Appendix-96
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PRINCIPLES OF MICROECONOMICS-I

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B.A.(Hons.) Economics Generic Elective (GE-I)

Principles of Microeconomics-I

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LESSON: 1

PROBLEM OF SCARCITY AND CHOICE

INTRODUCTION

Institutionalized behaviour pattern of man with regard to production, distribution and consumption of wealth or the material means of satisfying human desires, is the distinguishing mark of a particular economic system. But at the foundation of any such system, there will always be found a few universal economic conditions. Although each economic system has its own peculiarities, yet certain basic economic problems are common to all.

Learning Objectives

After going through the lesson, you will be able to

1. Know and analyse the central problems facing the economies of the world
2. Explain the concept of opportunity cost and its different types
3. Draw the various shapes of Production Possibility Curves (PPC)
4. Understand the role and limitations of price mechanism
5. Realise the importance and role of government

1.1 THE THREE CENTRAL PROBLEMS OF AN ECONOMY

There would not be existence of any problem if resources were unlimited, and an infinite amount of every good could be produced. The question of choice arises directly out of the scarcity of resources. The human wants that can be satisfied by consuming goods and services may be regarded, for all practical purposes, in today's world as limitless. In relation to the known desires of individuals (for better food, clothes, housing, schooling entertainment and the like), the existing supply of resources is highly inadequate.

Suppose a society possesses unlimited resources in the form of land, labour and capital equipment. There will then be no economic problem because the economy can produce enough goods and services to meet all the wants of persons, individually as well as collectively. There would then be no economic goods, i.e., no goods that are relatively scarce. And there would hardly be any need for a study of economics or economizing. All goods would be free goods, like air, sun-shine and rain water. But in reality, it is possible to produce only a small fraction of the goods and services that people desire.

Any society, whether simple or complex, advanced or backward, free or controlled must somehow confront three fundamental, interdependent and central economic problems given below:

(1) What goods and services shall be produced and in what quantities? This is called the problem of what to produce?

(2) How will these goods and services be produced, i.e., by what method or technology and with what resources? This is called the problem of how to produce?

(3) How will the goods produced be allocated among the members who make up the society, i.e., whom are the goods produced for? This is called the problem of for whom to produce?

Let us discuss these problems and their solutions.

The Problem of What to Produce

We know that resources can be used to produce more than one type of commodity. But the point to note is that the same unit of the factor/resource cannot be available simultaneously to all the activities for which it is useful. For example, a unit of labour can be employed either on a piece of land for *agriculture*, or for a factory building or housing. Therefore, the community must choose which activity to pursue from amongst the different activities. Choosing an activity further implies that other alternate activities have to be sacrificed. If a factor unit such as labour or combination of factors of production is used to produce one commodity, say steel, then you will have less of some other commodity, say, food grains. Similarly, if the community decides to consume more now, it will have less for the future, i.e., for the production of capital goods and machinery-which can produce more consumers goods in future. *The question what goods, to produce and what not to produce, therefore, concerns the allocation of scarce resources among alternative uses.*

For resource allocation, one needs two sets of information. One, the wants of the people should be known with their preference intensifies. In other words, for a rational allocation of resources a society must set priorities among their needs. Second, information regarding production possibilities of different commodities with the given resources ought to be available. Such information is summarized in the production possibility curve.

The Problem of How to Produce

The second problem concerns the organisation of resources, i.e., choice of technique. This question arises whenever there is more than one technically possible way to produce goods. Agricultural commodities, for example, can be produced by farming a large area of land while using small quantities of inputs like fertilizers and machinery or by farming a small area of land intensively, using large quantities of inputs such as fertilizers, labour and machinery. Both methods can be used to produce the same quantity of some commodity. One method economizes on land and uses large quantities of other resources, the other makes use of a large area of land and economizes on capital. Similar possibilities are available in the industrial sector also. It is usually possible to have the same output by several different techniques, ranging from highly labour intensive techniques using large quantity of labour and a few tools, to those using a large quantity of highly sophisticated machinery and only a very small number of workers commonly referred to as capital intensive technology.

Several considerations are made before choosing whether to use labour intensive or capital-intensive technology. One, a choice is open only to the extent one factor is substitutable for another. Two, factor costs are another important consideration. Firms or producers normally look for least-cost combinations of factors to produce certain level of output.

The Problem of For Whom to Produce

The third problem concerns the distribution of the national product among the members of the community. Since an economy can produce only a limited amount of goods and services (because of the resource constraint), it is not possible to meet all the demands of all the people. This poses before the community the problem of choosing criteria for allocating this limited amount of goods and services amongst various individuals and groups. In other words, the economy must decide as to who will share the limited output and to what extent, and who will go without it.

As we know that the value of national product is called national income, the problem of for whom to produce concerns distribution of national income in various forms such as wage, rent, interest and profit. It is well-known that in the process of generation of income through production of goods and services, the factors of production are compensated for factor services rendered. Accordingly, wage is given for labour service, rent is paid for services of land and building, interest is earned for lending capital and profit accrues to the entrepreneurial efforts made during production

process. Wage, rent, interest and profit are used to acquire goods and services produced by rendering factor services. Hence, the problem of for whom to produce relates to distribution of income.

The problems which we have just stated are common to all economies, but different economic systems try to solve them differently. In a primitive society, custom may rule every facet of behaviour. You can also imagine a dictator who by arbitrary decrees decides what, how and for whom to produce. On the other extreme there is the capitalist free enterprise economy where all the three questions are decided automatically by the price mechanism.

Intext Questions

Say True or False

1. Choice arises due to scarcity of resources.
2. The problem of how to produce concerns allocation of resources.
3. Choosing an appropriate technique of production is required to solve the problem of whom to produce.
4. Choice of technique of production depends on the ease of factor substitution.

Solutions to the Central Problems in Different Economic Systems: The capatialistic economic system and socialistic economic system have different approaches to solve the central problems. These two distinct approaches are, (i) role of price mechanism and (ii) role of the government. Let us discuss these two approaches.

1.2 THE ROLE OF PRICE MECHANISM

In a system of free enterprise economy, no individual or organisation is consciously concerned with any of the three central problems stated above. In such an economy, production and distribution are the outcome of millions of independent decisions made by consumer and producers, all acting through the market mechanism. Hundreds of thousands of commodities are produced by millions of people more or less of their own volition and without control, direction or any master plan. And yet it is not a system of chaos and anarchy. There is a certain order in it.

Immediately the question arises, "how does the automatic price mechanism operate?" The bare outlines of a competitive market system are simple to describe. Everything has a price. Every commodity and service and every factor of production base its own price, freely determined by demand and supply in the market. There are millions of prices in fact as many prices as there are goods and factors of production. It is these prices which collectively are called the price mechanism. Everybody receives money for what he sells and uses this money to buy what he wants.

In a free enterprise economy, the consumers have the final say because everything is done to satisfy them. What goods and services will be produced in an economy depend on consumer's demand and the resources are allocated accordingly. If they prefer more or A and less of B, then factors of production will be diverted from the manufacture of B to the manufacture or A. And this wish of the consumer is communicated to the producers through the price mechanism. If consumers prefer more of coffee and less of tea, the price of coffee will go up while that of tea will come down. This will induce the producers to divert resources from tea to coffee as coffee is now comparatively dealer than tea. Production of coffee will rise and that of tea will fall. Similarly, if more or a commodity becomes available, then people want to buy at a given market price, its price will fall as a result of competition amongst the sellers. At a lower price, producers will no longer produce so much. Equilibrium will thus be restored by the forces of supply and demand. Resources will be diverted to some other branch or economic activity. This happens because the foundation of a free enterprise economy is the profit motive. All activities are carried on with a view of earning profits.

In such a society resources will be allocated to those activities which promise more profits to the entrepreneurs. In this way, 'what goods will be produced' is determined by the votes of consumers or their everyday decisions to purchase various commodities.

What is true of the markets for consumers goods is also true of markets for factors of production such as labour, land and capital. Under competitive condition, only that producer who can adopt the most efficient method of production and keep the cost at the lowest, can hope to secure high profits. Thus every producer tries to produce in the cheapest possible mariner. The method that is cheapest at any time, will displace a more costly method. For example, motive power will be generated by atomic process rather than by steam, if the price of coal is high. But the most obvious choice is with regard to the use or capital and labour. If labour is cheaper than capital, as is the case in most of the underdeveloped countries, emphasis will placed on labour intensive techniques. On the contrary, highly sophisticated machines will be used with a minimum need for labour in developed countries where there is shortage of labour, but capital is in abundant supply. In agricultural sector, tractor-operated large farm will displace the family size farm if this leads to lower cost of production.

The price system, therefore, indicates to the producer which combination of factors of production should be chosen to make production cheapest, given the state of technology. The choice of technique will thus depend upon the relative availability of resources reflected through their respective prices.

The third problem, namely, the distribution of national product, is connected with the first. Goods and services will be produced for those who can afford to pay for them. This capacity to pay is reflected in the effective demand of the people for various goods and services. In other words, effective demand is dependent on people's income. The first problem and third, therefore, are like two sides of the same coin. If people demand more of luxury goods, more of them will be produced and given to those who can pay for them. In a capitalist economy, therefore, the distribution of goods and services will depend upon the effective demand of people which in turn will depend on their incomes. Income of a person is determined by the quantities or various factors of production he owns and their prices. Thus the distribution of national product depends on the prices of factors of production, given the pattern of ownership.

To sum up, we may say that in a capitalistic economy, there is no visible authority which controls and directs the economic system. However, the price mechanism solves and the economic problems-What goods will produced? How much will be produced? How will they be produced? Who will consume them?

Intext Questions

Say True or False

1. Choice arises due to scarcity of resources.
2. The problem of how to produce concerns allocation of resources.
3. Choosing an appropriate technique of production is required to solve the problem of whom to produce.
4. Choice of technique of production depends on the ease of factor substitution.

Limitations of Price Mechanism

We have tried to show above how in a modern capitalist economy, every economic activity is controlled, directed and guided by the price mechanism. A writer called the price mechanism as the "Invisible conductor of the economic orchestra". There are millions of prices and all of them are determined simultaneously in such a way that there is perfect co-ordination in the production, distribution and consumption of all these goods and services. Overproduction and underproduction

of any commodity at a given time, will be set right by the price mechanism in course of time. Overproduction, for instance, will lead to a fall in price and curtailment of production by the producer, and underproduction will lead to a rise in the price and increase in production. The question now is, whether the price system is really so effective, as it is made out to be.

Does the price mechanism really represent the wishes of the people? In a capitalist economy, demand is made effective by those who have an income and are prepared to spend and not by those who need various goods, but do not have the necessary purchasing power. The fortunate few with large, incomes are able to influence producers to manufacture those goods which they like. The poor, on the other hand, have sometimes to go without even the bare necessaries of life. The capilialist system, thus, does not bring about an equal and fair distribution of goods and services among the people according to their needs.

Prices, wages and profits are supposed to be determined by demand and supply in a free market. But actually, markets are not free and competition is not perfect. Prices are determined and influenced by a few powerful producers who are called monopolistic. A monopolist can fix a high price. As a result of imperfect competition, there can be divergence between demand and supply. Besides, the tastes and fashions may change suddenly and consequently, there may be overproduction in some industries and underproduction in others. It is possible that by the time the necessary adjustment in supply takes place, demand may have changed again.

The consumers, themselves may sometimes, be at fault. They may demand goods and services which do not yield real utility but which may be meant for show of power or prestige. Sometimes, they may even demand goods which are harmful. Many a time, a man will prefer a cheap detective novel to a good book. People may demand cheap films and drinks which tend to spoil their tastes and morals. In this connection, we can mention the possible adverse effects of advertisement on the consumers. It has been found that with the help of advertisement any commodity, however bad or inferior, can be sold. It is through the media of advertisement that many had and positively harmful drugs and medicines and other such goods are sold in a 'free' enterprise economy. Thus, though the capitalistic economy, may help in maximising national income, it is not necessary that this will automatically maximise national welfare.

1.3 ROLE OF GOVERNMENT

The modern capitalist economy is not solely a price economy, but is a mixed system. The government attempts to control and direct production, distribution and consumption.

The Government Controls through Social and Labour Laws: In the first place, the, governments enact laws to protect the women and children in mines, factories and workshops against exploitation. Women and children are weak and are not able to survive in a competitive economy without help. The workers are generally weaker than the employers in the matters of bargaining. Factory laws are passed to protect the labourers, to assure them minimum wages and to protect them from exploitation, by the factory owners.

Through various laws, the government also tries to control the quality of products, to prevent adulteration of goods, to enforce standard weight and measures, to see that trade is fair and so on. Further the government passes laws to control the activities of monopolies and monopolistic organisations which tend to act against the interest of the consumers. Thus, modern governments| take all types of measures to restrict free enterprise and free play of self-interest and ensure perfect competition. To keep competition perfect means to create a situation in which all have equal opportunities to participate in the competition or the competition is amongst equals.

Re-distribution of National Income by Taxes: Again, government attempts to control economic activity through its tax and expenditure measures. For instance, progressive taxes on income and property reduce the incomes of the rich and thus their effective demand for goods and

services. At the same time, through free education, free medical services, subsidised housing, recreational facilities, etc., the government can raise the real income of the masses. In these ways the government can influence and direct the volume of economic activity so as to promote the welfare of the community.

Welfare and Social Measures: Further, in all modern economies, the government undertakes to provide certain essential services which the community requires but which cannot be provided by the private businessmen. These services involve large investments which are beyond the capacity of private individuals and groups. For instance, the government provides water supply, education and other social services; it protects the people from foreign aggression and it maintains law and order within the country.

Government in certain countries have assumed responsibility of providing furl employment: In recent years the government has also taken the responsibility of maintaining full employment. The government helps people to secure jobs. During economic depression, the economy functions at a low level; there is a lot of unemployment. In certain countries, governments have gone far beyond all these. They undertake economic enterprises such as power projects, basic and heavy industries transport and communication, etc.

Thus in a modern capitalist economy the government has started playing a very important role in the field of economic activity. In the 20th century, some of the feature of capitalism such as private property, self-interest and free enterprise have been considerably modified by government regulations. Many economists have, therefore, started calling the modem capitalist economy as mixed system in which private enterprise has a free hand but within the overall control and direction of the state.

Intext Questions

1. Name three measures of the government which are helpful for raising real income of people?
2. Which type of tax can be used by government to redistribute income.

1.4 OPPORTUNITY COST AND PRODUCTION POSSIBILITY CURVE (PPC)

How much of goods and services can the economy produce? This will depend upon (a) the extent of resources the economy has in terms of land, labour and capital which it can devote to the production of these goods, (b) the quality or efficiency of these factors and (c) the nature of technology available to the community. It is possible over a period of time to bring in additional land under cultivation, to have more labour through an increase in population and to increase machines and other capital equipment by means of capital accumulation. The quality of these factors of production can also be improved and the state of technology can always be raised through innovation and invention. The total volume of goods will depend upon these conditions.

Every economy can produce a certain amount or goods with the help of its resources. Given the fact that resources have alternative uses and since the same factors of production can be used to produce more than one type of commodity, it is possible to have various combinations of different commodities, by transferring resources from the production of one commodity to another with each combination representing a distinct production possibility.

Definition of Production Possibility Curve (PPC)

Production Possibility Curve (PPC) or Production Possibility Frontier (PPF) is a graphical representation of maximum possible combinations of two goods that an economy can produce by efficiently utilizing its given resources and technology during a given time period.

Definition of Opportunity Cost

Opportunity cost of producing a good is defined as the amount of the other good which has been reduced / given up by transforming resources from it. Given two goods X and Y, the opportunity cost of production of extra unit of X is the amount of good Y that is reduced by transforming resources from it.

We can write Opportunity Cost as ratio of change in Y to that of X, i.e $\Delta Y/\Delta X$ where Δ represents change in. On a PPC this ratio represents the slope which is also called Marginal Rate of Transformation (MRT_{xy}).

$$MRT_{xy} = \Delta Y/\Delta X = \text{Slope of PPC} = \text{Measure of Opportunity Cost}$$

Depending on the rate at which a good is sacrificed to produce extra unit of other good, opportunity cost can be classified into three types – (i) Constant Opportunity Cost, (ii) Increasing Opportunity Cost, (iii) Decreasing Opportunity Cost. Accordingly, the shape of PPC will also change.

Shape of PPC under Constant Opportunity Cost

Let us take a simple example, say, production of wheat and cotton in India to explain the concept of opportunity cost. Let us assume that India is efficiently using all its resources to produce cotton and wheat. Let us further assume that all these resources are such that they are equally efficient in the production of both these goods. The table below gives the alternative possibilities of producing wheat and cotton by allocating different areas to the two crops out of the total available land.

TABLE 1

Wheat (W) (Million tons)	**Cotton (C) (Million bales)**	**Change in Wheat ΔW**	**Change in Cotton ΔC**	**$\bar{o}p\Delta C / \Delta W$**
0	100	-	-	-
20	80	20	20	1
40	60	20	20	1
60	40	20	20	1
80	20	20	20	1
100	0	20	20	1

You may note the two extreme possibilities. The first possibility shows that India is able to produce 100 million bales of cotton and no wheat if whole of the area is devoted to cultivation of cotton. The sixth possibility shows that India can produce 100 million tons of wheat and no cotton if whole of the area is devoted to cultivation of wheat. Between these two extreme possibilities the economy can produce different combinations of cotton and wheat. For instance, the second possibility shows that the country can produce 80 million bales of cotton and 20 million tons of wheat; the third possibility shows the combination of 60 million bales of cotton and 40 million tons of Wheat and so on. Here, the above table can be illustrated with the help of a straight line PPC given in diagram 1.1.

In the diagram, Wheat (W) is represented on the horizontal axis and cotton on the vertical-axis. Starting from origin 0, the X-axis is divided, into equal parts, each part presenting 20 million tons of wheat. Similarly, the Y-axis is divided, each division representing 20 million bales of Cotton (C). It is not necessary that the scales on both the axes should be the same which we have assumed for purpose of convenience. The first production possibility in this case is 100 million bales or cotton and no wheat. This is marked as A in the above figure. The second combination is 80 million bales of cotton and 20 million tons of wheat. Take a point against 80 on the Y-axis and 20 on the X-axis. This is point B For the other combinations, plot points C, D, E arid F. Connect all the points and you will have a downward sloping line AF. This line shows the production possibilities or two goods and is known as the production-possibility curve. It is also called the transformation curve, since the factors which can be used for the production of one commodity can be transformed to produce the other commodity. As we moved from A to B, resources employed in cotton production are being transferred to the production of wheat.

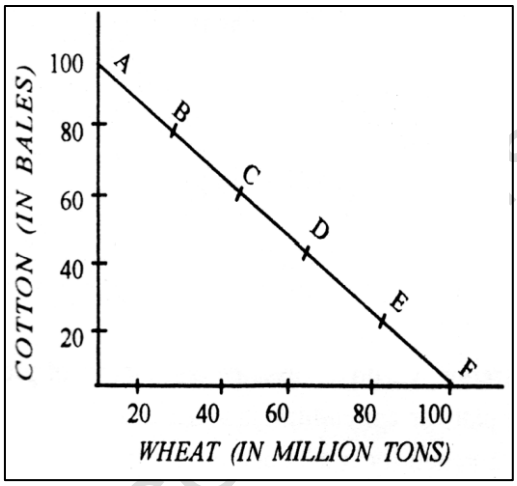


Diagram 1.1 Straight Line Production-Possibility Curve (Constant Opportunity Cost)

The downward shape of the AF curve shows that if the community wants more or wheat, it can have it only by reducing the quantity of cotton. Again, in the diagram, AF is a straight line. This implies that addition of a certain amount or wheat will replace the same amount or cotton throughout due to the assumption that the factors of production are equally efficient in the production of cotton and wheat. In the given example, for every increase of 20 million tons in the production of wheat, the production of cotton has to be decreased by 20 million bales. Here, change in Wheat is 20, change in Cotton is 20. Hence, opportunity cost or slope of PPC is given as

Change in Cotton / Change in Wheat = $\Delta C/\Delta W$ = MRT = 20/20 = 1 = Slope of PPC = Constant. So PPC or AF curve is a straight line.

Shape of PPC under Increasing Opportunity Cost

Normally, the production-possibility curve in real life is not a straight line but concave towards the point of origin. The slope of such a curve increases, i.e for each extra unit of one good to be produced, more and more units of other good need to be reduced. In other words, MRT increases for such type of PPC. In case of increasing opportunity cost, the rate at which the other good must be reduced keeps increasing in order to produce extra unit of the good in demand thus giving rise to concave shape of PPC.

To show this, continue with the above example by modifying the rate of change of cotton to produce a certain amount of wheat as given in the Table 2 below.

TABLE: 2

Alternative Possibilities in the Production of Wheat and Cotton

Wheat (Million tons)	Cotton (Million bales)	Change in Wheat ΔW	Change in Cotton ΔC	ΔC / ΔW
0	100	-	-	-
20	90	20	10	0.5
40	75	20	15	0.75
60	55	20	20	1
80	30	20	25	1.25
100	0	20	30	1.5

For the above illustration, we do not assume that factors of production are equally efficient. Let us assume that some plots or agricultural land are more suitable for the production of cotton and some others are better suited for production or wheat. By using all the plots of land only for cotton, the community can produce 100 million bales of cotton. Now if the community wants to have 20 million tons of wheat, some plots or land which are less suitable for cotton will be put under wheat. But as the community wants to have more and more wheat, then the land allotted for cotton cultivation will also be used to produce wheat. As a result, the cost of producing wheat in terms of cotton will increase. For instance, to produce the first 90 million tons of wheat, the community has to sacrifice only 10 million bales of cotton but to produce the next 20 million tons of wheat, the community has to sacrifice 15 million bales of cotton and so on. Finally, in the case of the last 20 million tons or wheat, the community has to sacrifice 30 minion bales of cotton. This implies that land suitable for the production of cotton, which could produce as much as 30 million bales of cotton, when put under wheat can produce only 20 minion tons of wheat. It is clear from the above illustration that the cost or producing additional wheat in terms of cotton goes on increasing. The increasing cost of wheat in terms of loss of cotton is represented in last column of Table 3 under the head ΔC / ΔW. See that ΔC / ΔW increases from 0.5 to 0.75 for producing 20 units of W initially but after that it keeps on increasing to reach 1.5 as wheat production increases further in same units.

Since ΔC / ΔW is the MRT or slope of PPC which is increasing here, the shape of PPC is concave in case of increasing opportunity cost as given in diagram 1.2.

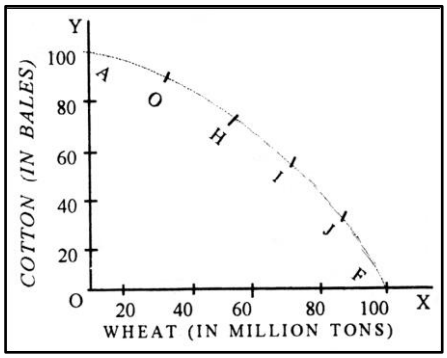


Diagram 1.2 Concave Production Possibility Curve (Increasing Opportunity Cost)

Note that increasing opportunity cost confirms to the law of diminishing returns in production. Refer to short run production function and law of variable proportion as well as diminishing returns to scale under long run production given in lesson 6.

Shape of PPC under Decreasing Opportunity Cost

Decreasing opportunity cost refers to a situation where in order to produce each extra unit of a good the rate of reducing the quantity of other good keeps decreasing. This means that the slope or MRT of PPC is negative or decreasing, thus giving rise to a convex shaped PPC. To illustrate this, we can modify our wheat and cotton example as given in Table 3. Here it is shown that for each 20 unit of wheat to be produced the economy sacrifices 30 units cotton initially but latter on the reduction in cotton falls to 25, 20, 15 and 10 for subsequent 20 units of wheat production respectively. The opportunity cost $\Delta C / \Delta W$ falls from 1.5 to 1.25 and so on as can be seen in the last column in Table 3.

TABLE: 3

Production Possibilities under Decreasing Opportunity Cost

Wheat (Million tons)	**Cotton (Million bales)**	**Change in Wheat ΔW**	**Change in Cotton ΔC**	**$\Delta C / \Delta W$**
0	100	-	-	-
20	70	20	30	1.5
40	45	20	25	1.25
60	25	20	20	1
80	10	20	15	0.75
100	0	20	10	0.5

If we draw a diagram of PPC according to Table 3 depicting decreasing opportunity cost, we get a convex shaped curve as shown in diagram 1.3.

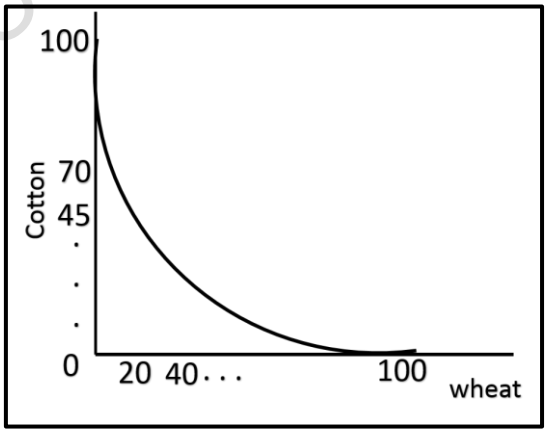


Diagram 1.3: Convex Production Possibility Curve (Decreasing Opportunity Cost)

One may question the existence of decreasing opportunity cost because of the fact that resources are scarce. Some economists believe that in a world of continuous advancement of technology there could be possibility of prevalence of decreasing opportunity cost in certain cases

while many other economists believe this to be a hypothetical situation or theoretical possibility only.

Intext Questions

1. Shape of PPC is downward sloping _____ line, when opportunity cost is constant.
2. _____ cost is next best alternative cost.

Answer

1. straight, 2. Opportunity

1.5 UNDERSTANDING ECONOMIC CONDITION THROUGH PPC

It may be observed that the curves have been constructed on the assumption that all the resources available for the production of wheat and cotton are being fully utilised. For any reason, if some of the resources remain idle, the production-possibility will not be indicated by the curve but will be anywhere below the curve. Secondly, if there is a quantitative and qualitative improvement in the factors of production available to the community to produce these goods and if there is an improvement in the technology of production, the production-possibility curve will be pushed outwards. This will indicate that both the goods can be produced in larger quantities, with the resources fully employed. See diagram 1.4 below.

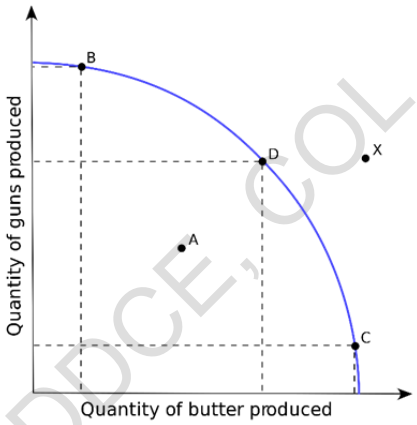
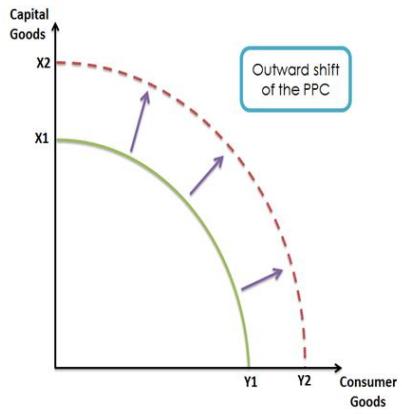
Efficient Use of Resources takes place on PPC such as at points B, D and C Unemployment situation is shown inside PPC such as at point A Point outside PPC such as point X is unachievable	Outward shift of PPC indicates Economic Growth Which happens due to improvement in technology and increase in productive resources.
	

Diagram 1.4 Unemployment (left side) and Economic Growth (Right Side)

Learning Outcomes:

In this lesson you have learned the following:

1. The three central problems of any economy are – what to produce? How to produce? and For whom to produce?
2. The two major approaches to solve the central problems are price mechanism prevalent under free market system and government control and regulations seen in mixed economies.

3. Production Possibility Curve (PPC) shows the maximum production capabilities of an economy given its resources.
4. Slope of PPC known as Marginal Rate of Transformation (MRT) is called Opportunity Cost of producing a good in terms of another.
5. Opportunity cost is the cost of next best alternative. Given two goods, opportunity cost of producing an extra unit of one good is the amount of other good given up for that purpose by transforming resources from the latter.
6. Shape of PPC is – (i) a straight under constant opportunity cost, (ii) concave under increasing opportunity cost and (iii) convex under decreasing opportunity cost conditions respectively.
7. Any point inside PPC indicates underutilization/unemployment of resources while points on PPC indicate efficient use of resources. Points out side PPC are unachievable.
8. Outward shift of PPC indicates economic growth due to improvement in technology and increase in resources.

TERMINAL QUESTIONS

Short Questions

1. What are the three central problems of Economics?
2. How can government improve market outcomes?
3. Explain PPC.
4. By using PPC describe the idea of "efficiency".
5. What do you mean by opportunity sets? Give one example.

Long Questions

1. Explain the role of government in controlling price, production, distribution and consumption.
2. What is PPC? Explain its different shapes.

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LESSON: 2

DEMAND

INTRODUCTION

Human wants are unlimited, but the resources which are required to satisfy these wants are limited. The scarcity of resources gives rise to economic problems which are termed as central problems. In a capitalist or free market economy these problems are solved with the help of what we call the price mechanism. Each commodity or service has a price. Earlier, goods were used to be exchanged for goods which was called the barter system of exchange. With the invention of money, the prices of goods and services are expressed in terms of money. Prices of all the goods and services collectively is known as price mechanism.

The price of a commodity is determined by its demand and supply. However, it is not the demand of a single buyer or the supply of a single seller which determines the price of a commodity in the market. It is the demand of all the buyers of a commodity taken together and the supply made by all the sellers selling that commodity taken together, which determine the price of that commodity in the market. The price of a commodity is determined when its demand is equal to its supply. This is called the equilibrium price. We shall now discuss in detail the demand and supply analysis and explain how these together determine the price of a commodity in the market.

Learning Objectives

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

1. Define individual demand for a good as well as market demand for that good.
2. Explain the determinants of individual demand and market demand for a good.
3. State the law of demand.
4. Make individual as well as market demand schedule for a good.
5. Draw the individual as well as market demand curves for a good respectively.
6. Find out the exceptions to law of demand.
7. Distinguish between change in quantity demanded and change in demand.

2.1 MEANING OF DEMAND

Demand, in economics, refers to the amount of a commodity which the consumers are prepared to purchase at a particular price per unit of time. Demand in economics, is therefore, is not the same thing as desire. You may have a desire to have a car but if you do not have sufficient money with you to purchase it and even if you have sufficient money with you but are not prepared to spend it on the purchase of the car, it will merely remain a desire and will not be called demand. Your desire to have a car will become demand when you have sufficient money with you and are willing to spend the money on the purchase of the car at the particular price per unit of time. The time may be one hour, one day, one week, one month and so on. It is meaningless to say that the demand of car in our country is 10,000 because this statement does not specify the price of car and the unit of time. Even it is not correct when you say that the demand of. car in India is 10,000 when price per car is Rs. 80,000, because it does not refer to the unit of time. The correct statement would be that the demand for car in India per year is 10,000 at the price of Rs. 80,000 per car. Thus desire becomes demand when the consumer has sufficient resources with him and is willing to spend those resources on the purchase of the commodity at a particular price and per unit of time. Even if you have, say, one lakh rupees with you but are not willing to spend the money on the purchase of a car at the price of Rs. 80,000 per car today, then you cannot say that you have a demand for a car.

Factors Determining Demand

The demand for a commodity does not remain constant. It keeps on varying with changing conditions. We shall, therefore, now discuss the various factors which determine the demand for a commodity by a consumer or the family of the consumer i.e. household demand and the total demand of the whole market i.e., market demand of a commodity.

(i) Factors Determining Household Demand

The demand for a commodity by a consumer or a household depends upon the following factors:

(a) *Income:* The income of family is a very important factor determining its demand for a commodity. Other things remaining constant, if the income increases, normally the demand for goods will increase and vice-versa. With increase in income the demand for superior goods and goods of comforts and luxuries will increase and the demand for inferior goods will decline. But if the income declines the demand for superior goods and those of comforts and luxuries will decline.

(b) *Price of the commodity:* Normally there is an inverse relationship between the price of a commodity and its demand. Other things remaining constant, if the price of a commodity declines normally more of it will be purchased and if the price increases, lesser amount of the commodity will be purchased.

(c) *Taste and Preferences of consumers:* Taste, fashion and preferences of the consumers also affect the demand for a commodity. If people have developed a taste or preference for a commodity-its demand will increase but if a commodity has gone out of fashion, its demand will decline.

(d) *Price of related goods:* The changes in the price of related goods i.e., complementary and substitute goods also affect the demand for a commodity. Complementary goods are those goods where one commodity has utility and is demanded only when the second related commodity is also available. For instance scooter and petrol are complementary goods. If the price of petrol increases, it will reduce the demand for scooter. Similarly, change in the price of refills will affect the demand for ball-pens. Substitutes goods are those where one goods can be used in place of another. For instance, tea and coffee are close substitutes. One can use tea in place of coffee and vice-versa. If the price of coffee increases, people will start substituting tea for coffee and therefore the demand for tea will increase even though there is no change in the price of tea.

(ii) Factors Determining Market Demand

The above factors determine the households demand for a commodity. When we take market demand i.e. the total demand for a commodity in the market, in addition to the above four factors, there are two other factors which also determine the market demand. These two factors are: the size and composition of the population and distribution of income:

(e) *Size and composition of Population:* Large and increasing population increases the demand for various types of goods and vive-versa. Similarly the composition of population i.e., ratios of male-female, children-adult-old-age people etc., also affect the demand for different types of goods. For instance, if there are more children, the demand for goods such as toys, baby foods, biscuits etc., will be more.

(f) *Distribution of Income:* If there is an unequal distribution of national income and few people have large income while other have to do with small income, the demand for goods of comforts and luxuries will be more and that of the goods needed by the majority

of people, who are poor, will be small. If there is an even distribution of income in a country, the demand for luxuries will be less and that of goods of mass consumption will be more.

Intext questions

Fill in the blanks.

1. _____ and _____ affects market demand.

2. The demand for a commodity _____ with changing conditions.

Answer

1. Population, size of income

2.2 LAW OF DEMAND

We have earlier explained that the demand for a commodity is always expressed with reference to a price. There will be different quantities of goods demanded at different prices. If the price of a commodity rises, normally less of its quantity will be demanded and vice-versa. This inverse relationship between the price of a commodity and the quantity of its demand is known as the Law of Demand.

We have explained that the price a commodity is only one of the various factors which determine the demand for a commodity. The other factors are the income of the consumer, their tastes, preference etc., prices of related goods, expectations about the future changes in the price of the commodity etc. the price of a commodity as well as these other factors keep on changing. We therefore, cannot find out the effect of the changes in the price of a commodity on its demand unless we assume that all other factors which also affect the demand for a commodity remain constant. For instance, suppose the price of a commodity has increased and therefore, normally its demand should decline. But if the same time, the income of the consumers has also increased, the consumers will demand more of the commodity even at a higher price because the increase in income may offset the impact of the price rise on his demand. Therefore, in order to find out the effect of the change in the price of commodity on its quantity demanded, we have to assume that there is no change in factors other than the price. We may say that 'other things being equal' normally more of a commodity will be demanded at lower price and less will be demanded at higher price. This is known as the Law of Demand. The Law of Demand is only a qualitative statement. It tells only the direction in which the quantity of a commodity will normally change in response to any change in its price. The Law of Demand does not say anything about the quantum or the amount of change in resporise to change in the price of a commodity.

We should like to emphasis, that the law of demand is always qualified by such phrases as 'in given conditions of demand' or' other things remaining equal or constant'. This relates to the assumption on which the law of demand is based. It means that law may not hold true if any of the factors, mentioned above, other than the price of a commodity in question is also changing. Law of Demand can be explained with the help of what is called a demand schedule and a demand curve.

Demand Schedule

If we put the different amounts of a commodity demanded at different prices in a tabular form, as given below in tables 2.1 and 2.2, it is called demanded schedule. Thus the demand schedule is a tabular statement which states different quantities of a commodity demanded at different prices. Demand schedule is of two types:

(i) Individual or Household demand schedule and (ii) Market demand schedule.

Individual or Household Demand Schedule: Individual Household demand schedule shows the different amounts of a commodity demanded by a consumer or a household at its different prices. Let us take an example. Suppose a consumer (or a household) demands 1, 2, 3 and 4 dozens of oranges at prices of Rs.3.00, Rs.2.50, Rs.2.00 and Rs. 1.50 per dozen of oranges respectively. When we put the different quantities of oranges demanded at different prices in a tabular form, as given in Table 2.1, we call it an individual (or household) demand schedule.

TABLE 2.1

Household Demand Schedule

Price of Oranges (Per dozen) Rs.	*Quantity Demanded (Oranges) (dozens)*
3.00	1
2.50	2
2.00	3
1.50	4

This demand schedule clearly shows that more of oranges are demanded at a lower price and vice-versa.

Individual or Household Demand Curve: If we represent the above demand schedule (Table 2.1) graphically we can get a demand curve as given in figure a 2.1 below:

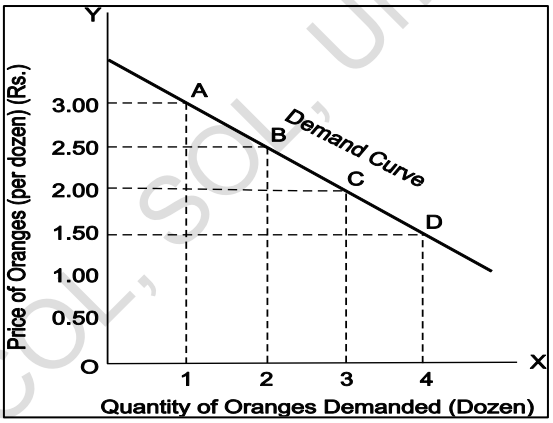

Diagram 2.1 Individual or Household Demand Curve:

In the diagram 2.1, the horizontal axis represents the quantity of oranges demanded and vertical axis represents the price of oranges per dozen. A, B, C and D, show the different quantities of oranges demanded at different prices as given in the demand schedule, Table 2.1. By joining these points, we get a curve which is called the demand curve. This demand curve shows the different quantities of a commodity demanded at different prices. It shows that at a higher price, less is demanded and at a lower price, more is demanded, other things remaining equal.

The demand curve may be a straight line or a curve depending upon the changes in quantities demanded in response to changes in price.

2.3 MARKET DEMAND SCHEDULE AND CURVE

Different consumers or household demand different amounts of a commodity at different prices. Therefore, if we add the demand schedule of all individuals or household, we can get the market demand schedule. Let us take an example. Suppose, for the sake of simplicity, say, there are only two consumers or household, say, A and B , that demand orange. Their demand for oranges

at different prices are given in table 2.2. If we add the demand schedule of these two consumers, we can get the market demand schedule, as given below:

TABLE 2.2

Prices of Oranges (per dozen)	*Individual Demand Schedule Quantity Demanded (dozens)*		*Market Demand Schedule Total Market Demand for Oranges (A+B)*
Rs.	*A*	*B*	*(dozens)*
3.00	1	2	3
2.50	2	3	5
2.00	3	4	7
1.50	4	5	9

Thus, the market demand schedules is the aggregate of the individual demand schedules. This also shows, as the individual demand schedule, that more of a commodity is demanded at a lower price and vice-versa.

If we represent the above table 2.2 on a diagram, we can get the market demand curve, as shown in diagram 2.2. The market demand curve DD as shown in figure (c) has been obtained by adding the individual demand curve D_1D_2 of consumer A as given in figure (a) and the individual demand curve D_2D_2 of consumer B as given in figure (b). For instance, consumer A buys 4 dozen (A) and (B) buys 5 dozen (B) of oranges when the price is Rs. 1.50 per dozen. Therefore, the market demand for orange will be 9 dozen its (A + B = C). Market demand curve also shows the inverse relationship between price of a commodity and its quantity demanded i.e. more of a commodity will be demanded at a lower price and less will be demanded at higher price.

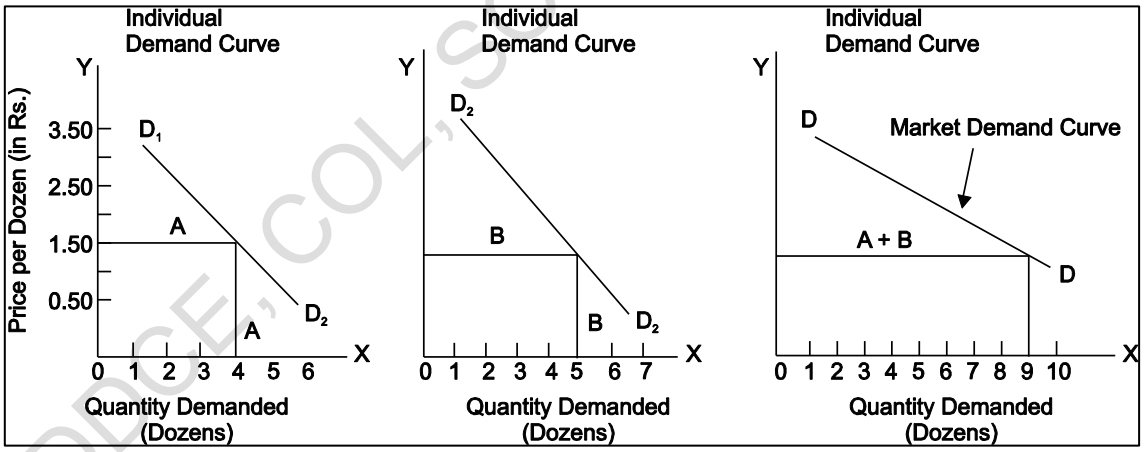

Diagram 2.2 From Individual Demand Curve to Market Demand Curve

In the examples of a market demand schedule and the market demand curve given above, for the sake of convenience we have assumed that there are only two consumers A and B of the commodity i.e. oranges. The market demand schedule and the market demand curve have been obtained by the addition of the individual schedules and the individual demand curves of the two consumers A and B. However, in practice we find that there are many consumers of a commodity. In such a case it becomes very difficult and cumbersome to determine the individual demand schedule or individual demand curves of all the consumers of that commodity and then add them all together to find out the market demand schedule and market demand curve of the commodity. There is an alternative method of finding market demand schedule or market demand curve of a

commodity. Of all the consumer of a commodity, one consumer of that commodity is taken as an average or representative consumer and find out the average consumer's demand schedule. Then we multiply the quantities being demanded by this average consumer at different prices by the estimated number of total consumers of this commodity. This will give us the market demand schedule of the commodity and on its basis, we can draw the market demand curve of the commodity. For example, suppose at the price of Rs. 2.50 per dozen, an average consumer demands 2 dozen of oranges. Suppose there are 1000 consumers of oranges. In that case the market demand for oranges at the price of 2.50 per dozen will be 2000 dozens of oranges. Similarly, we can find out the market demand for oranges at different price by multiplying with the total number of consumers of oranges i.e. 1000.

Both demand schedule and demand curve show the different quantities of a commodity which the consumers are prepared to but at different prices given in the market. It does not mean that at a particular time there are different prices of a commodity prevalent in the market. The demand schedule or demand curve is prepared on the basis of the past experience of a consumer (s). A consumer, on the basis of his past experience, can say that if other things remain constant, what will be the different quantities of a commodity which he would be prepared to buy at different prices in the market. Therefore, a demand schedule or demand curve is imaginary.

Intext Questions 2

1. Law of demand states that there is a positive relationship between price and demand.
2. Market demand is the aggregate of the individual demand schedule.

Answer

1. False 2. True

2.4 REASON FOR DOWNWARD SLOPING DEMAND CURVE

Why does a demand curve generally slope downwards from left to right: A demand curve generally slopes downwards from left to right or in other words it shows that more of a commodity is demanded at a lower price and less is demanded at a higher price. Why do people purchase more of a commodity at a lower price and purchase less at a higher price? In other words why does law of demand operate or demand curves slope downward? The law of demand operates or demand curves slope downwards due to the following reasons:

(i) Operation of Law of Diminishing Marginal Utility: The Law of Demand is based on the law of diminishing marginal utility. According to law of diminishing marginal utility, which we shall discuss in detail later on in section 4.1. As the consumer consumes more and more units of a commodity the marginal utility which he derives from the successive units will keep on diminishing. In the example of the individual demand schedule given in the table 1.1 the consumer demands one dozen of oranges when the price is Rs 3.00 per dozen. He is prepared to pay Rs 3 because as per the utility analysis, the marginal utility which he gets from the consumption of first dozen of oranges is worth Rs. 3.00 (As per the Marshallian utility analysis, the utility which a consumer gets from the consumption of a commodity can be measured in terms of money i.e., the maximum price which he gets from the second dozen will be less than what he had got from the first dozen of oranges and therefore he is prepared to pay to obtain that commodity). But when he consumes the second dozen, the utility which he will be prepared to buy second dozen of oranges only if price is less than Rs. 3.00. Suppose he gets marginal utility from the second dozen of oranges worth Rs 2.50 and therefore, he would be prepared to buy the second dozen of oranges, if price per dozen of oranges declines to Rs. 2.50. In other words, consumer will buy more of a commodity only at a lower price. A diminishing marginal utility curve can be converted into a demand curve. We shall discuss it

in detail later on when we discuss the Marshallian utility analysis of demand. Similarly consumer will be prepared to buy 3rd and 4th dozens of oranges only at lower and lower prices.

(ii) *New Consumers:* The market demand for any commodity is made up of individual demands of numerous consumers. When the price of any commodity is sky high, only the rich few can afford to purchase such a costly commodity and the poor sections of the society have to go without it or do with the inferior substitutes. When the price falls, the commodity becomes accessible to some more consumers who are not very poor. And when the price falls, still further the commodity becomes accessible to still more persons. Thus, one reason why market demand for any good increases in response to a fall in its price, is that each fall in its price brings in new consumers for the commodity.

(*iii*) *Income effect:* The change in the price of a commodity also affects the real income or the purchasing power of the consumer. A fall in the price of a commodity in fact amounts to a rise in the real income or the purchasing power of the consumer. Therefore, he can afford to buy more of the commodity. On the other, a rise in price will reduce his purchasing power or real income and therefore he will be able to buy only less amount of the commodity. In other words fall or rise in the price of a commodity induces consumers to buy more or less of a commodity. The change in the demand for a commodity as a result of the change in real income (due to fall or rise in the price of the commodity) is called income effect of a price change.

(*iv*) *Substitution effect:* When the price of a commodity falls, besides, increasing purchasing power or a real income, it becomes relatively attractive to the consumers to substitute this commodity in the place of other commodity and therefore they buy more of it. For instance a fall in the price of tea will induce consumers to substitute tea for coffee and therefore the demand for tea will increase but conversely, a rise in the price of tea will induce consumers to substitute coffee for tea and will reduce the demand for tea.

Because of these factors, normally a demand curve slopes downwards from left to right i.e. more of a commodity is demanded at lower price and vice-versa.

2.5 EXCEPTIONS TO THE LAW OF DEMAND

Normally, the demand curve slopes downwards from left to right, showing that more is demanded at lower price and vice-versa. However, there are some exceptions to the law of demand in which case the fall in the price of a commodity will contract the demand and vice-versa i.e., the demand curve may slope upward to the right. These are as follows:

(*i*) *Goods which are expected to become scarce or whose prices are expected to rise in future:* In case of goods which are expected to become scarce in future the consumers may buy more of those goods even at a higher price. Similarly when the price of a good has increased but consumers expect that it will rise further in future, then they will prefer to buy more of the commodity even at a higher price at present. Conversely, though the price has fallen but the people expect that it will fall further in future, they prefer not to buy more of it even at lower price at present and will prefer to wait for the further fall.

(*ii*) *Goods carrying social status (veblen goods):* There are some goods e.g., diamonds, the possession of which carry social status and are bought by rich people because their prices are very high. If the prices of these goods become low, the consumers will buy less of them because the fall in their prices will reduce their prestige value. If their prices go up, their demand may also go up because of increase in their social prestige.

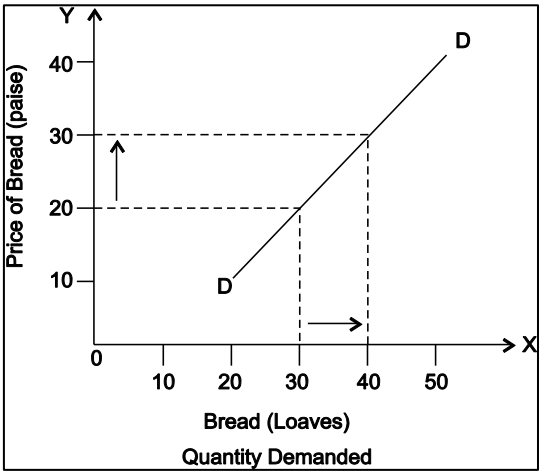

Diagram 2.3 Upward sloping Demand Curve for Giffen Good

(*iii*) *Giffen goods:* The real exception of the law of demands is in case of giffen goods. If the price of inferior good falls, its demand may also fall. This is because the fall in the price of an inferior good increases the real income of the consumers and therefore they can afford to buy superior goods. They will start substituting superior good in place of an inferior good and therefore the demand for the inferior good will decline. Conversely, if the price of an inferior good reduces the real income of the consumers and they will also increase. The increase in the price of an inferior good reduces the real income of the consumers and they will be forced to spend more on the inferior good. This phenomenon was first of all observed by Sir Robert Giffen. In Great Britain, in early 19th century when the price of bread (considered to be an inferior good) increased, low paid British workers purchased more bread and not less of it. This was contrary to the law of demand. Giffen explained this paradox by stating that the bread was a necessity of life. Low-paid British workers consumed a diet of mainly bread. When the price of bread increased, they had to spend more on the given quantity of bread. They were left with little income to be spent on meat and therefore could not afford to buy as much meat as before. They substituted even bread for meat in order to maintain their total food intake. Therefore, increased price of bread resulted into the increased demand for bread. In other words there was a direct price-demand relationship. After the name of Robert Giffen, all such goods whose demands increase with increase in prices and whose demands fall with fall in their prices, are called 'Giffen Goods'. However, it should be noted that a 'Giffen Good' is an inferior good but every inferior good can not be called a 'Giffen Good'. There is a difference between an inferior good and a Giffen good. Only those inferior goods are called Giffen Goods, in whose case there is a direct price-demand relationship i.e., both price and demand of the commodity move in the same direction as shown in diagram 2.3

In the figure, when the price per bread (loaf) is 20 paise each, a consumer buys 30 loaves of bread. But when the price of bread increases to 30 paise each, he buys 40 loaves of bread. It means that when the price of bread increases, a consumer buys more of it and vice-a-versa. In this case, there is a positive or direct relationship between the price of a commodity and its quantity demanded. Therefore, the demand curve will slope upward from left to right, as is shown by the demand curve DD in diagram 1.3 Here bread will be considered as 'Giffen' good. We shall discuss the case of Giffen Good in detail in the section on the Indifference Curve Analysis of the Demand. However, it is extremely difficult, if not impossible to find an example of a Giffen good in real life.

Intext Questions 3

1. Define giffen goods.
2. Why demand Curve slopes downward?
3. Name a good that violates law of demand?

2.6 DIFFERENCE BETWEEN EXPANSION AND CONTRACTION OF DEMAND OF A COMMODITY AND INCREASE AND DECREASE IN DEMAND OF A COMMODITY

Expansion and Contraction of Demand:

We have told you that the demand is affected by various factors. In explaining the law of demand we consider only the effect of the changes in the price of a commodity on its demand, assuming that there is no change in other factors e.g., income, taste and fashion of the consumers, prices of other goods etc. Change in the demand of a commodity due to changes in its price alone, are called extension and contraction in demand. It is also called 'change in the quantity demanded' or 'movement along the same demand curve'. When the quantity demanded of a commodity rise due to fall in its price alone, it is called extension of demand. On the other hand, if the quantity demanded falls due to rise in prices, it is called contraction of demand. Suppose, as a result of the fall in the price of oranges from Rs. 3.00 per dozen to Rs. 2.50 per dozen, the demand for oranges rises from 1 dozen to 2 dozens, it is called extension of demand. Conversely, if as a result of rise in price of oranges from Rs. 1.50 per dozen to Rs. 2.00 per dozen the demand for oranges falls from 4 dozens, it is called the contraction of demand. Here we have assumed that the rise or fall in the demand for a commodity has taken place only due to fall or rise in the price of oranges, assuming that there is no change in other factors which also affect the demand. We can explain them with the help of the diagram 2.4.

