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## **BLOCK 2**

# **CONSUMER BEHAVIOUR AND THE DEMAND THEORY**

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## BLOCK 2 CONSUMER BEHAVIOUR AND THE DEMAND THEORY

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In Block 1 you have learnt the concept of economic system, basic economic laws and various forms of economic system. This block deals with the law of diminishing marginal utility and Equimarginal utility, the various analysis of indifference curve, law of demand and elasticity of demand.

**Unit 3** explains the concept of Demand, its nature, its determinants, the law of demand, its application, change in demand and change in quantity demanded.

**Unit 4** deals with the meaning of utility, comparative analysis of total utility, average utility and marginal utility, the law of diminishing marginal utility, law of equimarginal utility and the concept of consumer's surplus.

**Unit 5** explains the concept of indifference curve, meaning of budget price line, derivation of price consumption curve, split up price effect into income and substitution effects and measurement of consumer's surplus with the help of indifference curve.

**Unit 6** deals with the meaning and factors influencing the demand, the law of demand, identification of the movement along the demand curve and the use of law of demand for government policy on pricing.

**Unit 7** explains the concept of elasticity of demand, price elasticity of demand, income elasticity of demand and price cross-elasticity of demand, types of elasticity, measurement of elasticity of demand, determinants and importance of price elasticity of demand.

**Unit 8** outlines the shortcomings of Marshallian utility analysis of consumer's demand behaviour, concept of a scale of preferences, indifference curve, enumerates the properties of indifference curves, derivation of income consumption curve, derivation of price consumption curve, distinguish between income effect, substitution effect and price effect, derivation of consumer's demand curve.

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## UNIT 3 CONSUMER DEMAND

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### Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Cause and Effect Relationship
- 3.3 The Nature of Demand
- 3.4 Determinants of Demand
  - 3.4.1 Determinants of Demand for a Consumer
  - 3.4.2 Determinants of Demand for a Market
- 3.5 The Law of Demand
  - 3.5.1 The Demand Schedule
  - 3.5.2 The Demand Curve
  - 3.5.3 The Explanation of the Law of Demand
- 3.6 Change in Demand and Change in Quantity Demanded
- 3.7 Application of Law of Demand
- 3.8 The Law of Demand and the Government Policy
- 3.9 Let Us Sum Up
- 3.10 Key Words
- 3.11 Answers to Check Your Progress
- 3.12 Terminal Questions

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### 3.0 OBJECTIVES

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After studying this unit, you should be able to:

- define demand;
- distinguish between want and demand;
- list the factors influencing demand for a commodity;
- explain the difference between demand for a commodity;
- for a consumer and for a market describe the law of demand;
- explain the law of demand with the help of a demand schedule and the demand curve;
- explain the reasons for the operation of the law of demand;
- identify the movement along a demand curve and a shift of the demand curve; and
- discuss the use of the law of demand for government policy on pricing.

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## 3.1 INTRODUCTION

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In this unit you will learn about the law of demand with the demand schedule and a demand curve. You will also learn the factors influencing demand of a commodity, the operation of the law of demand and its usefulness to the government in fixation of the prices of commodities.

Satisfaction of human needs is the basic end and goal of all production activities in an economy. As observed earlier, human wants are unlimited and recurring in nature, whereas means available to satisfy them are limit. Therefore, a rational consumer has to make an optional use of available resources. The demand theory provides a framework within which these decisions have to be made.

But before we talk about the demand theory, we take a little digression. We explain in brief the nature of cause-and-effect relations in economic analysis.

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## 3.2 CAUSE AND EFFECT RELATIONSHIP

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The foundation of economic analysis is cause-and-effect relationship (also called causal relationship).

### Examples

If the price of a commodity falls, quantity demanded of a commodity will rise; conversely, if the price of a commodity rises, its quantity demanded will fall.

In other words, price of a commodity and its quantity demanded move in the opposite direction; i.e., there is inverse relationship between the price of a commodity and its quantity demanded. Well, based on this relationship we make the following propositions.

Since there is inverse relationship between the price of a commodity and its quantity demanded, an increase in quantity demanded would result in a fall in the price of the commodity.

Before we proceed further, we reflect on this proposition. Is it true or false?

Let us keep this dialogue on hold and proceed to talk about these relationships:

**Proposition – 1:** If you wear high-heel shoes you look taller.

Therefore, if you are taller, you must be wearing high-heel shoes.

**Proposition – 2:** If it rains heavily, low-lying areas get flooded.

Therefore, whenever a low-lying area gets flooded heavy rains must have taken place.

Do you agree with the results following from proposition 1 and proposition 2?

The correct answer in both cases is:

**NO**

We will explain this with reference to situation of price – quantity demanded relationship given above.

A causal relationship explains the relationship between two variables (i) a cause variable, and (ii) an effect variable. Cause variable is also known as an independent variable. Effect variable is known as dependent variable.

Change in dependent variable depends upon changes in the independent variable; quantity demanded is a dependent variable. This relationship can be stated as follows:

Quantity demanded depends upon the price of a commodity.

This can also be stated as follows:

$$Q_d = f(p)$$

This is read as; quantity demanded is a function of (which means depends upon) the price of the commodity.

If P changes (cause), then Qd will also change (effect).

We cannot reverse this relationship. If we reverse this relationship, we will land ourselves in trouble. A blue shirt looks beautiful, but it does not mean every beautiful shirt would be blue. If it is cold outside, then people like to stay indoors. But it does not mean that if people are staying indoors it must be cold outside.

In economic analysis we generalize these relationships as follows:

$$x = f(y)$$

Where, x stands for a dependent variable and y for an independent variable.

$x = f(y)$  and x bears an inverse relation to y, which of the following figures is correct?

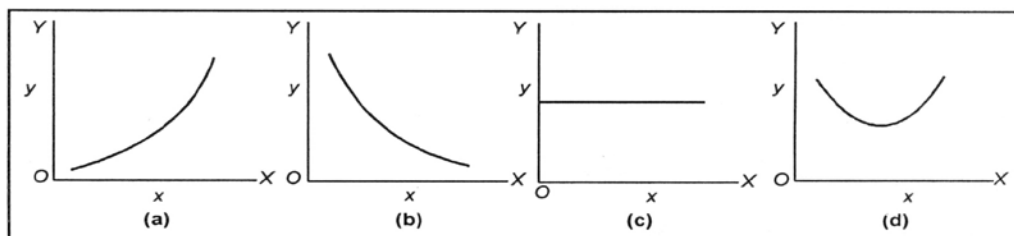


Fig. 3.1

Ans. Fig 3.1 (b)

### 3.3 THE NATURE OF DEMAND

At first we should distinguish between want and demand. The want of a commodity is just a wish on the part of the consumer to possess a

commodity. This want is not necessarily backed by the purchasing power to buy the commodity. It is like window shopping where irrespective of the money possessed by a consumer he/she goes around in the market and wishes to get the commodities for consumption or for accumulation purposes. The demand of the commodity, on the other hand, is the wish of the consumer to get a commodity, backed by the sufficient purchasing power. In economic theory we are concerned with the demand of the commodity rather than with the want of the commodity. The amount of a commodity that consumers wish to purchase backed by the purchasing power, is also called the quantity demanded of that commodity.

