus, managerial decision making requires two basic elements – (i) accurate forecast of demand, and (ii) effective communication between the production and marketing function.



CHECK YOUR PROGRESS

Q.11. What does the expansion path exhibit?

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6.11 LET US SUM UP

- A production function is a relation between inputs to the production process and the resulting output.
- An iso-quant or equal product line is a curve that shows all possible combinations of inputs that yield the same output. It is also known as producer's indifference curve.

- Amount by which the quantity of one input can be reduced when one extra unit of another input is added without any change in output is called marginal rate of technical substitution (MRTS).
- The degree of substitutability between two inputs is measured by elasticity of substitution. It is the proportionate change in the ratio of the factors divided by proportionate change in the MRTS.
- The law of variable proportions shows the changes in the quantity of one input while other inputs are kept constant.
- There are three stages in the law of variable proportions. A rational producer will always like to produce in stage two.
- It was first believed that the law was applicable in the field of agriculture only. But the modern economists propound that the law is equally applicable to industries and other productive activities.
- The study of changes in output as a consequence of changes in the scale is the subject matter of returns to scale.
- Returns to scale may be constant, increasing or decreasing. Returns to scale vary among different production functions. Normally returns to scale is greater in the production function associated with larger firms.
- The law of variable proportions shows how output changes with changes in the quantity of one input while other inputs are kept constant. But in case of returns to scale, all inputs are changed in a fixed proportion.
- The condition of equilibrium is determined at the point of tangency between iso-cost and iso-quant. Iso-cost is a straight line which shows various combinations of two factors that the firm can buy with a given outlay.
- It should be remembered that the point of tangency between the iso-cost and the iso-quant is not a necessary condition for producer's equilibrium. At the point of tangency, the iso-quant must be convex to the origin. In other words, marginal rate of technical substitution of labour for capital must be diminishing.

- When a firm increases output, it moves from one equilibrium point to another. Such change of equilibrium position form one to the other is captured by expansion path.
- Expansion path is the locus of the points of tangency between the equal product curves and iso-cost lines as the firm expands output. In other words, it is the locus of least cost combination points.



6.12 FURTHER READINGS

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3) Koutsoyiannis, A (1979). *Modern Microeconomics.* New Delhi: Macmillan
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6.13 ANSWERS TO CHECK YOUR PROGRESS

Ans. to Q. No. 1 : The law of variable proportions is based on the following assumptions–

- There should not be any change in the state of technology.
- Only one input will undergo change in quantity keeping all other inputs constant.
- All the units of the variable factor are homogenous.
- It is possible to change the proportion in which the various inputs are combined.

Ans. to Q. No. 2 : In the first stage of production, total output increases at an increasing rate upto a certain point. This point is called the point of inflexion.

Ans. to Q. No. 3 : The third stage is known as the stage of diminishing

returns as both the average and marginal products of the variable factor continuously fall during this stage.

Ans. to Q. No. 4 : When the producer changes both labour and capital in the same proportion and the changes in total production are studied, it refers to returns to scale. It is called so because there is change in the scale of production.

Ans. to Q. No. 5 : The law of variable proportions shows how output changes with changes in the quantity of one input while other inputs are kept constant. But in case of returns to scale, all inputs are changed in a fixed proportion.

Ans. to Q. No. 6 : An iso-quant or equal product line is a curve showing all possible combinations of inputs that yield the same level of output. This concept is analogous to consumer's indifference curve. Therefore, it is also known as producer's indifference curve.

Ans. to Q. No. 7 : The degree of substitutability between two inputs is measured by elasticity of substitution. It is the proportionate change in the ratio of the factors divided by proportionate change in the MRTS. Therefore:

$$Es = \frac{\text{proportionate change in the ratio of the factors}}{\text{proportionate change in the MRTS}}$$

where, Es = elasticity of substitution, MRTS = marginal rate of technical substitution.

Ans. to Q. No. 8 : The convexity property of an iso-quant means that as we move down on the curve less and less of capital is required to be substituted by a given increment of labour so as to keep the level of output constant. The degree of convexity of an iso-quant depends on the rate at which the MRTS diminishes.

Ans. to Q. No. 9 : The two options a firm will have to attain equilibrium are:

- maximizing output for a given cost, or
- minimizing cost subject to a given output.

Ans. to Q. No. 10 : The following two conditions must be fulfilled for the equilibrium of a firm:

- The iso-cost line should be tangent to the iso-quant.
- At the point of tangency, the iso-quant must be convex to the origin.

