Title: Principles of Microeconomics-I (Course Code: UECTC: 101)

UNIT 1

Meaning, Nature and Scope of Economics; Meaning, Nature and Scope of Micro Economics, Importance and Limitations of Micro Economics: Distinction between Micro Economics and Macro Economics, Concept of market, Demand and Supply Demand function, Supply function.

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NATURE AND SCOPE OF ECONOMICS:

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The word Economics is part and parcel of our daily life and has been derived from the Greek word 'Oikonomia' which means 'household management'. A Scottish thinker Adam Smith, who is known as Father of Economics is widely credited for creating the field of economics, however, he was inspired by French physiocrates. There is a great controversy among the economists regarding the nature of economics, whether it is considered as science or an art. If it is a science, then either positive science or normative science. Before we proceed, it becomes necessary to have a clear idea about science. Science is a systematized body of knowledge ascertainable through experiments and observation. It shows cause and effect relationship and its laws are universally acceptable.

Economics as a Science: Several economists like Robbins, Jordon and Robertson etc claimed that there are several characteristics of economics which resembles with science. These characteristics are:

1 Economics is also a systematic study of knowledge and facts. All the theories and facts related with both micro and macro economics are systematically collected, classified and analyzed.

2 The laws of demand and supply shows the cause and effect relationship where change in price is the cause and change in quantity demanded or supplied is the effect.

3 All the laws in economics are also universally accepted, like laws of demand and supply, law of diminishing marginal utility etc.

4 Open field experiments are also conducted in economics and the outcome of theories and laws of economics is observed. Like mixed economy is an experimental outcome between capitalist and socialist economies.

However, the most important question is whether economics is a positive science or a normative science? Positive science deals with all the real things and activities. It gives the solution what is? What was? What will be? The economists like Senior, Robbins and Freight-men were of the view that it was none of the functions of the economists to comment on the rightness or wrongness of an economic situation and their job is merely to explore and explain and not to advocate and condemn. On the contrary, normative science deals with what ought to be? What ought to have happened? It offers suggestions to the problems. Economists like Hawtrey, Pigou and Marshall believe that economics can not be dissociated from ethics. It is concluded that 'Economics' is both positive and normative science.

Economics as an Art: An art is the practical application of knowledge for achieving particular goals. It lays down precepts for the solution of some specific problems. According to T.K. Mehta, 'knowledge is science, action is art.' The solution of economic problems like unemployment, rising prices and high population growth fall under this category.

From the above discussion it is concluded that Economics is neither a science nor an art but both. It is a science in its methodology and an art in its application.

Scope of Economics: Scope means area of study or subject matter that something deals with or to which it is relevant. There is no unanimity among the economists regarding the subject matter of economics because it is expanding in its coverage. So, in order to understand its scope, the subject matter of economics is studied with the help of following three points:

i. On the basis of definition
ii. Traditional approach

iii. Modern approach

On the basis of definition

1 Wealth Definition: Adam Smith (1776) defined economics as , “a science which inquires into the nature and cause of wealth of nations.” He emphasized the production and growth of wealth as the subject matter of economics. But he takes into consideration only the tangible items of wealth and also ignores its distribution in the society.

2 Welfare Definition: Alfred Marshall (1890) defined, “Economics is a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of material requisites of wellbeing.” It is on one side a study of wealth; and on the other side, a study of human welfare. He says that wealth is only a mean to achieve an end and the end is social welfare but did not clear the meaning of welfare.

3 Scarcity Definition: Lionel Robbins (1932) defined, “Economics is that branch of science which studies human behavior as a relationship between ends and scarce means which have alternative uses.” He emphasized on ‘choice under scarcity’.

4 Growth Definition: Paul A Samuelson (1948) defined, “Economics is the study of how men and society choose with and without the use of money, to employ the scarce productive resources which have alternative uses, to produce various commodities over time and distribute them for consumption now and in future among various people and groups of society. It analyses the costs and benefits of improving pattern of resource allocation”. This definition introduced the dimension of growth under scarce situation.

Traditional approach

According to the traditional approach, economics deals with those activities of man through which he tries to satisfy his wants. The continuous circle of unlimited wants, efforts and satisfaction is the subject matter of economics. As per this approach, “Economics is that science which studies the pattern of consumption, production, distribution, exchange and public finance”.

Modern approach

According to modern view, the subject matter of economics is divided into two parts:

i. Microeconomics which studies about the behavior of individual economic units such as individual consumer, a firm, a household, an industry and so on.
ii. Macroeconomics which deals with the performance, structure, behavior and decision-making of an economy as a whole.

NATURE OF MICROECONOMICS

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The terms 'microeconomics' and 'macroeconomics' have been coined by a Norwegian economist Ragnar Frisch in 1933. The word micro is derived from a Greek word mikros which means small. When economic problems or economic issues are studied considering small economic units like an individual consumer or an individual producer, we are referring to microeconomics. The basic economic problem is the problem of choice related to allocation of scarce resources to alternative uses at an individual level (both consumer & producer). As Gardner Ackley says, "Microeconomics deals with the division of total output among industries, products and firms and the allocation of resources among competing groups. It considers problems of income distribution. Its interest is in relative prices of particular goods and services." According to Maurice Dobb, Microeconomics is, in fact, a microscopic study of the economy. It is like looking at the economy through a microscope to find out the working of markets for individual commodities and the behavior of individual consumers and producers.

Scope of Microeconomics

The scope or the subject matter of microeconomics is concerned with:

1 Product Pricing: The price of an individual commodity is determined by the market forces of demand and supply. Demand for goods and services and consumer's choice on the allocation of his income to different uses are the issues studied in the theory of consumer behavior or theory

of demand and the problems faced by a producer in deciding the product and combination of inputs used comes under the theory of producer behavior or theory of supply.

2 Factor Pricing Theory: Microeconomics helps in determining the factor prices for land, labor, capital and entrepreneurship in the form of rent ,wages, interest and profit respectively. These are the factors which contribute to the production process.

3 Theory of Economic Welfare: The welfare component in microeconomics is concerned with solving the problems in attaining economic efficiency to maximize public welfare. It attempts to gain efficiency in production, consumption/distribution to attain overall efficiency and provides answers for 'What to produce?', 'When to produce?', 'How to produce?', and 'For whom to produce?'.

IMPORTANCE OF MICROECONOMICS

1 Individual Behaviour Analysis: Microeconomics helps in studying the behaviour of individual consumer or producer in different situations where individual has freedom to take his own economic decisions.

2 Resource Allocation: We know that resources are limited in nature as compared to their demand and for that we have to use them judiciously. Microeconomics helps in proper allocation and utilization of these scarce resources to produce various types of goods and services.

3 Tools for Economic Policies: Microeconomics through price or market mechanism helps the state in formulating correct price policies and their evaluation in proper perspective.

4 Economic Policy: Microeconomics helps in the formulation of economic plans and policies to promote all round economic development.

5 Understanding the Problems of Taxation: Microeconomics helps the government in fixing the tax rate and the type of tax as well as the amount of tax to be charged to the buyer and the seller.

6 Helpful in International Trade: Microeconomics helps in explaining and fixing international trade and tariff rules, gains from trade, causes of disequilibrium in BOP and the determination of the foreign exchange rate.

7 Social Welfare: Microeconomics not only analyse economic conditions but also studies the social needs under different market conditions like monopoly, oligopoly etc. It helps in suggesting ways and means of eliminating wastages in order to bring maximum welfare. V+

LIMITATIONS OF MICROECONOMICS

1 Unrealistic Assumptions: Microeconomics is based on the unrealistic assumption of full employment in the economy which does not exist practically. It also assumes laissez faire policy which is no longer practised after Great Depression of the 1930s.

2 Narrow Picture: Microeconomics is concerned with the study of parts and neglects the whole. It presents an imprecise picture of the economy because behaviour of one individual can not be generalized as the behaviour of all.

3 Misleading Results: Microeconomics is based on the information dealing with individual behaviour. So, it is not necessary that principles which are true in case of a particular household, firm or industry may also be applicable to the economy as a whole.

4 Abstractness: Microeconomics fails to provide a description of the real world. Its abstractness mostly stems from the fact that it is not in a position to take into account the entire economic data of the real world.

5 Practical Solution: Microeconomics fails to offer practical guidance to government in the formulation of appropriate economic policies.

MACROECONOMICS- MEANING AND SCOPE

The word macro has been derived from a Greek word makros which means large. It studies economic problems from the point of view of the entire economy such as national output, national employment, general price level, total savings and total consumption etc. It is also called the study of aggregates. All the prominent reforms and policies are based on this concept. Macroeconomics is a vital field of study for the economists, government, financial bodies and researchers to analyze the general national issues and economic well-being of a country. The scope of macroeconomics is divided into two major fundamentals:-

Macroeconomic Theories which includes, theory of national income, employment, money, business cycle, international trade, general price level, and economic growth and development.

Macroeconomic policies which includes fiscal and monetary policy.

DISTINCTION BETWEEN MICROECONOMICS AND MACROECONOMICS

Although the two branches of economics differ in their approach, but they are very much interdependent on each other because the parts affect the whole and the whole affects the parts. The main points of difference are as follows:

1. The word micro has been derived from the Greek word mikros which means small and the word macro has been derived from the Greek word makros which means large.
2. Microeconomics studies economic relationships or economic problems at the level of an individual- an individual firm, an individual household or an individual consumer. Macroeconomics deals with such relationship and problems at the level of the economy as a whole such as national income, national output and general price level.
3. The objectives of microeconomics are to maximize utility and profits on the demand and supply side respectively, whereas the objectives of macroeconomics are full employment, price stability, economic growth and favourable BOP.
4. Microeconomics is basically concerned with determination of price and output for an individual firm or industry with the help of demand and supply forces and macroeconomics is concerned with determination of national income, output, employment and the general price level with the help of aggregate demand and aggregate supply.
5. Microeconomics assumes ‘ceteris paribus’ and rational behaviour in the explanation of various laws, where as macroeconomics assumes that micro variables such as distribution of income remains constant when we study the level of output in the economy.
6. Microeconomics is based on the partial equilibrium analysis which helps to explain the equilibrium conditions of an individual, a firm or an industry. On the other hand, macroeconomics is based on the general equilibrium analysis which is an extensive study

of a number of variables, their interrelations and interdependence for understanding the working of the economic system as a whole.

7 Microeconomics is considered as a static analysis because it does not explain the time element. On the other hand, macroeconomics is concerned with dynamic analysis and is based on time lags, rates of change, and past and expected values of the variables.

MEANING OF MARKET

A market is a place where two parties can gather to facilitate the exchange of goods and services. The parties involved are usually buyers and sellers. In Economics, however, the term "Market" does not refer to only particular place but it refers to a market for a commodity or commodities. It refers to an arrangement whereby buyers and sellers come in close contact with each other directly or indirectly to buy and sell goods. Further, it follows that for the existence of a market, buyers and sellers need not personally meet each other at a particular place. They may contact each other by any means such as a letter of exchange, telephone and mail, etc. Thus, the term "Market" is used in economics in a typical and specialised sense. It does not refer only to a particular place and fixed location.

Further, it refers to the conditions and commercial relationships facilitating transactions between buyers and sellers. Therefore, a market signifies any arrangement in which the sale and purchase of goods take place. Thus, in the word of Cournot, a French economist, "Economists understand by the 'Market' not any particular market place in which things are bought and sold but the whole of any region in which buyers and sellers are in such free intercourse with one another that the prices of the same goods tend to equality, easily and quickly."

DEMAND SIDE OF MARKET

Demand

Demand is an economic principle referring to a buyers' desire to purchase goods and services and willingness to pay a price for a specific good or service. In other words, it refers to the willingness or ability of a buyer to pay for a particular product. Demand is based on both wants and ability to pay because if you can't pay, you have no effective demand. There are number of factors affecting demand such as price of the product, income of the consumer , change in

customers' preferences, and standard of living, wealth, population, government policy, etc. Keeping the other factors constant, an increase in the price of a good or service will decrease the quantity demanded, and vice versa.

According to Prof. Benham, "*The demand for anything, at a given price is the amount of it which will be bought per unit of time at the price.*"

According to Prof Hibdon, "*Demand means the various quantities of goods that would be purchased per time period at different prices in a given market.*"

Factors affecting demand

There are number of factors affecting demand which are as follows:

1. Price of the Product

Price of the product is one of the important factors affecting demand. There is an inverse relationship between price and demand which is known as law of demand. According to the law of demand, this implies an increase in demand follows a reduction in price and a decrease in demand follows an increase in the price of similar goods if other factors remain constant or equal. .

2. Income of the Consumers

Income of the consumer is also an important factor determining demand. Rising incomes lead to a rise in the number of goods demanded by consumers. Similarly, a drop in income is accompanied by decreased consumption levels. This relationship between income and demand is not linear in nature. Marginal utility determines the proportion of change in the demand levels.

3. Prices of related goods

The demand for a product is also influenced by change in the price of related goods. Related goods can be of two types 1. Complementary products – An increase in the price of one good will cause a decrease in the quantity demanded of a complementary product. Example: Rise in the price of pen will reduce the demand for ink. This is because the products are complementary in nature. 2. Substitute Product – An increase in the price of one good will cause an increase in

the demand for a substitute good. Example: Rise in price of tea will increase the demand for coffee and vice versa.

4. Expectations regarding the future

Expectations of a higher income or expecting an increase in prices of goods in near future will lead to an increase the quantity demanded. Similarly, expectations of a reduced income or a decrease in prices of goods will decrease the quantity demanded

5. Number of buyers in the market

The number of buyers has a major effect on demand. An increase in the number of potential buyers will increase the demand for the good. Furthermore, this is true irrespective of changes in the price of commodities.

6. Taste

The demand for a commodity is also affected by the consumer's taste. Tastes include habit, fashion, custom, etc. If the taste for a good goes up, its amount demanded is even more at the same price. This is known as increase in demand.

7. Weather

The demand for a commodity is also influenced by weather. For example, in cold weather, there will be increased demand for fuel and warm weather clothes. On the other hand, ice cream is very much demanded in hot summer days.

8. Income Distribution

In a country with equitable distribution of income, there will be lesser demand for certain luxury goods, while in a country where the income is unequally divided among the very rich and very poor people, the demand for such luxury goods will be more.

Demand Function

Demand function is a mathematical function showing relationship between the quantity demanded of a commodity and the factors influencing demand. Therefore, a mathematical expression of relationship between quality demanded of the commodity and its determinants is known as the demand function.

Individual demand for a commodity can be expressed mathematically in the following general functional form:

$D_x = f(P_x, P_s, P_c, T, Y, A, P_p, E_p, E_y, u)$

In the above equation,

D_x = demand for commodity x

P_x = Price of the commodity x

Ps = Price of substitutes of x

Pc = Price of complements of x

T = Tastes and preferences of consumer

Y = Income level

A = Advertising and promotional activities

P_P = Population

E_P = Consumer's expectations about future prices

E_y = Consumer's expected future incomes

u = other determinants of the demand for x

Supply

Supply means the quantities that a seller is willing and able to sell at different prices. Supply is positively related to price given that at higher prices there is an incentive to supply more as

higher prices may generate increased revenue and profits. It is obvious that if the price goes up, he will offer more for sale

Determinants of Supply:

Supply can be influenced by a number of factors that are termed as determinants of supply. Some of the factors that influence the supply of a product are described as follows:

1. Price

Price is the main factor that influences the supply of a product to a greater extent. Unlike demand, there is a direct relationship between the price of a product and its supply. If the price of a product increases, then the supply of the product also increases and vice versa.

2. Cost of Production

Cost of production is one of the important factors influencing supply. It implies that the supply of a product would decrease with increase in the cost of production and vice versa. The supply of a product and cost of production are inversely related to each other. For example, a seller would supply less quantity of a product in the market, when the cost of production exceeds the market price of the product.

3. Technology

The supply of a commodity is also affected by the technology. A better and advanced technology increases the production of a product, which results in the increase in the supply of the product. For example, the production of fertilizers and good quality seeds increases the production of crops. This further increase the supply of food grains in the market.

4. Prices of other goods

As resources have alternative uses, the quantity supplied of a commodity depends not only on its price, but also on the prices of other commodities. Increase in the prices of other goods makes them more profitable in comparison to the given commodity. As a result, the firm shifts its limited resources from production of the given commodity to production of other goods. For

example, increase in the price of other good (say, wheat) will induce the farmer to use land for cultivation of wheat in place of the given commodity (say, rice).

5. Factor prices and their availability

The supply of a commodity is also determined by factor prices and their availability. The inputs, such as raw material man, equipment, and machines, required at the time of production are termed as factors. If the factors are available in sufficient quantity and at lower price, then there would be increase in production.

6. Number of Firms

If the number of firms producing a product increases, the market supply of the product will increase causing a rightward shift in the supply curve.

7. Government's Policies

Government policy affects the supply of a commodity. For example, increase in taxes raises the cost of production and, thus, reduces the supply, due to lower profit margin. On the other hand, tax concessions and subsidies increase the supply as they make it more profitable for the firms to supply goods. This would increase the supply of a product in the market.

Relationship between quantity Supplied and price

Supply of a commodity is functionally related to its price. The law of supply states that there is a positive relationship between the quantity supplied and price, keeping other factors constant. If the price of a product increases, then the supply of the product also increases and vice versa. Change in supply with respect to the change in price is termed as the variation in supply of a product.

The supply schedule and upward sloping supply curve reflect the law of supply. Supply schedule is a tabular presentation of various combinations of price and quantity supplied by the seller or producer during a period of time. We can show the supply schedule through the following table 1.1

Table: 1.1

Supply Schedule

Price of rice (in Rs.)	Quantity Supplied of rice (in Kg.)
10	1
20	2
30	3
40	4
50	5

The above schedule shows the direct relationship between price and quantity supplied of a commodity, say, rice. It can be seen from the table that when the price is Rs.10 per kg, quantity supplied by the seller is 1 kg. As the price of rice increases from Rs.10 per kg to Rs.20 per kg and then to Rs.30 per kg, the quantity supplied by the seller also increases from 1 kg to 2 kg and then to 3 kg, respectively. Further, price increase from Rs.40 to Rs.50 per kg results in increase in quantity supplied by the seller from 4 kg to 5 kg. Thus, the above schedule shows that there is positive relationship between price and quantity supplied of a commodity.

By plotting various combinations of price and quantity supplied of the table, we can derive an upward sloping demand curve. The X-axis represents the supply and Y-axis represents the price of a commodity. There exists a positive relationship between price and quantity supplied of a commodity. By plotting various combinations of price and quantity supplied we derived points A, B, C, D and E. By joining these various points A, B, C, D and E, we get an upward sloping supply curve.

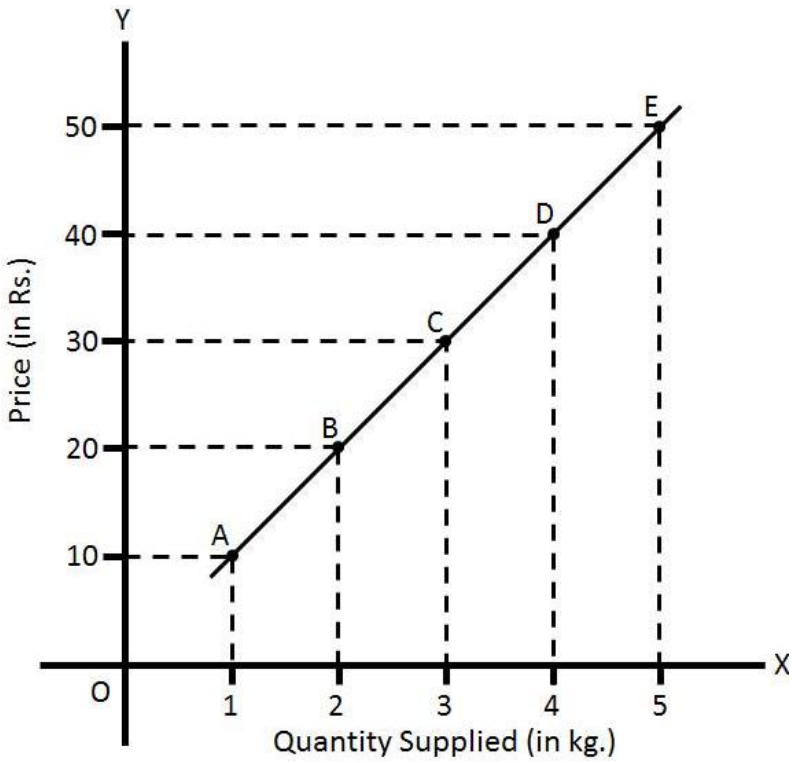

Fig. 1.1: Supply curve

Supply Function

Supply function is a mathematical function showing relationship between the quantity supplied of a commodity and the factors influencing supply. Therefore, a mathematical expression of relationship between quality supplied of the commodity and its determinants is known as the supply function.

In supply function, quantity supplied is expressed as a function of various variables. Individual supply of a commodity can be expressed mathematically in the following general functional form:

$S_x = f (P_x, C_x, T_x, P_y, E_p, u)$

Where,

S_x = Quantity supplied of the commodity x

P_x = Price of the commodity x

C_x = Cost of production

T_x= Technology of production

P_y= Prices of related factors

E_p= Future expectations regarding prices

u= other determinants of the quantity supplied of x

Questions

1. Explain nature and scope of Economics?
2. Is economics a science or an art. Comment?
3. What is microeconomics?
4. Explain meaning, scope, importance and limitations of microeconomics?
5. What is macroeconomics?
6. Explain the main points of difference between microeconomics and macroeconomics?

Books Recommended:

1 Principles of Microeconomics by H.L. Ahuja

2 Modern Economic Theory by K.K. Dewett

3 Microeconomics by M.L. Jhingan

4 Modern Microeconomics by Koutsoyiannis

Unit II: Elasticity of Demand and Supply

Law of demand; Law of supply ;Market price determination - Demand and supply; Elasticity of Demand: Meaning, Types and Degrees(Price, Income and Cross Elasticity of Demand); Factors affecting Elasticity of Demand; Methods for measuring price Elasticity of Demand; Price Elasticity of Supply

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Introduction of Unit -II

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Law of Demand

The law of demand is one of the most fundamental concepts in economics. Law of Demand establishes a functional relationship between the price and the quantity demand of a commodity. Other things remaining the same, when the price of a commodity rises its demand will fall and if price of a commodity falls, the quantity demanded of it will rise. These other things which are assumed to be remaining same are the taste and preferences of the consumer, income of the consumer and the price of the related commodity. Price and demand move in opposite direction.Although there is no proportionate relationship between price and demand. A 10% increase in price may not necessarily lead to 10% fall in demand.

Definitions:-

According to Marshall, "the greater the amount to be sold, the smaller must be the price at which it is offered in order that it may find purchases, or in other words, the amount demanded increases with a fall in price and diminishes with a rise in prices".

According to Samuelson, " Law of demand state that people will buy more at lower price and buy less at higher prices, other things remaining the same".

According to Ferguson's , " According to the Law of demand, the quantity demanded varies inversely with price".

According to Meyers, " People demand a larger quantity of goods and services only at a lower price than at a higher price".

Assumptions

The main assumptions of the law are:

1. No change in the taste and preference of consumer
2. The income of the consumer remains constant;
3. There is no change in customs;
4. The commodity to be used should not confer distinction on the consumer;
5. There should not be any substitutes of the commodity;
6. There should not be any change in the prices of other products;

7. There should not be any possibility of change in the price of the product being used;

8. There should not be any change in the quality of the product; and

9. The habits of the consumers should remain unchanged. Given these conditions, the law of demand operates. If there is change even in one of these conditions, it will stop operating.

Given these assumptions, the law of demand is explained in terms of Table and Figure .

Demand Scheduled

Price (Rs.)	Quantity Demanded
5	100 Units
4	200 Units
3	300 Units
2	400 Units
1	600 Units

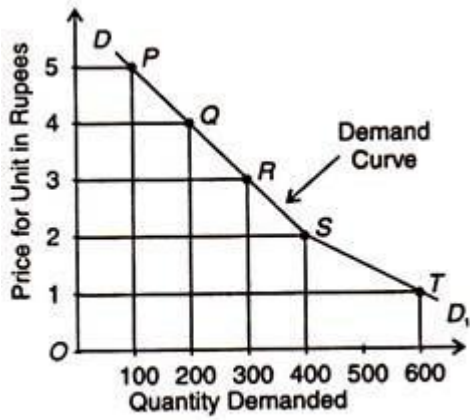

Fig. 7

The above table shows that when the price of say, orange, is Rs. 5 per unit, 100 units are demanded. If the price falls to Rs.4, the demand increases to 200 units. Similarly, when the price declines to Re.1, the demand increases to 600 units. On the contrary, as the price increases from Re. 1, the demand continues to decline from 600 units.

In the figure, point P of the demand curve DD_1 shows demand for 100 units at the Rs. 5. As the price falls to Rs. 4, Rs. 3, Rs. 2 and Re. 1, the demand rises to 200, 300, 400 and 600 units respectively. This

is clear from points Q, R, S, and T. Thus, the demand curve DD_1 shows increase in demand of orange when its price falls. This indicates the inverse relation between price and demand.

Exceptions to the Law of Demand:

In certain cases, the demand curve slopes up from left to right, i.e., it has a positive slope. Under certain circumstances, consumers buy more when the price of a commodity rises, and less when price falls, Many causes are attributed to an upward sloping demand curve. Some causes are:

1. Giffen Goods

Giffen Goods is a concept that was introduced by Sir Robert Giffen. These goods are goods that are inferior in comparison to luxury goods. However, the unique characteristic of Giffen goods is that as its price increases, the demand also increases. And this feature is what makes it an exception to the law of demand.

The Irish Potato Famine is a classic example of the Giffen goods concept. Potato is a staple in the Irish diet. During the potato famine, when the price of potatoes increased, people spent less on luxury foods such as meat and bought more potatoes to stick to their diet. So as the price of potatoes increased, so did the demand, which is a complete reversal of the law of demand.

2. Veblen Goods

The second exception to the law of demand is the concept of Veblen goods. Veblen Goods is a concept that is named after the economist Thorstein Veblen, who introduced the theory of "conspicuous consumption". According to Veblen, there are certain goods that become more valuable as their price increases. If a product is expensive, then its value and utility are perceived to be more, and hence the demand for that product increases.

And this happens mostly with precious metals and stones such as gold and diamonds and luxury cars such as Rolls-Royce. As the price of these goods increases, their demand also increases because these products then become a status symbol.

3. The expectation of Price Change

In addition to Giffen and Veblen goods, another exception to the law of demand is the expectation of price change. There are times when the price of a product increases and market conditions are such that the product may get more expensive. In such cases, consumers may buy more of these products before the price

increases any further. Consequently, when the price drops or may be expected to drop further, consumers might postpone the purchase to avail the benefits of a lower price.

For instance, in recent times, the price of onions had increased to quite an extent. Consumers started buying and storing more onions fearing further price rise, which resulted in increased demand.

There are also times when consumers may buy and store commodities due to a fear of shortage. Therefore, even if the price of a product increases, its associated demand may also increase as the product may be taken off the shelf or it might cease to exist in the market.

4. **Ignorance Effect:**

Consumers buy more at a higher price under the influence of the "ignorance effect", where a commodity may be mistaken for some other commodity, due to deceptive packing, label, etc.

5. **Necessities of Life:**

Normally, the law of demand does not apply on necessities of life such as food, cloth etc. Even the price of these goods increases, the consumer does not reduce their demand. Rather, he purchases them even the prices of these goods increase often by reducing the demand for comfortable goods. This is also a reason that the demand curve slopes upwards to the right.

6. **Depression:**

During a depression, the prices of commodities are very low and the demand for them is also less. This is because of the lack of purchasing power with consumers.

7. **War:**

If shortage is feared in anticipation of war, people may start buying for building stocks or for hoarding even when the price rises.

8. **Change in Weather:**

With change in season/weather, demand for certain commodities also changes, irrespective of any change in their prices. For example, demand for umbrellas increases in rainy season even with an increase in their prices. It must be noted that in normal conditions and considering the given assumptions, 'Law of Demand' is universally applicable.

9. **Change in Income**

Sometimes the demand for a product may change according to the change in income. If a household's income increases, they may purchase more products irrespective of the increase in their price, thereby increasing the demand for the product. Similarly, they might postpone buying a product even if its price reduces if their income has reduced. Hence, change in a consumer's income pattern may also be an exception to the law of demand.

10. Fashion related goods*:*

Goods related to fashion do not follow the law of demand and their demand increases even with a rise in their prices. For example, if any particular type of dress is in fashion, then demand for such dress will increase even if its price is rising.

11. Fear of shortage

When people feel that a commodity is going to be scarce in the near future, they buy more of it even if there is a current rise in price.

For example: If the people feel that there will be shortage of L.P.G. gas in the near future, they will buy more of it, even if the price is high.

Reasons for the Law of Demand: Why does Demand curve slope Downward?

We have explained above that when price falls the quantity demanded of a commodity rises and if price rises, the quantity demanded of a commodity falls, other things remaining the same.It is due to this law of demand that demand curve slopes downward from left to the right. Now, the important question is why the demand curve slopes downward, or in other words, why the law of demand describing inverse price-demand relationship is valid. There are some reasons given for the inverse relationship between price and amount demanded in case of ordinary commodities. These reasons are as follows:

1. Law of diminishing Marginal Utility

The law of demand is based on the law of Diminishing Marginal Utility. According to this law, when a consumer buys more units of a commodity, the marginal utility of that commodity continues to decline. Therefore, the consumer will buy more units of that commodity only when its price falls. When less units are available, utility will be high and the consumer will be prepared to pay more for the commodity. This proves that the demand will be more at a lower price and it will be less at a higher price. That is why the demand curve is downward sloping.

2. Substitution Effect

The other important reason why the quantity demanded of a commodity rises as its price falls, is the substitution effect. When the price of a commodity falls, it become relatively cheaper than other commodities. This induces the consumer to substitute the commodity whose price has fallen for other commodities which have now become relatively dearer. As a result of this substitution effect, the quantity demanded of the commodity, whose price has fallen, rises

3. Income Effect

When price of a commodity falls, the consumer can buy more quantity of the commodity with his given income. Or, if he chooses to buy the same amount of the commodity as before, some money will be left with him because he has to spend less on the commodity due to its lower price. In other words, as a result of fall in price of the commodity, consumer's real income or purchasing power increases. This increase in real income induces the consumer to buy more of that commodity . This is called income effects of change in price of the commodity. This is one reason why a consumer buys more of a commodity whose price falls.