There are three important points about the quantity demanded which should always be kept in mind. Firstly, it is the quantity demanded which is desired to be purchased by the consumers which we consider rather than the quantity which the consumers actually succeed in purchasing. Thus, quantity demanded is the desired purchases and the quantity actually bought is referred to as actual purchase. Secondly, quantity demanded is always considered as a flow which is a variable measurable over a period of time. Thus, for instance, when we say that demand or quantity demanded of oranges is 10, it must be per day or per week etc. We are never interested in a single isolated purchase but with a continuous flow of purchases. A problem may arise when we talk of the purchase of a durable consumer commodity like a car or a stereo system etc. Durable consumer commodities purchased at a point of time may not look like a flow. The new the problem can be overcome if we consider the service rendered by a durable consumer commodity. For example, if a stereo system is purchased, it may have an expected life of say 5 years or 60 months. Thus, the consumption of a stereo system which has an expected life of 60 months is  $1/60$  a month. If a stereo system costs say Rs. 10,000 then in money terms the consumption of a stereo system is  $\text{Rs. } 10,000/60 = \text{Rs. } 166.6$  per month.

Thirdly, the quantity demanded of a commodity has an economic meaning only at a given price. For example, to say that the quantity demanded of oranges is 10 units over a week has no meaning unless we specify the price of oranges per dozen or per unit. In short, the demand for oranges equal to 10 units per week at a price of Rs. 12 per dozen is a full and meaningful statement, as used in micro-economic theory.

#### FOR MORE CLARITY!

Consumption is a common concept in economics, and gives rise to derived concepts such as consumer debt. Generally, consumption is defined in part by comparison to production. But the precise definition can vary because different schools of economists define production quite differently. According to mainstream economists, only the final purchase of goods and services by individuals constitutes consumption, while other types of expenditure—in particular, fixed investment, intermediate consumption and government spending—are placed in separate categories. Other economists define consumption much more broadly, as the aggregate of all economic activity that does not entail the design, production and marketing of goods and services (e.g., the selection, adoption, use, disposal and recycling of goods and services).

### 3.3.1 Different Concepts of Demand

There are different ways in which the term demand can be interpreted. Some of the important concepts of demand are explained below:

- i) *Price Demand*: Price demand refers to the different quantities of a commodity which will be bought per unit of time in a market *at different prices*. Other things being equal, more of a commodity is demanded at a lower price than at a higher price.
- ii) *Income Demand*: It refers to the different quantities of a commodity which will be bought *at different levels of money income*.
- iii) *Cross Demand*: It refers to the different quantities of a commodity which will be bought as a result of change in the *price of related goods*. In case of complementary goods (such as mobile phones and sim cards), demand for one of the two commodities is inversely related to the change in the price of its complementary goods, whereas in case of substitutes (*e.g.*, tea and coffee) it moves in the same direction as the price of its substitutes.

When you demand a TV set you also demand Tata Sky connection. Demand for TV creates demand for its complementary goods.

### 3.3.2 Direct Demand and Derived Demand

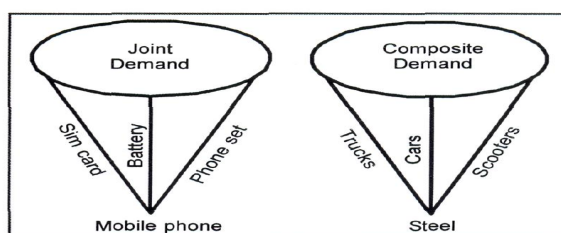
If a commodity is demanded for its own use, it constitutes direct demand for the commodity. It is also known as autonomous demand.

Example: Demand for any consumer goods, like shirts, jeans, DVD players, CDs, etc.

On the contrary, demand for factor inputs is derived demand. Software engineers are demanded when there is a demand for software solutions. Thus, derived demand arises from the demand for the products that factor services help to produce.

My desire to purchase a personal helicopter is merely an *ex-ante demand*. It affects nobody as I do not have the ability to pay. No one reacts to my desire. But my desire to purchase a Honda car is *ex-post demand*, if I have the ability to pay for it. Once I express my desire to purchase the car, it sets in motion the whole process of production of the cars.

### 3.3.3 Joint Demand and Composite Demand



Joint demand for two or more commodities arises when all of them are required in a single use.

One without the others is of little use.

**Example:** Demand of phone set, sim card, battery and charger together.

This kind of demand arises when a single commodity can be put to two or more uses. It is also known as Composite demand.

**Example:** The available steel in an economy can be used in production of trucks, cars, scooters, refrigerators, etc.

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### 3.4 DETERMINANTS OF DEMAND

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The demand for commodity or the quantity demanded of a commodity on the part of the consumer is dependent on a number of factors.

The factors influencing the demand for a commodity on the part of an individual consumer can be put as:

- i) Price of the commodity
- ii) Prices of other related commodities
- iii) Income of the consumers, and
- iv) Taste of the consumers.

A set of these factors is called a Demand Function. The Demand Function is an expression in which a dependent variable is shown as dependent on independent variables. Suppose, we use symbols to represent the demand for a commodity say X by  $D_x$ , the price of this commodity X by  $P_x$ , price of commodities other than the commodity X by  $P_L, P_M, \dots, P_Z$  and  $L, M, \dots, Z$  are other commodities, income of the consumer by Y and tastes of the consumer T, then the demand function can be shown as:

$$D_x = f(P_x, P_L, P_M, P_N, \dots, P_Z, Y, T)$$

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

#### 3.4.1 Determinants of Demand for a Consumer

The demand of a commodity or the quantity demanded of a commodity on the part of a consumer is dependent on a number of factors. Some of the important factors influencing the demand of a commodity are given below:



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

**FOR MORE CLARITY!**

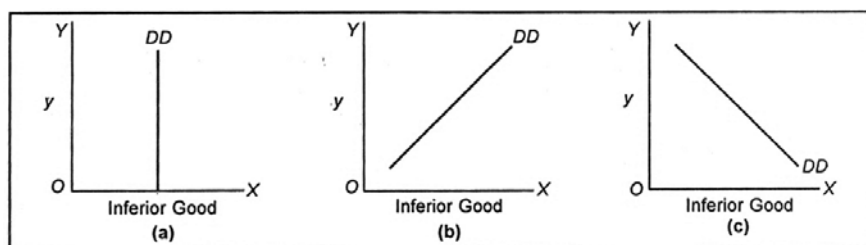
When income rises, the demand curve for normal goods shifts outward as more will be demanded at all prices, while the demand curve for inferior goods shifts inward due to the increased attainability of superior substitutes. With respect to related goods, when the price of a good (e.g., a hamburger) rises, the demand curve for substitute goods (e.g., chicken) shifts out, while the demand curve for complementary goods (e.g., tomato sauce) shifts in (*i.e.*, there is more demand for substitute goods as they become more attractive in terms of value for money, while demand for complementary goods contracts in response to the contraction of quantity demanded of the underlying good).

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

**Brain Teaser**

- Q.1.** Which of the following curves shows the income demand for inferior goods?

(a) (b) (c)



**Fig. 3.2**

**Ans.** Fig. 3.2 (c)

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

**Complementary goods** are those goods whose utility depends upon the availability of both the goods together. The demand for complementary goods bears an inverse relationship with the price of the related goods.

**Substitute goods** are those goods which can be used with equal ease in place of one another. Demand for a good will bear a direct relationship to the price of its substitute good.

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

Q.2. If the air travel fare between Bengaluru and Delhi falls significantly, how will it affect (i) demand for rail travel and (ii) demand for air travel. Show graphically.

(a) (b)

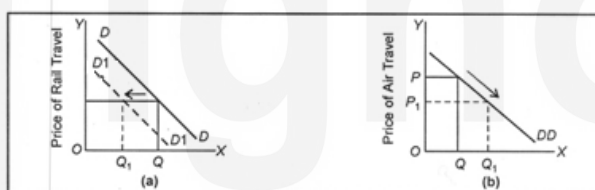


Figure 3.3

**Ans.** (i) Demand for rail travel will decrease (as shown in Figure 3.3 (a)).

(ii) Demand for air travel will expand (as shown in Figure 3.3 (b)).

Q.3 Draw a price demand curve for salt.