Ans. to Q. No. 11 : Since expansion path represents minimum cost combinations for various levels of output, it shows the cheapest way of producing each output given the relative prices of the factors.



6.14 MODEL QUESTIONS

Q.1. Describe the significance of the law of variable proportions.

Q.2. Write a short note on the concept of expansion path.

Q.3. Write a short notes on:

a) Constant returns to scale

b) Decreasing returns to scale

c) Increasing returns to scale

Q.4. Explain the law of variable proportions with the help of suitable diagram.

Q.5. What do you mean by returns to scale? Discuss its various types with the help of suitable diagrams.

Q.6. Discuss the equilibrium of a firm using iso-quant and iso-cost lines.

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UNIT 7: COST ANALYSIS

UNIT STRUCTURE

7.1 Learning Objectives

7.2 Introduction

7.3 Cost Function

7.4 Cost Concepts

- 7.4.1 Opportunity Cost or Alternative Cost
- 7.4.2 Explicit Cost and Implicit Cost
- 7.4.3 Money Costs and Real Cost
- 7.4.4 Accounting Cost and Economic Cost
- 7.4.5 Sunk Costs, Marginal Cost and Incremental Cost

7.5 Nature of Cost Curves in the Short-run

- 7.5.1 Total Variable Cost and Total Fixed Cost
- 7.5.2 Average Cost Curves
- 7.5.3 Marginal Cost Curve

7.6 Long Run Cost Curve of Firm

- 7.6.1 Long Run Average Cost Curve
- 7.6.2 Long Run Marginal Cost Curve

7.7 Managerial Uses of Cost Function

7.8 Let Us Sum Up

7.9 Further Reading

7.10 Answer to Check Your Progress

7.11 Model Questions

7.1 LEARNING OBJECTIVES

After going through this unit you will be able to

- explain the concepts of costs
- define cost function
- compare between various types of short run cost curves
- describe how long run average cost curves and marginal cost curves are derived

- explain the significance of cost function in managerial decision making

7.2 INTRODUCTION

Cost plays an important role in decision making process of a firm. Profit maximization is an important objective of a firm. Besides profit maximization, costs determined whether a new product is to be introduced or not, whether there should be new *acquisition* and so on. In the language of a layman, the sum of all expenditure incurred in the process of production is called cost. The term cost of production may be used in several senses. We will discuss all of them.



Acquisition-
It is the act of contracting or assuming or acquiring possession of something.

The costs incurred on the production process may be studied in both short run and long run. In the short run, fixed factors can not be changed. Output can be increased only by varying the quantities of variable factors. But in the long run there is no fixed factor. A period is called long run if all inputs can be changed within that period. In this unit we will discuss how long run average and long run marginal costs are derived. The concept of cost discussed in this unit falls within the purview of traditional theory of costs.

7.3 COST FUNCTION

The theory of costs plays a major role in managerial economics while allocating scarce resources. A cost function is a derived function. It is derived from the production function. The relationship between cost and output is known as cost function, i.e. it relates the cost of production to the firm's level of output. Economic theory distinguishes between short-run and long- run cost. Short run costs are the costs over a period of time during which some factors of production are fixed. The long-run costs are costs increased over a period of time during which it is possible to change all the factors of production. But both in the short run and in the long run, total cost is a multivariate function. Symbolically, we may write the short run cost function as

$$C=f\ (X, T, P_f, K)$$

where C= total cost

X= output

T= Technology

P_f= prices of factors

K= fixed factors

The long-run function is different from short run cost function. It does not contain the variable 'K' which represents the fixed factor. Every factor is a variable in the long run. Symbolically, the long-run cost function may be represented as

$$C=f(X, T, P_f)$$

If we compare the long-run production function with the short run production function, we see that the variable K representing technology is absent in the long run production function. This happens because technology undergoes changes in the long-run.

7.4 COST CONCEPTS

The term cost is frequently used without explaining what it actually means. Since the term cost has different meanings, it is essential that the term be defined precisely. Let us discuss them below.

7.4.1 Opportunity cost or Alternative cost

The concept of opportunity cost plays a major role in managerial decision making. While deciding the cost of a product, it is always important to consider what the customer is willing to sacrifice to obtain the particular product. The opportunity cost of any good is the next best alternative good that is sacrificed. Since resources are scarce, they can not be put in all uses simultaneously. If they are used to produce one thing they have to be withdrawn from other uses. For example, a plot of land can be used to produce either rice or wheat. When it is employed to produce rice, it means that we have sacrificed the quantity of wheat for rice. The opportunity cost of producing rice is the amount of wheat sacrificed.