4. **New Consumers**

When the price of commodity increase, some of the consumers now cannot afford to buy will withdraw its consumption and as a result demand decrease. On the contrary, if the price falls, many new consumer now start purchasing that commodity because now they may be able to afford that commodity. So, we can say that because of change in price some new consumer can add to total demand and some might withdraw.

5. Different uses of commodity:

If the commodity the consumer is consuming can be put to several uses, its demand can be effected by a change in its price. If the price of the commodity falls, consumer will use it for several purposes. Consequently, if the price of commodity increases, he will restrict its use for the most important purpose

Law of Demand

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Law of Supply

The law of supply is the microeconomic law that states that, all other factors being equal, as the price of a good or service increases, the quantity of goods or services that suppliers offer will increase, and vice versa. Law of supply depicts the producer behavior at the time of changes in the prices of goods and services. When the price of a good rises, the supplier increases the supply in order to earn a profit because of higher prices.

Assumptions :

Important assumptions of the law of supply are as follows:

1. No change in the income:

There should not be any change in the income of the purchaser or the seller.

2. **No change in technique of production:**

There should not be any change in the technique of production. This is essential for the cost to remain unchanged. With the improvement in technique if the cost of production is reduced, the seller would supply more even at falling prices.

3. **There should be no change in transport cost:**

It is assumed that transport facilities and transport costs are unchanged. Otherwise, a reduction in transport cost implies lowering the cost of production, so that more would be supplied even at a lower price.

4. **Cost of production be unchanged*:***

It is assumed that the price of the product changes, but there is no change in the cost of production. If the cost of production increases along with the rise in the price of product, the sellers will not find it worthwhile to produce more and supply more. Therefore, the law of supply will be valid only if the cost of production remains constant. It implies that the factor prices such as wages, interest, rent etc., are also unchanged.

5. **There should be fixed scale of production:**

During a given period of time, it is assumed that the scale of production is held constant. If there is a changing scale of production the level of supply will change, irrespective of changes in the price of the product.

6. **There should not be any speculation:**

The law also assumes that the sellers do not speculate about the future changes in the price of the product. If, however, sellers expect prices to rise further in future, they may not expand supply with the present price rise.

7. The prices of other goods should remain constant:

Further, the law assumes that there are no changes in the prices of other products. If the price of some other product rises faster than that of the product in consideration, producers might transfer their resources to the other product—which is more profit yielding due to rising prices. Under this situation and circumstances, more of the product in consideration may not be supplied, despite the rising prices

Given these assumptions, the law of supply can be explained with the help of supply schedule and supply curve as explained below.

Supply Schedule

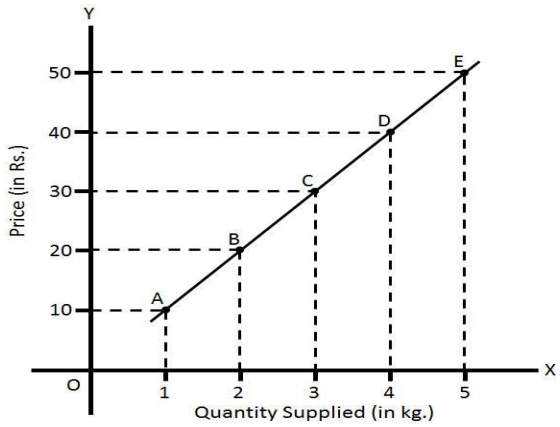
Supply Schedule is a tabular presentation of various combinations of price and quantity supplied by the seller or producer during a period of time. We can show the supply schedule through the following imaginary table.

Price (in Rs.)	**Quantity Supplied (in Kg.)**
10	**1**
20	**2**
30	**3**
40	**4**
50	**5**

The given schedule shows positive relationship between price and quantity supplied of a commodity. In the beginning, when the price is Rs.10 per kg, quantity supplied by the seller is 1kg. As the price increases from Rs.10 per kg to Rs.20 per kg and then to Rs.30 per kg, the quantity supplied by the seller also increases from 1 kg to 2 kg and then to 3 kg respectively.
Further rise in price to Rs.40 and then to Rs.50 per kg results in increase in quantity supplied by the seller to 4kg and then to 5kg. Thus, the above schedule shows that there is positive relationship in between price and quantity supplied of a commodity.

Supply curve

The supply curve is a graphical representation of a supply schedule. By plotting various combinations of price and quantity supplied of the table, we can derive an upward sloping demand curve as shown in the figure below



In the given figure, price and quantity supplied are measured along the Y-axis and the X-axis respectively. By plotting various combinations of price and quantity supplied we derived points *A*, *B*, *C*, *D*, *E* curve and joining these points we find an upward sloping i.e. SS_1. The positive slope of the supply curve SS_1 establishes the law of supply and shows the positive relationship in between price and quantity supplied.

Reasons for Law of Supply:

Let us now try to understand, why the supply of a commodity expands as the price rises. The main reasons for operation of law of supply are:

1. Profit Motive:

The basic aim of producers, while supplying a commodity, is to secure maximum profits. When price of a commodity increases, without any change in costs, it raises their profits. So, producers increase the supply of the commodity by increasing the production. On the other hand, with fall in prices, supply also decreases as profit margin decreases at low prices.

2. Change in Number of Firms:

A rise in price induces the prospective producers to enter into the market to produce the given commodity so as to earn higher profits. Increase in number of firms raises the market supply. However,

as the price starts falling, some firms which do not expect to earn any profits at a low price either stop the production or reduce it. It reduces the supply of the given commodity as the number of firms in the market decreases.

3. Change in Stock:

When the price of a good increases, the sellers are ready to supply more goods from their stocks. However, at a relatively lower price, the producers do not release big quantities from their stocks. They start increasing their inventories with a view that price may rise in near future.

Limitations/Exceptions of Law of Supply:

There are certain circumstances under which the law of supply may not hold true. It means that the price of the commodity and its supply may not move in the same direction. Thus, the exceptions to the law of supply are as follows:

1. **Agricultural Goods:**

The law of supply does not apply to agricultural goods as their production depends on climatic conditions. If, due to unforeseen changes in weather, the production of agricultural products is low, then their supply cannot be increased even at higher prices.

2. **Future Expectations:**

If sellers expect a fall in price in the future, then the law of supply may not hold true. In this situation, the sellers will be willing to sell more even at a lower price. However, if they expect the price to rise in the future, they would reduce the supply of the commodity, in order to supply the commodity later at a high price.

3. **Monopoly**

Monopoly is a situation where there is only a single seller of a commodity. Thus, he is the price maker and has control over the prices.In such a case, the law of supply may not apply as he may not be willing to increase the supply even if the prices are high.

4. Stock clearance sale

When a seller wants to clear its old stock in order to store new goods, he may sell large quantity of goods at heavily discounted price. It is also against the law of supply.

6. **Perishable Commodities:**

The commodities fall in different classes and not all of them can be stored for a longer period of time. Certain commodities have very short shelf life and they need to be made available in the market before they perish. The common examples of perishable goods are fruits, sea produce, flowers, meat, vegetables and so on. So for such goods the sellers cannot simply wait for a longer time and supply these in the market even when the prices are not rising.

7. **Out of Fashion Goods:**

When goods are in fashion then the sellers can command a high price. But there are certain goods that go out of fashion and are no longer in vogue. Such goods are supplied by the sellers at low prices in order to clear these goods.

8. Rare Articles:

Rare, artistic and precious articles are also outside the scope of law of supply. For example, supply of rare articles like painting of Mona Lisa cannot be increased, even if their prices are increased.

9. **Supply of Labour:**

Another fine example of the exception to the law of supply is the labour supply. The workers are interested in high wages till a certain point. Once that point is achieved they may like to devote their time to leisure activities. So after a particular point the workers may no longer be interested in higher wages. This simply means that initially the supply of labour is directly related to the wages but after a certain level the relation between wages and supply of labour turns inversely related.

10. Economic Slowdown

The businesses pass through different phases and the sellers have to adapt to these business-related changes. During the low economic phases, the sellers may not have an advantage of incremental prices and hence during such tough times, they sell goods even when they do not witness price rise in order to recover costs. So the law of supply is not applicable in this case also.

11. **Immediate requirement of funds**

The seller may face a time when there is in immediate need of funds. In this situation, he may supply the goods in the market even at lower prices.

Law of Supply

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Market Price Determination

Price is dependent on the interaction between demand and supply components of a market. Demand and supply represent the willingness of consumers and producers to engage in buying and selling. An exchange of a product takes place when buyers and sellers can agree upon a price. Equilibrium price is such a price at which the market demand becomes equal to market supply. If, at any particular price, demand and supply are equal, the buyers and sellers both remain satisfied, for, at the said price, the sellers supply what the buyers demand, and the buyers demand what the sellers supply. Therefore, the buyers and sellers accept this price, and they buy and sell accordingly. None of them is dissatisfied, and so, none of them would want a change in the price. That is why this price is called the equilibrium price.

The process of price determination is explained as a matter of interaction between demand and supply with the help of Fig. below. The DD curve in this figure is the aggregate or market demand curve for the product. This curve tells us what is the aggregate demand of the buyers at any particular price, and, as such, this curve is the horizontal summation of the individual demand curves of all the buyer.

For example, from the DD curve of Fig. , at the price $p = p_2$ the market demand for the good is p_1G. Again, at $p = p_2$, the market demand amounts to p_2H. Owing to the law of demand, the individual demand curves are downward sloping towards right.

That is why the market demand curve as a horizontal summation of the individual demand curves would also be downward sloping towards right (or negatively sloped).

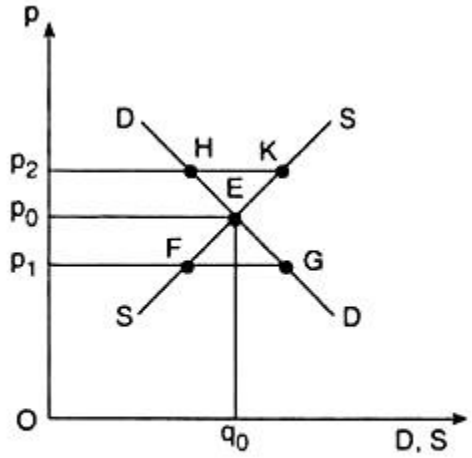


Fig. 1.15 Demand-Supply equilibrium

On the other hand, the SS curve in Fig. above is the aggregate or market supply curve for the good. From this curve the market supply of the good at any particular price, and so, this curve is the horizontal

summation of the individual supply curves of the sellers. For example, from the supply curve SS, at $p = p_1$, the market supply of the good is p_1F or, at $p = p_2$, the market supply is p_2K.

Since the supply curves of individual sellers are sloping upward towards right owing to the law of supply the aggregate supply curve as the horizontal summation of the individual supply curves would also be sloping upward towards right or positively sloped like the SS curve in Fig.above.

The price, p_0, of the good that would be obtained at the point of intersection, E, of the aggregate demand curve, DD, and the aggregate supply curve, SS, would itself be the equilibrium price of the good. At $p = p_0$, the market demand and market supply of the good are equal, both being equal to $q = q_0$ in Fig.above. That is why, here $p = p_0$ is the equilibrium price and $q = q_0$ is the equilibrium quantity demanded and supplied.

Now, if the price of the good be less than p_0, if it is $p_1 < p_0$, then the quantity demanded would be greater than the equilibrium quantity, q_0, and the quantity supplied would be less than q_0.

It is got because of the laws of demand and supply. As a result, there would be excess demand—demand in excess of supply—in the market. At $p = p_1$, the quantity of excess demand would be FG. In this case, the buyers are not able to buy what they want to buy, and so they would be willing to pay a higher price; consequently, the price of the good would be increasing from pi till it becomes equal to p_0.

As price increases from p_1, the quantity demanded would fall and the quantity supplied would rise leading to a fall in excess demand, and, when p rises to the level of p_0, the whole of excess demand would be wiped out and the market would be in equilibrium.

On the other hand, if the price of the good is $p = p_2 > p_0$, then supply in the market would be in excess of demand, i.e., there would be a negative excess demand in the market. In this case, the sellers would not be able to sell what they want to. As a result, they would be willing to accept a lower price, and p would be falling. As p falls from p_2, supply would fall and demand would rise, leading to a fall in excess supply. This would go on till p falls to the level of p_0 and the market equilibrium is restored

For, here, if for any reason, the price of the good be more or less than the equilibrium price, then the behavioural pattern of buyers and sellers mentioned above ensures that the price would again come back to the level of equilibrium price, i.e., the market equilibrium will be restored.

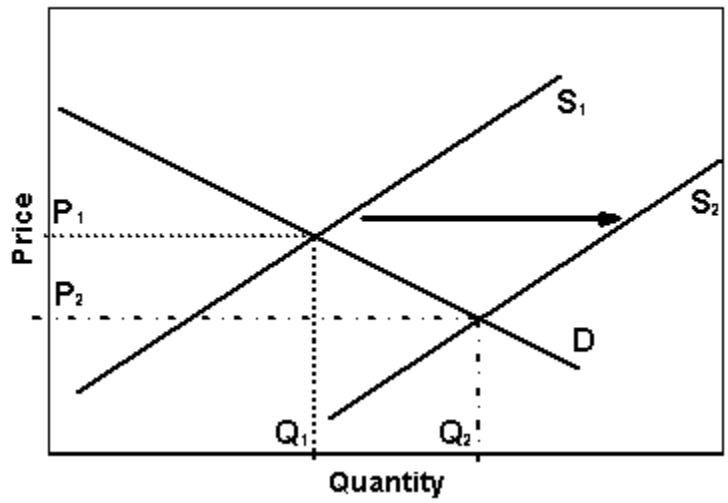
Change in equilibrium price

When either demand or supply shifts, the equilibrium price will change. The examples below show what happens to price when supply or demand shifts occur.

Example 1: Effect of Change in Supply on equilibrium price

When a bumper crop develops, supply shifts outward and downward, shown as S2 in fig. below, more product is available over the full range of prices. With no immediate change in consumers' willingness to buy crops, there is a movement along the demand curve to a new equilibrium. Consumers will buy more but only at a lower price. How much the price must fall to induce consumers to purchase the greater supply depends upon the elasticity of demand

Figure 2. Movement Along Demand Curve

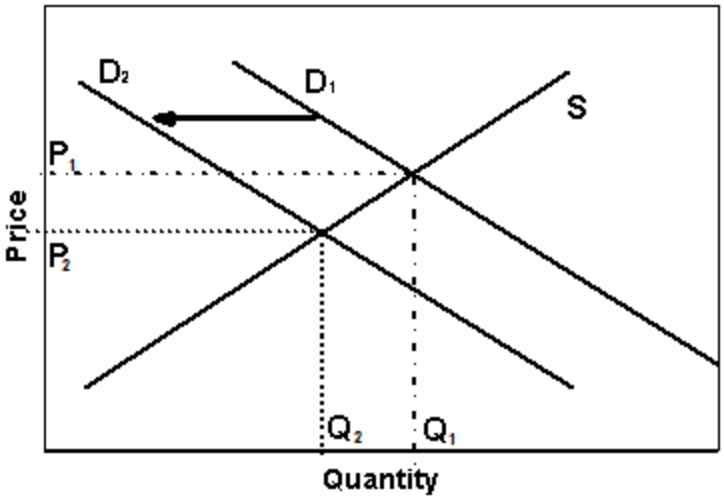


In fig., price falls from P1 to P2 if a bumper crop is produced. If the demand curve in this example was more vertical (more inelastic), the price-quantity adjustments needed to bring about a new equilibrium between demand and the new supply would be different.

Example 2:Effect of Change in Demand on equilibrium price

A decline in the preference for beef is one of the factors that could shift the demand curve inward or to the left, as seen in fig. below.

Figure 3. Movement Along Supply Curve



With no immediate change in supply .An inward shift of demand causes price to fall and also the quantity exchanged to fall. The amount of change in price and quantity, from one equilibrium to another, is dependent upon the elasticity of supply.

Market Price Determination

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Elasticity of Demand

The law of demand indicates the direction of change in quantity demanded in response to a change in price. But how much demand will rise in response to an increase in price cannot be known from the law of demand. To quantify such change, we require the concept of elasticity of demand that measures the extent of quantities demanded in response to a change in price. Demand changes not due to change in price only ,there are other determinants also .The concept of Elasticity of Demand refers to the degree of responsiveness of quantity demanded of a good to a change in its price , price of some related commodity or changes in consumers' income. According to this concept it is clear that there are three different types of Elasticity of Demand: price elasticity, income elasticity and cross elasticity. Price Elasticity of Demand is responsiveness of demand to changes in its price. Income Elasticity of Demand refers to the responsiveness of quantity demanded to changes in consumers income. Cross Elasticity of Demand means the degree of responsiveness of demand for a commodity A to a change in the price of a related commodity B. Let us discuss all the three types of elasticity of demand one by one

Price Elasticity of Demand

Elasticity of demand refers to price elasticity of demand. It is the degree of responsiveness of quantity demanded of a commodity due to change in its price, other things such as income ,price of related commodity that determine demand etc. remaining the same.Some popular definitions of the price elasticity of demand are:

According to Kenneth Boulding,"Elasticity of demand measures the responsiveness of demand to change in price."

According to Alfred Marshall, " The elasticity(or responsiveness) of demand in a market is great or small according as the amount demanded increases much or little for a given fall in price and diminishes much or little for a given rise in price."

According to A.K. Cairncross, "The elasticity of demand for a commodity is the rate at which quantity bought changes as the price changes"

Mathematical Expression of Price Elasticity of Demand

The price elasticity of demand is defined as the percentage change in quantity demanded due to certain percentage change in price. Thus

Mathematically, it can be expressed as:

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

Symbolically, it can be expressed as:

$$E_P = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

Where, E_P= Price elasticity of demand
q= Original quantity demanded

Δq = Change in quantity demanded

p= Original price

Δp = Change in price

For example,Suppose that price of a commodity falls down from Rs. 10 to Rs.9 per unit and due to this, quantity demanded of the commodity increased from 100units to 120 units. What is the price elasticity of demand?

Give that

P= initial price= Rs.10

Q= initial quantity demanded=100 units

Δp= change in price=Rs.(10-9)= Rs.1

Δq= change in quantity demanded=(120-100)= 20units

Now,

$$\therefore E_p = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$
$$= \frac{20}{1} \times \frac{10}{100}$$
$$= \frac{2}{1}$$
$$= 2\ \%$$

Thus elasticity of demand is highly elastic.The quantity demanded increases by 2% due to fall in price by Rs.1

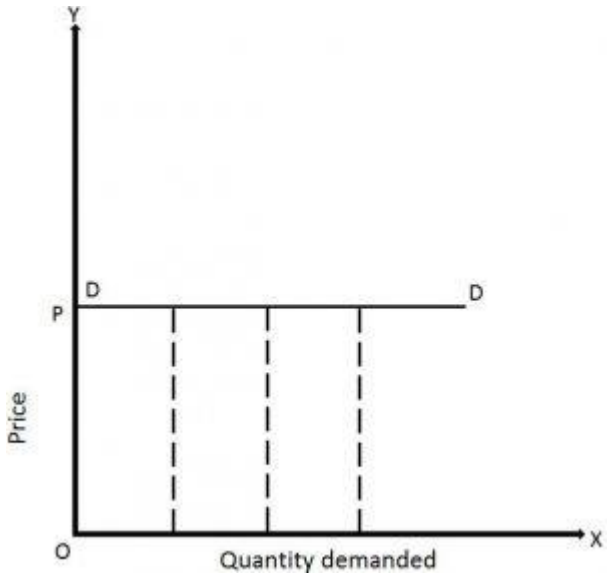
The Price Elasticity of Demand always having a minus sign. This shows that price and demand are inversely related to each other. The negative sign is not ordinarily used in writing the price elasticity of demand .The sign is understood

Types or degrees of price elasticity of demand

We have seen above that some commodities have very elastic demand, while others have less elastic demanddepending on the rate of change in the demand with respect to change in price of a product.. Elasticity of demand may have a value from Zero to infinity. Let us now try to understand the different degrees of elasticity of demand with the help of curves.

1. **Perfectly Elastic Demand ($E_P = \infty$)**

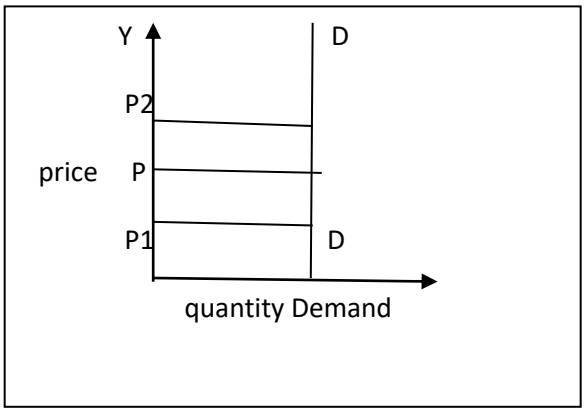
   When a small change in price of a product causes a major change in its demand, it is said to be perfectly elastic demand. In perfectly elastic demand, a small rise in price results in fall in demand to zero, while a small fall in price causes increase in demand to infinity. In such a case, the demand is perfectly elastic or $e_p = \infty$



In the given figure, price and quantity demanded are measured along the Y-axis and X-axis respectively. The demand curve **DD** is a horizontal straight line parallel to the X-axis shows infinite elasticity of demand. It shows that negligible change in price causes infinite fall or rise in quantity demanded.

2. Perfectly Inelastic Demand ($E_P = 0$)

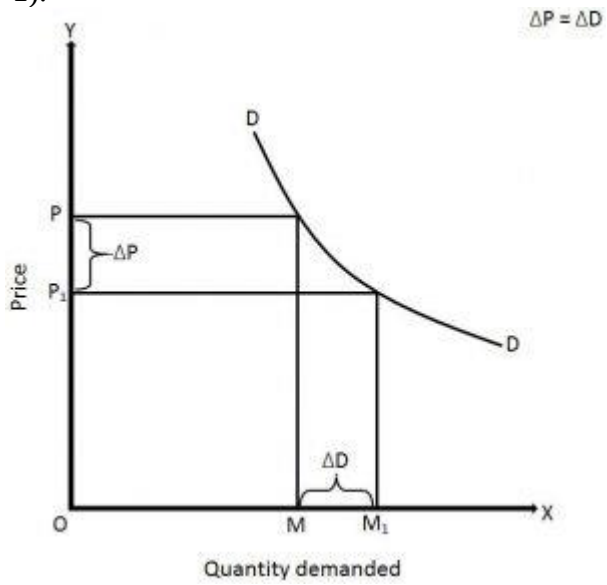
A perfectly inelastic demand is one when there is no change produced in the demand of a product with change in its price. The numerical value for perfectly inelastic demand is zero ($e_p=0$). Perfectly inelastic demand is a theoretical concept and cannot be applied in a practical situation. However, in case of essential goods, such as salt, the demand does not change with change in price. Therefore, the demand for essential goods is perfectly inelastic.



In the given figure, price and quantity demanded are measured along the Y-axis and X-axis respectively. The demand curve **DD** is a vertical straight line parallel to the Y-axis. It shows that the demand remains constant whatever may be the change in price. For example: even after the increase in price from **OP** to **OP_2** and fall in price from **OP** to **OP_1**, the quantity demanded remains at **OM**.

3. Unitary Elastic Demand ($E_p = 1$)

When the proportionate change in demand produces the same change in the price of the product, the demand is referred as unitary elastic demand. The numerical value for unitary elastic demand is equal to one ($e_p=1$).

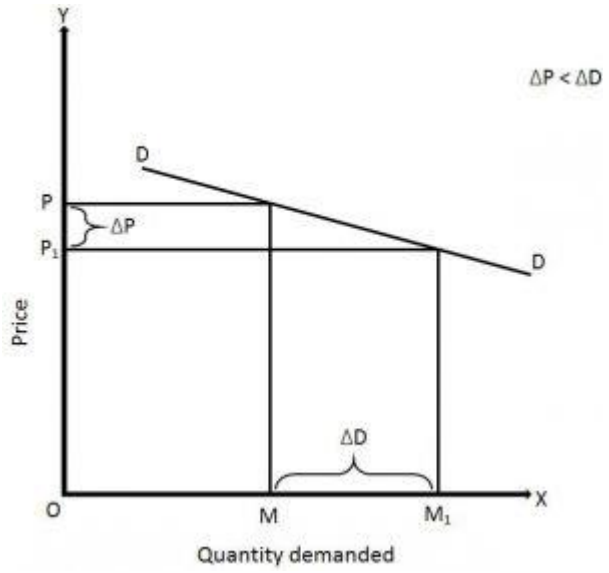


In the given figure, price and quantity demanded are measured along Y-axis and X-axis respectively. The demand curve DD for unitary elastic demand is represented as a rectangular hyperbola, as shown in Figure which shows that the demand is unitary elastic. Rectangular hyperbola is a curve at which rectangle formed on every point have the same area. Thus demand curve DD is a rectangular hyperbolacurve.The fall in price from OP to OP_1 has caused equal proportionate increase in demand from OM to OM_1. Likewise, when price increases, the demand decreases in the same proportion.

4. Relatively Elastic Demand ($E_P > 1$)

Relatively elastic demand refers to the demand when the proportionate change produced in demand is greater than the proportionate change in price of a product. The numerical value of relatively elastic demand ranges between one to infinity.

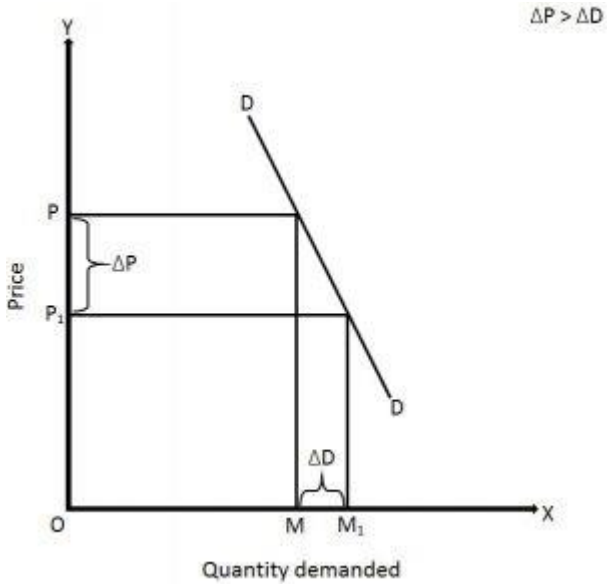
Mathematically, relatively elastic demand is known as more than unit elastic demand ($e_p>1$). For example, if the price of a product increases by 20% and the demand of the product decreases by 25%, then the demand would be relatively elastic.



In the given figure, price and quantity demanded are measured along the Y-axis and X-axis respectively. The demand curve DD is more flat, which shows that the demand is elastic. The small fall in price from OP to OP_1 has led to greater increase in demand from OM to OM_1. Likewise, demand decrease more with small increase in price.

5. Relatively Inelastic Demand ($E_p < 1$)

Relatively inelastic demand is one when the percentage change produced in demand is less than the percentage change in the price of a product. For example, if the price of a product increases by 30% and the demand for the product decreases only by 10%, then the demand would be called relatively inelastic. The numerical value of relatively elastic demand ranges between zero to one ($e_p<1$). Marshall has termed relatively inelastic demand as elasticity being less than unity.



In the given figure, price and quantity demanded are measured along the Y-axis and X-axis respectively. The demand curve DD is steeper, which shows that the demand is less elastic. The greater fall in price from OPto OP_1 has led to small increase in demand from OM to OM_1. Likewise, greater increase in price leads to small fall in demand.

Measurement of Price Elasticity of Demand

1. Total expenditure method

Total expenditure method, also known as total outlay method of measuring price elasticity of demand was developed by Professor Alfred Marshall. According to this method, price elasticity of demand can be measured by comparing total expenditure on a commodity before and after the price change. Marshall distinguished between three different cases of change in total outlay resulting from a change in the price of the commodity. The three cases are:

Elasticity of demand will be greater than unity (Ep > 1)

When total expenditure increases with fall in price and decreases with rise in price, the value of Price Elasticity of Demand will be greater than 1. Here, rise in price and total outlay or expenditure move in opposite direction.

Elasticity of demand will be equal to unity (Ep = 1)

When total expenditure on commodity remains unchanged in response to change in price of the commodity, the value of Price Elasticity of Demand will be equal to 1.

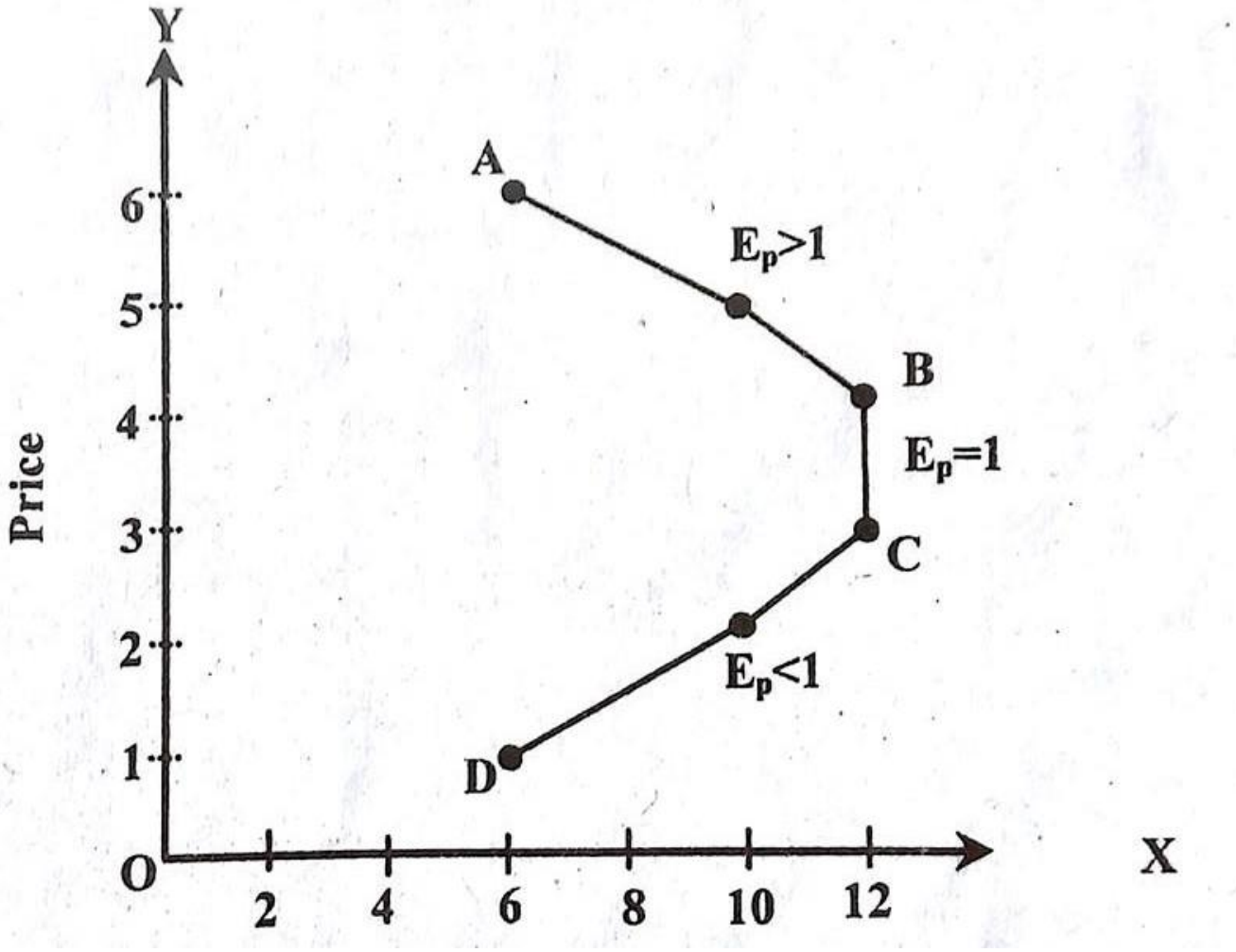
Elasticity of demand will be less than unity (Ep < 1)

When total expenditure decreases with fall in price and increases with rise in price, the value of Price Elasticity of Demand will be less than 1. Here, price of commodity and total outlay move in same direction.