**Ans.** It would be perfectly inelastic, horizontal curve parallel to Y-axis.

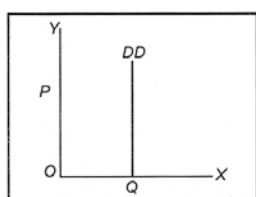


Figure 3.4

### Pick of The Day

Never give up. No matter how hard the situation is, always believe that something beautiful is going to happen.



—Lewis Hamilton (F1 driver)

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

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

### 3.4.2 Determinants of Demand for a Market

Given the price of a commodity we can find out the demand or quantity demanded on the part of a consumer. If the demand or quantity demanded of all the possible consumers purchasing this commodity in a market are added together, we get the market demand of the commodity in question. The factors determining the demand of a commodity for a market are the same as those which determine the demand of the commodity on the part of a consumer. Besides that two additional factors are also to be included. These two factors are:

- 1) **Size of the population:** All other factors remaining unchanged, the greater is the size of the population, more are the chances of a commodity being demanded more. Size of the population itself is dependent on so many other factors. The growth of population in a country is largely determined by birth rate and death rate. Death rates historically have shown a tendency to fall earlier than birth rates. But both these factors account for the growth rate in population. Marginally, population is also affected by emigration and immigration. This may of some importance in a small country, but in a country with a large population like India (1380 million in 2020), the effect of emigration/immigration is not significant.
- 2) **Income distribution:** It is a little difficult concept to explain. In simple terms, it implies how the National Income (the factor income of the nationals of an economy over a year) is distributed among lower and higher income groups of people. Let us explain it with the help of an illustration. In situation A, suppose the poorest 10 per cent of the total population accounts for 2 per cent of the national income of an economy and the richest 10 per cent of the total population enjoy 6 per cent of the national income of an economy. This situation is known as highly unequal distribution of income as compared to another situation B where the poorest 10 per cent of the total population account for 9 percent of national income and the richest 10 per cent of the total population enjoy 30 per cent of national income.

In situation A, richest 10 per cent of the population can have a command over 60 per cent of total demand and thus the basket of commodities demanded will be those consumed by the rich, on other hand in situation B, richest 10

per cent of the population can have a command over just 30 percent of total demand. The situation A represents higher inequalities of income than the situation B. More unequal is distribution of income, more will be the demand of the commodities which are purchased by the rich. Such commodities may be cars, refrigerators, air conditioners etc. Less unequal is distribution of income more will be the demand of the commodities which is purchased by relatively poorer people. Such commodities may be food items like wheat and rice, fans, bicycles etc.

The factors determining market demand of a commodity can be summarized as:

- i. Price of the commodity
- ii. Prices of other commodities
- iii. Income of the consumers
- iv. Tastes of the consumers
- v. Size of population
- vi. Income distribution.

In functional form, the market demand function can be represented by:

$$M_{Dx} = f(P_x, P_L, P_M, P_N, \dots, P_z, Y, T, N, Y_D)$$

where symbols  $P_x, P_L, P_M, P_N, \dots, P_z, Y, T, N$  are already explained earlier and  $M_{Dx}$  is market demand of commodity X, N is the size of the population and  $Y_D$  income distribution.

### **Check Your Progress A**

1. Distinguish between want and demand of a commodity.

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2. What are the determinants of demand of a commodity on part of a consumer?

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

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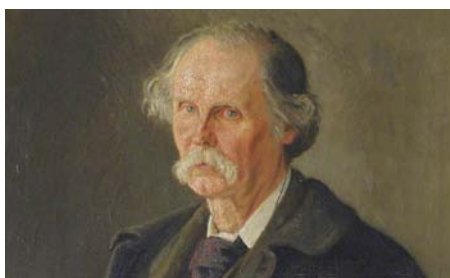
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4. Into which of the six categories ( $P_x, P_L, P_M, P_N, \dots, P_Z, Y, T, N, Y_D$ ) do the following factors fall?

- i. Dislike of paper bags for shopping purposes.....
  - ii. Price of deep freezing facilities falling, making the demand for fresh vegetables fall.....
  - iii. The price of ball pens falling leading to an increase in the demand for ball pens .....
  - iv. Increase in tax on the income of the consumer.....
  - v. The rich becoming richer and the poor becoming poorer.....
  - vi. The birth rate remaining constant and the death rate falling.....
5. State whether the following statements are **True** or **False**.
- i) The want and the demand of a commodity are the same.
  - ii) As the price of a commodity falls, its demand rises.
  - iii) As price of ink pens rise, the demand for ink rises.
  - iv) As more income tax is imposed on a person, his capacity to buy more commodities rises.
  - v) As income distribution becomes more unequal, the demand for food rises.
  - vi) As size of population rises, the demand for commodities falls.

### 3.5 THE LAW OF DEMAND

Among the factors influencing demand of a commodity explained in 3.4, the most important factor is price of the commodity in question.



**Alfred Marshall**

Generally speaking, in almost all commodities, the demand of a commodity increases as the price of the commodity falls and vice versa; price of other

commodities, income of the consumer and tastes of the consumer remaining unchanged. The reason of this tendency will be explained in 3.5.3. This particular relation between the price of a commodity and amount demanded is called the 'Law of Demand'. In short, the law of demand can thus be stated as follows: Other things remaining equal, there is an inverse relationship between the price of a commodity and its quantity demanded:

### 3.5.1 The Demand Schedule

Let us use imaginary figures to show the application of the law of demand. Table 3.1 given below, showing the application of the law of demand, is called the 'Demand Schedule'.

**Table 3.1 The Demand Schedule of a Consumer for Apples**

Price of an Apple in Rs.	Quantity Demanded of Apples in Units per week
100	15
200	12
300	8
400	3

There are four combinations of price and quantity demanded shown in the table 3.1. If we study this table we can easily infer that as price of an apple is rising quantity demanded of apples on the part of the consumer is falling. Thus, the figures chosen are such that the law of demand is applicable.

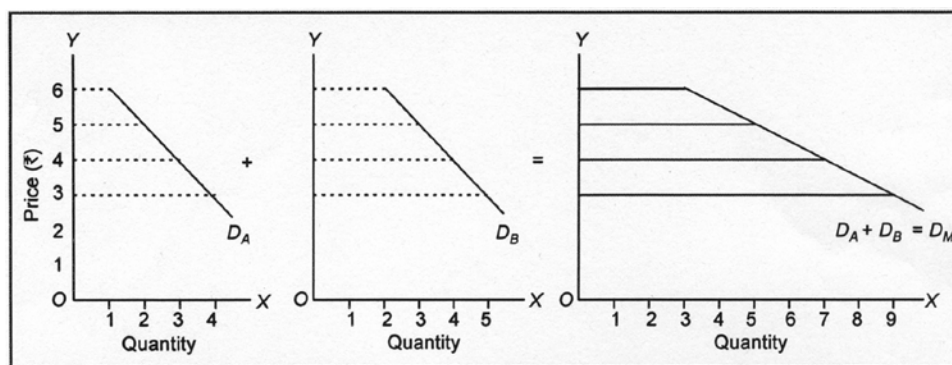
The demand schedules for ice cream for two individual households in a given period is given below. Suppose, there are only two households that demand ice cream. Draw market demand schedule and curve for ice creams.