LET US KNOW

Opportunity cost: It refers to the amount of subjective value foregone in choosing one activity over the next best alternative. The opportunity cost or transfer cost of any good is the next best alternative good that is given up. It is the opportunity missed or alternative foregone in having one thing rather than the other or in putting a factor service to one use instead of the other. While taking any production decision, opportunity cost associated with the use of firm's resources should be taken into account.

7.4.2 Explicit cost and Implicit cost

Explicit costs are those costs that involve an actual payment to other parties, while implicit costs represent the value of foregone opportunities but do not involve an actual cash payment. Implicit costs are as important as explicit costs. Ignoring implicit cost means that a part of the total opportunity cost has been ignored. Let us take the case of a person who does not hire a manager and runs his own business. While working for someone else, he could have earned a good salary. That salary foregone is often neglected in accounting statement but any rational decision making policy should include both explicit and implicit cost.

7.4.3 Money cost and Real cost

Money costs are total money expenses incurred by a firm for purchasing the inputs, together with certain other items. These will include wages and salaries of workers, cost of raw materials, expenditures on capital equipment, depreciation cost, rent on buildings, interest on capital invested and borrowed, advertisement and transportation cost, insurance charge, taxes and so on. It is also called nominal cost or expenses of production.

Some elements always lie behind the money cost which can not be explicitly measured. The efforts and sacrifices made by the capitalists to save and invest, the foregone leisure by the workers are some example of real cost. Marshall defined such expenditure as real cost. An unpleasant work does not always carry high wage and a pleasant work does not carry low wage. Thus, it can be said that money cost and real cost do not correspond to each other.

7.4.4 Accounting cost and Economic cost

The concept of cost as conceived by an accountant is different from the idea conceived by an economist. Accountants are concerned with reporting the past performance of the firm for external use, as in annual reports. Financial accountants tend to take a retrospective view of the firms finances and operations because they must keep track of assets and liabilities and evaluate past performances. It is called so because accountants use this cost concept. But an economists approaches cost somewhat differently. They take a forward looking view of the firm. They are concerned with the allocation of scarce resources. Therefore, they care about what cost is likely to be in future and about the ways in which resources could be rearranged to reduce cost and improve profitability. It refers to foregone opportunities. The word 'economic' tell us to distinguish between costs that the firm can control and those it can not.

7.4.5 Sunk cost, Marginal cost and Incremental cost

Sunk cost is an expenditure that has been made and can not be recovered. For example, let us take the case of a producer who buys specialized equipment designed for a particular purpose. That equipment can be used to do only what it was originally designed for and can not be converted for some other use. It has no alternative use and therefore, its opportunity cost is zero. The expenditure on this equipment is called sunk cost. In general, sunk costs are irrelevant in decision making.



LET US KNOW

Sunk costs: Sunk cost is incurred in the past and it is not affected by current decision. The money used as sunk cost can not be recovered. It has no opportunity cost. Sunk cost is an expenditure that has been made and can not be recovered.

Marginal cost refers to the change in total cost corresponding to an increase in output by an additional unit. On the other hand **incremental cost** refers to the total additional cost of implementing a managerial decision. It may be the increase in expenditure owing to introduction of a new product line or acquisition of a new unit of production and so on.



CHECK YOUR PROGRESS

Q1. Distinguish between marginal cost and incremental cost.

.....

.....

Q2. What is sunk cost? Is sunk cost relevant in managerial decision making?

.....

.....

.....

7.5 NATURE OF COST CURVES IN THE SHORT- RUN

The short-run is a period in which the firm can not change its plant, equipment and the scale of organization. To increase output, it can only employ more variable factors with the same quantity of fixed factors.

7.5.1 Total Variable Cost and Total Fixed Cost

Total cost is an all inclusive concept encompassing expenses of all kinds required to do business. It is the cost of producing any fixed

level of output. The total cost may further be subdivided into **total variable** and **total fixed** cost. Let us discuss them below.

Total variable cost:

The total variable costs are those expenses of production which change with the changes in total output of the firm. It means that they can be adjusted with the change in output level. For example a bread producer wants to increase the production of bread from 200 to 350 units. Now he will require more wheat and more labourers. Therefore, expenditure on these two items is called variable cost. Variable costs are also called primary cost or direct cost. Variable cost includes expenditure on labour, raw materials, power, fuel, etc.