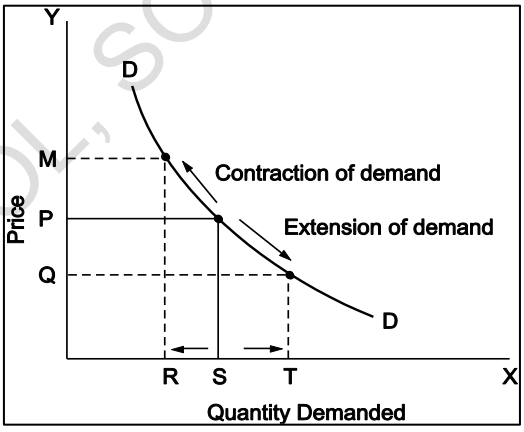

Diagram 2.4

We have drawn the demand curve DD which shows the different quantities of commodity X demanded at different prices, assuming that other factors which also effect the demand e.g. income, tastes and fashion of the consumers, prices of related goods etc. are constant. In the figure, when the price is OP, the quantity demanded is OS. If the price falls from OP to OQ the quantity demanded rises from OS to OT. This rise in demand ST is called extension of demand. Conversely, it the price of the commodity X rises from OP to OM, the quantity demanded falls from OS to OR. This RS fall in the quantity demanded is called contraction of demand. Thus the extension and contraction of demand takes place only due to changes in the price of the commodity and are represented by the movement on the same downward sloping demand curve.

Increase and Decrease in Demand:

The changes in the demand for a commodity due to the factors other than the price of the commodity e.g., changes in consumer's income, tastes, fashion, prices or related goods etc., are called increase and decrease in demand. Suppose the income of the consumer has increased (assuming the price of commodity has remained constant) and therefore he will demand more of the goods. The rise in his demand for goods is called increase in demand. On the other hand if the income of the consumer declines he demands less of goods. This fall in his demand is called decrease in demand. Though the extension and contraction of demand can be represented on the same demand curve, but the increase or decrease in demand are represented by the upward or downward shifts in demand curve. This is explained in diagram 2.5.

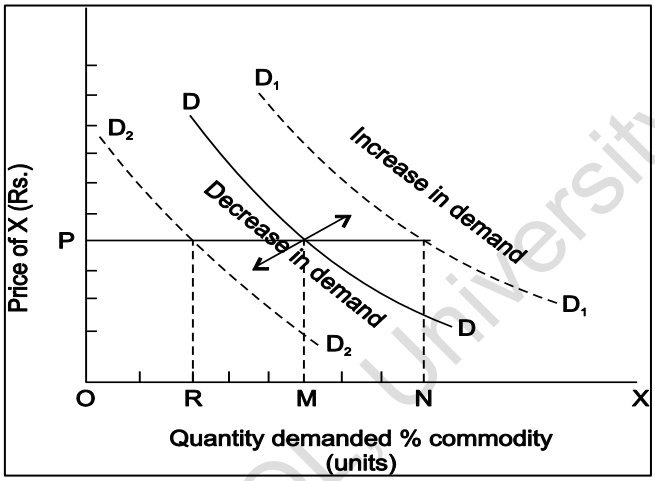

Diagram 2.5

Initially, DD is the demand curve. At price OP the quantity demanded of commodity X is OM. Suppose the price of the commodity has remained constant but the consumer's income increases or the fashion of a good has increased, the consumer is able to buy greater quantities of the good than before and therefore the demand curve DD will shift upward to right and the new demand curve is D_1D_1. The consumer will now buy ON quantity instead of OM quantity at the old price OP. This is called increase in demand. On the other hand, when the consumer's income declines or the fashion of a good has declined, the demand curve DD will shift downwards to the left and the new demand curve will be D_2D_2. The consumer will now be able to buy only OR quantity of the good at the old price OP instead of OM quantity and this decline in demand is called decrease in demand.

To sum up, extension and contraction of demand take place due to changes in the price of the commodity alone assuming other things being equal and are represented by the movements on the same demand curve. Increase and decrease in demand take place due to changes in other factors e.g., consumer's income, tastes, preferences, fashion, prices of related goods etc., and are represented by upward or downward shifts in the demand curve.

Intext Questions

True / False

1. Extension and contraction of demand occurs because of changes in the income of the consumer.

2. There can be increase or decrease in demand because of other factors affecting demand except the price of the commodity.

Answer

1. false 2. True

2.7 LEARNING OUTCOMES

In the preceding sections of this lesson you have learned the following:

1. The individual demand for a commodity is defined as the quantity of the commodity purchased by the individual at a given price at a given time period.
2. The individual demand schedule provides the information about different quantities of the goods purchases by the individual at different prices.
3. The determinants or the factors affecting individual demand of a commodity are: own price of the commodity (P), income of the consumer (Y), prices of related goods (Pr) and taste and preferences of the consumer
4. The law of demand gives relationship between price of the commodity and quantity purchased of the commodity keeping other determinants of demand constant. The law of demand states that other things remaining same, price of the commodity and its quantity are inversely related.
5. The market demand for the commodity is derived by horizontal summation of the individual demand curves i.e., by adding the quantity purchased by different consumers in the market at the given price.
6. Besides the determinants of the individual demand, the market demand curve is also affected by distributions of income in the market/economy and number of buyers of the commodity in the market.
7. Change in quantity demanded refers to increase or decrease in the quantity of the good due to decrease or increase of the price of the goods on the same demand curve. Hence change in quantity demanded implies movement along the same demand curve, keeping other factors except price constant.
8. Change in demand refers to increase or decrease in the quantity of the good at the given price due to change in other factors such as income price related goods taste and preference for the good. In other words, change in demand implies shift in the demand curve at the given price. Increase in demand implies rightward shift of the demand curve, whereas decrease in demand implies leftward shift of the demand curve.

Terminal Questions

1. What is the difference between change in demand and change in the quantity demanded?
2. Explain the law of demand. Why does a demand curve slope downward? What are its determinants?

❑❑❑

LESSON: 3

ELASTICITY OF DEMAND

INTRODUCTION

The demand for a commodity depends, as we have already discussed in detail, on a number of factors such as price of the commodity itself, prices of other commodities, incomes of consumers., their tastes and preferences, advertisement, taxes or subsidies, and a host of other factors including weather and expectations about movement of prices in future. For example, the law of demand tells us that, other things remaining constant, normally the quantity demanded of a commodity increases when its price falls and vice versa. Similarly, we known how quantities demanded of different goods vary in response to changes in the incomes of the consumers or prices of related goods. Or, to take another example the demand for ice varies with changes in temperature. However, these laws or tendencies only point to the direction in which quantities demanded of various goods tend to vary in response to changes in certain factors but do no tell us the extent of changes in the quantities demanded.

Learning Objectives

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

1. Define price elasticity of demand
2. Draw different demand curves as per the different types of elasticity
3. Measure elasticity of demand at a point on a straight-line demand curve
4. Measure arc elasticity of demand
5. Measure price elasticity of demand by using total outline on the commodity
6. Explain the determinants of price elasticity of demand
7. Compare price elasticity of demand on various demand curves

3.1 THE CONCEPT

For analytical purposes and practical decision-making it is often necessary to know the degree of responsiveness of demand to each of the factors that may be influencing it as well as relative responsiveness of demand to one factor compared to another factor or a comparison of the relative responsiveness of demand for different goods to the same factor. *The concept of elasticity of demand is a device to measure the responsiveness of the quantity demanded to change in any factor that may influence the demand for a commodity.*

In principle, it be possible to use the concept of elasticity of demand to measure the responsiveness of quantity demanded to changes in any factor that may influence the demand for various goods are quantifiable and it is, therefore, possible to measure responsiveness of demand to changes in them, some other factors cannot be quantified and responsiveness of demand to changes in them cannot possibly be measured. The concept of elasticity of demand is generally used to measure the responsiveness of demand to changes in (a) prices of the goods themselves, (b) changes in the prices of related goods and (c) changes in the incomes of the consumers. The measure of the degree of responsiveness of the quantity demanded of a good change in its price is described as 'price elasticity of demand'. A measure of the degree of responsiveness of demand for a good to changes in the incomes of the consumers is described as the 'income elasticity of demand'. And, finally, a measure of the degree of responsiveness of demand for a good X to changes in the price of another related good Y is called the 'cross elasticity of demand'.

3.1.1 Price Elasticity of Demand (e)

Price elasticity of demand in defined as the degree of responsiveness of quantity demanded to change in the price of the commodity.

$$\text{Price elasticity of demand} = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in price}}$$

$$= \frac{\dfrac{\%\text{ change in quantity demanded}}{\text{original in quantity}} \times 100}{\dfrac{\text{change in price}}{\text{original price}} \times 100}$$

For example, suppose when the price of a good falls from Rs. 20 to Rs.19, the quantity demanded increases from 1000 units to 1100 units. In this example the percentage change in price is 5% (1/20 × 100 = 5) and percentage change in quantity demanded is 10% ($\frac{100}{100}$ × 100 = 10). Thus, value of elasticity in the case would be 10% 5% = 2.

Symbolically, if we write 'e' for elasticity of demand, 'Q' and 'P' for the original quantity demanded and the original price respectively and AQ and AP for absolute changes in quantity and price respectively, we can write the above formula in the form of the following expression.

$$e = \frac{(\Delta Q/Q)100}{(\Delta P/P)100}$$

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

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

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

Normally e is negative because of negative relationship between price and quantity given other things. The value of e ranges from 0 to ∞. The shape of the demand curve will vary depending on value of e.

1. In the extreme case when there is no change in the quantity demanded in response to a price change, elasticity of demand is said to be equal to zero or demand is described as 'perfectly inelastic'. The demand curve is vertical as shown in diagram 3.1 (A).
2. On the other hand, when there is an infinite change in quantity demanded due to a change in price, elasticity of demand is said to be equal to infinity or demand for the good is described as 'perfectly elastic'. The demand curve is horizontal as shown in dig. 3.1 (B).
3. If the percentage change in quantity demanded is equal to the percentage change in price, elasticity of demand is said to be equal to be equal to one or demand for the good in question is described as of 'unit elasticity'. The demand curve is rectangular hyperbola as shown in diagram 2.1 (C),

4. It the percentage change in quantity demanded is greater than the percentage change in price, elasticity of demand is said to be greater than one or demand for the good in question is described as 'elastic'. The curve is flatter as shown in diagram 3.1 (D).

5. If the percentage change in quantity demanded is less than the percentage change in price, elasticity of demand is said to be less one or demand for the good in question is described as 'inelastic'. The curve is steeper as shown in diagram 3.1 (E).

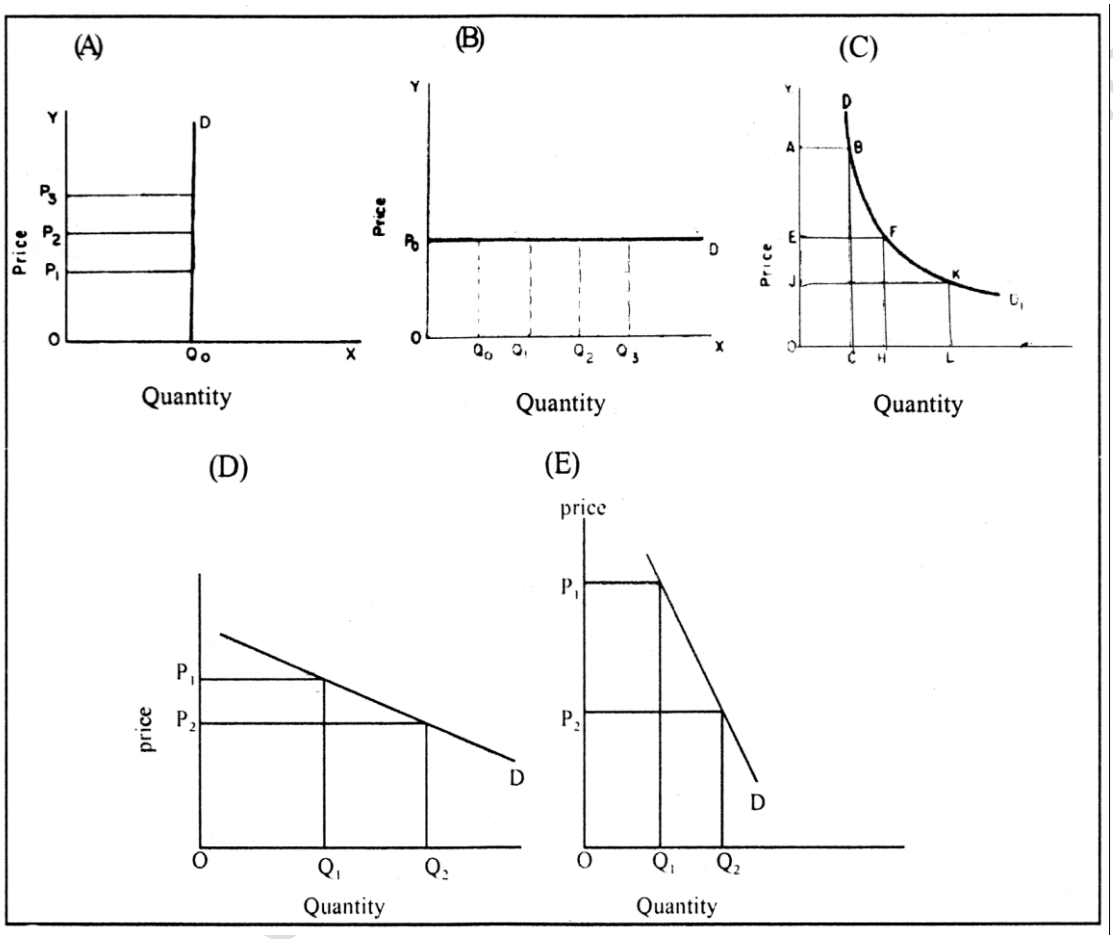

Diagram 3.1 (A) Perfectly Inelastic Demand, (B) Perfectly Elastic Demand, (C) Unitary Elastic Demand, (D) Elastic Demand and € Inelastic Demand

Intext Questions

MCQ

1. The Price elasticity of demand depends on

   a) The units used to measure price but not the units used to measure quantity.

   b) The units used to measure price and the units used to measure quantity.

   c) The units used to measure quantity but not the units used to measure price.

   d) Neither the units used to measure price nor the units used to measure quantity.

2. If there is no change in quantity demand in response to price, then price elasticity of demand is

a) inelastic
b) elastic
c) less than unit elastic
d) None of the above

Ans. 1. (d) 2. (a)

3.2 MEASUREMENT OF ELASTICITY OF DEMAND

When we think of measuring elasticity of demand one method which at once suggests itself is to measure responsiveness of quantity demanded in terms of absolute changes in price and quantity demanded. However, from the nature of the problem it is evident that we cannot measure responsiveness of demand in terms of absolute changes in price and quantity demanded. For example, due to a one rupee fall in price the quantity demanded of rice may increase by 1000 quintals. But the units of measurement being different (e.g., price is measured in rupees and rice in quintals), there is no basis for comparing a rupee change in price with a 1000 quintal change in demand. On the basis of these figures we cannot say whether the change in quantity demanded is more than equal to or less than the change in the price. And, when it is a question of comparing the relative responsiveness of the quantities demanded of two or more than two goods, even equal absolute changes in their prices or quantities demanded as a measure of relative responsiveness may actually conceal more than what it reveals. For example, suppose that as a result of a Rs.5/- reduction in the prices of wheat and radios, the demand for the former expends by 10,000 quintal and the demand for the latter. expands by 500 units. Ignoring the question of incomparability of a quintal of wheat with a unit of radio, on the basis of the absolute changes in prices and quantities we are tempted to conclude that demand for wheat is more price-elastic than the demand for radios. But the given change in the prices of the two goods may not have the same significance for the consumers. Suppose the original price of wheat was Rs. 100 per quintal and that of radios was Rs.500 per set. A Rs.5 reduction out of Rs.100 is certainly a more significant price cut than the same reduction out of Rs.500. This simply means that the prices cut is 5% in case of wheat and only 1% in case of radios. Similarly, a given change in demand may be an insignificant change if the original quantity demanded was high and it would be a significant change if the original demand was small. Suppose, according to the above example, the demand for wheat expanded from 1,000,000 tons to 1,0010,000 tons and the demand for radios expanded from 10,000 to 10,500 units. This means that the demand for wheat expanded only by 1 % while the demand for radios expended by 5%. By comparing the percentage change in prices and quantities it turns out that due to a 5% fall in the price of wheat its demand expanded only by 1% whereas due to a 1% fall in the price of radios demand expanded by 5%. It is thus evident that the demand for radios is much more price-elastic than the its demand for wheat. A comparison of the absolute changes in prices and quantities had given us an entirely distorted impression. Therefore, elasticity of demand (and for that matter all elasticities) is always measured in terms of (i.e., percentage or proportionate) changes in prices and quantities demanded. These percentage changes are independent of the units of measurement. Merely by comparing the percentage changes in price and quantity demanded we can immediately say whether percentage change in demand is more than, equal to or less than the percentage change in price. *Because of the difficulties mentioned above elasticity is never measured in terms of absolute changes. It is always measured in term of relative (i.e., the proportionate or percentage) changes in price and quantity demanded. The purpose of all elasticity measures is to determine whether the percentage change in demand is more than equal to or less than the percentage change in price causing the change in the former.*

3.3 METHODS OF MEASUREMENT

We will discuss three different methods of measuring elasticity of demand, namely-total outlay method, point method and arc elasticity.

(i) The Total Outlay Method

A variant of the above method is to compare the consumer's total outlay (i.e., expenditure = quantity bought * price) on the commodity after the price change with their original outlay and make qualitative statements about the value of elasticity as was done above. The logic behind this variant is very simple. When due to a price change the quantity demanded of a good change, this tends to change the total outlay of the consumers on the commodity. We know that if the percentage in the quantity demanded is greater than the percentage change in price, the total outlay of consumers will be larger than before in case of a fall in price and less than before in case of a rise in price. On the other hand if the percentage change in quantity demanded is less than the percentage change in price, the total outlay of consumers will be smaller than before in case of a fall in price and larger than before in case of a rise in price. And if the percentage change in quantity demanded is equal to the percentage change in price, the total outlay will remain constant. Making use of this simple arithmetical property economists have devised a variant of the percentage change method which is known as the *'total outlay method'*.

According to the total outlay method, instead of comparing the percentage change in quantity demanded with the percentage change in price, we simply compare the total outlay of consumers on the commodity after the price change with their original outlay and make following qualitative statements about the value of elasticity:

1. If the total outlay of consumers on the commodity after the price change (i.e.$Q_1 \times P_1$) is greater than the original outlay ($Q_0 \times P_0$) in case of a fall in price (and less than the original outlay in case of rise in price), elasticity of demand is said to be greater than one or demand is described as'elastic'.
2. If the total outlay of consumers remains the same even after a rise or fall in price (i.e.$Q_1 \times P_1 = Q_0 \times P_0$) then elasticity of demand is said to equal one or demand is described as of 'unit elasticity'.
3. If the total outlay of consumers after the price change is less than the original outlay in case of a fall in price ($Q_1 \times P_1 < Q_0 \times P_0$) and greater than the original outlay in case of a rise in price ($Q_1 \times P_1 > Q_0 \times P_0$) or the changes in the price and total outlay move in the same direction, elasticity of demand is said to be less than one or demand is described as 'inelastic'.

Let us explain the above method with a simple arithmetical example. Suppose, as the price of a commodity falls, the total outlay of consumers changes as shown in the table 3.1:

TABLE 3.1

Price	*Quantity demanded (Units)*	*Total Outlay*	*Value of elasticity*
Rs. 9	13	Rs. 117	
Rs. 8	15	Rs. 120	> 1
Rs. 6	20	Rs. 120	= 1
Rs. 5	23	Rs. 115	< 1

Elasticity of demand is said to be greater than one when total outlay on the commodity increases from Rs. l 17 to Rs. 120 due to a fall in price from Rs. 9 to Rs. 8. Alternatively, we can say that when price rises the total outlay decreases from Rs. 120 to Rs. 117. Therefore, elasticity of demand is greater than one.

Elasticity of demand is equal to unity when total outlay remains constant at Rs.120 as price falls from Rs. 8 to Rs. 6 (Or alternative when price rises from Rs. 6 to Rs. 8, the total outlay remains the same).

Elasticity of demand is less than one when due to a fall in price from Rs. 6 to Rs. 5 total outlay decreases from Rs. 120 to Rs. 115. (Alternatively, we can say that when price rises from Rs.5 to Rs.6 the total outlay increases from Rs. 115 to Rs. 120 elasticity of demand is greater than one.

Let us note that the outlay method enables us only to know whether elasticity of demand is greater than, less than or equal to one. This method does not give us the exact value of elasticity except in the unit elasticity case. The following two methods enable us to calculate the exact value of elasticity of demand.

(ii) The Graphical Method of Measuring Elasticity (Point Elasticity)

This method is only a graphical version of the 'Percentage change method' discussed above. The demand curve is only a graphical representation of demand schedule. Therefore, the results obtained through the two methods must necessarily be identical. In order to illustrate how value of elasticity is measured with the help of a demand curve, we draw a straight-line demand curve such as TS in the diagram 3.2.

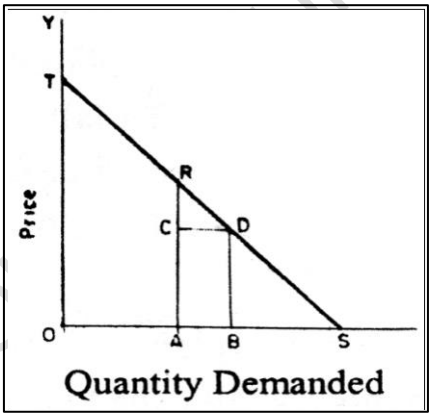

Diagram 3.2 Measuring Price Elasticity at a Point on the Demand Curve

According to diagram 3.2 when price falls from RA to BD, quantity demanded increases from OA to OB. Thus, the change in quantity demanded (ΔQ) is equal to AB (or CD), the change in price (ΔP) is CR, while the original quantity demanded (Q) is OA and the original price (P) is AR. According to the percentage method the elasticity of demand,

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

In terms of the above diagram we have:

$$e = \frac{AB}{CR} \times \frac{AR}{OA}$$

$$= \frac{CD}{CR} \times \frac{AR}{OA} \text{ (because AB = CD)}$$

$$= \frac{AS}{AR} \times \frac{AR}{OA}$$ (because RCD and RAS are similar triangles).

Therefore,

$$= \frac{CD}{CR} \times \frac{AS}{AR}$$

$$= \frac{AS}{OA}$$

$$= \frac{RS}{TR}$$ (because AR, being parallel to OT, divides OS and TS in the same ratio)

Note that in the fraction $\frac{RS}{TR}$ the numerator RS is the lower segment and TR is the upper segment of the straight-line demand curve which meets the two axis in T and S. Therefore, for measuring elasticity at any point on a downward sloping straight-line demand curve which meets the two axis, we can devise a rule of thumb and say *that value of elasticity at any point on a downward sloping straight-line demand curve which meets the two axis is equal to the lower segment divided by the upper segment of the demand curve.*

$$\mathbf{E} = \frac{\boldsymbol{lower\ segment\ of\ the\ demand\ curve}}{\boldsymbol{upper\ segment\ of\ the\ demand\ curve}}$$

Intext Questions

1. Suppose a rise I the price of pen from Rs. 5.50 to Rs. 6.50 per pen decreases the quantity demanded from 12,500 to 11,500 pens. The elasticity of demand is
   a) greater than unit elastic
   b) less than unit elastic
   c) unitary elastic
   d) inelastic

2. Point elasticity is only a graphical version of
   a) Total outlay method
   b) Percentage method
   c) Arc method
   d) None of the above

Ans. 1 (a) 2 (b)

(iii) 'ARC' Elasticity

We must study arc elasticity because of the problem of a sang in the elasticity expression (e = (ΔQ/ ΔP).(P/ Q)) which was derived above. The fraction Q/ P is the rate of change of Q per unit change in P but it does not specify whether the change in P is small or relatively large. When ΔP is relatively large it creates a range of prices (and quantity demanded associated with each price) thus, giving birth to a number of P/Q; ratios. For example, in the diagram 3.3 opposite the fall in price from P_0 to P_1creates a number of P/Q ratios such as

$$\frac{P_0Q_0}{OQ_0}, \frac{P_2Q_2}{OQ_2}, \frac{P_3Q_2}{OQ_2}, \frac{P_1Q_1}{OQ_1}$$

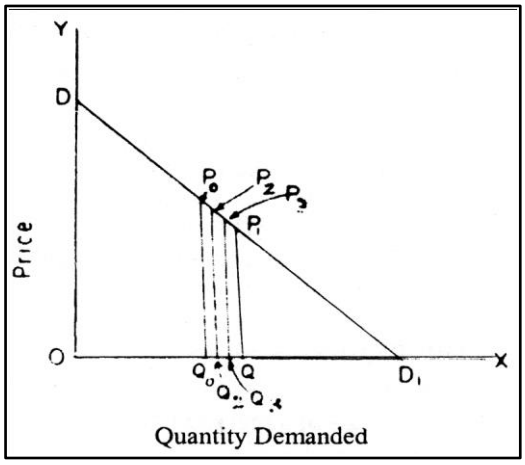

Diagram 3.3

and so on. In other words, we have a different P/Q ratio at each point over the stretch of the demand curve P_0P_1. Which one of the several P/Q ratios occurring over the stretch P_0P_1 to choose for calculating the value of elasticity? This is one problem. Secondly, the fraction $\Delta Q/\Delta P$ will be the same for a finite as well as for an infinitesimally small change in P over a whole price range only when the rate of change of Q per unit change in P is constant over the relevant price range (i.e., when the given segment of the demand curve is a straight line) From the above the following conclusions follows:

A. In case of a straight-line demand curve (so that $\Delta Q/\Delta P = dQ/dP$ throughout) value of elasticity ($e = dQ / dP. P/Q$) will normally vary from one point to another (because of the variations in the value of the ratio P/Q) except in the following two cases:

I. When $\Delta Q/\Delta P = dQ/dP$ = zero, i.e., in case of a vertical demand curve along which quantity demanded does not vary at all in response to price changes. The elasticity of demand will be zero (i.e., $dQ/dP \times P/Q$ = zero) at all points. Such a demand curve is described as 'perfectly inelastic'. It is vertical and runs parallel to the Y axis as shows in the diagram 3.4 (A).

According to this diagram quantity demanded remains constant at OQ_0 whether the price is zero or OP_1 or OP_2 or OP_3 or anything else.

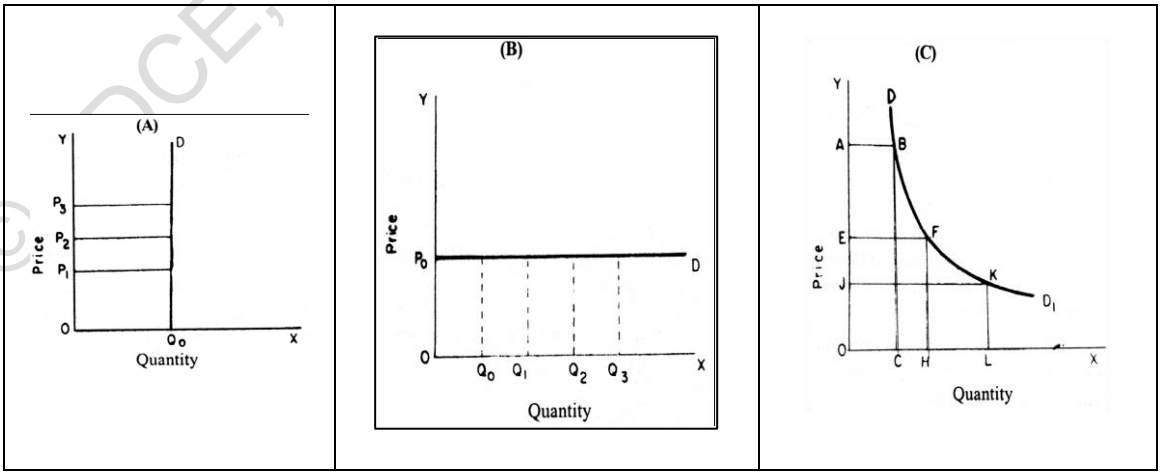

Diagram 3.4

II. When $\Delta Q / \Delta P = dQ/dP$ (infinity), i.e., in a case in which an infinite amount of a commodity is bought at a certain price and nothing at all at any slightly higher price. Such a demand curve will be horizontal and parallel to the X axis as P_0D in the diagram 3.4 (B).

According to diagram 3.4 (B), an infinite amount of the commodity is brought at P_0 price and nothing at all at any higher price. Such a demand curve is known as 'perfectly elastic'.

B. In case of a non-linear demand curve, in addition to the variations in the value of the ratio P/Q, the value of the ratio $\Delta Q / \Delta P$ will also be different for a relatively large (finite) change in P and for an infinitesimally small change in P. Therefore, in case of a non-linear demand curve value of elasticity will normally vary from one point to another except when $dQ/dP \cdot P/Q$ always equals 1.

A demand curve with unit elasticity at all points is of the shape of a rectangular hyperbola as shown in the diagram 3.4 (C).

It is the peculiar property of a rectangular hyperbola that the areas of all the rectangles subtended through different points on it are all equal. Thus, in the diagram above ABCO-EFHO-JKLO, etc. What do these rectangles represent? They only represent the total outlays. For example, the area the rectangle ABCO is calculated by multiplying OC (the quantity demanded) by BC (the price) which is nothing but the total outlay. Similarly the areas of rectangles EFHO and JKLO would represent total outlays at prices FH and KL. All these outlays are equal when the elasticity of demand is unity at all points along the demand curve.

In case of all other non-linear demand curves the value of elasticity varies from one point to another.

(iii) a. The Concept of Arc Elasticity

The moral of the above discussion is this: When there is a relatively large (finite) change in P, it creates a price range over which value of elasticity normally varies from one point to another except the special cases mentioned above. In such a case no unique value of elasticity can be taken as the elasticity of the whole price range (i.e., the given segment of the demand curve). In order to take care of this problem we use the concept of 'arc elasticity'. Arc elasticity is a measure of the average responsiveness of Q to relatively large (finite) changes in P (or average responsiveness to price change exhibited by a demand curve over a finite stretch such as P_0P_1 in the diagram 3.5).

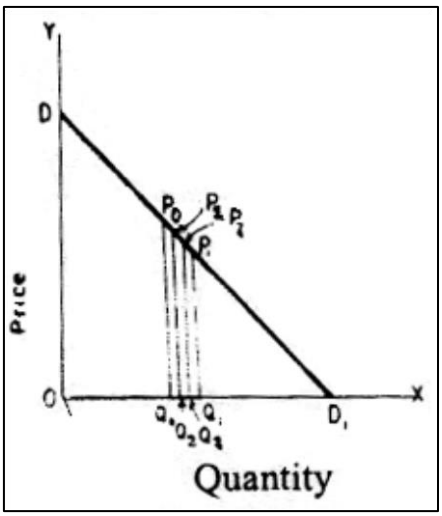

Diagram 3.5

(iii) b. Method for Measuring Arc Elasticity

For measuring arc elasticity, instead of picking up any particular P and the Q associated with it for the ratio P/Q, it is customary to fix P = $\frac{P_1 + P_0}{2}$ (i.e., the average of the two end values P_0 i.e, original price and P_1 i.e., changed price and similarly to fix Q = $\frac{Q_1 + Q_0}{2}$ (i.e., average of the two end values Q_0 i.e., the original quantity and Q_1 i.e., changed quantity. Hence arc elasticity is defined by the following expression:

$$\text{Are elasticity of demand} = \frac{\Delta Q}{\Delta Q} \times \frac{P}{Q}$$

$$= \frac{Q_1 - Q_0}{P_1 - P_0} \times \frac{\frac{P_1 + P_0}{2}}{\frac{Q_1 + Q_0}{2}}$$

$$= \frac{Q_1 - Q_0}{P_1 - P_0} \times \frac{P_1 + P_0}{Q_1 + Q_0}$$

Let us illustrate the method for measuring arc elasticity with a simple numerical example. Suppose, due to a fall in the price of a commodity from Rs. 10 to 8 per unit the quantity demanded of it increases from 1000 units to 1500 units. What will be the value of arc elasticity in this case? Let us translate these figures in symbols of the above expression.

According to the example $P_0 = 10$, $P_1 = 8$, $Q_0 = 1500$, ΔQ (i.e., $Q_1 - Q_0$) = 500 and ΔP (i.e., $P_1 - P_0$) = 2.

$$\text{Arc elasticity of demand} = \frac{Q_1 - Q_0}{P_1 - P_0} \times \frac{P_1 + P_0}{Q_1 - Q_0}$$

$$= \frac{1500 - 1000}{10 - 8} \times \frac{8 + 10}{1500 + 1000}$$

$$= \frac{500}{2} \times \frac{18}{2500} = 1.8.$$

Had we used either of the two end values of P and Q in the ratio P/Q (i.e., either P_0/Q_0 or P_1/Q_1) we would have obtained different results. For example, if we had calculated value of elasticity on the basis of the ratio P_0/Q_0 (i.e., 10/1000), ΔQ / ΔP remaining the same (1500 – 1000 / 10 – 8), its value would have equaled 2.5. $\left| \frac{1500 - 1000}{10 - 8} \times \frac{10}{1000} = \frac{500}{2} \times \frac{10}{1000} \right|$. On the other hand, if we had calculated value of elasticity on the basis of the ratio, P_1/Q_1 (i.e., 8/1500), ΔQ / ΔP remaining the same, its value would have equaled 1.33. $\left| \frac{1500 - 1000}{10 - 8} \times \frac{8}{1500} = \frac{500}{2} \times \frac{800}{1500} = 1.33 \right|$. Thus, we get different values of elasticity according to the ratio P/Q we choose. It is 2.5 when we calculate value of elasticity on the basis of P_0/Q_0 (= 10/1000), 1.33 when we calculate it on the basis of

P_1Q_1 (8/1500) and 1.8 when we calculate the elasticity on the basis of $\frac{\frac{P_1 + P_0}{2}}{\frac{Q_1 + Q_0}{1}}$. The values 2.5 and 1.33 are the extreme values of elasticity of the price P_0P_1 (the arc or the given stretch of the demand curve). On the other hand, are elasticity (= 1.8 in the present case) does not measure responsiveness of demand with reference to a particular P/Q (at any particular point) but in fact represents the approximate average responsiveness of demand over a finite price range (or a given stretch) of the demand curve.

METHOD FOR MEASURING POINT ELASTICITY ON A NON-LINEAR DEMAND CURVE

The value of elasticity at any point on a straight-line demand curve is given by the fraction: right hand side segment of the demand curve from the given point divided by the left-hand side segment. Also, as explained above, at the point of tangency of a straight-line tangent with a non-linear curve the values of the two terms P/Q and dp/dq are the same on the tangent as well as the curve. From this it follows that at the point of tangency the value of elasticity on the straight-line tangent as well as on the curve will be same. Therefore, in order to measure elasticity at any point on a non-linear demand curve, we draw a straight-line tangent to it at that point meeting the two axes at T and R. The value of elasticity on the straight-line tangent at the point of tangency is also the value of elasticity on the nonlinear demand curve at that point. For example, in the diagram 3.6 DD_1 is a non-linear demand curve and TR has been drawn tangent to it at P. The value of elasticity at P on DD_1 is given by the fraction $\frac{PR}{PT}$.

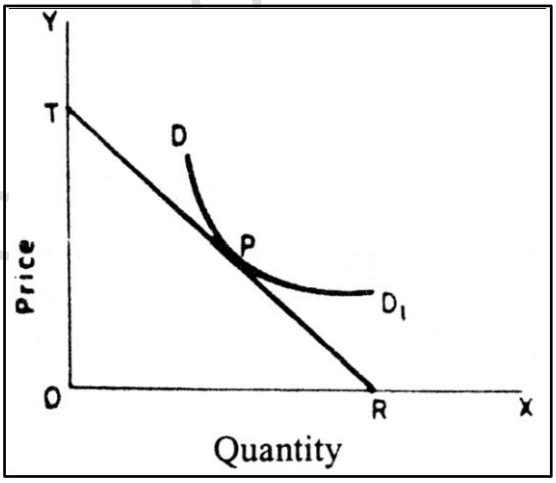

Diagram 3.6

Intext Questions

1. The elasticity of demand will be _____ if dQ/dP=0
2. In case of 'giffen goods', price elasticity of demand is _____.

Ans. 1. Zero

2. positive

Note Regarding the Sign of the Coefficient of Elasticity of Demand

An important point about the sign of the elasticity coefficient needs to be mentioned here. Elasticity coefficient is calculate d by multiplying. According to the law of demand price and quantity demanded are inversely related, that is, the two move in opposite directions. When price falls quantity demanded increases, and vice-versa. From this it follows that if the change in one is a positive quantity the change in the other must be a negative quantity. For example, if due to a fall in price from Rs. 10 to Rs. 8 quantity demanded increases from 100 to 120 units, the change in price will be a negative quantity (–2) and the change in quantity will be positive quantity (+20). Hence in all normal cases the Q/P must be a negative fraction and as a result in all normal cases the elasticity coefficient must have a negative sign. Only in the unlikely case i.e. in case of 'giffen good', when price and demand move in the same-direction, however, elasticity coefficient will be a positive fraction. *Conventionally, however, when price and quantity behave in the normal manner (i.e., move in opposite directions in accordance with the law of demand) elasticity coefficient is taken to be a positive fraction and in the abnormal case (when price and quantity more in the same direction) elasticity coefficient is taken to be a negative fraction. Therefore, the sign of the elasticity coefficient should be carefully marked and its significance should be accordingly interpreted.*

3.4 FACTORS DETERMINING ELASTICITY OF DEMAND FOR DIFFERENT GOODS

The price-elasticity of demand varies from commodity to commodity. The demand for certain commodities is highly elastic while the demand for some other commodities is less elastic or highly inelastic. This is because a number of factors influence elasticity of demand for different goods. It is not possible to discuss all such factors here. Below we mention only some of the more important factors which determine elasticity of demand for different goods.

(*i*) *Availability of Close Substitutes:* One of the most important factors determining elasticity of demand for a good is the availability of close substitutes. Some commodities like tooth paste, shaving blades, soaps, shoe polish, etc., have a number of quite close substitutes (i.e., different brands). If the price of a particular brand of tooth paste (say, Forhan's) change, price of other brands of tooth paste remaining constant; it is likely to cause substantial substitution-a fall in price leading consumers to buy more of it and a rise in the price leading consumers to buy more of the other brands. Therefore, elasticity of demand for a good which has several close substitutes is bound to be high. On the other hand, elasticity of demand for goods which have few or no satisfactory substitutes is bound to be inelastic. Salt, for example, has hardly any substitute for it. Therefore, elasticity of demand for salt is inelastic.

(*ii*) *Character of the commodity:* Elasticity of demand depends also upon the character of the good-whether it is considered a necessity or a luxury by the consumers. The demand for necessities of life is usually inelastic while the demand for luxuries tends to be highly elastic. The demand for a staple food is likely to be insensitive to price changes because when its price rises a consumer has no alternative but to continue buying it. On the other hand, luxury goods can be easily dispensed with when their prices are high. Therefore, demand for necessities of life is usually inelastic while the demand for luxuries is highly elastic.

(*iii*) *Level of Price:* At very high and at low prices elasticity of demand is usually very low. If the price of a commodity is very high or very low a slight change in it will not effect its demand significantly. Pencils, for example, which are already selling at low prices will not be purchased in larger quantities if prices fall still lower. On the other hand, slight fall in the price of cars, for example, will not bring them within the reach of average consumers. Cars will still be purchased only by the rich who, in any case, buy them whether the price is somewhat

higher or lower. Therefore, elasticity of demand is usually low at very high and at very low prices.

(*iv*) *Importance of the commodity in the consumer's budget (i.e., the proportion of income spent on the commodity):* When a commodity claims only a small fraction of a consumer's income, he makes no great effort to look for substitutes when its price rises. For example, one normally spends a very small amount of money on goods like match boxes, salt, shoe polish, newspapers, etc. When the price of such a good rises it will not affect the consumer's budget significantly and consequently he is not inclined to change its consumption very much. The demand for such a good is bound to be relatively inelastic. On the other hand, when a good claims a fairly large fraction of a consumer's income, as for instance with most groceries, a rise in price will affect the consumer's budget significantly. This will compel him to look for some cheaper substitute and somehow cut down his expenditure on the commodity in question. Therefore, the demand for a good on which a consumer speeds a large proportion of his income is likely to be relatively more elastic as compared to another goods on which a consumer spends a small amount.

(*v*) *The possibility of new customers entering the market:* When the price of a commodity is high only the relatively rich people can afford to buy it. But as the price gradually falls, it becomes accessible to new customers who could not afford to but it when price was high. Thus, with each fall in price more and more new customers are induces to buy the commodity. Hence a fall in price which induces consumers in several income-groups to buy will result in a considerable elasticity of demand.

(*vi*) *Possibility of postponing purchases:* The elasticity of demand for a good also depends on whether or not its purchases can be postponed if the situation so demands. The demand for consumer durables such as furniture, refrigerators, television sets and less essential items can usually be postponed for better time in future. The demand for a good the purchase of which can be easily deferred to future is likely to be more elastic as compared to the demand for a good the purchase of which cannot be postponed. For this reason the demand for commodities such as medicines, education, necessities of life, etc. is usually very inelastic.

(*vii*) *The period of time under consideration:* In the event of a rise in price of a good a consumer's real income is reduced and he is compelled to readjust his consumption pattern. He does so by changing his consumption habits and by finding cheaper substitutes. Since it takes time to find suitable substitutes and to change one's consumption habits, elasticity of demand for any good will tend to greater the longer the period of time allowed for these adjustments. Elasticity of demand for a good will tend to be lower shorter the period of time under consideration.

Finally, let us note that a number of factors may be in operation in making the elasticity of demand for a good what it is. For example, salt is a necessity of life, it has no substitute for it, is sells cheap and therefore, claims a very small fraction of one's income, its consumption cannot be postponed either. Thus, more than one factor account for the low elasticity of demand for salt. Therefore, in order to explain the magnitude of elasticity in any particular case, it is necessary to look for all the possible factors that may influence the demand for the good in question.

3.5 CROSS ELASTICITY AND INCOME ELASTICITY OF DEMAND

So far in our discussion we have been concerned with the responsiveness of demand to changes in the price of the good itself i.e. price elasticity of demand. However, the demand for a commodity depends on a number of other factors besides price of the good. The more important and quantifiable among these factors are price of related goods and incomes of the consumers. Just as we measure responsiveness of demand to change in the price of a good, similarly we can measure responsiveness of demand for a good to changes in the incomes of the consumers and to changes

in the price of a related good. A measure of the degree of responsiveness of the demand for a good to changes in the incomes of the consumers is known as the "income-elasticity of demand". And a measure of the degree of responsiveness of demand for a good X to changes in the price of some other related good Y is described as the 'cross-elasticity of demand'.

Income-elasticity of Demand

The same percentage or proportionate change method is used to measure income-elasticity of demand for a good. The formula is:

$$\text{Income-elasticity of demand for a good} = \frac{\%\text{ change in the demand for X}}{\%\text{ change in Income of consumer}}$$

Suppose, for instance that due to a 20% increase in the real incomes of the consumers the demand for television sets increases by 10%. In this example income-elasticity of demand for television sets equals 0.5 (i.e., 10% – 20 = 0.5). Normally, an increase in the consumer's incomes tends to increase the demand for most goods except what are known as 'inferior goods'. In case of inferior goods an increase in the incomes of the consumers tends to reduce demand for them and a decrease in incomes tends to increase demand for them. As a matter of convention value of income-elasticity of demand is taken to be positive when the demand for a good behaves in the normal manner in response to changes in income-increase in incomes leading to increase in demand and a decrease in incomes leading to a decrease in demand. In the abnormal case (i.e., in case of an inferior good) when incomes of consumer increase demand for a good decrease and vice versa, value of income-elasticity of demand is taken to be negative.

Intext Questions

TRUE / FALSE

1. Sign of income elasticity of demand is always positive.
2. In case of substitute goods, the price of one good and demand for other goods move in the opposite direction.

Ans. 1. True

2. False

Cross-elasticity of Demand

The same percentage change method is used to measure cross-elasticity of demand. Suppose X and Y are two related goods and we want to measure the cross-elasticity of demand for X with respect to changes in the price of Y. The formula for measuring cross-elasticity of demand is:

$$\text{Cross-elasticity of demand for X} = \frac{\%\text{ change in the demand for X}}{\%\text{ change in the price of Y}}$$

For example, suppose X and Y are two substitute goods and a 10% reduction in the price of Y causes the demand for X to increase by 15%. In this case the cross-elasticity of demand for X ' will equal 15% ÷ 10% =1.5. Goods may also be related to each other as complements. In case of complementary goods a reduction in the price of one will cause the demand for the other complementary good to increase. Thus, in case of substitute goods price of one good and the demand for the other good move in the same direction whereas in case of complementary goods they move in opposite directions. However, as a matter of convention value of cross-elasticity is taken to be positive when price and demand move in the same direction (as is the case with substitute goods) and value of cross-elasticity is taken to be negative when price and demand move in opposite directions (as is the case with complementary goods). In other words, value of cross-

elasticity of demand is treated as positive in case of substitute goods and negative in case of complementary goods. Thus on the basis of the value of the cross elasticity of demand, we may find out whether the two goods are related to each other as substitutes or complements and what is the degree of substitutability and complementarily between them.

3.6 SOME THEOREMS ABOUT ELASTICITY OF DEMAND

1. Value of point elasticity varies from zero to infinity along a downward sloping straight line demand curve.

Proof:

$$e = (dq/dp).(P/O)$$

See the diagram 3.7 wherein DD_1 is a straight-line demand curve. So, its slope (dp/dq) and its reciprocal, the ratio (dq/dp) is constant at all points. The ratio P/Q varies from zero to infinity (∞) along DD_1 . P/Q = zero at D1 where DD_1 meets the quantity axis and P/Q = ∞ at D where DD_1 meets the price axis. Therefore, e = zero at D_1 and e = ∞ at D. At the middle point A on the demand curve DD_1, the elasticity of demand will be unity (e = 1) because lower segment AD_1 of the demand curve is equal to the upper segment AD of the demand curve. On any point, say, B, above the mid-point A on the demand curve DD_1, the elasticity of demand will be more than one (e > 1) because BD_1 > BD. On the other hand, the elasticity on any point say C, which lies below the mid-point A on the demand curve DD_1, the elasticity of demand will be less than one (e < 1) because CD_1 < CD. In other words, as we move towards D_1, the elasticity of demand goes on decreasing because the lower segment of the demand curve becomes smaller and smaller and the upper segment will be increasing. At point D_1 the elasticity will become zero because at D_1, the lower segment will be equal to zero and the upper segment will be the whole DD_1.

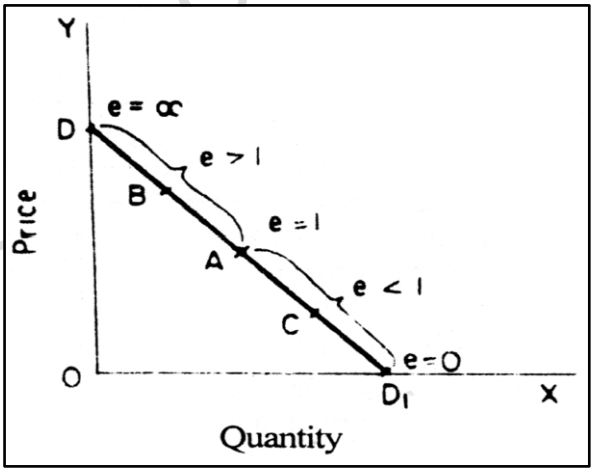

Diagram 3.7 Price Elasticity varies from 0 to ∞ on a straight-line demand curve

2. Elasticity at different points along two (or more) parallel (i.e., having the same slope) demand curves.

A. Of the two (or more) parallel demand curves, the one farther from the origin is less elastic at each price than the one closer to the origin.

Proof: $e = \frac{dq}{dp} \times \frac{P}{Q}$

See diagram 3.8. Being parallel the value of dq/dp is the same at all points along D_1D_2 and D_2D_2 but the ratio P/Q is smaller at each price on D_2D_2 than D_1D_1.

Therefore, D_2D_2 is less elastic at each price than D_1D_1. From this also follows the conclusion that parallel rightward shift of a downward sloping demand curve makes it less elastic at each price and a parallel leftward shift makes it more elastic at each price.

B. The one farther form origin is more elastic at each level of demand than the one closer to the origin given same quantity.

Proof: $e = dq/dp \cdot P/Q$

In the diagram 3.9, being parallel the ratio dq/ dp is the same at all point along D_1D_1 and D_2D_2. But the ratio P/Q is greater at each level of demand along D_2D_2 than D_1D_1 (e.g., $P_2Q/OQ > P_1Q/OQ$). Therefore, D_2D_2 is more elastic at each level of demand than D_1D_1.

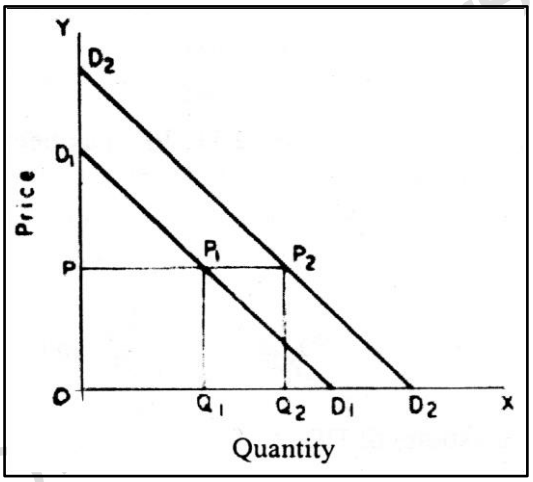

Diagram 3.8: Comparison of price elasticity on two parallel straight-line demand curves at given price

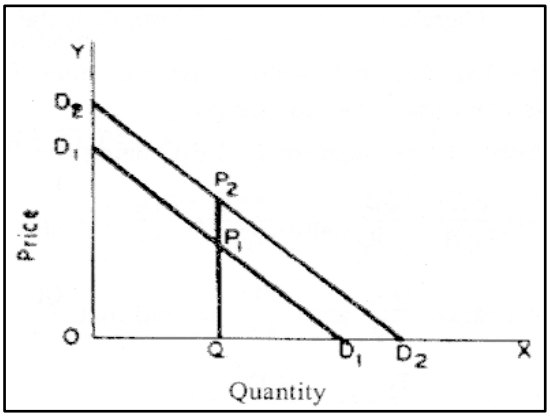

Diagram 3.9 Comparison of price elasticity on two parallel demand curves at given quantity

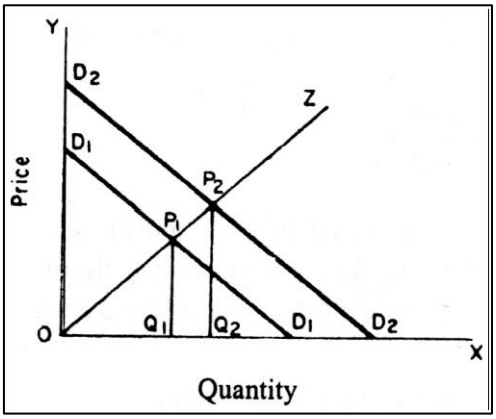

Diagram 3.10

C. Have the same elasticity at points lying along a straight line drawn from the origin (0)

Proof: $e = \frac{dq}{dp} \times \frac{P}{q}$

In the diagram 3.10, being parallel the ratio dq./dp is the same at all points along D_1D_1 and D_2D_2. The ratio P/Q is also the same at all points along OZ because the two triangle OQ_1P_1 and OQ_2P_2 are similar and therefore,

the ratio = $\frac{P_qQ_1}{OQ_1} = \frac{P_2Q_2}{OQ_2}$

Therefore, elasticity of two (or more) parallel demand curves at points lying along a straight line drawn from the origin (0) is the same.

3. Value of elasticity of downward sloping straight-line demand curves originating from the same point on the price axis.

(i) Are iso elastic at each price

Proof: In the diagram 3.11, PP_2 has been drawn parallel to OD_2.

Therefore, $\frac{P_2D_2}{P_2D} = \frac{P_1D_1}{P_1D} = \frac{OP}{PD}$

Elasticity of DD_2 at $P_2 = \frac{P_2D_2}{P_2D}$ and

Elasticity of DD_1 at $P_1 = \frac{P_1D_1}{P_1D}$

Therefore, elasticity at P_2 and P_1 is the same.

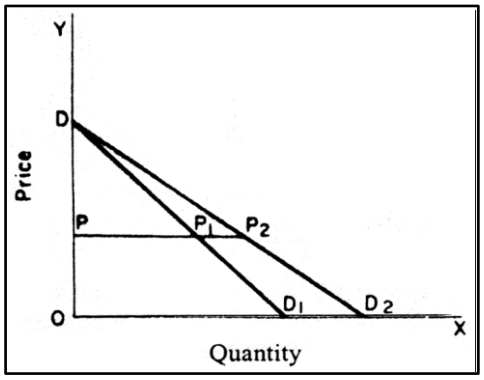

Diagram 3.11

(ii) The flatter is more elastic at each level of demand than the steeper one.

Proof: In the diagram 3.12 P_2Q being paralleled to OD, $\frac{P_1D_1}{P_1D}=\frac{QD_1}{OQ}$ and $\frac{P_2D_2}{P_2D}=\frac{QD_2}{OQ}$. Comparing the two ratios $\frac{QD_2}{OQ}$ and $\frac{QD_1}{OQ}$ we find that $\frac{QD_2}{OQ}>\frac{QD_1}{OQ}$. Therefore, $\frac{P_2D_2}{P_2D}>\frac{P_1D_1}{P_1D}$. Hence value of elasticity at $P_2\left(=\frac{P_2D_2}{P_2D}\right)$ is greater than value of elasticity at $P_1\left(=\frac{P_1D_1}{P_1D}\right)$.