In the table we find three possibilities:

Cases	Price (P)	Quantity demanded (Q)	Total outlay or expenditure (E = PXQ)	Price elasticity of demand (PED)
I	6 5	1 2	6 10	PED = 10/6, > 1
II	4 3	3 4	12 12	PED = 12/12, = 1
III	2 1	5 6	10 6	PED = 6/10, < 1

When the information from the above table is plotted in the graph, we get graph like the one shown below.



In the graph, total outlay or expenditure is measured on the X-axis while price is measured on the Y-axis. In the figure, The curve from A to B is downward sloping. The movement from point A to point B shows elastic demand as we can see that total expenditure has increased with fall in price and decreased with increase in price.So elasticity of demand is greater than one or ED>1.

The movement from point B to point C shows unitary elastic demand as total expenditure has remained unchanged with the rise or fall in price. The slope of price –total expenditure curve in this range is vertical or parallel to y-axis. The elasticity of demand in this case is equal to one or ED=1. Similarly, the movement from point C to point D shows inelastic demand as with the fall in price, total expenditure also falls and vice versa In this case, the elasticity of demand is less than one or ED<1

Total outlay method of measuring price elasticity of demand does not provide us exact numerical measurement of elasticity of demand but only indicates if the demand is elastic, inelastic or unitary in nature. Therefore, this method has limited scope.

2. Percentage Method

This method is also associated with the name of Dr. Alfred Marshall. Under this method, we measure elasticity by comparing the percentage change in price with the percentage change in demand. The elasticity of demand is unity, greater than unity, or less than unity, according as the change in demand is proportionate, more than proportionate, or less than proportionate to the change in price respectively. The elasticity is the ratio of the percentage change in the quantity demanded to the percentage change in the price charged.

Mathematically, it can be expressed as:

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

Symbolically, it can be expressed as:

$$E_P = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

Where, E_P= Price elasticity of demand
q= Original quantity demanded

Δq = Change in quantity demanded

p= Original price

Δp = Change in price

For example,Suppose that price of a commodity falls down from Rs. 10 to Rs.9 per unit and due to this, quantity demanded of the commodity increased from 100units to 120 units. What is the price elasticity of demand?

Give that

P= initial price= Rs.10

Q= initial quantity demanded=100 units

Δp= change in price=Rs.(10-9)= Rs.1

Δq= change in quantity demanded=(120-100)= 20units

Now,

$$\therefore E_p = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$
$$= \frac{20}{1} \times \frac{10}{100}$$
$$= \frac{2}{1}$$
$$= 2\ \%$$

Thus elasticity of demand is highly elastic. The quantity demanded increases by 2% due to fall in price by Rs.1

3. Point Method

This method was also suggested by Marshall and it takes into consideration a straight line demand curve and measures elasticity at different points on the curve.

The point elasticity of demand method is used as a measure of the change in the quantity demanded in response to a very small changes in price. The point elasticity of demand is defined as:

"The proportionate change in the quantity demanded resulting from a very small proportionate change in price".

Measurement of Geometric/Point Elasticity Method:

(i) Measurement of Elasticity on a Linear Demand Curve:

The price elasticity of demand can also be measured at any point on the demand curve. If the demand curve is linear (straight line), it has a unitary elasticity at the mid point. The total revenue is maximum at this point.

Any point above the midpoint has an elasticity greater than 1, ($E_d > 1$). Here, price reduction leads to an increase in the total revenue (expenditure). Below the midpoint elasticity is less than 1. ($E_d < 1$). Price reduction leads to reduction in the total revenue of the firm

Graph/Diagram:

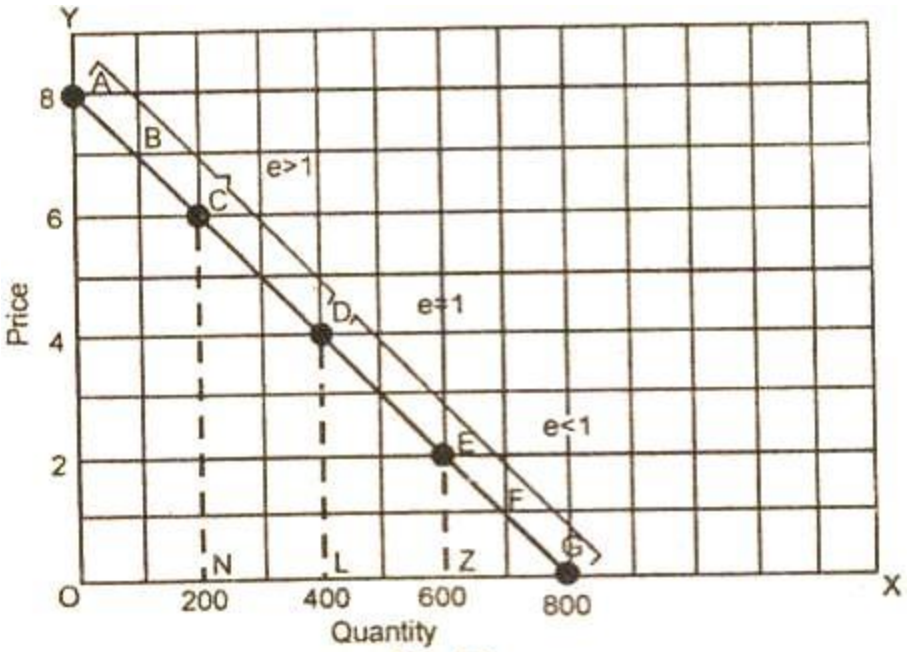


Fig. 6.9

The **formula** applied for measuring the elasticity at any point on the straight line demand curve is:

$$E_d = \frac{\%\Delta q}{\%\Delta p} \times \frac{p}{q}$$

The elasticity at each point on the demand curve can be traced with the help of point method as:

$$E_d = \frac{\text{Lower Segment}}{\text{Upper Segment}}$$

In the figure (6.9) AG is the linear demand curve (1). Elasticity of demand at its mid point D is equal to unity. At any point to the right of D, the elasticity is less than unity ($E_d < 1$) and to the left of D, the elasticity is greater than unity ($E_d > 1$).

(1) Elasticity of demand at point D = $\frac{DG}{DA} = \frac{400}{400} = 1$ (Unity).

(2) Elasticity of demand at point E = $\frac{GE}{EA} = \frac{200}{600} = 0.33$ (<1).

(3) Elasticity of Demand at point C = $\frac{GC}{CA} = \frac{600}{200} = 3$ (>1).

(4) Elasticity of Demand at point C is infinity.

(5) At point G, the elasticity of demand is zero.

Summing up, the elasticity of demand is different at each point along a linear demand curve. At high prices, demand is elastic. At low prices, it is inelastic. At the midpoint, it is unit elastic.

(ii) Measurement of Elasticity on a Non Linear Demand Curve:

If the demand curve is non linear, then elasticity at a point can be measured by drawing a tangent at the particular point. This is explained with the help of a figure given below:

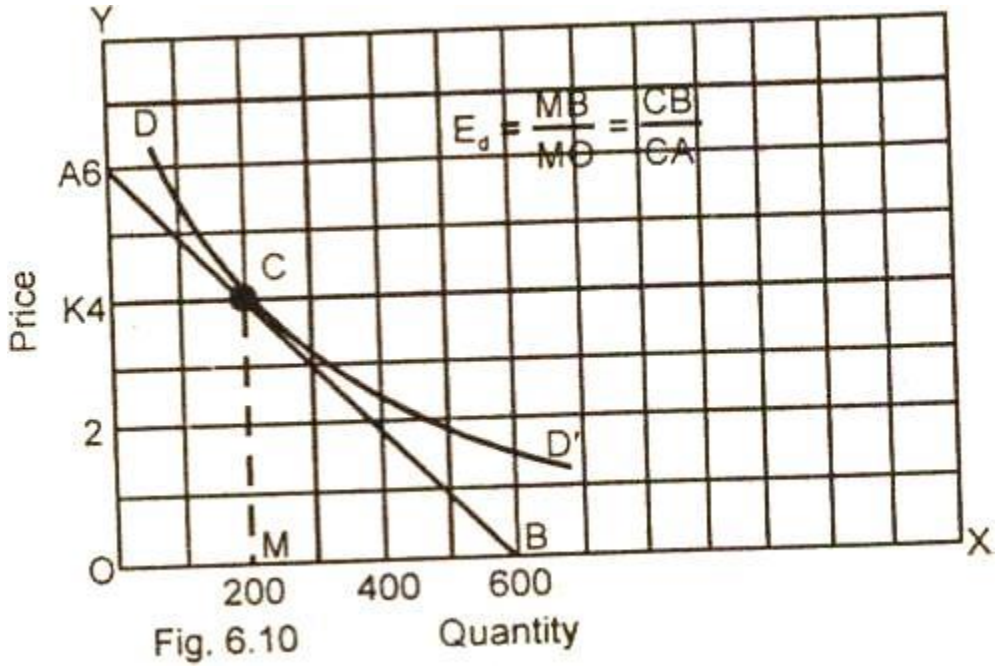


Fig. 6.10

In figure 6.10, the elasticity on DD/ demand curve is measured at point C by drawing a tangent. At point C:

$E_d = \frac{BM}{MO} = \frac{BC}{CA} = \frac{400}{200} = 2\ (>1).$

Here elasticity is greater than unity. Point C lies above the midpoint of the demand curve DD/. In case the demand curve is a rectangular hyperbola, the change in price will have no effect on the total amount spent on the product. As such, the demand curve will have a unitary elasticity at all points.

4. Arc Elasticity of Demand

We have studied the measurement of elasticity at a point on a demand curve. But when elasticity is measured between two points on the same demand curve, it is known as arc elasticity.Some of the definitions of Arc elasticity are;

“Arc elasticity is the elasticity at the mid –point of an arc of a demanded curve” Watson

“Arc elasticity is a measure of the average responsiveness to price change exhibited by demand curve over some finite stretch of the curve” Prof. Baumol

“when elasticity is computed between two separate points on a demand curve, the concept is called Arc elasticity” Leftwitch

Any two points on a demand curve make an arc. The area between P and M on the DD curve in Figure. (Below) is an arc which measures elasticity over a certain range of price and quantities. On any two points of a demand curve, the elasticity coefficients are likely to be different depending upon the method of computation. Consider the price-quantity combinations P and M as given in Table.

Table 2: Demand Schedule

Point	*Price (Rs)*	*Quantity (Kg)*
P	8	10
M	6	12

If we move from *P* to *M*, the elasticity of demand is

$$E_p = \frac{\Delta Q}{\Delta P} \times \frac{p}{q} = \frac{(12-10)}{(6-8)} \times \frac{8}{10} = \frac{2}{-2} \times \frac{8}{10} = \frac{4}{5}$$

If we move in the reverse direction from M to P, then

$$\frac{(10-20)}{(8-6)} \times \frac{6}{12} = \frac{-2}{2} \times \frac{6}{12} = -\frac{1}{2}$$

Thus the point method of measuring elasticity at two points on a demand curve gives different elasticity coefficients because we used a different base in computing the percentage change in each case.

To avoid this discrepancy, elasticity for the arc (PM in Figure) is calculated by taking the average of the two prices $[(p_1 + p_2)^{1/2}]$ and the average of the two quantities $[(q, +q_2)^{1/2}]$. The formula for price elasticity of demand at the mid-point (C in Figure) of the arc on the demand curve is

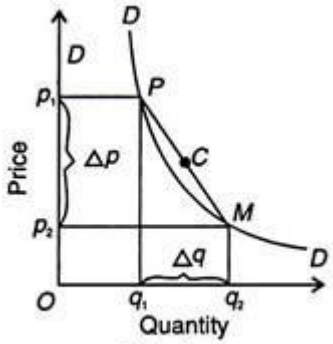


Fig. 4

$$E_p = \frac{\frac{\Delta q}{(q_1+q_2)^{1/2}}}{\frac{\Delta p}{(p_1+p_2)^{1/2}}} = \frac{\Delta q}{(q_1+q_2)^{1/2}} \times \frac{(p_1+p_2)^{1/2}}{\Delta p} = \frac{\Delta q}{\Delta p} \times \frac{p_1+p_2}{q_1+q_2}$$

On the basis of this formula, we can measure arc elasticity of demand when there is a movement either from point P to M or from M to P.

From P to M at point P, p_1 =8, q_1 = 10, and at point M, p_2 = 6, q_2 = 12.
Applying these values, we get

$$E_p = \frac{\Delta q}{\Delta p} \times \frac{p_1+p_2}{q_1+q_2} = \frac{(12-10)}{6-8} \times \frac{(8+6)}{(10+12)} = \frac{2}{-2} \times \frac{14}{22} = -\frac{7}{11}$$

From M to P at point M, $P_1 = 6$, $q_1 = 12$ and at point, $p_2 = 8$, $q_2 = 10$.

Now we have $E_p = \frac{(10-12)}{(8-6)} \times \frac{(6+8)}{(12+10)} = \frac{-2}{2} \times \frac{14}{22} = -\frac{7}{11}$

Thus whether we move from M to P or P to M on the arc PM of the DD curve, the formula for arc elasticity of demand gives the same numerical value. The closer the two points P and M are, the more accurate is the measure of elasticity on the basis of this formula.

If the two points which form the arc on the demand curve are so close that they almost merge into each other, the numerical value of arc elasticity equals the numerical value of point elasticity.

Choice among the three methods

Which one of the four methods of measuring price elasticity of demand is the best? The answer is that it all demand upon the objective of measuring price elasticity and nature of price-demand data at our disposal.If we want an accurate measure of price elasticity, the mathematical method using the average price and quantity may be the most desirable method.If our aim is simply to know whether price elasticity is greater than or less than one, we may use the total expenditure method. However, if we are dealing with a demand curve and the data is plotted on a graph, the graphic

method is the only one to be used. However , use of graphic method is only for purposes. Its practical use is nil.

Elasticity of demand (meaning, degrees and methods of measurement)

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Factors Affecting Price Elasticity of Demand

The price elasticity of demand depends upon a number of factors which determine whether the demand for a good is elastic or inelastic. The following are the main factors which determine price elasticity of demand for a commodity.

1. Nature of commodity:

Elasticity of demand of a commodity is influenced by its nature. A commodity for a person may be a necessity, a comfort or a luxury.

i. When a commodity is a necessity like food grains, vegetables, medicines, etc., its demand is generally inelastic as it is required for human survival and its demand does not fluctuate much with change in price.

ii. When a commodity is a comfort like fan, refrigerator, etc., its demand is generally elastic as consumer can postpone its consumption.

iii. When a commodity is a luxury like AC, DVD player, etc., its demand is generally more elastic as compared to demand for comforts.

iv. The term ‘luxury’ is a relative term as any item (like AC), may be a luxury for a poor person but a necessity for a rich person.

***2*. Number of Uses of a commodity:**

If the commodity under consideration has several uses, then its demand will be elastic. When price of such a commodity increases, then it is generally put to only more urgent uses and, as a result, its demand falls. When the prices fall, then it is used for satisfying even less urgent needs and demand rises.

For example, electricity is a multiple-use commodity. Fall in its price will result in substantial increase in its demand, particularly in those uses (like AC, Heat convector, etc.), where it was not employed formerly due to its high price. On the other hand, a commodity with no or few alternative uses has less elastic demand.

***3*.Availability of Substitute Goods:**

If close substitutes for a particular good are available in the market, then the demand for the good would be relatively more elastic. For example, since tea, a close substitute for coffee, is available in the market, a rise in the price of coffee would result in a considerable fall in its demand and a consequent rise in the demand for tea.

Therefore, demand for coffee would be relatively more elastic because of the availability of tea.

Again, conversely, if the price of coffee decreases, then people might reduce their consumption of tea and they might considerably increase their use of coffee. Therefore, the demand for coffee would be relatively more elastic, since its close substitute, viz., tea, is available in the market.

Again, since egg and meat are available in the market as close substitutes for fish, demand for fish would be relatively more elastic. It may concluded that the more the number of close substitutes for a particular good, the more would be the price-elasticity of demand for the good.

4 .Level of income of the consumer:

Elasticity of demand for any commodity also depends upon income level of the consumer.Elasticity of demand for any commodity is generally less for higher income level groups in comparison to people with low incomes. It happens because rich people are not influenced much by changes in the price of

goods. But, poor people are highly affected by increase or decrease in the price of goods. As a result, demand for lower income group is highly elastic.

***5.* Proportion of income spent on the commodity:**

Proportion of consumer's income that is spent on a particular commodity also influences the elasticity of demand for it. Greater the proportion of income spent on the commodity, more is the elasticity of demand for it and vice-versa.

Demand for goods like salt, needle, soap, match box, etc. tends to be inelastic as consumers spend a small proportion of their income on such goods. When prices of such goods change, consumers continue to purchase almost the same quantity of these goods. However, if the proportion of income spent on a commodity is large, then demand for such a commodity will be elastic.

6.* Prevailing Price of the Good*:

The elasticity of demand for a good also depends on its own price. As price changes, quantity demanded of the good changes, owing to the law of demand. Also, at different prices of the product, i.e., at different points on the demand curve for a good, the coefficient of price-elasticity of demand for the good would be different.

Generally, the smaller the price of a good, the less is the elasticity of its demand. For, when the price is very small, a change in price would have no considerable effect on demand.

On the other hand, the larger the price, the more would be the elasticity of demand. For, when the price is relatively large, a further rise in price would have a considerable dampening effect on demand and a fall in price would have an encouraging effect on demand.

7. Joint demand:

Price Elasticity of demand for any commodity is also dependent upon the nature of price elasticity of of jointly- demanded commodities. If the demand for cars is inelastic ,the demand for petrol will also be

inelastic. The Elasticity of demand for ink depends directly on the nature of elasticity of demand for pens.

8**. Time Period:**

Price elasticity of demand is always related to a period of time. It can be a day, a week, a month, a year or a period of several years. Elasticity of demand varies directly with the time period. Demand is generally inelastic in the short period.

It happens because consumers find it difficult to change their habits, in the short period, in order to respond to a change in the price of the given commodity. However, demand is more elastic in long rim as it is comparatively easier to shift to other substitutes, if the price of the given commodity rises.

9. **Possibility of postponing the Consumption:**

if the buyers are able to postpone the purchase or consumption of a good, if required, then it would have a relatively high elasticity of demand. For, if its price rises, its purchase would be deferred and its demand would fall, and if its price falls the deferred demand would appear in its market. The examples of such a good are building materials like cement, iron rods, etc.

10. **Habitual necessities:**

Commodities, which have become habitual necessities for the consumers, have less elastic demand. It happens because such a commodity becomes a necessity for the consumer and he continues to purchase it even if its price rises. Alcohol, tobacco, cigarettes, etc. are some examples of habit forming commodities.

Finally it can be concluded that elasticity of demand for a commodity is affected by number of factors. However, it is difficult to say, which particular factor or combination of factors determines the elasticity. It all depends upon circumstances of each case

Factors affecting elasticity of demand

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Income elasticity of demand

Another important concept of elasticity of demand is income elasticity of demand. The demand for a product and consumer's income are directly related to each other, unlike price-demand relationship.The income elasticity of demand is the degree of the responsiveness of the quantity demanded for a good to a change in consumer income. It is measured as the ratio of the percentage change in quantity demanded to the percentage change in income. The method for calculating the income elasticity of demand is similar to the method used to calculate any elasticity.

"Income elasticity of demand means the ratio of the percentage change in the quantity demanded to the percentage in income"- Watson.

Mathematical Expression of Income Elasticity of Demand

Mathematically, it is expressed as:

$$\text{Income elasticity of demand} = \frac{\%change\ in\ quantity\ demanded}{\%change\ in\ income}$$

Symbolically, it is expressed as:

$$E_Y = \frac{\Delta q}{\Delta y} \times \frac{y}{q}$$

Where, E_Y = Elasticity of demand
q = Original quantity demanded
Δq = Change in quantity demanded

y = Original consumer's income
Δy= Change in consumer's income

Suppose that the initial income of a person is Rs.2000 and quantity demanded for the commodity by him is 20 units. When his income increases to Rs.3000, quantity demanded by him also increases to 40 units. Find out the income elasticity of demand.

Solution:

Here, q = 100 units

Δq = (40-20) units = 20 units

y = Rs.2000

Δy =Rs. (3000-2000) =Rs.1000
Now,

$$\therefore E_Y = \frac{\Delta q}{\Delta y} \times \frac{y}{q}$$

$$= \frac{20}{20} \times \frac{2000}{1000}$$

$$= 2\%$$

Hence, an increase of Rs.1000 in income i.e. 1% in income leads to a rise of 2% in quantity demanded.

Types of Income Elasticity of demand

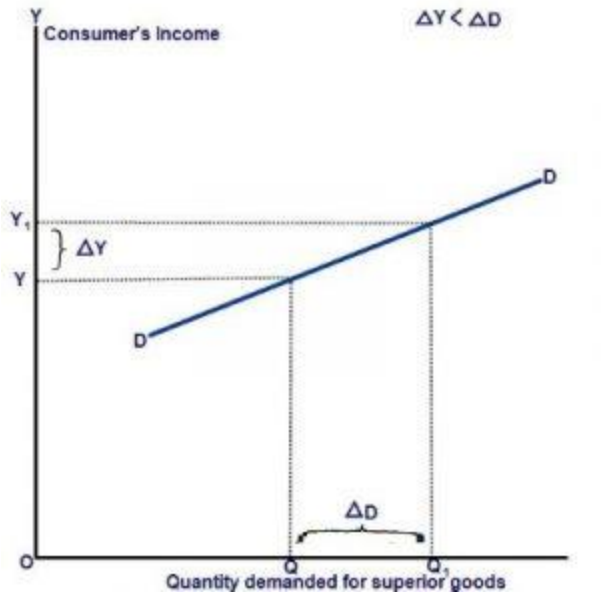
1. Positive income elasticity of demand (E_Y>0)

If there is direct relationship between income of the consumer and demand for the commodity, then income elasticity will be positive. That is, if the quantity demanded for a commodity increases with the rise in income of the consumer and vice versa, it is said to be positive income elasticity of demand. For example: as the income of consumer increases, they consume more of superior (luxurious) goods. On the contrary, as the income of consumer decreases, they consume less of luxurious goods.

Positive income elasticity can be further classified into three types:

(a) Income elasticity greater than unity ($E_Y > 1$)

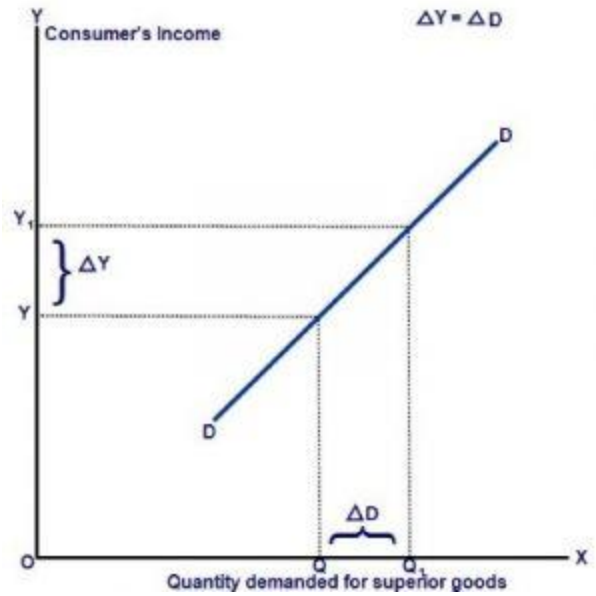
If the percentage change in quantity demanded for a commodity is greater than percentage change in income of the consumer, it is said to be income greater than unity. For example: When the consumer's income rises by 3% and the demand rises by 7%, it is the case of income elasticity greater than unity.



In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The small rise in income from **OY** to **OY_1** has caused greater rise in the quantity demanded from **OQ** to **OQ_1** and vice versa. Thus, the demand curve **DD** shows income elasticity greater than unity.

(b) Income elasticity equal to unity ($E_Y = 1$)

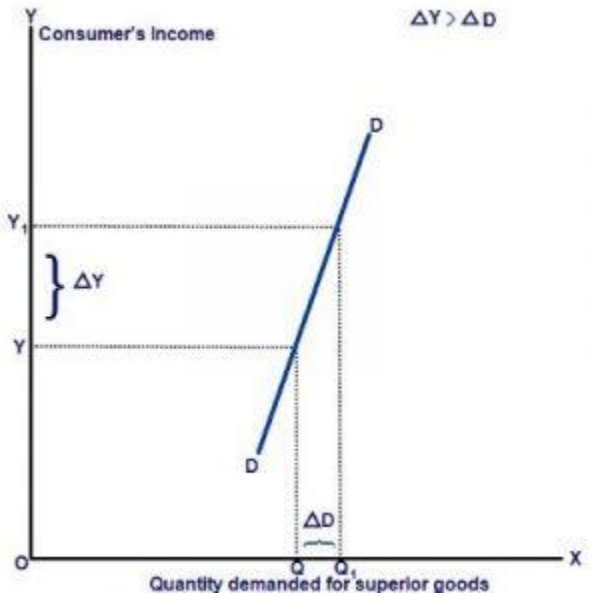
If the percentage change in quantity demanded for a commodity is equal to percentage change in income of the consumer, it is said to be income elasticity equal to unity. For example: When the consumer's income rises by 5% and the demand rises by 5%, it is the case of income elasticity equal to unity.



In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The small rise in income from **OY** to **OY_1** has caused equal rise in the quantity demanded from **OQ** to **OQ_1** and vice versa. Thus, the demand curve **DD** shows income elasticity equal to unity.

(c) Income elasticity less than unity ($E_Y < 1$)

If the percentage change in quantity demanded for a commodity is less than percentage change in income of the consumer, it is said to be income greater than unity. For example: When the consumer's income rises by 5% and the demand rises by 3%, it is the case of income elasticity less than unity.



In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The greater rise in income from **OY** to **OY_1** has caused small rise in the quantity demanded from **OQ** to **OQ_1** and vice versa. Thus, the demand curve **DD** shows income elasticity less than unity.

2. Negative income elasticity of demand ($E_Y<0$)

If there is inverse relationship between income of the consumer and demand for the commodity, then income elasticity will be negative. That is, if the quantity demanded for a commodity decreases with the rise in income of the consumer and vice versa, it is said to be negative income elasticity of demand. For example:
As the income of consumer increases, they either stop or consume less of inferior goods.

In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. When the consumer's income rises from **OY** to **OY1** the quantity demanded of inferior goods falls from **OQ** to **OQ_1** and vice versa. Thus, the demand curve **DD** shows negative income elasticity of demand.

3. Zero income elasticity of demand ($E_Y=0$)

If the quantity demanded for a commodity remains constant with any rise or fall in income of the consumer and, it is said to be zero income elasticity of demand. For example: In case of basic necessary goods such as salt, kerosene, electricity, etc. there is zero income elasticity of demand.

In the given figure, quantity demanded and consumer's income is measured along X-axis and Y-axis respectively. The consumer's income may fall to **OY_1** or rise to **OY_2** from **OY**, the quantity demanded remains the same at **OQ**. Thus, the demand curve **DD**, which is vertical straight line parallel to Y-axis shows zero income elasticity of demand.

Cross elasticity of demand

Very often demands for two goods are so related to each other that when the price of any of them changes, the demand for the other also changes, its own price remaining the same. Therefore, degree of responsiveness of demand for one good in response to the change in price of another good represents the cross elasticity of demand of one good for the other.

Some of the definitions of cross-elasticity of demand are as follows:

In the words of Liebhafsky, "The cross elasticity of demand is a measure of theresponsiveness of purchase of Y to change in the price of X"

According to Ferugson, "the cross-elasticity of demand is the proportional change in the quantity of good-X demanded resulting from a given relative change in the price of the related good-Y."

It should be noted that the cross-elasticity of demand would be positive, when two goods are substitute of each other. This is because the increase in the price of one good increases the demand for the other. On the other hand, in case of complementary goods, the cross-elasticity of demand would be negative as increase in the price of one good decreases the demand for the other. For example, increase in the price of tea would result in the increase in the demand for coffee, whereas increase in the price of petrol would cause decrease in the demand for cars.