Price (Rs.)	Quantity Demanded by	
	Household A	Household B
3	4	5
4	3	4
5	2	3
6	1	2

**Ans.** We will estimate the market demand schedule as follows:

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

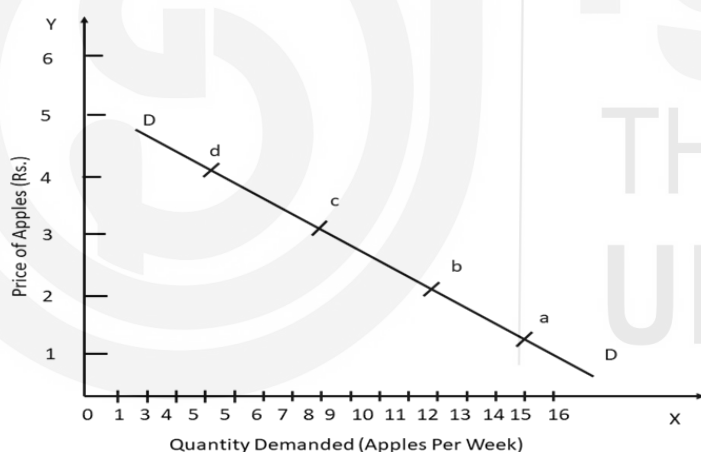
Market demand curve is a *horizontal summation* of individual demand curves, as illustrated below



### 3.5.2 The Demand Curve

The information given above can also be presented with the help of a graph as shown in Figure 3.5.

On the Y-axis, price of apples in rupees is measured on the X-axis the quantity demanded of apples per week on the part of a consumer measures. The



**Figure 3.5 : Straight Time Demand Curve**

first combination of Table 3.1 is shown by point a where at Rs. 1 price per apple 15 units of apples are demanded. Similarly points b, c, d represent combinations of Rs. 2 price- 12 quantity demanded, Rs. 3 price - 8 quantity demanded and Rs. 4 price-2 quantity demanded respectively. The joining together of points a, b, c, and d give us what is called the demand curve. Thus  $DD$  is the demand curve.

The most important feature of a demand curve is that it slopes downward from left to right. In Figure 3.5 the demand curve has been shown as a straight line. But the demand curve need not always be a straight line. It can also be in the form of curve as shown in Figure 3.6.

Whether a demand curve is a straight line or a curve depends on how much quantity demanded rises with the fall of its price or how much quantity demanded falls with the rise in the price of the commodity. Whether we take Figure 3.5 or 3.6, in both the cases the law of demand is applicable.

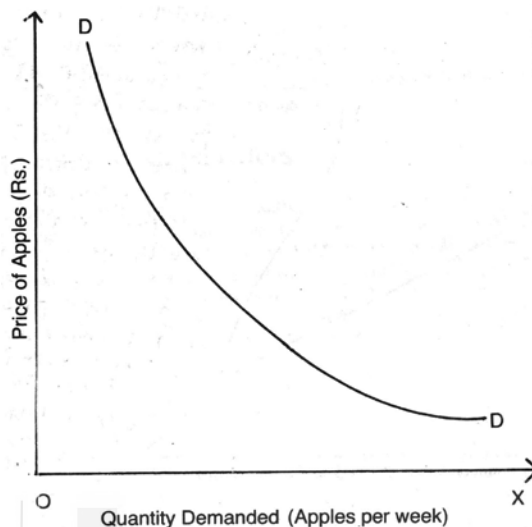


Figure 3.6:

### 3.5.3 The Explanation of the Law of Demand

Law of demand states that there is inverse relationship between the price of a commodity and its quantity demanded. Why is it so? The answer can be given with the help of three concepts.

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

$$PE = SE + IE$$

Where PE = Price Effect.

SE = Substitution Effect

IE = Income Effect

#### 1. Substitution Effect

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

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



consumer to buy more of mango, when the price of mango falls, provided prices of other fruits remain unchanged.

## 2. Income Effect

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

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

### FOR MORE CLARITY!

The income effect in economics can be defined as the change in consumption resulting from a change in real income.

### FOR MORE CLARITY!

The substitution effect is the effect observed with changes in relative price of goods. This effect basically affects the movement along the curve.

## 3. Price Effect

Substitution effect and income effect are combined together to get what is called '**price effect**' which relates the quantity demanded of a commodity to the price of the commodity. It is important to realize that substitution effect and income effect do not operate in a sequence, when the price of a commodity changes. In fact, **both substitution and income effects operate simultaneously** with the change in the price of the commodity. Given '**substitution effect**', and '**income effect**' when taken together give 'price effect.' We can identify three cases.

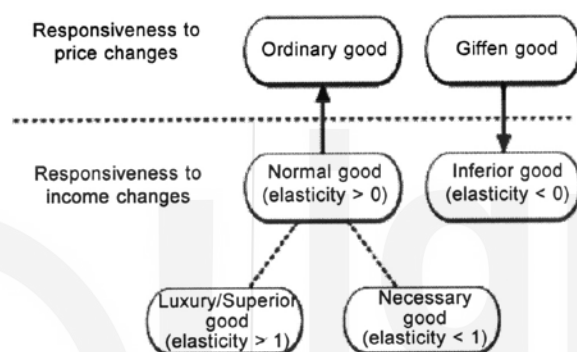
1. Substitution effect always operates in a manner such that as price falls, quantity demanded of this commodity increases. If along with substitution effect, we take income effect and if that happens to be positive (a case of normal commodity) the law of demand will necessarily apply.
2. Given substitution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

substitution effect outweighs or is more powerful than the negative income effect, and

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

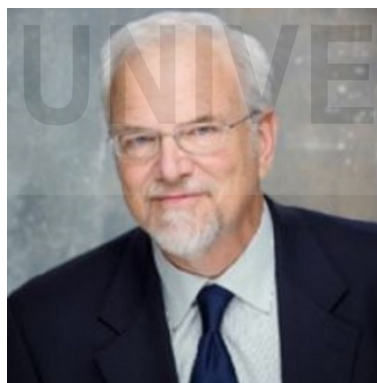
### GIFFEN GOOD

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



#### FOR MORE CLARITY!

In economics and consumer theory, a **Giffen** good is one which people paradoxically consume more of it as the *price* rises, violating the law of demand. In normal situations, as the price of a good rises, the substitution effect causes consumers to purchase less of it and more of substitute goods. In the Giffen good situation the income effect dominates, leading people to buy more of the good, even as its price rises.



Robert Giffen

## 3.6 CHANGE IN DEMAND AND CHANGE IN QUANTITY DEMANDED

As explained earlier in this unit, the demand or quantity demanded of a commodity on the part of the consumer is determined by factors like price of the commodity, prices of commodities other than the commodity in question, income of the consumer and the taste of the consumer purchasing the commodity.

Whenever the demand of the commodity changes because of the change in the price of the commodity, it is called 'change in demand'. On the other hand, when

the demand of the commodity changes because of change in factors other than the price of the commodity it is called 'change in quantity demanded'.

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

Extension and contraction in demand is explained in Figure 3.7.

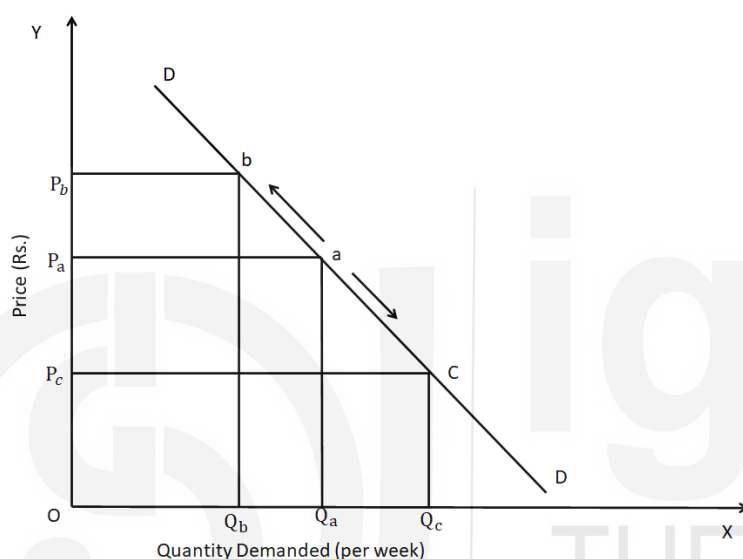


Figure 3.7 : Change in Demand

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

### Change in Demand

Change in demand takes place when the whole demand condition undergoes a change. This change occurs due to a change in any determinant of demand, except the price of a commodity. For example, due to an increase in the income of a household it may begin to consume more of milk (although there is no change in price of milk). Likewise, with the introduction of satellite TV, demand for cable TV has substantially come down. (although the price of Cable TV has not been changed).