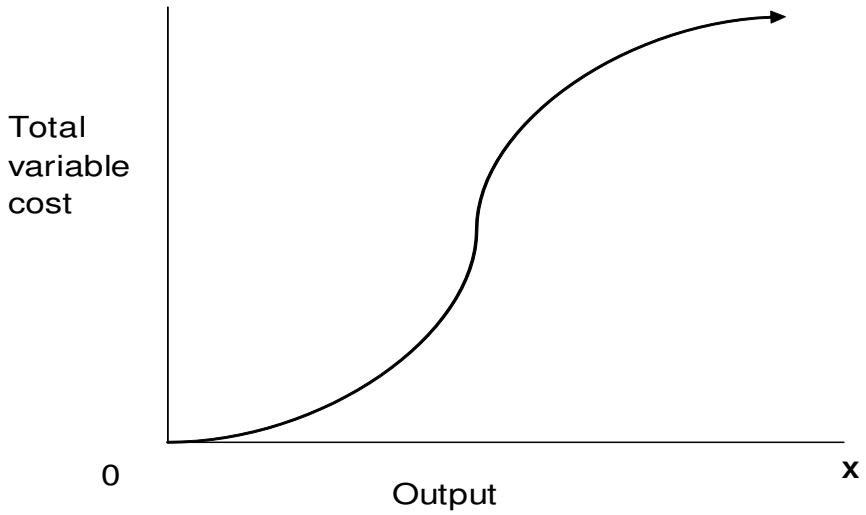


Fig: 7.1

The total variable cost curve starts from the origin as shown in the Fig: 7.1. It is so because when nothing is produced total variable cost is zero.

Total Fixed cost:

On the other hand, some components of production can not be varied in the short run. For example, our bread producer can not increase its plant size quickly in the short run. He has to collect capital and order the equipment for purchasing. Such expenditure

on capital equipment, building, administrative staff salaries, land maintenance etc are called fixed costs. It is called so because it can not be adjusted in the short run. Fixed cost is the cost which does not vary with the level of output. Fixed costs are known as 'overhead' cost. The total fixed cost curve is horizontal line as shown in diagram 2 which is parallel to the X axis. In the diagram 7.2, 0A is the quantity of fixed cost incurred in the short run.

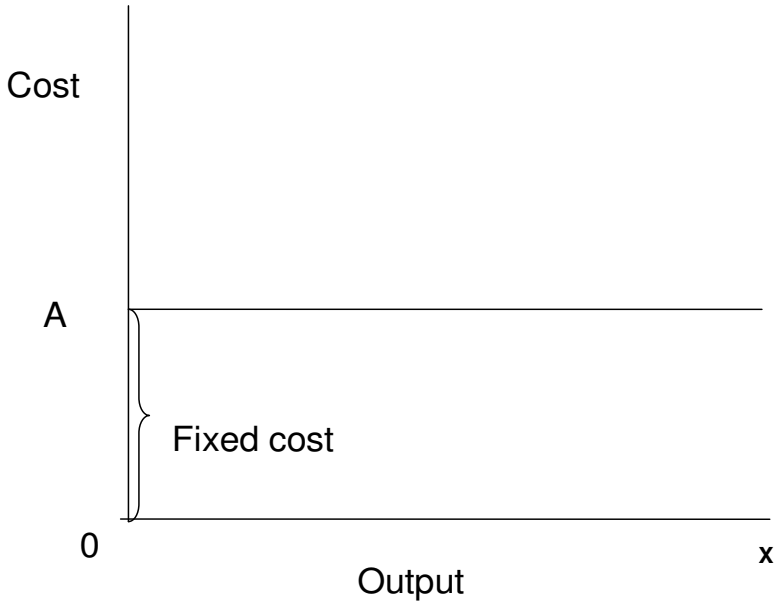


Fig: 7.2

Both total fixed costs (TFC) and total variable cost (TVC) together constitute total cost (TC). Thus,

$$TC = TVC + TFC$$

The shape of the total cost curve resembles the shape of the total variable cost curve as shown by fig 7.3. The distance between the total cost curve and the total variable cost curve represents total fixed cost.