Measurement of Cross Elasticity of Demand:

Cross elasticity of demand can be measured by the following formula:

$$EC = \frac{\text{Percentage change in quantity demanded of Good} - X}{\text{Percentage change in the price of Good} - Y}$$

$$= \frac{\dfrac{\text{Change in quantity demanded of X}}{\text{Original Quantity of X}}}{\dfrac{\text{Change in Price of Y}}{\text{Original Price of Y}}} \times 100$$

$$= \frac{\dfrac{\Delta Q_x}{Q_x}}{\dfrac{\Delta Q_y}{Q_y}} = \frac{\Delta Q_x}{Q_x} \times \frac{P_y}{\Delta P_y}$$

$$EC = \frac{P_y}{\Delta_n} \times \frac{\Delta Q_n}{\Delta P_y}$$

Where P_y = Original price of good-Y

ΔP_y = Change in price of good-Y

Q_x = Original quantity demanded of X

ΔQ_x = Change in the quantity demanded of X

Suppose the price of coffee rises from Rs. 10per tin of 250 grams to Rs.12 per tin. As a result,consumers' demand for tea, an immediate substitute, rises from 70 kilos to 100 kilos. Then, the cross elasticity of demand of tea for coffee can be calculated as follows:

∆Qx = 100 – 70 = 30 kilos

Qx = 70 kilos

∆Py = Rs. 12 – Rs. 10 = Rs. 2

Py = Rs. 10

Cross elasticity of demand = EC= Py×∆Qx

Qx∆Py

$$= \frac{30}{2} \times \frac{10}{70}$$

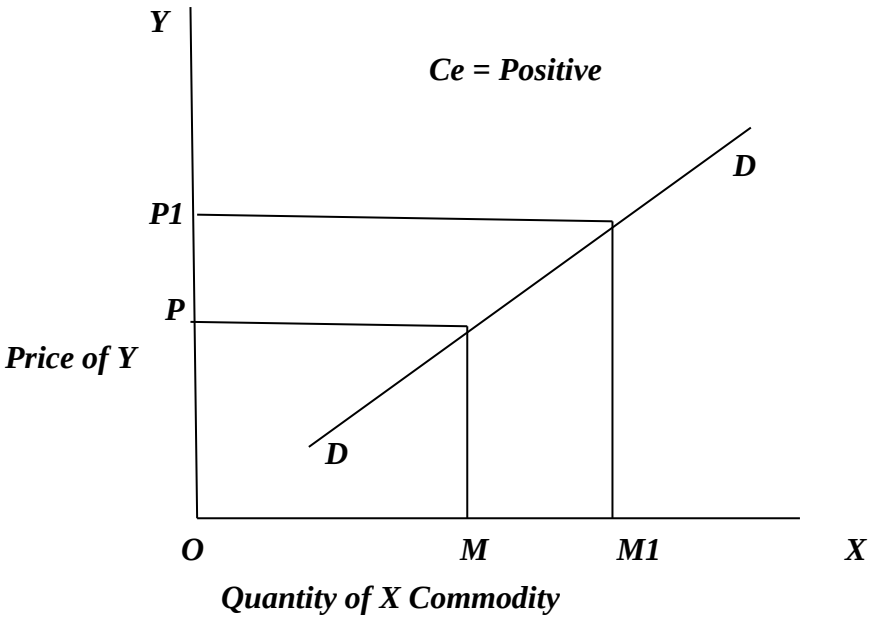
$$= 2.14$$

Types of Cross Elasticity of Demand:

1. **Positive cross elasticity of demand*:***

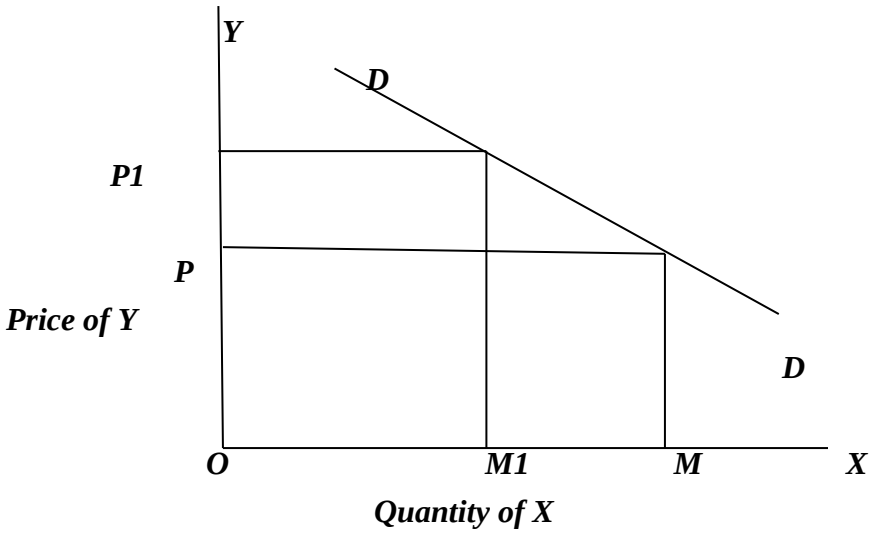
When goods are substitute of each other then cross elasticity of demand is positive. In other words, when an increase in the price of Y leads to an increase in the demand of X. For instance, with the increase in price of tea, demand of coffee will increase.

In fig. below quantity has been measured on OX-axis and price on OY-axis. At price OP of Y-commodity, demand of X-commodity is OM. Now as price of Y commodity increases to OP_1 demand of X-commodity increases to OM_1 Thus, cross elasticity of demand is positive.



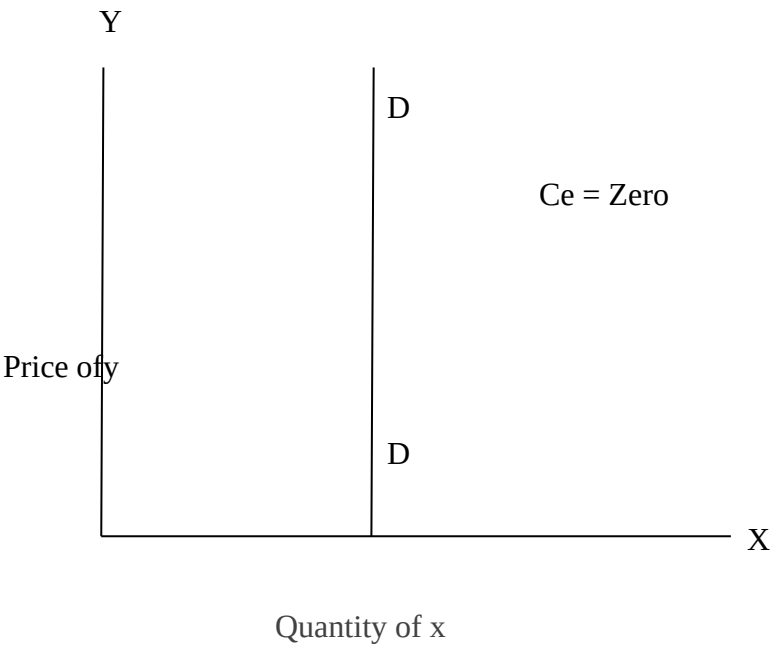
2. Negative cross elasticity of demand:

In case of complementary goods, cross elasticity of demand is negative. A proportionate increase in price of one commodity leads to a proportionate fall in the demand of another commodity because both are demanded jointly. In fig.below quantity has been measured on OX-axis while price has been measured on OY-axis. When the price of commodity increases from OP to OP_1 quantity demanded falls from OM to OM_1. Thus, cross elasticity of demand is negative.



3. Zero cross elasticity of demand:

Cross elasticity of demand is zero when two goods are not related to each other. For instance, increase in price of car does not effect the demand of cloth. Thus, cross elasticity of demand is zero. It has been shown in fig. below



The study of the concept cross elasticity of demand plays a major role in forecasting the effect of change in the price of a good on the demand of its substitutes and complementary goods. Therefore, it helps in deciding the price of a good by determining the change in the demand of its substitutes and complementary goods.

Apart from this, cross elasticity of demand helps in determining the nature of relationship between two goods whether they are substitutes, complementary to each other or totally different from each other.

Income elasticity of demand and cross elasticity of demand (meaning and types)

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Elasticity of Supply

The law of supply indicates the direction of change—if price goes up, supply will increase. But how much supply will rise in response to an increase in price cannot be known from the law of supply. To quantify such change, we require the concept of elasticity of supply that measures the extent of quantities supplied in response to a change in price. Thus, the elasticity of supply establishes a quantitative relationship between the supply of a commodity and its price. The concept of elasticity of supply is a relative measure of the responsiveness of quantity supplied of a commodity to the changes in its price. The greater the responsiveness of quantity supplied of a commodity to the changes in its price, the greater its elasticity of supply. In precise term, elasticity of supply is a percentage change in quantity supplied of a good to a certain percentage change in the price of the good. The elasticity of supply can be explained as under:

Elasticity of supply = Proportionate change in quantity supplied
Proportionate change in price

$e_s = \Delta q/q \div \Delta p/p$

$= \Delta q/q \times p/\Delta p$

$= \frac{\Delta q}{\Delta p} \times \frac{p}{q}$

Here,

q = denotes original quantity supplied

Δq = denotes change in quantity supplied

p = denotes original price

Δp = denotes change in price

For an example: A firm supplies 50 units of a commodity at Rs 8 per unit. When the price rises to Rs 11, the firm increased its supply to 75 units. Here, price elasticity of supply can be measured as

$$PES = \frac{\%\text{ change in quantity supplied}}{\%\text{ change in price}}$$

$$= \frac{\frac{75 - 50}{50} \times 100}{\frac{11 - 8}{8} \times 100}$$

$$= \frac{50}{37.5}$$

$$= 1.33$$

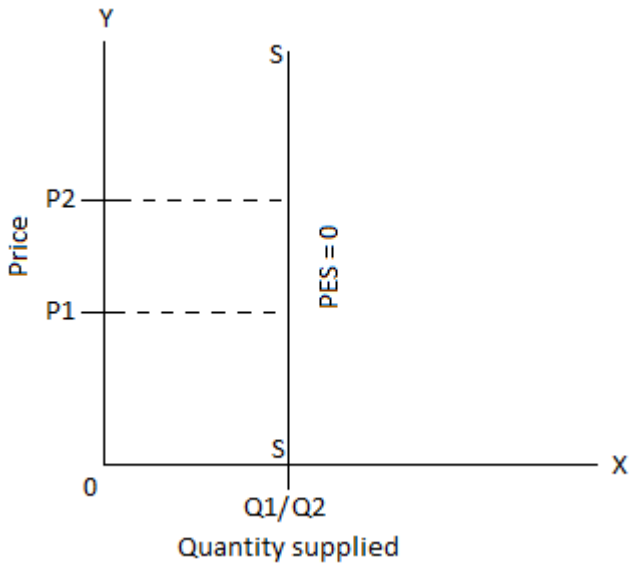
Since there is usually a positive relation between price and quantity supplied, elasticity of supply has a positive sign ,Unlike price elasticity of demand which has a negative sign.

` Types/Degrees of Elasticity of Supply:

There are five types of elasticity of supply. These are as follows:

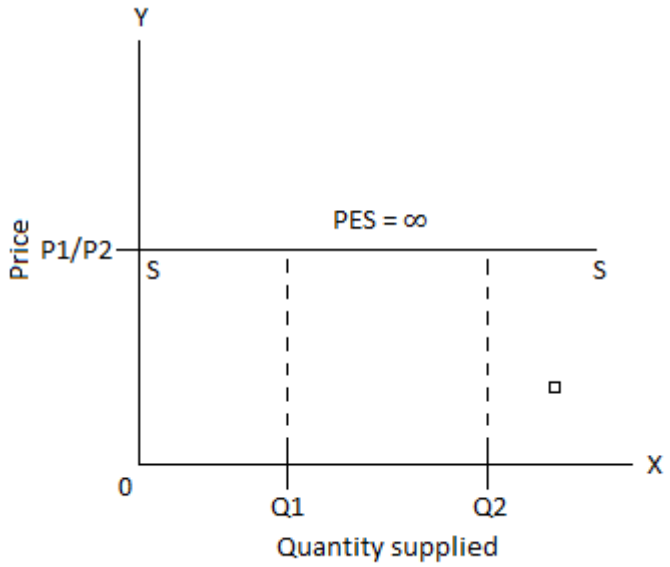
1. Perfectly Inelastic Supply ($e_s = 0$):

When quantity supplied remains unchanged with change in price, it is said to be zero or perfectly inelastic supply. In figure below, we can see that the amount of commodity supplied has remained unchanged even when the price has greatly changed. The supply curve SS runs parallel to y-axis showing that quantity supply remains same even if price increases from OP1 to OP2.This type of price elasticity is expected to be observed in highly essential goods such as medicines.



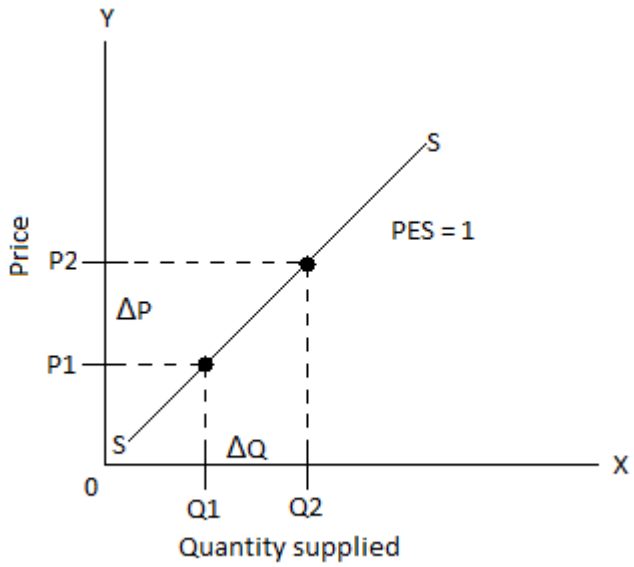
2. Perfectly elastic supply ($e_s = \infty$):

When a slight or minimal change in price causes infinite change in quantity supplied, it is said to be infinite or perfectly elastic supply. This kind of price elasticity is expected to occur in highly luxurious goods. However, perfectness of anything, including perfectly inelastic supply is considered to be rare or impractical in economy. we can see in the below figure that quantity supplied has varied significantly even at the same price level. Such a supply curve parallel to X-axis.



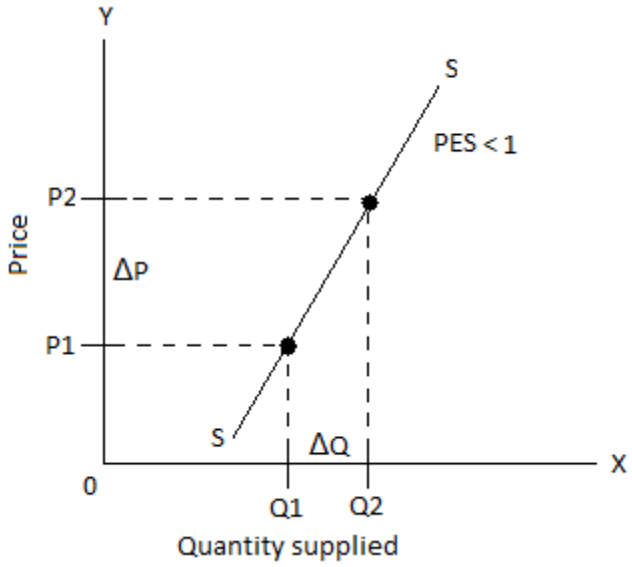
3. Unitary Elastic Supply ($e_s = 1$):

For a commodity with a unit elasticity of supply, the change in quantity supplied of a commodity is exactly equal to the change in its price. In other words, the change in both price and supply of the commodity are proportionately equal to each other. To point out, the elasticity of supply in such a case is equal to one. In figure below, SS is the unitary elastic curve. This is clear from the fact that an increase in price from OP1 to OP2 is attended by a proportionate change in supply from OQ1 to OQ2.



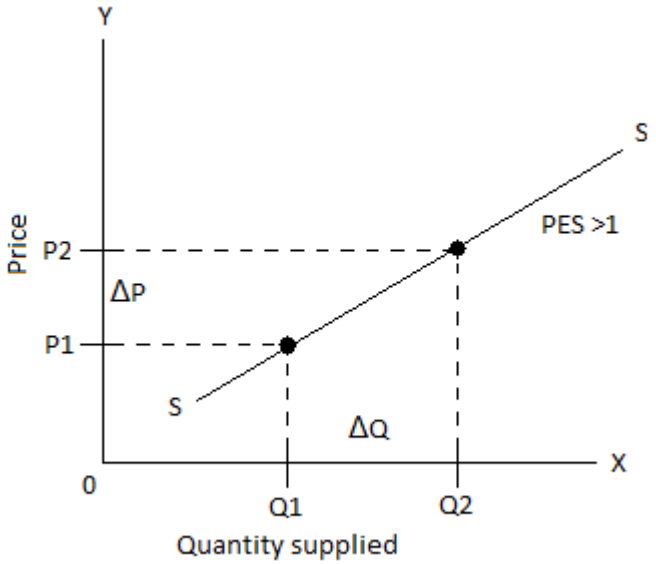
4. Relatively less-elastic supply ($e_s < 1$):

When the percentage change in quantity supplied is lesser than percentage change in price, the condition is known as relatively inelastic supply. In the figure, it is clearly shown that ratio of change in price is greater than ratio of change in quantity supplied. According to this figure, a rise in price from OP1 to OP2 brings about less than proportionate change in supply from OQ1 to OQ2. Hence the supply curve SS is relatively inelastic. Such kind of price elasticity can be observed in goods which are necessary in our day to day lives. Clothes, foods, etc. are good examples of these kinds of goods.



5. Relatively greater elastic supply ($e_s > 1$):

When percentage change in quantity supplied is greater than percentage change in price, the condition is known as relatively elastic supply. In figure, we can see that ratio of change in quantity supplied is greater than the ratio of change in price. A given change in price from OP1 to OP2 is attended by a proportionately much more change in supply, that is from OQ1 to OQ2.Hence supply curve SS is relatively elastic. Elasticity tends to be greater than 1 in case of products which are not necessary to sustain our lives. Luxury goods such as expensive smart phone, gold, etc. show this kind of price elasticity.



Elasticity of supply

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Measurement of Elasticity of supply

There are two ways to calculate the price elasticity of supply, both of which make use of the supply curve. We can either calculate the elasticity at a specific point on the supply curve, known as point elasticity or between two prices, known as arc-elasticity.

The concept of elasticity of supply, like the elasticity of demand, occupies an important place in price theory. As explained above, the elasticity of supply is the degree of responsiveness of supply to changes in the price of a good. More precisely, the elasticity of supply can be defined as a proportionate change in quantity supplied of a good in response to a given proportionate change in price of the good. Therefore,

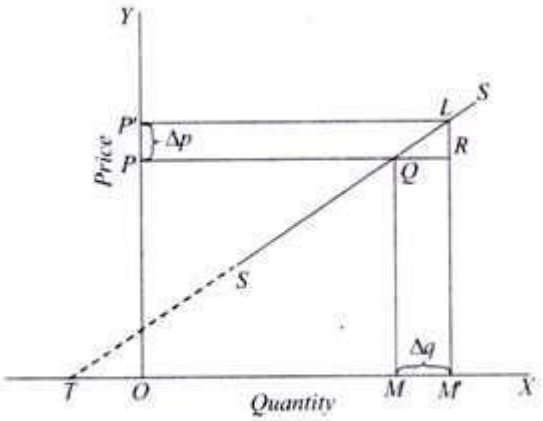

Fig. 20.8 . *Measurement of Point Elasticity of Supply ($e_s > 1$)*

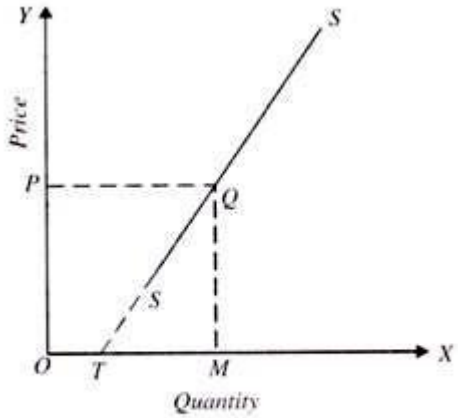

Fig. 20.9. *Measurement of Point Elasticity of Supply. $e_s < 1$*

e_s = Proportionate change in quantity supplied/ Proportionate change in price.

In terms of symbols, we can write elasticity of supply as:

$e_s = \Delta q/q \div \Delta p/p = \Delta q/q \times p/\Delta p$

$= \Delta q/\Delta p \times p/q$

The elasticity of supply at a point on the supply curve can be easily measured by a formula. We shall derive this formula below.

In Fig. 20.8 the supply curve SS is given and elasticity of supply at point Q is required to be measured. At price OP the quantity supplied is OM. With the rise in price from OP to OP' the quantity supplied increases from OM to OM. Extend supply curve SS downward so that it meets the X-axis at T.

The elasticity of supply at point $Q = \frac{\Delta q}{q} \div \frac{\Delta p}{p}$

or, $$e_s = \frac{MM'}{OM} \div \frac{PP'}{OP} = \frac{MM'}{OM} \times \frac{OP}{PP'}$$

$$= \frac{MM'}{PP'} \times \frac{OP}{OM}$$

Substituting QR for MM', RL for PP' and MQ for OP, we get

$$e_s \text{ at point } Q = \frac{QR}{RL} \times \frac{MQ}{OM} \qquad ...(i)$$

Now, in triangles QRL and QMT

$\angle LQR = \angle QTM$ (corresponding angles)

$\angle QRL = \angle QMT$ (right. angles)

$\angle QLR = \angle MQT$

Therefore, triangles QRL and QMT are similar

Hence, $$\frac{QR}{RL} = \frac{MT}{MQ}$$

Substituting $\frac{MT}{MQ}$ for $\frac{QR}{RL}$ in (*i*) above, we obtain

$$e_s \text{ at } Q = \frac{MT}{MQ} \times \frac{MQ}{OM}$$

$$= \frac{MT}{OM}$$

Thus, we can get the value of elasticity of supply from dividing MT by OM. Since in Fig. 20.8, MT is greater than OM, supply elasticity MT/OM. will be greater than one.

In Fig. 20.9 supply curve when extended meets the X-axis to the right of the point of origin so that MT is smaller than OM. Therefore, in Fig. 20.6 the elasticity of supply is less than unity.

In Fig. 20.10 supply curve SS when extended meets the X-axis exactly at the point of origin so that the MT is equal to OM. Therefore, in Fig. 20.10 elasticity of supply will be equal to one.

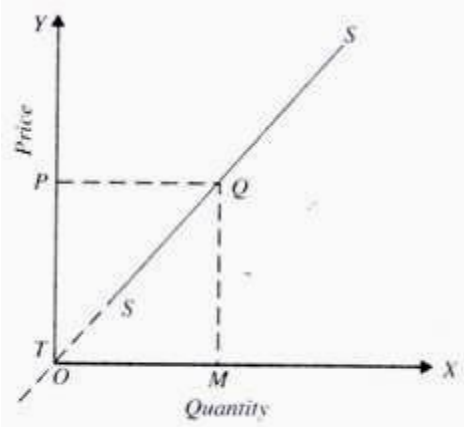

Fig. 20.10. $e_s = 1$

In Fig. 20.8 elasticity of supply will be greater than one at every point of the curve, but it will differ from point to point. Similarly, in Fig. 20.9 supply elasticity is less than one at every point of the curve, but it will differ from point to point. However, in Fig. 20.10 elasticity of supply will be equal to one at every point of the curve.

We have studied above how the elasticity of supply is measured at a point on the straight-line supply curve. But now the question is how the point elasticity of supply can be measured on the real curve-type supply curve. Consider Fig. 20.11 where a supply curve of true curve type has been drawn and it is required to measure elasticity at point A on it. The general principle involved is the same as described above. In order to apply the above principle for estimating the point elasticity at point A on the supply curve SS, we have to draw a tangent at it.

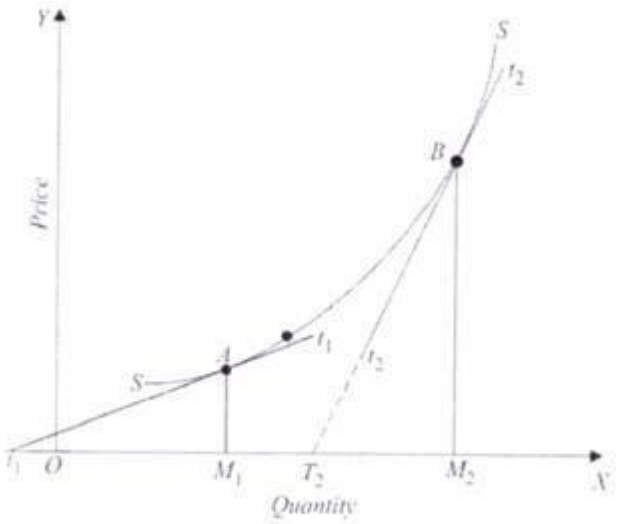

Fig. 20.11. *Varying Elasticity at Different Points on the Supply Curve*

Now, a tangent t_1t_1 has been drawn at point A. On being extended, tangent t_1t_1 meets the X-axis at point T_1. Therefore, elasticity of supply at point A on the supply curve is M_1T_1/OM_1

Likewise, we can find out the elasticity of supply at point B on the supply curve. For this, tangent t_2t_2 has been drawn at point B and has been extended to meet the X-axis at point T_2. Thus, the elasticity at point B on the supply curve SS is equal to M_2T_2/OM_2. It is also evident from Figure 20.11 that elasticity of supply at point A and B is different. Since M_2T_2/OM_2 is less than M_1T_1/OM_1, the elasticity of supply at point B is less than that at A.

Factors Determining Elasticity of Supply

1. The Nature of the Industry:

The most important factor affecting price elasticity of supply in the nature of the industry under consideration.

This will indicate the extent to which production can be increased in response to an increase in the price of the product. If inputs (especially raw materials) can be easily found existing market prices, as in the textile industry, then output can be greatly increased if price rises slightly.

This means that supply is fairly elastic in the textile industry. On the other hand, if production capacity is severely limited, as in gold mines, then even a very large increase in price of gold will lead to a very small increase in production. This means that the supply of gold is fairly inelastic.

2. Conditions Regarding Cost of Production:

If the cost of production of a good increase (or decreases), i.e., if its cost curve shifts upwards (or downwards), then the quantity supplied of the good would decrease (or increase) at any particular price, i.e., the supply curve would shift to the left (or to the right).

Now, the cost of production of a good depends on the quantity and availability of factor inputs, on the method of production and also on the business organization methods. Again, the elasticity of supply of a good depends on the nature of its cost of production.

If the cost of production rises at a relatively faster rate as the quantity produced increases, then the supply would increase at a slower rate in response to an increase in price. In this case, E_s would be relatively small.
However, if the cost of production rises at a relatively slower rate as production increases, the supply would increase at a relatively faster rate in response to an increase in price. In this case, E_s would be relatively large.

3. Changes in Marginal Cost of Production:

Elasticity of supply of a commodity depends upon the ease with which increases in output can be obtained without bringing about rise in cost of production. If with the increase in production, the marginal cost of production goes up the elasticity of supply to that extent would be less.

In the short run, with some factors of production being fixed, the increase in the amount of a variable factor eventually causes diminishing marginal returns and as a result with the expansion of output marginal cost of production rises.

This causes supply of a commodity in the short run less elastic. However, in the long run, the firms can increase output by varying all factors and also the new firms can enter the industry and thereby add to the supply of a commodity. Therefore, the long-run supply curve of a commodity is more elastic than that of the short run.

In the increasing cost industry, that is, the industry which experiences increases in cost when industry expands through the entry of new firms, the long-run supply curve, like the short-run one, is upward sloping, but will be more elastic than in the short run.

In the constant-cost industry, i.e., the industry wherein costs do not change with the expansion of the industry as a whole, the long-run supply curve is perfectly elastic, because in this case increases in the industrial output can be obtained at the same cost of production.

In the decreasing-cost industry, that is, industry which is subject to increasing returns, long-run supply curve is downward sloping and has therefore a negative elasticity of supply. This is because in the case of decreasing-cost industry expansion in the industry brings down the cost of production and therefore additional output is forthcoming at a lower supply price.

4. **Response of the Producers:**

Besides the change in cost of production, the elasticity of supply for a product depends on the responsiveness of producers to changes in its price. If the producers do not respond positively to the increase in prices, the quantity supplied of a product would not increase as a result of rise in its price.

A profit-maximizing producer will increase the quantity supplied of a product following the rise in its price. However, producers who not always exhibit profit-maximizingbehaviour may not raise supply in response to the rise in price.

For example, it has been argued by some with some empirical evidence that farmers in developing countries respond negatively to the rise in price of their agricultural products. They point out that with the higher agricultural prices, their need for fixed money income is met by selling smaller quantities of food-grains and therefore at higher prices they may produce and sell smaller quantities rather than more.

5. Nature of the Good:

The supply of a good also depends upon the nature of the good, e.g., on the perishability and lumpiness of the good.

6. Possibilities of substitution of one product for the other:

The change in quantity **supplied of a product following the change in its price depends on the**possibilities of substitution of one product for the other.e.g if market price of wheat rises, the farmers will try to shift resources such as land ,labour, fertilizers away from other products such as pulses to devote them to the production of wheat. The greater the extent of possibilities of shifting of resources from the other products to the production of a given product, the greater the elasticity of wheat

7. Length of Time:

Time also exerts considerable influence on the elasticity of supply. Supply is more elastic in the long run than in the short run. The reason is easy to find out. The longer the time period the easier it is to shift resources among products, following a change in their relative prices.

As Paul Samuelson has commented, **"A given change in price tends to have a larger effect on amount supplied"** as suppliers get more time to respond to price changes. Business firms may find it difficult to increase their usage of labour and output immediately after price rise. So, supply is likely to be less elastic.

However, with the passage of time, business firms can hire more labour, capital and set up new factories so as to expand production capacity. Thus, supply will increase considerably. So, supply will be more elastic in the long run than in the short run because producers take some time to adjust their capacity to changes in demand.

8. Risk-Taking*:*

The willingness of entrepreneurs to take risks also affects price elasticity of supply. This, in its turn, depends on the system of incentives and disincentives. If, for example, the marginal rates of tax are very high, a price rise will not evoke much response among producers.

9. The Level of Price:

The supply and elasticity of supply of a good depends upon the price of the good.Elasticity of supply is likely to vary at different prices. If the price of a good increases or decreases, the quantity supplied of it will also increases or decreases respectively. This is the law of supply. Also the coefficient of price elasticity of supply will depend on the price of the good. Elasticity of demand may be greater than, less than, or equal to one depending upon the price.