Change in demand may take two forms:

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

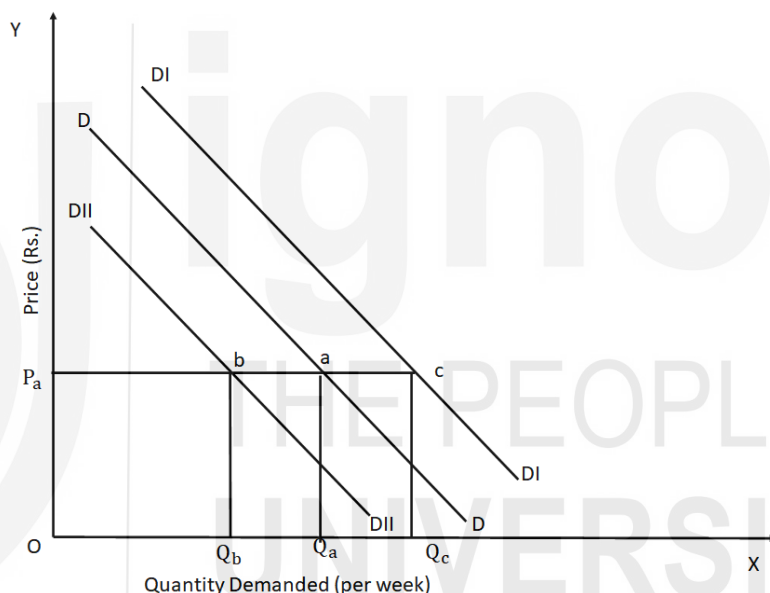
Increase in demand takes place when;

- (a) at a given price higher quantity is demanded, or  
(b) at a higher price, the same quantity is demanded

Decrease in demand takes place when:

- (a) at a given price lower quantity is demanded, or  
(b) at a lower price, the same quantity is demanded

Graphically, increase in demand results in rightward shift of the whole demand curve. Likewise, decrease in supply results in leftward shift of the demand curve. This is shown in the Fig. 3.8



**Figure 3.8: Change of Quality demanded**

As usual, on X-axis quantity demanded of a commodity is measured and on Y-axis price of a commodity is measured in rupees. At price  $P_a$ , on the demand curve  $DD$  at point 'a', quantity demanded is  $OQ_a$ , and at the same price  $OP$  quantity demanded, rises to  $OQ_c$  at point c on the demand curve  $D'D'$ . This rise in demand is called 'increase in quantity demanded'. Similarly, at price  $OP$ , the quantity demanded comes down to  $OQ_b$  on point b of demand curve  $D''D''$ . This change in quantity demanded from  $OQ_a$  to  $OQ_c$  is called 'decrease in quantity demanded'. Or the movement of the demand curve to the right of the initial demand curve is called 'increase in quantity demanded' and a movement of the demand curve to the left of the initial demand curve is called 'decrease in quantity demanded'. There can be a number of factors responsible for the shift of the demand curve. Some of the factors are given below:

1. Increase in quantity demanded or shift in the demand curve to the right can be because of increase in money income of the consumer. An increase in money income of the consumer enables him to demand more of a commodity at a given price. Similarly, a decrease in quantity demanded or shift in the demand curve to the left can be because of decrease in money income of the consumer.
2. A rightward shift in the demand curve can also take place because of increase in price of a substitute or decrease in price of a complement. Similarly, a leftward shift in the demand curve can be because of decrease in price of a substitute or increase in price of a complement.
3. If the consumer has developed a taste for a commodity, he can start demanding more of that commodity even if the price remains unchanged. Thus, a rightward shift in the demand curve can be caused by the fact that the consumer has developed a taste for the commodity in question. Similarly, a leftward shift in the demand curve can be the result of the fact that the consumer has started disliking the commodity. It may be remembered that we have been considering movements of only the demand curve of an individual consumer. The market demand curve and its movements are not been discussed here.

### 3.7 APPLICATIONS OF THE LAW OF DEMAND

The application of the law of demand can be of great assistance in framing the Government policy relating to fixation of prices of commodities. Some of the important applications of the law of demand in government policy are given below:

1. **Fixation of price of a commodity:** As usual X and Y-axis measure quantity demanded of a commodity and price of a commodity respectively. At  $OP$ , price, quantity demanded of a commodity is  $OQ_1$ . Suppose the quantity of a commodity produced is  $OQ_1$ , represented by a straight line  $SQ_1$ , parallel to Y-axis showing that the quantity

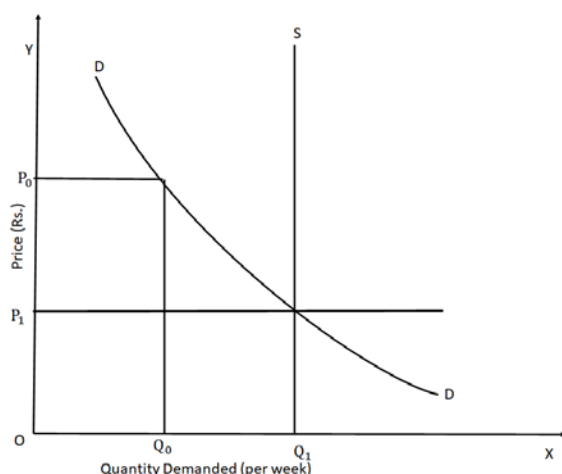


Figure 3.9 : Fixation of Price of a Commodity

produced does not undergo a change with the change in the price of the commodity. Now, if the government is interested to dispose off the whole of the quantity produced, then the only way it can be done is by reducing the price of the commodity from  $OP_0$  to  $OP_1$  (Figure 3.9). This the government can do because it knows that the law of demand is applicable for the commodity.

2. **Announcement of the subsidy or tax:** The subsidy is assistance in form of cash given by the government to the producer. Suppose that the capacity to produce in the economy is more but for some reason the quantity demanded is not sufficient, the government can announce a subsidy to the producer to create more demand for the commodity. Similarly, if the capacity to produce is less than the demand for the commodity, the government can impose a tax on the commodity to reduce the quantity demanded of the commodity.
3. **Law of demand and the consumer's surplus:** The consumer's surplus is the difference between the price, the consumer is prepared to pay rather than go without the commodity and the price which he actually pays. It is measured in Figure 3.10.