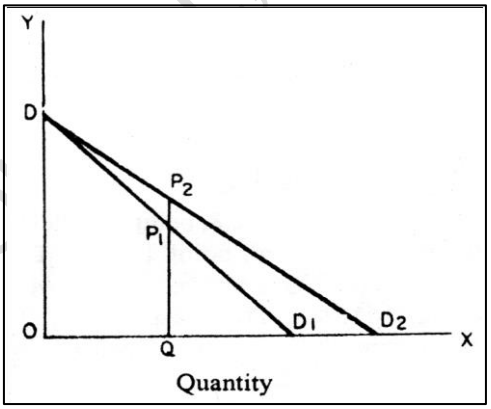

Diagram 3.12

Therefore, of two (or more) demand curves originating from the same point on the price axis, the flatter is more elastic at each levels of demand than the steeper one.

4. Downward sloping straight-line demand curves meeting the quantity axis at the same point have the same elasticity at each level of demand.

Proof: In the diagram 3.13 since P_2Q is parallel to OD_2 therefore, $\frac{P_2D}{P_2D_2}=\frac{P_1D}{P_1D_1}=\frac{QD}{OQ}$.

Elasticity at $P_2 = \frac{P_2D}{P_2D_2}$ and elasticity at $P_1 = \frac{P_1D}{P_1D_1}$. Hence elasticity at P_2 = elasticity at P_1. Therefore, D_1D and D_2D have the same elasticity at each level of demand.

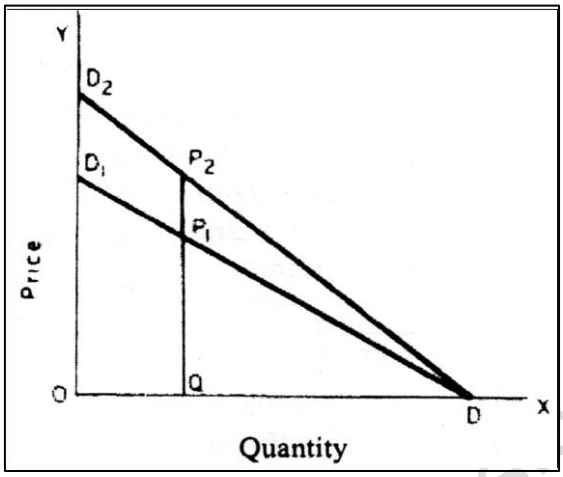

Diagram 3.13

5. Of the two (or more) intersecting straight-line demand curves the flatter one is more elastic at the point of intersection, than the steeper one.

In the diagram 3.14, at P the ratio P/Q is the same for D_1D_1 as well as D_2D_2. Therefore, value of elasticity will vary only with the value of dq/dp along the two curves. Value of dq/dp is larger at each point along D_2D_2. (i.e the flatter curve) than along D_1D_1 (i.e., the steeper of two). Therefore elasticity of D_2D_2 at P is greater than elasticity of D_1D_1 at the same point p.

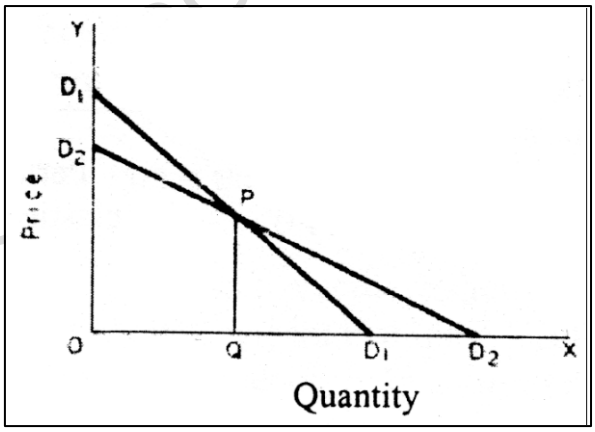

Diagram 3.14

Intext Questions

Fill in the blanks

1. Value of price elasticity of demand varies from _____.
2. At the mid point of downward sloping demand curve, elasticity of demand is _____.

Ans. 1. 0 to infinity

2. One

Learning outcomes

1. Price elasticity of demand is defined as the ratio of percentage change in quantity demanded to percentage change in price
2. For given price and quantity of the good, its price elasticity of demand is inversely related to the slope of the demand curve
3. Demand curve is vertical when price elasticity is *Zero*, steeper for price elasticity less than *One*, rectangular hyperbola for price elasticity equals *One*, flatter for elasticity greater than *One* and horizontal for elasticity *Infinity*.
4. On a straight-line demand curve the elasticity at any point equals the ratio between lower portion of the demand curve at that point and upper portion of the demand curve. Accordingly the price elasticity of demand varies from *zero* on the quantity axis to *infinity* on the price axis along the straight-line demand curve with *unity* at the mid-point.
5. The arc elasticity of demand takes into consideration the average of prices and quantities respectively before and after change along with their differences. This is done in order to measure price elasticity in case of large changes in prices.
6. The price elasticity of demand is related to the Total Expenditure (TE) in the following way:-
   a) e=1 if, TE does not change with change in price
   b) e<1if, TE is positively related to price
   c) e>1if, TE is negatively related to price
7. The factor affecting elasticity of demand are: -
   Number of substitutes of the commodity, number of various uses of the commodity, time period of consumption, level of income of the consumer, level of the price of the good, etc.
8. At the point of intersection of two straight-line demand curves the elasticity is higher on the flatter demand curve than that on the steeper one.
9. At a given price on various parallel straight-line demand curves the price elasticity of demand decreases as the demand curve moves away from the origin.
10. At a given quantity on a various straight-line parallel demand curves the price elasticity of demand increases as the demand curves moves away from the origin.
11. Elasticity of demand remains same at a given price on two or more straight-line demand curves originating from the same point on the price axis.
12. Elasticity of demand remains same at a given quantity on two or more straight-line demand curves originating from the same point on the quantity axis.
13. Price elasticity remains same along the straight-line from the origin which intersects two or more parallel demand curves.

TERMINAL QUESTIONS

Short Questions

1. Explain the total expenditure method of measuring price elasticity of demand.
2. Discuss the factors affecting price elasticity of demand.
3. Explain the various degree of price elasticity of demand.
4. The demand for a commodity at Rs. 4 per unit is 100 units. The price of the commodity rises and as a result its demand falls to 75 units. Find the new price, if the price elasticity of demand is one.

Long Questions

1. Explain the various theorems of elasticity of demand
2. What is elasticity od demand? Explain Price elasticity of demand, Income elasticity of demand and Cross elasticity of demand.
3. What is elasticity of supply. Explain its degree and factors affecting supply.

❑❑❑

LESSON: 4

SUPPLY AND ELASTICITY OF SUPPLY

The price of a commodity is determined by its demand and supply. We have so far discussed the demand aspect. We shall now discuss the supply aspect.

Learning Objectives

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

1. Define individual supply for a good as well as market supply for that good.
2. Explain the determinants of individual supply and market supply for a good.
3. State the law of supply.
4. Make individual as well as market supply schedule for a good.
5. Draw the individual as well as market supply curves for a good respectively.
6. Distinguish between change in quantity supply and change in supply.
7. Define elasticity of supply
8. Draw various supply curves as per the different types of elasticity of supply

4.1 MEANING OF SUPPLY

Supply refers to the quantity of a commodity which the producers are prepared to sell in the market at a particular price per unit of time. Like demand, supply is also expressed with reference to a particular price and time. The amount of goods available with the producers (i.e., stock) cannot be called supply because the producers may not be prepared to offer the entire stock of a commodity for sale in the market at a particular price and time. Only that amount of the goods which the sellers are actually prepared to offer for sale in the market at a particular price and time is called supply. Like demand, quantities supplied will be different at different prices. In case of demand, there is an inverse relationship between the price of a commodity and its quantities demanded i.e., more is demanded at a lower price and vice-versa. But in case of supply there is a direct relationship between the price of a commodity and its quantities supplied i.e., more of the quantities of a commodity will be supplied at a higher price and vice-versa.

4.2 FACTORS DETERMINING THE SUPPLY

(*i*) *Price of a commodity:* The objective of the producer is to get maximum profits. Other things being equal, producers will supply more of a commodity at a higher price and less at a lower price. This direct relationship between the price of a commodity and its quantities which the producers are prepared to offer for sale in the market is called the Law of Supply.

(*ii*) *Prices of other goods:* If the prices of other goods have increased, whereas the price of the commodity which the producers have been producing has not increased or not increased to the same extent to which the prices of other goods have increased, it will become profitable for the producers to produce other goods and therefore the supply of the particular commodity which they have been producing will fall. The supply of one commodity, therefore, falls when the prices of other goods increase and vice-versa.

(*iii*) *Prices of Factors of Production:* Other things being equal, the changes in the prices of factors of production also affect the cost of production. The rise in the price of one factor or factors of production used in the production of a commodity will cause increase in its cost of production and reduces the profitability of the production of that

commodity. The producer will reduce the supply of that commodity and increase the supply of other commodity.

(*iv*) *State of Technology:* There have been tremendous technological improvements during the last few years and are also taking place every day. There have made it possible to produce varieties of goods at low cost of production and therefore the supply of various types of commodities has increased.

(*v*) *The Goals of Producers:* The objectives of the producers is to maximize their profits. But if the producer of a commodity wants to sell as much as possible even if it costs him some profits, he will produce more of that commodity and therefore, its supply will increase. If the producers are prepared to take risk, the supply of the commodity whose production is risky, will increase.

Intext Questions

MCQ

1. Which one is increasing function of price.

   a) Demand b) Supply

   c) Market demand d) None of the above

2. Supply is effected by

   a) Price of the commodity b) Prices of the goods

   c) Technology d) All of the above

   Answer

   1. c 2. d

4.3 THE LAW OF SUPPLY

Supply of a commodity directly depends upon the price of that commodity. Higher the prices, larger will be quantities supplied. This direct relationship between the price of a commodity and its quantities supplied is called the Law of Supply. We can define Law of Supply in the following way

"Other things being equal, more of a commodity will be supplied at higher prices and less at lower prices" i.e., the price of a commodity and its supply is directly related.

It is apparent from the fact that the objective of the producer is to maximize his profits, therefore, if the price of a commodity has risen, it is profitable for the producer to produce and supply more of that commodity. Lower prices will induce the producers to reduce the supply of that commodity.

Law of supply can be explained with the help of supply schedule and supply curve. Supply Schedule of a Firm

We have-said earlier that supply of a commodity is expressed with reference to a price and there will be different quantities of a commodity supplied at its different prices. Suppose a producer (firm) supplies 10, 14, 17 and 19 ball-pens per day when the prices of ball-pens are Re. 1, Rs. 1.50 Rs. 2.00 and Rs. 2.50 per ball-pen respectively. If we put it in a tabular form as given below in Table 4.1, showing the different quantities of a commodity which, a producer is prepared to supply at its different prices, we call it a firm's supply schedule of that commodity.

TABLE: 4.1

Supply Schedule of an Individual Firm

Price (per ball-pen)	*Quantity supplied Ball-pens*
Rs.	*(Units)*
1.00	10
1.50	14
2.00	17
2.50	19

The supply schedule clearly shows that more quantities of ball-pens will be supplied at higher prices and vice-versa.

Supply Curve of a Firm

If we represent the above supply schedule on a graph, we can get the supply curve of a firm, as given in diagram 4.1.

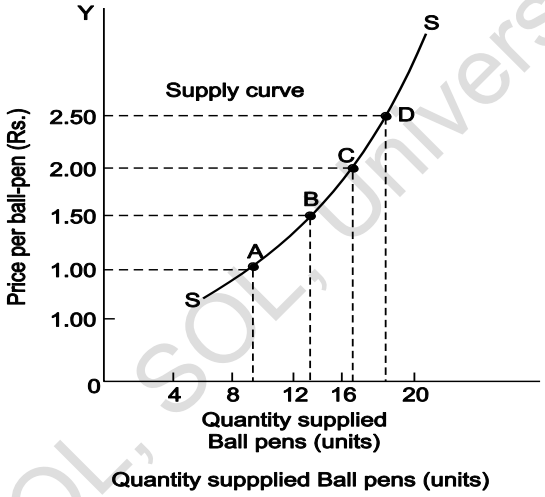

Diagram 4.1

In diagram 4.1, vertical axis OY represents the different prices of ball pens and horizontal axis, OX, the quantities of ball-pens supplied. A, B, C, and D represent the different quantities of ball-pens supplied at different prices as given in the supply schedule Table 2.3. If we join A, B, C and D, we get a curve which is called the supply curve. Supply curve slopes upward from left to right. This supply curve shows that there is a direct relationship between the prices of ball-pens and their quantities supplied i.e., larger will be the quantities supplied at higher prices and smaller will be the quantities supplied at lower prices, assuming other things remaining same.

Market Supply Schedule and Market Supply Curve

In order to find out the market demand schedule and the market demand curve, we aggregate the individual demand schedules and individual demand curves. Similarly, we can find out the market supply schedule and the market supply curve of a commodity by aggregating the individual supply schedules and individual supply curves of all the firms which are supplying that commodity. Suppose for the sake of simplicity, there are only two firms A and B which are supplying ball pens in the market. The table 4.2 below, gives the different quantities of ball pens supplied by the firms A and B at different prices.

TABLE 4.2
Market Supply Schedule

Price (per ball-pen) (Rs.)	*Quantities supplied Ball pens (dozens)* *A*	*B*	*Market Supply (Total quantities supplied) (A + B)*
1.00	10	11	21
1.50	14	15	29
2.00	17	18	35
2.50	19	20	39

If we represent the supply schedule given above in table 4.2 on a diagram, we can find out the market supply curve of ball pens as shown in diagram 4.2:

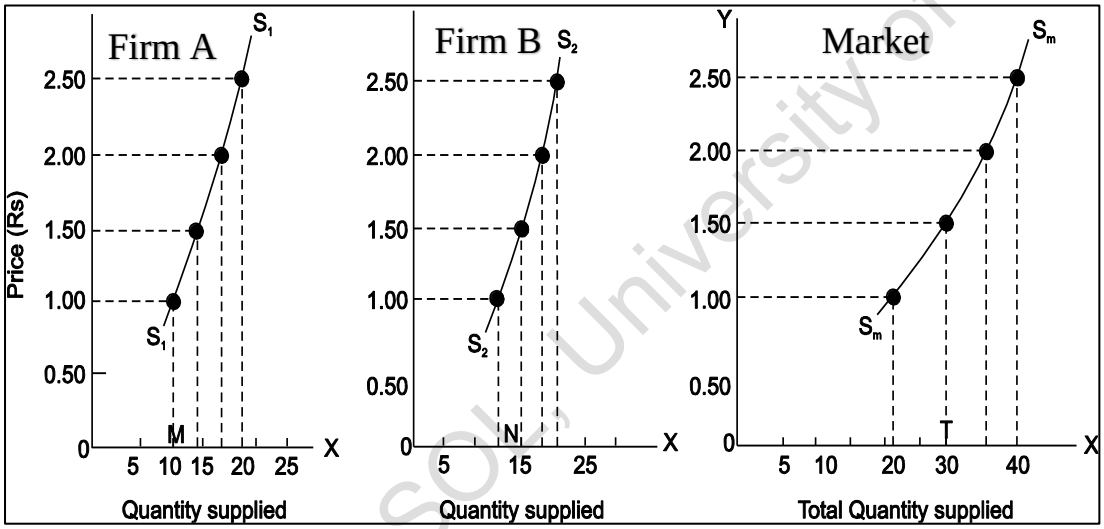

Diagram 4.2 From Individual to Market Supply Curve

In diagram 4.2, the market supply curve Sm Sm has been obtained by aggregating the supply curves of firms A and B respectively. For instance, at price Rs. 1.50 per ball pen, firm A supplies 14 ball pens (OM quantity) and firm B supplies 15 ball pens (ON quantity). Therefore, the total market supply will be 29 ball pens (OT quantity) at price Rs. 1.50 per ball pen. The market supply curve also shows the direct relationship between the price of a commodity and its quantities supplied. More of a commodity will be supplied at a higher price and less at a lower price.

Intext Questions

1. A supply curve shows the relation between the quantity of a good supplied and _____.

2. Supply curve, supply schedule and supply equations describes the law of _____ .

Answer

1. price 2. supply

4.4 DIFFERENCE BETWEEN A CHANGE IN QUANTITY SUPPLIED AND AN INCREASE OR DECREASE IN SUPPLY

Increase or Decrease in Quantity Supplied (Change in Quantity Supplied)

On a supply curve quantity supplied increases or decreases due to increase or decrease in the price of that commodity alone, assuming all other factors which affect the supply of a commodity

mentioned earlier, remains constant, we call it increase or decrease in the quantity supplied. This is represented by the movements along the same supply curve as given in diagram 4.3. With the rise in price from P_1 to P_2 to P_3, quantity supplied increases from Q_1 to Q_2 to Q_3 respectively on the same supply curve involving upward movement from point A to B to C in the north-east direction. In the reverse way, decrease in quantity supplied takes place when price falls from P_3 to P_2 to P_1, quantity falls from Q_3 to Q_2 to Q_1 respectively thus involving a downward movement from point C to B to A along the supply curve.

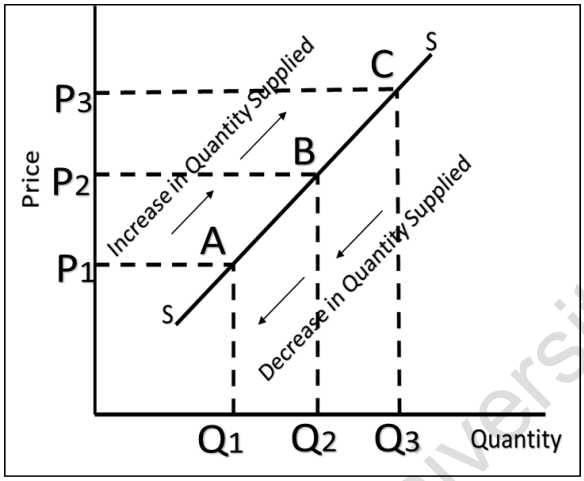

Diagram: 4.3: Increase or Decrease in Quantity Demanded

Increase or Decrease in Supply (Change in Supply)

If the price of a commodity remains constant but the supply changes due to the changes in any of the other factors (factors other than price) affecting the supply of a commodity e.g., an innovation, discovery of cheap raw materials, prices of other goods etc., it is called an increase or a decrease in supply. If as a result of an innovation, the producers are willing to produce and sell more in the market, it is called an increase in supply. On the other hand, if as a result of an increase in the prices of factors of production the producers are willing to produce and sell less, this will be called a decrease in supply.

An increase in the Supply of a commodity is represented by a shift in its supply curve to the right and a decrease in the supply is represented by a shift to left of the original supply curve, as given in the following diagram 4.4.

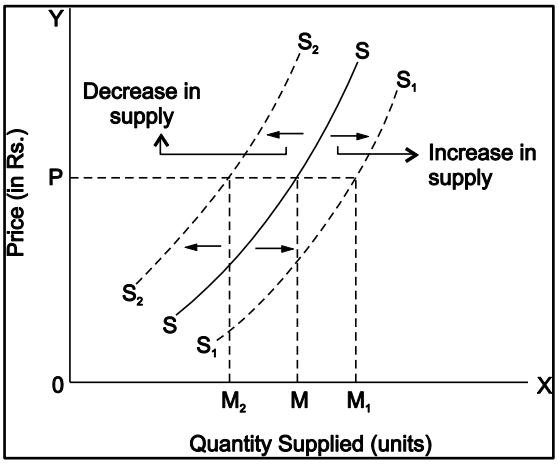

Diagram 4.4: Increase or Decrease in Supply

If as a result of the change in factors other than the price, the supply of a commodity increases, the supply curve SS will shift to the right and the new supply curve will be S_1S_1. This shows that even if the price OP remains constant, the Supply of the commodity has increased from OM to OM_1. On the other hand, if as a result of the changes in factors other than the price, the supply has decreased, the supply curve SS will shift to the left and the new supply curve will be S_2S_2. This shows that price remaining constant at OP, the supply has decreased from OM to OM_2.

Intext Questions

MCQ

1. Supply curve will shift when
   a) Price falls
   b) Price rises
   c) Demand shifts
   d) Technology changes

2. Contraction of supply is the result of
   a) Decrease in the price
   b) Changes in the
   c) Increase in the price of the commodity
   d) Increase in the income

Answer

1.d 2.c

4.5 ELASTICITY OF SUPPLY

Elasticity of supply is defined as the degree of responsiveness of quantity supplied to change in the price of the commodity. The percentage formula for measuring the elasticity of supply in given as

$$es = \frac{\text{percentage change in quantity suplied (Qs)}}{\text{percentage change in price (P)}}$$

$$= \frac{\frac{\Delta Qs}{Q}\times 100}{\frac{\Delta P}{P}\times 100} = \frac{\Delta Qs}{\Delta P}\cdot\frac{P}{Qs}$$

Elasticity of Supply varies from 0 to ∞.

(1) If e_s is 0 then supply is perfectly inelastic. The supply curve is vertical in this case.

(2) If e_s is ∞ then supply is perfectly elastic. The supply curve is horizontal.

(3) If $e_s > 1$, then supply is elastic. The supply curve passes through price (vertical) axis.

(4) If $e_s < 1$, then supply is inelastic. The supply curve cuts the quantity (horizontal) axis.

(5) If $e_s = 1$, then supply is unitary elastic and the supply curve passes through the origin.

See diagram 4.5.

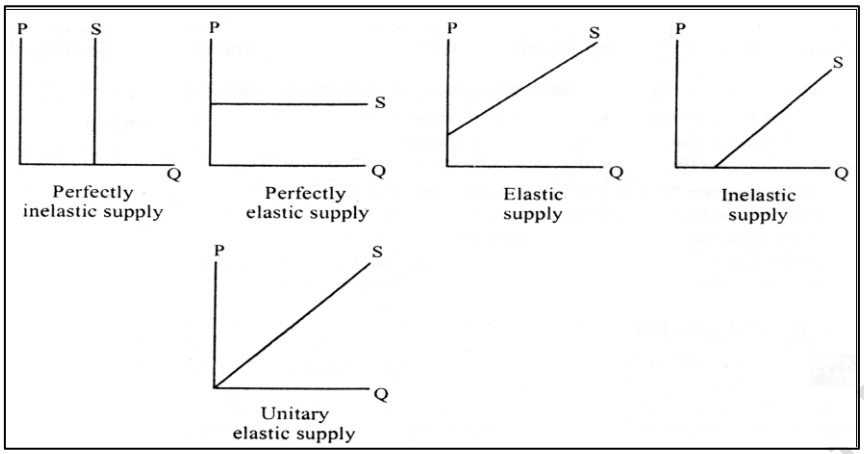

Diagram 4.5: Shape of Supply Curve as per Elasticity of Supply

Intext Questions

True/False

1. Perfectly elastic supply curve is parallel to vertical axis.
2. Unitary elastic supply curve passes through the origin.

Learning Outcomes

1. Determinants of Supply of a good are: Price of a commodity, Prices of other goods, Prices of Factors of Production, State of Technology, The Goals of Producers
2. Other things being equal, more of a commodity will be supplied at higher prices and less at lower prices i.e., the price of a commodity and its supply is directly related.
3. The market supply for the commodity is derived by horizontal summation of the individual supply curves i.e., by adding the quantity sold by different sellers in the market at the given price.
4. Change in quantity supplied refers to increase or decrease in the quantity of the good due to increase or decrease of the price of the good on the same supply curve. Hence change in quantity supplied implies movement along the same supply curve, keeping other factors except price constant.
5. Change in supply refers to increase or decrease in the quantity of the good at the given price due to change in other factors such as technology, prices of factors of production etc. In other words, change in supply implies outward or inward shift in the supply curve at the given price.
6. Elasticity of supply is defined as the ratio of percentage change in quantity supply of the commodity of percentage change in its price.
7. The supply curve takes following shapes as per the value of its elasticity – vertical when es=0 starts from quantity axis, if es < 1 starts from the price axis, if es > 1 starts from the origin, if es=1 and horizontal if es=∞

Terminal Questions

1. Give imaginary supply schedules and derive market supply curve? Give diagrams.
2. Distinguish between change in supply and change in quantity supplied?

❑❑❑

LESSON: 5

DETERMINATION OF EQUILIBRIUM PRICE AND QUANTITY

Market is important institution created to distribute the good produced for satisfaction of wants. A market for a good works through the forces of demand and supply of that good. Buyers and sellers must come to an agreement regarding the price at which the good must be made available and the quantity of the good that must be offered.

Learning Objectives

After going through this lesson, you will be able to

1. Determine equilibrium price and quantity of a good.
2. Explain excess demand and excess supply of the good.
3. Know the direction of change in equilibrium price and quantity when a change in either demand or supply or both take place.
4. Understand the role of elasticity of demand and supply respectively in determination of price and quantity of the good.

5.1 DETERMINATION OF EQUILIBRIUM PRICE

The price of a commodity in the market is determined jointly by its demand and supply. The price of a commodity is determined where its quantity demanded is equal to its quantity supplied.

Let us take an example. The following Table 5.1 shows the market demand schedule and market supply schedule of ball pens i.e, the different quantities of ball pens demanded and supplied at different prices in the market.

TABLE 5.1

Price (Per ball pen) (Rs.)	***Demand schedule (quantity supplied) (Ball Pens)***	***Supply schedule Quantity supplied (Ball Pens)***	***Pressure On Price***
1.00	38	8	upward
1.50	31	13	upward
2.00	25	17	upward
2.50	20	20	Equilibrium
3.00	16	22	Downward
3.50	13	23	Downward

The table shows that as the price is increasing the quantity demanded is falling but the quantity supplied is increasing. At the price of Rs. 2.50 per ball pen, quantity of ball pens demanded (20) and supplied (20) are equal. Therefore, price of ball pen in the market will be Rs. 2.50 each. This is also called the equilibrium price. This can also be explained with the help of the diagram 5.1.

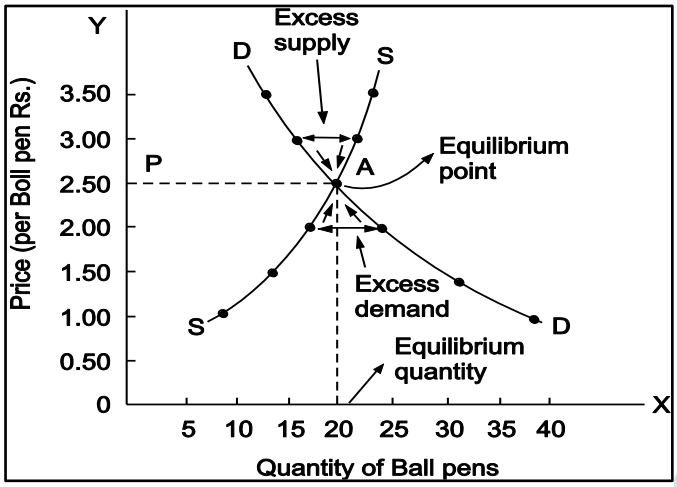

Diagram 5.1 Market Equilibrium

DD is the market demand curve and SS is the market supply curve which show the quantity of ball pens demanded and supplied at different prices. Demand and supply curves intersect each other at point. A showing the equality of demand (OM or 20) and supply (OM or 20) of ball pens. At this point the price is OP or Rs. 2.50 per ball pen. Therefore, the market price will be Rs. 2.50 (OP) per ball pen. It is not possible to have the price of ball pen in the market different (less or more) than that of Rs. 2.50 per ball pen and therefore this is also known as equilibrium price and the quantity demanded and supplied i.e., OM is known as equilibrium quantity. Suppose the price in the market is Rs. 3 per ball pen. At this price, 22 ball pens are supplied but 16 ball pens are demanded. The supply is in excess (22–16 = 6) of demand. The producers will be left with unsold quantity and will incur losses and therefore they will reduce the price. The consumers, finding glut of unsold quantity, will be prepared to purchase the commodity at a lower price. As a result, the price will decline and will ultimately come down to the equilibrium price. This hypothesis is shown by the arrow indicating a downward pressure to all prices above Rs. 2.50, On the other hand, let us take the example when the price is Rs. 2.00 per ball pen. At this price there is an excess demand; demand is for 25 ball pens and its supply is 17. The excess demand will increase the price. The consumers will offer higher price in order to get the commodity which is in short supply and the producers will also offer the commodity at higher price. As a result, the price will start increasing till it becomes equal to the equilibrium price. This is illustrated by the arrow indicating an upward pressure on all prices below Rs. 2.50 per ball pen. Therefore, if the price is above Rs. 2.50 per ball pen it will fall and if price is below Rs. 2.50, it will rise till it becomes equal to Rs. 2.50. At the price of Rs. 2.50, the quantity supplied is equal to the quantity demanded and there is no tendency for the price to change. Therefore, this price is called equilibrium price. The term equilibrium means a state of balance; such a state of balance occurs when consumers are prepared to buy the same quantity as the suppliers are prepared to offers for sale in the market. It is the equilibrium price which will ultimately prevail in the market. If at any time the price in the market is above or below the equilibrium, certain forces in the system will operate to bring the price to the level of the equilibrium price.

Interest Questions

TRUE / FALSE

1. The price of the commodity is determined by the demand of the commodity.
2. Price of the commodity increase when there is excess supply in the market to get equilibrium back.

(Answer : 1. F 2. F)

5.2 Effects of Shifts In Demand And Supply Curves On Equilibrium Price

Since the price of a commodity is determined by its demand and supply, any change in its demand or/and supply will therefore affect its price. Let us now discuss the effects of the changes in demand-supply conditions on the price.

(a) Shifts of The Demand Curve and Equilibrium

(i) Leftward shifts of the Demand Curve (Decrease in Demand)

Normally, a leftward/downward shift of the demand curve, given any supply curve, tends to decrease the equilibrium price as well as the quantity bought and sold as shown in diagram 5.2.

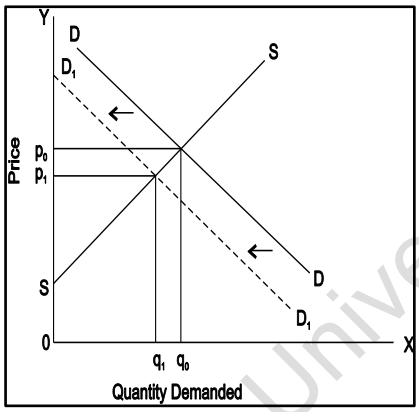

Diagram 5.2

In diagram 5.2 as a result of the leftward shift of the demand curve DD to D_1D_1, price falls from P_0 to P_1 and the quantity brought and sold falls from q_0 to q_1.

However, as shown in the diagrams 5.3 for a given leftward shift to the demand curve, the higher the elasticity of the supply curve, the greater the fall in price and lesser the decrease in the quantity bought and sold and vice versa. In the extreme case of a perfectly inelastic supply curve (diagram 5.3 A) the fall in price is the maximum while the quantity bought and sold does not change at all. On the other hand, in case of a perfectly elastic supply curve, (diagram 5.3 B) price does not fall at all and only the quantity bought and sold decreases. In the intermediate case, when supply is neither perfectly elastic nor perfectly inelastic (i.e., upward rising supply curve in diagram 5.3 C) the price falls and the quantity bought and sold decreases.

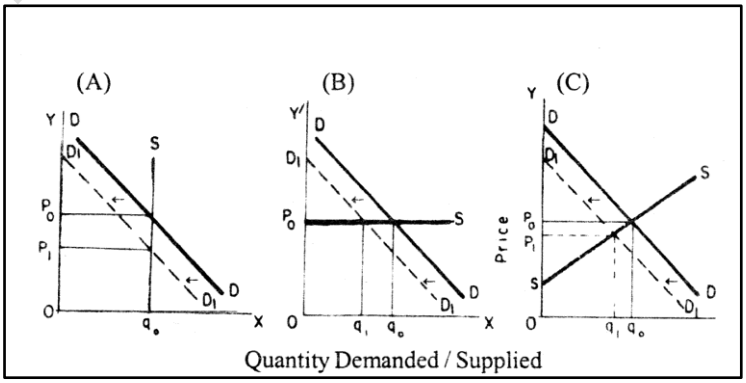

Diagram 5.3

In part A of the diagram 5.3, as a consequence of a leftward shift of the demand curve DD to D_1D_1, price falls from p_0 to p_1 while quantity bought and sold remains constant at q0. In part B on the other hand, price remains constant at p_0 whereas quantity bought and sold decreases from q_0 to q_1. In part C, partly the price falls and partly the quantity bought and sold decreases.

(ii) Rightward shifts of the Demand Curve (Increase in Demand)

Normally, a rightward shift of the demand curve, given and supply curve, tends to increase the equilibrium price as well as quantity bought and sold as shown in the diagram 5.4.

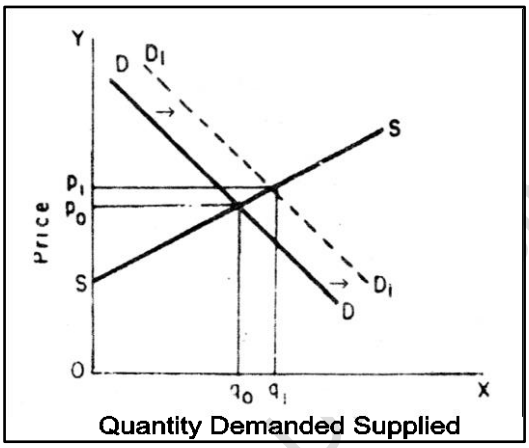

Diagram 5.4

In the diagram 5.4, as a result of a rightward shift of the demand curve DD to D_1D_1, price increases from p_0 to p_1 and quantity increase from q_0 to q_1.

However, for any rightward shift of the demand curve, move elastic the supply curve, lower will be the increase in price and higher will be the increase in quantity. In the extreme case of a perfectly elastic supply curve, price does not increase at all and only the quantity bought and sold increases. On the other hand, when the supply curve is perfectly inelastic, only the price increases and the quantity remain unchanged. This is shown in the diagrams 5.5 (A) and 5.5 (B).

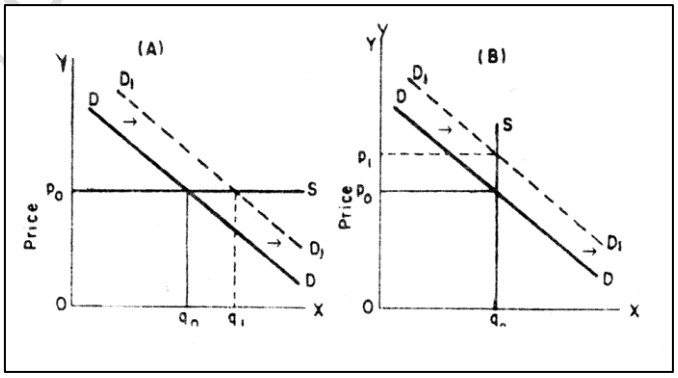

Diagram 5.5

Diagram 5.5 (A) shows that when the supply curve is perfectly elastic price remains unchanged at P0 and quantity increase from q0 to q1. Diagram 5.5 (B) on the other hand, shows

how quantity remains unchanged and only price increases from p0 to p, when the supply curve is perfectly inelastic.

Interest Questions

1. When there is left ward shift in the demand curve, price of the commodity _____ to get back the equilibrium.
2. If supply curve is perfectly elastic, with the increase in demand curve, equilibrium price _____ while quantity _____.

Ans. 1. False 2.. Increases, remains constant

(b) Shifts of the Supply Curve and Equilibrium

(i) Leftward shift of the Supply Curve (Decrease in Supply)

Normally, given and demand curve, a leftward shift of the supply curve tends to increase price and reduce quantity bought and sold as shown in the diagram 5.6.

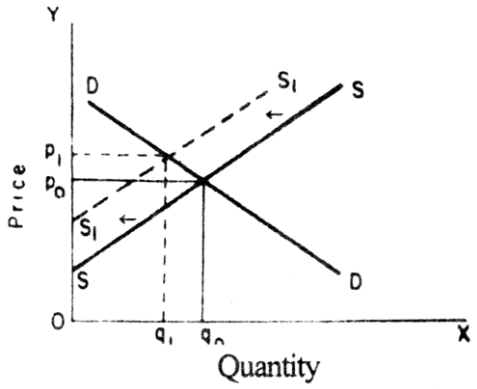

Diagram 5.6

In the diagram 5.6, as a result of a leftward shift of the supply curve from SS to S_1S_1, price rises from p_0 to p_1 and quantity decrease from q_0 to q_1.

However, for any given leftward shift of the supply curve, higher the elasticity of demand, lower the increase in price and greater the reduction in the quantity bought and sold and vice versa. If the demand curve happens to be perfectly elastic, equilibrium price remains unchanged and only the quantity bought and sold decreases. On the other hand, if the demand curve is perfectly inelastic, quantity remains unchanged while price increases. In the intermediate case partly price rises and partly quantity decreases. Diagrams below demonstrate extreme cases of perfectly inelastic demand curves.

Diagram 5.7 (A) depicts the case of a perfectly elastic demand curve in which case price remains constant at OP_0 but the quantity decreases from Oq_0 to Oq_1. Diagram 5.7 (B), on the other hand, shows the case of a perfectly inelastic demand curve in which increases from Op_0 to Op_1 while quantity remains unchanged at Oq_0.

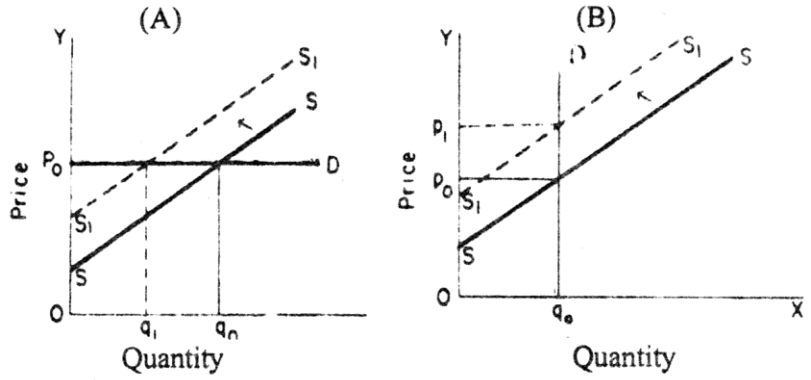

Diagram 5.7

(ii) Rightward shift of the Supply Curve-Increase in supply

In case of a rightward shift of the supply curve the results are exactly the opposite of what have been explained above. Normally, a rightward shift of the supply curve, given any demand curve, tends to lower equilibrium price and to increase the quantity. However, for a given rightward shift of the supply curve, more elastic the demand curve, lower is the fall in price and greater is the increase in the quantity bought and sold and vice versa. If the demand curve is perfectly inelastic, the quantity bought and sold remains unchanged and only the price falls. On the other hand, if the demand curve happens to be perfectly elastic, price remains unchanged while quantity increases. These cases are depicted in the diagrams 5.8 (A), (B) and (C):

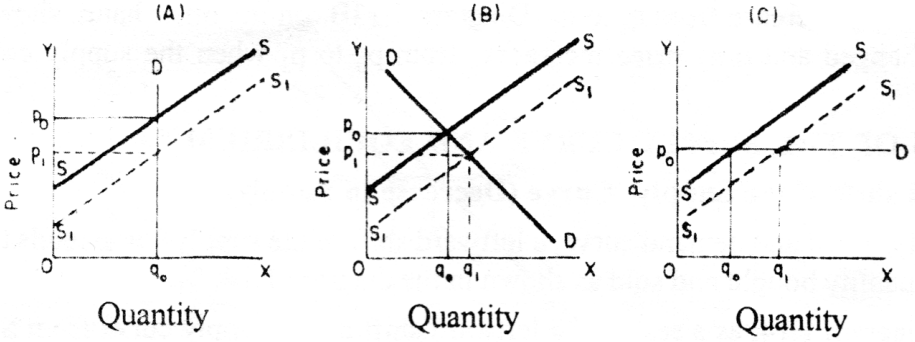

Diagram 5.8

Diagram 5.8 (A) shows that if the demand curve is perfectly inelastic, only the price falls as a result of a rightward shift of the supply curve but the quantity remains constant. In case of a perfectly elastic demand curve (shown in diagram 5.8 C) the quantity bought and sold increase from q_0 to q_1, whereas price remains constant at p_0. In the intermediate case (shown in 5.8 B) there is some decline in.the price but the there is some increase in quantity.

Intext Questions

1. When demand curve is perfectly in elastic, increase in supply curve results in

   a) Fall in price
   b) Fall in quality
   c) Increase in price
   d) Increase in quality

2. Price remains constant and quantity bought and sold increases when

   a) when demand curve is perfectly

   b) when DC is perfectly in elastic and supply curve increases

   c) When DC is perfectly inelastic and SC increase

   d) None of the above

Ans. 1. (a)

2. (c)

Learning Outcomes

In this lesson you have learnt the following:

1. The equilibrium price and quantity of a good is determined at the point where demand for the good is equal to its supply.
2. Excess supply of a good exists when its price exceeds the equilibrium price. This causes price to fall.
3. Excess demand of the good is created when price of that good falls below its equilibrium price.
4. Given the supply of the good, an increase in its demand leads to increase in price and quantity and decrease in demand leads to decrease in price and quantity.
5. Given the demand of the good, an increase in its supply leads to fall in price and increase in quantity and decrease in supply leads to increase in price and decrease in quantity.
6. Given perfectly elastic demand (supply) curve, price remains fixed and quantity increases with increase in supply (demand) and quantity decreases with decrease in supply (demand).
7. Given perfectly inelastic demand (supply) curve, quantity remains fixed and price increases with decrease in supply (increase in demand) and decreases with increase in supply (decrease in demand).

Terminal Questions

1. Suppose the total demand for wheat and the total supply of wheat in grain market are as follows:-

Price	Quantity demand	Quantity supply
16	140	20
32	120	60
48	100	100
64	80	140
80	60	180

   a) What is the equilibrium price.

   b) What would be the excess demand or supply of price was set at Rs. 32

   c) Plot in diagram

2. What do you mean by market equilibrium? How it is determined? Explain the impact of change in demand and supply on market equilibrium.

3. Determine new price and quantity under following situations:

   (i) Increase in supply given that demand curve is perfectly inelastic.

   (ii) Decrease in demand given that supply curve is perfectly elastic.

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LESSON: 6

SOME APPLICATIONS OF DEMAND & SUPPLY

The determination of market price through demand and supply was explained in previous chapter. The analysis of price determination in terms of demand and supply is not merely of great theoretical significance, it has numerous important practical applications also in economic system as well as life of the country. It is also helpful in analysing and predicting the effects of government policies. Present chapter discuss few applications of demand and supply and their elasticities.

Learning Objectives

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

1. Understand the working of price control / price ceiling.
2. Explain the meaning, need and working of the minimum support price.
3. Know the division of tax burden between buyer and seller.
4. Explain the price stabilization program in agriculture.

6.1 PRICE CONTROL AND RATIONING

Often, in view of shortages due to natural or manmade factors, government try to hold down prices of essential commodities by fixing 'price ceiling'. At present our government is trying to control the rate of inflation by imposing price controls on a wide range of commodities. What would you expect to be the consequences of fixing some prices by law rather than allowing them to be determined by the market forces of supply and demand?

The purpose of fixing a maximum price is to prevent price from rising above some desired level. However, it does not prevent it from falling below the desired level. It is evident that if the legally fixed maximum price is above the equilibrium price, it will have no effect either on the quantity or the price. This can be clearly seen from the diagram 6.1.

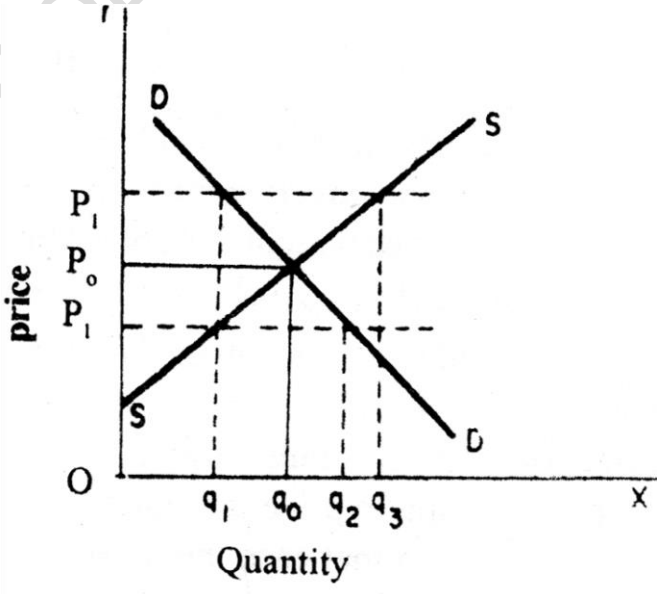

Diagram 6.1

The equilibrium price is p_0. If the maximum price is fixed at a level higher than p0, say at p_1, there is nothing to prevent it from falling to the equilibrium level. In such a case, the market price will stay at its equilibrium level. On the other hand, if the maximum price is fixed at a level lower than the equilibrium level, say at p_2 then the equilibrium price will no longer be legally obtainable in the market. At this price suppliers will offer to supply q_1 quantity of the commodity whereas buyers will be willing to buy q_2 quantity. In other words, excess demand equal to the excess of q_2 over q_1 will emerge.

In a situation of excess demand, unless the available supply is allocated to purchasers through some method of rationing, they will try "to compete away the limited supply by offering higher prices. Therefore, in the absence of strictly enforced rationing, a black market will develop in which the commodity will sell at a price higher than the legally fixed price. Normally, what happens is that even in the presence of strict rationing measures some of the limited supply is sold at the controlled price and some at the black-market price.

6.2 RENT CONTROL - AN ILLUSTRATION

With the objective of ensuring residential accommodation at a reasonable rent, governments very often pass legislation fixing maximum rents for private accommodation. The peculiar feature of built houses is that in the short period their 'supply is fixed-completely inelastic-since once rental houses are built the owners have no alternative but to let them out for whatever rent is available. As shown in the diagram 6.2, in the short run the effect of rent control, which reduces market rent from p_0 to p_1, is to create a shortage because the quantity demanded increases from q_0 to q_1, whereas the supply remains unchanged.

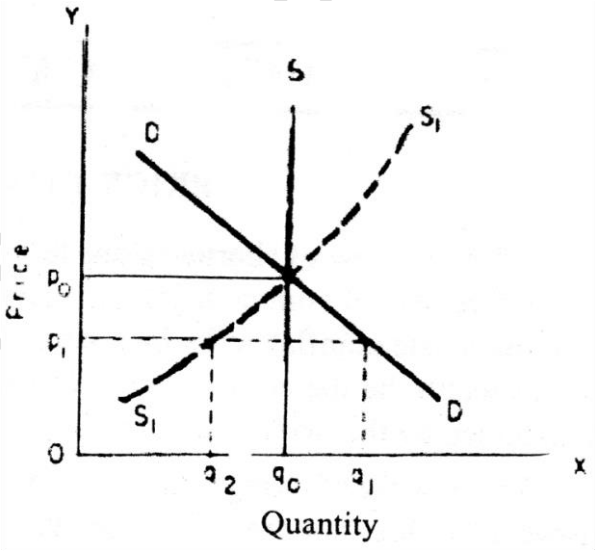

Diagram 6.2

However, with the passage of time, the lower return on rental housing will cause the supply to shrink. Because of the lower return, new rental houses will not be built and old houses will not be maintained properly. In fact, if the legally fixed rent is below the cost of maintenance, landlords may simply abandon their buildings to let them collapse with decay. As a result, the supply curve will become much more elastic as years pass by as S_1S_1, in the diagram above. When supply

becomes elastic, supply adjusts to the new situation and becomes equal to q_2. As a result, shortage increases further from q_0 q_1 to q_2 q_1.

In a situation of shortage of houses, tenants would compete for the available supply by offering higher rents. Since this is not legally permissible, landlords find it convenient to charge lump sum amounts as 'entrance fee' (as security deposit) from new tenants. When this becomes possible, there is also an incentive for the landlords to evict sitting tenants with the objective of charging security deposit from new tenants.

In text Questions

True/False

1. Price Ceiling price is lower than the equilibrium price.
2. Charging lesser rent than the equilibrium rent can increases the shortage of houses.

Answer: 1.True 2. True

6.3 MINIMUM PRICE LAWS

Sometimes, with a view to protecting the interests of certain sections of society, it becomes necessary for the government to pass laws fixing minimum price below which certain goods and services cannot be bought and sold. Minimum wages laws for different categories of labour, Minimum Support Price (MSP) in agriculture, resale price, etc. are some examples.

It is evident that the need for fixing minimum prices arises only when the free market price is considered to be lower than the desired price. Therefore, fixing a price lower than the free market price would be meaningless and ineffective. The free-market price in the case would be compatible with the minimum price law. On the other hand, when the minimum price is fixed above the free-market price, in that case the latter price is not legally obtainable in the results in the market. As already explained, in section I above, a price higher than the equilibrium price results in the emergence of excess supply-suppliers ready to offer for sale more of the commodity than purchasers are willing to purchase. In other words, there emerges a shortage of buyers and suppliers try to attract buyers in various ways such as price cutting, finding loopholes in laws or flouting them altogether. For example, when minimum wages are fixed for certain categories of labour, it will create unemployment which will induce workers to offer their services for less than the legally fixed wage. It is a general practice in smaller establishments such as shops, small factories, workshops, etc. See diagram 6.3.

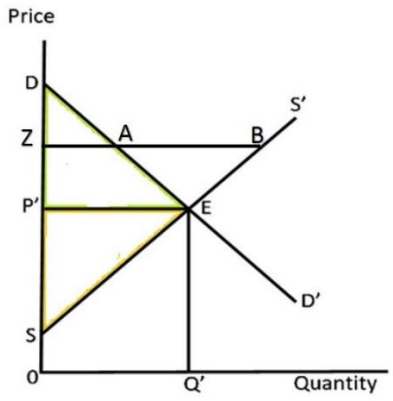

Diagram: 6.3

In the diagram 6.3, assume that the market is for agricultural produce. The demand curve DD' can be taken as demand for agricultural produce by farmers and the supply curve SS' can be taken as supply of agricultural produce. At equilibrium point E, the market price is OP and quantity is OQ'. If the market price is found to be very low for the farmers such that they suffer loss by selling at this price, the government can intervene to safeguard the interest of farmers by fixing MSP at point Z such that this price is greater than the market price. OZ > OP'. However, at this minimum price, there will be excess supply of food grains equal to line AB. But farmers will benefit from this.

On the hand, assuming that diagram 6.3 represents a perfectly competitive labour market, DD' can be taken as demand for labour by firms and SS' can be taken as supply of labour. The vertical axis measures price of labour or wage rate and horizontal axis measures quantity or employment of labour. At point E which is the equilibrium point, price of labour or wage rate is OP' and employment of labour is given as OQ'. If wage rate OP' is not acceptable to labour union or government feels that OP'is a lower wage, then a minimum wage higher than market wage rate can be fixed by government that is equal to, say, OZ. Note that at this minimum wage rate, employment is reduced to ZA and there will be unemployment equal to the line AB resulting due to excess supply of labour at the higher minimum wage.

Consumer Surplus

Consumer surplus is defined as is the difference between the price the consumer is willing to pay for a good or service and the amount or market price that he/she is actually paying for it in the market. It is one way to determine the welfare that consumers receive from purchase of their goods and services.

The height of the demand curve on the price axis gives the measure of the price that the consumer is willing to pay. Actual price payed by the consumer is determine at any point on the demand curve that corresponds to a particular value of quantity demanded on the quantity axis (horizontal axis) and corresponding price for it on the price axis (vertical axis).

In the diagram, 6.4 height of the demand curve DD' is OD which is the measure of price that the consumer is willing to pay. At a point, say, E on the demand curve, quantity demanded is OQ' and corresponding price for it is shown as OP'.

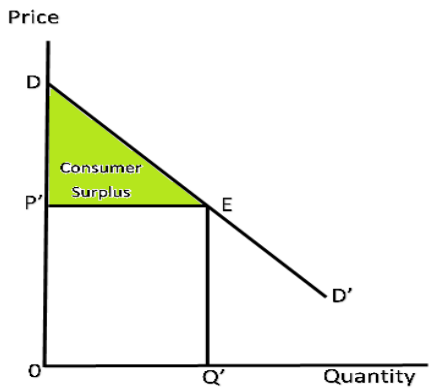

Diagram 6.4

So, the difference between the two prices is given as:

OD – OP’ = P’D.

P’D is the measure of the price that the consumer is actually saving here to buy OQ’ amount of the good.

Hence Consumer Surplus = P’D * OQ’ = PD’ * P’E = Area P’DE (The shaded area in the diagram 6.4).

Producer Surplus

Producer surplus is defined as is the difference between the market price at which the producer is selling a good or service and the minimum supply price of that good or service.

The distance between the origin and the point on the price axis from which the supply curve passes through is taken as the measure of minimum supply price of the commodity. Actual price received by the producer by the selling the commodity is determine at any point on the supply curve that corresponds to a particular value of quantity supplied on the quantity axis (horizontal axis) and corresponding price for it on the price axis (vertical axis).