10.Factor Mobility:

If the factors of production have high mobility means if they can be moved from one place to another easily when price rises and opportunity to gain profit increases, the supply of commodity will be elastic. And if the factors are immobile then the supply cannot be made available when price rises; so the supply will be inelastic.

11.Stocks of finished products and components:

If stocks of raw materials and finished products are at a high level then a firm is able to respond to a change in demand - supply will be elastic. Conversely when stocks are low, dwindling supplies force prices higher because of scarcity

12. Excess supply.

When there is excess capacity and the producer can increase output easily to take advantage of the rising prices, the supply is more elastic. In case the production is already up to the maximum from the existing resources, the rising prices will not affect supply in the short period. The supply will be more inelastic.

Elasticity of supply

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Students can also visit: copy and paste in google to open it

Market price Determination: https://youtu.be/B5ByPL-YMYI

Elasticity of Demand : https://youtu.be/2bvkhZ6J_OI

Elasticity of Supply : https://youtu.be/96uuYGmT06Y

Questions for reference

Q1. State and explain Law of demand.

Q2. What is Law of supply? How would you explain it?

Q3. Explain how equilibrium price is determined by demand and supply of a commodity. Illustrate it with a diagram.

Q4. Explain different methods of measuring elasticity of demand.

Q5. Define Elasticity of demand. What are the factors which determine price elasticity of demand?

Q6. Explain the concept of income elasticity of demand.How would you define necessities and luxuries on the basis of income elasticity of demand?

Q.7 Explain the concept of cross elasticity of demand. Using the concept of cross elasticity of demand, define substitute and complements.

Q8. Explain different factors determining elasticity of supply.

Q9. Explain elasticity of supply. What are the different methods of measuring elasticity of supply? Discuss

References:

1. Ahuja, H.L,Advanced Economics Theory
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3. Chopra,P.N, The Principles of Economics

E-Content of Undergraduate Students of University of Jammu

Semester -1st Title of the course: Principles of Microeconomics-l

Unit- 3rd Theory of Consumer Demand l (Cardinal Utility Approach)

Syllabus of the Unit: Cardinal Utility Approach To Demand Analysis;Law Of Diminishing Marginal Utility;Consumer Equilibrium Under Cardinal Utility Approach;Derivation Of Demand Curve; Drawbacks Of Cardinal Utility Approach

By Neha Bandral, Assistant Professor, Govt. Degree College, Kathua

Learning Outcomes:

After studying this unit, you shall be able to know the concept of consumer behaviour and utilities concept.

- Learn how to measure the cardinal utility.
- Identify the level of consumer's equilibrium which provides him maximum utility.
- Evaluate the equilibrium quantity consumed by a consumer for each good which maximises his total utility, given his income and prices of other goods.
- Various shortcoming of Cardinal approach.

Introduction

In this Unit, we will study the behaviour of an individual consumer. The consumer is the basic economic unit that determines which commodities are purchased and in what quantities. He has to decide how to spend her income on different goods. Economists call this the problem of choice. Most naturally, any consumer will want to get a combination of goods that gives her maximum satisfaction. What will be this 'best' combination? . What guides these individual consumer decisions? Why do consumers purchase some commodities and not others? How do they decide how much to purchase of each commodity? What is the aim of a rational consumer in spending income? These are some of the important questions to which we seek answers in this chapter.The choices of the consumer depends on the likes of the consumer and what the consumer can afford to buy. The 'likes' of the consumer are also called 'preferences'. And what the consumer can afford to buy, depends on prices of the goods and the income of the consumer. This chapter presents thelines that explain consumer behaviour i.e Cardinal Utility Analysis.

Utility Analysis

In this section, we discuss the meaning of utility, distinguish between total utility and marginal utility. The concept of utility is used here to introduce the consumer's tastes. The analysis of consumer tastes is a crucial step in determining how a consumer maximizes satisfaction in spending income.

Utility:

According to Jevon (1835-1882): "Utility is the basis on which the demand of a individual for a commodity depends upon".

Utility is defined as:"The power of a commodity or service to satisfy human want".

Utility is thus the satisfaction which is derived by the consumer by consuming the goods.

For example, cloth has a utility for us because we can wear it. Pen has a utility we can write with it. The utility is subjective in nature. It differs from person to person. The utility of a bottle of wine is zero for a person who is non drinker while it has a very high utility for a drinker. Here it may be noted that the term 'utility' may not be confused with pleasure which a commodity gives to an individual. Utility is a subjective satisfaction which consumer gets from consuming any good or service.

Total Utility (TU)

"Total utility is the total satisfaction obtained from all units of a particular commodity consumed over a period of time".

For example, a person consumes eggs and gains 50 utils of total utility. This total utility is the sum of utilities from the successive units (30 utils from the first egg, 15 utils from the second and 5 utils from the third egg).

Summing up total utility is the amount of satisfaction (utility) obtained from consuming a total quantity of a good or service within a given time period. It is the sum of marginal utilities of each successive unit of consumption.

Formula:

$TU_x = \sum MU_x$

Marginal Utility (MU):

"Marginal utility means an additional or incremental utility. Marginal utility is the change in the total utility that results from unit one unit change in consumption of the commodity within a given period of time".

For example, when a person increases the consumption of eggs from one egg to two eggs, the total utility increases from 30 utils to 45 utils. The marginal utility here would be the15 utils of the 2nd egg consumed.

Marginal utility, thus, can also be described as difference between total utility derived from one level of consumption and total utility derived from another level of consumption.

Formula:

$$MU = \frac{\Delta TU}{\Delta Q}$$

It may here be noted that as a person consumes more and more units of a commodity, the marginal utility of the additional units begins to diminish but the total utility goes on increasing at a diminishing rate.

When the marginal utility comes to zero or we say the point of satiety is reached, the total utility is the maximum. If consumption is increased further from this point of satiety, the marginal utility becomes negative and total utility begins to diminish.

The relationship between total utility and marginal utility is now explained with the help of following schedule and a graph.

Table no. 4.1

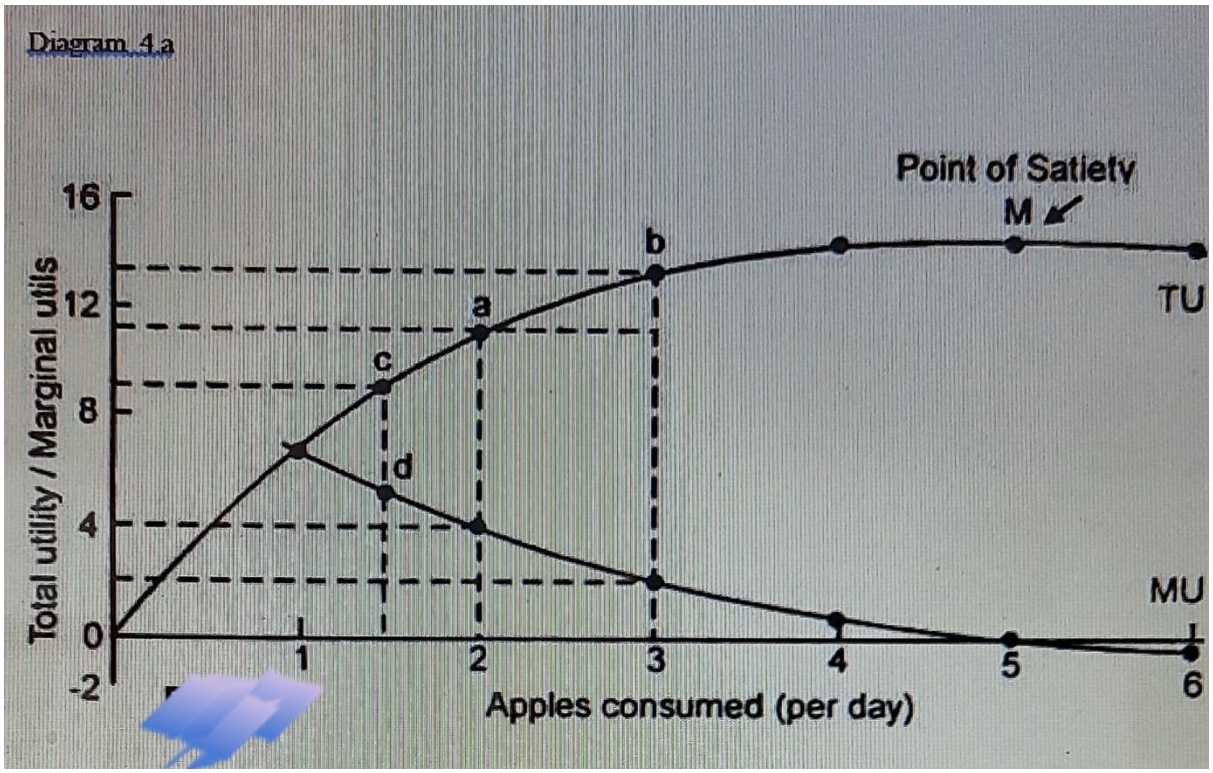
Units of apples consumed daily	Total Utility in utils per day	Marginal Utility in utils per day
1	7	7
2	11	4 (11-7)
3	13	2 (13-11)
4	14	1 (14-13)
5	14	0 (14-14)
6	13	-1 (13-14)

The above table shows that when a person consumes no apples, he gets no satisfaction. His total utility is zero. In case he consumes one apple a day, he gains seven units of satisfaction. His total utility is 7 and his marginal utility is also 7.

In case he consumes second apple, he gains extra 4 utils (MU). Thus given him a total utility of 11 utils from two apples. His marginal utility has gone down from 7 utils to 4 utils because he has a less craving for the second apple.

Same is the case with the consumption of third apple. The marginal utility has now fallen to 2 utils while the total utility of three apples has increased to 13 utils (7 + 4 + 2). In case the consumer takes fifth apple, his marginal utility falls to zero utils and if he consumes sixth apple also, the total showing total utility and marginal utility is gone negative which is plotted in figure below:

Diagram 4.a



(i) The total utility curves starts at the origin as zero consumption of apples yield zero utility.

(ii) The TU curve reaches at its maximum or a peak of M when MU is zero.

(iii) The MU curve falls through the graph. A special point occurs when the consumer consumes fifth apple. He gains no marginal utility from it. After this point, marginal utility becomes negative.

(iv) The MU curve can be derived from the total utility curve. It is the slope of the line joining two adjacent quantities on the curve. For example, the marginal utility of the third apple is the slope of line joining points a and b. The slope of such given by the formula:

$$MU = \frac{\Delta TU}{\Delta Q}$$

Here MU = 2.

Cardinal Utility Analysis

The traditional theory of demand starts with the examination of the behaviour of the consumer, since the market demand is assumed to be the summation of the demands of individual consumers.

Cardinal Utility Approach:

Cardinal utility analysis is the oldest theory of demand which provides an explanation of consumer's demand for a product and derives the law of demand which establishes an inverse relationship between price and quantity demanded of a product.

The cardinal utility approach for explaining the behaviour of consumer was stressed by the classical economists right from Adam Smith, Dupit, Gossen, Jevons, Walras, J.S Mill and got systematically developed by the neo-classical writers including Marshall and Pigou.

This analysis is also known as "Marshallian Approach" or "Marginal Utility approach" or "Cardinal Approach" developed by Alfred Marshall. This approach maintains that the purchase of a certain commodity on service by the consumer is basically or account of its utility.

The most significant idea in the cardinal approach is that utility is additive. It means the utilities from different units of commodity can be added or subtracted.

Assumptions of Cardinal Utility Analysis:

The main assumption or premises on which the cardinal utility analysis rests are as under.

(i) Rationality. The consumer is rational. He seeks to maximize satisfaction from the limited income which is at his disposal.

(ii) Utility is cardinally measurable. The utility can be measured in cardinal numbers such as 1, 3, 10, 15, etc. The utility is expressed in imaginary cardinal numbers tells us a great deal about the preference of the consumer for a good.

(iii) Marginal utility of money remains constant. Another important premise of cardinal utility of money spent on the purchase of a good or service should remain constant.

(iv) Diminishing marginal utility. It is also assumed that the marginal utility obtained from the consumption of a good diminishes continuously as its consumption is increased.

(v) Independent utilities. According to the Cardinalist school, the utility which is derived from the consumption of a good is a function of the quantity of that good alone. It does not depend upon the quantity consumed of other goods. The goods, we can say, possess independent
Utilities and are additive.

(vi) Introspection method. The Cardinal school assumes that the behaviour of marginal utility in the mind of another person can be judged with the help of self observation. For example, I know that as I purchase more and more of a good, the less utility I derived from the additional units of it. By applying the same principle, I can read other people mind and say with confidence that marginal utility of a good diminishes as they have more units of it.

Laws under Cardinal Utility Analysis:

1. Law of diminishing marginal utility
2. Law of equi-marginal utility

Law of Diminishing marginal Utility

Introduction: H.H Gossen, an Austrian Economist was the first to formulate this law in economics in 1854. Jevons called this law as “Gossen’s First Law of Consumption”. But credit goes to Marshall, because he perfected this law on the basis of cardinal analysis. This law is based on the characteristics of human wants, i.e wants are satiable.

Explanation of the law: The law of diminishing marginal utility states that if a consumer continues to consume more and more units of the same commodity, its marginal utility diminishes. This means that the more we have of a thing, the less is the satisfaction or utility that we derive from the additional unit of it. In other words, the marginal utility of a commodity to the consumer depends upon the volume of the stock of the commodity purchased or possessed by him. The larger the stock purchased or possessed by the consumer, the smaller in the utility derived from an additional unit of the commodity.

Definitions:

Marshal states the law as, "the additional benefit which a person derives from a given increase of his stock of a thing, diminishes with every increase in the stock that he already has."

Prof. Boulding defines the law, "as a consumer increases the consumption of any one commodity keeping constant the consumption of all other commodities, the marginal utility of the variable commodity must eventually decline."

We can explain this law with a simple illustration. Suppose a consumer wants to consume 7 apples one after another. The utility from the first apple is 20.. But the utility from the second apple will be less than that of the first (say 15), the third less than that of the second (say 10) and so on. Finally, the utility from the fifth apple becomes zero and the utilities from sixth and seventh apples are negative. This tendency is called the "law of diminishing marginal utility". This is illustrated in the following table..

Table no. 4.2

Number of apples	Total utility	Marginal utility
1	20	20
2	35	15 (35-20)
3	45	10 (45-35)
4	50	5 (50-45)
5	50	0 (50-50)
6	45	-5 (45-50)
7	35	-10 (35-45)

In table 4.2, we find that total utility goes on increasing but at a diminishing rate. On the other hand, marginal utility goes on diminishing. When marginal utility becomes zero, the total utility is maximum and when marginal utility becomes negative, the total utility diminishes.

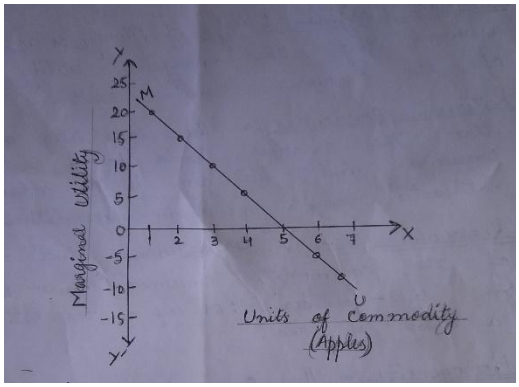


Fig..4.b

In figure 4.b, X-axis represents unit of the commodity (Apple) and Y-axis represents the marginal utility. The MU curve is the marginal utility curve. This curve slopes downward from left to right which shows, that as the stock increases, the marginal utility diminishes.

Assumptions:

The law of diminishing marginal utility is based on the following assumptions:

1. Cardinal Utility: This law assumed that utlity can be measured by cardinal number such as 1, 2, 3 and so on.
2. Constant Marginal Utility of money: The law assumed that the marginal utility of money of the consumer remain constant.
3. Rational Consumers: The law also assumed that the consumer should be a rational consumer and his aim is to attain maximum satisfaction with minimum expenditure.
4. Reasonable Units: It assumed that the units of the commodity consumed must be reasonable in size – e.g: A cup of tea rather than a drop of tea.
5. Homogeneity: The commodity consumed should be homogenous or uniform in character like weight, quality, taste, flavour, color etc.
6. Period of consumption: It is further assumed that the consumption of goods must be made continuously at a given period of time. In other words, units of the commodity must be consumed one after another successively without a long interval of time.
7. Character of the consumer: This law also assumed that there should be no change in the taste, habits, preferences, fashions, income and character of the consumer during the process of consumption.

Criticism Of The Law Of Diminishing Marginal Utility:

1. This law is not applicable to indivisible commodities because on one would normally buy at a time more than one unit of the commodities like T.V, A.C, V.C.R etc.
2. This law is based on the unrealistic assumption like homogeneity, continuity, rational consumer and constant marginal utility of money.
3. The law assumed that utility can be measured. But in practice, utility cannot be measured numerically, because utility is subjective.

Exception Of The Law Of Diminishing Marginal Utility:

1. **Hobbies:** The law is not applicable to hobbies like collection of old coins, stamps etc. The more one collects of these, the more is the desire to collect further.
2. **Misers:** The law is inapplicable to abnormal persons like miser because the more he has of money, the greater is the desire to acquire still more.
3. **Drunkards**: The law does not apply to abnormal persons like drunkards. Because marginal utility of liquor is said to be rising and not falling with every additional dose of liquor.
4. **Reading:** The law is also not applicable to reading. Because more reading gives more knowledge. A scholar would get more and more satisfaction with reading of every additional book.
5. **Music and poetry**: The law is also inapplicable to music and poetry. In this case, it is commonly experienced that a repeat hearing gives a better satisfaction than the first one.

Law of Equi-marginal Utility:

In the cardinal utility analysis, the principle of equal marginal utility occupies an important place.

Definition of Law of Equi-Marginal Utility:

The *law of equi-marginal utility* is simply an extension of law of diminishing marginal utility to two or more than two commodities. The law of equilibrium utility is known, by various names. It is named as the Law of Substitution, the Law of Maximum Satisfaction, the Law of Indifference, the Proportionate Rule and the Gossen's Second Law.

Lipsey stated in the following words:

"The household maximizing the utility will so allocate the expenditure between commodities that the utility of the last penny spent on each item is equal".

As we know, every consumer has unlimited wants. However, the income in his disposal at any time is limited. The consumer is, therefore, faced with a choice among many commodities that he can and would like to pay. He, therefore, consciously or unconsciously compress the satisfaction which he obtains from the purchase of the commodity and the price which he pays for it. If he thinks the utility of the commodity is greater or at-least equal to the loss of utility of money price, he buys that commodity.

As he buys more and more of the commodity, the utility of the successive units begins to diminish. He stops further purchase of the commodity at a point where the marginal utility of the commodity and its price are just equal. If he pushes the purchase further from his point of equilibrium, then the marginal utility of the commodity will be less than that of price and the

household will be loser. A consumer will be in equilibrium with a single commodity symbolically:

$MU^x = P^x$

A prudent consumer in order to get the maximum satisfaction from his limited means compares not only the utility of a particular commodity and the price but also the utility of the other commodities which he can buy with his scarce resources. If he finds that a particular expenditure in one use is yielding less utility than that of other, he will try to transfer a unit of expenditure from the commodity yielding less marginal utility. The consumer will reach his equilibrium position when it will not be possible for him to increase the total utility by uses. The position of equilibrium will be reached when the marginal utility of each good is in proportion to its price and the ratio of the prices of all goods is equal to the ratio of their marginal utilities.

The consumer will maximize total utility from his income when the utility from the last rupee spent on each good is the same. Algebraically, this is:

$MU_a / P_a = MU_b / P_b = MU_c = P_c = MU_n = P_n$

Here: (a), (b), (c)…. (n) are various goods consumed.

Assumptions of the Law :

The main assumptions of the law of equi-marginal utility are as under.

(i) Independent utilities. The marginal utilities of different commodities are independent of each other and diminish with more and more purchases.

(ii) Constant marginal utility of money. The marginal utility of money remains constant to the consumer as he spends more and more of it on the purchase of goods.

(iii) Utility is cardinally measurable.

(iv) Every consumer is rational in the purchase of goods.

Example and Explanation of Law of Equi-Marginal Utility:

The doctrine of equi-marginal utility can be explained by taking an example. Suppose a person has Rs5 with him whom he wishes to spend on two commodities, tea and cigarettes. The marginal utility derived from both these commodities is as under:

Table no. 4.3

Units of Money	MU of Tea	MU of Cigarettes
1	10	12
2	8	10
3	6	8
4	4	6
5	2	3
Rs 5	Total Utility = 30	Total Utility = 30

A rational consumer would like to get maximum satisfaction from $5.00. He can spend money in three ways:

(i) Rs 5 may be spent on tea only.

(ii) Rs 5 may be utilized for the purchase of cigarettes only.

(iii) Some rupees may be spent on the purchase of tea and some on the purchase of cigarettes.

If the prudent consumer spends Rs5 on the purchase of tea, he gets 30 utility. If he spends Rs 5 on the purchase of cigarettes, the total utility derived is 39 which is higher than tea. In order to make the best of the limited resources, he adjusts his expenditure.

(i) By spending Rs 4 on tea and Rs 1 on cigarettes, he gets 40 utility (10+8+6+4+12 = 40).

(ii) By spending Rs3 on tea and Rs2 on cigarettes, he derives 46 utility (10+8+6+12+10 = 46).

(iii) By spending Rs2 on tea and Rs3 on cigarettes, he gets 48 utility (10+8+12+10+8 = 48).

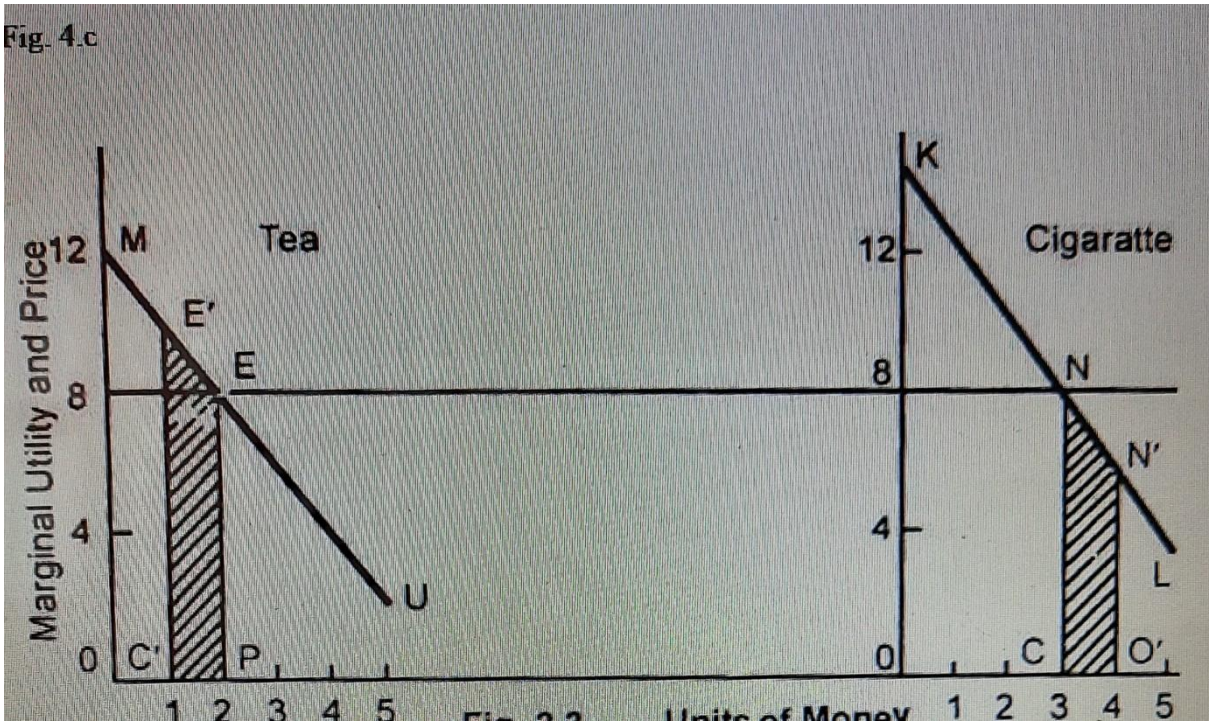
(iv) By spending Rs 1 on tea and Rs 4 on cigarettes, he gets 46 utility (10+12+10+8+6 = 46).

The sensible consumer will spend Rs 2 on tea and Rs 3 on cigarettes and will get maximum satisfaction. When he spends Rs 2 on tea and Rs3 on cigarettes, the marginal utilities derived from both these commodities is equal to 8. When the marginal utilities of the two commodities are equalizes, the total utility is then maximum, i.e., 48 as is clear from the schedule given above.

Diagram of Law of Equi-Marginal Utility:

The law of equi-marginal utility can be explained with the help of diagrams.

Fig. 4.c



In the figure 4.c MU is the marginal utility curve for tea and KL of cigarettes. When a consumer spends OP amount (Rs2) on tea and OC (Rs3) on cigarettes, the marginal utility derived from the consumption of both the items (Tea and Cigarettes) is equal to 8 units (EP = NC). The consumer gets the maximum utility when he spends Rs 2 on tea and Rs 3 on cigarettes and by no other alternation in the expenditure.

We now assume that the consumer spends Rs1 on tea ($OC^{/}$ amount) and Rs4 ($OQ^{/}$) on cigarettes. If $CQ^{/}$ more amounts are spent cigarettes, the added utility is equal to the area $CQ^{/}N^{/}N$. On the other hand, the expenditure on tea falls from OP amount (Rs2) to $OC^{/}$ amount ($1). There is a toss of utility equal to the area $C^{/}PEE$. The loss is utility (tea) is greater than that The loss in utility (tea) is maximum satisfaction except the combination of expenditure of Rs2 on tea and Rs3 on cigarettes.

This law is known as the *Law of maximum Satisfaction* because a consumer tries to get the maximum satisfaction from his limited resources by so planning his expenditure that the marginal utility of a rupee spent in one use is the same as the marginal utility of a rupee spent on another use.

It is known as the *Law of Substitution* because consumer continuous substituting one good for another till he gets the maximum satisfaction.

It is called the *Law of Indifference* because the maximum satisfaction has been achieved by equating the marginal utility in all the uses. The consumer than becomes indifferent to readjust his expenditure unless some change fakes place in his income or the prices of the commodities, etc.

Limitations/Exceptions of Law of Equi-Marginal Utility:

(i) Effect on fashions and customs: The law of equi-marginal utility may become inoperative if people forced by fashions and customs spend money on the purchase of those commodities which they clearly knows yield less utility but they cannot transfer the unit of money from the less advantageous uses to the more advantageous uses because they are forced by the customs of the country.

(ii) Ignorance or carelessness: Sometimes people due to their ignorance of price or carelessness to weigh the utility of the purchased commodity do not obtain the maximum advantage by equating the marginal utility in all the uses.

(iii) Indivisible units: If the unit of expenditure is not divisible, then again the law may become inoperative.

(iv) Freedom of choice: If there is no perfect freedom between various alternatives, the operation of law may be impeded.

CONSUMER EQUILIBRIUM UNDER CARDINAL UTILITY APPROACH:

Consumer's Equilibrium refers to the situation when a consumer is having maximum satisfaction with limited income and has no tendency to change his way of existing expenditure.

Consumer's Equilibrium in case of Single Commodity:

The Law of DMU can be used to explain consumer's equilibrium in case of a single commodity. Therefore, all the assumptions of Law of DMU are taken as assumptions of consumer's equilibrium in case of single commodity.

A consumer purchasing a single commodity will be at equilibrium, when he is buying such a quantity of that commodity, which gives him maximum satisfaction. The number of units to be consumed of the given commodity by a consumer depends on 2 factors:

1. Price of the given commodity;

2. Expected utility (Marginal utility) from each successive unit.

To determine the equilibrium point, consumer compares the price (or cost) of the given commodity with its utility (satisfaction or benefit). Being a rational consumer, he will be at equilibrium when marginal utility is equal to price paid for the commodity. We know, marginal utility is expressed in utils and price is expressed in terms of money However, marginal utility and price can be effectively compared only when both are stated in the same units. Therefore, marginal utility in utils is expressed in terms of money.

Marginal Utility in terms of Money = Marginal Utility in utils/ Marginal Utility of one rupee (MU_M)
MU of one rupee is the extra utility obtained when an additional rupee is spent on other goods. As utility is a subjective concept and differs from person to person, it is assumed that a consumer himself defines the MU of one rupee, in terms of satisfaction from bundle of goods.

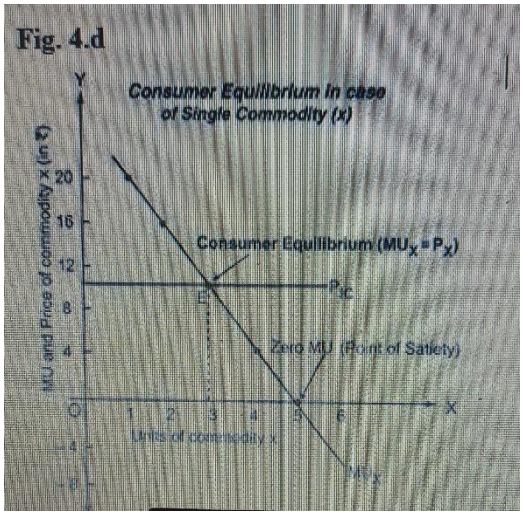
Equilibrium Condition:
Consumer in consumption of single commodity (say, x) will be at equilibrium when:

Marginal Utility (MU_x) is equal to Price (P_x) paid for the commodity; i.e. MU = Price
i. If $MU_X > P_x$, then consumer is not at equilibrium and he goes on buying because benefit is greater than cost. As he buys more, MU falls because of operation of the law of diminishing marginal utility. When MU becomes equal to price, consumer gets the maximum benefits and is in equilibrium.
ii. Similarly, when $MU_X < P_x$, then also consumer is not at equilibrium as he will have to reduce consumption of commodity x to raise his total satisfaction till MU becomes equal to price.
Note:
In addition to condition of "MU = Price", one more condition is needed to attain consumer's equilibrium: "MU falls as consumption increases". However, this second condition is always implied because of operation of Law of DMU. So, a consumer in consumption of single commodity will be at equilibrium when MU = Price.

Let us now determine the consumer's equilibrium if the consumer spends his entire income on single commodity. Suppose, the consumer wants to buy a good (say, x), which is priced at Rs. 10 per unit. Further suppose that marginal utility derived from each successive unit (in utils and in is determined and is given in Table 4.4 (For sake of simplicity, it is assumed that 1 util = Rs. 1, i.e. MU_M = Rs. 1).