Total fixed cost

Total variable cost

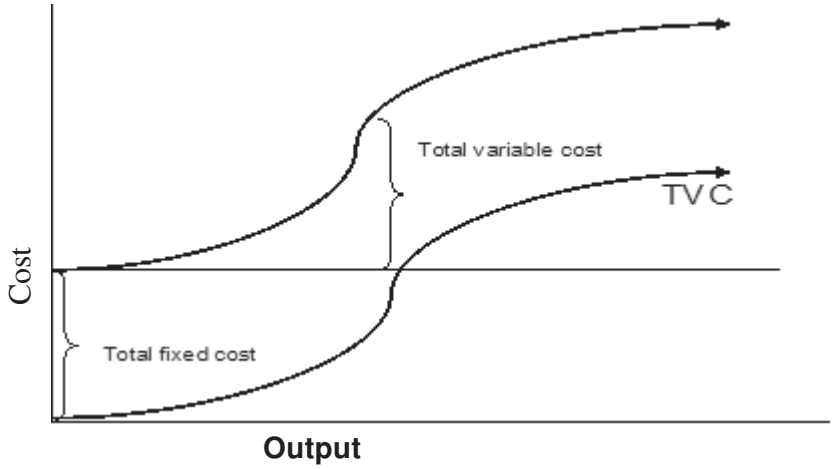


Fig 7.3

The slope of the total cost curve is related to returns to scale concept. We know that returns to scale refers to resultant increase in output for increase in all inputs in a particular proportion. A production function does not always exhibit the same degree of returns to scale over the entire range of output. It has been found in most of the cases that returns to scale is increasing at the initial stage, followed by constant returns to scale over the intermediate levels of output and finally decreasing returns to scale operates at high levels of output.

7.5.2 Average cost Curve

Average cost (AC) is defined as total cost of production divided by the total number of output produced. Cost per unit is more relevant in decision making than the total cost function. This is because the manager must compare cost per unit of output to the market price of that output.

$$AC = \frac{TC}{Q}$$

Here, TC represents total cost incurred in the process of production and Q represents the number of output produced. We have already studied that total cost (TC) is nothing but the sum of total fixed cost and total variable cost.

$$ATC = \frac{TC}{Q}$$

$$\text{Or,} \quad ATC = \frac{TVC + TFC}{Q}$$

$$= \frac{TVC}{Q} + \frac{TFC}{Q}$$

$$= AVC + AFC$$

It means that average cost is the sum total of average variable cost and average fixed cost. Now we will discuss the shape of average fixed cost and average variable cost curves.

Average fixed cost:

If the total fixed cost is divided by the total number of units of output produced, we arrive at average fixed cost. Average fixed cost is the amount of fixed cost required to produce a single unit of production. It is calculated by

$$AFC = \frac{TFC}{Q}$$

Where, Q is the number of total output produced. The shape of the average fixed cost curve is shown in Fig:7.4.

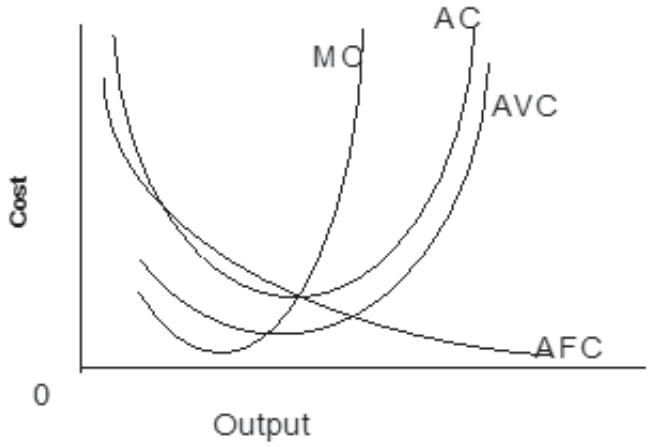


Fig: 7.4

Note: MC must cut both the AVC and AC at their respective minimum points

Average variable cost (AVC):

Average variable cost is the total variable cost divided by the number of units of output produced. It can be calculated in the following way-

$$AVC = \frac{TVC}{Q}$$

Where, Q stands for the total output produced. The average variable cost will generally fall as output increases from zero to the normal capacity output. But beyond the normal capacity of output it will rise steeply, because of the operation of the law of diminishing return. Average variable cost curve is shown in Fig 7.4.