In the diagram, 6.5 height of the supply curve SS’ from the origin is OS is the measure of minimum supply price of the producer. For quantity supplied OQ’ the price for it is shown as OP’ which corresponds to point E on the supply curve SS’.

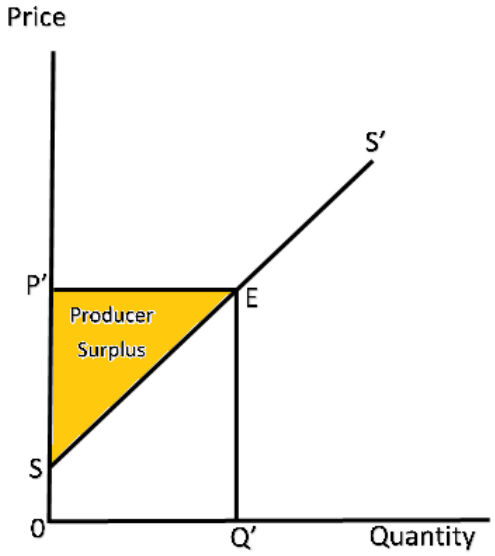

Diagram 6.5

As shown in the diagram 6.5, the producer surplus can be measured as
(OP’- OS) * OQ’ = Area SP’E (the shaded area).

Economic Surplus

The sum of consumer and producer surpluses give the measure of total surplus in the market trade which is also called Economic Surplus. Diagram 6.6 shows the economic surplus as the area SDE.

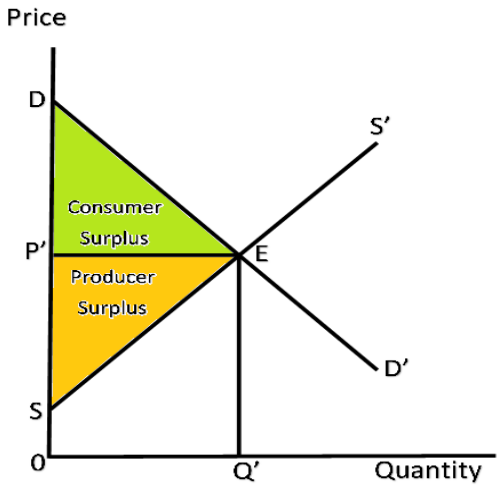

Diagram: 6.6

Learning Outcomes:

In this lesson you have learnt the following:

- Price ceiling by the Government is fixed below the equilibrium price with the objective to help the poor consumers consume essential commodities.
- Price ceiling creates shortage in supply of the commodity which is managed by quantity rationing.
- If not properly monitored price ceiling will lead to black marketing of the commodity.
- Rent control is special case of price ceiling which is implemented by the Government in the urban area to protect the interest of the tenants.
- Minimum support price is fixed by the Government above the equilibrium price to support farmers getting their due share.
- Minimum wage law has been enacted by the Government to protect the interest of the labourers.
- Consumer surplus is the difference between the price the consumer is willing to pay and the price which he/she is actually paying for a good in the market for a particular quantity.
- Producer surplus is the difference between the price which the producer receives by selling a commodity and its minimum supply price in the market.

TERMINAL QUESTIONS

1. What is the effect of price ceiling on equilibrium price and output?
2. "Effective rent control leads to housing shortage, black market prices, security of tenure laws and pressure for public housing". Discuss
3. Suppose the government wants to guarantee a minimum price of Rs. 500 per quintal of wheat growers. What steps are required on the part of the government to make it effective.

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TOPIC 2: CONSUMER THEORY

LESSON: 7

THEORY OF CONSUMER'S DEMAND

Every consumer has limited income but there is a large number of goods and services that he would like to purchase for his consumption. In quantitative terms one's income may be small or large but it is never sufficient to purchase all the goods and services that one would like to purchase. Perforce everyone has to make a rational choice of what to have and in what quantities and what not to have. His choice of spending his limited income on different goods and services would be rational when he spends it in such a manner that he gets maximum total satisfaction. The theory of consumer's demand, therefore, explains the economic principles underlying the allocation of the consumer's limited income over various goods and services in a manner that leads to the maximization of his total satisfaction. Therefore, you will study the economic principles a rational consumer should follow while spending his limited income over various goods and services so as to maximize his total satisfaction.

There are various alternative approaches to the theory of consumer's demand out of which, we shall discuss the two alternative approaches - one is known as the "Utility Analysis" and the other as the "Indifference Curve Analysis". The utility analysis is associated with the name of Alfred Marshal, a British economist and therefore is also known as 'Marshallian Utility Analysis.' J.R. Hicks, another British economist propounded "indifference Curve Analysis", as alternative to the Marshallian utility analysis, to explain the consumer's behavior. The utilitarian analysis assumes that utility derived by a consumer from the consumption of a commodity can be measured in quantitative terms. But the indifference curve analysis refutes the basic assumption that utility can be measured and explains that quantitative measurability of utility is not necessary to explain the consumer's behavior.

Learning Objectives

After going through this lesson you will be able to:-

- Define total and marginal utility
- Explain the law of diminishing marginal utility and law of equilibrium marginal utility.
- Determine consumers equilibrium by using utility theory.
- Know the limitations of utility theory

7.1 MARSHALLIAN UTILITY ANALYSIS

Nobody ever offers to pay a price for something which has no utility for him. I purchase a book because it has utility for me. A vegetarian does not purchase meat simply because it has no utility for him. Price after all involves a sacrifice on the part of a consumer and nobody will sacrifice anything unless he gets some benefit in return.

According to the Marshallian utility analysis, the utility of a commodity for any consumer can be measured by the maximum amount of money he is willing to offer for a unit of the commodity rather than go without it. Suppose, you are willing to offer for an orange only 50 paise and no more, then the utility of that orange for you is worth 50 paise. Suppose for an orange your friend might offer to pay a rupee rather than go without it. The utility of an orange to your friend is worth one rupee. The utility of any good for any consumer can be measured indirectly by the maximum amount of money he is willing to offer for a unit of the good rather than to go without it. This is only an indirect way of measuring utility.

The Law of Diminishing Marginal Utility

As explained above, the utility of the same good may be different to different persons and may even be different to the same persons in different circumstances. But one important aspect of utility is that at any given time, all the units of commodity that a consumer adds to his stock, do not give equal utility to him. Suppose the first orange that you consume gives you utility worth 50 paise, the second orange will give you utility worth less than 50 paise, and the third one still less and so on. This tendency of the marginal utilities of successive units of a good to diminish, when a consumer adds more to his stock at any given time, is known as the 'Law of Diminishing Marginal Utility,' and is considered to be universal true.

The Law of Diminishing Marginal Utility states that as a consumer consumes (acquires) more of a good at any given time, its marginal utility (or what is the same thing - the extra utility added by successive units) tends to diminish. This means that as you consume more oranges at any given time, utility derived from the successive oranges would diminish. Your total utility will not doubt increase, but the total utility will increase at a diminishing rate. Let us examine the important law with the help of a simple example. Imagine a man is consuming oranges one by one and telling you exactly how much utility he gets form each orange. Table 7.1 below records his statement about the utility of each orange separately as he consumes 6 oranges, one by one:

TABLE 7.1

Marginal and Total Utility

No. of Oranges	*Marginal Utility*	*Total Utility*
1st	4	4
2nd	3	7
3rd	2	9
4th	1	10
5th	0	10
6th	(–)1	(–)9

Marginal utility means the utility of an "additional" unit. The first orange is the marginal orange and the utility from the first orange is the marginal utility. The second orange is the marginal orange and the utility from it is the marginal utility. "Marginal" is not fixed, it is moving. As all the units are identical, every unit consumed should be considered as the marginal unit and the satisfaction from that unit should be termed as marginal utility. It is clear from table 7.1 that marginal utility of oranges to a consumer is going down. Marginal utility can decline to zero and can even become negative. Negative utility means that the consumer does not anticipate positive satisfaction but hopes to get only negative satisfaction.

Total utility is the utility derived from the consumption of all the units. It is the sum of marginal utilities.

The table 7.1 shows that the total utility goes on increasing, but at a decreasing rate, so long as the marginal utility is positive. When marginal utility becomes negative, the total utility also starts diminishing. Total utility is maximum when the marginal utility is zero. The same phenomenon can be shown with the help of the diagram 7.1.

In the diagram 7.1 the quantity of oranges is measured along the X-axis and utility along the Y-axis. The marginal utility curve (MU) has a downward or negative slope additional unit of oranges give the consumer less and less utility. The consumer hopes to get only zero utility at point N from the fifth orange and negative utility from the sixth orange. The marginal utility curve declines and cuts through the X-axis at N. The total utility curve (TU), on the other hand, slopes upwards to the right to indicate that total utility increases with the consumption of additional units up to point L. The rate of increase in total utility is not constant but declines steadily. The total utility curve reaches a maximum point at L and then declines.

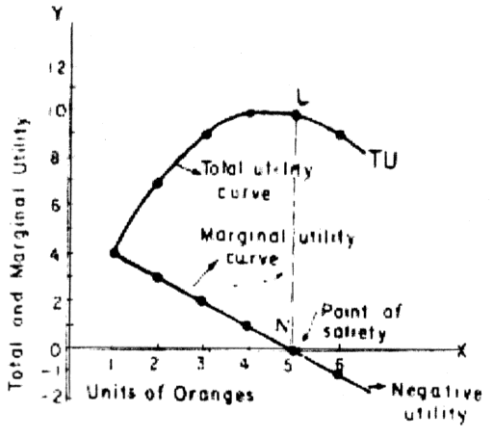

Diagram 7.1

The relationship between marginal utility and total utility can be summarized as follows:

(i) When marginal utility declines but is positive.	Total utility increases but at diminishing rate.
(ii) When marginal utility reaches zero.	Total utility has reached maximum; and
(iii) When marginal utility becomes negative:	total utility declines from the maximum point

This, in substance, is the famous law of diminishing marginal utility. This law is based on the following assumptions:

(i) different units of a commodity are homogeneous or identical in all respects i.e., in size, quality, taste etc.;

(ii) there is no time interval between the consumption of two units of a commodity i.e., consumption of the different units of a commodity should be continuous;

(iii) tastes, fashions etc., of the consumer remain the same.

7.2 EXCEPTIONS TO THE LAW OF DIMINISHING MARGINAL UTILITY

The law of diminishing marginal utility is a basic law and is applicable to all people and all things. Really speaking, there are no exceptions to this law. Some, however, have spoken, of a few exceptions, as given below: -

(i) The law, according to them, does not apply to money. It is argued that the more money one has, the greater will be the desire to acquire still more money. This exception is sought to be proved with reference to misers who are supposed to have unlimited desire to accumulate and hoard money. It is however, wrong to argue that the utility of the first rupee is the same as

that of the hundredth rupee. If a person has only one rupee, he will be very careful while spending it. But if he has one hundred rupees, he may not exercise any care while spending one rupee out of the 100 rupees. It means that the marginal utility of the hundredth rupee is less than the marginal utility of the first rupee. Even the miser has to spend some money on food and other items of necessity and not on acquiring additional wealth. This indicates that the utility of food and other items to the miser is greater than that of money which he spends to buy them.

(ii) Another exception relates to hobbies such as collection of rare stamps and coins, pictures by famous artists etc. It is argued that the more stamps one collects, the greater is the desire to collect still more. People spend large amount of money to secure a rare stamp or a famous picture. Apparently, the law of diminishing marginal utility does not apply to hobbies pursued by some people. This however, is not correct. A stamp collector does not actually spend increasing amounts of money in acquiring one more stamp of the variety he already has. Rather, he is willing to spend large amount of money to add a new and rare stamp to his collection. When a collector acquires additional stamps of the same variety, the marginal utility from his additional collection will definitely diminish. In other words, the law of diminishing utility will apply to hobbies too.

In fact, there are no real exceptions to the law of diminishing marginal utility. The marginal utility which a consumer gets from the additional units of a commodity eventually keeps on diminishing. Therefore, it is said to be universally true.

Intext Question

1. The desire to have a commodity or service is called:
   (i) Want,
   (ii) Utility
   (iii) Goods
   (iv) None of these

2. When Marginal utility diminishes, total utility:
   (i) Diminishes
   (ii) Increases
   (iii) Remains constant
   (iv) Increases at a diminishing rate

Answer: 1. (i) 2. (iv)

7.3 THE LAW OF DEMAND AND THE LAW OF DIMINISHING MARGINAL UTILITY

(Derivation of Demand Curve)

The law of diminishing marginal utility is the basis of law of demand which explains the inverse relationship between price and quantity of a commodity. According to the principle of diminishing marginal utility, a person gets less and less utility from additional units of a commodity, naturally he is prepared to buy more units only at a lower price. We can express the same idea in another way also. Marginal utility of a commodity diminishes as a person has more of it; accordingly, and therefore, an additional unit will not be demanded unless it is available at a lower price. The marginal utility curve has a negative slope and therefore, the demand curve based on marginal utility curve also has a negative slope. Marshal goes one step further. He measures the marginal utility of a commodity in terms of money which a person is willing to pay; naturally, the marginal utility curve itself becomes the demand curve. This is explained in Table 7.2 and diagram 7.2.

TABLE 7.2

Marginal Utility Schedule for Oranges

(in money)

No. of Oranges	*Marginal Utility (Rs.)*	*Price the consumer is willing to pay (Rs.)*
1 st orange	1.00	1.00
2nd orange	0.75	0.75
3rd orange	0.50	0.50
4th orange	0.40	0.40
5th orange	0.30	0.30

The table 7.2 shows that the marginal utility of every additional orange is declining and therefore, the consumer will be prepared to buy additional units of oranges only if the price of orange declines in the market. In other words, a consumer buys more of a commodity if its price falls in the market. When we represent this table on a diagram, we can get the diagram 7.2. DD is the marginal utility curve. If we represent price instead of marginal utility on Y-axis, DD curve can be called demand curve of the commodity.

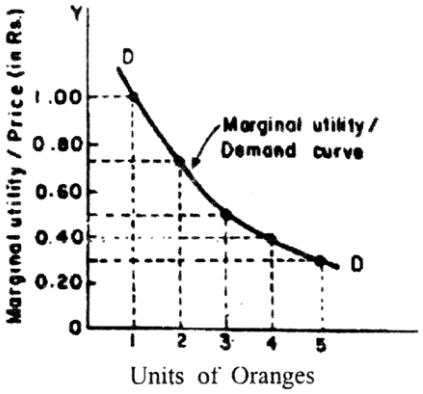

Diagram 7.2

Therefore, the downward sloping curve can be taken as marginal utility curve for oranges; it is also the demand curve for oranges.

Marshall derives the demand curve form the law of diminishing marginal utility on the basis of the following three basic assumptions:

(i) *The utility of a commodity is measurable quantitatively:* The assumption is basic to the law of diminishing marginal utility. We assume that utility can be calculated by adding marginal utilities; and that marginal utility of unit can be found out through subtraction - as for example the marginal utility of the 5th unit of a commodity is equal to total utility for 5 units minus total utility for 4 units.

(ii) *The utility of money remains constant:* The utility of a commodity is measured by Marshall in terms of money which is the measuring rod used in economics analysis. Like every measuring rod, money should have constant value. For instance, in table 7.2 we have said that the consumer gets or hopes to get utility worth of one rupee form the first orange and,

therefore, he is willing to pay Rs.l for it. He hopes to get from the second orange utility worth of 75 paise and, therefore, he is willing to pay 75 paise to buy it. In all these cases money measures utility, and as such it must have constant value or utility to the consumer. This assumption implies that whatever be the volume of money with the consumer, its value or marginal utility will remain the same to him. In practice, however, money like any other commodity is also subject to the law of diminishing marginal utility.

(iii) *Each commodity is an independent commodity:* Marshall assumes away the interrelationship between goods and considers each commodity as an independent commodity and studies demand for it accordingly. In practice, this is not proper. Most of the commodities are related to each other either as substitutes or complements and therefore, the demand for one commodity will depend upon the price and availability of other related commodities. We cannot properly study the demand for potatoes in isolation, without relating it to the demand for other vegetables in the market.'

Given all these assumptions, the law of diminishing utility is the basis for deriving the law of demand in Marshallian demand theory.

Intext Question

TRUE/FALSE

1. Demand curve slopes downward because of the law of Utility maximization.
2. The utility of a commodity is qualitatively measurable.

Answer 1. False 2. False

7.4 DIAMOND – WATER PARADOX (PARADOX OF VALUE)

Marginal Utility (MU) analysis can be applied to resolve the issue of Diamond – Water Paradox which is also known as paradox of value. We know that water is a fundamental requirement of life. But its value is very less where as diamond, which is not required to sustain life, is highly priced in the market and commands very high value. How to explain this phenomenon?

It is a well-known fact that that supply of water in the world is higher than that of diamond. Since water is essential for life and diamond is not essential, the total utility of water is higher than that of diamond. In the diagram 7.3 on "paradox of value" given below, the total utility of water (TUw) is the area ORQ which is below the MU curve of water marked as RQ and the total utility of diamond (TUD) is the area OMN which is below its MU curve marked as MN. Clearly, area ORQ > area OMN, i.e, TUw > TUD. Due to high demand, quantity of water is OK which is higher than the quantity demanded of diamond which stands at OJ. The marginal utility of water (MU_W) is OW' and the same diamond is OD'. As per diagram, OD'> OW' i.e $MU_W < MU_D$. Since as per the condition for equilibrium, MUW = Price of Water and MU_D = Price of Diamond, hence Price of Diamond > Price of Water, i.e Value of diamond is greater than that of water.

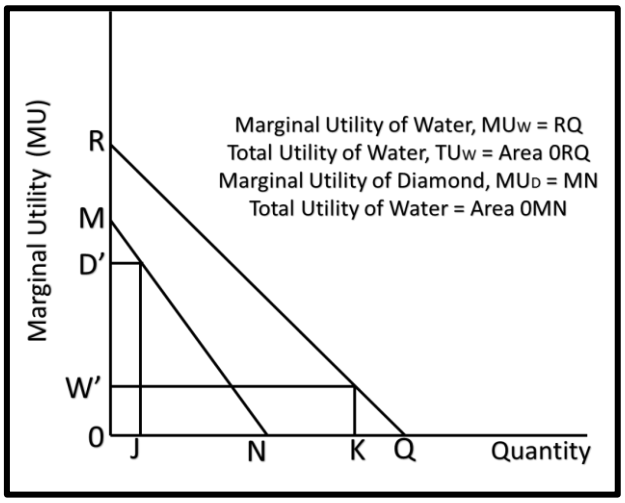

Diagram 7.3 : Paradox of Value

7.5 LAW OF EQUI-MARGINAL UTILITY AND CONSUMER'S EQUILIBRIUM

In economic analysis, we assume that every consumer is rational and he/she spends his income in a rational manner with the object of maximizing his satisfaction.

The income of every consumer is limited but the goods and services that he would like to have for consumption are numerous. Income is limited in the sense that it is impossible for my consumer to purchase, with his given income, all the goods and services he would like to purchase. In quantitative terms a person's income may be less or more, but it is always in-sufficient for his innumerable wants. It is, in these circumstances of limited income and numerous wants, that a consumer is forced to choose between different goods and services rationally. Every consumer spends his limited income over various goods and services in such a way that he gets the maximum possible satisfaction in the given circumstances. Within the given conditions of his limited income, his tastes and the given market prices of different goods and services, when a consumer has selected that bundle of different goods and services which gives him the maximum possible satisfaction, we say that the consumer is in equilibrium. The notion of equilibrium simply emphasizes the fact that any deviation from this position would make the consumer worse off, in terms of total satisfaction and certainly not better off. It means that he would be best off in equilibrium. Law of equi-marginal utility states that consumer will reach the stage of equilibrium, i.e., maximum total satisfaction when the marginal utilities of the various commodities that he consumes are equal.

At any given time, a number of commodities complete for the limited income of the consumers. In terms of utilities, different goods offer different opportunities for him. For each rupee of his income the consumer always selects the best of the available opportunities. When each rupee of a consumer's income has been spent in its best available use, his total satisfaction (or utility) is maximized and the consumer is said to be in equilibrium. In order to elaborate this point, let us take an example. Suppose the daily income of a consumer is Rs. 15 and with this income he wants to purchase his daily supplies of goods X, Y and Z, all of which sell at Rs. 1 per unit. Table 7.3 given below gives the marginal utility schedules of the three goods in question.

TABLE 7.3

Unit of Goods	*Marginal Utility Schedule of X (MUx)*	*Marginal Utility Schedule of Y (MUy)*	*Marginal Utility Schedule of Z (MUz)*
1	18 (1)	10 (5)	9 (7)
2	16 (2)	9 (6)	7 (11)
3	14 (3)	8 (9)	5 (15)
4	12 (4)	7 (1.0)	3
5	8 (8)	6 (12)	
6	5 (13)	5 (14)	
7	3	3	

The marginal utilities of different units of the three goods offer the different opportunities of spending his money to the consumer. In order to maximize his total satisfaction, the consumer will look for the best available opportunity for each rupee of his income. The three goods offer three different opportunities in terms of utility for the first rupee of his income. The consumer can spend his first rupee on any of the three goods. If he spends the first rupee on X, then he will obtain 18 units of utility; if he spends it on Y, then he will get 10 units of utility; and if he spends it on Z, then he will get only 9 units of utility. Out of these three alternative opportunities for his first rupee, which one do you think he will choose? Naturally, he will choose to spend his first rupee on X and not on Y or Z. If you examine the marginal utility schedules of the three goods carefully, you will find that for the first four rupees the best opportunities of spending are offered by the first four units of X which give him 18, 16, 14 and 12 units of utilities. Having spent first four rupees on the first four best opportunities, the next best opportunity is offered by the first unit Y, which offers 10 units of utility for the fifth rupee of the consumer. According to the next available opportunities, the consumer will spend sixth rupee on the second unit of Y or seventh rupee on the first unit Of Z. In this way the consumer proceeds step by step and spends each rupee of his income to its best available use. If a rupee spent on Y gives him greater utility than a rupee worth of X or Z, the consumer will spend his rupee on Y and so on. One by one the consumer exhausts all the best available opportunities and ultimately ends up in a situation where the last rupee brings in the same utility i.e., 6, whether spent on X or Y or Z. If the last rupee brings in the same increment of utility, when spent on any good, total utility for a given income is maximized and we say that the consumer is in equilibrium. In the example given above, the consumer will spend his income (Rs. 15) on the purchase of 6 units of X, 6 units of Y and 3 units of Z. If we add the marginal utilities which the consumer gets from the 6 units of X, 6 units of Y and 3 units of Z, he will get the maximum total utility, i.e., 139 as follows:

Total utility from X = 18 + 16 + 14 + 12 + 8 + 5 = 73

Total utility from Y = 10 + 9 + 8 + 7 + 6 + 5 = 45

Total utility from Z = 9 + 7 + 5 = 21

Total utility from X, Y and Z = 139

If the consumer spends his income on any other combination of X, Y and Z, his total utility will be less than 139. Suppose he spends his income on the purchase of 7 units of X, 5 units of Y and 3 units of Z. In this case, his total utility will be 76 + 40 + 21 = 137, which is less than the maximum he can obtain. Therefore, the fundamental equilibrium condition that has to be satisfied if a consumer is to be best off in terms of total utility, would be that he gets the same marginal

utility for his last rupee when spent on any good. In the above example, the last rupee brings in 5 units of utility, whether spent on X, Y or Z. In other words, the consumer will be in equilibrium if

$MU_X = MU_y = MU_Z$

MU_X, MU_y and MU_Z are the marginal utilities of X, Y and Z commodities.

In the above example we have assumed the same price i.e., Rs. l per unit of the three goods. But in the real-world different goods have different prices. However, this does not affect our conclusion at all. By dividing the marginal utilities of the different goods by their respective prices, we find out ratios of marginal utilities to respective prices. These ratios of marginal utilities to prices are nothing but marginal utilities per rupee when spent on different goods. If we substitute MU_X, MU_y and MU_Z for marginal utilities of the goods X, Y, Z respectively and Px, Py and Pz for their respective prices, then the equilibrium condition can be expressed either by the equality of

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_z}{P_z}$$

or by the equality of marginal utility per rupee when spent on X, Y and Z.

Limitations of the Law of Equi-marginal Utility

The law of equi-marginal utility is an important principle since it guides consumers how to spend their limited income on different goods so that they can get maximum satisfaction. But in practice, consumers may find it difficult to apply this principle. First of all, it is really difficult for consumers to know the marginal utilities of different goods. Secondly, consumer are normally ignorant and cannot compare the marginal utilities of different goods. In other words, they may not know which goods give them greater satisfaction and which less. Thirdly, most consumers acquire certain habits-as for example, smoking beedies and cigarettes or drinking liquor. In such cases, they will buy and consume these goods even though they know that they can buy better goods and get more utility. Many a time, a worker will spend his daily wages on liquor though his wife and children may be starving. He knows food is more essential for his family but buys liquor instead, because he has become a victim of his habit.

Thus, for various reasons, a consumer may find it difficult to spend his income according to the law of equi-marginal utility.

7.6 WEAKNESSES OF THE UTILITARIAN ANALYSIS

1. *Utility cannot be measured:* The utilitarian approach to the theory of demand is based on the assumption that utility can be measured in quantitative terms. In order to determine the quantities of goods which an individual will buy at given prices, this theory implies that we must first know how much utility a consumer gets from each unit of different goods. But there exists no scientific method for measuring utility. Utility has been defined as the quality which makes commodities desirables to consumers. Utility is not an inherent or intrinsic quality of goods. It is purely a subjective phenomenon which depends upon the psychological ability of a person to appreciate a good. Such a purely subjective phenomenon, as the concept of utility is, cannot be measured in quantities. Utility actually is not a quantity but only an index of one's scales of preferences. As utility cannot be measured, the utilitarian explanation of theory of demand is arbitrary.

2. *Assumption of independent utilities is not valid:* According to the law of diminishing marginal utility, marginal utility and hence total utility from a good, depends upon the stock of the good in question alone and not at all on the stocks of other goods. This means that the total utility that a consumer gets form oranges depends upon the total stock of oranges alone and not on

the stock of any other good. The law of diminishing marginal utility assumes that the utility from the stock of a good is completely independent of the stocks of other goods. But this assumption of independent utility on which the law of diminishing marginal utility is based, is true only in the case of completely independent goods. Most of the goods are related to each other either as substitutes or as complements. Tea and coffee are also substitutes (rival in consumption) whereas, car and petrol are complements in the sense that one is useless without the other. If you increase consumption of tea, marginal utility of tea for you will diminish but with this the marginal utility of coffee too will diminish, without there being any change in its stock or consumption. On the other hand, if you own two cars in place of one, and if your stock of petrol remains unchanged, the marginal utility of the second car will no doubt be less than that of the first car, but without there being any change in your stock of petrol, the marginal utility petrol will increase. Thus in the case of related goods their marginal utilities increase or decrease, not because of any change in their stock alone but also because of changes in the stock of the other related goods. This is a very serious criticism against the law of diminishing marginal utility. The utilitarian approach to the theory of consumer's demand, which derives its logical strength form the law of diminishing marginal utility, thus suffers from this weakness.

3. *Marginal utility of money is assumed constant:* The utilitarian approach also assumes that the marginal utility of money is constant. What is meant by the marginal utility of money being constant? Constant marginal utility of money implies that the law of diminishing marginal utility does not apply to one's stock of money (income). One's stock of money is one's income. This means that one's stock of money (income) increases or decreases, the marginal utility of money remains unchanged. If marginal utility of money remains constant, this would mean that a consumer's demand for goods is completely independent of changes in his income. A fall in the price of one of the two goods X and Y, disturbs the equality between MU_X/ P_X and MU_y/P_y ratioes by making and MU_X/ P_X greater than MU_y/P_y. Equilibrium is resorted by reducing MU_X (by increasing the stock of X) to the extent that the new MUx_X/ P_X ratio once again becomes equal to MU_y/P_y, but if marginal utility of money remains constant, even when money stock (income) increases or decreases, the equilibrium condition will not be disturbed because nothing happens either to the utility of the good or the utility of money and therefore, more of no good will be demanded. From this it follows that one's demand for goods is responsive to price changes but not to income changes. On the very face of it, this is a very absurd conclusion. You know it well that an important factor determining one's demand for goods is one's income. Higher the income, other things remaining constant, larger will be demand for most of the goods (except in case of inferior goods).

Intext Question

Fill ups

1. The law of equi-marginal utility is also called as _____

2. The law of equi marginal utility considers price of money as _____

Answer 1. Law of substitution; 2. One

Learning Outcomes

In this lesson you have learnt the following:

1. The total utility is defined as the total physiological satisfaction of consumer from consuming certain units of the commodity. Marginal utility is defined as the addition to the total utility is a result of one-unit addition of the commodity.
2. The law of diminishing marginal utility states that the marginal utility of the commodity falls when the consumer consumes more and more unit of that good.
3. This law is used to derive the equilibrium of the consumer on the basis of the following condition
4. Price = Marginal Utility
5. If the consumer consumes more than one commodity then the equilibrium of the consumer is derived by applying the law of equilibrium marginal utility which states that the ratio of the marginal utility and price in case of each commodity should be equal for arriving at maximum satisfaction.
6. The Marshallian utility theory suffer through certain limitations such as:-
   (i) Utility being physiological phenomenon, hence cannot be quantified.
   (ii) Assumption of independent utilities is not valid and finally the marginal utility of money being constant is also not true because value of money changes with change in price of the commodity.

TERMINAL QUESTIONS

1. Explain determination of consumers equilibrium in case of a single good by using the concept of marginal and total utilities? Derive demand curve of the good from its marginal utility?
2. State and explain law of equi-marginal utility?
3. Give a critique of utility theory of consumer's equilibrium?

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LESSON: 8

INDIFFERENCE CURVE ANALYSIS

An alternative theory to determine consumer's equilibrium is given in the form of indifference curve analysis. As already said, utility theory suffered from several criticisms from various quarters. But keeping in view its importance and usefulness, indifference curve technique makes an attempt to improve upon utility theory while still preserving its relevant aspects.

Learning Objectives

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

1. Define indifference curve and know its properties.
2. Understand the concept of budget line. Determines consumers equilibrium by using indifference curve technique. Explain the change in equilibrium due to change in price of the goods and income of the consumer. Destabilizes the price impact into income and substitution impact for normal as well as GRIF case. Derive demand curve of the commodity.
3. Compare indifference and utility analysis.
4. Know the limitations of indifference curve analysis.

8.1 INTRODUCTION TO INDIFFERENCE CURVE ANALYSIS

The indifference curve analysis of demand was originally propounded by Slutsky but later on was scientifically developed and popularized by J.R. Hicks. The analysis was developed as an alternative to the utility analysis of consumer's demand. The basic defect of the utility analysis is that it is based on the cardinal number system which assumes that the utility of a commodity is measurable in quantitative terms. Utility, of a commodity can be added and subtracted and can be measured in terms of money. We have told you earlier that utility, being a subjective phenomenon cannot be measured quantitatively. Therefore, Hicks developed an alternative approach, known as 'Indifference Curve Analysis', which can explain the consumer's behaviour without measuring the utility which a consumer gets from the consumption of a commodity. Indifference curve analysis is based on the ordinal number system, in which we do not measure the utility in quantitative terms. It assumes that a consumer can express clearly his scale of preferences for any two or more goods. In other words, a consumer, without measuring the satisfaction, can say whether the various combinations of two commodities, say X and Y, give him more or less or equal satisfaction as compared to other combinations. The combinations giving him more satisfaction will rank higher in his order of preferences and he will be indifferent among those combinations which give him equal satisfaction. Let us take an example. Suppose there are two commodities X and Y and the consumer knows that the different combinations A,B,C,D, and E of two commodities X and Y, as given below in table 8.1, give him same satisfaction. Since the consumer is getting the same satisfaction form each of the combinations, he will be indifferent in choosing any of them. He can choose the 1st of these five combinations, i.e., 1 unit of X and 25 units of Y or the 4th combination i.e., 4 units of X and 13 units of Y or any other combination, i.e., 2nd or 3rd or 5th combination of X and Y gives commodities, because each combination of X and Y equal satisfaction. The consumer simply says that each of these five combinations of X and Y gives him the same satisfaction, but he does not say how much satisfaction he gets from each of the combinations. If we plot these various combinations of X and Y on a diagram, as shown in diagram 8.1, we will get a curve which is known as indifference curve.

TABLE 8.1

Indifference Schedule

Combination	*Commodity X (Units)*	*Commodity Y (Units)*
1st (A)	1	25
2nd (B)	2	20
3rd (C)	3	16
4th (D)	4	13
5th (E)	5	11

We represent commodity X on horizontal axis and Y on the vertical axis. Five different combinations, as given in Table 8.1 are represented by points A, B, C, D and E on the diagram and by joining these points, we get a curve which is known as an indifference curve. All these combinations are alike to him as each gives him same satisfaction and therefore, the consumer will have no reason to prefer one combination to any other. In other words, the consumer is indifferent in choosing any of these combinations. An indifference curve may, therefore, be defined as the diagrammatic representation of all combinations (or collections) of the two commodities which give equal satisfaction to a consumer or among which the consumer is indifferent and has no reason for preferring one combination to any other combination.

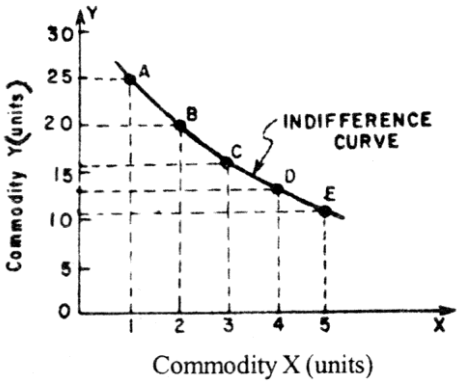


Diagram 8.1

8.2 ASSUMPTION OF THE INDIFFERENCE CURVE ANALYSIS

Indifference curve analysis is based on the following assumptions:

1. *Rationality:* The consumer is assumed to be rational. Given his income and prices of the commodities, he aims at maximization of his satisfaction. He has full knowledge of the various combinations of two commodities which give him more or less or equal satisfaction i.e., he fully knows his scale preferences.
2. *Independence of Scale of preferences:* A consumer's scale of preference is independent of his income and the prices of the commodities and other consumers.
3. *Consistency or Transitivity of Choice:* The consumer is consistent in his choice. For instance, if he chooses commodities A over B, he will not choose B over A at any other time. Similarly, if combination A is preferred to B and B is preferred to C then A is a preferred to C.

4. *The Principle of diminishing marginal rate of substitution:* Marginal Rate of Substitution (MRS) is the rate at which a consumer can exchange a small amount of one commodity for a very small amount of another commodity without affecting his total satisfaction. In other words, MRS of X for Y (MRS_{xy}) will be the quantity of Y which will just compensate the consumer for the loss of marginal unit of X, MRS_{xy} can be expressed as the ratio between the change in commodity X (ΔX) and change in the commodity, Y(ΔY) without affection the consumer's level of satisfaction. It can be expressed as $MRS_{xy} = \Delta y/ \Delta x$. In the example given in Table 8.2, as we move form the first combination to the second, we find that the consumer adds one unit of X and gives up some units of Y, but gets the same satisfaction. Between the first and second combination –1 unit of X substitutes 5 units of Y; between the second and third combinations –1 unit of X substitutes 4 units of Y and so on. This is given in the Table 8.2.

TABLE 8.2

Marginal Rate of Substitution

Commodity X (Units)	***Commodity Y (Units)***	***Marginal Rate of Substitution of X for Y (Units)***
1	25	-----
2	20	1X = 5Y
3	16	1X = 4Y
4	13	1X = 3Y
5	11	IX = 2Y

We find that the consumer substitutes X for Y but continues to get the same satisfaction. But for every increase of 1 unit of X, the consumer gives up lesser and lesser quantity of Y. Therefore, this is called the law of diminishing marginal rate of substitution. This follows from the law of diminishing marginal utility. As the consumer is substituting more and more of X for Y, the marginal utility which he gets form the additional units for X is declining and therefore he will be prepared to forego lesser amount of Y in exchange for X. The 3^{rd} unit of X and therefore, the consumer less satisfaction as compared to what he has got from the 2^{nd} unit of X and therefore, the consumer will be prepared to forego lesser amount of Y (4 units) to obtain 3^{rd} units of X, as compared to what he was prepared to forego (5 units of Y) to obtain 2nd unit of X. The indifference curve analysis is based on the assumption of the operation of the law of diminishing marginal rate of substitution.

Intext Question

1. Define Indifference Curve
2. Explain the term Marginal Rate of Substitution.

8.3 Properties of Indifference Curves

We can recognize indifference curves form their features (or characteristics or properties). Generally, they have four following properties:

I. An indifference curve slopes downward form left to right.

II. Higher indifference curve gives higher satisfaction.

III. Indifference curve is convex to the point of the origin of the two axes.

IV. Two different indifference curves never intersect or touch each other.

Indifference Curves always slope downward form left to right:

In other words, indifference curves are negatively sloped. Every indifference curve is based on the based on the assumption that the various combinations of two commodities give equal satisfactions to a consumer. In order to remain at the same level of satisfaction, the consumer will have to reduce the consumption of one commodity if he wants to increase the consumption of another commodity. In the example given earlier, if the consumer adds second unit of X he will have to give up some units of Y. If he adds second unit of X without giving up some units of Y, he will have more satisfaction, which is inconsistent with the assumption of indifference curve. In terms of a diagram, this means that a indifference curve will slope downward form left to right. This is explained in the diagram 8.2.

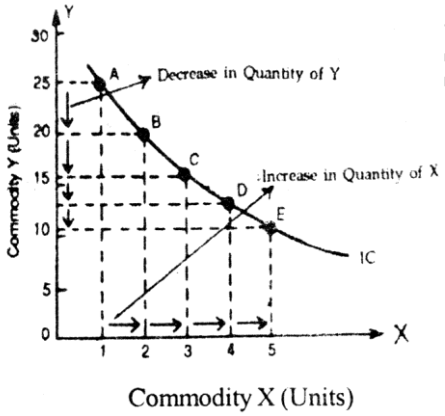


Diagram 8.2

In the diagram 8.2, as the consumer increases the consumption of X form 1 units to 2 units, he has to reduce the consumption of Y from 25 units to 20 units, so that he remains at the same level of satisfaction.

The slope of the indifference curve is called Marginal Rate of Substitution between good X and Y. On a downward sloping curve this indicates the amount of good Y (measured on vertical axis) that has to be reduced to get an extra unit of good X (measured on the horizontal axis), keeping total utility unchanged along the curve. Symbolically, it can be written as:

$$MRSxy = \Delta Y/\Delta X \text{ which is negative.}$$

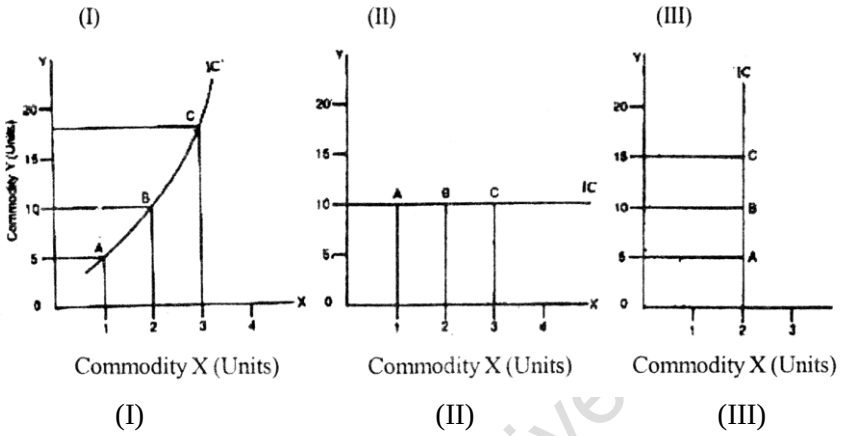
It can be proved that MRSxy is also a ratio of the marginal utilities of the goods X and Y. SS

An indifference curve cannot be of any other shape, except that of the downward sloping form left to right.

(i) An upward sloping indifference curve, as shown in the diagram 8.3 (I) is impossible as it implies that more units of both the commodities represent the same level of satisfaction. In the figure, combination and B consists of 2x + 10y i.e. more of both the commodities X and Y, as compared to combination-A (1x and 5y). Therefore combination-B will give more satisfaction as compared to the combination A.

(ii) Similarly, horizontal or vertical indifference curve, as shown in the diagram 8.3 (II) and 8.3 (III), is also an impossibility since difference combinations with more of one commodity and

the same quantity of another commodity cannot yield the same level of satisfaction to the consumer. In the diagram 8.3 (II), The combination – B (2x + 10y), consists of more of X and same amount of Y, as compared to combination – A (1x + 10y), and therefore, the consumer will have more satisfaction from B as compared to A. Likewise, in the diagram 8.3 (III), combination B (2x + 10Y) consists of more of Y and same amount of X, as compared to combination A(2x + 5y), and therefore, the consumer will have more satisfaction from B as compared to A.



(I) (II) (III)

Diagram 8.3

From the above, it follows that an indifference curve can never be upward sloping or horizontal or vertical. It will always slope downward from left to right, because it is based on the assumption that the various points on an indifference curve, showing different amounts of two commodities give the same level of satisfaction to the consumer.

Indifference Curves generally are Convex to the point of origin of the two axes:

An indifference curve is relatively steep at first but becomes flatter as it extends to the right. In other words, an indifference curve is convex to the point of origin of the two axes as shown in diagram 8.4. In the diagram O is the point of origin of two axis – OX and OY and the indifference curve IC is convex towards the point O. The convex slope of the indifference curve means that as we move on it form left to right, its slope diminishes. This is because of the operation of the principle of diminishing marginal rate of substitution about which you have already studied in detail. In the Table 8.2, as the consumer adds more of one commodity – X, he will be prepared to forego lesser and lesser amount of the other commodity –Y, for each successive unit of Y. In other words, the marginal rate of substitution of X for Y ($MRS_{xy} = \Delta y/ \Delta x$) keeps on declining. Since an indifference curve is based on the diminishing marginal rate of substitution, it is of convex shape.

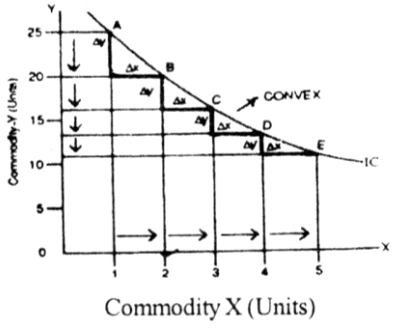


Diagram 8.4

Indifference curve can never be concave, as given in diagram 8.5, because such curves represent increasing marginal rate of substitution. In diagram 8.5 we find that $AA_1 = A_1A_2 = A_2A_3$ but $BB_1 < B_1B_2 < B_2B_3$. This is an example of increasing marginal rate of substitution. It shows that with increasing amount of X, the consumer is willing to give up more and still more units of Y. This is possible only if we assume that (a) marginal utility of X increases when the consumer has more of it; and that (b) marginal utility of Y decreases as he has less of it. This is clearly absurd. A concave indifference curve therefore is an impossibility.

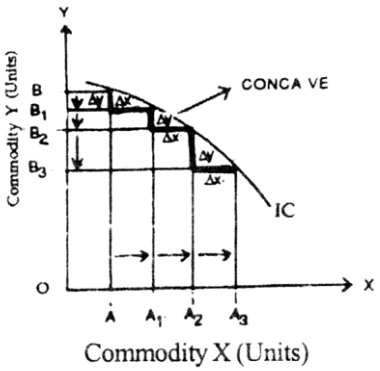


Diagram 8.5

The indifference curves are generally convex to the point of origin. But there are two exceptions (a) If the two commodities are perfect substitutes of each other, the marginal rate of substitution between these two commodities will be constant. In this case, the indifference curve will be a straight line as shown in the diagram 8.6. It shows that for one unit of X, the consumer is prepared to give one unit of Y, (b) If the two commodities are perfect complements of each other, as for example gasoline and a car, the indifference curve will consist of two straight lines with a right angle bent which is convex to origin, as shown in diagram 8.7. Perfect complementary goods are those goods, which are used by the consumer in a certain fixed ratio. They cannot be substituted for each other and therefore, the marginal rate of substitution between them will be zero.

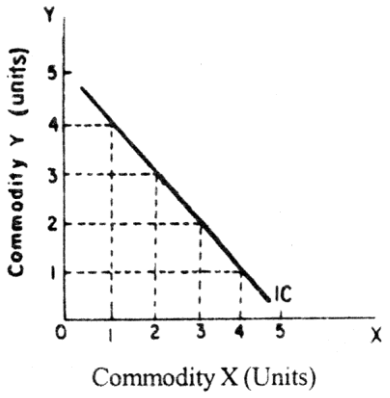


Diagram 8.6

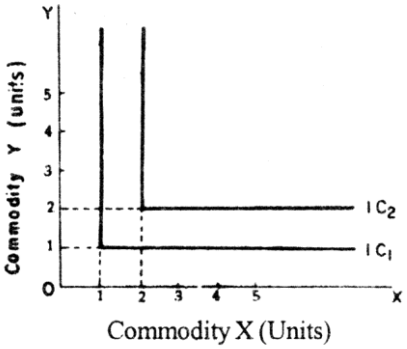


Diagram 8.7

However, perfect substitutes and perfect complementary goods are normally not found in practical life. They indicate more an imaginary situation, that the real one. Therefore, we may say that the indifference curves are generally convex to the origin.

Indifference Curves never intersect each other*:*

Each in difference curve represents only one level of satisfaction. Different indifference curves represent different levels of satisfaction. One satisfaction level may be higher or lower than the other but cannot be higher and lower as well as equal to the other at the same time. This is clearly absurd, but this is what happens when two indifference curves intersect each other. Let us assume that two indifference curves intersect each other at A as shown in diagram 8.8 below:

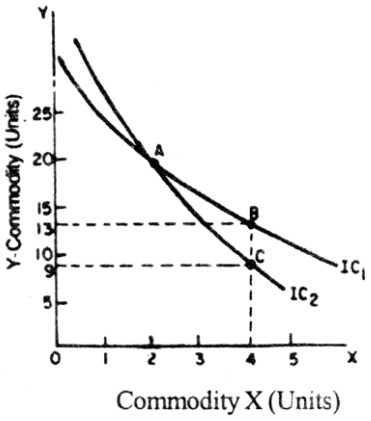


Diagram 8.8

In diagram 8.8 we have given two intersection indifference curves IC_1 and IC_2. On IC_1 we have taken two combinations represented by A and B – both represent the same level of satisfaction because both of these combinations are on the same indifference curve $1C_1$. On IC_2 we have taken two combinations again viz. A and C, both of which represent the same level of satisfaction as these are on the same indifference curve IC_2. Now we find that A = B and A – C; and therefore B = C. This is absurd as both represent different combinations of two commodities X and Y. B shows 4 units of X and 13 units of Y whereas C shows 4 units of X and 9 units of Y. Since B shows the same amount of X but more of Y as compared to C combination, therefore, the consumer will get

more satisfaction form B combination as compared to C combination. Obviously two indifference curves representing two different levels of satisfaction can never intersect or touch each other.

Intext Question

True/False

1. Two Indifference Curve can cut each other
2. In case of substitute good, the shape of Indifference curve is downward sloping straight line.

Answer 1. False; 2. True

8.4 CONSUMER'S EQUILIBRIUM THROUGH INDIFFERENCE CURVE ANALYSIS

When the consumer spends his income on different goods in such a way that he gets maximum satisfaction, he is said to have reached equilibrium position. According to the Marshallian utility analysis which was discussed earlier, a consumer reaches equilibrium position when the ratios of the marginal utilities of different commodities to their respective prices are equal. We shall now discuss how we can find out consumer's equilibrium with the help of indifference curves analysis.

In order to explain the equilibrium of a consumer with the help of indifference curve analysis, we require the following data:

(a) Consumer's different scales of preferences for the two goods, each scale is being represented by one indifference curve.

(b) The income of the consumer. It is assumed that he spends his income fully on both the goods and does not save anything.

(c) The prices of the two commodities are given in the market. It is assumed that the prices remain constant.

In other words, we must know scales of preference (which is also called an indifference map) and the price line of the consumer.

(i) Scale of Preferences of the Consumer or Indifference Map

There are various combinations of two commodities which give equal, more or less satisfaction to a consumer. The combination giving him more satisfaction will rank higher in his order of preference than the combinations giving him lower satisfaction. And if certain combination give him the same satisfaction all such combinations will find the same place in his order of preference. Proceeding in this way, we can thus arrange various combinations of the goods in order of a consumer's preferences - combinations giving more satisfaction finding accordingly higher places, combinations giving lower satisfaction finding accordingly lower places and all combinations giving the same satisfaction finding the same place in his order to preferences. This kind of arrangement (in terms of higher, lower and equal levels of satisfaction) of all possible combinations of two goods constitutes what economists call a consumer's scale of preferences or an indifference map. A consumer's scale of preferences is a sort of map which shows how different combinations of various goods are arranged by him in order of higher, lower and equal levels of satisfaction.

In the Table 8.1 we took the example of 5 combinations of commodities X and Y .i.e. 1X + 25Y, 2X + 20Y, 3X + 16Y, 4X + 13Y, and 5X + 11Y, each of which give equal satisfaction to the consumer and therefore, the consumer is indifferent in choosing any one of them. On the basis of these combinations, we had drawn indifference curve in the diagram 8.1. All points on this indifference curve, showing different combinations of two commodities X and Y which yield equal satisfaction to the consumer. There may be many other combinations of two commodities X and Y

which may give more or less satisfaction to the consumer as compared to the 5 combinations given above. Different combinations of X and Y, which give different levels of satisfaction to the consumer cannot be shown by one indifference curve, but for this we have to draw different indifferent curves. In order to explain it, we take a sample as given in Table 8.3.

TABLE 8.3

A		***B***		***C***	
Indifference Curve I		***Indifference Curve II***		***Indifference Curve III***	
X	***Y***	***X***	***Y***	***X***	***Y***
1	18	1	25	1	31
2	13	2	16	3	25
3	9	3	16	3	20
4	6	4	13	4	17
5	4	5	11	5	15

When the various combinations given in the table are shown on a diagram, we can draw three indifference curves I, II, III, as given in the diagram 8.9. Any combination of X and Y given in the column (A) gives equal satisfaction to the consumer and therefore, can be shown by one indifference curve I. Similarly, any combination given in column (B) gives equal satisfaction to the consumer and therefore, can be shown the indifference curve II. The indifference curve III shows the combinations given in the column (C). Any combination given in the column (B) gives more satisfaction to the consumer as compared to any combination of X and Y given in the column (A), and therefore, the indifference curve II is higher than the indifference ins curve I. Similarly, any combination of X and Y given in the column (C) still gives higher satisfaction as compared to any combination given in columns (B), and therefore the indifference curve III is higher than the indifference curve II. Thus while one indifference curve shows one level of satisfaction different indifference curves show different levels of satisfaction. A higher indifference curve will show greater satisfaction as compared to the lower indifference curve. In the diagram 8.9 we have drawn only three indifference curves, I, II, III, on the basis of the different combinations of X and Y given in the table 8.3. There may be many more combinations of X and Y which can be shown by drawing different indifference curves. The diagrammatical representations of all possible indifference curves relevant to a consumer is called his scale of preference or his indifference map. Every consumer has his won indifference map, showing his tastes and preferences between the different combinations of two commodities. So long his tastes and preferences remain unchanged, his indifference map will be the same. If the consumer's tastes and preferences undergo a change, then and indifference map corresponding to new tastes and preferences will have to be drawn.

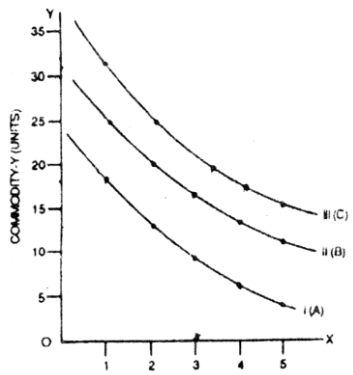


Diagram 8.9

(ii) Budget Line or Price Line

We have explained that a higher indifference curve shows a higher level of satisfaction than a lower one. Since the objective of the consumer is to have maximum satisfaction, he will try to reach the highest possible indifference curve. But while a consumer tries to have a combination of two goods which gives him maximum satisfaction, but he is to work under two limitations: firstly, he has to pay the prices of the goods and secondly, he has a limited money income. Therefore, how much a consumer can purchase, depends upon the prices of the goods and his money income.

On the basis of his given money income and given market prices of goods, we can draw a line on a diagram which is called the price line or budget line showing the limit upto which a consumer can reach. Suppose a consumer gets Rs 20. per week. He wants to spend this income on the purchase of rice and wheat which he needs. Suppose the market prices of rice and wheat are Rs.2 and Rs. 1 per kg. Respectively. If he spends his total income, i.e., Rs.20 on the purchase of wheat he can buy 20 kgs. of wheat and if he spends his -total income on the purchase of rice, he can buy 10 kgs. of rice. 5 With this information his budget line equation can be given on

$$20 = 1 \text{ (Wheat)} + 2 \text{ (Rice)}$$

$$\text{Symbolically } M = P_X X + P_y Y$$

Where M = income, P_X = Price of X, X being wheat

Py = Price of Y, Y being Rice

Let us draw a diagram.