Table 4.4: Consumer's Equilibrium in case of Single Commodity

Units of X	Price ($P_{X)}$ in Rs	Marginal Utility (utils)	Marginal Utility in Rs. (MUx) 1 util=Rs 1	Difference MUx and Px	Remarks
1	10	20	20/1=20	20-10=10	MUx>Px,so
2	10	16	16/1=16	16-10=6	Consumer will increase the consumption
3	10	10	10/1=10	10-10=0	Consumer's Equilibrium (MUx=Px)
4	10	4	4/1=4	4-10= -6	MUx<Px, so
5	10	0	0/1=0	0-10= -10	Consumer will decrease the consumption
6	10	-6	-6/1=-6	-6-10= -16	



In Fig. 4.d, MU_X curve slopes downwards, indicating that the marginal utility falls with successive consumption of commodity x due to operation of Law of DMU. Price (P_x) is a horizontal and straight price line as price is fixed at Rs. 10 per unit. From the given schedule and diagram, it is clear that the consumer will be at equilibrium at point 'E', when he consumes 3 units of commodity x, because at point E, $MU_X = P_x$

i. He will not consume 4 units of x as MU of Rs. 4 is less than price paid of Rs. 10.

ii. Similarly, he will not consume 2 units of x as MU of Rs. 16 is more than the price paid.

So, it can be concluded that a consumer in consumption of single commodity (say, x) will be at equilibrium when marginal utility from the commodity (MUJ) is equal to price (PJ) paid for the commodity.

Consumer's equilibrium in case of two Commodities:

The Law of DMU applies in case of either one commodity or one use of a commodity. However, in real life, a consumer normally consumes more than one commodity. In such a situation, 'Law of Equi-Marginal Utility' helps in optimum allocation of his income.

Law of Equi-marginal utility is also known as**:**Law of Substitution, Law of maximum satisfaction and Gossen's Second Law.
As law of Equi-marginal utility is based on Law of DMU, all assumptions of the latter also apply to the former. Let us now discuss equilibrium of consumer by taking two goods: 'x' and 'y'. The same analysis can be extended for any number of goods.

In case of consumer equilibrium under single commodity, we assumed that the entire income was spent on a single commodity. Now, consumer wants to allocate his money income between the two goods to attain the equilibrium position.

According to the law of Equi-marginal utility, a consumer gets maximum satisfaction, when ratios of MU of two commodities and their respective prices are equal and MU falls as consumption increases. It means, there are two necessary conditions to attain Consumer's Equilibrium in case of Two Commodities:

(i) Marginal Utility (MU) of last rupee spent on each commodity is same:

i. We know, a consumer in consumption of single commodity (say, x) is at equilibrium when $MU_x/P_x = MU_M$

(ii) Similarly, consumer consuming another commodity (say, y) will be at equilibrium when $MU_Y/P_Y = MU_M$

Equating 1 and 2, we get: $MU_X/P_X = MU_Y/P_Y = MU_M$

As marginal utility of money (MU_M) is assumed to be constant, the above equilibrium condition can be restated as:

$MU_X = MU_Y/P_Y$ or $MU_X/MU_Y = P_X/P_Y$

What happens when MU_X/P_X is Not Equal to MU_Y/P_Y

(i) Suppose, $MU_X/P_X > MU_Y/P_Y$. In this case, the consumer is getting more marginal utility per rupee in case of good X as compared to Y. Therefore, he will buy more of X and less of Y. This will lead to fall in MU_X and rise in MU_Y. The consumer will continue to buy more of X till $MU_X/P_X = MU_Y/P_Y$

(ii) When $MU_X/P_X < MU_Y/P_Y$, the consumer is getting more marginal utility per rupee in case of good Y as compared to X. Therefore, he will buy more of Y and less of X. This will lead fall in MU_Y and rise in MU_X. The consumer will continue to buy more of Y till $MU_X/P_X = MU_Y/P_Y$.

It brings us to a conclusion that $MU_X/P_X = MU_Y/P_Y$ is a necessary condition to attain Consumer's Equilibrium.

(ii) MU falls as consumption increases:

The second condition needed to attain consumer's equilibrium is that MU of a commodity must fall as more of it is consumed. If MU does not fall as consumption increases, the consumer will end up buying only one good which is unrealistic and consumer will never reach the equilibrium position.

Finally, it can be concluded that a consumer in consumption of two commodities will be at equilibrium when he spends his limited income in such a way that the ratios of marginal utilities of two commodities and their respective prices are equal and MU falls as consumption increases.

Explanation with the help of an Example:

Let us now discuss the law of equi-marginal utility with the help of a numerical example. Suppose, total money income of the consumer is Rs. 5, which he wishes to spend on two commodities: 'x' and 'y'. Both these commodities are priced at Rs. 1 per unit. So, consumer can buy maximum 5 units of 'x' or 5 units of 'y'. In Table 4.4, we have shown the marginal utility which the consumer derives from various units of 'x' and 'y'.

Table 4.5: Consumer's Equilibrium in case of Two Commodities

Units	MU of Commodity "X" (in utils)	MU of Commodity "Y" (in utils
1	20	16
2	14	12
3	12	8
4	7	5
5	5	3

From Table 4.5, it is obvious that the consumer will spend the first rupee on commodity 'x', which will provide him utility of 20 utils. The second rupee will be spent on commodity 'y' to get utility of 16 utils. To reach the equilibrium, consumer should purchase that combination of both the goods, when:

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

(ii) MU falls as consumption increases.

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

i. MU from last rupee (i.e. 5^{th} rupee) spent on commodity y gives the same satisfaction of 12 utils as given by last rupee (i.e. 4^{th} rupee) spent on commodity x; and
ii. MU of each commodity falls as consumption increases.

The total satisfaction of 74 utils will be obtained when consumer buys 3 units of 'x' and 2 units of 'y'. It reflects the state of consumer's equilibrium. If the consumer spends his income in any other order, total satisfaction will be less than 74 utils.

DERIVATION OF DEMAND CURVE:

Dr. Alfred Marshal was of the view that the law of demand and so the demand curve can be derived with the help of utility analysis.He explained the derivation of law of demand:

(i) In the case of a single commodity and (ii) in the case of two or more than two commodities. In the utility analysis of demand, the following assumptions are made:

Assumptions:

(i) Utility is cardinally measurable.

(ii) Utilities of different commodities are independent.

(iii) The marginal utility of money to the consumer remains constant.

(Iv) Utility gained from the successive units of a commodity diminishes.

Derivation of Demand Curve in the Case of a Single Commodity (Law of Diminishing Marginal Utility):

Dr. Alfred Marshall derived the demand curve with the aid of law of diminishing marginal utility. The law of diminishing marginal utility states that as the consumer purchases more and more units of a commodity, he gets less and less utility from the successive units of the expenditure. At the same time, as the consumer purchases more and more units of one commodity, then lesser and lesser amount of money is left with him to buy other goods and services.

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

To put it differently, as the consumer consumes more and more units of a commodity, its marginal utility goes on diminishing. So it is only at a diminishing price at which the consumer would like to demand more and more units of a commodity.

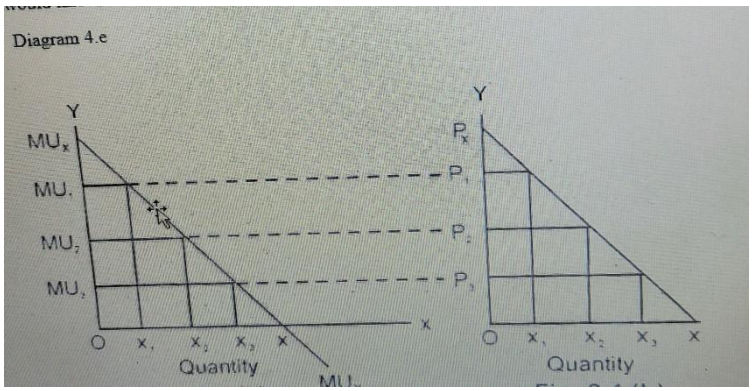


Diagram 4.e (i) & 4.e (ii)

In fig. 4.e(i) the MU_x is negatively slopped. It shows that as the consumer acquires larger quantities of good x, its marginal utility diminishes. Consequently at diminishing price, the quantity demanded of the good x increases as is shown in fig. 4.e(ii).

At X^1, quantity the marginal utility of a good is MU^1. This is equal to P^1 by definition. The consumer here demands OX^1 quantity of the commodity at P^1 price. In the same way X^2 quantity of the good is equal to P^2. Here at P^2 price, the consumer will buy OX^2 quantity of commodity. At X^3 quantity the marginal utility is MU^3, which is equal to P^3. At P^3, the consumer will buy OX^3 quantity and so on.

We conclude from above, that as the purchase of the units of commodity X are increased, its marginal utility diminishes. So at diminishing price, the quantity demanded of good X increases as is evident from fig.4.e (ii). The rational supports the notion of down slopping demand curve that when price falls, other things remaining the same, the quantity demanded of a good increases and vice versa.

Derivation of the Demand Curve in the Case of Two or More than Two Commodities (Law of Equi-marginal Utility):

The law of diminishing marginal utility can also be applied in case of two or more than two goods. When a consumer has to spend a certain given income on a number of goods, he attains maximum satisfaction when the marginal utilities of the goods are proportional to their prices as stated below.

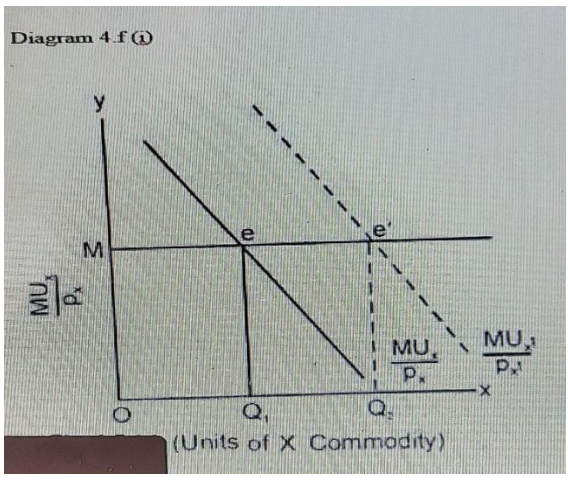
$$\mathbf{MU^x / P^x = MU^y / P^y = \ldots\ldots\ldots MU^n / P^n}$$

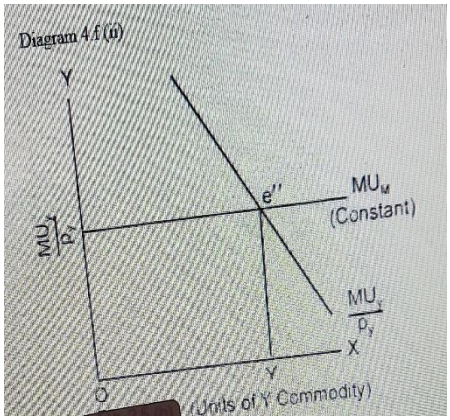
Derivation of Demand Curve:

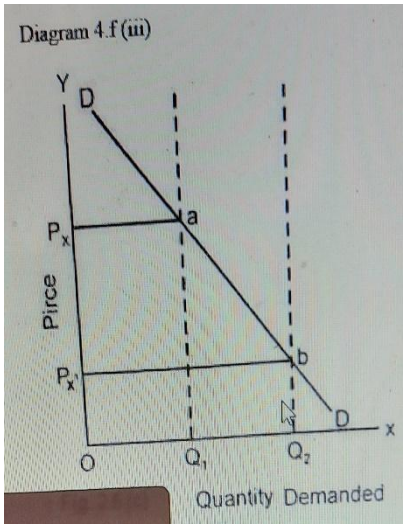
In the fig. 4.f (i), (ii) and (iii) given the money income, the price of X commodity (P_x) and the price of Y commodity (P_y) and constant marginal utility of money (MU_m), the demand curve derived is illustrated. The consumer allocates his money income between X and Y commodities to get OQ^1 units of good X and OY unit of good Y commodities because the combination correspondence to:

$$\mathbf{MU_x / P_x = MU_y / P_y = MU_m}$$

At the OM level (constant).







Let us assume that money income and price of Y commodity remain constant but the price of X commodity decreases. As a result of this money expenditure on commodity X rises resulting MU_x / P_x curve to shift towards right. The consumer now allocates his income to OQ_2 quantity of X commodity and O_y quantity of Y commodity because the combinations correspondence to

$$\mathbf{MU_x / P_x = MU_y / P_y = MU_m}$$

(constant) at OM level.

Thus in response to decrease in the price from Px to Px^1, the quantity demanded of a good X increases from OQ_1 to OQ_2. The DD is a negatively sloped demand curve.

DRAWBACKS OF CARDINAL UTILITY APPROACH

The following points highlights the shortcomings of cardinal utility approach:

1. **Cardinal measurability of utility is unrealistic**: Cardinal utility analysis of demand is based on the assumptions that utility can be measured in absolute, objective and quantitative terms i.e how much utility a consumer obtains from goods can be stated

in cardinal numbers such as 1, 2, 3 and so forth. But in actual practice, utility cannot be measured in such quantitative numbers because utility is a psychic feeling and a subjective thing which cannot be measured in quantitative terms.

2. **Hypotheses of independent utilities is wrong:**The assumption of independent utilities implies that the utility which a consumer obtains from a good does not depend upon the quantity consumed of other goods; it depends upon the quantity purchased of that good alone. The total utility which a person gets from the whole collection of goods purchased by him simply the total sum of the separate utilities of the various goods i.e utility function is additive. But in real life, the utility or satisfaction derived from a good depends upon the availability of some other goods which may be either substitutes or complementary with each other.
3. **Assumption of constant marginal utility is not valid:** While discussing the effect of a change in price rise or fall on the amount demanded by an individual consumer, the cardinal utility analysis assumes that the marginal utility of money remains constant. The utility analysis overlook the fact that a fall in the price of a commodity itself releases some money and therefore the marginal utility of money cannot remain constant. With more money becoming available to the consumer, the marginal utility of money is bound to fall. This is reallya serious defect of utility analysis.
4. **Cardinal utility analysis does not splits up the price effect into substitution and income effect:** Another shortcoming of cardinal utility analysis is that it does not distinguish between the income effect and substitution effect of a fall in the price of the commodity. This analysis simply tells us that a fall in the price of a commodity will lead to an increase in the amount demanded. But it does not clearly explain how much of the increase on the amount demanded will be due to the income effect and how much due to the substitution effect.
5. **Marshall's marginal utility analysis could not explain Giffen paradox**: By not visualising the price effect as a combination of substitution and income effects and ignoring the income effect of the price change..Marshall could not explain Giffen paradox. He treated it merely as an exception to his law of demand. Because of the constant marginal utility of money and therefore the neglect of income effect of the price change that Marshall could not explain why the quantity demanded of the giffen good falls when its price falls and rises when its price rises.
6. **Single Commodity Model is Unrealistic:**The cardinal utility analysis is a single commodity model in which the utility of one commodity is regarded independent of the other. Marshall considered substitutes and complementary as one commodity, but it makes the utility analysis unrealistic.
7. **Money is an Imperfect Measure of Utility:**Marshall Measure's utility in terms of money, but money is an incorrect and imperfect measure of utility because the value of money often changes i.e if two consumers spend the same amount of money at a time, they will not be getting equal utilities because the amount of utility depends upon the intensity of desire of each consumer for the commodity.

Frequently Asked Questions from the Unit.

1. Define the term Utility with example.

2. Distinguish between marginal utility and total utility and their relationship.
3. Write down the main premises on which cardinal utility analysis rests upon.
4. Elaborate the marginal utility of money remain constant as an assumption of cardinal analysis.
5. Explain the Gossen's first law of consumption in detail.
6. What are the main exceptions of the law of diminishing marginal utility.
7. Explain diagrammatically law of equi-marginal utlity.
8. How can we obtained consumer equilibrium in case of two commodities in cardinal analysis.
9. Elaborate the concept of derivation of demand curve in cardinal analysis.
10. Critically explain the cardinal utility analysis of consumer behaviour.

Suggested Links for Further Readings:

1. https://economicsconcepts.com/cardinal_utility_analysis.htm
2. https://www.toppr.com/guides/business-economics/theory-of-consumer-behavior/marginal-utility-analysis/

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Title Of Course: Principles Of Microeconomics

•Type Of Course: Core

•Number Of Credits:06

•Semester and Year For Which Offered: Semester Ist 2020

•Course Co-Ordinator: Prof. Surinder Singh Parihar

Pre-Requisite: Basic Knowledge of Supply, Demand Indifference Curves, Production Possibility Curve, Utility Etc

Aims:

.To Know ordinal concepts of utility

To know the consumer's equilibrium

To know and measure the consumer's surplus

•To analyze utility in real life

.To work out the efficient policy decisions

•Video/Text Transcript: English

•Price: Free

Brief Discussion:

The chapter has been divided into three modules as under

•Module 1: Indifference Curves, Meaning, Types and Properties (Ordinal Approach)-Week 1

•Module 2a Consumer's Equilibrium under Ordinal Approach - Week-2

•Module 2b: Effects of Changes in Income and price on Consumer's Equilibrium

•Module 3: Consumer's Surplus - Week 3

•Module 1: Indifference Curves, Meaning, Types and Properties(Ordinal Approach):The learners are expected to go through the Module and note the important point for the class activity .Click here for the link : https://youtu.be/1OqvzTzVSCQ

The learners are further advised to go through the additional e-contents as listed below:

https://economictimes.indiatimes.com/definition/indifference-curve

https://youtu.be/jGDhjcjYHdA

Discussion:1.How you can draw an indifference curve?2.How ordinal approach is better than Cardinal Approach?

Self Assessment:After going through the Module ,the learners have go through this link for FAQs/Self Assessment,click at link below

https://docs.google.com/forms/d/e/1FAIpQLSfxYfmacS5_FdgBcaBae7swq0a8KwG8WMDFbcgzWhgxrOXePA/viewform?usp=sf_link

or click here

https://docs.google.com/forms/d/e/1FAIpQLSfxYfmacS5_FdgBcaBae7swq0a8KwG8WMDFbcgzWhgxrOXePA/viewform?usp=sf_link

•Module 2a. Consumer's Equilibrium under Ordinal Approach

•Module 2b: Effects of Changes in Income and price on Consumer's Equilibrium

The learners are expected to go through the Module and note the important point for the class activity .Click here for the link : https://youtu.be/TI5AsSM43-s

https://youtu.be/HzHBAqhgTUw

The learners are further advised to go through the additional e-contents as listed below:

https://www.toppr.com/guides/business-economics/theory-of-consumer-behavior/consumers-equilibrium/

https://youtu.be/YZpjtDVj4RY

Discussion:1.Discuss what consumer's equilibrium signifies? 2.Explain what are the results of change in income and prices on the consumer's equilibrium?

Self Assessment:After going through the Module the learners are expected to go through the link for self assessment .The link for FAQs/Quiz is https://docs.google.com/forms/d/e/1FAIpQLSdY0gL2Cy6JCS5cOZ_6nmltOQ8ZrA47fnUh_H8nawM3Kylbvw/viewform?usp=sf_link

•Module 3: Consumer's Surplus:

The learners are expected to go through the Module and note the important points for the class activity .Click here for the link : https://youtu.be/hBLQRf-EVjk

The learners are further advised to go through the additional e-contents as listed below:

https://www.economicsdiscussion.net/consumers-surplus-2/consumers-surplus-with-diagram-economics/25150

https://youtu.be/LF5Q1PazCyc

Discussion:1.Is the concept of consumer surplus relevant today? 2.What are the difficulties in measuring the consumer surplus?

Self Assessment:After going through the Module the learners have go through FAQs/Self Assessment through the Link below.Click here https://docs.google.com/forms/d/e/1FAIpQLSfEZ3_fLk6P-jfAWTLXmLVEhff6UOcTHOT2FYGKqUQuK9iXSg/viewform?usp=sf_link

Or here https://docs.google.com/forms/d/e/1FAIpQLSfEZ3_fLk6P-jfAWTLXmLVEhff6UOcTHOT2FYGKqUQuK9iXSg/viewform?usp=sf_link

References:1.Ahuja,H.L,Advanced Economic Theory

2.Jhingan,M.L,Advanced Economic Theory

3.Chopra,P.N,The Principles of Economics

4.Parihar,S.S,The Theory of Microeconomics

UNIT 5

THEORY OF PRODUCTION

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Unit 5th

1. **Production Function: Meaning and Types**
2. **Isoquant- Meaning and Properties**
3. **Producer Equilibrium- Least cost combination of Factors.**
4. **Expansion Path**
5. **Law of variable Proportions**
6. **Law of Returns to Scale**

PRODUCTION FUNCTION

Production function relates physical output of a production process to physical inputs or factors of production. It is a mathematical function that relates the maximum amount of output that can be obtained from a given number of inputs – generally capital and labor. The production function, therefore, describes a boundary or frontier representing the limit of output obtainable from each feasible combination of inputs.

In simple words, production function refers to the functional relationship between the quantity of a good produced (output) and factors of production (inputs).

Mathematically, such a basic relationship between inputs and outputs may be expressed as:

Q = f(L, K, N, B, M etc)

Where Q = Quantity of output

L = Labour

K = Capital

N = Land.

B = Building

M= Machinery

Hence, the level of output (Q), depends on the quantities of different inputs (L, K, N) available to the firm. In the simplest case, where there are only two inputs, labour (L) and capital (K) and one output (Q), the production function becomes.

Q =f (L, K)

Firms use the production function to determine how much output they should produce given the price of a good, and what combination of inputs they should use to produce given the price of capital and labor. When firms are deciding how much to produce they typically find that at high levels of production, their marginal costs begin increasing. This is also known as diminishing returns to scale – increasing the quantity of inputs creates a less-than-proportional increase in the quantity of output. If it weren't for diminishing returns to scale, supply could expand without limits without increasing the price of a good.

Definitions:

"The production function is a technical or engineering relation between input and output. As long as the natural laws of technology remain unchanged, the production function remains unchanged**." *Prof. L.R. Klein***

"Production function is the relationship between inputs of productive services per unit of time and outputs of product per unit of time." ***Prof. George J. Stigler***

"The relationship between inputs and outputs is summarized in what is called the production function. This is a technological relation showing for a given state of technological knowledge how much can be produced with given amounts of inputs." ***Prof. Richard J. Lipsey***

Short Run and Long Run Production Function

A **short-run production function** refers to that period of time, in which the installation of new plant and machinery to increase the production level is not possible. On the other hand, the **Long-run production function** is one in which the firm has got sufficient time to install new machinery or capital equipment, instead of increasing the labour units.

Short Run production Function

The short run production function is one in which at least is one factor of production is thought to be fixed in supply, i.e. it cannot be increased or decreased, and the rest of the factors are variable in nature. In general, the firm's capital inputs are assumed as fixed, and the production level can be changed by changing the quantity of other inputs such as labour, raw material, capital and so on. Therefore, it is quite difficult for the firm to change the capital equipment, to increase the output produced, among all factors of production.

In such circumstances, the law of variable proportion or laws of returns to variable input operates, which states the consequences when extra units of a variable input are combined with a fixed input. In short run, increasing returns are due to the indivisibility of factors and specialization, whereas diminishing returns is due to the perfect elasticity of substitution of factors.

Long Run Production Function

Long run production function refers to that time period in which all the inputs of the firm are variable. It can operate at various activity levels because the firm can change and adjust all the factors of production and level of output produced according to the business environment. So, the firm has the flexibility of switching between two scales. In such a condition, the law of returns to scale operates which discusses, in what way, the output varies with the change in production level, i.e. the relationship between the activity level and the quantities of output. The increasing returns to scale is due to the economies of scale and decreasing returns to scale is due to the diseconomies of scale.

Some More Types of Production Function:

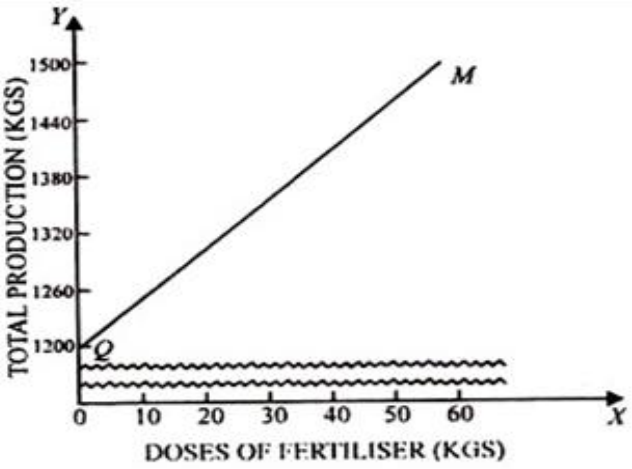
There are two types of production function:

1. Increasing production function
2. Decreasing production function

Increasing Production Function:

When the total output increases with an increase in inputs. Like any other function, all such functions where output increase as the inputs increase total, are known as increasing production functions, it is important to know whether the rate of increase in production in response to successive equi-proportional changes in all inputs taken together (expressed in terms of returns to scale) or to successive changes in the amount of single input taken in isolation (expressed in terms of returns to a variable factor), is itself increasing, is constant or is decreasing.

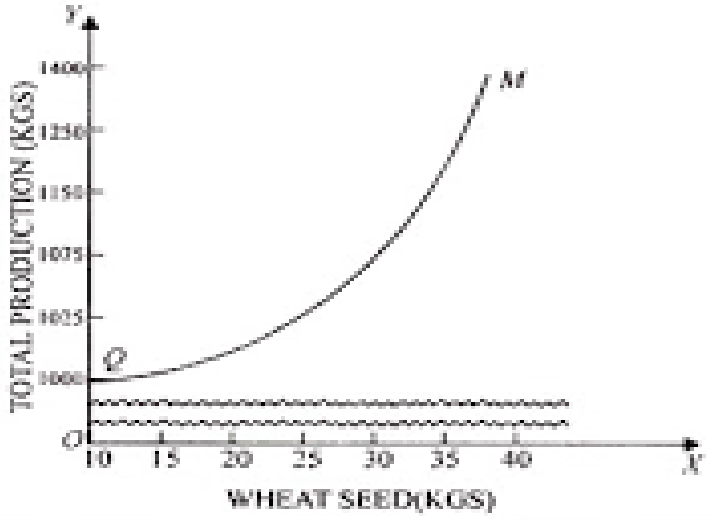
it is the marginal returns to a variable factor which are the main focus and shall be explain, the increasing production function by categorizing it into parts, on the basis of constant, increasing, and decreasing marginal returns to a variable as shown in the figure1.



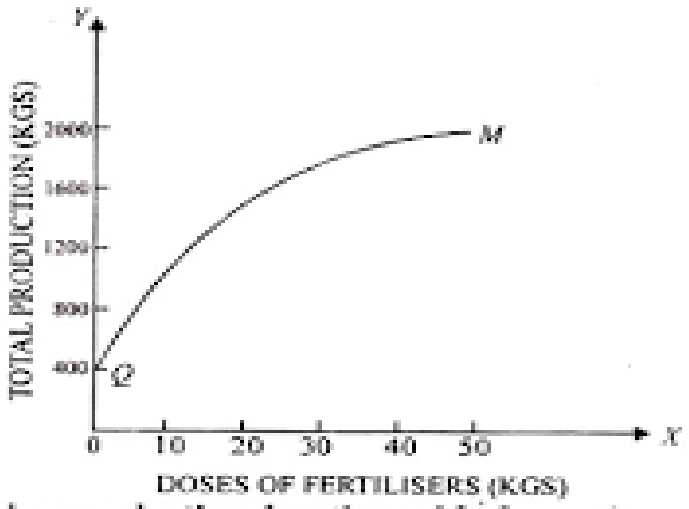
Increasing production function with constant marginal returns **Fig 1.**

Increasing production function with increasing marginal returns on the variable input:

In this case, every successive dose of input brings about an increasing addition to the total output i.e., the output increasing rate when more and more units of an input are used. This type of relationship generally emerges when the fixed factors being used in production are having an excess capacity and use of additional units of the variable input results in a better utilization of these fixed factors as shown in fig 2 and increasing production function with decreasing marginal returns in fig 3.



Increasing production function with increasing marginal returns **FIG 2**



Increasing production function with decreasing marginal returns **FIG 3**

Decreasing Production Function:

There are also situations in the real world where an increase in inputs, instead of bringing about an increase in the total output, may decrease it. Such a production function will be known as decreasing production function. A decreasing production function is one in which the total output declines when the input increase. In terms of marginal returns to the variable factor, one could say that it is negative (less than zero). The decreasing production function could also be divided into three categories on the basis of increasing, decreasing or constant rate of decrease in output as shown in fig 4.

The Following diagram shows the decreasing production function:

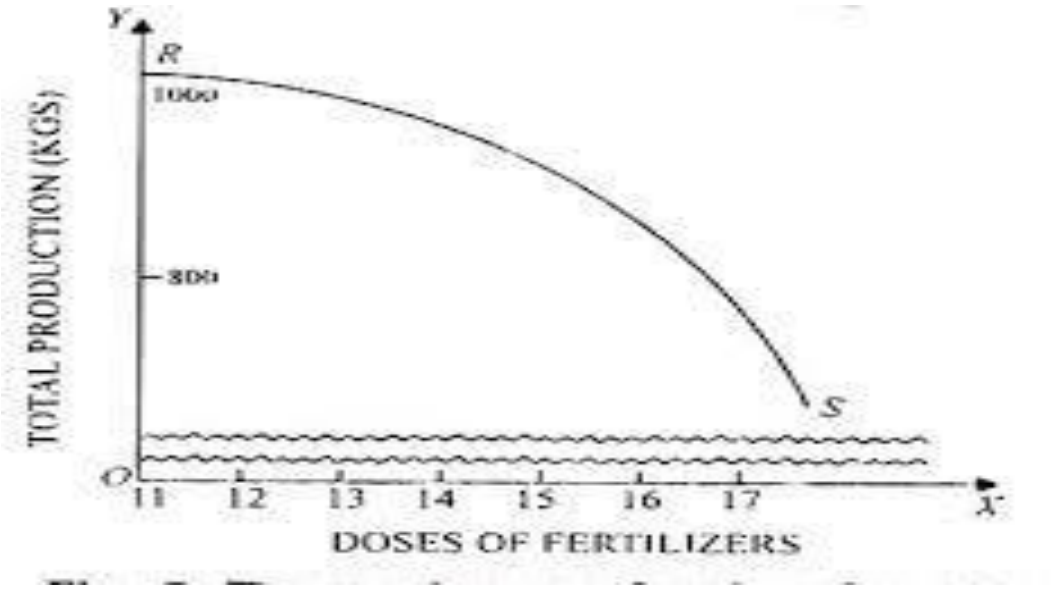


Fig 4

The decreasing production function implies a line or a curve with negative slope. The curve can be concave or convex to the origin depending upon whether the output declines at an increasing rate or at a decreasing rate when more and more doses of an input are used.