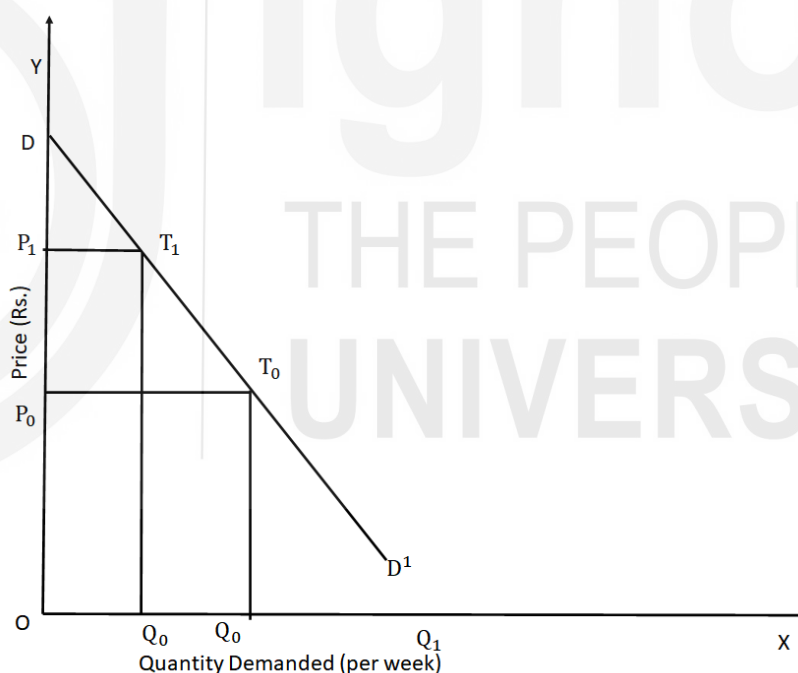


Figure 3.10 : Consumer Surplus

Given the demand curve  $DD'$ , at the price of  $OP$ , the quantity demanded is  $OQ_0$ . and the consumer's surplus is  $P_0T_0D$ . Suppose, the government finds that the consumers are enjoying a higher consumer's surplus. The government in that case can increase the price of the commodity say to  $OP_1$ . This reduces the consumer's surplus to  $P_1T_1D$ . The price can be increased by imposing a tax. Whether or not to impose a tax will depend on what is the extent of the loss of consumer's surplus in relation to the tax imposed. For example, in the Figure 3.10, we find that the loss to consumer's surplus is  $P_1P_0T_0T_1$ . This loss in consumer's surplus has to be compared to the tax revenue collected by

the government. The tax will be imposed only when the tax collected is more than the loss of consumer's surplus. Similarly, if the government decides to subsidize a commodity, it will be done only when the gain of consumer's surplus is more than the amount of subsidy given by the government.

### Check Your Progress B

1. Distinguish between movements along a demand curve and movements of the demand curve.

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2. What is the difference between expansion in demand and increase in demand?

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3. State whether the following statements are **True** or **False**.

- i) The law of demand states that there is an inverse relationship between the price of a commodity and its quantity demanded.
- ii) The demand curve is always straight line sloping downwards from left to right.
- iii) If substitution effect outweighs positive income effect, the law of demand does not operate.
- iv) Substitution effect + Price effect = Income effect.
- v) If the price of a substitute falls, the quantity demanded of a commodity falls.
- vi) Change in taste leads to a movement along the demand curve.
- vii) If increase in consumer's surplus is less than the amount of subsidy given by the government, subsidy needs to be given to an industry.
- viii) If quantity produced is more than the quantity demanded at a particular price, the government should reduce the price of the commodity.

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## 3.8 LET US SUM UP

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The demand for a commodity is a flow which is measured over period and is backed by purchasing power and always expressed with reference to a price.

There are many factors which influence the demand of a commodity on the part of a consumer. These factors are price of the commodity in question, income of the consumer, prices of commodities other than the commodity in question and the tastes of the consumer. The market demand is influenced by two additional factors namely, size of population and distribution of income.

The law of demand states that there is an inverse relationship between the price of the commodity and its amount demanded, other things remaining unchanged. The law of demand can be explained with the help of a demand schedule where quantity demanded of a commodity is stated at different levels of prices. The law of demand can also be explained with the help of a demand curve which slopes downwards from left to right, such that on X-axis quantity demanded of the commodity and on the Y-axis price of the commodity are measured.

The operation of the law of demand is explained by making a distinction between substitution effect and income effect and the sum of these two effects is referred to as price effect. Income effect is positive for a 'Normal commodity' where there is a direct relationship between income of the consumer and amount demanded of a commodity. Income effect is negative for an 'Normal commodity' where there is an inverse relationship between income of the consumer and the amount demanded of a commodity. If negative income effect operates and it outweighs substitution effect, then it is a case of exception to the law of demand. Both substitution and income effects operate simultaneously. There is a distinction between the movement along a demand curve and the movement of the curve. If we move along a demand curve to the right, it is a case of extension in demand and if the movement is to the left of a given point on the demand curve we get contraction in demand. If the demand curve moves to the right it implies that at a given price more is demanded. It is called Increase in quantity demanded. Similarly, a movement of the demand curve to the left implies that there is Decrease in quantity demanded. The increase or decrease in quantity demanded takes place due to change in the price of commodities other than the commodity in question or because of change in tastes. The operation of the law of demand can help the government in fixing up the price of the commodity. If quantity produced is more than the demand of a commodity at a particular price, it is an indication to the government to lower the price of the commodity. It also helps the government to decide whether to subsidize or tax a commodity.

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### 3.9 KEY WORDS

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**Change in Demand:** Movement along a demand curve in relation to a particular point on the demand curve.

**Change in Quantity Demanded:** Movement of the demand curve itself caused by factors other than the price of the commodity in question.

**Consumer's Surplus:** The difference between the price the consumer is prepared to pay rather than go without the commodity and the price which he actually pays to buy the commodity.



**Demand Curve:** A line or a curve which shows different combinations of prices of a commodity and its amount demanded. It normally slopes downwards from left to right.

**Demand Schedule:** A table showing the amount demanded of a commodity at different levels of prices of a commodity.

**Demand:** The want of the commodity backed by the purchasing power.

**Flow Variable:** A variable which can be measured only over a period of time.

**Giffen Good:** A commodity in which there is a direct relationship between the price of a commodity and its amount demanded.

**Inferior Commodity (Good):** A commodity in which there is an inverse relationship between the income of the consumer and amount demanded of a commodity.

**Income Effect:** It shows the effect of a change in income of the consumer on the quantity demanded of a commodity.

**Income Distribution:** The distribution of national income percentage wise among different income groups in the society.

**Law of Demand:** It states that there is an inverse relationship between the price of a commodity and its amount demanded, other things remaining unchanged.

**Normal Commodity:** A commodity in which there is a direct relationship between the income of the consumer and amount demanded of a commodity.

**Subsidy:** The cash help given by the government to the producer so that he charges relatively a less price from the consumer.

**Substitution Effect:** It shows how with a change in the price of a commodity, prices of other commodities remaining unchanged, a consumer substitutes one commodity for the other.

**Want:** The wish on the part of a consumer to possess the commodity. It need not be backed by the purchasing power to buy the commodity.

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### 3.10 ANSWERS TO CHECK YOUR PROGRESS

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#### Check your progress A

- 4 i) Tastes, ii) Price of other commodities, iii) Price of ball pens, iv) Income of the consumer, v) Distribution of income, vi) Population.
- 5 i) False, ii) True, iii) False, iv) False, v) False vi) False.

#### Check your progress B

3. i) True ii) False iii) False iv) False v) True vi) False vii) False viii) True

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### 3.11 TERMINAL QUESTIONS

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1. Explain the main determinants of demand of a commodity in the market.
2. Explain the law of demand with the help of a demand schedule and a demand curve.
3. Distinguish between substitution and income effects of a price rise.
4. Explain the exceptions to the law of demand using the distinction between substitution and income effects.
5. Distinguish between an Inferior good (commodity) and a Giffen good.
6. What uses can be made by the government of the law of demand in deciding about the price policy and tax cum subsidy policy.

**Note: These questions will help you to understand the unit better. Try to write answers for them. But do not submit your answers to the University. These are for your practice only.**



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## UNIT 4 ELASTICITY OF DEMAND

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### Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Concept of Elasticity of Demand
  - 4.2.1 Price Elasticity of Demand
  - 4.2.2 Income Elasticity of Demand
  - 4.2.3 Price Cross-Elasticity of Demand
- 4.3 Measurement of Price Elasticity of Demand
- 4.4 Determinants of Price Elasticity of Demand
- 4.5 Importance of Price Elasticity of Demand
- 4.6 Let us Sum Up
- 4.7 Key Words
- 4.8 Answers to Check Your Progress
- 4.9 Terminal Questions

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### 4.0 OBJECTIVES

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After studying this unit, you should be able to:

- explain the concept of elasticity of demand
- identify price elasticity of demand, income elasticity of demand and price
- cross-elasticity of demand
- describe various methods to measure price elasticity of demand
- identify the case of unitary price elastic
- demand curve list the factors determining price elasticity
- explain the importance of the price elasticity of demand.