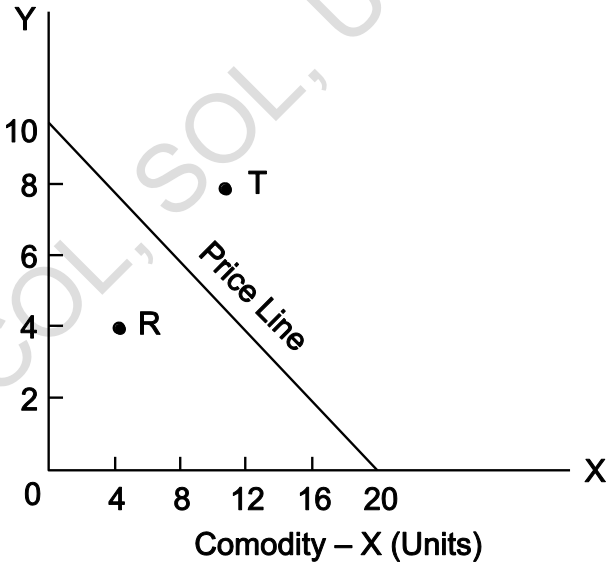


Diagram 8.10

In the diagram 8.10 wheat is measured along the X-axis and rice along the Y-axis. If the consumer spends all his money income (i.e., Rs.20) on wheat alone, he can purchase 20 kgs. Or OB amount of wheat and if he chooses to spend his entire income on rice, then he can purchase 10 kgs. or OA amount or rice. We join points A and B. The slope of the line AB shows the market rate of exchange between rice and wheat or wheat for rice. Such a line is usually referred to as the price line or the budget line relevant for a consumer with given money income and given prices of goods. The price line or the income line may be defined as the line which shows all the possible combinations of two goods which a consumer with a given money income can choose from, at the given prices. The function of the price line or the income line is to show the area of choice open of

the consumer. Let us take diagram 8.10 again. The consumer will not like to choose a point say R, below the price line because any such combination of the two goods, represented by any point below the price line will not exhaust his entire money income. Some of his money income will remain unspent in that case. The consumer cannot choose any point say T, which is to the right of the price line because he has not enough money to reach to such point. Therefore, the consumer has to choose a position along the price line.

The slope of price line (OA/OB) is equal to the ratio of the prices of two commodities (prices of X/price of Y).

A price line is drawn of the basis of the given money income of the consumer and the price of the commodities. Therefore, a change in the consumer's income or the price/ prices of the commodities will cause a change in the price line. Suppose the prices of the gods remain constant but the money income of the consumer increases, the price line will shift upward to the right parallel to itself and if the consumer's money income declines, the price line will shift downward to the left parallel to it. This is shown in the diagram 8.11:

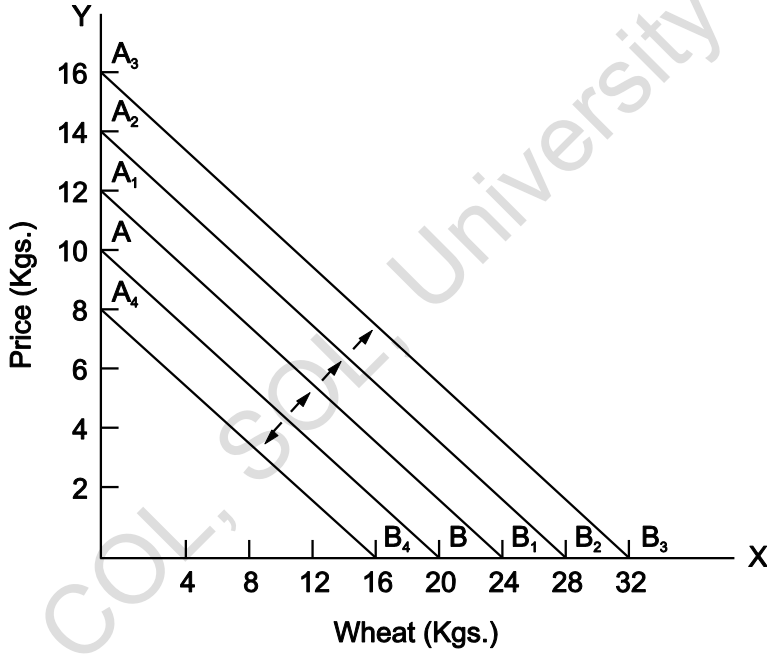


Diagram 8.11

When the money income of the consumer increases form Rs.20 per week to say Rs.24, the price line AB moves upward parallel to itself and takes the position represented by the line A_1B_1. Similarly, A_2B_2 and A_3B_3 represent the price or the budget lines relevant to the consumer when his money income is Rs.28 and Rs.32 per week. If the consumer's income declines to, say, Rs.l6 per week, the price line AB moved downward to the left parallel to itself and takes the position represented by line A_4B_4.

If the money income of the consumer remains constant, but there is a change in the price of a commodity, it will result into a change in the price line of the consumer, as is explained in the diagram 8.12. Suppose the price of wheat falls from Rs.1 per kg. to 0.50 paise per kg. When the price of wheat was Rs.l per kg. The consumer with the given income of Rs.20 could buy OB amount of wheat (i.e., 20 kgs. of wheat) if he decided to spend the entire income on the purchase of wheat. But when the price falls to 0.50 paise per kg., the consumer with the same income can buy OB_1 amount of wheat (i.e., 40 kgs. Of wheat). Therefore, his price line will shift to right to become AB_1.

On the contrary, if the price of wheat rises form Rs.l per kg. to Rs.l.25 per kg. He can buy a maximum amount of 16 kgs. Of wheat i.e. OB_2 amount of wheat. Therefore, the price will shift to the left and becomes AB_2.

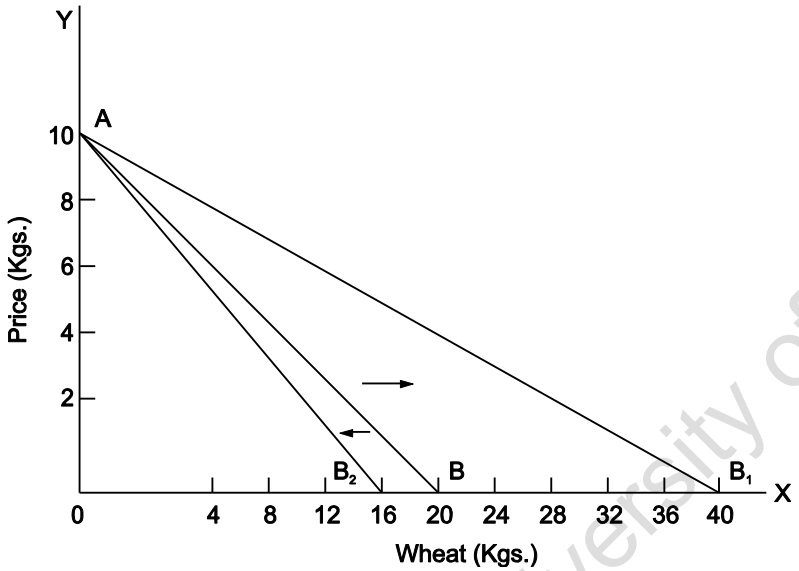


Diagram 8.12

Intext Question

MCQs

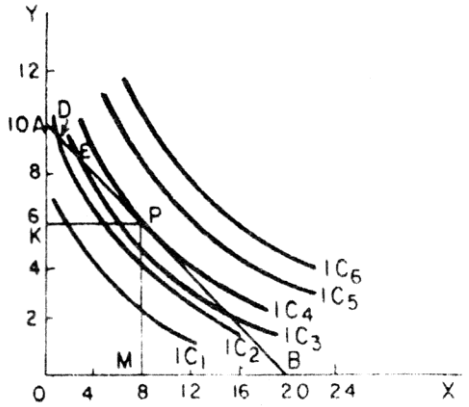
1. How would that budget line be effected if both income and the price of both goods fall?
   a) The budget line would not shift.
   b) The new budget line will have the same slope as the original so long as the price of both goods change in the same proportion
   c) The new budget line must be parallel to the old budget line.
   d) The budget line must become shallower.

2. Consider a consumer who spends his income on Goods (G) and Services (S). If the consumer's budget line can be written as G = 300 – 2 S, then we know that:
   a) Goods costs twice as much as Services.
   b) the consumer's nominal income is 300.
   c) Services costs twice as much as Goods.
   d) the consumer's nominal income is 600.

Answer 1. b; 2. c

8.5 CONSUMER'S EQUILIBRIUM

We can find out consumer i.e., the combination of wheat and rice which given the consumer maximum satisfaction, by combining the indifference map. (i.e., scale of preferences) and the price line of the consumer i.e., by combining the diagrams 8.9 and 8.10. This is done in diagram 8.13.



Wheat (Kgs.)

Diagram 8.13

The diagram 8.13 shows the price line AB based on the consumer's limited income (i.e., Rs. 20) and given market prices of the two goods (wheat Re. l per kg. and Rice Rs. 2 per Kg.) and indifference curves IC_1, IC_2, IC_3, IC_4, IC_5 and IC_6, show his scale of preferences or indifference map of the consumer. His aim is to reach the highest possible indifference curve but in doing so he will have to act within the limits imposed by his limited income and the market prices of the two goods as depicted by the price line AB. His area of choice is restricted to the triangle OAB. He can choose any point inside the area OAB but this he will not do so simply because in that case his entire income will not be utilized. He cannot move to any point beyond AB because his income does not permit him to do so. He will therefore choose a point along the price line AB only. But AB represents a number of combinations. Which one maximizes his satisfaction?

Suppose in the process of trial and error the consumer selects the point D on the price line which also lies on indifference curve IC_2. Having selected D, he finds that by moving to point E on the price line he could be better off because E lies on indifference curve IC_3. He will therefore reject point D in favour of E. But at E he again finds that point P, which lies on indifference curve IC_4 is also open to him. Therefore, he rejects E also in favour of P. Now having reached P he feels as if he is at the top of a hill from where any movement in either direction leads him only to a lower level. The consumer will therefore, stick to position at P. At P, price line just touches the indifference curve IC_4 (is tangential to it) and does not cut it. He is maximizing satisfaction at P. He purchases OK of rice and OM of wheat (i.e., 6 kgs. of rice and 8 kgs. of wheat).

Conditions of Consumer's Equilibrium

Now we are in a position to state the conditions in which a consumer would be maximizing satisfaction within the limits imposed by his monetary income and the market prices. We can say that the consumer will be maximizing satisfaction when he selects the point where the price line is tangent to the indifference curve. This is the point of maximum satisfaction attainable under the given conditions because any deviation form this position leads the consumer to a lower level of satisfaction. We hope you remember that the slope of an indifference curve at any point measures the marginal rate of substitution between the two goods. At the point of tangency (at point P in the above diagram) the slopes (OA/OB) of the indifference curve and the price line are the same. This simply means that at the point of tangency the marginal rate of substitution (MRS_{xy}) of the consumer, as indicated by his indifference curve, is equal to the price ratio of the two goods (P_x/P_y). We can, therefore, also express the equilibrium by saying that the consumer will be in equilibrium

when his marginal rate of substitution between the two goods is equal to the price ratio between the two goods.

The tangency between the price line and the indifference curve or in other words, the equality between the marginal rate of substitution between the two commodities and their price ratio, is a necessary but not a sufficient condition for consumer's equilibrium. Another condition for consumer's equilibrium is that at the point of equilibrium, the indifference curve must be convex to the origin, or, in other words, the marginal rate of substitution of X for Y must be falling at the point of equilibrium, otherwise it will not be a stable equilibrium. This can be explained with the diagram 8.14. In the diagram the price line AB is tangent t the indifferent curve IC_1 at F and therefore point F should be the consumer's equilibrium position. But point F cannot be a position of stable equilibrium because the satisfaction would not be maximum there. At point F, the indifference curve is concave to the point of origin, or, in other words, the marginal rate of substitution of X for Y is increasing. It means, that if the consumer moves in either direction – left or right, on the price line, he can reach a higher indifference curve and can have greater satisfaction. In the diagram, by moving on the price line AB, the consumer can reach at point P. Since at P, price line is tangent to indifference curve IC_2 and therefore, the consumer will have more satisfaction. At P, the price line AB is not only tangent to indifference curve IC_2 but IC_2 is also convex to the origin. Therefore, P represents a consumer's stable equilibrium position.

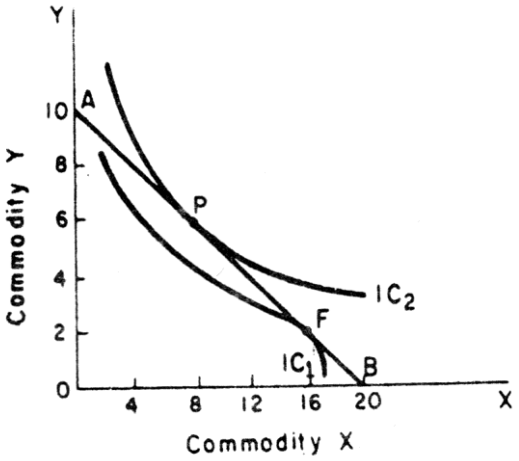


Diagram 8.14

Thus, there are two conditions which are required to be fulfilled for a consumer to be in equilibrium position:

(a) The price line must be tangent to an indifference curve, or marginal rate of substitution of X for Y must be equal to the price ratio between the two commodities, i.e

$MRS_{xy} = P_x/P_y$

(b) Indifference curve must be convex to the origin at the point of tangency.

Intext Question

1. At equilibrium, the price line must be tangent to_____
2. Indifference Curve is always _____ to origin

Answers

1. Indifference curve; 2. Convex

8.6 EFFECT OF THE CHANGES IN THE CONSUMER'S INCOME AND PRICES OF GOODS

So far, we have discussed how a consumer decides which goods to buy and in what amounts, when his monetary income and prices of the goods are given. But the monetary income of the consumer and the prices of goods do not remain constant. The changes in consumer's money income and the prices of goods will affect the consumer's equilibrium position.

(i) Effects of the Changes in Income on Consumer's Demand: Income Effect

Let us first analyse the effects of the changes in the monetary income of the consumer on consumer's equilibrium assuming that the prices of goods remain constant.

What happens if the consumer has more or less money income with all other conditions remaining the same? Assuming that the prices of the two goods remain the same, a higher monetary income enables a consumer to go to a higher budget line and choose a combination of the two goods on a higher indifference curve. In other words, a higher monetary income enables the consumer to buy a larger quantity of one commodity or both commodities. The changes in demand for a commodity due to a change in monetary income of the consumer is known as the income effect on demand for that commodity.

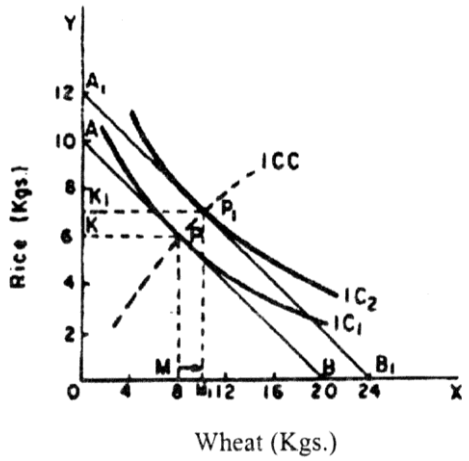


Diagram 8.15

In the diagram 8.15 we measure wheat on the X-axis and rice on the Y-axis. Suppose the consumer's monetary income is Rs.20 per week and the price of wheat and rice is Rs. 1 arid Rs.2 per kg. respectively. If he spends his entire income on the purchase of wheat, he can buy OB amount (20 kgs.) of X and alternatively, if he spends his entire income on the purchase of rice, he can buy OA amount (10 kgs.) of rice. AB, therefore, is his price line. This price line is tangent to the $1C_1$ at point P. Therefore, this would be his equilibrium position. The consumer is spending his entire income (i.e., Rs. 20/-) in such a way that he purchases OM (i.e. 8 kgs.) amount of wheat and OK (i.e., 6 kgs.) of rice. Now suppose his monetary income increases to Rs. 24 per week, the prices of goods remaining the same. Therefore, as explained earlier, his price line will shift upwards to the right parallel to the original price line AB. A_1B_1 is the new price line. Now consumer can move to a higher indifference curve. What will be his equilibrium position? The new price line A_1B_1 is tangent to the IC_2 at P_1. Therefore, P_1 will now be consumer's equilibrium position. Previously when the consumer's monetary income was Rs. 20/- per week, he was buying OM (i.e., 8 kgs.) amount of wheat and OK (i.e., 6 kgs.) amount of rice. Now his monetary income has increased to Rs.24/- per week, prices of goods remaining constant, he buys OM1 (i.e. 10 kgs.) amount of wheat

and OK1 (i.e.7 kgs.) amount of rice i.e. more of both wheat and rice. The shift in the consumer's equilibrium position form P to P_1 is called income effect which is positive. If we join P and P_1 we get a curve which is called Income Consumption Curve (ICC). The income consumption curve usually slopes upwards to the right.

We would like to tell you here that income effect can be positive as well as negative. If the increase in monetary income leads to an increase in the demand of a commodity the income effect is positive. But if the increase in monetary income results in a fall in the demand for a commodity, the income effect will be negative. Normally, income effect is positive. But while discussing the law of demand we have told you that in case of inferior goods the income effect is negative, i.e., the increase in the consumer's monetary income (or real income due to the fall in the price of the inferior commodity) will result in the decline in the demand for an inferior good and vice versa.

(i) a. Case of Inferior Goods

Inferior goods are those goods which consumers demand when they have low incomes. When consumers have more monetary income, they would shift form inferior goods to superior ones. In other words, with increase in monetary income, the demand for inferior goods declines. The negative income effect, in case of inferior goods, can be explained with the help of a diagram 8.16.

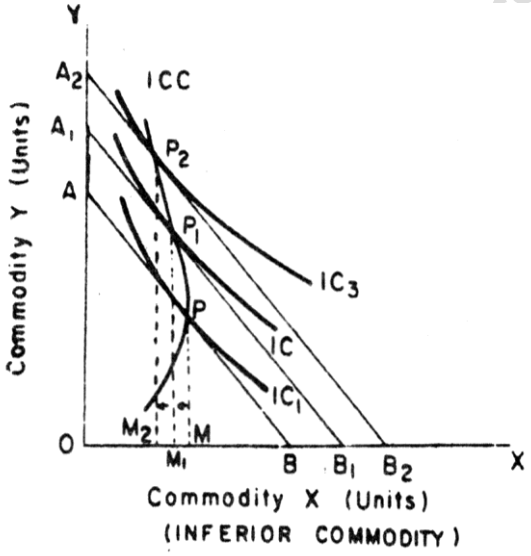


Diagram 8.16

In the diagram 8.16 we measure X commodity which is an inferior commodity, on the X axis and Y commodity (which is not inferior) on the Y axis. AB is the price line. The consumer is at equilibrium at point P. He buys OM amount of the X commodity. Suppose his income increases and therefore the price line shifts upwards. A_1B_1 is the new price line which touches the IC_2 at point P_1 and therefore P_1 is the new equilibrium point. Now, the consumer buys OM_1 amount of the commodity X which is less than what he was buying earlier when he was at equilibrium point P. Previously he was buying OM amount of X but now he is buying OM_1 amount of X. In other words he buys less of X to the extent of MM_1 even though his income has increased. MM_1 is the negative income effect. Suppose the consumer's income increase further and price lines shifts upward and becomes A_2B_2 and P_2 becomes his new equilibrium position. The consumer now buys OM_2 amount of X which is less than what he was buying when he was at equilibrium point P_1. In other words, as a result of further increase in his income, the consumer buys less of X, to the extent

of M_1M_2. Again the income effect is negative. This negative income effect has taken place because we have assumed that the commodity X is an inferior commodity. Here you find that the income consumption curve (ICC) slopes backward to the left.

The income effect may also take place due to the changes in the price of a commodity, assuming the monetary income of the consumer remaining constant. A fall in the price of a commodity or commodities will result in an increase in the real income or the purchasing power of the consumer which will increase the demand for the commodity. We shall discuss this in detail below.

(ii) Effects of Price Changes on Consumer's Demand: Price Effect

We have explained the effects of the changes in the money income of the consumer on his equilibrium position, assuming the prices of goods remaining constant. Let us now examine the effects of the changes in the price of one commodity on consumer's equilibrium, assuming that the price of the other commodity and the consumer's tastes and money income remain constant.

A change in the price of one commodity, say X, keeping the price of the other commodity, say Y, and consumer's money income constant, will result into a change in the price line as already explained in the diagram 8.12. This will lead a change in the consumer's equilibrium position.

If the price of X alone falls, the price line will shift to the right and this will enable the consumer to reach on a higher indifference curve. On the other hand, if the price of X increases, the price line will shift to the left and therefore the consumer's equilibrium position will lie at a lower indifference curve. The total effect of the change in the price of a commodity on its quantity demanded is called the price effect. This can be shown by the diagram 8.17.

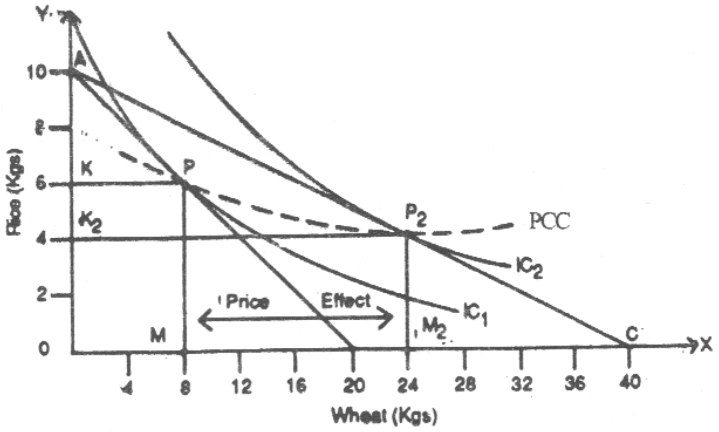


Diagram 8.17

Given the consumer's money income at Rs. 20, and price office at Rs. 2 per kg. and price of wheat at Rs.1 per kg. The price line AB is tangent to the indifference curve $1C_1$ at P and therefore, P will be the consumer's equilibrium position. The consumer will purchase OM amount of wheat and OK amount of rice. Suppose the consumer's money income and the price of rice remain constant, but the price of wheat falls from Rs. 1 per Kg to 0.50 paise per kg. Therefore, with the same money income, the consumer can now buy OC amount (i.e. 40 Kgs.) of wheat. Therefore, his price line will shift to the position of AC. The consumer can now reach on a higher indifference curve IC_2. The new price line AC is tangent to the indifference curve IC_2 at point P_2. Therefore, the P_2 will be the new equilibrium position. Instead of OM amount of wheat, the consumer now buys OM_2 amount of wheat. If we join points P and P_2, we get a curve, which is called Price

Consumption Curve (PCC). The Price Consumption Curve traces the price effect. It shows how the changes in price of a commodity will affect the consumer's purchases of that commodity, assuming that the price of the other commodity and the consumer's tastes and monetary income have remained constant. In the diagram8.17, the demand for wheat has increased form OM to OM_2. In this case, the MM_2 i.e. increase in quantity demanded, is the price effect.

Intext Question

TRUE/FALSE

1. There is negative income effect in case of inferior commodities
2. PCC shows the changes in consumer equilibrium due to change in price of the commodity

Answer

1. True
2. True

8.7 SEPARATION OF INCOME AND SUBSTITUTION EFFECTS

The effect of a price changes is in reality the result of the actions of two different forces and can legitimately be looked at in two parts, i.e., income and substitution effects.

(a) ***Income Effect:*** Firstly, as the price of one goods falls (price of other good and monetary income of the consumer remaining the same) the consumer becomes better off than before roughly by the amount of the saving which he would be able to make if he continues to purchase the old quantities of both the goods. Suppose the price of wheat falls from Rs. l per kg. to 75 paise per kg. and the price of rice stays at Rs. 2 per kg. At the old prices the consumer was purchasing 6 kgs. of rice and 8 kgs. of wheat. If after the price fall the consumer continues buying 6 kgs. of wheat then he will save Rs. 2, because at the lower price 8 kgs. of wheat will now cost him Rs. 6 instead of Rs. 8 as previously. This saving in money i.e., Rs. 2 is comparable to an increase in the consumer's real income which he can spend on either or both goods. Thus, income effect can be defined as the change in the quantity of a commodity demanded due to change in its price, given the money income as constant. This is called the income effect of a price change. The effect of a price rise will be just the opposite.

(b) ***Substitution Effect:*** Secondly, the fall in the price of one good makes it cheaper relatively to the other good whose price has remained constant (or whose price has fallen but not to the same extent to which the price of other good has fallen) and therefore the consumer will tend to substitute the cheaper good for the dearer one, and as a result the demand for the cheaper good will tend to increase. A change in the demand for a commodity as a result of a change in the relative price of two commodities (one commodity becoming cheaper as compared to the other commodity) is called the substitution effect.

Any change in the relative prices of two commodities brings about a change in the slope of the price line. The consumer remains on the same indifference curve. In other words, he remains on the same level of satisfaction. But because of the changes in the relative prices of the two commodities, consumer rearranges his purchases by substituting cheaper commodity in place of the relatively dearer one. This will result in a change in the quantity of the two commodities bought and therefore, his equilibrium position will shift on the same indifference curve. In other words, the substitution effect implies a movement form one point to another on the same indifference curve.

Thus, price effect may be defined as the extent of the change in the demand of a commodity as a result of the changes in price of that commodity. The price effect is composed of two separate effects i.e. income effect and substitution effect and the resultant effect of price changes on the

demand for goods (i.e., price effect) will be the net effect of these two forces. This can be shown by a diagram 8.18.

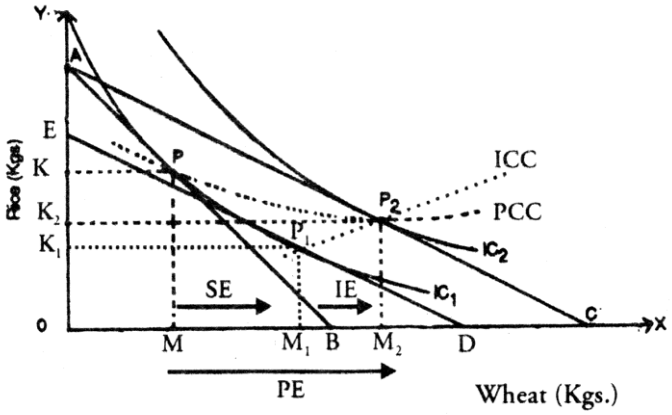


Diagram 8.18

In the diagram 8.18 we measure wheat along the X-axis and rice along the Y-axis. At the old price line AB, the consumer was in equilibrium at point P attaining utility level represented by indifference curve IC_1. At point P, the consumer has purchased OM of wheat and OK of rice. Let price of wheat falls., say, from Rs. l per kg to 0.50 paise per kg. As a result of the fall in the price of wheat the consumer can now purchase (with the same money income) OC amount of wheat if he spends his entire income on purchase of wheat, but since the price of rice is unchanged, he will keep on purchasing same OA amount of rice if he spends his entire income on the purchase of rice. So, due to fall in price of wheat, AC becomes the new price line. At the new prices, i.e a less price for wheat on AC, the consumer attains equilibrium at point P_2 on a higher indifference curve IC_2 and starts buying OM_2 of wheat and OK_2 of rice. If we join points P and P_2, we get Price Consumption Curve (PCC) for good wheat. You will notice that at the new prices the consumer starts buying more of wheat (OM_2 is greater than OM) and less of rice (OK_2 is less than OK).

So, Price Effect = OM_2 - OM = MM_2

This increase in the demand of wheat (i.e., price effect), as a result of the fall in its price, has taken place because of two effects i.e., income effect and substitution effect. Let us now find out how much of this increase in the demand for wheat is due to income effect and how much is due to substitution effect. In order to know this, let us withdraw the increase in real income from the consumer caused due to fall in price of good X so that she comes back to attain her original level of utility which was represented by initial indifference curve IC_1. This is done by shifting the budget line AC parallelly downwards till it is tangent to IC_1. In the diagram 8.18 price line ED is parallel to the price line AC and is tangential to the indifference curve IC_1 at point P_1. Note that, ED is parallel to AC which implies that ED has the same price ratio as has AC on which price of wheat is less than that on AB. But since ED is below AC, the income level in ED is less than that of AC. The difference in income level between AC and ED is nothing but the rise in real income due to fall in price of wheat. Look that the earlier budget line AB with higher income level and new budget line ED with lower income level are both tangent to the original utility level IC_1 at points P and P_1 respectively., thus giving same utility. This implies that when price of wheat was higher on AB, consumer was getting utility at point P on IC_1 and after fall in price of wheat the consumer can retain the same utility at a less income represented by ED but at a different equilibrium point P_1. We can say that the real value of income on AB has been made equal to that on ED due to fall in price. The shift of AC to ED done to adjust for increase in real income is called Compensating

Variation in income so that consumer remains on same utility. Now see that, movement from point P on AB to point P_1 on ED along same IC_1 has resulted in increase in quantity of wheat from OM to OM_1 which involves increase in wheat whose price has decreased and fall in quantity of the other good rice whose price has remained same. In a way, the cheaper good wheat has been substituted in place of rice. This increase in wheat i.e $OM_1 - OM = MM_1$ is called Substitution Effect.

However, the consumer does not stay at point P_1. After fall in price of wheat, her actual budget line is AC on which she has attained higher satisfaction on IC_2 at point P_2. The movement of the consumer from point P_1 on lower income ED to point P_2 on a higher income AC has happened due to income effect. The locus P_1P_2 traces the Income Consumption Curve (ICC).

The difference in quantity, i.e $OM_2 - OM_1 = M_1M_2$ is called Income Effect

Clearly, $MM_2 = MM_1 + M_1M_2$

i.e, Price Effect = Substitution Effect + Income Effect

Thus, in diagram 8.18 the movement form P to P_1 is due to the substitution effect and the movement form P_1 to P_2 is due to the income effect. We can summaries it, as a result of the fall in the price of wheat, its demand has increased by MM_2 (price effect). Out of this increase, the increase to the extent of MM_1 is due to substitution effect and increase to the extent of M_1M_2 is due to income effect.

Thus, we see that the effect of a change in the price of a good can legitimately be looked upon as consisting of two separate effects namely, the income effect and the substitution effect and the total price effect on demand is the sum of these two effects. As far as the substitution effect is concerned, it is always negative, i.e, a fall in price results in increase in quantity demanded in substitution effect. In case of normal good as discussed above, the income effect also acted opposite to price change, i.e a fall in price of normal good caused real income to rise, thus, also causing quantity to rise. The combination of two effects caused quantity to rise due to fall in price.

8.8 GIFFEN'S PARADOX

A Giffen good, after the name of Sir Robert Giffen, is a special type of inferior good, which does not follow the law of demand. In other words, in case of a Giffen good, while a fall in its price will reduce its demand, a rise in the price will increase its demand. This can be explained with the help of diagram 8.19. Suppose commodity X is a Giffen good which is represented On X-axis . With a given monetary income (line AC) and prices of the two commodity X (Giffen good) and Y the consumer is at equilibrium point P on indifference curve IC_1. The consumer buys OM quantity of X. Suppose the price of X rises and the consumer's price line shifts to AB. Price line AB is tangent to indifference curve IC_2 at P_2. At this new equilibrium point P_2, the consumer buys OM_2 amount of X. Thus, as a result of the rise in the price of X (Giffen good), the consumer increases the consumption of X from OM to OM_2. In other words, the demand for X has increased to the extent of MM_2. This is price effect. This price effect is composed of income effect and substitution effect. In order to find out these, we again draw an imaginary price line ED (following the rule of compensating variation in income), which is parallel to the price line AB. The price line ED is tangent to the indifference curve IC_1 at P_1. The consumer buys OM_1 of Giffen good. The difference $OM - OM_1$ which is equal to MM_1 is called substitution effect. The substitution effect induces consumer to buy less of commodity X to the extent of MM_1 since price of X has increased, thus indicating that it is negative. However, consumer does not stay at point P1 on ED. Her actual budget line after increase in price of Giffen good is AB where she is buying OM_2 amount which more than OM and OM_1. The income effect acts in opposite direction and is greater than the substitution

effect. The income effect here is M_1M_2. Therefore, the net effect i.e. price efffect is MM_2, i.e. with the rise in the price of X, its quantity demanded increased by the amount MM_2.

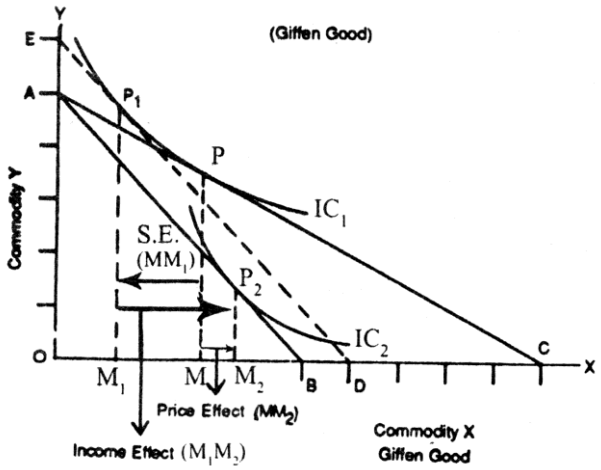


Diagram 8.19

Thus, if a good is Giffen good, a fall in its price reduces its quantity demanded and a rise in its price will increase the quantity demanded. In other words, in case of a Giffen good, there is a direct relationship between its price and quantities demanded, i.e., both vary in the same direction. It means that in case of Giffen good, the law of demand does not operate. If a commodity is a Giffen good, its demand curve will slope upward from left to the right. Such a situation is also referred to as Gifen's Paradox. However, a Giffen good is rarely found.

Intext Question

1. Price effect is
   (a) Income effect – substitution effect
   (b) Substitution effect – income effect
   (c) Income effect + substitution effect
   (d) Income effect + substitution effect- negative effects

2. The substitution effect for a commodity is
   (a) Is always positive
   (b) Depends upon the nature of the commodity
   (c) Depends upon price effect
   (d) Sometimes negative and sometimes positive

Answer 1. (c); 2. (a)

8.9 DERIVATION OF INDIVIDUAL'S DEMAND CURVE (Price Consumption Curve and Demand Curve)

We can derive a demand curve with the help of the indifference curve analysis. What is the difference between Marshall's demand and the price consumption curve (PCC) which Hicks has popularized? The conventional price-quantity demand curve tells us as to how much quantities of a commodity, a consumer will demand at different prices of a commodity. The PCC explains the same thing how a change in the price of a commodity brings about a corresponding change in the consumption or demand of the commodity. Further the demand curve and the PCC are based on the same assumptions, viz.,

(a) There is no change in the preferences, tastes etc., of the consumer.
(b) The monetary income of the consumer remains the same.
(c) 'The price of one commodity alone changes.
(d) The price of all other goods are constant.

Under these assumptions, normally consumers generally demand more at lower prices and less at higher prices.

The basic difference between the demand curve and the PCC is their shape and this essentially follows form the fact that they have been constructed in different ways. The conventional demand curve is drawn with quantity of a commodity demanded on the horizontal axis and the price of that commodity on the vertical axis. The PCC, however, is drawn with one commodity on the horizontal axis and other commodity or monetary income on the vertical axis.

As a result in case of the usual demand curve the price of the commodity is clearly mentioned on the vertical axis and quantity demanded on the horizontal axis i.e., the various prices and the corresponding quantities which will be demanded at those prices. On the other hand, the PCC does not mention the price of commodity directly; instead, the slope of the budget line indicates the ratio of prices between the two goods. The PCC does not directly sell us the different quantities demanded at different prices.

The essential function of the conventional demand curve is to show the price effect. It cannot show separately the income effect and the substitution effect. On the other hand, the PCC shows separately the income and substitution effects of a fall in the price of a commodity.

The comparison between Marshall's demand curve and Hicks' PCC brings out clearly that each has some merits of its own. The demand curve establishes a direct relationship between the price and the quantity demanded while the PCC helps in dividing the price effect into income and substitution effects. It is, however, possible to derive the usual demand curve from the PCC. This is shown in diagram 8.20 given below:

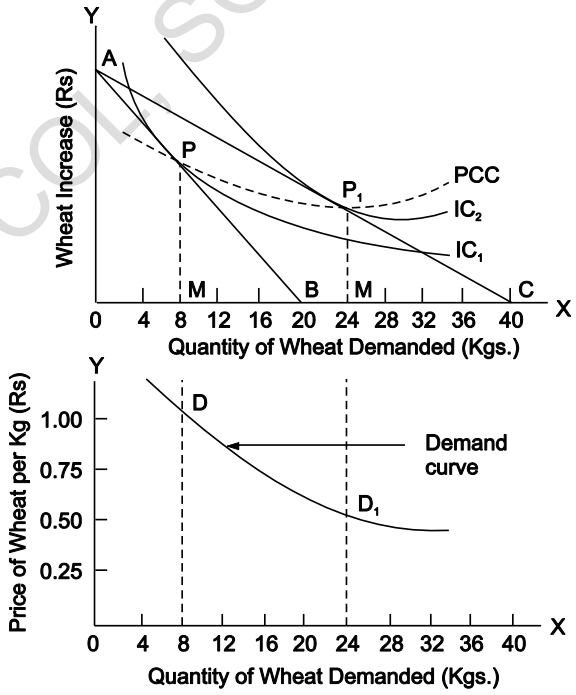


Diagram 8.20

In the top portion of the diagram 8.20, the price consumption curve for wheat has been constructed, In the top portion, the X-axis represents the quantity of wheat and the Y-axis represents the monetary income of the consumer. The monetary income is Rs. 20 which is constant. When the price of wheat is Rs. 1. per kg., the price line is AB, which is tangent to the $1C_1$ at P. Therefore, P is the consumer's equilibrium position. The consumer buys OM amount of wheat (i.e., 8 kgs.). When the price of wheat falls to 0.50 per kg., the price line shifts to AC which is tangent to IC_2 at P_1 becomes the new equilibrium position of the consumer. The consumer now buys OM_1 amount of wheat (i.e., 24 kgs.) By joining these two points P and P_1, we can draw the price consumption curve (PCC). The PCC shows that consumer demands OM (8 kg.) and OM_1 (24 kg.) amounts of wheat when the prices are Rs. 1 and 0.50 paise respectively. This price-quantity relationship has been represented in the lower portion of the figure. In the lower portion of the figure, the horizontal axis represents the quantity of wheat demanded and the vertical axis represents the price of wheat. Point D shows that the demand for wheat is OM (8 kg.) when the price is Rs. l per kg. Point D_1 shows that when the price is 0.50 paise per kg. The demand for wheat is OM_1 (24 kg.). By joining these point D and D_1 we get a curve, which is known as the demand curve. This demand curve shows the different quantities of wheat demanded by a consumer at different prices. This is how a demand curve can be derived from the price consumption curve.

Intext Question

1. The slope of a demand curve depends on the units used to measure price and the units used to measure quantity.
2. PCC is demand curve.

Answer 1. True; 2. False

8.10 EVALUATION OF THE INDIFFERENCE CURVE ANALYSIS

Let us now assess to what extent the indifference curve analysis is free from the defects of the Marshallian utilitarian analysis. In the first place, in order to know what quantities of a good a consumer will buy at given market prices the utilitarian analysis implies that we must know how much utility the consumer derives form each unit of a good. But according to the indifference curve analysis we need only know that a consumer prefers such and such sets of good to such and such sets. We need not know by how much one set is preferred to the other. Thus according to the indifference curve analysis quantitative measurement of utility is not necessary in order to explain the consumer's behaviour.

Secondly, the utilitarian analysis implies that the utility which the consumer derives form each commodity purchased, depends upon the stock of that commodity alone, and the total utility of the whole collection of goods is simply the sum of these separate utilities. We have already explained to you the implications of this assumption with examples. Indifference curve analysis admits interdependence of utilities. If utility of one good is partly influenced by the utility of another good it will be reflected in the marginal rate of substitution.

Finally, the utilitarian analysis ignores income effect by assuming marginal utility of money as constant. With the help of indifference curve technique the income effect and the substitution effect are brought out very clearly.

Limitation of Indifference Curve Analysis

The indifference curve analysis has two important limitations. The first limitation relates to the assumption that consumers are familiar with their preference schedules, as for example between

apples and oranges, coffee and biscuits, shirts and shoes and so on. For each pair of goods, the consumer is supposed to have full knowledge of all the different combinations and of all the marginal rates of substitution, of the total satisfaction to be realized, etc. It is possible to argue that a consumer may know that 8 cups of coffee and 16 biscuits, will give him as much satisfaction as 10 cups of coffee and 14 biscuits because these are the combinations which he may buy often. But he cannot really compare the desirability of 10 cups of coffee and 5 biscuits with that of 6 cups of coffee and 8 biscuits. Thus, the basic limitation of the indifference curve approach is its assumption that an average consumer knows about all possible combinations of any two goods.

Secondly, the indifference curve analysis deals with only simple cases of consumer's choice between two goods and his expenditure on them. In practice, these situations may not be of much significance. For one thing, consumer often buy more than two goods. If they buy three goods, geometry fails altogether. Lastly, the indifference curve technique can handle goods between which there is some rate of substitution. The analysis fails in the case of complementary goods between which there is no substitution.

Despite these limitations, the indifference curve analysis has become very popular not only in the theory of demand but also in the theory of production, international trade etc.`

Intext Question

1. What are the main similarities between utility analysis and indifference curve?
2. Which approach is better for consumer equilibrium?

Learning Outcome: -

In this lesson you have learnt the following: -

- Indifference curve is defined as the locus of various combinations of two goods which give equal satisfaction to the consumer,
- Indifference curve slopes downward from left to right, it is strictly convex, higher indifference curve gives higher satisfaction and two indifference curves never intersect.
- The budget line shows various combinations of quantities of two goods. The consumer can purchase given the price of the goods and income of the consumer.
- Consumer equilibrium is achieved at the point of tangency between the budget line and the highest possible indifference curve.
- Price consumption curve is the locus of different equilibrium point due to change in the slope of the budget line resulting from change of price of one good.
- Income consumption curve is the locus of various equilibrium price arising because of shift of the budget line.
- Change in quantity of a good due to change in its price is called price effect. This change happens because the consumer changes the quantity of the good whose price has changed relative to the other good, known as the substitution effect and change the quantity of good due to change in real income resulting from change in price of the good which is knows as income effect. Therefore, price effect is a combination of price and income effect.
- The demand curve of a commodity can be derived by using the price consumer curve of the commodity.

TERMINAL QUESTIONS

Short Questions

1. What Is an Indifference Curve? What is the Shape of an Indifference Curve?
2. Why does higher indifference curve gives higher levels of satisfaction?
3. What are the assumptions underlying the indifference curve approach?
4. The indifference curve should be convex to the point of origin at the consumer equilibrium point. Comment.

Long Questions

1. Explain the difference between utility analysis and indifference curve analysis.
2. . What is meant by consumer's equilibrium? How is equilibrium achieved with the help of indifference curve analysis?
3. Explain graphically how indifference analysis can be used to derive a demand curve.
4. Assume that the data in the accompanying table indicate an indifference curve for Mr. Rajesh. Graph this curve, putting A on the vertical and B on the horizontal axis. Assuming the prices of A and B are $1.50 and $1.00, respectively, and that Raj has $24 to spend, add the resulting budget line to your graph. What combination of A and B will Rajesh purchase? Does your answer meet the MRS = P_B/P_A rule for equilibrium?

Units of A	Units of B
16	6
12	8
8	12
4	24

Note: Mr. Raj will purchase 8A and 12 B

❑❑❑

LESSON: 9

PRODUCTION

INTRODUCTION

Traditional economic theory centers around the working of a capitalist economy (which is also termed as free enterprise or free market economy). As observed earlier too, all the three central problems (viz. (1) what goods to produce and in what quantities, (2) how to produce them, and (3) how to distribute the net output amongst the members of society) are solved basically through the price mechanism in a capitalist economy. Price mechanism is nothing but the sum total of all prices (both of goods and factors of production) prevailing in the economy and determined jointly by the forces of demand and supply in the respective markets. You have had an elementary view of the price mechanism in a previous set, but for a thorough understanding, it is necessary to go deeper into what lies behind the forces of demand and supply in a capitalist economy. Set 4 gave you a fair idea of the major factors underlying demand and how changes in them influence the latter. We now propose to take up supply or production for a detailed analysis. Only after examining what lies beneath the forces of demand and supply, will you be equipped to analyse the working of price mechanism in a capitalist economy in all its aspects.

While analyzing the behaviour of a consumer (i.e., the basic decision-taking unit in the theory of Demand) and determining his equilibrium, it was assumed that the consumer, being a rational human being, always tries to maximize his utility. In the field of production economics, firms - the basic decision-taking units - are assumed to have profit maximization as their objective. The common-sense relationship between rationality and maximization of utility (utility being defined as the capacity of a good to yield satisfaction) is more obvious and justifiable than the rationality of the goal of profit maximization in the context of firms. Still, the latter is basic to the traditional economic analysis of a private enterprise economy. It follows from this basic premise that a firm will always try to operate at that level of price and output at which the difference between its total revenue and total cost is the largest. We take up the cost aspect first, postponing the discussion of revenue conditions of a firm to the next set of lessons. The cost of production of a commodity depends upon two things: (i) the quantities of various factors of production used and their physical productivities, and (ii) prices per unit of the factors of production. The former specifies purely technical relationships while the latter has to be taken into account by the firms when taking economic decisions. We shall consider the technical relationships first.

After going through this lesson, you will be able to : -

- Define production function.
- Distinguish between short and long run production function.
- Explain the working of the law of variable proportions.
- Explain the law of returns to scale in the long run.
- Define and draw isoquant for two variable inputs.
- Determine the equilibrium of a producer, and the choice of optimum combination of factors.
- Find out explanation path of the producer.

9.1 CONCEPT OF PRODUCTION FUNCTION

You know that various inputs are required to produce a particular product. For example, land, water, seeds, fertilizers, plough, bullocks etc., are required to produce wheat. Similarly, a firm planning to produce cloth requires a factory, workers with requisite skills, cotton yam, machinery, fuel, tools and implements etc. Economists divide inputs into certain broad categories on the basis of similar economic features and call them 'factors of production'. The outcome of the process of production using these factor inputs is called output which may be a final consumption good (e.g.. bread, cloth), a service (e.g., teaching), an intermediate good (e.g. coal for a steel furnace or power for a cloth mill) or a durable-use capital good (e.g. factory building, blast furnace). Now the production function describes the technical relation that may exist at any time between the quantities of factor inputs and the resulting output, given the prevailing state of technology. It describes the laws governing transformation of factor inputs into products per unit of time. In other words the production function represents the technology of a firm or industry or the economy as a whole. Thus, with technological progress, the production function necessarily undergoes a change.

Let us note that a production function includes only technically efficient methods of production, that is, methods which produce maximum possible output for a given quantity of factor inputs (or, which is the same thing, which use the minimum quantity of inputs for a given output). Moreover, a production function may describe the alternative combinations of the various factor inputs (i.e. alternative methods of production) for producing a given output or it may describe the response of total output either (a) to changes in all factor inputs in the same or different proportions (a long run possibility) or (b) to changes in the amounts of some variable factor (or factors) while keeping the amount of other factors constant (a short run possibility).

A production function can be expressed either as a schedule (or a table) or as a graph (or a curve) or in the form of an algebraic equation (or as a mathematical model). Production function in one form can be converted in any of the alternative forms. Real life production functions include a wide range of independent variables (i.e., factor inputs) such as land, labour, raw materials, fixed capital, entrepreneurial- organizational efficiency, scale factor, etc.

In equation form, we can write production function as follows:

$Q = f (L, K, D, E, \Upsilon, \lambda)$

Where, Q = Output, f = function, L = Labour, K = Capital, D = Land, E = Entrepreneurship, Υ is a Greek letter pronounced as upsilon and stands for Efficiency in production, λ is a Greek letter pronounced as lamda and stands for scale factor in production.

Intext questions:

Q.1. Define Production Function.

Q.2. What are the 4 Factors of production?

9.2 DISTINCTION BETWEEN THE SHORT-RUN AND THE LONG-RUN PRODUCTION FUNCTIONS

There are three possible ways of increasing the level of output. Output can be increased either by changing the amounts of all factors by the same proportion or by increasing their amounts in different proportions or by increasing the amounts of some factor(s) while keeping the amounts of other factors fixed. While the first two alternatives are available only in the long run, the third alternative is available in the short run. This brings us to the important question of the

distinction between the short run and long run and the analytical significance of this distinction in the present context.

The Fixed and Variable Inputs

In order to produce any commodity, a producer needs two kinds of factor inputs which can be described as 'variable inputs' and 'fixed outputs'. The amounts of some factor inputs can be varied easily in accordance with the requirements of production as and when necessary, while the amounts of some factors cannot be so adjusted over certain periods. The inputs of the first type are known as 'variable inputs' and the inputs of the other type are known as 'fixed inputs'. Raw materials, direct labour, fuel, power, lubricants, ordinary repairs and maintenance, etc,, are examples of variable inputs. Their amounts can be adjusted according to the level of output without any difficulty. If production stops, these inputs can be completely dispensed with. On the other hand, fixed inputs include durable-use capital goods such as machines, building, land, tools and equipment which, if looked after and maintained, properly, can aid production over long periods. The use of such equipment does not finish with a single act of production but extends over several years. In other words, the returns from such durable use capital goods are spread over the whole of their productive lives. Therefore, while planning to install such equipment, the producer has necessarily to base his plan on the expected average level of sales over the whole of its productive life.

The planning of a firm consists in deciding the 'size' of the 'fixed' factors, which determine the size of the 'plant' because they set limits to its production. (Variable factors such as lab our and raw materials are assumed not to set limits on 'size' because the firm can acquire them easily form the market without any time lag). A businessman starts his planning with a certain figure for the average level of output which he expects selling over the relevant period and will choose the plant size which will enable him to produce that level of output most efficiently over the whole of its productive life. Before an investment is decided, the producer is in the long-run situation in the sense that he is free to choose any plant size from among the different available plant sizes. Once, However, the investment decision is taken and funds are tied up in a given plant, the producer's long-run freedom of choice ceases. So long as the productive life of the installed plant lasts he cannot discard it and choose another plant simply because of the heavy costs involved. During this period he can meet fluctuations in demand only by working the given plant more or less intensively (i.e., by applying larger or smaller amounts of other variable inputs with the given plant), but cannot choose a different plant. Executives, managers, supervisors and other permanent staff, constituting what is known as the 'management of the firm', are also of the nature of fixed inputs. Their services also cannot be adjusted in accordance with the requirements of output. The configuration of the durable use capital goods and the management, known as 'plant', represents affixed cost for the producer because he cannot escape these costs even if he stops production completely. That is the reason why the costs of such inputs are called 'fixed costs'.

We will discuss this aspect latter in greater detail. At this point it should suffice to say that in the short run a producer can increase or decrease the level of output only by increasing or decreasing the application of 'variable' inputs with a fixed amount of some other factors (i.e., the plant). On the other hand, in the long run (when the producer is free from short-run commitments) all factors are variable and he can vary the level of output by varying the amounts of all factors. Short run may be defined as the period which is too short to permit firms to adjust amounts of all factors in accordance with the requirements of production but long enough to permit adjustment of output by applying larger or smaller amounts of variable factors with the fixed equipment of the firm. Long run, on the other hand, refers to the time period which is long enough to permit firms to adjust amounts of all factors to suit long-run requirements. Short and long runs do not refer to any definite time period . Short and long periods vary from industry to industry. For

example, the short run from the standpoint of steel industry may range over five to seven decades, whereas it may be just a few months for fishermen who do not use much fixed capital except their fishing nets.

Corresponding to the distinction between short and long runs, we have short-run and long-run production functions. The short-run production function describes the technical relation between the quantities of some variable input(s) and the resulting output when amounts of some factors are fixed. On the other hand, the long run production function describes the technical relation between quantities of factor inputs and the resulting output when amounts of all factors are variable in the same proportion or different proportions.

Intext Questions:

Q.1. Fill in the blanks:

- All inputs/Factors of Production become variable in nature in the _____ run.
  (Answer: Long Run)

Q.2. True/False:

- 'Plant size' of a firm is a variable input / Factor of Production.
  (Answer: False)
- Raw materials, Fuel, power are variable factors of production.
  (Answer: True)
- All Factor of Production are fixed (in nature) I the short run
  (Answer: False)

9.3 THE SHORT-RUN PRODUCTION FUNCTION

In the preceding section we explained in some detail the basis of the distinction between the long-run and the short-run. Short-run is a period during which the durable-use capital equipments (and also the management) of a firm are fixed and changes in output can be brought about only by applying larger or smaller amounts of the variable factor(s) with the given equipment. When a firm tries to increase its output in this way, it evidently changes the proportion between the fixed and the variable factors. Let us assume that fixed factors are represented by capital (K) and variable factors are represented by labour (L).

We can write the short-run production function as:

$Q = f (L) \acute{K}$

This says that output (Q) is a function of or depends on labour (L) given fixed amount of capital at $\acute{K}$.

The production function in this case is described by the Law of Variable Proportions or what is more popularly known as the 'Law of Diminishing Returns'.