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ISOQUANT AND ITS PROPERTIES:

An isoquant is a firm's counterpart of the consumer's indifference curve. An isoquant is a curve that shows all the combinations of inputs that yield the same level of output. 'Iso' means equal and 'quant' means quantity. Therefore, an isoquant represents a constant quantity of output. The

isoquant curve is also known as an “Equal Product Curve” or “Production Indifference Curve” or Iso-Product Curve.”

The concept of isoquants can be easily explained with the help of the table given below:

Table 1: An Isoquant Schedule

Combination of labour and Capital	Units of Labour (L)	Units of Capital (C)	Output of cloth (meters)
A	5	9	100
B	10	6	100
C	15	4	100
D	20	3	100

The above table is based on the assumption that only two factors of production, namely, Labor and Capital are used for producing 100 meters of cloth.

Combination A = 5L + 9K = 100 meters of cloth

Combination B = 10L + 6K = 100 meters of cloth

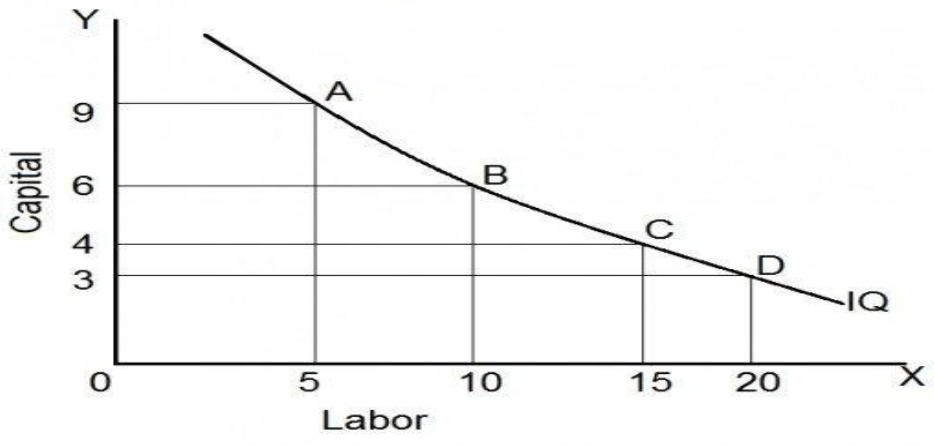
Combination C = 15L + 4K = 100 meters of cloth

Combination D = 20L + 3K = 100 meters of cloth

The combinations A, B, C and D show the possibility of producing 100 meters of cloth by applying various combinations of labor and capital. Thus, an isoquant schedule is a schedule of different combinations of factors of production yielding the same quantity of output.

An iso-product curve is the graphic representation of an iso-product schedule.

Figure 1

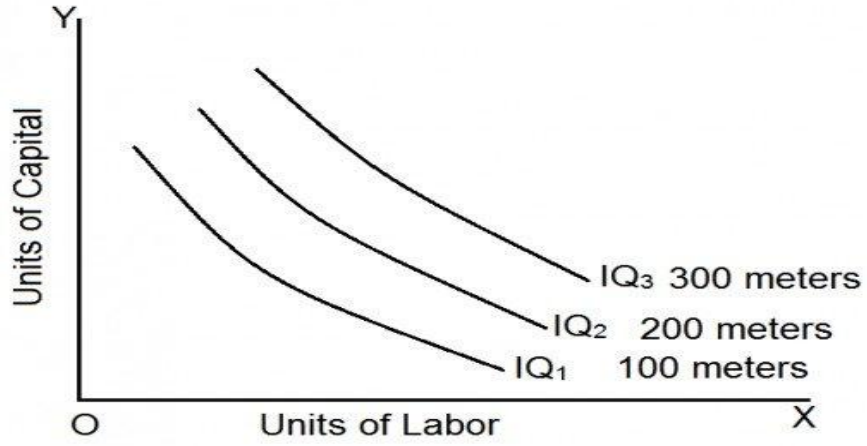


Thus, an isoquant is a curve showing all combinations of labor and capital that can be used to produce a given quantity of output.

Isoquant Map

An isoquant map is a set of isoquants that shows the maximum attainable output from any given combination inputs.

Figure 2



Isoquants Vs Indifference Curves

An isoquant is 'analogous' to an indifference curve in more than one way. The properties of isoquants are similar to the properties of indifference curves. However, some of the differences may also be noted. Firstly, in the indifference curve technique, utility cannot be measured. In the

case of an isoquant, the product can be precisely measured in physical units. Secondly, in the case of indifference curves, we can talk only about higher or lower levels of utility. In the case of isoquants, we can say by how much IQ_2 actually exceeds IQ_1 (figure 2).

PROPERTIES OF ISOQUANT

1. An isoquant lying above and to the right of another isoquant represents a higher level of output.

This is because of the fact that on the higher isoquant, we have either more units of one factor of production or more units of both the factors. This has been illustrated in figure 3. In figure 3, points A and B lie on the isoquant IQ_1 and IQ_2 respectively.

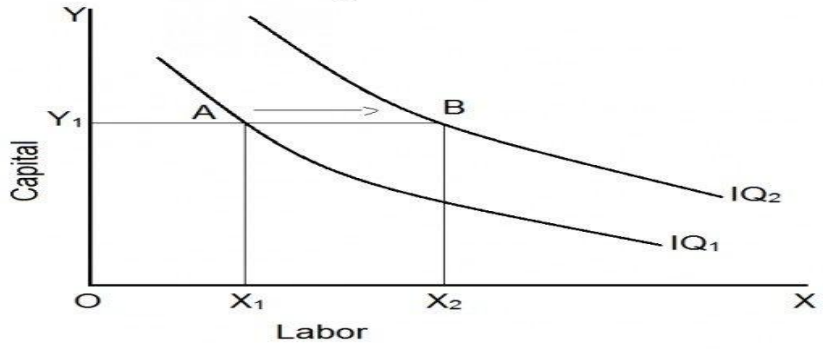
At point A we have = OX_1 units of Labor and OY_1 units of capital.

At point B we have = OX_2 units of Labor and OY_1 units of capital.

Though the amount of capital (OY_1) is the same at both the points, point B is having X_1X_2 units of labor more. Therefore, it will yield a higher output.

Hence, it is proved that a higher isoquant shows a higher level of output.

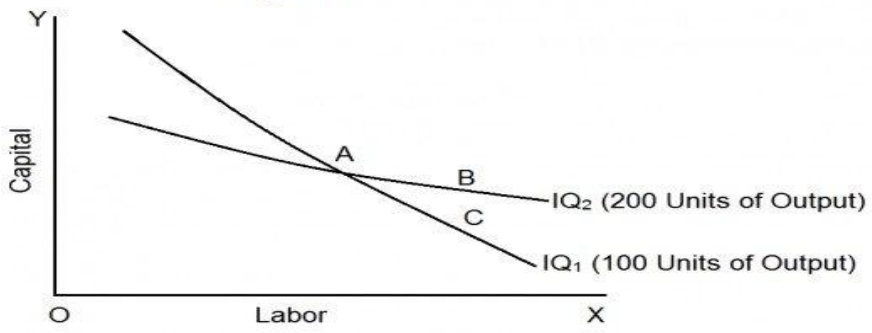
Figure 3



2. Two isoquants cannot cut each other

Just as two indifference curves cannot cut each other, two isoquants also cannot cur each other. If they intersect each other, there would be a contradiction and we will get inconsistent results. This can be illustrated with the help of a diagram as in figure 4.

Figure 4



In figure 4, the isoquant IQ_1 shows 100 units of output produced by various combinations of labor and capital and the curve IQ_2 shows 200 units of output,

On IQ_1, we have A = C, because they are on the same isoquant.

On IQ_2, we have A = B

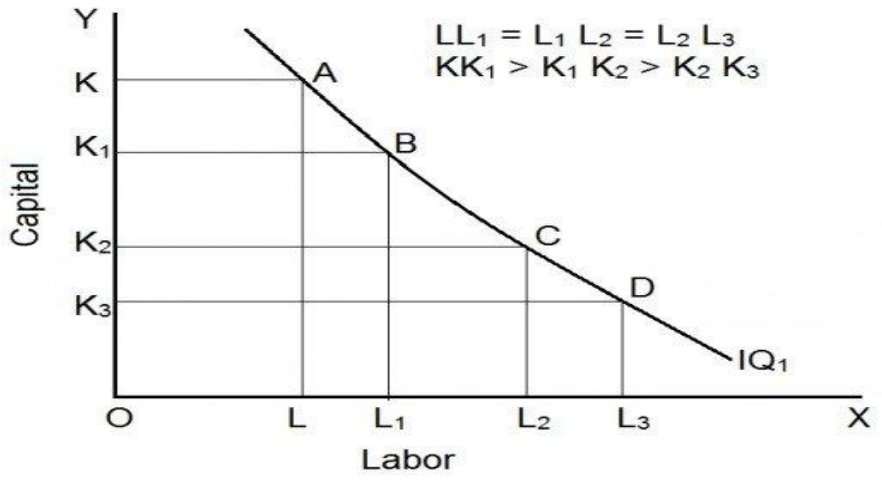
Therefore B = C

This is however inconsistent since C = 100 and B = 200. Therefore, isoquants cannot intersect.

3. Isoquants are convex to the origin

An isoquant must always be convex to the origin. This is because of the operation of the principle of diminishing marginal rate of technical substitution. MRTS is the rate at which marginal unit of an input can be substituted for another input making the level of output remain the same.

Figure 5

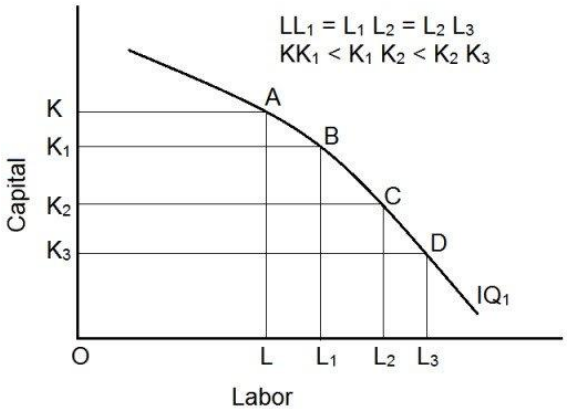


In figure 5, as the producer moves from point A to B, from B to C and C to D along an isoquant, the marginal rate of technical substitution (MRTS) of labor for capital diminishes. The MRTS diminishes because the two factors are not perfect substitutes. In figure 5, for every increase in labor units by (ΔL) there is a corresponding decrease in the units of capital (ΔK).

It cannot be concave as shown in figure 6. If they are concave, MRTS of labor for capital increases. But this is not true of isoquants.

Since MRTS must diminish, the isoquants must be convex to the origin.

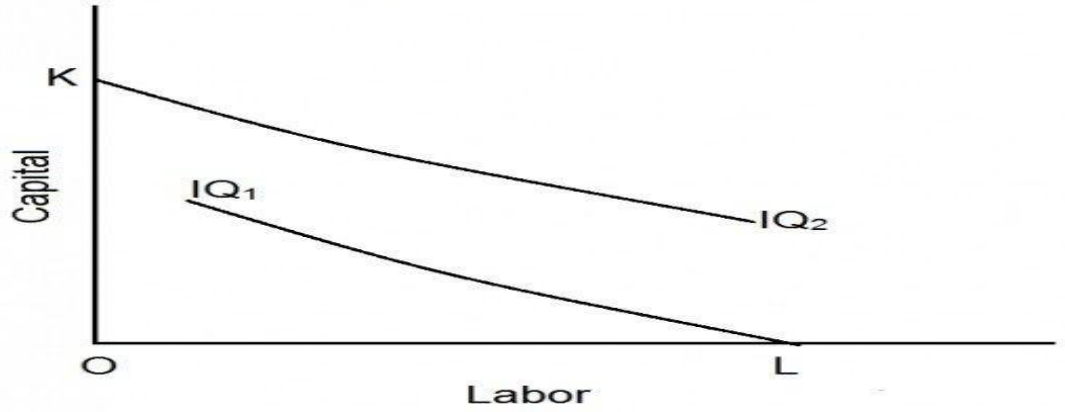
Figure 6



4. No isoquant can touch either axis

If an isoquant touches the X-axis it would mean that the commodity can be produced with OL units of labor and without any unit of capital.

Figure 7



Point K on the Y-axis implies that the commodity can be produced with OK units of capital and without any unit of labor. However, this is wrong because the firm cannot produce a commodity with one factor alone.

5. Isoquants are negatively sloped

An isoquant slopes downwards from left to right. The logic behind this is the principle of diminishing marginal rate of technical substitution. In order to maintain a given output, a reduction in the use of one input must be offset by an increase in the use of another input.

Figure 8

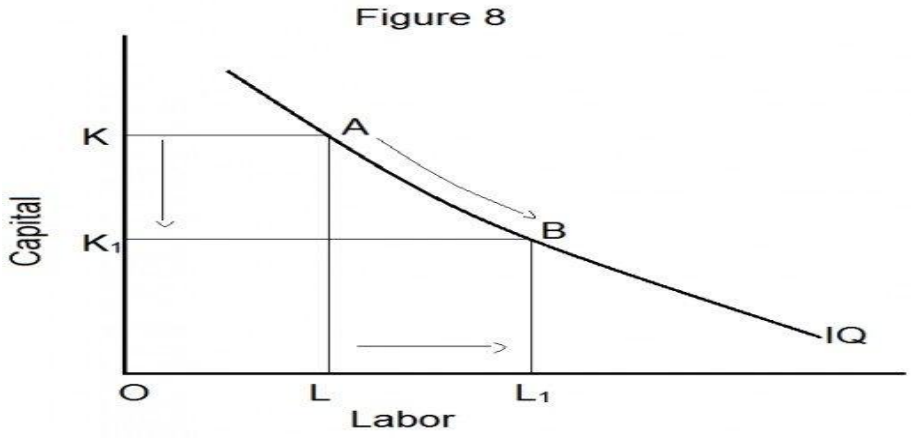


Figure 8 shows that when the producer moves from point A to B, the amount of labor increases from OL to OL_1, but the units of capital decreases from OK to OK_1, to maintain the same level of output.

The impossibility of horizontal, vertical or upward sloping isoquants can be shown with the help of the following diagrams.

Consider figure 9(A)

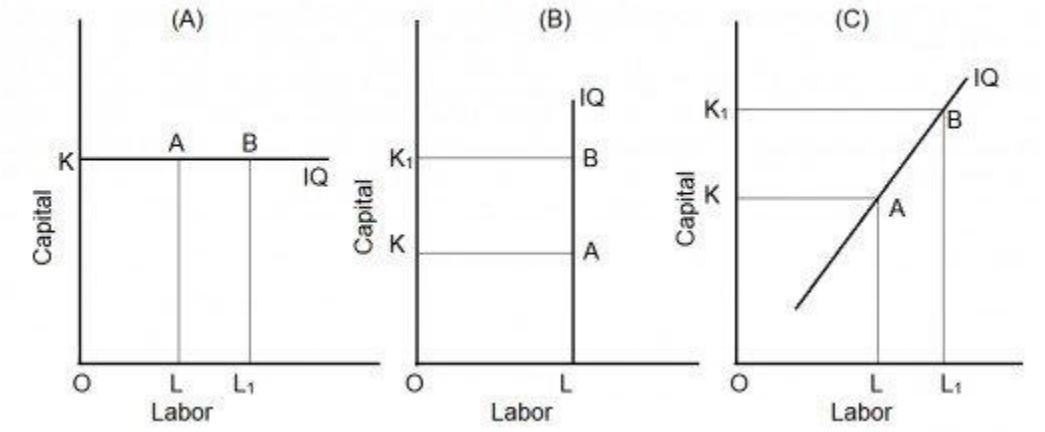
At point A, we have OL units of labor and OK units of capital and at B, we have OL_1 units of labor and OK units of capital.

OL_1 + OK > OL + OK, and so combination B will yield a higher output than A. Therefore, points A and B on the IQ curve cannot represent an equal level of the product. Hence, the isoquant cannot be a horizontal straight line like AB.

Consider figure 9(B)

At point A, we have OL units of labor and OK units of capital. At point B, we have OL units of labor and OK_1 units of capital.

Figure 9



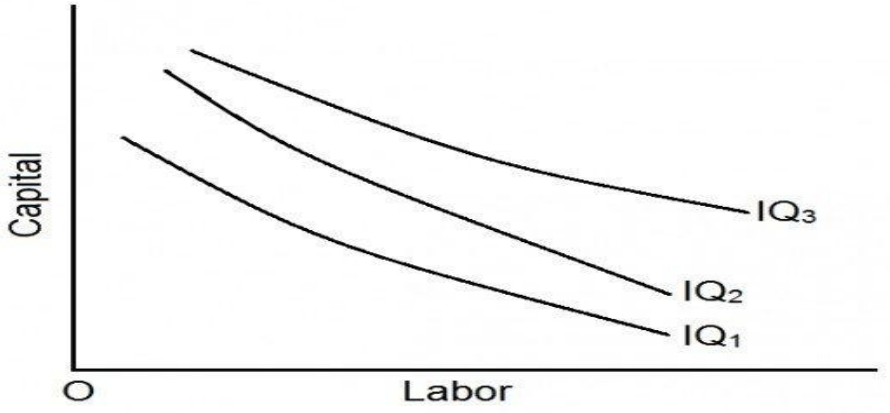
Since B is having KK_1 more units of capital it is wrong to assume that both A and B will yield the same level of output. The conclusion is that the isoquant cannot be a vertical straight line.

Similarly at point B in figure 9(C), we have LL_1 units of more labor and KK_1 units of more capital. As compared to point A, both the inputs are higher at point B. Therefore, it is absurd to assume that both the combinations A and B will give the same level of output.

6. Isoquants need not be parallel

The shape of an isoquant depends upon the marginal rate of technical substitution. Since the rate of substitution between two factors need not necessarily be the same in all the isoquant schedules, they need not be parallel.

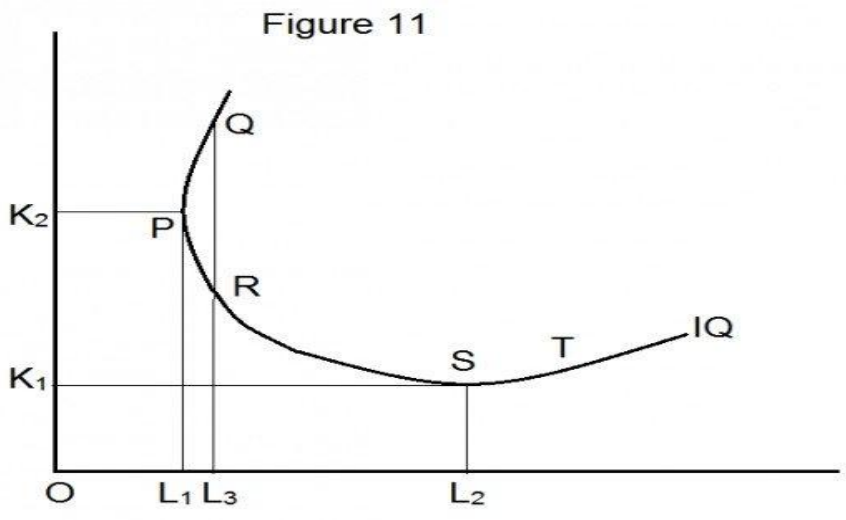
Figure 10



7. Each isoquant is oval-shaped

An important feature of an isoquant is that it enables the firm to identify the efficient range of production consider figure 11.

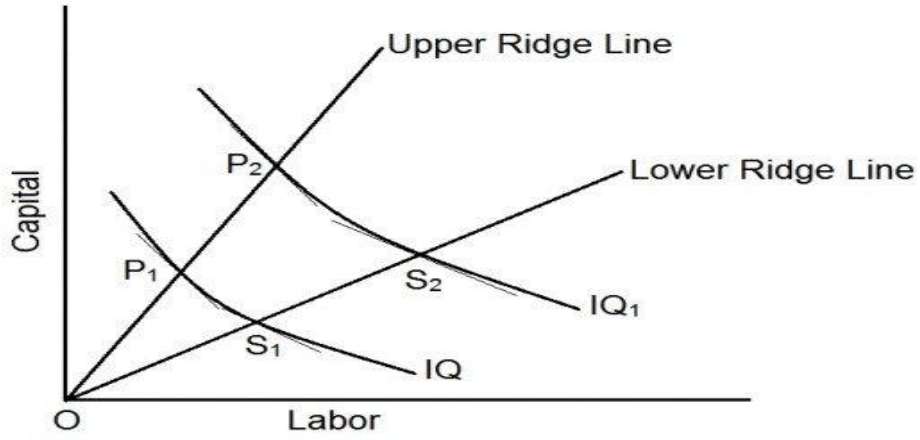
Figure 11



Both the combinations Q and P produce the same level of total output. But the combination Q represents more of capital and labor than P. combinations Q must therefore be expensive and would not be chosen. The same argument can be made to rule out combination T or any other combination lying on a portion of the isoquant where the slope is positive. Positively sloped isoquants imply that an increase in the use of labor would require an increase in the use of capital to keep production constant.

In general, for any input combination on the positively sloped portion of an isoquant, it is possible to find another input combination with less of both the inputs on the negatively convex portion that will produce the same level of output. Therefore, only the negatively sloped segment of isoquant is economically feasible.

Figure 12



In figure 12, the segment P_1S_1 is the economically feasible portion of the isoquant for IQ. If we consider such feasible portions for all the isoquants, then the region comprising of these portions is called the economic region of production. A producer will operate in this region. It is shown in figure 12. The lines OP_1P_2 and OS_1S_2 are called ridge lines. Ridge lines may be defined as lines separating the downward sloping portions of a series of isoquants from the upward sloping portions. They give the boundary of the economic region of production.

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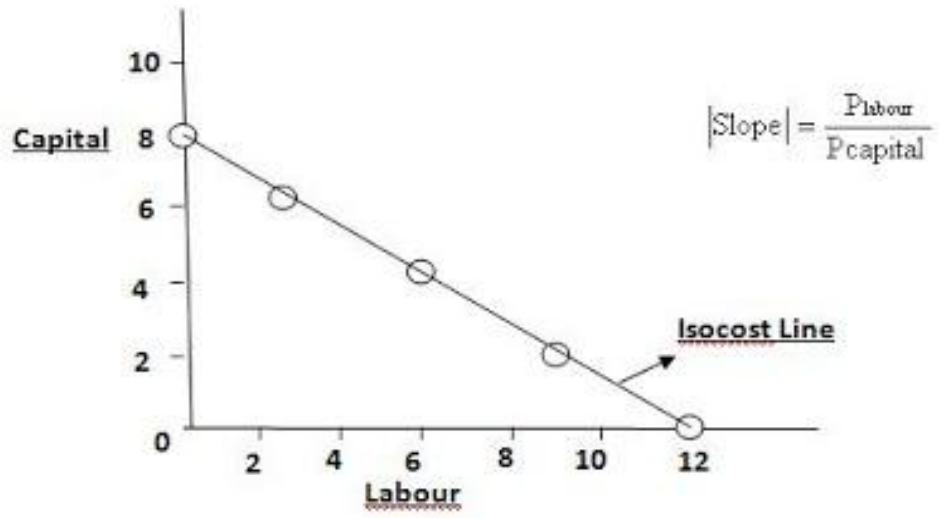
ISOCOST LINES:

The Isocost line is an important component when analyzing producer's behavior. The Isocost line illustrates all the possible combinations of two factors that can be used at given costs and for a given producer's budget. In simple words, an Isocost line represents a combination of inputs which all cost the same amount.

Now suppose that a producer has a total budget of Rs 120 and for producing a certain level of output, he has to spend this amount on 2 factors A and B. Price of factors A and B are Rs 15 and Rs. 10 respectively.

Combinations	**Units of Capital**	**Units of Labour**	**Total expenditure**
	Price = 150Rs	**Price = 100 Rs**	**(in Rupees)**
A	**8**	**0**	**120**
B	**6**	**3**	**120**
C	**4**	**6**	**120**
D	**2**	**9**	**120**
E	**0**	**12**	**120**



The isocost line shows all the possible combinations of two factors Labour and capital. T he extent to which a factor is combined to the other factor depends on the prices of factor and the willingness of organization to spend money on factors. Iso-cost line represents the price of factors along with the amount of money an organization is willing to spend on factors.

In other words, it shows different combinations of factors that can be purchased at a certain amount of money. For example, a producer wants to spend Rs. 300 on the factors of production, namely X and Y. The price of X in the market is Rs. 3 per unit and price of Y is Rs. 5 per unit.

In such a case, the iso-cost line is shown in Figure-

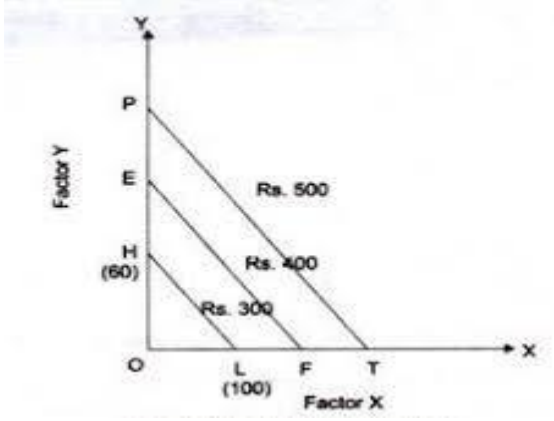


FIG A

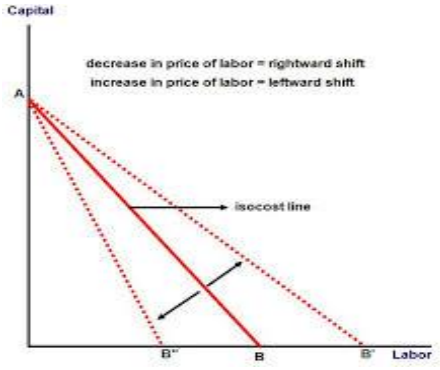


FIG B

As shown in Figure, A if the producer spends the whole amount of money to purchase X, then he/she can purchase 100 units of X, which is represented by OL. On the other hand, if the

producer purchases Y with the whole amount, then he/she would be able to get 60 units, which is represented by OH.

If points H and L are joined on X and Y axes respectively, a straight line is obtained, which is called iso-cost line. All the combinations of X and Y that lie on this line, would have the same amount of cost that is Rs. 300. Similarly, other iso-cost lines can be plotted by taking cost more than Rs. 300, in case the producer is willing to spend more amount of money on production factors. In figure B producer spends whole amount of money to purchase Labour.

With the help of isoquant and iso-cost lines, a producer can determine the point at which inputs yield maximum profit by incurring minimum cost. Such a point is termed as producer's equilibrium.

Shifts in Isocost Line

A firm's isocost line can shift if there is (a) a change in total expenditure of the firm on inputs and (b) change in price of the inputs. If a firm decides to spend more money on production, its isocost line shifts outwards/rightwards parallel to the original isocost line. It is because more budgets allow the firm to simultaneously employ more capital and labor at the same time. A reduction in budget would have an exactly opposite effect i.e. it would move the isocost line inwards. A parallel shift can also happen if prices of both inputs change by equal proportion. However, where the change in prices of inputs is not proportionate, it changes the slope of the isocost line (recall the fact that the slope of the isocost line equals the ratio of price of one factor to the other). Such a change in slope rotates the isocost line.

PRODUCER EQUILIBRIUM

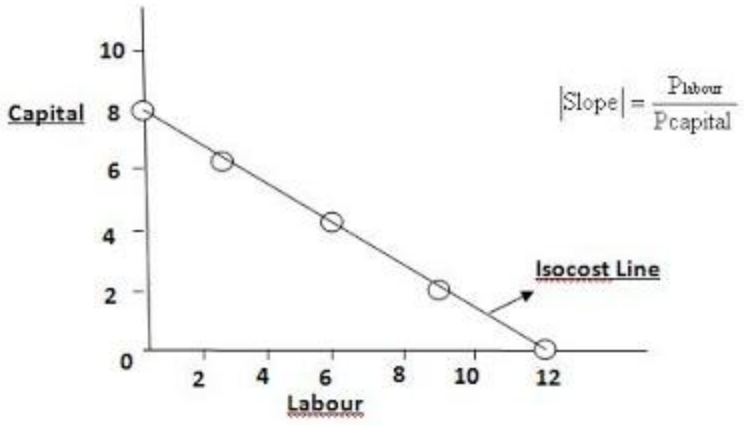
Production is the result of the output we produce by employing factors like land, labour, capital, and entrepreneurship. It is possible to determine the optimum amount of production possible considering different combinations of these inputs. Such a determination is called the producer's equilibrium.

The value of all assets used for production is limited. Hence, the producer has to use such a combination of inputs as would provide him with maximum output and profits. This optimum level of production, also called producer's equilibrium, is achieved when maximum output is derived from minimum costs. In order to achieve this, producers first have to classify their resources into different combinations. Each combination would provide production in different quantities. The combination that provides the highest amount of produce at the least amount of costs is the optimum level of production.

Using this equilibrium, the producer can determine different combinations to increase output. He can also use this information to find ways to cut costs using the same inputs and consequently generate more profit. We can find out the least expensive combinations of factors by superimposing isoquant curves on isoquant lines.

Isocost Lines

Isocost lines represent combinations of two factors that can be bought with different outlays. In other words, it shows how we can spend money on two different factors to produce maximum output. These lines are also called budget lines or budget constraint lines.



Producer's Equilibrium or Optimization.

Producer's equilibrium or optimization occurs when he earns maximum profit with optimal combination of factors. A profit maximization firm faces two choices of optimal combination of factors (inputs).

1. To minimize its cost for a given output; and

2. To maximize its output for a given cost.

Thus the least cost combination of factors refers to a firm producing the largest volume of output from a given cost and producing a given level of output with the minimum cost when the factors are combined in an optimum manner. We study these cases separately.