7.5.3 Marginal cost Curve

To understand the concept of marginal cost, let us go back to the concept of marginal product. Marginal product is an additional output produced. For example, one producer produces 100 units. When he produces 101 units, the extra unit is called marginal output. Therefore, marginal cost is an addition to the total cost incurred on the production of an additional unit. Since total fixed cost does not

undergo any change in the short run, marginal cost may also be called an addition to the total variable cost in the short run. With the help of mathematics MC can be expressed as

MC= (TC) / Q

where TC is total cost and Q is output, " stands for a small change.

There is a direct relationship between AC and MC. When AC falls MC also falls but it is below AC. When AC rises MC is above it and AC equals MC at the lowest point of AC.

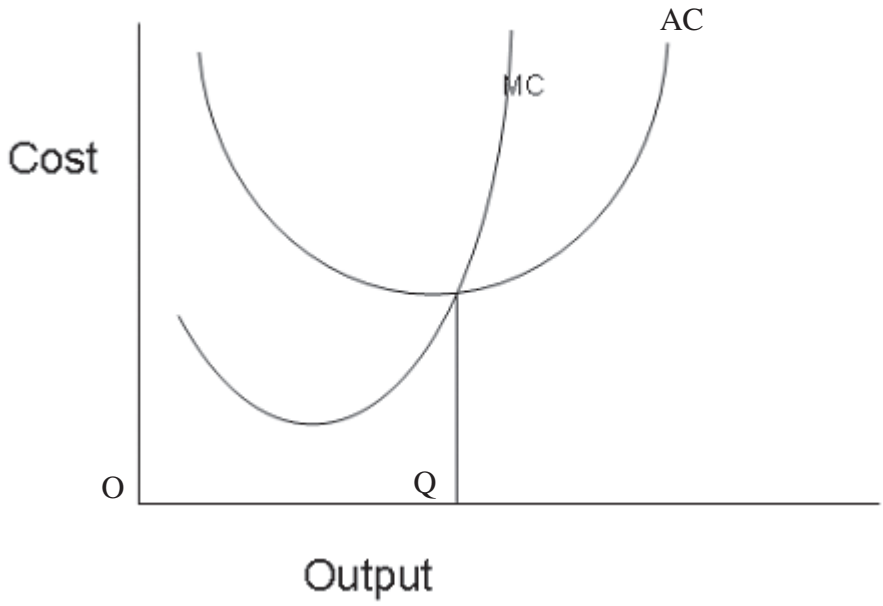


Fig: 7.5

Note: MC must cut AC from below at its minimum point

From the Fig: 4.5 it is clear that to the right of output Q, MC is higher than AC and to the left of Q, MC is lower than AC. But at output level Q, MC=AC. Thus, we find that

1. If MC< AC, then AC will be falling as output increases.
2. If MC>AC, then AC will be rising as output increases.
3. At point Q where AC is minimum, we have AC=MC.

7.6 LONG-RUN COST CURVE

Long run is a period when a firm can change its plant size and scale of operation. In the long run all factors are variable. Now the question is how short is the short run and how long is the long run? This depends on the industry and the production techniques used. Production length will vary from firm to firm. If there are no transactions and no specialized inputs, then all inputs can be quickly adjusted, and the long run is not very long.

7.6.1 Long-Run Average Cost Curve

Let us first discuss how long-run average cost curve is derived in the long run. We all know that a particular plant can produce a particular range of output. It is the lowest point of average cost curve beyond which production is not economic because of the operation of law of decreasing returns to scale which may occur for various reasons. Suppose the demand for a firm's product increases. Now the producer will install a new plant. The firm will be making use of the newly installed plant till it reaches the lowest point on the average cost curve. This way more new plants will be installed with the increase in demand for the firm's product.

We can derive the long-run average cost (LAC) curve from the short run average cost curves by fitting a line which is tangent to all SAC curves.

In Fig: 7.6, LAC is the long run average cost curve. Each point on the LAC is a point of tangency with the corresponding short run average cost curve. Therefore, it is also called Envelope Curve. The firm will produce OM amount of output at the minimum point E. If the firm produces less than OM, it is not reaping fully the economies of scale and if it produces beyond OM, there will diseconomies of scale. In both the cases, the average cost of production will be higher.