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### 4.1 INTRODUCTION

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In the previous unit, we have studied the demand function and also the law of demand. The demand function and the law of demand tell us about the direction of change if the value of any independent variable changes. But these do not tell us anything about the magnitude of the change. If, for example, the price of a commodity falls, we know its quantity demanded will increase. By how much, we do not know. To measure the change we make use of another concept. This is called Elasticity of Demand. In this unit you will study the extent to which the price of a commodity, income of the consumer and prices of other commodities exercise influence on the quantity demanded of a commodity. This you will study with the help of price

elasticity of demand, income elasticity of demand and the cross-elasticity of demand. You will also study the factors on which the price elasticity of demand of a commodity depends along with the importance of the concept of price elasticity of demand in various government policies.

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## 4.2 CONCEPT OF ELASTICITY OF DEMAND

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The elasticity of demand is the responsiveness of a dependent variable (demand) to a given change in independent variables (price of a commodity, income of the consumer or price of a commodity other than the commodity in question). Elasticity is always worked in terms of a percentage or proportionate change in the dependent variable to a given percentage or proportionate change in the independent variable.

It is important to remember that though the demand of a commodity is dependent on various factors, yet the law of demand states that the demand of a commodity is inversely related to its price. This is possible because the factors other than the price of the commodity are assumed to remain unchanged. In technical terms, such a situation is referred to as partial equilibrium approach. It is called partial because all the factors exercising influence on demand of a commodity are not allowed to change at the same time. It is also possible to assume the price of the commodity and prices of other commodities remain unchanged and we can work out a relationship between the demand of the commodity and the income of the consumer who demands the commodity. Similarly, we can assume the price of the commodity and income of the consumer as unchanged and a relationship can be worked out between the demand of the commodity and the price of the commodity other than the commodity in question.

The concept of elasticity, on the other hand, tries to quantify the relationship between the demand of the commodity and the price of the commodity or income of the consumer or price of the commodity other than the commodity in question, but at a time only one of the three factors mentioned above are allowed to change, keeping other factors as unchanged. Accordingly, there are three concepts of elasticity we are going to consider in this unit. They are (i) price elasticity of demand, (ii) Income elasticity of demand, and (iii) Cross elasticity of demand.

### 4.2.1 Price Elasticity of Demand

Price elasticity of demand measures the relative change in quantity demanded of a commodity resulting from a given (percentage or proportional) change in its price. This can also be stated by saying that the price elasticity of demand is the relative responsiveness of quantity demanded of a commodity to change in the price of the commodity. This can be expressed in a different way by stating that the price elasticity of demand is the proportional or percentage change in quantity demanded of a commodity divided by the proportional or percentage change in the price of the commodity.

Let price elasticity of demand be represented by  $P_{ed}$  where P stands for price and  $_{ed}$  for elasticity of demand. Then,

$$P_{ed} = \frac{\text{Proportional Change in quantity demanded of the commodity}}{\text{Proportional change in price of the commodity}}$$

Proportional change of a variable need to be explained. This can be explained with the help of an example.

Suppose, the quantity demanded is 20 units and it gets increased to 30 units, then the proportional change in quantity demanded is the new quantity demanded (30 units) minus the old quantity demanded (20 units) and whatever figure of quantity demanded is left (30 units – 20 units) if divided

by the old figure of quantity demanded (20 units), this  $\frac{30-20}{20}$  or  $\frac{10}{20}$  is the

proportional change in quantity demanded.

Similarly, proportional change in the price of a commodity can also be explained with the help of an example.

Suppose the price of a commodity is Rs. 3 per unit and it falls to Rs. 2, then the proportional change in price is the new price (Rs. 2) minus the old price (Rs. 3) and whatever figure is left (Rs. 2 - Rs. 3) if divided by the original

price (Rs. 3) will give the proportional change price  $\frac{(Rs.2-Rs.3)}{Rs.3}$  or  $\frac{Rs.-1}{Rs.3}$

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

#### FOR MORE CLARITY!

Price elasticity of demand (PED or  $E_d$ ) is a measure used in economics to show the responsiveness, or elasticity, of the quantity demanded of a good or service to a change in its price. More precisely, it gives the percentage change in quantity demanded in response to a one per cent change in price (holding constant all the other determinants of demand, such as income). It was devised by Alfred Marshall.

let us represent the difference between the new price and the old price by  $\Delta P$  and the original price be represented by  $P$ , then the proportional change in

price is  $\frac{\Delta P}{P}$

If proportional change in quantity demanded of a commodity  $\left(\frac{\Delta D}{D}\right)$  is divided by proportional change in price  $\left(\frac{\Delta P}{P}\right)$  then price elasticity of demand  $P_{ed}$  is:

$$P_{ed} = \frac{\frac{\Delta D}{D}}{\frac{\Delta P}{P}}$$

The above expression can also be represented as :

$$P_{ed} = \frac{\Delta D}{D} \times \frac{P}{\Delta P}$$

$$\text{Or } P_{ed} = \frac{\Delta D}{\Delta P} \times \frac{P}{D}$$

Since, the price of a commodity and its quantity demanded are inversely related minus sign will appear either in the denominator or in the numerator. Therefore, in the final form price elasticity of demand ( $P_{ed}$ ) can be represented as:

$$P_{ed} = \frac{\Delta D}{\Delta P} \times \frac{P}{D}$$

The figure in the examples given above can be put in the formula to find out the price elasticity of demand. Thus, price elasticity of demand ( $P_{ed}$ ) is

$$\begin{aligned} P_{ed} &= \frac{\Delta D}{\Delta P} \times \frac{P}{D} \\ &= \frac{10}{-1} \times \frac{2}{-20} = -1 \end{aligned}$$

In this case, price elasticity of demand is negative which indicates an inverse relationship between price and quantity demanded.

Without going into details, it is important to state that the method to find out price elasticity of demand given above is used or valid only for very small changes in price and quantity demanded of a commodity. The method given above is called "point" price elasticity of demand.

### Interpretation of price elasticity coefficient

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

1.  $P_{ed}$  equal to infinity ( $P_{ed} = \infty$ ). This type of elasticity of demand obtains when a small change in price results in infinite changes in quantity demanded. Alternatively, it can be represented as a situation in which it is not possible to determine the quantity that would be demanded at a given price. This type of demand is also called perfectly elastic demand. Perfectly elastic demand can be represented graphically with the help of a horizontal straight line, as shown in Fig. 4.1
2.  $P_{ed} = 0$ . This happens when the quantity demanded *does not change absolutely* with a change in the price of the commodity. This situation is called *perfectly inelastic* demand. Graphically it can be represented in the form of a vertical straight line demand curve as shown in Fig. 4.1. This would be seen that the quantity demanded of commodity remains unchanged at OQ, irrespective of the change in the price of the commodity.
3.  $P_{ed}$  equal to one ( $P_{ed} = 1$ ). This value is obtained when the percentage change in quantity demanded equals the percentage change in price. A 10 percent fall in price induces a 10 percent increase in quantity demanded. This type of demand is said to be equal to Unitary Elastic.
4.  $P_{ed}$  more than one ( $P_{ed} > 1$ ). This type of elasticity of demand obtains when the percentage change in quantity demanded is more than the percentage change in the price of a commodity. For example, a 10 per cent reduction in the price of quality chocolate may result in a 30 percent increase in the quantity demanded of chocolates. In this case,  $P_{ed} = \frac{30\%}{10\%} = 3$ . This type of demand is called more than unit elastic demand or Relatively elastic
5.  $P_{ed}$  greater than zero but less than one – ( $P_{ed} > 0 < 1$ ). This value is obtained when the percentage change in quantity demanded is less than the percentage change in price. For example, a 10 percent fall in price may induce 8 percent rise in quantity demanded. This type of demand is known as less than unit elastic or Relatively inelastic