Assuming that there is only one variable factor (consisting of homogeneous units) and constant technology, the Law can be stated as follows:

'Other things remaining constant, when more and more units of a variable factor are used with a fixed quantity of other factors, eventually the marginal product of the variable factor starts diminishing'. Marginal product refers to the addition made to total output due to the use of an additional unit of a variable factor, the amounts of all other factors remaining constant. For example, if due to the employment of 11 labours instead of 10 the total output increases form 100

units to 115 units per day, in that case the marginal product due to the eleventh labourer will be 15 units. The operation of the Law of Variable Proportions (or The Law of Diminishing Marginal Returns) is illustrated with a simple example. Suppose a small production unit producing shoes obtains the following results when it engaged more and more labourers with the given equipment.

TABLE 9.1

Unit of Variable Input Labour	*Total Product*	*Marginal Product*	*Average Product*
(1)	**(2)**	**(3)**	**(4)**
1	15	15	15
2	60	45	30
3	123	63	41
4	200	77	50
5	285	85	57
6	372	87	62
7	455	83	65
8	530	75	66
9	596	66	66
10	640	44	64
11	660	20	60
12	660	Zero	55
13	650	(–)10	50

We see in the Table 9.1 above that total output increases continuously with every increase in the variable input i.e., labour- in this example. Only when the 12th Unit of labour is employed does the total product remain constant at 660. And with the employment of the 13th labourer total output diminishes from 660 to 650. However, the increase in total product corresponding to each addition to labour is not the same. Column (3) is derived by finding the addition to total product made by each successive unit of labour. This is calculated by finding the absolute difference between every two consecutive figures of total product and is called Marginal Product. The law of variable proportions states that as the input of a factor increases, with all other factor inputs remaining constant, the marginal product of variable factor starts diminishing after a point. In the present example, marginal product increases upto the employment of sixth unit of labour where it is maximum and decreases continuously after that till it becomes (–)10 for the last unit of labour employed.

Just as we have derived marginal product form the total product, we can also derive average product from the latter. This can be done by dividing each figure of total product by the number of units of labour employed i.e. by dividing each element in column (2) by the corresponding element in column (1) average product, as the name indicates, represents the average productivity of the variable input (i.e, output per unit of input) at each point. Looking at column (4) we observe that average product also increases in the beginning. In fact, the raising phase of the average product is even longer than that of the marginal product. Marginal product starts declining with the employment of the seventh unit of labour while average product continues to rise upto the eighth unit after which it also falls. The relationship between the average and the marginal values is as expected. If a marginal value is above the average value, it pulls the average up while a marginal value below the average value pushes it down. Since both marginal and average values use up to a point and then fall, it stands to reason that the highest point is different for both. The marginal value reaches its highest point before the average reaches its maximum. The reason is that for some lime, the marginal value, though falling, is above the average which, as a consequence rises. But the average starts fallings as soon as the marginal value becomes lower than the average. As a result, the marginal and average values are equal at the point where

the average reaches its highest point, in the example given above, this happens when the ninth unit of labour is employed. You may also observe that the marginal product falls at a much faster rate compared to the average product which experience a relatively gradual decline. As for the reason for first rising and then falling average product we may say that there exists an optimum proportion in which fixed and variable inputs can be combined. When the variable input is combined with the fixed factors in this particular proportion, average product attains its highest value or output per unit of input is the maximum. Before this point, the variable input is spread too sparsely over the fixed factor inputs and every increase in the variable input leads to a more than proportionate increase in total product, thus raising the average product. After this point, the variable input is used too intensively and further increases in this input result in less than proportionate increase in total product, thus lowering the average product.

The law of variable proportions can also be illustrated with the help of a diagram. In part (a) and (b) of diagram 9.1 below, we draw the total product and marginal product curves respectively. In order to keep the diagram simple, we do not draw the average product curve. However, you are expected to remember the relationship between average and marginal values and draw the average product curve as an exercise.

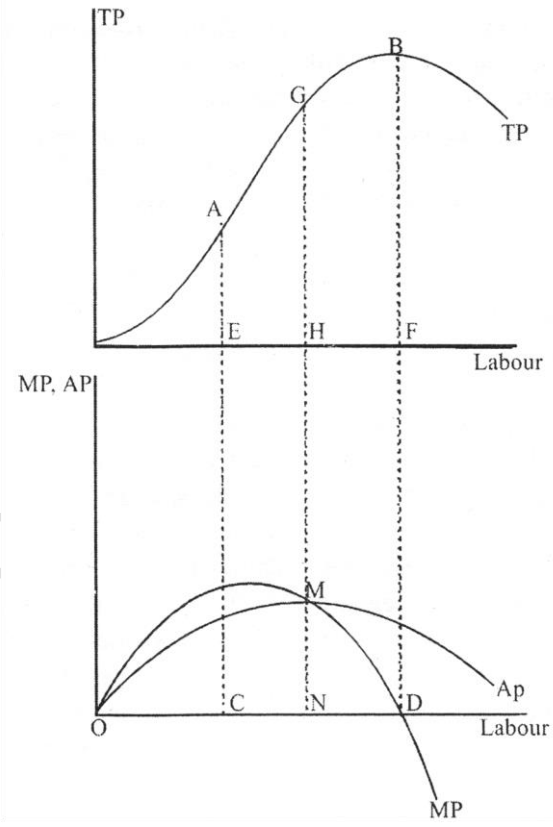


Diagram 9.1

The law of variable proportions states that as successive additions are made to the input of a particular factor, keeping all other factor inputs constant, the marginal product falling after a point.

In part (a) of diagram 9.1 above, curve TP is the production function specifying the relationship between the variable input (i.e. labour) on the one hand and total output on the other. It must be clear to the students familiar with elementary' mathematics that the slope of the curve

rises form the origin to point A. As the slope of the curve signifies marginal product of the variable factor, we can say that marginal product of labour on this stretch is positive and increasing. In mathematical notation, both the first and the second derivatives of the production function with respect to labour input are positive. The same phenomenon is shown in part (b) where the marginal product curve MP lies in the first quadrant and rises form point O to point C which is the highest point. Curve TP in part (a) keeps on rising even after point A but its slope falls. At point B, the curve attains its highest point and starts falling after that. In other words, the slope of curve TP, though remaining positive, declines continuously between point A and point B and approaches zero. It however, changes its sign after point B and becomes negative. Hence the behavior of curve MP between point C and point D in part (b) and beyond that. The average product (AP) curve as shown in part (b) above rises till point M and falls after that. Unlike MP, the AP never becomes negative because both TP and Labour units arc positive amounts. There is no need to emphasis here that no rational producer will venture to go beyond point B on the total product curve or point D on the marginal product curve i.e., the range of diminishing total output or negative marginal productivity of the variable factor. This statement holds good irrespective of the price of the product or that of the variable factor. The reason is obvious. Any addition to the quantum of the variable factor detracts form the total output rather than adding to it. Therefore, on the basis of technical efficiency alone, no producer will employ an amount of the variable factor greater that OF (=OD). What about the range of increasing marginal productivity? As application of each successive unit of the variable factor results in successively higher additions to total output, it is not rational on the part of the producer to stop short of point A on the total product curve or point C on the marginal product curve and leave unutilized the potential for increasing productivity further. Therefore, we can say that on purely technical grounds, the ranges of the production function depicted in Figure I before point A or after point B are ruled out as irrational. A rational producer will neither operate in the range of positive and increasing marginal productivity nor in that of the negative marginal productivity of the variable factor. By the method of elimination, we observe that the range of rationality lies between point A and B on the total product curve (where the latter rises, but at a failing rate) or between point C and D on the marginal product curve (where the variable factor has positive, but decreasing marginal productivity). In order to know where exactly in the rational range will the producer operate, we require additional information regarding prices. But at the moment, we are only concerned with technical relationships and not with efficiency in the economic sense.

Intext Questions :

Q.1. Define the Law Diminishing Returns.

Q.2. Fill in the blanks:
'The law of diminishing returns is also known as the Law of _____ _____.
(Answer : Variable Proportions)

Q.3. Define Total Product (TP), Marginal Product (MP) and Average Product (AP) curves.

Q.4. A rational Producer will not operate where his TP/MP/AP is _____ .
(answer : Positive and rising)

9.4 THE LONG RUN PRODUCTION FUNCTION

As explained in section II above, long run is the period during which all the factors are variable. In the long run total output can be increased or decreased by changing all factor inputs by the same proportion or by different proportions. We will, however, concentrate only on the first case, that is, the changes in the level of output in response to changes in all inputs in the same

proportion. The term ‘returns to scale’ refers to the response of total output to changes in all inputs by the same proportion. The laws of "returns to scale’ refer to the effects of scale relationships. However, before studying the laws of ‘returns to scale’ let us explain and important tool of analysis- the concept of an ‘isoquant’ (’iso’ meaning equal and ‘quant’ meaning quantity). An ‘isoquant’ or an ‘iso-product curve’ is a graphical depiction of the alternative combinations of two factor inputs (i.e. methods of production) to produce a given level of output.

The Concept of Isoquant

Usually, it is possible to produce a commodity using different combinations of factor inputs (or what is the same thing, methods of production). For example, it may be possible to produce one unit of a commodity X by the following combinations of capital and labour:

	Method A	***Method B***	***Method C***
Units of Capital	5	4	3
Units of Labour	2	3	4.5

These three alternative processes or methods of producing one unit of X are shown in the Diagram 9.2 below:

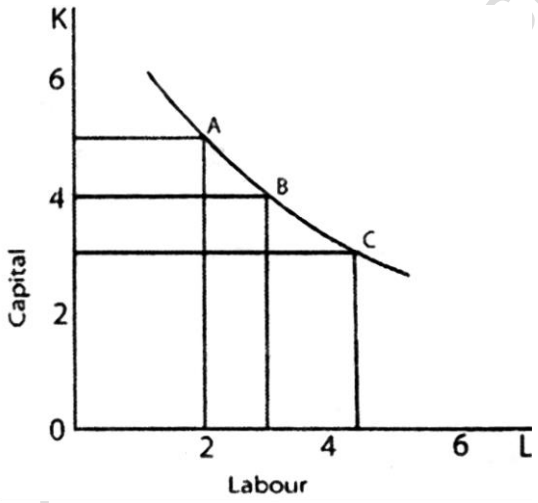


Diagram 9.2

In this diagram we measure units of capital along the vertical axis and units of labour along the horizontal axis. Point A represents method A which combines 5 units of capital with 2 units of labour. Point C represents method C combining 3 units of capital with 4.5 units labour. The three points represent three alternative methods of producing the same output-one unit of X, Therefore, a curve, such as ABC in the diagram, is called ‘an isoquant’ or ‘iso-product curve because it represents alternative methods (i.e., combinations of factor inputs) for producing the same output (’iso’ meaning equal and ‘quant’ meaning quantity).

As is evident form the above diagram, method A combines the largest number of units of capital with the smallest number of units of labour while it is just the opposite with method C and method B lying in between. The "isoquant’ ABC represents a production function which includes 3 alternative methods of producing a given output. It is a long- run production function in the sense that these alternatives exist only so long as an investment decision is not taken. There cease to be available the moment a producer selects one of them and sinks his funds in it.

To sum up we can say that the production function is the sum total of ail technically efficient methods of production available to produce a given output at any time given the prevailing state of technology. It we measure two factor inputs (viz., capital and labour), as in Diagram. 6.2 above, the locus of ail such points as A,B,C, etc; representing different combinations of capital and labour, for producing the same output, is the production function. We show it in Diagram 9.3.

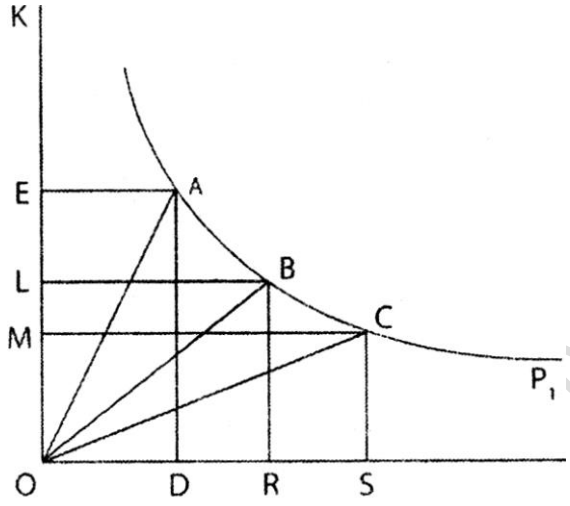


Diagram 9.3

The smooth curve P, in Diagram 9.3 is the locus of all points like A,B,C. which represent alternative technically efficient processes using different combinations of labour and capital to produce a give output. Isoquant P, is the production function prevailing at a particular point of time, i.e., representing a particular state of technology.

It is necessary' at this stage to clarify that we do not consider technically inefficient method i.e., those methods which compared another method, use the same number of units of one factor and a larger number of unit of the other or a larger number of units of both the factors. In the example given below, method B is inefficient compared to method A as it uses the same amount of capital (3 units) with a higher amount of labour (3). This simply means that the extra unit of labour used in method B makes no contribution to output and as such its use is wasteful. Method C is still more inefficient using more

	Method A	***Method D***	***Method B***	***Method C***
Units of Capital	2	3	3	3
Units of Laour	3	3	4	2

both labour and capital compared to method A. Method B and C are also technically inefficient compared to method D. Therefore, method B and C are rejected straightway as technically inefficient. But it is not possible to compare method A and method D from the viewpoint of efficiency. Both are technically efficient as each one of them uses a higher amount of one factor with a lower amount of another but it is not possible to determine which one is economically efficient without bringing in the factor prices. While technical efficiency is concerned with only quantities of factor inputs, economic efficiency is concerned with total cost in terms of money. Therefore, you should clearly grasp the difference between technical efficiency and economic efficiency. A technically efficient method may turn out to be economically inefficient with one set of factor prices and the dame method may become efficient with a different set of prices. But a technically inefficient method can never turn out-to be economically whatever be the factor

prices. We illustrate this point with a simple example. Let us suppose that in order to produce a unit of X the following three methods are available:

	Method A	*Method B*	*Method C*
Units of Capital	5	4	3
Units of Labour	3	4	5

It we assume per unit prices of capital and labour to be Rs. 5 and Rs. 3 respectively, then method C is the most efficient. However, if the per unit prices of capital and labour are Rs. 3 and Rs. 5 respectively, in that case method A turns out to be the cheapest. Thus, technical efficiency and economic efficiency are not the same thing. Production function describes not only a single isoquant, but the whole array of isoquants, each representing a different level of output. It shows how total output responds when a mounts of both inputs are multiplied. Diagram 6.4 shows that doubling of output from 100 × 200*x* requires only a 50% increase in both inputs-from 4K plus 6L to 6K. plus 9L. It also shows that doubling of both inputs from 4K plus 6L to 8K plus 12L results in trebling of output from 100 × 300*x*. In other words, the response of total output to charges in both inputs is more than proportionate.

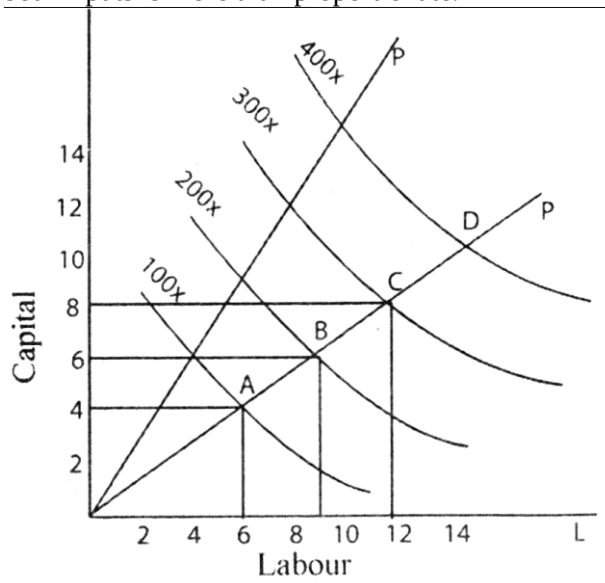


Diagram 9.4

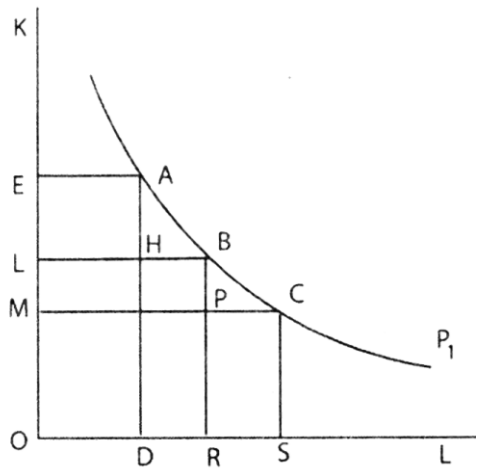


Diagram 9.5

What does a movement from one point to another on the same isoquant imply? It implies that total output remaining constant, labour is being substituted for capital. For example, in diagram 5.5 above point A represents OE of capital of OD of labour and point and point B represents OL of capital and OR of labour. A movement from point A to point B means that the reduction in the amount of capital (=EL=AH) is just being compensated by an increase in the amount of labour (=DR=HB). In other words, HB of labour is being substituted for AH amount of capital. By dividing AH by HB we get the amount of capital that a unit of labour can substitute, total output remaining constant. This rate at which one factor can be substituted for another, at the margin is called the Marginal Rate of Technical Substitution (MRTS). MRTS at any point is measured by the slope of the curve at that point. The slope of a curve at any point equals the slope of the tangent at that point. MRTS measures the degree of substitutability of the two factors or the ease with which one factor can be substituted for another. Suppose point A in the above diagram represents 10 unit of capital and 2 units of labour while point B represents 8 units of capital and 3 units of labour. In this case the reduction in the amount of capital (=2 units) is just being

compensated by one unity increase in the amount of labour so that the total output remains the same. In other words, the MRTS of labour for capital in this case is(–)2/l = (–)2.

Depending upon the degree of substitutability between the two factors isoquants can also have other shapes as shown in the diagrams 9.6 to 9.8.

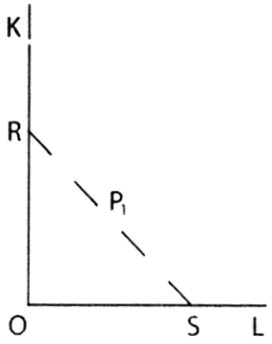


Diagram 9.6

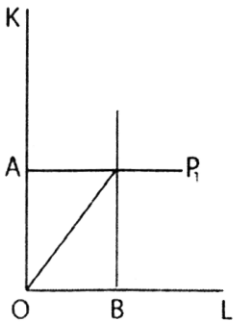


Diagram 9.7

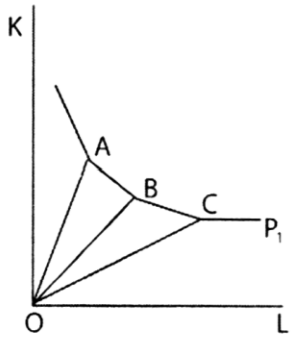


Diagram 9.8

Isoquant P_1 in Diagram 9.6 is Linear (i.e. a straight line) implying that one input can be substituted for the other at a constant rate. This type of isoquant assumes that the factors are perfect substitutes of each other. In other words, it is possible to produce the given commodity with either factor alone or with any combination of two factors at the given constant rate of substitution. The extreme cases are represented by processes R and S using OR of capital with zero labour and OS of labour with zero capital respectively. In Diagram 9.7, the production isoquant P_1 is a right angle meaning thereby that there exists only one method of production or process using OA of capital and OB of labour to produce one unit of output. It also implies zero substitutabitity of the factors of production which are strictly complementary. The linked curve P, in Diagram 9.8 exhibits that there are only a few specific methods (A.B and C) available for producing the commodity in question, it is possible to substitute one factor for the other only at links (points A.B and C in the diagram). In other words, this type of isoquant assumes limited substitutability between the two between the two factors shown on the two axis.

Just as curves TP and MP in the last section can be compared to the total utility curve and marginal utility curve respectively of the Theory of Demand, production isoquants can be linked to consumer indifference curves. However, in the case of consumer indifference curves, two different products are measured on the axis while in the case of production isoquants (which may be called 'producer indifference curves' by analogy), the axis measure quantities of the two variable factor inputs. While various points on an indifference curve represent the same level of utility (which is a psychic entity about the measurability of which economists have difference of opinion), various points on a production isoquant represent the same level of output (which lends itself to unambiguous and precise measurement). Just as an indifference curve shows various combinations to two commodities yielding the same total satisfaction to the consumer, a production isoquant represents various combinations of two factors yielding the same total output to the producer. As far as the shape is concerned, the two curves look exactly alike, i.e, both slope downwards and both are convex to the origin. Just as downward slope of the consumer indifference curves implies positive marginal utility of each of the commodities considered, downward slope of the production isoquant means that both the factor inputs considered have positive marginal productivity. Let us explain this with the help of diagrams.

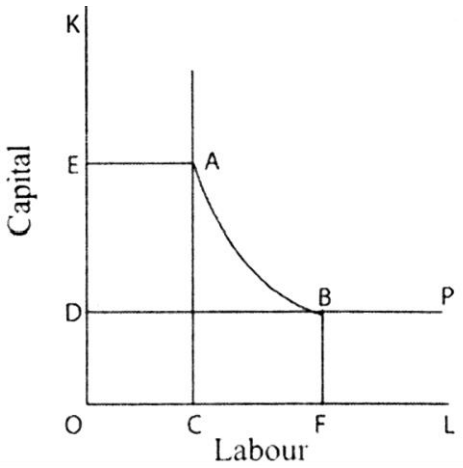


Diagram 9.9

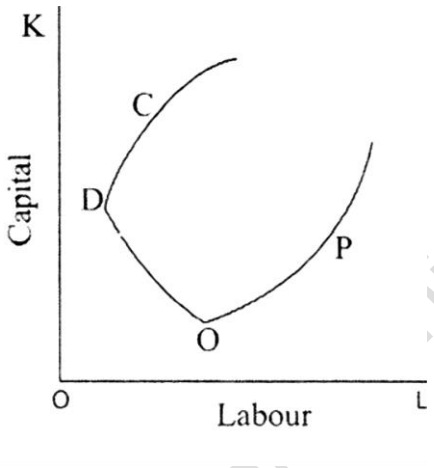


Diagram 9.10

In Diagram 9.9 above, production isoquant P shows various techniques of producing a given level of output, say 100 units. These techniques are nothing but different combinations of labour and capital inputs. You can observe that choosing a point above point A on the isoquant means combining a given quantity of labour (= OC) with a higher and higher input of capital, compared to that at point A, for producing a given level of output. This entails marginal productivity of capital equal to zero. Similarly, choosing a point to the right of point B on curve P involves combining a given amount of capital (= OD) with larger and larger inputs of labour compared to that at point B for producing a fixed output. This implies zero marginal product of labour. In other words, the stretches of isoquant P above point A and to the right of point B represent techniques which are technically inefficient. Thus we rule out parts of production isoquants parallel to any of the axis as irrational. In Diagram 9.10, points to the right of points A and B (e.g., point C and point D) mean that more of both the inputs (compared to points A and B) are used to produce a given level of output. The implication is that the marginal productivity of both the factors is zero on these stretches. Thus we can say that parts of production isoquants with positive slopes are also not in the range of rationality. This leaves us with stretches like those between points A and B in Diagram 9.9 and 9.10. These parts of production isoquants which slope downwards represent methods of production which are technically efficient. Having established the downward slope of the production isoquant we are further faced with three alternative shapes; a straight line, a concave and a convex curve and a convex curve as shown in diagram 9.11, 9.12 and 9.13 below:

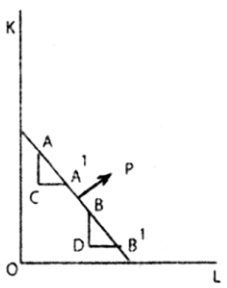


Diagram 9.11

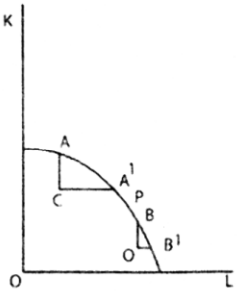


Diagram 9.12

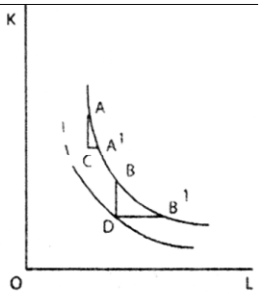


Diagram 9.13

As you see, all these isoquants have negative slopes, but different shapes. It is but proper to spell out the implications of these shapes. A straight line, by definition, has constant slope. Now the slope of the production isoquant is nothing but the marginal rate of substitution of the factor

measured on the X axis (i.e., labour) for the factor measured on the Y axis (i.e., capital). Analogously, the slope of the consumer indifference curve measures the marginal rate of substitution of commodity X for commodity Y. Slope of an isoquant at a particular point can be expressed as the numerator showing the decrease in the input of capital and the denominator measuring the increase in the input of labour. But we know that total output remains the same. This means that the increase in output on account of additional input of labour just equals the decrease in output on account of a smaller input of capital. In other words, $K.MP_K = L.MP_L$, (where MP_K and MP_L stand for the marginal productivity of capital and labour respectively).

If $\Delta K.MP_K = \Delta L.MP_L$

Then $\frac{\Delta K}{\Delta L} = \frac{MP_L}{MP_K}$

Thus, we see that the slope of the isoquant equals the ratio of the marginal products of labour and capital. A straight line production isoquant means that whatever the factor intensity of the method of production (in other words whether the point chosen is nearer the Y axis or the X axis) one unit of capital has to be replace by the same amount of labour in order to maintain the given level of output (or remain on the same isoquant). In diagram 9.11, distance CA' = DB' while AC (=BD) represents one unit of capital. In other words, we can say that a straight line isoquant characterises the situation when the two factor inputs are perfect substitutes for each other and each successive unit of one factor has to be replaced by a constant amount of the other factor. This is the case of constant marginal rate of substitution and also constant ratio of marginal productivities of two factors. Technically, this is all right, but in real life factors are seldom perfect substitutes of each other. A concave production isoquant like the one shown in a diagram 9.12 has a constantly increasing slope as we move along the curve form the left to the right. In other words, as we substitute labour for capital, successively decreasing amounts of labour are required to replace the same quantity (say, one unit) of capital. While AC = BD in diagram 6.12, DB' <C'A>. This means that as techniques using less and less of capital (and more and more of labour) are adopted, there is a continuous increase in the efficiency of labour as a result of which smaller and smaller amounts of labour are required to replace each successsive unit of capital. This is the case of increasing marginal rate of substitution of labour for capital and also increasing ratio of the marginal productivity of labour to that of capital.The common sense meaning of all this is that as more and more of labour is used, it proves to be a better and better substitute of capital and the same holds good for capital. The obvious implication is that a rational producer should never choose a method using both the factors. We shall take it up again in the context of the optimum, combination of factors in section IV.

Now we consider a convex production isoquant as shown in diagram 9.13. This is the way it is usually drawn in the textbooks on economics. Like indifference curves, isoquants are convex to the origin because of diminishing marginal rate of technical substitution (MRTS). Convexity of an isoquant implies that the MRTS diminishes along the isoquant. The marginal rate of technical substitution between L and K is defined as the quantity of K which can be given up in exchange for an additional unit of L. It can also be defined as the slope of an isoquant.

$MRTS_{LK} = -\Delta K/\Delta L = dK/dL$
Where ΔK is the change in capital and ΔL is the change in labour.

Obviously, it is a curve with constantly decreasing slope as one moves along it form left to the right. The decreasing slope signifies that as more and more labour intensive methods are used to produce a given level of output, larger and larger quantities of labour are required to replace

each successive unit of capital. (In diagram 9.13, AC = BD while DB'>CA'). The same can be said about the substitution of capital for labour. This, in other words, means that the factors are imperfect substitutes of each other. This case of decreasing marginal rate of substitution (and thus decreasing ratio of the marginal productivities of the factors) is also consistent with the law of diminishing returns. (Refer back to the law of Variable Proportions explained in Section 9.3.).As more and more labour is used with less and less of capital, the marginal product of labour falls on two accounts. One because a larger amount of labour used with fixed amount of capital results in a fall in the marginal product of labour on account of the law of diminishing returns. Two, because the amount of capital combined with larger input of labour is not fixed in this case, but in fact, declines, thus resulting in a sharper fall in the marginal product of labour. Hence the decline in the ratio of marginal productivity of labour to that of capital i.e. $\frac{MP_L}{MP_K}$ (Note that apart form the numerator falling the denominator also increases as less and less of capital is used). Just as convexity of the consumer indifference curves implies diminishing marginal rate of substitution of goods (based on the law of diminishing marginal utility), convexity of the production isoquant also implies diminishing marginal rate of substitution of factors and is consistent with the operation of the law of diminishing returns to a variable factor. To the extent that increasing or constant marginal product of a variable factor (combined with a given amount of fixed factor) is conceivable, the production isoquant may have straight line or concave stretches. But it is always technically efficient to operate on a convex stretch of the isoquant just as it is rational to operate on that part of the total product curve which is characterized by positive but declining marginal productivity of the variable factor.

While concluding the discussion on the shape of production isoquants, we may add that just as higher and higher indifference curves signify higher and higher levels of satisfaction, higher and higher production isoquants represent larger and larger volumes of output. Moreover, just as no two indifferences curves but each other, no two isoquants cut each other. (If there do so, absurd conclusions can be shown to follow. Do it as an exercise). If however, a particular isoquant shifts to the left (as the broken curve shown in diagram 9.13). It means that the same output can be produced with less of both the inputs. This happens when technical progress takes place. Having equipped ourselves with the concept of a production isoquant (a special form of the production function), we now proceed to make use of this concept in describing the laws of production.

9.4.1 Elasticity of Substitution

Apart from the concept of production function we also have to explain some related concepts. First of all, we take up the concept of the 'marginal productivity' of a factor of production and explain it with the help of a simple diagram showing total product curve corresponding to inputs of a variable factor (labour). A movement form point R to unit S on curve P_1 involves an increase in the input of labour equal to BD resulting in CA of additional output. Dividing this additional output (=CA) by additional input of labour (=BD). we get additional output due to additional unit of labour or what is called in economics, 'the marginal productivity' of labour. To repeat, marginal productivity of a factor is the addition to total output that results form a small increase in the input of this factor, all other factor inputs remaining the same. Geometrically, marginal productivity of labour in Diagram 6.1 is represented by the slope of the total product curve TP. Obviously, the slope of TP is different at every point of the curve. In fact, after point A, it decrease continuously with every increase in labour input. The curve TP in Diagram 9.1 implies decreasing marginal productivity of labour after point A or diminishing returns to labour (which is the variable factor in this case). Going back to diagram 9.5 what does the slope of curve P1 signify in this case? Well, each point on this curve represents a particular

combination of the two inputs measured on the X axis and Y axis (i.e, labour and capital respectively). Therefore, any movement to the right signifies substitution of labour for capital and vice versa. For example, a shift form point B to point C on curve P1 in Diagram 9.5 means a decrease in the input of capital form OL to OM (= LM=BN) accompanied by an increase in the input of labour form OR to OS (=RS=NC). Dividing BN by NC, we get the amount of labour which is required to compensate for a small decrease in the input of capital so that total output remains the same. Thus, the slope of isoquant P_1 signifies the rate of technical substitution or the 'marginal rate of technical substitution' of factors. As is evident from the downward slope of curve P1 in diagram 9.5, the MRTS is negative (because the changes in the two inputs have opposite signs) and falls continuously as we move to the right on this curve (because the curve is convex to the origin). The marginal rate of substitution measures the degree of substitutability of the two factors or the ease with which one factor can be substituted for another. But it suffers form a serious defect. It depends on the units of measurement of the factors in question. In order to make it independent of the units of measurement, we divide the percentage change in the capital -labour ratio (a shift from one point to another on the isoquant P1 involves obviously a change in the capital-labour ratio) by the percentage change in the MRTS. The resulting ratio, independent of the units of measurement, i.e, a pure number, is called the 'elasticity of substitution' (Compare it with the 'elasticity of demand' which is the ratio of percentage change in quantity demanded to the percentage change in price). The elasticity of substitution tells us what is the relative magnitude of a change in the capital-labour ratio consequent upon a small change in the MRTS. You will know later on that under perfect competition, the marginal rate of substitution equals the ratio of factor prices. In other words, the elasticity of substitution tells us how producers respond to a small change in relative factor prices by changing the relative factor inputs. The capital-labour ratio K/L (i.e. the input of capital uivided by the input of labour) characterizing a particular process can also be described as the 'factor intensity' of that process. Thus, the factor-intensity at point B on curve P1 in Diagram 9.5 is the ratio of Y co-ordinate to X co-ordinate (i.e., OL/OR). Similarly, the factor intensities of different processes in that figure are measured by the slopes of the respective lines through the origin. As lines OA, OB and OC have constant slopes by virtue of being straight lines, the factor intensity (or the factor proportion) represented by each of these lines remains constant. For example the factor-intensity of process. A equals 3/1 or in other words, process A uses 3 units of capital per unit of labour. Obviously, the exact value of this ratio depends upon the units of measurement. We shall have occasion to refer back to the concepts explained above in later sections.

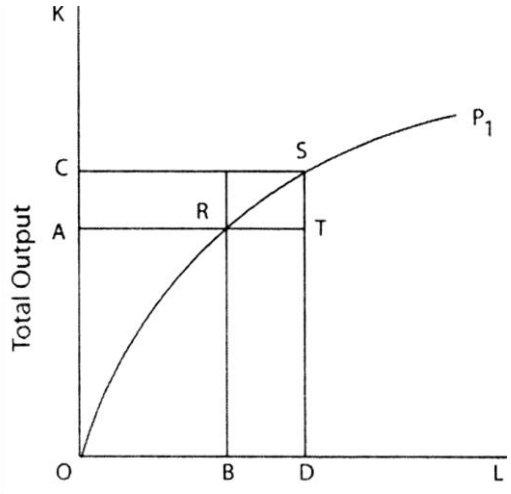


Diagram 9.14

Intext questions :

Q.1. Define Returns to Scale (RTS).

Q.2. Define Isoquants.

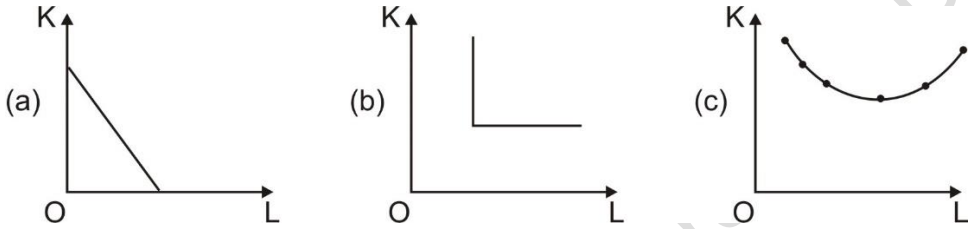
Q.3. True/False.

(i) There are Returns to scale in the Short Run and Long Run.
(Answer : False)

(ii) Isoproduct curve are same output curve with different input variations.
(Answer : True)

Q.4 Define Marginal Rate of Technical substitution (MRTS).

Q.5. Mention the shape of isoquant for following diagrams.



Ans. (a) Linear (b) Strictly Complementary (c) Limited Substitutability

Q.6. True/False

'Indifference curves for consumers are similar to isoquants of producers.
(Ans.: True)

Q.7. Scopes of Isoquants are _____ in the range of efficient production.
(Ans: Negative)

Q.8. _____ shaped isoquants are consistent with law of Diminishing returns.
(Ans. Convex)

Q.9. Define marginal productivity of a factor (MP)

Q.10. Define Marginal Rate of substitution (MRS)

Q.11. What is Elasticity of substitution (EOS)?

9.5 RETURNS TO SCALE vs RETURNS TO A FACTOR

Distinction between 'Returns to Scale' and 'Returns to a Factor'

We have explained in detail (in section II above) the distinction between the long-run and the short-run production function. In the long-run all factors are variable and there fore, a firm can achieve expansion of its output by increasing all factor inputs in the same or different proportions. The term ‘returns to scale’ refers to the response of output when a firm increases ail factor inputs by the same proportion. On the other hand, in the short run a firm increase the amounts of its fixed capital equipment (and also top management) and consequently it is coerced to increase its output by applying larger mounts of the variable factor (s) with the given capital equipment and management. The response of output in this case describes the law of variable proportions. Lest you should confuse the two terms, let us clarify that the term ‘returns to scale’ is used to describe the response of output when the magnitude (or size or scale) of all factors increases by the same proportion whereas the term ‘return to a factor’ is used to describe the response of output to changes in the amounts of a single factor, the amounts of all other factors remaining constant.

The distinction between 'returns to scale' and 'returns to a factor' is brought out very clearly in the diagram 9.15.

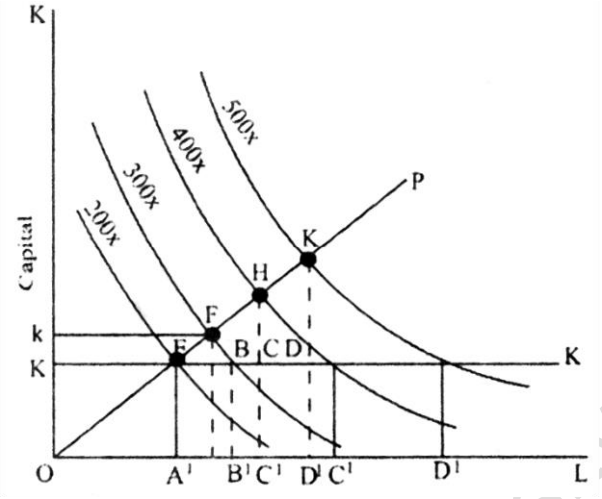


Diagram 9.15

Along the straight line OP the proportion between the two factors (K/L) remains constant throughout. Therefore, this line can be used to measure changes in the amounts of the two factors combined in a fixed proportion. In the long run a firm can achieve the expansion of its output by moving along OP(-that is, by increasing both factors by the same proportion), in the short run, however, the firm cannot increase the capital equipment and management at its disposal (equal to K), It can expand its output along KK – that is, by applying more operative labour with the fixed amount of other factors.

If it were possible for the firm to increase both inputs (which is a long-run possibility), it owould move form point E to point F (i.e, by increasing the amounts of both factors) to expand output from 200*x* to 300*x* per day. This is, however not possible in the short run because the capital equipment of the firm (=K) is not variable for some time. The firm can expand its output by moving along K.K. form point E to point B. Movement along OP characterises 'returns to scale' whereas movement along KK describe 'returns to a variable factor'.

9.5.1 Returns to Scale

As stated earlier, the term 'returns to scale' refers to the response of output as all factors change by the same proportion. Obviously, there are three possibilities the change in output may be proportional, less than proportional to the increase in the inputs. For instance, in response to a 10% increase in the quantities of all factor inputs (–factor proportion remaining constant) output may (increase by exactly 10%, or less than 10% (say, 5%) or more than 10% (say, by20%). Now if the change in output is proportional to the change in inputs, we say that there are constant returns to scale. If the change in output is less than proportional we say that we have decreasing returns to Scale, And if the change hi output is more than proportional to the change in inputs, we say that we have increasing returns to scale. The three possibilities are summarized below:

Percent changes in Inputs	*Percent change in output*	*Returns to scale*
10%	= 10%	Constant
10%	< 10%	Decreasing
10%	> 10%	Increasing

Alternatively, we can exhibit returns to scale with the help of diagram 6.16. Let us measure units of the composite input. (i.e. all inputs combined in a fixed proportion) along the horizontal axis and output along the vertical axis.

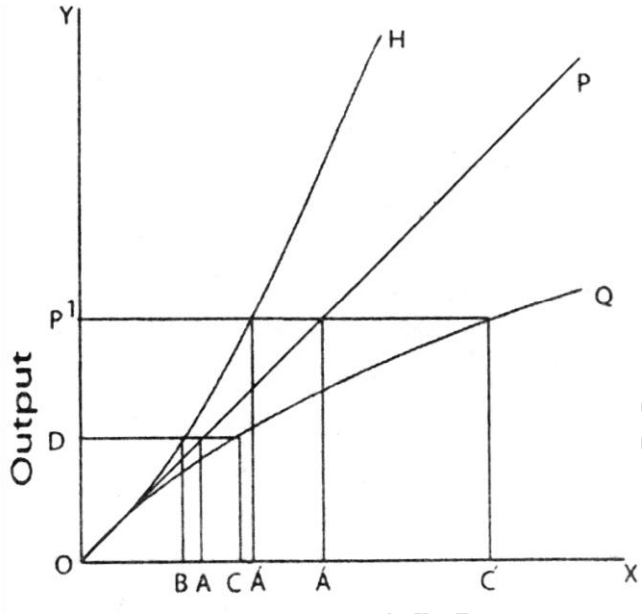


Diagram 9.16

The total product curve originating form point O will show the response of total output to changes in the amounts of the composite input. If the total product curve is a straight line, it will represent constant returns to scale. A movement along this line means a proportional change in output in response to changes in the level of the composite input. For instance, a doubling of the composite input (form OA to OA) results in doubling of the output (from OD to O) and so on. However, if the total product curve is like the curve OR in the diagram 9.16, whose slope is constantly increasing, it will represent increasing returns to scale. A movement along this curve means a more than proportional change in output in response to changes in the level of the composite input. In this case, a doubling of output (from OD to OD) requires less than doubling of the composite input (from OB to OB). On the other hand, if the total product curve has a constantly decreasing slope (it will lie to the right of the straight line product curve), it will represent decreasing returns to scale. In this case for doubling the output from OD to OD requires more than doubling of the composite input (OC>twice OC).

Returns to scale can also be described with the help of production isoquants by drawings inferences regarding the relative positions of the successive 'multiple-level-of-output' isoquants, that is, isoquants that show levels of output which are multiples of some base level of output, e.g., *x*, 2*x*, 3*x*, etc.

A straight line passing through the origin such as OP measures the amounts of the composite input (factors combined in a fixed proportion). Such a line is usually called a product line but it may also be called 'constant factor proportion line'. The distances between the successive 'multiple isoquants' on such a line will indicate whether the input requirements for the successive additions. If the distances between the successive 'multiple isoquants' along a product line are equal, in that case we have constant return.to scale. For example, in -the diagram 9.17 the distances between the successive 'multiple isoquants' along the product line OP are equal (OA = AB = BC = CD, etc.), In case the distances between the successive 'multiple isoquants' along a

product line OP increase implying that for successive additions to output the input requirement is increasing, it would be a case of decreasing returns to scale.

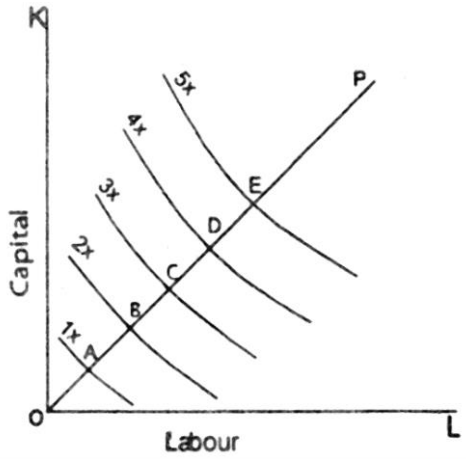


Diagram 9.17

In diagram 9.18 the distance between the successive 'multiple isoquants' is increasing as we move along the product line OP. On the other hand, when the distances between the successive 'multiple isoquants' along a product line tend to decrease, we have increasing returns to scale. In diagram 5.19 the distances between successive multiple isoquants are decreasing (ED < CD < BC < AB). Increasing returns to scale mean that for doubling the output the inputs have to be less than doubled or (which means the same thing) doubling of inputs results in output being more than doubled. On the other hand, in case of decreasing returns, for doubling the output, the inputs have to be more than doubled or (which is the same thing) doubling of inputs results in output being less than doubled.

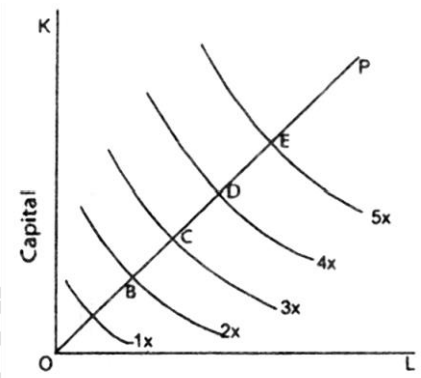


Diagram 9.18

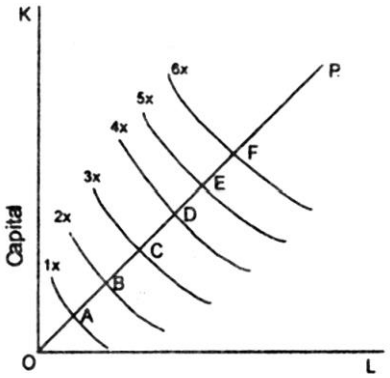


Diagram 9.19

In our discussion above, we have shown constant, increasing and decreasing returns to scale separately. However, it is quite likely that a firm may be faced with different returns to scale over different ranges of output. It may happen that in the beginning a firm may obtain increasing returns to scale as the firm is able to reap technical and managerial economies with increase in its scale of production. For example, efficient mass production methods with higher degree of specialization can be-adopted only when the level of output is sufficiently large. Then there may be purely dimensional returns. (Doubling the diameter of a pipe will more than double the flow

through it). Indivisibility may also give rise to increasing returns to scale. For example, certain equipment may be available in minimum size or in definite ranges of sizes. Such equipment may be used more fully at a higher scale of production. Then, along with an increase in other inputs, a larger amount of managerial talent may result in more efficient functioning through increased specialization. This phase may be followed by constant returns to scale when reaching a 'multiple isoquant requires replication of the plant accordingly. For example, output may be doubled by building and operation another plant which is exactly like the previous one. Decreasing returns to scale are generally explained through indivisibility of the factor of production called 'entrepreneurship'. It is argued that the entrepreneur and his decision-making are indivisible and incapable of augmentation. Therefore, as the scale increases, mounting difficulties of coordination and control lead to decreasing returns. But the use of the term 'scale' here is suspect as at least of the factor inputs has been assumed to be fixed while increase in scale implies a proportional increase in all the inputs.

9.5.2 Are Increasing or Constant Returns to Scale Consistent with Diminishing Returns to a Factor?

In section 5 above we have explained the difference between 'returns to scale' and 'returns to a factor' and also illustrated this difference with production isoquants. You would recall that diminishing returns to a factor account for the convexity of the production isoquants. (Refer to the discussion regarding the shapes of production isoquants). Given the convexity of production isoquants, it can be shown that constant or diminishing returns to scale cannot prevent diminishing returns to a factor. For this purpose we first demonstrate the case of constant returns to scale in the diagram below:

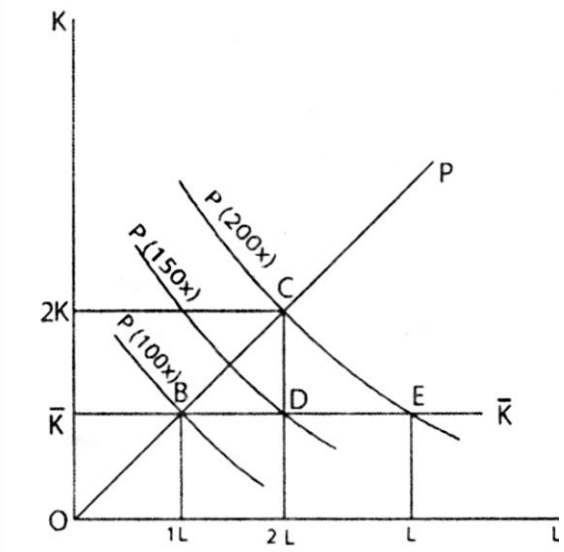


Diagram 9.20

Diagram 9.20 shows that whereas output can be doubled form l00*x* to 200*x* by doubling both inputs (because constant returns to scale obtain), doubling of labour input alone from 1L to 2L, keeping capita! constant at k, results in diminishing marginal product of labour (=50 units of *x*). If however, the firm wants to double its output along this line, it has to operate on point E which lies on P(200), where the input of labour is L which lied on P (200), where the input of labour is L which is more than 2L. Thus we have demonstrated that not only in there no contradiction between constant returns to scale and decreasing returns to the variable factor (or diminishing marginal productivity), the former, in fact, implies the latter, It follows logically that if constant

returns to scale entail diminishing marginal productivity of the variable factor, decreasing returns to scale will mean, faster diminishing returns to the single variable factor. This is shown in diagram 9.21. Since returns to scale are decreasing, with 2 L of labour and 2 K of capital, output reaches level C which is on a lower isoquant that 200*x*. Further, if only labour input is doubled while keeping capital constant, output reaches only level D which is on a still lower isoquant. If, however, the production function shows increasing returns to scale, two opposite influences work on the returns to a single variable factor, increasing returns to scale pulling it up while diminishing marginal productivity pushing it down. The net effect depends upon the relative intensities of the two effects. The returns to the single variable factor(labour in this case) will be diminishing (see diagram 9.22 below) unless the increasing returns to scale are so strong as to more than offset the diminishing marginal productivity of the variable factor (see diagram 9.23).

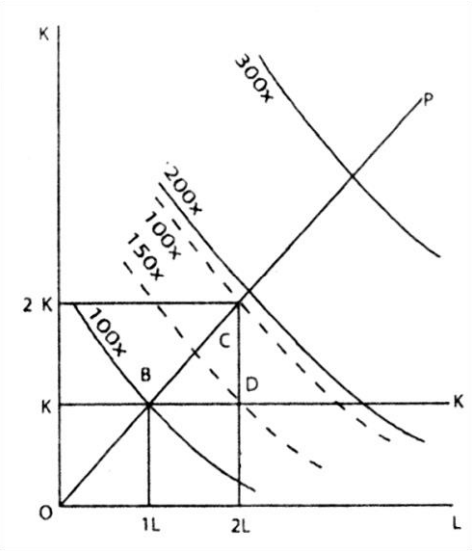


Diagram 9.21

Thus we can conclude that diminishing returns to a single variable factor are in-built into constant and decreasing returns to scale and may also co-exist with increasing returns to scale in certain cases.

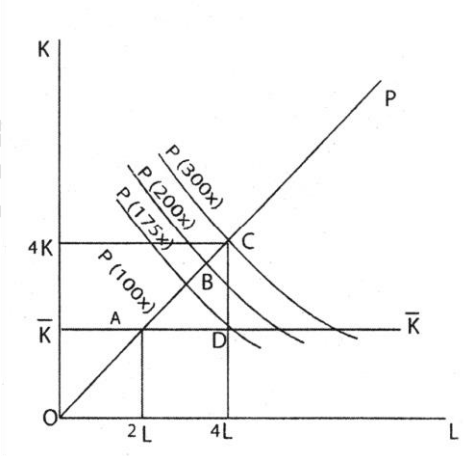


Diagram 9.22

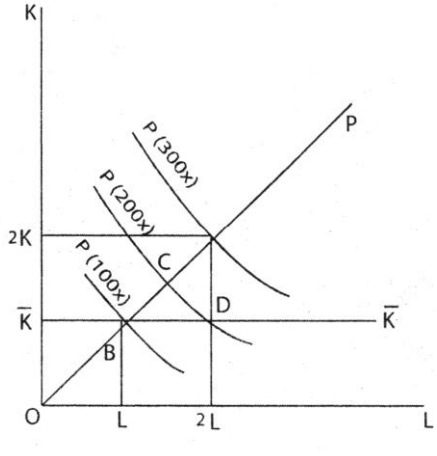


Diagram 9.23

Intext Questions :

Q.1. Define Returns to scale (RTS).

Q.2. Define Returns to Factor (RTF).

Q.3. MCQ type:

When the output change is more than change in input level in production, the returns to scale are _____.

(a) Decreasing (b) Increasing

(c) Zero (d) Constant

[Ans : (b)]

Q.4. When the distance between successive isoquants increases, it represents a case of :

(a) Decreasing RTS (b) Increasing RTS

(c) Constant RTS (d) Zero RTS

[Ans. (a)]

Q.5. State 2 causes for IRS.

Q.6. Indivisibility of the factor of production _____ can result in DRS over time.

(a) Capital (b) Labor

(c) Land (d) Entrepreneurship

[Ans. (d)]

9.6 OPTIMUM COMBINATION OF FACTORS

Till now, we have considered only technical relationships and tries to delineate the area of a firm's choice on the basis of technical efficiency only. But, as you saw, the range of rationality on the production function is quite wide (e.g., the stretch of the total product curve with positive, but decreasing slope or the convex stretch of the production isoquant). The question that now arises is: where does the firm attain equilibrium with regard to the use of factors? Or what is the optimum combination of factors for the firm? You can immediately see that in order to answer this question, knowledge of the technical relationships alone is not sufficient, and prices have to come into the picture. We shall discuss below how the knowledge of the production function combined with that of prices enables a firm to choose the optimum combination of factors. We shall first consider the case of a single product firm, i.e., a firm engaged in producing a single commodity. At the end of this section, we shall consider the case of a firm producing two commodities, which can easily be generalized for a multi-product firm. While considering the case of a single-product firm, we shall first discuss its equilibrium in the short run and then go on to the long-run equilibrium. The essential difference between short run and long run (assuming perfect knowledge of the future and thus ruling out uncertainty) is that the firm has to work under one constraint or the other in the short run while most of the constraints disappear in the long run and the firm can take decisions regarding the level of output more freely. Whatever the time period under consideration, we assume that the objective of the firm is maximization of profit. As we stated earlier, profit is the difference between revenue and cost i.e., the excess of what a firm receives from the sale of its output over how much it spends for producing the output which includes all costs. We confine our analysis to the case where a single firm is too small to influence the price of the product it sells or the prices of the factors it buys. Therefore, the firm has to take the product and factor prices as given and find the optimum position accordingly. This is the implication of perfect competition for an individual firm.