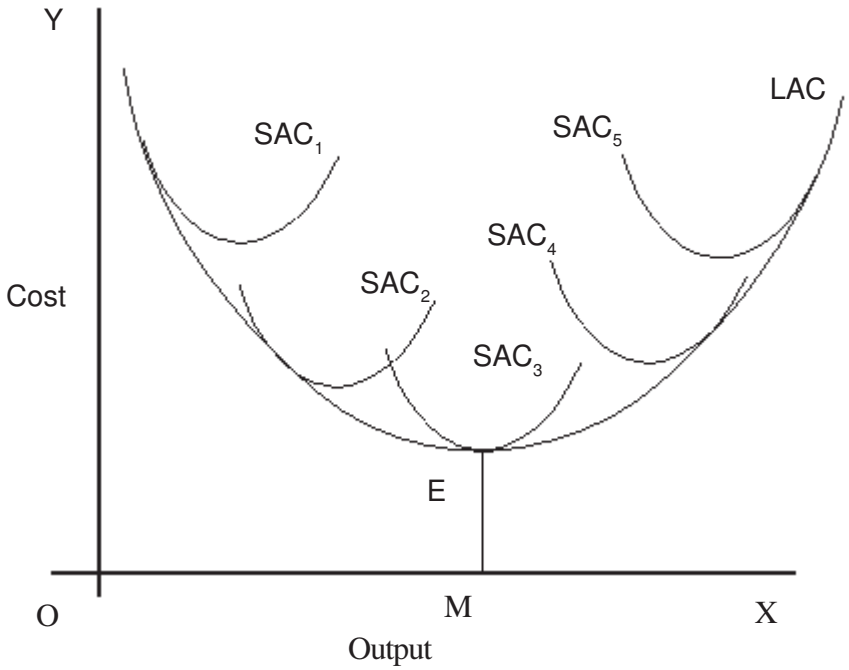


Fig: 7.6

The shape of the long-run average cost curve is like U. This shape reflects the laws of returns to scale. According to this law, the unit cost of production decreases as plant size increases, due to the economies of scale which large plant sizes make possible. It has been assumed that this plant is completely inflexible. There is no reserve capacity, not even to meet temporary rise in demand. If this plant size increases further than this optimum size there are diseconomies of scale. The turning up of the LAC is due to managerial diseconomies of scale when output is increased beyond the optimum size.

7.6.2 Long Run Marginal Cost Curve

The long-run marginal cost can be derived from the short run marginal cost curves (SRMC) but it does not envelope them like the LAC. The LRMC curve is formed from the point of intersection of the SRMC curves with vertical lines to the X axis drawn from the points of tangency of the corresponding SAC curves and the LRA cost curves. At that level of output, the LMC must be equal to the SMC curve at which the corresponding SAC curve is tangent to the LAC curve.

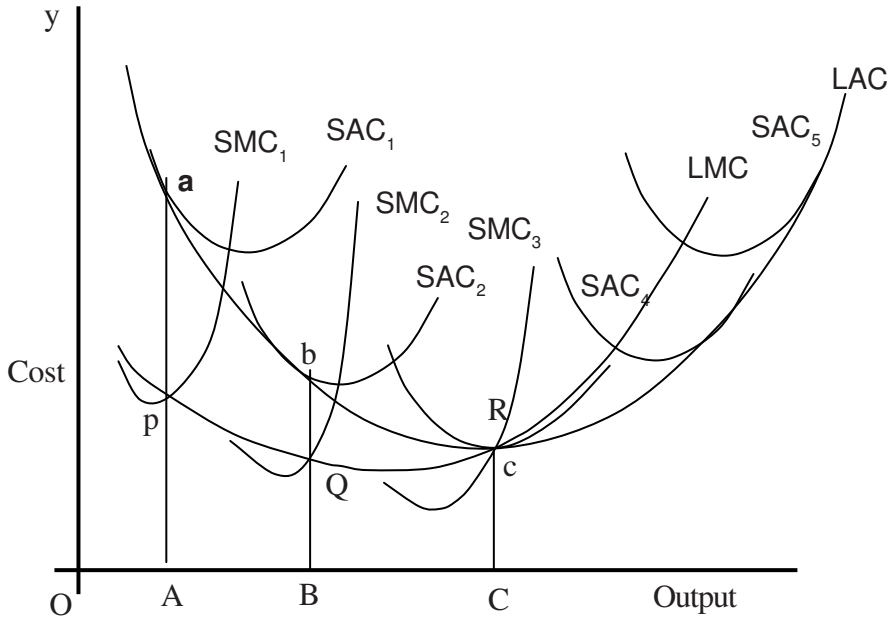


Fig: 7.7

In Fig: 7.7, let us start with the point 'a' which is a point of tangency between SAC and LAC. From this point a vertical line aA is drawn on the X axis and it cuts the SMC_1 at point P. Similarly 'b' and 'c' are the other two points of tangency between other two SAC curves and the LAC curve. Corresponding to these two points of tangency, the point of intersection between vertical lines bB and cC are Q and R. After joining P, Q and R we get the LMC curve. At this minimum point R, the LMC curve intersects the LAC curve. Long run marginal cost bears direct relationship with the long run average cost. When both LAC and LMC falls, LMC is lower than LAC. But as LAC and LMC both increase, LMC is higher than LAC. But the LMC cuts the LAC at the lowest point. The same relationship is true in the short run also.