Cost-Minimization for a Given Output:

In the theory of production, the profit maximization firm is in equilibrium when, given the cost-price function, it maximizes its profits on the basis of the least cost combination of factors. For this, it will choose that combination which minimizes its cost of production for a given output. This will be the optimal combination for it.

Assumptions:

This analysis is based on the following assumptions:

1. There are two factors, labour and capital.

2. All units of labour and capital are homogeneous.

3. The prices of units of labour (w) and that of capital (r) are given and constant.

4. The cost outlay is given.

5. The firm produces a single product.

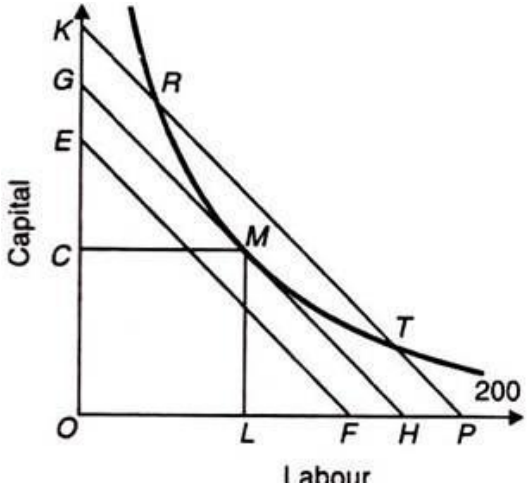
6. The price of the product is given and constant.

7. The firm aims at profit maximization.

8. There is perfect competition in the factor market.

Explanation:

Given these assumptions, the point of least-cost combination of factors for a given level of output is where the isoquant curve is tangent to an iso-cost line. In Figure, the iso-cost line GH is tangent to the isoquant 200 at point M. The firm employs the combination of OC of capital and OL of labour to produce 200 units of output at point M with the given cost-outlay GH. At this point, the firm is minimizing its cost for producing 200 units.



Any other combination on the isoquant 200, such as R or T, is on the higher iso-cost line KP which shows higher cost of production. The iso-cost line EF shows lower cost but output 200 cannot be attained with it. Therefore, the firm will choose the minimum cost point M which is the least-cost factor combination for producing 200 units of output.

M is thus the optimal combination for the firm. The point of tangency between the iso-cost line and the isoquant is an important first order condition but not a necessary condition for the producer's equilibrium.

There are two essential or second order conditions for the equilibrium of the firm:

1. The first condition is that the slope of the iso-cost line must equal the slope of the isoquant curve. The slope of the iso-cost line is equal to the ratio of the price of labour (w) to the price of capital (r) i.e… W/r. The slope of the isoquant curve is equal to the marginal rate of technical substitution of labour and capital ($MRTS_{LC}$) which is, in turn, equal to the ratio of the marginal product of labour to the marginal product of capital (MP_L/MP_C).

Thus the equilibrium condition for optimality can be written as:

$W/r = MP_L/MP_C = MRTS_{LC}$

2. The second condition is that at the point of tangency, the isoquant curve must he convex to the origin. In other words, the marginal rate of technical substitution of labour for capital ($MRTS_{LC}$) must be diminishing at the point of tangency for equilibrium to be stable. In Figure 18, S cannot be the point of equilibrium, for the isoquant IQ_1 is concave where it is tangent to the iso-cost line GH.

At point S, the marginal rate of technical. substitution between the two factors increases if move to the right or left on the curve lQ_1 .Moreover, the same output level can be produced at a lower cost CD or EF and there will be a corner solution either at C or F. If it decides to produce at EF cost, it can produce the entire output with only of labour. If, on the other hand, it decides to produce at a still lower cost CD, the entire output can be produced with only OC capital.

Both the situations are impossibilities because nothing can be produced either with only labour or only capital. Therefore, the firm can produce the same level of output at point M where the isoquant curve IQ is convex to the origin and is tangent to the iso-cost line GH. The analysis assumes that both the isoquants represent equal level of output $IQ = IQ_1 = 200$.

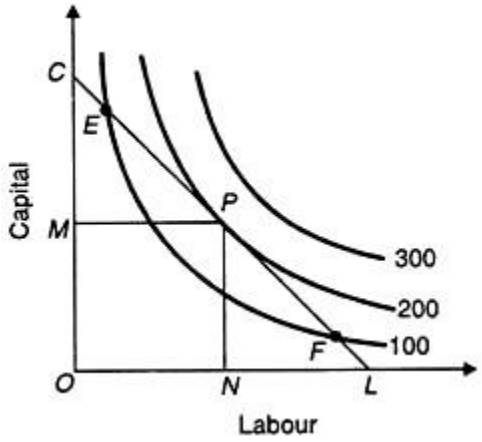
Output-Maximization for a given Cost:

The firm also maximizes its profits by maximizing its output, given its cost outlay and the prices of the two factors. This analysis is based on the same assumptions, as given above.

The conditions for the equilibrium of the firm are the same, as discussed above.

1. The firm is in equilibrium at point P where the isoquant curve 200 is tangent to the iso-cost line CL in Figure.

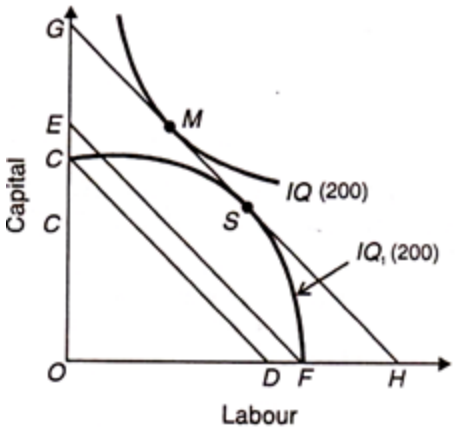
At this point, the firm is maximizing its output level of 200 units by employing the optimal combination of OM of capital and ON of labour, given its cost outlay CL. But it cannot be at points E or F on the iso-cost line CL, since both points give a smaller quantity of output, being on the isoquant 100, than on the isoquant 200.



The firm can reach the optimal factor combination level of maximum output by moving along the iso-cost line CL from either point E or F to point P. This movement involves no extra cost because the firm remains on the same iso-cost line.

The firm cannot attain a higher level of output such as isoquant 300 because of the cost constraint. Thus the equilibrium point has to be P with optimal factor combination OM + ON. At point P, the slope of the isoquant curve 200 is equal to the slope of the iso-cost line CL. It implies that $w/r = MP_L/MPC = MRTS_{LC}$

1. The second condition is that the isoquant curve must be convex to the origin at the point of tangency with the iso-cost line, as explained above in terms of Figure below.



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Expansion Path

In economics, an expansion path also called a scale line is a curve in a graph with quantities of two inputs, typically physical capital and labor, plotted on the axes. The path connects optimal input combinations as the scale of production expands. A producer seeking to produce a given number of units of a product in the cheapest possible way chooses the point on the expansion path that is also on the isoquant associated with that output level.

Economists Alfred Stonier and Douglas Hague defined “expansion path” as "that line which reflects the least–cost method of producing different levels of output, when factor prices remain constant. The points on an expansion path occur where the firm's isocost curves, each showing fixed total input cost, and its isoquants, each showing a particular level of output, are tangent; each tangency point determines the firm's conditional factor demands. As a producer's level of output increases, the firm moves from one of these tangency points to the next; the curve joining the tangency points is called the expansion path.

Meaning of Expansion Path:

We know that the production function of the firm

$q = f(x,y)$

gives us the isoquant map of the firm, one isoquant (IQ) for each particular level of output, and the cost equation of the firm

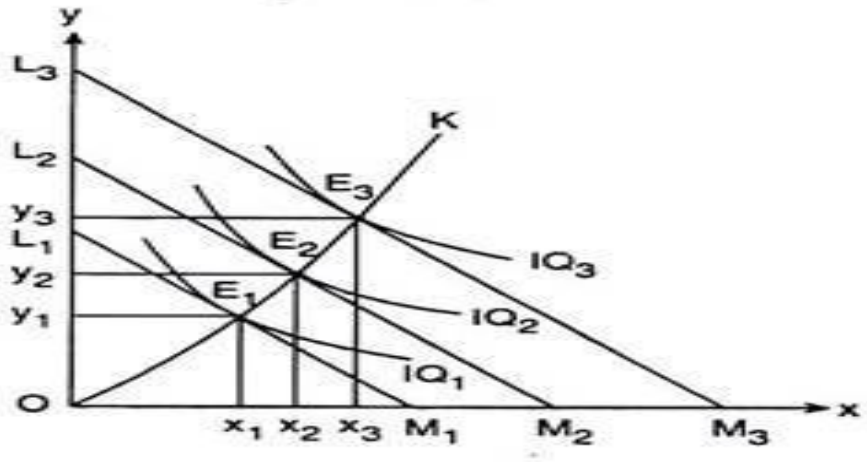
$C = r_X x + r_Y y$

gives us the family of parallel iso-cost lines (ICLs), given the prices of the inputs r_X and r_Y, one ICL for one particular level of cost. The IQ-map and the family of ICLs have been given in Fig. If we now join the point of origin and the points of tangency, E_1, E_2, E_3, etc., between the IQs and the ICLs by a curve, then this curve would give us what is known as the expansion path of the firm.

The expansion path is so called because if the firm decides to expand its operations, it would have to move along this path. Let us note that the firm may expand in two ways.

First, it may want to expand by successively increasing its level of cost or its expenditure on the inputs X and Y, i.e., by using more and more of inputs, and, consequently, by producing more of its output.

Second, the firm may decide to expand by increasing its level of output per period. This the firm may do by increasing the expenditure on the inputs, i.e., by using more and more of them.



The two approaches to expansion apparently appear to be the same, for both involve an increase in expenditure. However, there is a fundamental difference. In the first case, decision is taken initially at the point of cost. Cost levels are made higher and higher and then efforts are made to maximize the level of output subject to the cost constraint.

On the other hand, in the second case, decision-making occurs initially and directly at the point of output. Here the firm first decides to produce more of output and then efforts are made to produce the output at the minimum possible cost.

Types of Expansion Path:

(a) Expansion by Means of Increasing the Level of Expenditure on the Inputs:

In Fig. 8.14, let us suppose that, initially, the firm's level of cost is such that its ICL is L_1M_1 and output-maximization subject to cost constraint occurs at the point of tangency, E_1, between the ICL, L_1M_1, and an IQ which is IQ_1. At E_1 the firm uses X_1 of the first input and y_1 of the second input to produce the maximum possible output, say, q_1, which is represented by IQ_1.

Now, if the firm decides to expand by increasing the cost level from the level of L_1M_1 to that of L_2M_2, then the firm would be in output-maximizing equilibrium at the point of tangency E_2 (x_2, y_2), on IQ_2, using more of the inputs, $x_2 > x_1$ and $y_2 > y_1$, and producing an output level, say, q_2, $q_2 > q_1$, since IQ_2 is a higher isoquant than IQ_1.

In the same way, if the firm decides to expand further, it would increase its cost level from that of L_2M_2 to that of L_3M_3 and it would produce the maximum output subject to the cost constraint at the point of tangency E_3 (x_3, y_3) on IQ_3 using more of the inputs, $x_3 > x_2$ and $y_3 > y_2$, and producing a higher level of output, say, q_3, $q_3 > q_2$, since IQ_3 is a higher IQ than IQ_2.

The process of expansion of firm's operations through increases in the level of cost may go on in this say so long as the firm decides in its favour. If we now join the point of origin O and the points E_1, E_2, E_3, etc. by a path, then we would obtain the firm's expansion path OK in Fig. 8.14.

That is, if the firm expands by increasing its level of cost, it would have to move successively from one equilibrium point to another along this expansion path.

We have joined the path through the equilibrium points E_1, E_2, etc. with the point of origin O, because if the firm moves backward along the expansion path by decreasing the cost level then it would be moving from the initial equilibrium point, say, E_3 to E_2, then from E_2 to E) and would approach the point O which would be the limiting point in this process.

As the firm's cost level decreases and tends to zero, the input quantities and the output quantity would all decrease and tend to zero, and thus the point of origin O would be the limiting point.

(b) Expansion by Means of Increasing the Level of Output:

In Fig. 8.14, let us suppose that initially the firm decides to produce q_1 of output which can be produced at any point on the isoquant, IQ_1. The firm would be in cost-minimizing equilibrium at the point E_1 which is the point of tangency between IQ_1 and an iso-cost line say, ICL_1. At the point E_1, the firm would use Xi and y] quantities of the two inputs and its cost amounts to, say, C_1, which is the minimum possible.

The firm may now decide to expand by increasing its level of output from q_1 to q_2 on IQ_2. If the firm makes this decision, its cost-minimizing equilibrium will be obtained at the point of tangency E_2 (x_2, y_2) on L_2M_2 using more of the inputs, $x_2 > x_1$ and $y_2 > y_1$ and incurring a cost level C_2 on L_2M_2, which is the minimum possible required to produce the output of q_2. However, $C_2 > C_1$ since L_2M_2 is a higher ICL than L_2M_2.

In the same way, the firm may decide to increase again its level of output from q_2 to q_3 on IQ_3. In this case, the firm's equilibrium point would be the point of tangency E_3 (x_3, y_3) on the ICL, L_3M_3. At E_3, the firm would use still more of the inputs, $x_3 > x_2$ and $y_3 > y_2$, incurring a cost level C_3 on L_3M_3, which is the minimum required for producing q_3 of output. However, $C_3 > C_2$ since L_3M_3 is a higher ICL than L_2M_2.

The firm's process of expansion may go on like this as long as it decides to expand. The expansion path again would be OK that would start from the point of origin O and pass through the points E_1, E_2, E_3, etc.

If the firm decides to contract and produce less of output, then the limiting point of the process of contraction would be the point of origin O, where the firm's use of the inputs, its cost level and output would all tend to zero.

THE LAW OF VARIABLE PROPORTIONS

This law apply in short run and if one input is variable and all other inputs are fixed, the firm's production function exhibits the law of variable proportions. If the number of units of a variable input is increased, keeping other inputs constant, how output changes is the concern of this law.

Suppose land, plant, and equipment are the fixed factors, and labor the variable factor. When the number of laborers is increased successively to have larger output, the proportion between fixed and variable factors is altered and the law of variable proportions sets in.

The law states that as the quantity of a variable input is increased by equal doses, keeping the quantities of other inputs constant, total product will increase, but after a point, at a diminishing rate. This principle can also be defined thus – When more and more units of the variable factor are used, holding the quantities of fixed factors constant, a point is reached beyond which the marginal product, then the average, and finally the total product will diminish.
The law of variable proportions (or the law of non-proportional returns) is also known as the law of diminishing returns.

Definitions:
As the proportion of the factor in a combination of factors is increased after a point, first the marginal and then the average product of that factor will diminish." ***Benham***

"An increase in some inputs relative to other fixed inputs will in a given state of technology cause output to increase, but after a point the extra output resulting from the same additions of extra inputs will become less and less." ***Samuelson,***

Assumptions:

This law is based on the following assumptions:

(i) Constant Technology:

The state of technology is assumed to be given and constant. If there is an improvement in technology the production function will move upward.

(ii) Factor Proportions are Variable:

The law assumes that factor proportions are variable. If factors of production are to be combined in a fixed proportion, the law has no validity.

(iii) Homogeneous Factor Units:

The units of variable factor are homogeneous. Each unit is identical in quality and amount with every other unit.

(iv) Short-Run:

The law operates in the short-run when it is not possible to vary all factor inputs.

(V) Measured in Physical units

The product is measured in physical units, i.e., in quintals, tonnes, etc. The use of money in measuring the product may show increasing rather than decreasing returns if the price of the product rises, even though the output may have declined.

Marshall applied the operation of the law to agriculture, mining, forests, fisheries, and the building industry.

Let us illustrate the law with the help of Table, where on the fixed input land of 10 acres, units of the variable factor labor are employed and the resultant output is obtained.

Table 1.

Units of Land	Units of Labour	Total Production	Average Production	Marginal Production
10 Acres	0	–	–	–
”	1	20	20	20
”	2	50	25	30 1st stage
”	3	90	30	40 MP > AP
”	4	120	30	30 AP = MP
”	5	140	28	20
”	6	150	25	10 2nd stage
”	7	150	21.3	0 MP=0 and TP Maximum
”	8	140	17.5	–10 3rd stage MP < 0

From the table 1 it is clear that there are three stages of the law of variable proportion. In the first stage average production increases as there are more and more doses of labour and capital employed with fixed factors (land). We see that total product, average product, and marginal product increases but average product and marginal product increases up to 40 units. Later on, both start decreasing because proportion of workers to land was sufficient and land is not properly used. This is the end of the first stage.

The second stage starts from where the first stage ends or where AP=MP. In this stage, average product and marginal product start falling. We should note that marginal product falls at a faster rate than the average product. Here, total product increases at a diminishing rate. It is also maximum at 70 units of labour where marginal product becomes zero while average product is never zero or negative.

The third stage begins where second stage ends. This starts from 8th unit. Here, marginal product is negative and total product falls but average product is still positive. At this stage, any additional dose leads to positive nuisance because additional dose leads to negative marginal product.

Graphic Presentation:

In fig. 1, on OX axis, we have measured number of labourers while quantity of product is shown on OY axis. TP is total product curve. Up to point ‘E’, total product is increasing at increasing

rate. Between points E and G it is increasing at the decreasing rate. Here marginal product has started falling. At point 'G' i.e., when 7 units of labourers are employed, total product is maximum while, marginal product is zero. Thereafter, it begins to diminish corresponding to negative marginal product. In the lower part of the figure MP is marginal product curve.

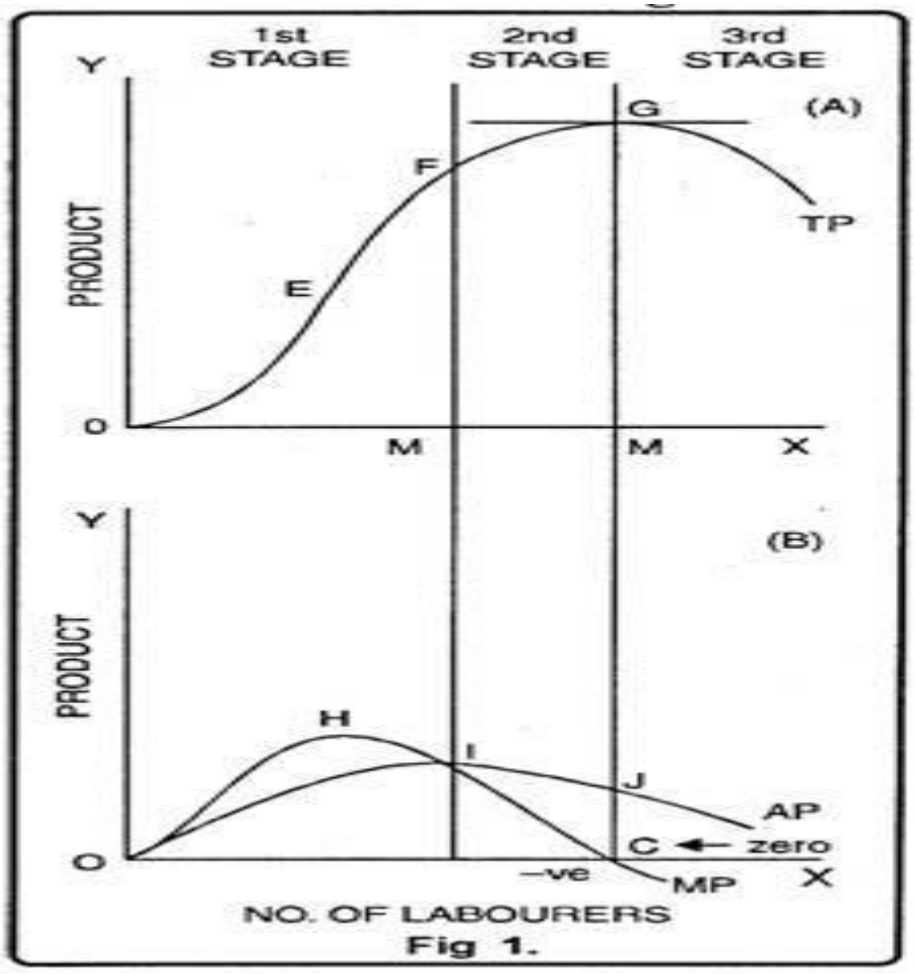


Fig 1.

Up to point 'H' marginal product increases. At point 'H', i.e., when 3 units of labourers are employed, it is maximum. After that, marginal product begins to decrease. Before point 'I' marginal product becomes zero at point C and it turns negative. AP curve represents average product. Before point 'I', average product is less than marginal product. At point 'I' average product is maximum. Up to point T, average product increases but after that it starts to diminish.

Three Stages of the Law:

1. First Stage:

First stage starts from point 'O' and ends up to point F. At point F average product is maximum and is equal to marginal product. In this stage, total product increases initially at increasing rate up to point E. between 'E' and 'F' it increases at diminishing rate. Similarly marginal product also increases initially and reaches its maximum at point 'H'. Later on, it begins to diminish and becomes equal to average product at point T. In this stage, marginal product exceeds average product (MP > AP).

2. Second Stage:

It begins from the point F. In this stage, total product increases at diminishing rate and is at its maximum at point 'G' correspondingly marginal product diminishes rapidly and becomes 'zero' at point 'C'. Average product is maximum at point 'I' and thereafter it begins to decrease. In this stage, marginal product is less than average product (MP < AP).

3. Third Stage:

This stage begins beyond point 'G'. Here total product starts diminishing. Average product also declines. Marginal product turns negative. Law of diminishing returns firmly manifests itself. In this stage, no firm will produce anything. This happens because marginal product of the labour becomes negative. The employer will suffer losses by employing more units of labourers. However, of the three stages, a firm will like to produce up to any given point in the second stage only.

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Law of Returns to Scale

The law of returns are often confused with the law of returns to scale. The law of returns operates in the short period. It explains the production behavior of the firm with one factor variable while other factors are kept constant. Whereas the law of returns to scale operates in the long period. It explains the production behavior of the firm with all variable factors. There is no fixed factor of production in the long run. The law of returns to scale describes the relationship between variable inputs and output when all the inputs, or factors are increased in the same proportion. The law of returns to scale analysis the effects of scale on the level of output. Here we find out in what proportions the output changes when there is proportionate change in the quantities of all inputs. The answer to this question helps a firm to determine its scale or size in the long run.

It has been observed that when there is a proportionate change in the amounts of inputs, the behavior of output varies. The output may increase by a great proportion, by in the same proportion or in a smaller proportion to its inputs. This behavior of output with the increase in scale of operation is termed as increasing returns to scale, constant returns to scale and diminishing returns to scale. These three laws of returns to scale are now explained, in brief, under separate heads.

Definition:

"The term returns to scale refers to the changes in output as all factors change by the same proportion." Koutsoyiannis.

"Returns to scale relates to the behaviour of total output as all inputs are varied and is a long run concept". Leibhafsky

Returns to scale are of the following three types:

1. Increasing Returns to scale.

2. Constant Returns to Scale

3. Diminishing Returns to Scale

Explanation:

In the long run, output can be increased by increasing all factors in the same proportion. Generally, laws of returns to scale refer to an increase in output due to increase in all factors in the same proportion. Such an increase is called returns to scale.

Suppose, initially production function is as follows:

P = f (L, K)

1. Increasing Returns to Scale:

Increasing returns to scale or diminishing cost refers to a situation when all factors of production are increased, output increases at a higher rate. It means if all inputs are doubled, output will also increase at the faster rate than double. Hence, it is said to be increasing returns to scale. This increase is due to many reasons like division external economies of scale. Increasing returns to scale can be illustrated with the help of a diagram 8.

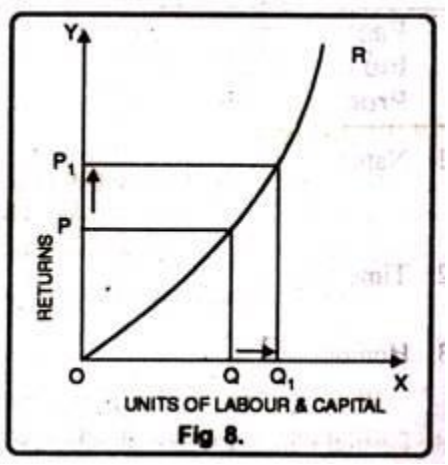

Fig 8.

In figure 8, OX axis represents increase in labour and capital while OY axis shows increase in output. When labour and capital increases from Q to Q_1, output also increases from P to P_1 which is higher than the factors of production i.e. labour and capital.

2. Diminishing Returns to Scale:

Diminishing returns or increasing costs refer to that production situation, where if all the factors of production are increased in a given proportion, output increases in a smaller proportion. It

means, if inputs are doubled, output will be less than doubled. If 20 percent increase in labour and capital is followed by 10 percent increase in output, then it is an instance of diminishing returns to scale.

The main cause of the operation of diminishing returns to scale is that internal and external economies are less than internal and external diseconomies. It is clear from diagram 9.

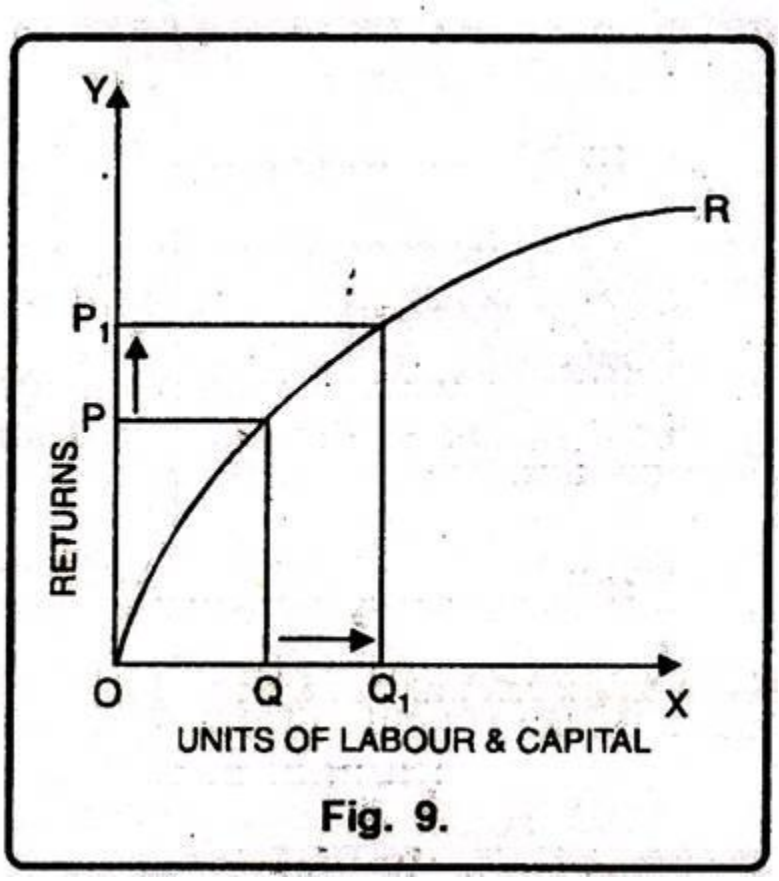

Fig. 9.

In this diagram 9, diminishing returns to scale has been shown. On OX axis, labour and capital are given while on OY axis, output. When factors of production increase from Q to Q_1 (more quantity) but as a result increase in output, i.e. P to P_1 is less. We see that increase in factors of production is more and increase in production is comparatively less, thus diminishing returns to scale apply.

3. Constant Returns to Scale:

Constant returns to scale or constant cost refers to the production situation in which output increases exactly in the same proportion in which factors of production are increased. In simple terms, if factors of production are doubled output will also be doubled.

In this case internal and external economies are exactly equal to internal and external diseconomies. This situation arises when after reaching a certain level of production, economies of scale are balanced by diseconomies of scale. This is known as homogeneous production function. Cobb-Douglas linear homogenous production function is a good example of this kind. This is shown in diagram 10. In figure 10, we see that increase in factors of production i.e. labour and capital are equal to the proportion of output increase. Therefore, the result is constant returns to scale.

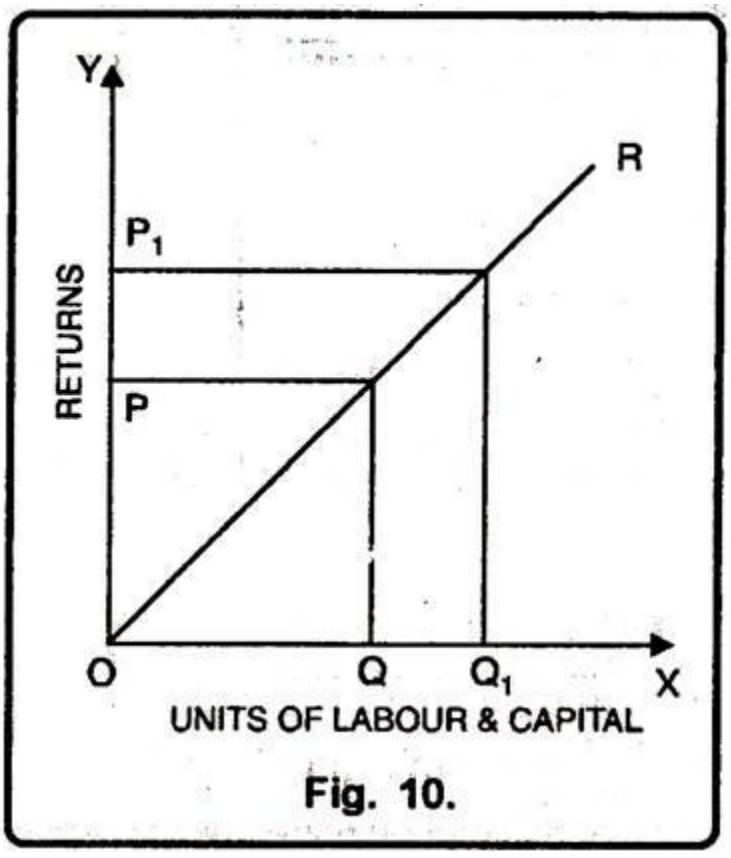

Fig. 10.

Frequently Asked Question

Q1. What is Production Function and explain its different Types.

Q2. Explain the properties of Isoquant.

Q3. Discuss law of variable proportions in details.

Q4. What is Producer Equilibrium? Explain producer equilibrium with least Cost combination and Optimum Cost combination.

Q5. Discuss in detail Law of Returns to scale