One possible situation is that the amount of total resources at the disposal of the firm is given. In other words, the firm has to operate within the framework of a cost constraint. The goal of the firm, as stated earlier, is to maximize profit. If we denote profit by Π, revenue by R and cost by C, we can write the problem as:

$$\text{maximise } \Pi = R - C$$

Now the revenue of the firm depends upon the level of its output and the price of the product. In other words, $R = P_X . X$ where X is the output of product X and P_X is the price per unit of X. As both P_X and total cost assumed to be constant, the problem boils down to:

$$\text{maximise } \Pi = \bar{P}_X . X - \bar{C}$$

The bar over P_X and C signifies that these are constants. Thus, we are left with X as the only variable on the right-hand side of the above equation. In ordinary language, it means that the firm has to maximize its output with the given amount of resources at its disposal if it wants to maximize profit.

Let us see how the firm goes about it. We conduct the analysis with the help of production isoquants (described in detail in Section 4) and isocost lines. We shall first explain what an 'isocost line' means. !n Section 4, we compared an isoquant to a consumer indifference curve. In the same way, we can compare an isocost line to the price line (or budget line) of the consumer. Just as consumer's budget line shows various combinations of two factors which have the same total cost (equal to the firm's resources assumed to be given). As you can see in Diagram 9.24 below, an isocost line looks exactly like a budget line. Given the prices of the two factors (P_1 and P_k), the producer can spend all his resources (=C) on capital and purchase OA of it or exhaust all his resources in buying OB of labour or buy any combination of labour and capital on line AB (e.g. combinations represented by points such as C,D, etc.) Evidently. $OA=C/P_k$ (in words, the amount of capital which a producer can buy is equal to the resources at his command divided by the price per unit of capital) and $OB= C/P_1$. As you know, line AB is a downward sloping straight line and its slope = OA/OB. Substituting for the value of OA and OB, we find that slope of line AB= OA/OB

$$= C/P_k - CP_1 = \frac{C}{P_k} \times \frac{P_1}{C} \times \frac{P_1}{P_k}$$

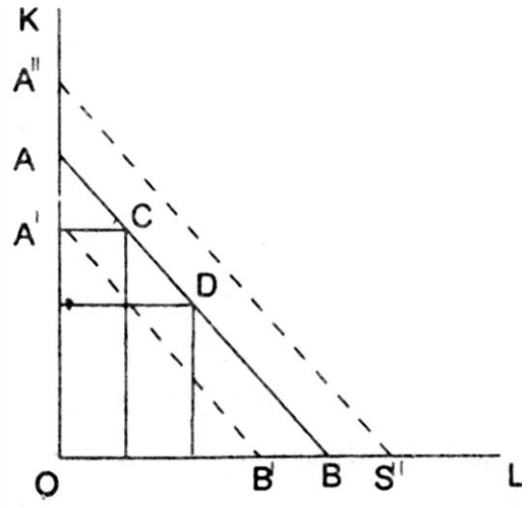


Diagram 9.24

Thus, you see that the slope of the isocost line represents the ratio of factor prices. (You remember that the slope of consumer's budget line equals the ratio of commodity prices). To take the analogy further, the position or location of an isocost line depends upon the firm's cost or outlay just as the location of a budget line depends upon the level of consumer's income. Line A B in diagram 9.24 represents a lower level of cost or outlay compared to that relating to line AB, while A B signifies a higher cost level. Since we are considering the case of a given cost level, there is only one relevant isocost line as shown in diagram 9.25 below. We super impose the isoquant map of the firm on this to determine the point of equilibrium. As explained above the objective of the firm is to maximize output, i.e., to reach the highest possible isoquant. But there is the cost constraint defined by AOB which represents the area of feasibility of the firm. Any point below line AB will imply less than full utilization of the firm's resources while any point above line AB is clearly beyond the reach of the firm, (as it costs more than the given outlay). Thus the highest attainable production isoquant (P_2 in diagram 9.25) is that which is just touched by the given isocost line. The point of equilibrium in digaram 9.25 is point M on isoquant P_2 which is attained by using OK of capital and OL of labour. (You can see that the analogy with the theory of consumer's demand is complete. The point of tangency between the budget line and the highest attainable indifference curve represented consumer's equilibrium).

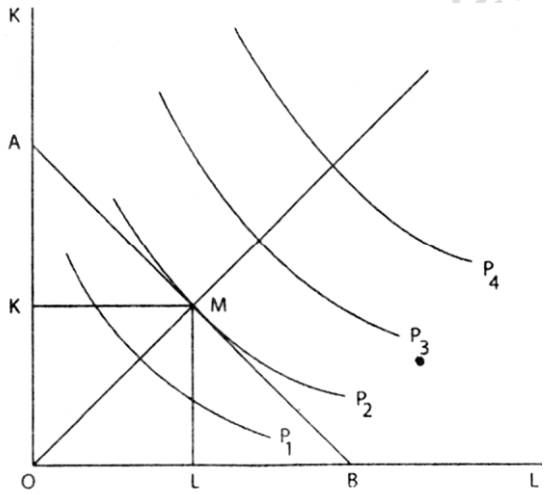


Diagram 9.25

Another situation can be that a firm has decided on a particular level of output taking into consideration various relevant factors e.g. demand for the product, price output policies of other producers (the current situation as well as the expected future trends regarding these factors) etc. Alternatively the level of output may be determined for the firm by an outside agency e.g. the firm may get a contract for a particular job (for building a bridge, road, or tower) or a specific order. In this case, the problem is to maximize profit, given the output constraint i.e.,

$$\text{Maximise} \quad \Pi = R - C$$
$$= P_X \cdot X - C$$

Since both the price of the product (px) and the level of output (X) are given, the only variable left on the right-hand side is C i.e. total cost or outlay. Since C has a negative sign in the above equation, maximisation of profit Π is equivalent to minimisation of cost C. Therefore, the goal of the firm is to minimise C for the given level of output. A given level of output means, diagrammatically, a given production isoquant as shown in diagram 9.26 below.

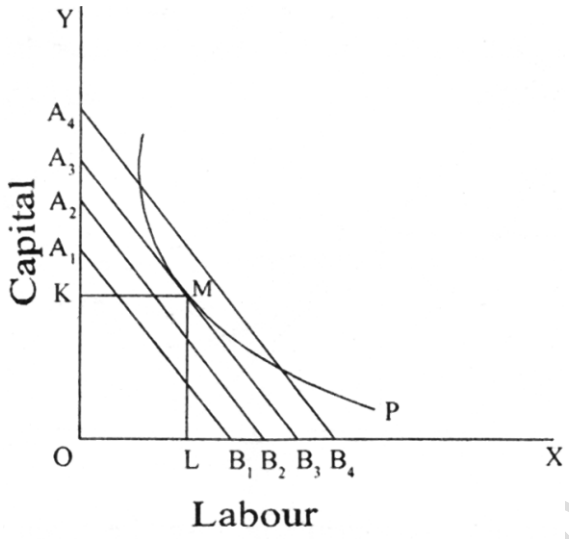


Diagram 9.26

We superimpose on this isoquant various isocost line parallel to each other. With given factor prices, different iso-cost lines are parallel to each other, though at different positions dependent upon the level of total cost. (If factor prices remain constant various isocost lines have the same slope though different positions depending upon the level of total cost or outlay). The firm will be in equilibrium at the point where the given production isoquant touches the lowest possible isocost line. Such a point is represented by point M in diagram 9.26 where the firm produced output given by isoquant P, using L of labour and K of capital so that the total cost at given factor prices is the minimum for this level of output. You must have noticed that whether the firm works under cost constraint and wants to maximize output or it operates under output constraint and aims to minimize cost, the point of equilibrium in both the situations is the point of tangency between a production isoquant and an isocost line. You know that the two curves have the same slope at the point where these are tangent to each other. Now the slope of the production isoquant signifies the marginal rate of (technical) substitution between the factors while the slope of the isocost line signifies the ratio of factor prices. Thus we can say that the firm achieves equilibrium where the marginal rate of substitution of labour for capital equals the ratio of the price of labour to that of capital, that is $MRTS_{l,K} = P_L/P_K$. As we know, $MRS_{l,K}$ is nothing but the amount of capital required to compensate for one unit of labour in order to maintain a given level of output. In other words, $MRS_{l,K} = \Delta K/\Delta L$ (We may remind you that ΔK and ΔL have opposite signs, but we are concerned with their absolute values at the moment). Therefore, we can wirte,

$$MRS_{1,k} = \Delta K/\Delta L = P_L/P_K$$

or $$\Delta K.P_K = \Delta L.P_L$$

This means that on the margin, the cost of capital replaced just equals the cost of additional labour employed. You can see intuitively that if $\Delta L.P_L < \Delta K.P_K$, it is profitable for the firm to substitute labour for capital. If, however, $\Delta L.P_L > \Delta K.P_K$, a profit maximizing firm should replace labour by capital. Thus, a firm stops substituting one factor of the other and attains equilibrium where the cost of additional capital replaced is equal to the cost of additional labour employed at given factor prices. To conclude, we can say that the point of tangency between the given isocost line and the highest attainable production isoquant or the given isoquant and the

lowest possible isocost line indicates to the firm the optimum proportion in which it would combine the two factors.

Intext Questions :

Q.1. In perfect competition :

(a) TR=TC (b) TR=TC=0

(c) TR > TC (d) TR < TC

(Where TR=total Revenue , TC= Total cost)

[Ans. (a)]

Q.2. Define Isocost line.

Q.3. Isocost lines are also called _____ of the consumer.

(Ans. Budget Line / Price Line)

Q.4. Point of equilibrium of the firm is the point of tangency between :

(a) Indifference curve and isocost line

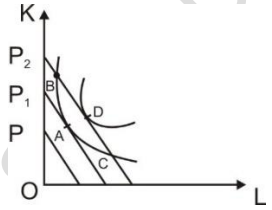
(b) Isocost line and isoquant

(c) Isoquant and indifference curve

(d) Isoquant and x-axis

[Ans. (c)]

Q.5. In figure 1, Equilibrium of consumer is correctly shown by point :



(a) A (b) B

(c) C (d) D

[Ans. A]

Q.6. Formula for MRTS (L,K) is:

(a) $\frac{P_L}{P_K} = \frac{\Delta K}{\Delta L}$ (b) $\frac{P_L}{P_K} = \frac{\Delta L}{\Delta K}$

(c) $\frac{P_K}{P_L} = \frac{\Delta K}{\Delta L}$ (d) $\frac{P_K}{P_L} = \frac{\Delta L}{\Delta K}$

[Ans. (a)]

9.7 EXPANSION PATH

We now assume away all constraints on the firm relating to cost or output and see how it behaves in order to maximize its profit in the long run. This kind of unconstrained profit maximization boils down to the choice of optimal expansion path over time. We first consider the case when all factors are variable thus there is no limitation, technical or financial, on the expansion of output. The objective of the firm is to choose the optimal way of expanding its output so as to maximize its profits. As you must have guessed, with given factor prices and

production function, the optimal expansion path is determined by the points of tangency between successive isocost lines and successive production isoquants as shown in diagram 9.27.

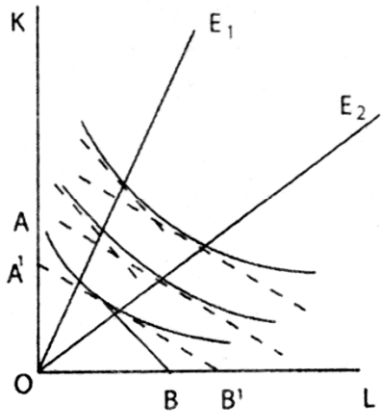


Diagram 9.27

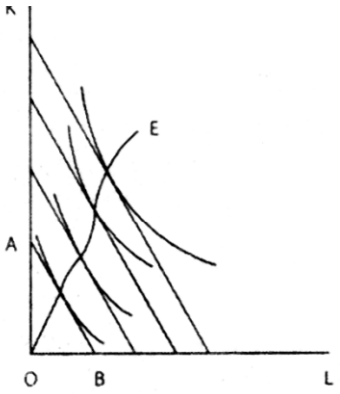


Diagram 9.28

If the production function is homogeneous, the expansion path will be a straight line through the origin like OE_1 or OE_2 as shown in diagram 9.27, (Homogeneity means that if we increase both the factors by the same proportion 'h' i.e., form L and K to hL and hK respectively, the resulting new level of output is such that k can be factored out. For example, if both the factor inputs are doubled, the resulting level of output $P = 2v.P_0$ where P_0 is the initial level of output and v is the degree of homogeneity. When v = 0. there is no change in output, when v=l the output doubles with the doubling of inputs and the function is called linear homogeneous or homogeneous of degree 1. Obviously v > 1 signifies increasing returns and v < 1 decreasing returns to scale). As already explained, the slope of this line will determine the optimal K/L ratio. The slope will, however, depend upon the prevailing factor prices. A higher ratio of factor prices P_L/P_K signified by the steeper isocost lines (likes AB and lines parallel to it in comparison to relatively Hatter A'B' and lines parallel to it) will result in an expansion path closer to the Y axis (OE, compared to OE; in diagram 9.27). Expansion path OE_1 which has a higher slope than OE_2. Obviously, a change in the ratio of of factor prices leads to a change in the optimal expansion path. If, however, the production function is non-homogeneous, the optimal expansion path will not be a straight line even if the ratio of factor prices remains constant. It is curvilinear like OE in diagram 9.28.

Intext Questions:

Q.1. Define expansion path.

Q.2. True/False

1. When production function is homogeneous, the expansion path is a straight line.

   [Ans. True]

2. When production function is non-homogenous, the Expansion Path is a straight line.

   [Ans. False]

Learning Outcomes

In this lesson you have learnt the following:-

- Production function is defined as the technique, combination of various inputs required to produce a product.
- In the short run there is presence of both fixed and variable factors whereas in the long run all the factors are variable. The law of variable proportion which operates in the short run states that when more and more units of a variable factor is used with a fixed factor the marginal product of the variable factor may increase in the beginning but it will eventually fall.
- Stages of variable factor known as:-
  1. Stage of increasing returns to factor
  2. Stage of decreasing returns to factor
  3. Stage of negative returns to factors
- In the long run assuming homogenous production function the law of return to scale operates in three different ways:-
  1. Law of constant returns to scale
  2. Increasing returns to scale
  3. Decreasing returns to scale
- Isoquant is defined as the locus of various combinations of two variable factors giving same level of output at each combination. If factors are prevented, it substitutes the isoquant becomes straight line, which is L shaped when factors are complementary to each other. The slope of the isoquant is called marginal rate of technical substitution.
- The optimum combination of factor which is also the equilibrium of the producer is achieved at the point where the isocost and isoquant are tangent to each other.
- The locus of the equilibrium points resulting out of changing isocost of the producer is called expansion path.

TERMINAL QUESTIONS

Q.1. Explain RTS and its 3 types with diagrams.

Q.2. Critically examine the Law of variable proportions in the short and Long run with diagrams.

❑❑❑

LESSON: 10

COST

INTRODUCTION

It bears repetition to say that we are analyzing the behavior of a rational producer who is assumed to produce each level of output at the minimum possible cost under the given set of conditions and to sell the output produced to obtain maximum total revenue. This implies that the producer has perfect knowledge regarding technical aspects of production (physical input/ output relationship), factor prices (and hence the optimum factor combinations) and the demand conditions for this product. This is a purely theoretical construct aimed at simplifying the analysis. That the producer (or the so called 'entrepreneur') has no such knowledge in a capitalist economy and the consequences arising out of the lack of knowledge are discussed in Set VIII of this paper. Till then we will continue to assume that the producer has perfect knowledge of the magnitudes relevant for his decision-making.

After going through this lesson you will learn:-

- Distinguish between fixed and variable cost
- Draw the short run cost curves
- Explain the U-shape of the cost curves
- Derive the long run cost curves
- Determine the relationship between various cost curves, such as average cost and marginal cost.
- Define total average and marginal revenue
- Determine relationship between average and marginal revenue.

10.1 COMPONENTS OF TOTAL COSTS; FIXED AND VARIABLE COSTS

Whatever costs a firm incurs in order to produce a certain output (including implicit costs) constitute total costs of that output. However, when we carefully examine the nature of various inputs used in production, we find that while some inputs can be varied as and when desired, some others cannot be varied at will over certain period, which restrict the firm's freedom of choice of alternative production possibilities over the relevant period.

A. Fixed Costs

Firstly, in order to produce a certain level of output a firm has to equip itself with a certain amount of durable-use capital goods such as machines, buildings, tools, equipment, etc., which if property maintained aid production over a long period of time. Their use is not confined to a single act of production but extends over time into the future. The returns form such capital goods are spread over the whole of their productive lives. Therefore, while planning to install them a producer has necessarily to take into consideration the whole stream of returns obtainable form over the whole of their productive lives. A producer would install such capital goods only if they are expected to yield a normal return (at least equal to the rate of interest) over the whole of their productive lives and not merely on the basis of short-run prospect. Also such capital goods generally take considerable time to build. Because of these constraints the amounts of such durable use capital goods cannot be varied over short periods. In other words, their amounts are fixed in the short run. The only alternative available to the firm for meeting short run fluctuations in demand is to produce a larger or a smaller output by applying more or fewer units of other factors with the fixed equipment of the firm. Executives, managers, supervisors and other

permanent staff, constituting what is called the 'management of the firm', are also of the nature of fixed factors. This configuration of the fixed capital equipment and management is designed to produce a certain output at the minimum average cost. This, however, does not mean that the given fixed equipment cannot produce a larger or a smaller than the optimum output. It is possible to produce a larger or a smaller output by using given equipment more or less intensively (by applying more or fewer other variable inputs) but in that case average cost would be more than the optimum level. *The costs of factors whose amounts cannot be increased or decreased over certain periods are called fixed costs*.

B. Variable Costs

There are certain other inputs whose amounts can be varied in the short run according to production requirements. The costs of such inputs are called variable costs. Costs of operative labour, raw materials, power, fuel, lubricants, transport, etc., are some examples of various costs. For example, if a spinning mill decides to produce more yarn, it will need more cotton, more labour, more power, fuel, lubricants, etc. On the other hand, if it decides to produce less it will need less of such items. And if the mill stops production completely, it will require no amount of such items and consequently its variable costs will be zero. *Thus, we see that (a) variable costs need to be incurred only when some output is produced and (b) their total varies directly with variations in the level of output produced.*

Intext Questions :

Q.1. Define fixed cost (FC).

Q.2. Define variable cost (VC).

Q.3. Total cost (TC) for a firm is :

(a) TC=FC (b) TC=VC

(c) TC=VC+FC (d) TC=TI (profit)

[Ans. (b)]

10.2 ANALYTICAL SIGNIFICANT OF THE DISTINCTION

What is the analysis significance of the classification of costs into the fixed and variable components? By definition, fixed costs are independent of the short run changes in the level of output. In the short run, whether a firm produces a larger or a smaller output, the total of fixed costs remains unaffected. Having once committed its resources in such factors, the firm has no alternative but to bear the loss represented by the total fixed costs even if the firm produces no output at all. On the other hand, a firm needs to incur variable costs only when it undertakes some production. It will not incur any variable costs at ail when production is suspended. But the burden of fixed costs will continue even when production is suspended in the short run. It short, while variable costs are 'avoidable' fixed costs are 'unavoidable' and have to be borne even if no output is produced. From this it follows that the costs relevant for short-run production decisions of a firm are the variable costs and not fixed costs.

If the firm stops production completely, its maximum loss would equal the amount of Total Fixed Costs (TFC). If it decides to produce some output, it will have to incur some variable costs as well. If, in the short run, the price of the product does not cover even the variable costs, the firm will not undertake production because by producing some output under these conditions, it will incur a loss on variable cost, also (besides the loss represented by the fixed costs) and thus, will further add to the loss represented by the fixed costs. But the loss on variable costs is avoidable. Therefore, under such conditions the firm will prefer smaller loss (=TFC) to a greater loss. On the other hand, if the price of the product covers the variable costs and also leaves a

margin which goes to meet at least a part of the fixed costs (though not the w hole of the fixed costs). It would be rational for the firm to undertake production because by doing so it would be minimizing the loss which, it has to bear even in case of stoppage of production. From this it follows that fixed costs have no bearing on the short run production decisions of a firm. Whether or not a firm will undertake any production in the short run, will depend on whether or not the price of the production covers the average variable cost. If the price covers the average variable cost and leaves some margin, the firm will undertake production other wise it will not. *It is in this sense that fixed costs are irrelevant form the stand point of short-run production decisions*.

The bearing of variable costs on the short run production decisions of a firm is clearly brought out with the help of hypothetical figures given in the Table below. We assume that total of fixed costs (TFC) of the firm is Rs. 10,000 and for producing 1000 units of output it has to incur Rs. 5,000 as variable costs so that total cost (total of variable and fixed costs) of producing 1,000 units amounts to Rs. 15,000. Four alternative price situations are considered in the Table 10.1 below.

TABLE 10.1

	Px	*AVC*	*TFC*	*TVC*	*TC*	*TR*	*Losses*
1	–	–	10,000	–	10,000	–	11,000
2	4	5	10,000	5,000	15,000	5,000	10,000
3	5	5	10,000	5,000	15,000	5,000	10000
4	6	5	10,000	5,000	15,000	6,000	9,000

In the table above;
Px stands for the market price of the product.
AVC stands for average variable cost per unit of output.
TFC stands for total fixed costs.
TC stands for total cost whihc equal TFC + TVC.
TR stands for total revenue form the sale of 1,000 units, and Losses equal TC – TR.

In the above table, figures in the first row relate to the situation when the firm undertakes no production at all in the short run. Total loss of the firm in that case would equal to Rs. 10,000. Figures in the second row relate to the situation when the market price of the commodity produced does not cover even the variable costs and consequently the firm's total loss would amount to Rs. 11,000 if it produces output in that situation. If this were the cost-price-situation confronting the firm, it will stop production. (it will prefer a smaller loss of Rs. 10,000 to a greater loss of Rs. 10,000 to a greater loss of Rs. 11,000). Figures in the third row relate to the situation where price of the product just covers the variable costs. Firm's total loss in this case is the same as it would be when no output is produced (situation I). Therefore the firm would be indiffernet whether or not to undertake production in this situation. It may or may not undertake production in this situation. Figures in the fourth row relate to the situation when the price of the product covers the variable costs and leaves a margin of Rs. 1 per unit of output whihc goes to meet a part of the total fixed costs, thus reducing the losses of the firm to Rs. 9000. It is, thus, evident that though even in this situation the firm is producing at a loss but the loss in this case is smaller than what it would be in the event of stoppage of production.

We thus, reach the following conclusions:

1. *Fixed costs have no bearing on the short run production decisions of a firm. Costs relevant for decision making in the short run are variable costs and not fixed costs.*

2. *In the short run a firm will not undertake any production if the price of the product does not cover even the variable costs (price<AVC). Production will be undertaken when price more*

than covers the variable costs even if it does not cover the full costs (price > AVC but <AC). It will be indifferent when price just covers the variable cost (price = AVC).

10.2.1 All Costs are Variable in the Long Run

The distinction between the short run and the long run is based on the invariability of certain factors over certain periods. *Short run may be defined as the period which is too short to permit firms to adjust quantities of all factors in accordance with the requirements of production hut long enough to permit them to adjust their outputs by applying more or fewer units of other variable factors with their given fixed factors. Long period, on the other hand, refers to the time period which is long enough to permit firms to adjust quantities of all factors to suit their requirements*. The distinction between short and long runs does not refer to any definite time period. Short and long periods vary form industry to industry, For example, the short run form the stand point of steel industry may range over a few years, where as it may be just a few months for fishermen who do not use much fixed capital except their fishing nets and boats.

In the long run all costs are variable. It is difficult to think of a factor input whose quantity cannot be varied, given sufficient time for producing it and for allowing old ones to decay and thus, go out of use. Thus, in the long run firms can vary the quantities of all factors as desired. From this it follows that if in an industry a firm is not able to cover its full costs (variable as well as fixed), in the long run (i.e.as soon as it is free from its short run cost commitments) it will leave that industry for better prospects elsewhere. In the short-run a firm is compelled to undertake production even at a loss (i.e., price > AVC but <AC) because of its short run commitments. But in the long run a firm free form all commitments and can choose to stay in the industry or to leave it. It follows that in the long run a firm will not stay in an industry where the price of the product does not cover the average cost including both the fixed and variable components. We may express the same thing by saying that in the long run a firm will continue prodution only if the price of the product is at least equal to AC (including both fixed and variable components). As summary of out discussion of the fixed and variable costs and the corresponding short and long runs, we may state the following:

1. *In the short run a firm will undertake production only if price of the product at least covers AVC.*
2. *In the long run a firm will undertake or continue production only if price of the product at least covers AC(inclusive affixed and variable components).*

Intext Questions :

Q.1. In short run, _____ cost remain unaffected.
(Ans. Fixed costs)

Q.2. A firm will not operate in the short run when :

(a) P < AVC (b) P > AVC
(c) P= AVC (d) P =AVC = 0
[Ans. (a)]

10.3 TOTAL, AVERAGE AND MARGINAL COST CONCEPTS

Total Cost (TC): Total Cost of inputs (purchased from other as well as those supplied by the owners themselves) used for producting a certain output constitute the total cost of that output. Since there are two components of total costs, the variable costs and the fixed costs, therefore, total costs equal the sum of total fixed costs and total variable costs.

Thus:

TC = TFC + TVC

Average Cost (AC): Total costs incurred for producing a certain output divided by the number of units produced is the average cost per unit of output. Since total costs equal the sum of total fixed costs (TFC) and total variable costs (TVC), it follows that average cost will also equal average fixed cost (AFC) plus average variable cost (AVC). AFC equals TFC divided by the number to units of output produced and, similarly, AVC equals TVC divided by the number of units of output produced.

Thus:

TC = TFC + TVC

AFC = TFC / Q where Q = units of output produced

AVC = TVC / Q where Q = units of output produced

Therefore, AC = AFC + AVC.

For example, if for producing 100 units of output a firm incurs Rs.5,000 as variable costs over and above its total fixed costs amounting to Rs. 10,000, the three average cost concepts explained above will be as given below.

TFC = Rs.10,000

TVC = Rs.5.000

TC = Rs. 10,000 + Rs. 5,000 = Rs. 15.000

AFC = Rs. 10,000 / 100 = Rs. 100

AVC = Rs 5,000 / 100 = Rs. 50

AC = Rs. 100 + Rs.50 = Rs.l50

Marginal Cost

The addition made to total costs of a firm due to the production of an additional unit of output (e.g., 101 units instead of 100) is called the marginal cost (MC) of the additional unit. For example, if the total costs of a firm increased from Rs. 15,000 to Rs. 15,200 when it produced 101 units instead of 100, the MC of the l0l the unit would be Rs. 200. In general we can say that MC of the nth unit of output equals TC of n units minus TC of (n–1) units.

Thus:

MC = TCn – TCn–1

As explained above, TFC does not change in the short run with variations in the level of output produced. In other words, the addition to TFC due to the production of additional units equals zero in the short run. Therefore, MC on account of fixed costs equals zero: MFC = zero. From this it follows that MC is essentially MVC, i.e., equals the change in total variable costs due to the production of an additional unit of output.

Thus:

MC = MFC + MVC

MFC = zero

Therefore,

MC = MVC

MCn = TVCn – TVC(n–l)

Thus, in calculating MC we can completely ignore fixed costs. MC can be calculated directly from variable costs. However, the result would be the same whether MC is calculated as a change in TVC or TC.

10.3.1 Relationship between Average and Marginal Cost

MC is the addition made to TC due to the production of an additional unit of output. AC is TC divided by the number of units produced. Naturally, MC, which affects TC, will immediately affect AC as well. For example, if the MC due to the production of an additional unit is greater than the AC of the other units, it will push up the latter. Suppose, the AC of 100 units is Rs. 150 and the MC to the 101th unit is Rs.251 (i.e. greater than the earlier AC of 100 units), AC of 101 units will equal Rs. 151 (150 × 100 + 251 = 15,251 / 101 = 151). On the other hand, if the MC of the additional unit is less than the AC of the earlier units, the AC of all the units taken together would fall. In the example above, if the MC of the 101th unit were only Rs. 49 (instead of Rs. 251), AC of all the 101 units taken together would fall to Rs. 149 (i.e 150 × l00 + 49 = 15, 049 / 101 = 149). And finally, if the MC of the additional unit happens to equal the AC of the other units, AC of the units taken together would remain unchanged. In the example above, if the MC of the 101th unit were Rs. 150, the AC of 101 units would have remained constant at Rs. l50 (i.e., 150 × 100 + 150 = 15150 / 101 = 150).

Table 10.2 below gives some figures of AC, TC and MC which clearly bring out the relationship between AC and MC.

TABLE 10.2

Units of output (n)	*AC of (n)*	*TC of (n)*	*MC of (n+l) th unit*	*TC of (n+1) unit*	*AC of (n+1) unit*
1	2	3	45	6	
1	10	10	9.0	19	9.5
2	9.5	19	8.0	27	9.0
3	9.0	27	7.0	34	8.5
4	8.5	34	6.0	40	8.0
5	8.0	48	8.0	48	8.0
6	8.0	40	8.0	56	8.0
7	8.0	56	8.0	64	8.0
8	8.0	64	8.0	72	8.0
9	8.0	72	18.0	90	9.0
10	9.0	90	20.0	110	10.0
11	10.0	110	22.0	132	11.0
12	11.0	132	24.0	156	12.0

The first four rows of the above Table show that so long as MC is less than the preceding AC, the successive AC falls. The next four rows show that so long as MC equals the preceding AC, the successive AC will remain constant. The last four rows shows that so long as MC is greater than the preceding AC, successive AC will rise.

Regarding the relationship between Me and AC (and for that matter between any marginal average value) it should be very carefully understood that what maters is the absolute value of MC and not its rise or fall or constancy. For example, the necessary condition for the AC to rise is that the MC should be greater (in absolute terms) than the former, whether MC is rising, falling or constant is immaterial. Thus whether MC is rising, falling or constant, so long as it is higher than AC the latter will rise. Similarly, the necessary condition for then AC to fall is that MC should be less than the former, whether the latter is rising, falling or constant is not material. *Thus in conclusion we may say that rising, falling or constant MC is compatible with a rising AC*

provided the former is higher (in absolute terms) that the latter, Similarly, rising, falling or constant MC is compatible with a falling AC provided the former is smaller (in absolute terms} than the latter. What matters in the relationship of MC with AC is the absolute value of MC and not its rise, fall or constancy parse.

Intext Questions :

Q.3. In Long run, firm undertakes production if :

(a) P = AC (b) P > AC

(c) P < AC (d) Both (a) and (b)

[Ans. (d)]

10.4 BEHAVIOUR OF VARIOUS COSTS WITH CHANGES IN OUTPUT: BEHAVIOUR OF AFC

Whether level of output produced is small or large (or even zero) TFC remains constant. From this it follows that higher the level of output, smaller accordingly will AFC tend to be because the given total of fixed costs will be spread over a larger and larger number of units. For example, if the TFC of a firm is Rs. 10,000, AFC will equal Rs. 1,000 if only ten units are produced, it will be Rs. 100 when 100 units are produced, and so on. Thus, larger the number of units produced, smaller accordingly, will AFC tend to be. The AFC curve will form a rectangular hyperbola as the one drawn in the diagram 10.1 below.

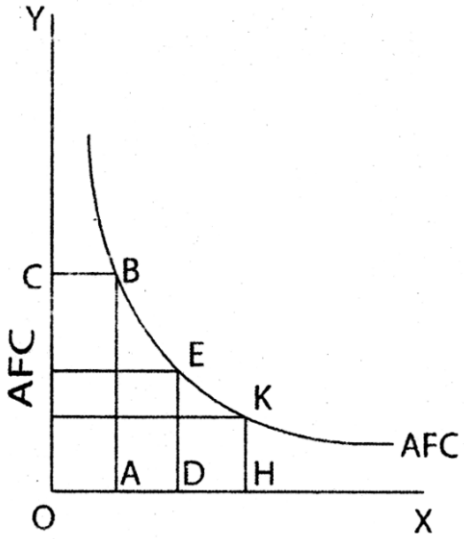


Diagram 10.1

The geometrical property of a rectangular hyperbola is that areas of all the rectangles subtended from different points on it are all equal. The area of a rectangle subtended from any point on the rectangular hyperbola in the above diagram represents the given TFC. For example, the area of rectangle OABC equals OA (units of output) *x* OC(AFC), that is, TFC, though AFC will fall continuously with increases in the level of output produced but it will never be zero because AFC multiplied by the number of units of output has to equal the given TFC.

10.4.1 The Behavior of Variable Costs

The behavior of variable costs will depend upon (a) the physical input output relations and (b) the prices of the factor inputs used in production. We, therefore, start with the former aspect first. As explained in detain above, in the short run a firm cannot achieve the vest combinations of factors appropriate for different level of output because amounts of certain factors cannot be varied for some time to come. Reasons for this fixity of certain factors have been explained above. The fixed combination of factors, known as the plant of the firm, is designed to produce a certain output at the minimum cost. This is called the optimum output of the plant. However, this does not mean that the given plant cannot produce a larger or a smaller than the optimum output. Within certain limits, a larger or a smaller than the optimum output can be produced with the given plant by applying more or fewer units of the variable inputs. Thus, in the short run when a firm cannot vary the amounts of all factors to achieve optimum results, the second best alternative available to it to meet short run situations is to produce larger or smaller quantities of output by applying more or fewer units of other variable factors with the given plant. What happens to output when the given plant is used with increasing amounts of the variable inputs is described by the Law of Diminishing Returns or the Law of Variable Proportions as discussed earlier in section.

It should be carefully noted that the phases of increasing and diminishing MP and AP are entirely the results of technical conditions of production. Increasing and diminishing returns describe the physical relationships of inputs to output. Increasing (physical) returns obtain because the increasing employment of the variable factor with given fixed factors (i.e. plant) makes better organisation of production possible and consequently the efficiency of all the units increases. For example, higher level of employment of labour offers better scope for the division of labour which improves skills of workers in production and management. With improved skills of workers in production and management. With improved skills wastes of raw materials and other input are reduced. In short, so long as the given fixed equipment is not fully utilized, application of more and more units of a variable factor results in improving the efficiency of the productive organization and consequently total output increases more than proportionately. However, beyond the point of optimum utilization, further application of the variable factor results in a less than proportionate increase in total output because marginal product of the variable factor starts diminishing. For example, when the same machines are worked longer hours per day, more frequent break-down of machinery occur. Similarly, when labourers work longer hours per day, their efficiency declines and due to over work, wastes of raw materials and other inputs also increase. As a result of these and similar other factors, the efficiency of the whole productive organization falls and total output starts increasing at a diminishing rate.

Summing up out discussion of the production possibilities open to a firm we can say that so long, as the given fixed equipment of the firm is not fully utilized, increased application of variable factor leads to a progressively better and better utilisation of the given productive capacity and as a result increasing returns obtain. However, beyond the point of optimum utilization of the fixed equipment, further application of variable factors results in diminishing returns, not because the units of the bariable factor are less efficient than others, but for the simple reason that different factors are not perfect substitutes of each other. Variable factors can be substituted for the fixed factors but not without loss of efficiency. Once this basic tact is recognized, diminishing returns follow as a matter of logical necessity.

Given the short run production possibilities open to a firm. How will the variable costs behave with variations in the level of output? Assuming that the price of the variable factor is given for the firm, we can say that so long as the MP of the variable factor increases. MC must necessarily fall and when MP diminishes, MC must necessarily rise. Similarly, we can say that so

long as AP rises, AVC must fall and when AP falls AVC must rise. Regarding the behaviour of TVC we can say that so long as AVC fall, TVC will rise at a diminishing rate and when AVC rises, TVC will rise at an increasing rate. Assuming that the variable factor in question is available to the firm at a constant price of Rs. 100 each. Table 10.3 below which is based on the hypothetical output figures of Table 10.2 above, describes the behaviours of AVC and MVC with changes in the level of output produced.

TABLE 10.3

Units of labour employed	*TVC (Total wage BillRs.)*	*Total ouput (In kgs.)*	*AP (In kgs.)*	*AVC (Rs. per kg.)*	*MP (In kgs)*	*MC (Rs. per kg)*
1	100	50	50	2.00	50	2.00
2	200	110	55	1.82	60	1.67
3	300	174	58	1.72	64	1.56
4	400	236	59	1.69	62	1.61
5	500	285	57	1.75	49	2.04

A careful comparison of the AP and MP figures with the AVC and MC figures of the above Table will show the following.

1. MP rises up to the employment of 3 units of labour and thereafter it starts diminishing. In contrast MVC falls up to the employment of 3 units of labour and thereafter it starts rising.
2. AP rises upto the employment of 4 units of labour and thereafter it starts diminishing. In contrast AVC falls upto the employment of 4 units and thereafter starts increasing.

T*he conclusion is obvious. Rising productivity means falling variable cost per unit of output and declining productivity means increasing variable cost per unit of output. This applies to AP and MP equally. This implies that given the price of variable factor, AP of variable factor is inversely related to the AVC and MP of variable factor is inversely related to MC. See the proof below:*

First, take relation between AVC and AP

AVC = TVC / Q, where Q = Output

We know that TVC = W * L where W = Price of Variable Factor and L = Units of Variable Factor

So, AVC = W * L / Q

Or, AVC = W / (Q / L)

We know that Q / L is AP of variable factor.

Hence AVC = W / AP, i.e AVC and AP are inversely related.

Second, take relation between MC and MP

MC = ΔTVC / ΔQ, where Δ = Change in, Q = Output

We know that TVC = W * L where W = Price of Variable Factor which is constant and L = Units of Variable Factor

So, MC = W * (Δ L) / ΔQ

Or, AVC = W / (ΔQ / ΔL)

We know that (ΔQ / ΔL is MP of variable factor.

Hence MC = W / MP, i.e MC and MP are inversely related.

Upper and lower panel of diagram 10.2, contrast the behaviour of AP and MP respectively with that of AVC and MC with changes in the level of output of a firm.

The upper diagram depicts the behaviours of AP and MP with changes in the level of employment of the variable factors. The lower diagram depicts the behaviours of AVC and MVC with changes in the level of output associated with changes in the level of employment of the variable factor in question. The two diagrams clearly show the following:

1. So long as AP rises, AVC fails, when AP is the maximum, AVC is the minimum and when AP falls, AVC rises.
2. MP and MC also behave in the same manner as do AP and AVC.

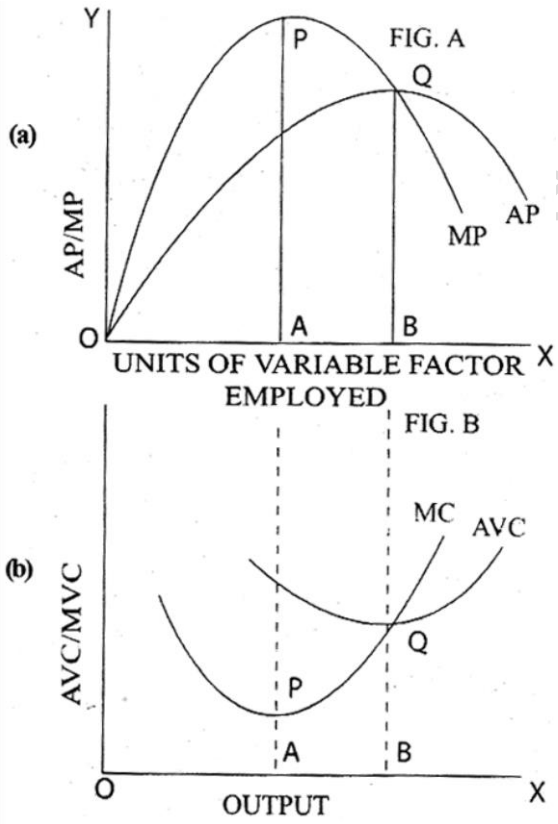


Diagram 10.2

Summing up our discussion of the behaviours of AVC and MC we can say that both are 'U-shaped', i.e., fall upto a point, reach the minimum and then start rising. The minimum points of MVC and AVC are different. The relationship between the two has been described in detail above. It may be noted that over the range AB, even though MVC is rising, AVC is still falling. This will happen so long as the rising MVC is still below the AVC. Thus, we have U shaped AVC and MVC curves.

10.4.2 The Behaviour of AC (i.e., AFC plus AVC)

The behaviour of AC naturally depends upon the combined behaviour of its components - the AVC and the AFC. AFC, as explained above, falls continuously as output expands but AVC

falls only upto a point and then starts rising. Assuming the TFC of a firm to be Rs. 500/-, the Table 10.4 brings out the behaviours of AC and MC with variations in the level of output produced by putting the two components together.

TABLE 10.4

Units of output	*Fixed Costs*			*Total Cost*				*Variable Cost*	
production	*TFC*	*MFC*	*AFC*	*TVC*	*MVC*	*AVC*	*TC*	*MC*	*AC*
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	100	zero	100	40	40	40	140	40	140
2	100	zero	50	70	30	50	170	30	85
3	100	zero	33	90	20	30	190	20	63.3
4	100	zero	25	136	46	34	236	46	59
5	100	zero	20	200	64	40	300	64	60
6	100	zero	167	300	100	50	–400	100	66.7
7	100	zero	14.3	434	137	62	534	134	76,3

In the Table above, TFC remains constant at Rs.100, therefore, MFC is always zero and AFC falls continuously. TVC increases at a diminishing rate upto 3 units of output and thereafter it increases at an increase rate. MVC falls up to 3 units of output and thereafter it starts increasing. AVC keeps falling upto 3 units and then starts increasing. TC is total of TFC and TVC. MC is essentially MVC. AC is the sum of AFC and AVC. MC falls upto 3 units and thereafter starts increasing. But AC falls up to 4 units and thereafter it starts increasing.

Diagrams 10.3 show the derivation of AC by adding AFC on top of AVC.

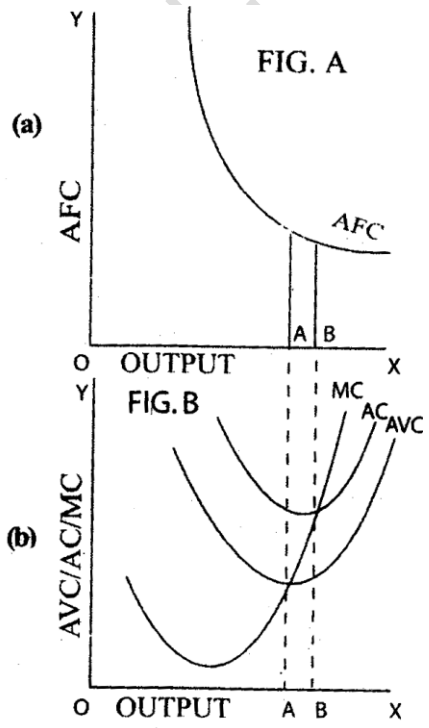


Diagram 10.3

In figure B of diagram 10.3, we have drawn the AC curve by adding AFC figures corresponding to each level of output on top of the AVC curve. Regarding the behaviour and shape of AC curve we can clearly identify the following four phases:

1. *So long as both, the AFC and the AVC fall, AC too must fall. Upto the output level OA both AFC and AVC are falling. Therefore, AC is also falling.*
2. *Beyond output level OA, AVC starts rising but AFC continues falling. However, so long as the absolute fall in AFC is greater than the absolute rise in AVC, AC continues falling. In the diagram this happens over the output range AB.*
3. *For a while the absolute fall in AFC is exactly offset by an equal absolute rise in AVC. Therefore, during this phase AC becomes constant (i.e., neither falls nor rises).*
4. *Then a stage comes when the absolute rise in AVC far exceeds the absolute fall in AFC and consequently the AC starts rising.*

The relationship between the AC and MC can be explained as follows:

1. So long the MC is less than the AC, the AC will fall. In the diagram up to the level of output OB, the MC curve lies below the AC curve and as a result AC falls.
2. If MC equals AC, as at point P in the diagram, AC remains constant.
3. If MC is more than AC, will rise. Beyond point P, the MC curve lies above the AC curve and as a result AC keeps rising.

Conclusion

Thus, finally we have the 'U-shaped AC curve as we have a 'U'-shaped AVC curve. With variations in the level of output, the AC curve behaves in exactly the same manner as the AVC does. Just as the AVC curve initially falls over a certain range of output and then starts rising, the AC curve too falls over a certain range of output and then takes an upward turn, tracing a 'U' shape in the process. The gap (i.e the vertical distance) between the two curves, as drawn in the diagram above, is accounted for by AFC corresponding to each level of output.

INTEXT QUESTION :

Q.1. Shape of AFC (Average fixed cost) curve is :

(a) Linear (b) Rectangular Hyperbola
(c) Convex (d) Concave
[Ans. (b)]

Q.2. AFC is always :

(a) Negative (b) Zero
(c) Constant (d) Positive
[Ans. (d)]

10.5 SHORT RUN INDUSTRY SUPPLY CURVE

In the short-run, the minimum point of the average variable cost indicates the shut-down point at which no firm will supply its output. At each equilibrium point of the firm, marginal cost is equal to the given price of the good. Hence, the short-run supply curve of the firm is the upward sloping marginal cost curve which is above the minimum point of the average variable cost. The horizontal addition of such supply curves of all individual firms give rise to industry supply curve which is upward sloping and flatter than the individual supply curves. The diagram below shows industry supply curve in the short run.

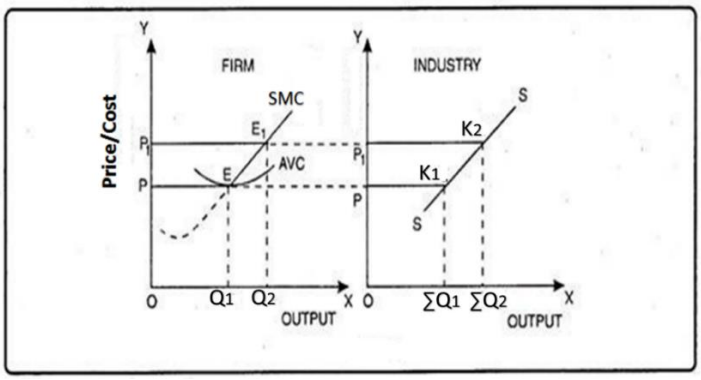


Diagram 10.4 : Short-Run Industry Supply Curve

In the diagram 10.4 above, the left-hand side panel shows the firm's supply curve in the short-run. Point E is the minimum point of average variable (AVC) cost which is also called shut-down point. So, OP or EM is the minimum price below which firm will not supply its output. The equilibrium points E, E_1 are the points where price of the firm equals its short-run marginal cost (SMC). Hence, short-run supply curve is the upward sloping SMC starting from point E. The industry supply curve, as shown in the right-hand side panel of the diagram, is the upward sloping curve SS which is derived by horizontal addition of firm supply curves.

10.6 LONG RUN COSTS

Derivation of Long Run Average Lost-(LAC):

In the long run all costs are variable. So there is no need to make distinction between variable and fixed costs. The average cost in the long run can be derived from short run average costs (SACs) when the firm changes its plant size in order to reduce average cost of producing more output. So, LAC curve is the locus of reducing SACs. Initially LAC may fall as output expands due to increasing returns to scale. But when decreasing returns occur the LAC curve will increase. At the minimum point LAC exhibits constant returns to scale. This makes LAC curve 'U' shaped as it envelops the SACs. See diagram 10.5 below.

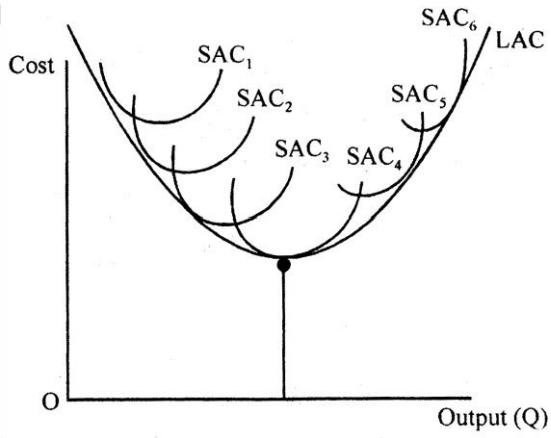


Diagram 10.5

In the diagram 10.5 above LAC is derived by joining those points on various SAC curves such as SAC_1, SAC_2, SAC_3 and so on which give the lower possible cost of producing the

particular amount of output. Infact the plant size has to be changed in the long run becuase all factors are variable. This is shown by changing SACs from SAC_1 to SAC_2, SAC_3 and so on. Due to economies of scale that cause increasing returns the successive points on shifting SACs keep coming below the previous one thus making the locus of LAC downward sloping till a minimum point, say, M is reached. After that LAC increases due to decreasing returns. At point M which is the minimum point the plant size is optimum giving constant returns to scale.

Long Run Marginal Cost (LMC):

LMC is derived in the following way (See diagram 10.6):

(i) First drop perpendiculars on the output (horizontal) axis from all those points on LAC where LAC = SAC. In the diagram they are shown AQ_1, BQ_2, CQ_3 and DQ_4 etc.

(ii) Locate the points of intersection of these perpendiculars with respective short run marginal cost curves (SMCs). These points are shown as A_1, B_1, C, D_1 etc in the diagram

(iii) Join these points through minimum of LAC to get LMC curve.

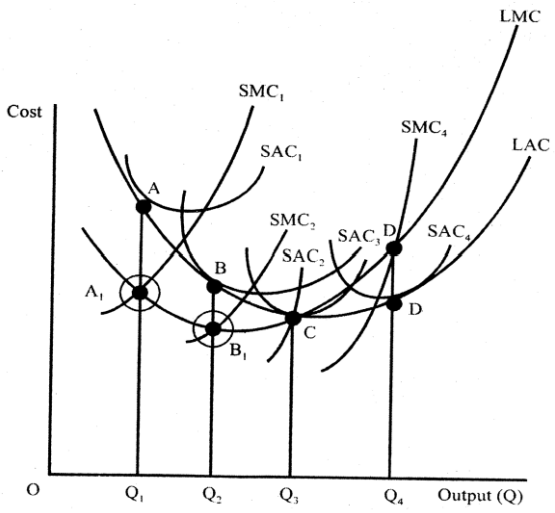


Diagram 10.6

Intext Questions :

Q.1. True / False :

'All cost curve are 'U' shaped, wheareas, all production curves are mostly inverted 'U' shaped'.

(Ans. True)

Q.2. Define short-run average cost curves. (SAC)

Q.3. Define Long Run average cost curves (LAC).

Q.4. Falling part of the LAC curve represents:

(a) Increasing RTS (b) Constant RTS

(c) Decreasing RTS (d) None

[Ans. (a)]

Q.5. Define Total, Average and Marginal revenue with diagrams.

10.7 REVENUE

Introduction

A capitalist firm is assumed to produce with a view to selling its output on the market. By selling the product firm realizes its revenue and it pockets the excess of its total revenue over total costs as its profits.

DIFFERENT CONCEPTS OF REVENUE

Total Revenue

Whatever revenue a firm gets by selling its output in the market constitutes its total revenue (TR). TR, naturally, depends on how much the firm sells and at what price it sells. We are assuming that the firm sells its entire output at a single price.

Therefore,

TR = Output price

Average Revenue

What buyers pay as price per unit in the market constitutes average revenue (AR) per unit when looked at from the firm's point of view. Thus, price and AR are one and the same thing, TR, thus, equals output sold multiplied by AR. Or, AR equals TR divided by the number of units sold. For example, if a firm's TR form the sale of 1000 unit is Rs. 15,000, naturally, its AR per unit is Rs. 15 (15000/1000=15).

Thus,

AR = TR / Q where Q = Output or Number of units sold.

Marginal Revenue

Marginal revenue (MR) refers to the contribution (i.e., addition) made to the TR of a firm due to the sale of an additional units of output. For example, a firm's TR rises from Rs. 15000 to Rs. 15500, when it sells 101 units of its output instead of 100. Obviously, according to this example, the contribution of the additional unit lo the total revenue of the firm is Rs.500. Therefore, Rs.500 will be said 10 be the MR of the additional unit. In general, MR of any nth unit of output (where n stands for the number of units) will equal TR of n units minus TR of (n-1) units. For example, MR form the 20lh units will equal TR of 20 units minus TR of 19 units.