7.7 MANAGERIAL USES OF COST FUNCTION

The theory of cost is a fundamental concern of managerial economics. It is difficult to make managerial decisions without taking help of cost. For a profit maximizing firm, the decision to add a new product is made by comparing additional revenues to the additional costs associated with that new product. Similarly, the decision on capital investment is made

by comparing the rate of return on the investment with the opportunity cost of the funds used to make the capital acquisitions. Cost is also important in the non profit sectors. For example, in obtaining new fund for a project on dam, the respective authority must show that the benefit of cost must be higher than all negative externalities arising from the cost.

Managerial decision making is facilitated by information that shows the cost of each level of output, i.e. average cost. A firm operates in short run but plans in the long run. At a particular point of time, the firm has one or more fixed factor of production. Therefore, production decision must be based on short run cost curves. But a firm can change the scale of operation in the long run. The long run cost functions are used for planning the optimal scale of plant size.



CHECK YOUR PROGRESS

Q3. Fill in the blanks with appropriate words:

(i) The total cost may further be subdivided into .....and .....cost.

(ii) Average cost = ...

(iii) .....refers to the change in total cost corresponding to an additional increase in production.

(iv) .....is an expenditure that has been made and can not be recovered.

(v) The shape of the long run average cost curve is like .....



7.8 LET US SUM UP

This unit is associated with the learning of the concepts of cost, short run costs and long run costs. Opportunity cost is the best measure of a resource cost which is nothing but the value of that resource in its highest valued alternative use. Money cost can be explicitly measured in terms of money. But real costs can not be directly measured. Money costs are total

money expenses incurred by a firm in producing a commodity where the efforts and sacrifices of the factor or the entrepreneur is called real cost of production. Accounting costs are concerned with a firm's financial statements but economic cost is concerned with the firm's past performance. Sunk cost is an expenditure that has been made and can not be recovered but it is not so relevant in managerial decision making. Marginal cost and incremental costs play crucial role in decision making.

The theory of cost has been approached here from both short term and long term perspectives. In the short run, total cost is the sum of total variable and total fixed cost. The total variable costs are those expenses of production which change with the changes in total output of the firm. But some components of production can not be varied in the short run, they are called fixed costs. Average fixed cost is the fixed cost per unit of output and average total cost is total cost per unit of output. Marginal cost is the increase in cost resulting from the production of one extra unit of output. There is a direct relationship between AC and MC. When AC falls MC is below AC. When AC rises MC is above it and AC equals MC at the lowest point of AC.

In the long run, average cost curve is an envelope curve of the short run average cost curve. The shape of the LAC curve is like the U. The U shape occurs due to the laws of returns to scale. The long run marginal cost curve can be derived from the short run marginal cost curves (SRMC), but it does not envelope the short run marginal cost like the LAC curve. The same direct relationship between average cost and marginal cost curve which is applicable in the short is also applicable in the long run. Break Even Analysis is concerned with finding out the break even point i.e. the point at which total cost equals sales revenue.



7.9 FURTHER READING

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7.10 ANSWERS TO CHECK YOUR ROGRESS

Ans to Q.No.1: Marginal cost refers to the change in total costv corresponding to an additional increase in production and incremental cost refers to the total additional cost of implementing a managerial decision

Ans to Q.No. 2: Sunk cost is an expenditure that has been made and can not be recovered. In general, sunk costs are irrelevant in decision making.

Ans to Q.No. 3: (i) Total variable cost and total fixed cost,

(ii) Total cost,

(iii) Marginal cost,

(iv) Sunk cost

(v) U shape of cost curve .



7.11 MODEL QUESTIONS

1. Describe the relationship between average cost and marginal cost with the help of a diagram.
2. Distinguish between fixed cost and variable cost.
3. Explain why there is no fixed cost in the long run.
4. What is the main reason behind the U shape of LAC curve?
5. Describe the Break even Analysis and its assumptions

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