Thus:

$MR_n = TR_n - TR_{n-l}$

10.7.1 Relationship between AR and MR

The relationship between AR and MR is essentially the same as between AC arid MC explained earlier. So long as AR falls, MR must be less than AR. For example, suppose a firm's AR falls from Rs.100 to Rs.98 when it sells 21 units instead of 20. In this case MR of the 21st unit will equal TR of 21 units (i.e., 98 × 21 = 2058) minus TR of 20 Units (i.e., 100 × 20 = 2000), which comes to Rs.58. MR in this case is less than AR (58 <98) as shown in part A of diagram 10.6. On the other hand, when AR rises, MR must be more than AR. For example, if the firm's AR had risen from Rs. 100 to Rs. 102 when it sold 21 units instead of, the MR. of 21st unit would have been Rs. l42 (i.e., 102 × 21 – 100 x 20 = 142). MR, Thus, is greater than AR in this case (142>102) as shown in part B of diagram 10.7. Finally, if AR remains constant when a firm sells larger output, MR must equal AR. For example, if the firm could sell 21 units instead of 20 at same price Rs. 100–MR from the 21st unit would have been Rs. 100 as shown in part C of diagram 10.7.

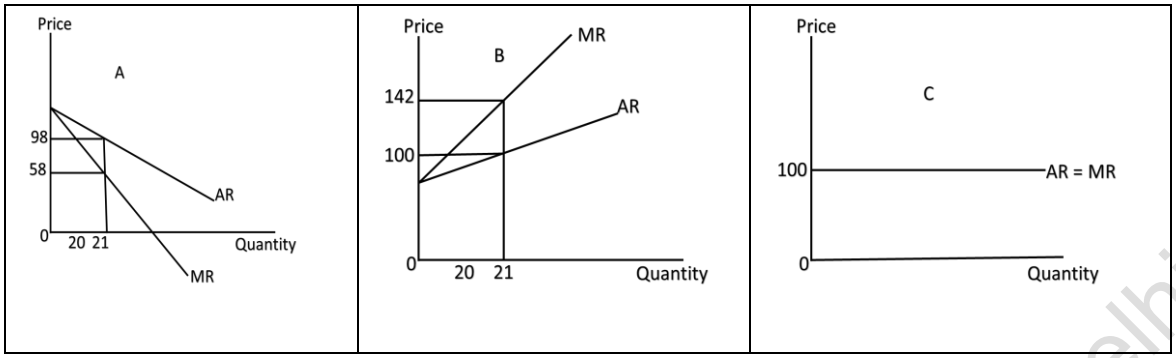


Diagram: 10.7

Thus, we see that technically MR will be less than AR if the latter is falling as in case of monopoly market, MR will equal AR if the latter is constant as in case of perfectly competitive market and MR will be greater than AR if the latter is rising. However, it should be carefully noted that a rising AR curve (i.e., demand curve) is not a normal phenomenon. It is a very rare occurrence. Normally, individual as well as market demand curve for most commodities are downward sloping. However, under certain specific market conditions to be explained in the following section, a firm may behave as if the demand curve for its product is horizontal, imply ing that it can sell any amount at a constant price.

Intext Questions :

Q.1 Define AR , MR , TR.

Learning Outcome: -

In this lesson you will learn the following: -

- In the short run both fixed and variable cost exists. Fixed cost is the expenditure incurred to hire or purchase fixed factors such as capital, whereas variable cost is the same relevant for variable factor such as labor.
- Total fixed cost is independent of the level of output whereas total variable cost varies with the level of output.
- Average fixed cost is a continuously falling curve with increase in output and looks like hyper bola
- Average variable cost, average cost and marginal cost curves are U-shaped in the short run due to operation of the law of variable proportion.
- When average cost falls marginal cost remains below it, at the minimum of average cost, marginal cost is equal to average cost and when average cost increases marginal cost remains above it.
- Long run average cost curve is derived from short run average cost curves and is known as envelope curve.
- long run average cost falls due to increasing returns to scale and the rises due to decreasing returns to scale while at its minimum point there is constant returns to scale.
- The long run marginal cost curve is derived by using LAC, SAC and SMSs.

- Total revenue is the total sale receipts of the firm from selling a product while average revenue is the price of the product. Marginal revenue is defined as the change in total revenue due to change in the quantity of the product.
- Given price as a constant value AR=MR, if price falls with increase in quantity then MR remains below AR.
- Under perfect competition the total revenue is straight line through the origin as it appears on the quantity sold, whereas under monopoly the total revenue increases at a decreasing rate and finally reaches the maximum and then falls with increase in output.

Long Answer type questions

Q.1. In detail, explain and derive the Long Run Production function Curve.

Q.2. Explain the relationship between TP, AP, MP diagrammatically.

Q.3. Diagrammatically explain the relationship between MC and AC.

❐❐❐

LESSON: 11

ECONOMIIES OF SCALE

INTRODUCTION

Increasing returns to scale are cause economies of scale Economies of scale can be internal or external. The former arise due to change in the size of the firm and the latter on account of expansion of the industry, i.e., number of firms. In each case, however, the economies accrue to the firm (though in the case of external economies, for no action of its own). A firm can increase its production only by increasing its outlay or expenditure on various factors of production. It can do this either by keeping the factor proportions constant i.e., by increasing the amount of each factor used by the same proportion (e.g., doubling or trebling all the inputs) or by increase the factor quantities, but varying at the same time the proportions in which various factors are used. When various factor are varied in level, but kept constant in proportion, the relationship between the change in composite input and that in output is characterized by 'returns to scale'. If all the factor inputs are multiplied by a factor λ and the resulting output is μ times the original output, increasing, constant and decreasing returns to scale can be defined according to whether $\mu>\lambda$, $\mu=\lambda$ or $\mu<\lambda$ respectively. If the firm decides to increase the number of plants identical to each other (e.g., building another plant in order to double the output). It can at least achieve constant returns to scale. The process is known as 'replication'. Returns to scale may increase or decrease or remain constant if, however, the firm increases the size of the plant but keeps the factor proportions constant. However, the firm may find it more profitable to change the proportion in which factors are combined, i.e, to change the technique of production to achieve a higher level of output. The economies which accrue to the firm in some of the above-mentioned cases are 'real economies' as these originate from the technical relationships. In contrast, 'pecuniary economies' arise due to lower prices paid by a firm for the factors of production it buys while increasing its level of output. The former is associated with lower physical quantities of resources required per unit of output while the latter with lower prices per unit for the factor/factors. We shall first discuss real economies in some detail.

After going through this lesson you will learn: -

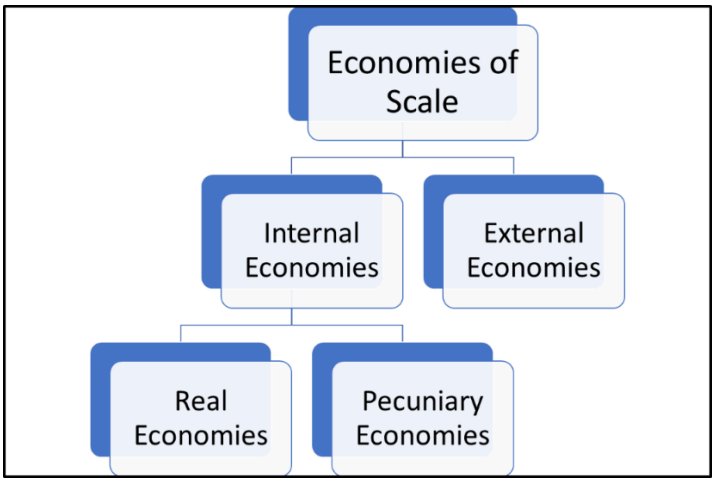
- Understand the concept of economies and diseconomies of scale
- Distinguish between internal and external economies

11.1 CONCEPT AND TYPES OF ECONOMIES OF SCALE

Economies of Scale refer to the cost advantages experienced by a firm when it increases its level of output by increasing its scale of operation. It assumed that scale of operation can be increased by increasing the factors simultaneously. This results in decreasing per unit cost of production manifested by a fall in long run average cost curve till it reaches its minimum point.

Economies of scale can be of two types: (i) Internal economies and (ii) External economies. See the Chart below. Internal economies are further divided into two groups – Real and Pecuniary economies respectively. Internal economies are the advantages or benefits reaped by the firm due the factors which are under its control. Real economies consist of a mixture of several functions noticed at work place such as: efficiency of labour or labour economies, use of better technology called technical economies, existence of inventories, managerial abilities, marketing and demand and supply management. Pecuniary economies include immediate monetary gains due to discounts.

CHART 11.1



A) Real Economics of Scale

When production takes place on a large scale, all the advantages of 'division of labour' can be reaped. Division of labor or specialization signifies a process which breaks up a job into many parts, each part to be done by a different person. Thus, every person becomes an expert in doing his part of the job and can do it very quickly and efficiently. This acquisition of dexterity leads to considerable increase in labour productivity. It also leads to saving in time as a person does not have to keep on shifting from one job to another and wasting time in the process in order to warm up to the new job. The tools required for each job are used constantly and do not lie unused as would happen when the worker is engaged in different jobs. Break up of a job into many separate parts encourages inventions and innovations. Machines are used to perform simple, repetitive parts with precision, thus increasing further the productivity of labour. This process of mechanization implies more specialized capital equipment as well as more investment, thus resulting in high overhead costs. These methods of production with high overhead costs and lower variable costs become profitable only at large scale of production. The total unit cost keeps on falling as output rises due to 'indivisibility' of capital. ('Indivisibility' implies the existence of a minimum size of plant which can produce a specific output at. the minimum cost. This plant can be duplicated but cannot be halved at the same level of productivity).

When a new product is introduced, certain initial costs have to be incurred on research and development, market exploration, designing etc. Once these initial, fixed costs are incurred, a range of output can be produced without an increase in these costs. Obviously, the larger the scale of output the smaller this fixed cost per unit. In certain industries, multipurpose machines are used for performing different functions, but for each specific function, the machine has to be 'prepared' which involves set up costs. For performing a different function, re-setting of the machine is required which again involves some cost. Obviously, the larger the scale of production, the smaller the set-up cost per unit and the lesser the frequency of resetting.

Some technical economies arise due to pure dimensional relationships. For certain processes, tanks, chambers and pipes are required. The material and labor costs of constructing such structure are proportional to the surface area that they occupy while their capacity varies with the volume which increase more than proportionately with the area. Thus the technical cost of installing plants with such structures falls as the level of output rises. If firms want some

reserve capacity to maintain a smooth flow of output in case of breakdown of machinery, again firms with larger output stand to gain. A small firm has to spend a proportionately larger part of its investment in fixed capital to maintain some reserve capacity while the cost of reserve capacity to a big firm is lower. Similarly, in order to meet random changes in the supply of inputs, especially raw materials, and demand, a firm needs to keep stocks of raw materials and finished product. But the required size of inventories does not increase proportionately with the size of output. A bigger firm can maintain its flow of input and output with proportionately smaller inventories of raw materials and output.

Under monopolistic competition, all firms whether old or new need to advertise their products. But advertising costs do not increase proportionately with the size of output. The advertising budget is decided based on availability of funds, profits of the firm, existence of close substitutes of the product, advertising activities of the competitors etc. Therefore, selling costs per unit generally fall with increase in output. The expenditure on other types of selling activities (e.g. number of salesmen, distribution of samples, agreements with distributors etc.) also increases less than proportionately with the size of output. A change in the model or style of the product involves considerable expenditure on research and development, new materials and equipment, sales promotion etc. The spreading of such overheads is lower per unit if the size of output is large. To sum up, we can say that whatever the social and economic role of advertising, selling cost per unit of output does fall with scale of output up to a point at least due to existence of marketing economies.

Large size of a firm makes possible division of managerial tasks relating to production, sales, finance, personnel etc. This division of labor increases managerial efficiency and reduces cost per unit of output. But small firms cannot reap the advantages of such specialization. Moreover, with decentralization of decision making, the efficiency of management increases. Large firms can also afford to apply highly mechanized and efficient techniques of management, e.g., telephones, telex machines, closed circuit televisions, computers etc. The use of such aids increases managerial efficiency and reduces cost per unit of output. However, many economists think that after a point the management of a large enterprise becomes extremely complex and difficulties of supervision and coordination give rise to managerial diseconomies, thus leading to an upward turn in the average cost curve.

There are economies of large scale with respect to storage and transport also. Storage and transport costs are incurred both on the production side and selling side. As the construction of store-houses follows the geometrical relationship between area and volume, the cost of storage per unit falls with size of output. Increasing the number of floors of storehouses will be still more economical. Similarly, the unit cost of transport will fall up to the point of full capacity of the firm's means of transportation. Use of larger vehicles at a larger scale of output would also lead to a fall in unit cost of transport. However, with public transport, the unit costs will normally increase with distance unless there are concessional freight rates for bulk transport.

B. Pecuniary Economies of Scale

Firms engaged in large scale operations can generally obtain 'discounts' or concessions on many accounts. They can purchase raw materials at lower prices, get loans at lower rates of interest (and other favorable terms), advertise their products at concessional rates and transport their goods at lower rates. All these concessions are given due to the large size of operations. Big firms can also sometimes hire workers at lower wages due to their monopolistic power. (A monopsonist is one who controls a major part of the demand for a commodity or a factor of production). Due to all such pecuniary economies, the average cost falls with size of output. The economists do not, however, agree on whether there is continuous reduction in unit costs with increase in output or the average cost curve rises after a certain point due to diseconomies (mainly

managerial) of scale. Only a sufficiently large number of empirical studies, conducted scientifically, can resolve this issue.

Intext Questions :

Q.1. What are the types of EOS.

Q.2. Which of the following is not a part of Real EOS?

(a) Technical (b) Marketing

(c) Labor (d) Cheap raw material

[Ans. (d)]

Q.3. Define Real EOS..

Q.4. Define Pecuniary EOS.

11.2. EXTERNAL ECONOMIES:

External economies refer to all those benefits which accrue to all the firms operating in a given industry. Generally, these economies accrue due to the expansion of industry and other facilities expanded by the Government. They are benefits which are shared by several firms or industries when the scale of production in any industry increases.

Locational advantage of a firm is an example of external economies. Similarly, when the number of firms in an area increases each firm enjoys some benefits like, transport and communication, availability of raw materials, research and invention etc. Further, financial assistance from banks and non-bank institutions easily accrue to individual firms. When many firms come together to form an industrial cluster or township, they become mutually dependent on each other. These firms can form their trade association/confederation etc to serve the common purpose by sharing cost. There will be no need of independent research on individual basis. Many scientific and trade journals can be published to supply information to all relating to new markets, sources of raw materials, latest techniques of production etc at a lower cost. These benefits are called **Economies of Information**.

As an industry develops, all the firms engaged in it decide to divide and sub-divide the process of production among themselves. Each firm specializes in its own process. These benefits are called **Economies of Disintegration**. It is of two types-horizontal disintegration and vertical disintegration. In case of horizontal disintegration each firm in the industry tries to specialize in one item whereas, under vertical disintegration every firm endeavour to specialize in different types of items. Material of one firm may be available and useable as raw materials in the other firms. Thus, wastes are converted into by-products. The selling firms reduce their costs of production and drive the average cost of production down.

The industry can also develop common R&D for benefit of all firms.

11.3 DISECONOMIES OF SCALE

A) Internal diseconomies of scale:

Refer to diseconomies that raise the cost of production of an organization. The main factors that influence the cost of production of an organization include the lack of decision, supervision, and technical difficulties.

B) External diseconomies of scale:

Refer to diseconomies that limit the expansion of an organization or industry. The factors that act as restraint to expansion include increased cost of production, scarcity of raw materials, and low supply of skilled labourer.

C) Decreasing returns to scale are caused by diseconomies of scale which maybe due to the following factors-

(i) Managerial inefficiency caused by excess burden of work on managers

(ii) Fall in availability of non-renewable resources due to continuous consumption overtime. Livestock and fisheries do have gestation period during which there may not be an adequate supply.

(iii) Taxation by government may drive a firm out of business.

INTEXT QUESTIONS :

Q.1. Which of these factors will NOT result is Diseconomies of scale?

(a) Managerial inefficiency
(b) Reduction in Non-Renewable Resources
(c) Small Plant size
(d) Taxation
[Ans. ©]

Q.2. Define Diseconomies of scales.

LEARNING OUTCOMES

In this lesson you have learnt the following: -

- Increasing returns to scale are caused by economies of scale line while decreasing returns are caused by diseconomies of scale.
- Internal economies arrives due to efficiency of the factors indigenous to the firm. Some of the internal economies are division of labour, technical economies, inventories, managerial efficiency, marketing strategy, transport and wage facilities, low cost finance and discontinuous due to bulk purchase.
- External economies are caused by exogenous factors such as Government subsidy, Tax rebate, export promotion, good rainfall in agriculture etc.
- Diseconomies of scale are caused due to heavy burden of working load on managers, unavailability of resources caused by increasing competitions and depletion in natural resources.
- External diseconomies are caused by exogenous factors such as tax by Government.

TERMINAL QUESTION

Q. Discuss in detail the Economies and Diseconomies of scale.

LESSON: 12

PERFECT COMPETITION

INTRODUCTION

Market demand curves for most commodities are downward sloping indicating that larger quantities of a commodity can be sold in the market only at lower and lower prices. However, what matters for a profit maximizing firm is not the total market demand for the commodity, but that part of it which flows to it. If a firm happens to be the only producer of a commodity, then the market demand for it is the demand for the firm's product. In such a case the firm will know that by increasing or decreasing its sales it will affect the price of the product. In contrast to this, consider a situation in which the market demand for a commodity is met by such a large number of firms that an individual firm meets a negligibly small fraction of it. In such a case, the firm can never imagine that it can influence the market price by increasing or decreasing its scale of operation. Besides the question of number of firms in the market, there are other variables such as availability of close substitutes, their prices, preferences of buyers, advertisement, and so on; which have a considerable bearing on the demand for an individual firm's product. It is beyond the scope of this paper to consider all market situations and analyze their effects on firm's revenue. We will consider only two extreme market situations, viz., perfect competition and monopoly in addition to imperfect competition.

After going through this lesson, you will be able to learn: -

- Know the features of perfect competition
- Equilibrium of firm and industry under perfect competition in the short run.
- Equilibrium of firm and industry under perfect competition in the long run.
- Derivation of short run supply curve of firm under perfect competition and finally derivation of long run supply curve of industry.
- Explain allocative efficiency of perfect competition

12.1 MEANING AND FEATURES OF PERFECT COMPETITION

Perfect competition refers to a theoretical market situation in which a single price, determined by the market forces of supply and demand for a commodity, ruling in the market is a datum for individual buyers and sellers and when firms in the industry, in the long run, are able to earn no more than normal profits (i.e., normal earnings of management) which are assumed included in the firm's average (total) cost as an element of fixed cost. In other words, *perfect competition prevails when (a) individual buyers and sellers of the commodity are price takers and not the price-sellers (i.e., are unable to influence the given market price in the slightest degree by increasing their sales or purchase} and (b) when in the long run TR of a firm equals its TC which includes normal profits (or alternatively when AR equals AC).*

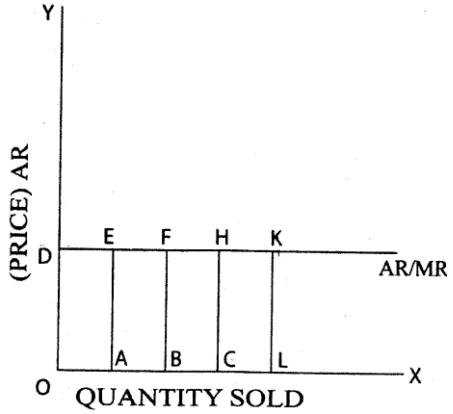


Diagram 12.1

What are the conditions necessary for perfect competition to prevail? The first requirement of perfect competition is that no individual buyer or seller is able to influence the market price by his own actions, i.e. by increasing or decreasing his sales or purchase. For a Finn this condition implies that it can sell any amount of the commodity that it is feasible for it to produce, without perceptibly influencing the market price. In other words, the demand curve for an individual firm's output is perfectly elastic as the one shown in the diagram 12.1.

The horizontal demand curve in the diagram above shows that whether the firm sells OA or OB or OC or OL, output price (or AR) remains constant at OD(OD = AE = BF = CH = LK). Similarly, for an individual buyer this implies that he can purchase any amount of the commodity at the going market price. In other words, supply of the commodity to an individual buyer is perfectly elastic. What are the conditions necessary for such a market situation? A moment's reflection would show that, given the assumption of rationality on the part of buyers and sellers, the following three conditions are essential for this state of the market.

(1) Large Number of Buyers and Sellers

There must be a large number of buyers and sellers of the commodity in the market so that no one is able to influence the market price by increasing his sales or purchases. Imagine the impact of a small wheat producer's actions on the market, who is one among a large number of wheat producers in the country. Can he, by increasing or decreasing his scale of operations, influence the market price in a perceptible manner? The answer is 'No', for the simple reason that, compared to the total wheat output in the country, his contribution is no more than a drop in the ocean. He produces such a small fraction of the total wheat output in the country that by producing 10% or 20 % more or less wheat he cannot influence the market price of wheat in the slightest manner. Therefore, he would passively accept the ruling market price as a datum. Perfectly elastic demand curve for an individual producer's output does not imply that if he could multiply his output a thousand fold even then the market price will not be affected. *What price taking actually implies is that an individual producer s productive capacity is so small that he cannot effect such big changes in his output which may exert some influence on the market price of the product.*

(2) Homogeneous Product

The second condition necessary for the price-taking position of individual buyers and seller to prevail is that the commodity produced by different firms should be perfectly homogeneous. This means that no producer should be able to influence the buyers of the basis of some real or imaginary quality' of his product. In other words no producer should be able to contend that his product is, in any manner, different form other. Similarly, buyers should not be able to distinguish

between the products of different producer X or producer Y or producer Z. In short, products of different firms should be perfect substitutes of each other.

(3) Perfect Knowledge

Without perfect knowledge about the market conditions assumption of rationality does not work. For example, unless buyers know the prices charged by different sellers, they will not be able to buy form the seller who sells the cheapest. With perfect knowledge of the market conditions, buyers will switch over their purchases from sellers who charge a higher price to those who sell cheaper. Only this mobility of buyers can ensure a single price in the market.

Normal profit in the Long Run

The second condition necessary for perfect competition is that in the long run price must equal average (total) cost. For this to prevail, the following are the pre-conditions.

(1) Freedom of Entry and Exit of Firm from the Industry

This implies that there are no legal or institutional or technical barriers to entry (and exit) such as legal restriction, threats of price wars or sabotage form the existing firms, or possibility of boycotting buyers, monopoly of raw materials or of some other inputs, patents of products or processes, huge economies of scale making for large size of plants and huge initial investment, etc.

(2) Perfectly Elastic Supply of Factors

This requires that factors should be perfectly mobile in response to price incentives. Perfect mobility assumes perfect knowledge of the available alternative opportunities without which perfect mobility is not ensured. In addition to these, it is also necessary that factor owners have unique expectations about how the range of opportunities and the reward that each promises, will vary in the future.

The above mentioned conditions ensure that (a) individual firms are price takers and (b) in the long run they are able to earn only normal profits and no more. What are called normal profits, let us recall, are included in AC as an element of fixed costs.

Firm's MR Curve Under Perfect Competition (see diagram 12.1)

The demand curve or the AR curve of a firm under perfect competition is horizontal (or perfectly elastic). A horizontal AR curve implies that the firm can sell any amount at the going market price. How will firm's MR curve behave in this case? In the preceding sub-section we have explained that when AR remains constant, MR equals AR, For example, if a firm can sell 21 units instead of 20 at the same price, say Rs.25 per unit, naturally, MR will also be Rs.25. By implication, it follows that under perfect competition firm's MR curve will coincide with its AR curve. *In other words, the horizontal AR curve is also the firms MR curve. In fact the horizontal AR/MR curve can be said to be the hall mark of perfect competition to distinguish it form all other market situations*.

Total Revenue

Total Revenue (R) is defined as the product of average revenue (AR) or price of the commodity (P) and quantity of output (Q). Under perfect competition price is given or constant implying that AR = MR. So, total revenue increases with increase in quantity only. Hence, the total revenue curve can be drawn as a straight line through the origin as shown in the diagram 12.1.1.

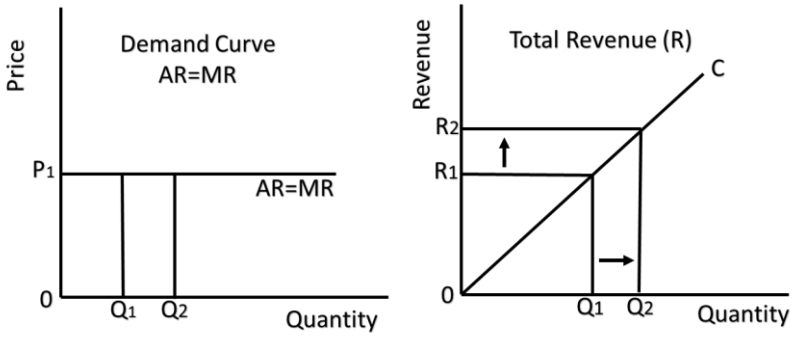


Diagram: 12.1.1 Revenue under Perfect Competition

Intext Questions :

Q.1. On perfect competition, profits are :

(a) Positive (b) Normal

(c) Negative (d) None

[Ans. (b)]

Q.2. TRUE/FALSE

'In perfect competition, firms are price sellers'.

(Ans. False)

Q.3. Shape of Demand curve for a firm –'s output in perfect competition is :

(a) Perfectly elastic (b) Zero elastic

(c) Perfectly inelastic (d) Less the perfed elastic

[Ans. (a)]

12.2 EQUILIBRIUM OF THE FIRM UNDER PERFECT COMPETITION

The objective of a producer is to earn the maximum profits, given the cost and revenue conditions for his product.While the sale of an additional unit of output yield some additional revenue to the producer, it also adds something to his total cost. The addition made to the total revenue (TR) of a producer due to the sale of an additional units of output is called marginal revenue (MR) and addition made to his total costs (TC) is called marginal costs (MC). Whatever be the market structure or the time period under consideration, in deciding whether or not to produce an extra unit of output, a rational producer would always compare MR with MC. If MR of any unit is greater than its MC, its production will increase the producer's profits by the excess of MR over MC. On. the other hand, if the MC of any unit is greater than its MR, its production will reduce profits by the excess of MC over MR. Thus, when MR>MC the producer will increase profits by increasing the level of his output and when MC>MR, he will increase profits by reducing the level of his output. From this it follows that profits would be maximum when the firm chooses that level of output at which:

(1) MC = MR and

(2) Beyond which MC>MR.

Equality of MC and MR, though a necessary condition, does not by itself ensure maximum profits. If beyond the point of equality between MR and MC, the MR>MC, the firm will tend to increase the level of output to increase profits further and equilibrium will not be stable at the

point of the equality of MC and MR. This can be shown with a simple diagram such as the following.

In diagram 12.2. the MC curve intersects the MR curve at points Q and R. Thus, MO = MR at both these points. However, the equality of MC with MR does not maximize profits at Q simply because beyond this point MR exceeds MC and consequently the firm will increase its profits by increasing the level of output further. Therefore, the firm will tend to increse the level of output beyond Q till MC once again equals MR at point R. Beyond R. however, MC exceeds MR and as a result the firm will reduce its profits if it extends the level of output beyond that point. *Therefore, equilibrium of the firm requires the simultaneous fulfillment of two conditions, i.e. (I) MC = MR and (2) MOMR beyond the point where MC–MR.*

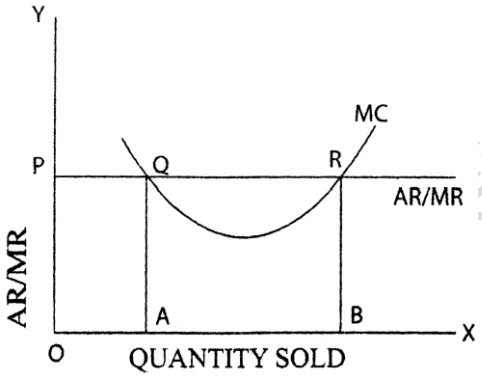


Diagram 12.2

Once again, we emphasize the point that these are two basic conditions for the determination of a firm's equilibrium, whatever be the market structure or the time period under consideration. Let us also warn that while the equality of MC with MR determines the equilibrium level of output (profit maximizing output) but it says nothing about the price of the product. Given the level of output determined by the equality of MC and MR, price will be determined by demand curve of the firm. With this background knowledge of the profit maximizing conditions (i.e., equilibrium conditions), we are in a position to analyse firm's equilibrium under specific market structure in the short and long runs.

12.3 FIRM'S SUPPLY CURVE

An individual firm under perfect competition is a price taker and not a price setter, it cannot perceptibly influence the market price by its own actions, i.e., by increasing or decreasing the level of its output. The market price is determined by the forces of market demand for and supply of the product. Thus, a perfectly elastic demand curve for the firm's product may be said to be the hail mark of perfect competition. As a result, MR always equals AR and thus, the horizontal AR curve of the firm is also its MR curve. The equilibrium condition of the equality of MC with MR, in case of perfect competition also implies the equality of MC with AR (i.e., price). *Therefore, under perfect competition a firm only adjusts the level of its output so as to equate its MC with the given market price*. Thus, under perfect competition price always equals MC as shown in the diagram below.

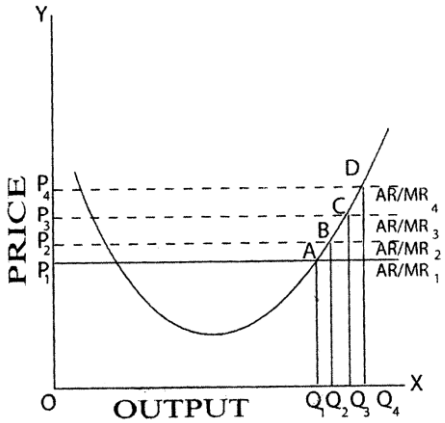


Diagram12.3

In diagram 12.3, when the market price is OP_1 the firm produces OQ_1 amount of the commodity which equates its MC with the given price at A, When the market price is OP_2, the firm produces. OQ_2 amount which equates its MC with the given price at B. Similarly, the firm would produce OQ_3 and OP_4 amounts respectively when the market price rises to OP_3 and OP4 respectively. *Thus, the firm adjusts its level of output so as to equate its MC with the given market price.*

The equality of the firm's MC with the given market price of the product enables us to derive the firm's supply curve. How much a firm will supply at any given price is determined by the point of intersection of the given AR/MR curve and the MC curve. *In other words, the upward rising portion of the MC curve of the firm determines the different amounts the firm will supply at different market prices. Therefore, the upward rising portion of the MC curve is firm's short run supply curve.*

12.4 MARKET SUPPLY CURVE

The lateral summation of the individual supply curves (i.e., MC curves) of all the firms given us the short-run market supply curve of the product. Since the individual firm's supply curve (i.e., the MC curves) are upward rising, the market supply curve will also be upward rising. Given the market supply and demand curves of the product, the market price is determined by the intersection as shown in the diagram 12.4.

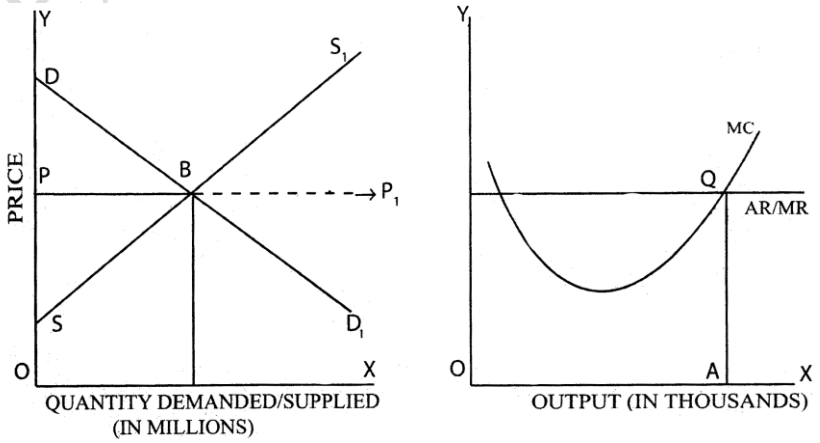


Diagram 12.4

In diagram 12.4, on the left side, SS is the market supply curve (i.e., the lateral summation of the individual MC curve of all firms) and the DD is the market demand curve of the product. The two curves intersect at B, thus determining OP as the equilibrium price at which amounts demanded and supplied are both equal to OA. *The price thus determined becomes a datum for the individual firm which it cannot influence by its own actions.* The firm only adjusts its level of output so as to equate its MC with the given price as shown in the right side of the diagram 12.4. The firm produces OA amount which equates MC with the given price at point Q. OA is the profit maximizing output for the firm under the given costs and demand conditions.

Intext Questions :

Q.1. What are the conditions for equilibrium is a perfectly competitive market?

12.5 SHORT-RUN EQUILIBRIUM OF FIRM

Given the horizontal AR/MR curve of a firm and the usual U-shaped AC and MC curve, equilibrium take place at a point where the horizontal AR/MR curve cuts the rising MC curve. This is subject to the only qualification that equilibrium cannot take place if the horizontal AR/MR curve cuts the MC curve below E, the 'shut down point as shown in diagram 12.5.

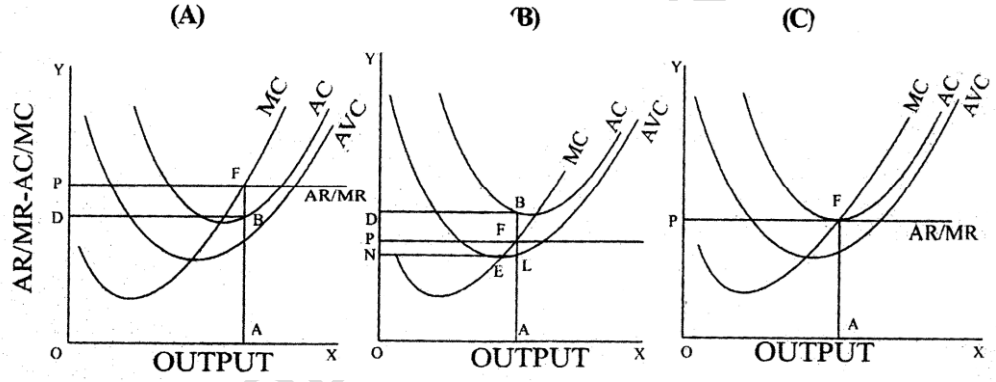


Diagram 12.5

The diagrams 12.5 depict three possible short-run equilibrium positions of a firm under perfect competition. In each case equilibrium take place at point F where the horizontal AR/MR curve cuts the rising MC curve. Figure A depicts an equilibrium position in which the firm is earning abnormal profits. While the given market price (as indicated by the horizontal AR/MR curve) is AF, average cost is only AB and thus, the firm earns abnormal profit equal to BF per unit of output. Total abnormal profits earned by the firm are represented by the area of the rectangle PFBD. Figure B, on the other hand, depicts an equilibrium position in which the firm is incurring losses equal to the area of the rectangle PDBF because price in the case (OP = AF) falls short of average cost AB. Loss per unit of output equals BF, Figure C depicts an equilibrium position in which the firm is neither earning abnormal profits nor incurring any loss. The AR/MR curve is tangential to average cost curve at F and thus, price just covers the average cost.

The rationale behind a firm's decision to continue producing even at a loss in the short run (as depicted in Figure B) lies in the fact that by doing so, in fact, it is minimizing its loses which would be greater in case it stopped production. What will be the maximum loss if the firm stopped production completely? In the given cost-price situation, if the firm decided to stop production, it would have to bear losses equal to the full amount of total fixed costs. However, even though n the gven cot-prce tuaton the price does not cover the full average cost (i.e., average

variable cost plus average fixed cost), nonetheless, it does not cover the average variable cost (=AL) and also a part of average fixed cost of average fixed cost (= LF). The uncovered part of average fixed cost is BF. *Thus, by producing output OA in the given cost price situation, the firm, in fact is minimizing its short run losses which would amount to the total fixed costs in the event of complete stoppage of production.*

12.6 LONG-RUN EQUILIBRIUM OF FIRM AND INDUSTRY

Freedom of entry and exit of firms in the long run is the characteristic feature of the perfect competition. Therefore, equilibrium position with abnormal profits or losses, as shown in figure A and B above, are sustainable only in the short run but not in the long run. Short run is a period too short to permit adjustment of productive capacity to the desired level. In the short sun firms in the industry can produce more or less only by using their given fixed equipment more or less intensively (i.e., by applying more or fewer units of the variable factors with the given fixed equipment) but cannot increase or decrease their given fixed equipment. For the same reasons, new firms also cannot enter into the industry in the short run. Long run may to defined as the period which is long enough to permit variations in the amounts of all factors. In the long run, existing firms have the freedom to remain in the industry and to choose whatever factor combinations are most profitable or to quit the industry if future prospects are bleak. Similarly, new firms can enter the industry if future prospects are bright. Thus, in the long run all factors are variable and no factor remains fixed. It is difficult to think of any factor whose amount cannot be adjusted to the requirements, given sufficient time to do so. The long run however, is not any precise period of time which is the same for all industries. It varies from industry to industry. While for the steel industry it may extend over several years, for fishermen it may extend over just a few weeks. Once, however, a firm chooses a particular field of production and fixed equipment is purchased and installed, its freedom of choice is circumscribed by these factors.

When a firm chooses a particular industry and the size of its plant it expects to earn over the long period at least as much as it can earn elsewhere in the economy. These are called "normal profits". We have included them in average cost as an element of fixed costs. This is the position when the firm makes its long run planning decisions. However, these expectations may or may not come true. If the firm fails to earn normal profits and expects this situation to persist in the long run, it will revise its earlier decisions and may decide either to leave the industry or to adjust the size of its plant in the light of its revised expectations. On the other hand, if the existing firms in the industry earn more than normal profits (i.e., abnormal profits) and expect this situation to persist over the long period, they will expand the size of their plants to suit their revised long run expectations. The same considerations will induce new firms to enter the industry. *In short, long run prospects of earning more than normal profits (i.e., the chance of earning abnormal profits) in the industry induce new firms to enter the industry and old firms to expand induce new firms to enter the industry and old firms to expand their productive capacities*. As a result total output of the commodity increases and given the demand conditions, market price falls. When price falls abnormal profits are reduced. This process of the entry of new firms into the industry (and the expansion of the productive capacities of the old firms) continues till the total output of the commodity increases so much as to bring down its market price into equality with the average cost. When price equals average cost, abnormal profits are wiped out and firms earn only normal profits which are included in average cost. When firms earn only normal profits, there is no incentive left for the entry of new firms into the industry or for old firms to expand their productive capacity. *In other words, the total productive capacity in the industry (in terms of number of firms and the size of their plants) will neither tend to increase nor to decrease. In such a state the firms in the industry are said to be in their long run equilibrium and so is the industry.*

The opposite process of the exit of old firms form the industry and /or contraction of the size of their plants sets in when firms in the industry fail to earn normal profits and expect this

situation to continue in the long run. In the event of losses being incurred by the existing firms, some or them leave the industry while some adjust their productive equipment to the long run expectation. Total output of the commodity decreases and consequently market price rises. When market price rises, the losses of firms are reduced. This process comes to an end when total output of firms are reduced. This process comes to an end when total output of the commodity is reduced so much as to increase its price to equality with the average cost. When price once again equals average cost the remaining firms start earning normal profits. *Thus, under perfect competition, freedom of the entry and exist of firms ensures equality of price with average cost in the long run.*

Diagram 12.6 shows how in the event of abnormal profits the process of entry of firms and expansion of their productive equipment by the old firms bring about long run equilibrium of the firms and the industry.

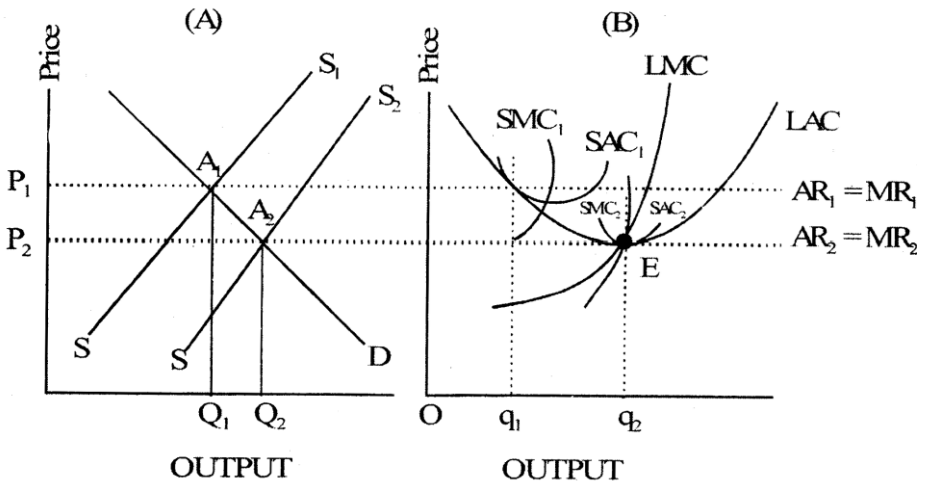


Diagram 12.6

Partt B of the diagram depicts the position of an individual firm while part A depicts price determination by the interaction of the market forces of demand and supply of the commodity. With OP, (in figure B) as the given market price, the firm is earning abnormal profits because average cost is less than the price. New firms start entering the industry (and old ones expand their productive equipment), and consequently total output of the commodity increases, causing the market supply curve SS1 (in figure A) to shift right ward to SS2. The supply curve SS2 intersects the given market demand curve at A2, thus determining OP2 as the equilibrium price and OQ2 as the equilibrium output. The fall in the market price form OP1 to OP2 causes the horizontal AR1/MR1 curve of the firm (in figure B) to shift downward to AR2/MR2 which cuts the MC curve at E. This process of the entry of new firms into the industry (and expansion of their productive equipment by the old firms) comes to an end when the increased total output of the commodity (i.e., rightward shift of the supply curves) has depressed the market price so much that it only covers average cost. In figure A when the market supply curve shifts to SS2 and brings down market price to OP2, the corresponding AR2/MR2 curve (in figure B) becomes tangential to the U-shaped average cost curve at E, the firm earns only normal profits. When firms in the industry earn only normal profits, the influx of new firms comes to an end. Firms in the industry are said to be in their long- run equilibrium when they earn only normal profits that is, when price (minimum of) equals (minimum of) average cost. The industry is said to be in its long run equilibrium when there is no tendency on the part of new firms to enter the industry or on the part of old firms to leave the industry.

Intext Questions:

Q.1. The relationship between Price and marginal cost (MC) in perfect competition is given as:

(a) P=MC (b) P< MC

(c) P > MC (d) P = O = MC

[Ans. (a)]

12.7 THE LONG-RUN INDUSTRY SUPPLY CURVE (LRS)

The long-run industry supply curve shows the relation between equilibrium price and the output which the firms are willing to supply after ail the desired entry or exit has taken place. Entry takes place in response to increase in product price due to increase in the demand for the product. Entry will continue until the excess profits due to higher price are wiped out and all firms are once again just covering average total costs. On the other hand, exit of firms from the industry starts taking place when price falls due to decrease in industry demand. If price falls below average total cost but remains above average variable cost then exit will occur as old capital wears out and is not replaced. If price fall below average variable cost then exit will occur very quickly because some existing capacity is scrapped or shifted to other uses.

The long run supply curve then becomes the locus of various long run equilibrium positions after all such demand induced changes have occurred.

The shape/slope of the long run supply curve depends on the manner in which the changes in factor prices take place in the competitive industry. We can identify three types of industry on this basis-(i) constant cost (ii) increasing cost and (iii) decreasing cost.

(i) Long-run supply curve in constant cost industry:

The industry in which input prices do not change as industry output expands or contracts, is called constant cost industry. This also leaves the long run cost-curves of the existing firms unchanged. This implies that more output can be supplied at the same price on the supply curve. So, the supply curve looks horizontal. Diagram 12.7 shows this situation:

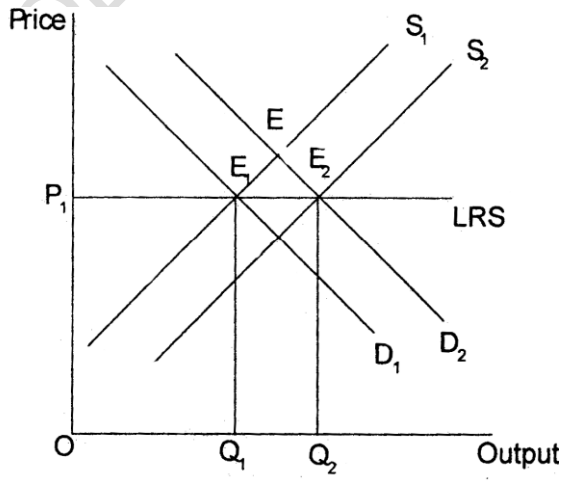


Diagram 12.7

(ii) Long-run supply curve under increasing cost industry

The industry in which input prices increase with expansion of industry output (and decrease with contraction of industry output) is called increasing cost industry. This happens because the

costs of production per unit of output increase with increase in output. This implies that more output can be supplied at higher price. So the long run supply curve looks upward sloping. (Diagram 12.8)

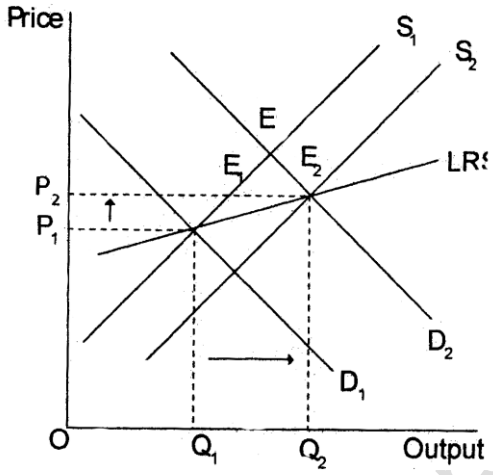


Diagram 12.8

(iii) Long run supply curve in decreasing cost industry

The industry in which input prices decrease with expansion of industry output and vice versa is called decreasing cost industry. The long run cost per unit of output falls with increase in production. As a result the long run supply curve looks downward sloping. This means that higher output can be supplied at lower price. This may happen due to external economies say, e.g. if the industry which supplies inputs to the competitive industry in question, enjoys increasing returns to scale then it is possible that the competitive industry in turn experiences decreasing costs.

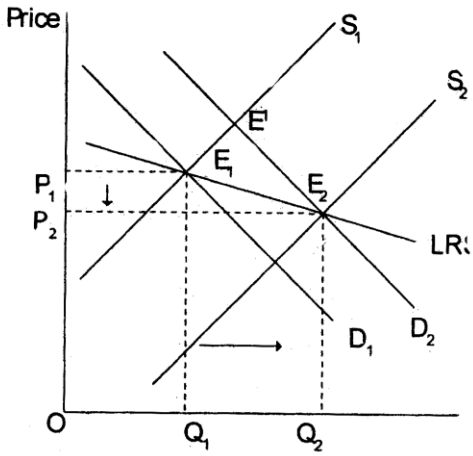


Diagram 12.9

Description of diagram 12.9—The initial equilibrium point of the competitive industry is at E_1 where original demand D_1 equals original supply S_1. The initial equilibrium price and quantity are P_1 and Q_1 respectively. Let demand for product increases so that D_1 shifts right to D_2. With supply unchanged at S_1 position the new equilibrium occurs at E where price of the product is more than original price P_1. This prompts the firms to supply more in anticipation of

higher profits. As a result, the industry output increases and accordingly the supply curve S_1 shifts to right to S_2. So, price falls from E. Finally, the equilibrium with new demand D_2 and Supply S_2 occurs at point E_2. Join E_1 and E_2 to get the long run supply curve.

Note that in constant cost industry as in diagram 10.6, the shift in supply is equal to shift in demand so that the ($S_1S_2 = D_1D_2$) locus E_1E_2 becomes horizontal. This is because of the fact that the price which earlier increased to E due to increase in demand now falls back to original level P_1 due to equal increase in supply. So LRS curve is horizontal.

In diagram 12.8, in case of increasing cost industry, the long run supply curve E_1E_2 is upward sloping because the increase in supply in this industry is less than the increase in demand ($S_1S_2 < D_1D_2$) due to higher cost of output.

In diagram 12.89 in case of decreasing cost industry the long run supply curve E_1E_2 downward sloping because the increase in supply is more than the increase in demand ($S_1S_2 > D_1D_2$) due to decreasing costs of output.

Intext Questions :

Q.1. TRUE/FALSE:

(a) The supply curve of a firm under Perfect competition is the rising part of MC curve in the short run.
(Ans. TRUE)

(b) Equilibrium is a the point where supply is greater than demand of a good.
(Ans. FALSE)

Q.3. In short run, if average Revenue > Average cost, the firm incurs : (AR> AC)

(a) Profits (b) Losses
(c) Equilibrium (d) None
[Ans. (a)]

Q.4. Supply curve of a decreasing cost-Industry is :

(a) Upward rising
(b) Horizontal
(c) Vertical
(d) Document sloping
[Ans. (d)]

12.8 ALLOCATIVE EFFICIENCY UNDER PERFECT COMPETITION

Allocation efficiency refers to the situation where allocation of resources lead to maximum gain to the society reflected in maximization of the sum of consumers and producers surplus.

Consumer surplus is the difference between the total value which the consumers are willing to place on all the units consumed of the product and the actual payment that they make on its purchase.

Producers surplus is the difference between the value the producers receive by selling the product at its equilibrium price at which demand and supply of the product are equal and the value of the product at its minimum supply price which is its transfer earning.

Sum of consumers and producers surplus is maximized when price equals marginal cost of the product which actually occurs under perfect competition. We know that price reflects the value that household place on a good and marginal cost reflects the opportunity cost of the resources needed to produce the good. This implies that as long as price exceeds marginal cost then society gains by producing more of the good and when price falls below marginal cost society gains by producing less. Hence maximum gain takes place when price equals marginal cost which is referred to as allocative efficiency.

The left-hand panel of diagram 12.10 gives equilibrium of competitive firm showing price P_0 = MC at point e. The price P_0 is market clearing price at which market demand AD equals supply BS at point E as shown on right hand panel of the diagram. For equilibrium quantity Q_0, the maximum price consumers are willing to pay is at point A so that consumers surplus is the area P0AE. Similarly, minimum supply price being at point B the producer surplus is the area BP_0E. The total surplus is the area BAE which is maximum possible for quantity Q_0 because the total surplus is reduced if quantity is either below or above Q_0.

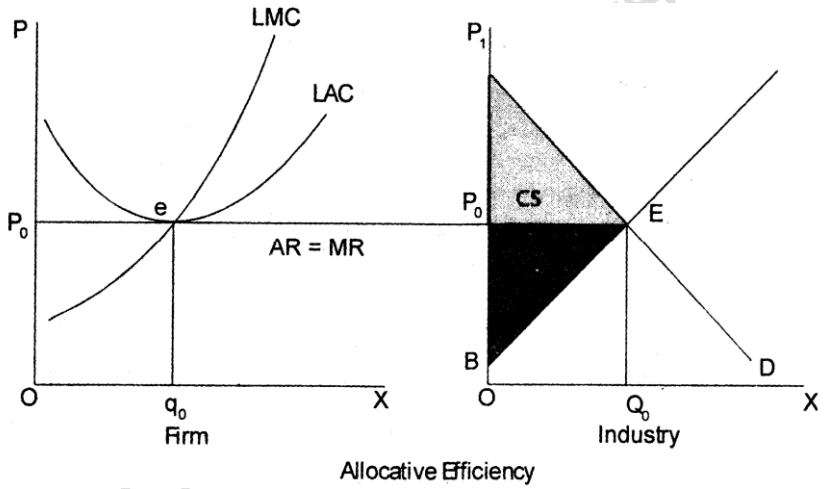


Diagram 12.10

Intext Questions :

Q.1. Define allocative efficiency

Q.2. Define consumer surplus.

Q.3. Define producer surplus.

Q.4. Allocative efficiency is at the point where :

(a) MC = AC (b) P = MC

(c) MC > MR (d) MC = AR

[Ans. (b)]

LEARNING OUTCOME

In this lesson you have learned the following: -

1. There are large number of buyers and sellers, product is homogenous, freedom of entry and exit, no Government intervention, objective of profit maximization, perfect knowledge and perfect mobility of factors.
2. In the short the firm may earn abnormal profit or normal profit. There may be losses or even the firm may shut down.
3. The industry is a price maker as it determines price of the product at the point of intersection between downward sloping demand curve and upward slopping demand curve of the product.
4. The supply curve of the curve of the firm is upward portion of the marginal cost curve above the minimum point of its average variable cost.
5. In the long run the firm earns normal profit because the price is equal to movement of the long run average variable cost.
6. Allocative efficiency implies maximization of the sum of consumers and producer surplus which happens under perfect competition. There is also productive efficiency due to the fact that competitive firm produces at the minimum point of its long run average cost curve.
7. The shape of long run supply curve of all competitive firm depends on the cost conditions in the industry. In an increasing cost industry long run supply curve is upward sloping whereas it is downward sloping in the decreasing cost industry and horizontal in a constant curve industry.

TERMINAL QUESTIONS

Q.1. Diagrammatically explain the concept of consumer surplus, producer surplus and total surplus.

Q.2. Diagrammatically explain shapes of supply curve in constant, increasing and decreasing cost industries.

Q.3. Examine Long and Short Run Equilibrium of a firm in a Perfectly competitive Market.

Q.4. List the features of firm of a perfectly competitive market.

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