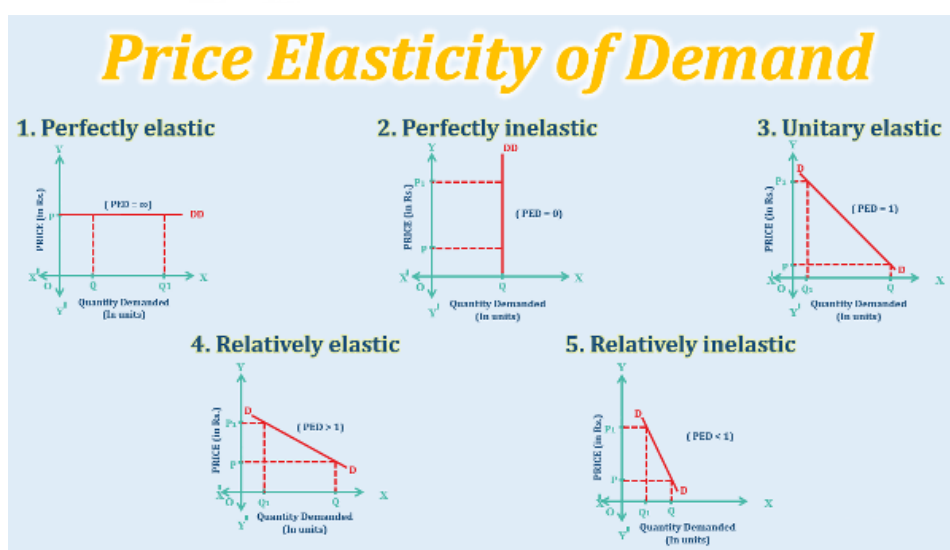


Figure 4.1: Price elasticity of Demand

## Application of Interpretation

The value of  $P_{ed}$  is of significant use, especially in business decision-making. For example, What does  $P_{ed} = 1.2$ , means?

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

### BRAIN TEASERS

#### 1. Why do we ignore the minus sign in the calculation of price elasticity coefficient?

**Ans.** Strictly speaking, minus sign should not be ignored while estimating price elasticity coefficient. But all the same, it is yet ignored for the following two reasons:

- i) Price and demand have an inverse relationship, therefore, elasticity coefficient will always have a minus sign.
- ii) For the convenience of understanding. Strictly speaking,  $(-1)$  is greater than  $(-3)$ . But elasticity coefficient of  $(-1)$  makes demand more elastic than the elasticity coefficient of  $(-3)$ , and hence  $(-)$  sign is ignored.

#### 2. Are slope of a demand curve and elasticity of a demand curve the same thing?

**Ans.** No. Elasticity of demand is not the same thing as the slope of a demand curve. Often the two are confused. Slope of a demand curve is the absolute change in price and quantity demanded and is measured as  $\Delta P / \Delta Q$ . Slope of a curve will be the same along its length. Elasticity of demand is a relative change. Elasticity will differ on different points of a curve; except when the curve is a vertical straight line ( $E_P = 0$ ), and when it is a horizontal straight line ( $E_P = \infty$ ).

#### 3. A consumer spends Rs. 40 on a good at a price of Rs. 1 per unit and Rs. 60 at a price of Rs. 2 per unit. What is the price elasticity of demand?

**Ans.** By the percentage method, we estimate price elasticity as follows:

$$E_P = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

In the given problem,

Original	price	=	Rs.	1
New	price	=	Rs.	2
Original	quantity	=	40	units
New quantity = 30 units				

$$E_P = \frac{10}{1} \times \frac{1}{40} = 0.25$$



*i.e.*, demand is less than unit elastic, or inelastic.

4. A decline in the price of good Y by Rs. 5 causes an increase of 20 units of its demand which goes up to 50 units. The new price is Rs. 15. Calculate the elasticity of demand.

Ans. Given,

$$\begin{aligned}\Delta P &= 5 \\ \Delta Q &= 20 \\ P &= 15 \quad +5=20\end{aligned}$$

$$Q = 50 - 20 = 30$$

$$E_p = \frac{20}{5} \times \frac{20}{30} = 2.6$$

*i.e.*, demand is more than unit elastic.

5. The price elasticity is 2. The percentage change in price is equal to 5. Find the percentage change in quantity.

Ans. By percentage method,

$$E_p = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}$$

$$\therefore 2 = \frac{X}{5}$$

$$\text{or } X = 2 \times 5 = 10$$

*i.e.*, a 5% change in price will cause a 10% change in quantity demanded.

## 4.2.2 Income Elasticity of Demand

Income elasticity of demand is the relative responsiveness of quantity demanded of a commodity to changes in income of the consumer demanding the commodity. It is the proportional or percentage change in quantity demanded of a commodity divided by the proportional change in income of the consumers demanding the commodity. Let us use symbols to represent income elasticity of demand ( $Y_{ed}$ ) where Y stands for income and  $_{ed}$  for elasticity of demand. Thus,

$Y_{ed}$  is :

$$Y_{ed} = \frac{\text{Proportional Change in quantity demanded}}{\text{Proportional Change in income}}$$

$$= \frac{\frac{\Delta D}{D}}{\frac{\Delta y}{y}}$$

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

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

Where  $\Delta Y$  the change in income of the consumer, Y is the original income,

$\Delta D$  is the change in quantity demanded of a commodity, D is the original demand.

Income elasticity of demand can be illustrated with the help of a numerical example. Study Illustration 1 for the calculation of income elasticity of demand.

#### Illustration 1

Income (in Rs.)	Quantity Demanded (in Units)
500	20
510	21

The change in income is  $510 - 500 = 10$ , the change in quantity demanded is  $21 - 20 = 1$ , original income is 500 and the original quantity demanded is 20. Thus

income elasticity of demand ( $Y_{ed}$ ) is:

$$Y_{ed} = \frac{\Delta D}{\Delta Y} \times \frac{Y}{D}$$

$$= \frac{1}{10} \times \frac{500}{20} = +2.5$$

It is worth noting that no minus sign is attached to the co-efficient. It is so because we have assumed that there is a direct relationship between the quantity demanded and the income of the consumer demanding the commodity.

The income elasticity coefficient is +2.5. The plus sign shows that the commodity in question is a normal good. If the income of the consumer increases he will demand more of the commodity. In the given situation, a 10 percent increase in income will result in 25 per cent increases in quantity demanded.

Sometimes, the relationship between the quantity demanded of a commodity and the income of the consumer is inverse. Study Illustration 2 for this calculation.

### Illustration 2

Income (in Rs.)	Quantity Demanded (in Units)
500	21
510	20

Income elasticity of demand ( $Y_{ed}$ ) is:

$$Y_{ed} = \frac{\Delta D}{\Delta Y} \times \frac{Y}{D}$$

$$= \frac{-1}{10} \times \frac{500}{21} = -2.38$$

In this case, minus sign is attached to income elasticity of demand coefficient because as income has increased from Rs. 500 to Rs. 510, the quantity demanded has fallen from 21 to 20 or there is an inverse relationship between the quantity demanded of a commodity and the income of the consumer demanding the commodity.

The case where there is a direct relationship between the quantity demanded of a commodity and the income of the consumer is termed as a case of 'Normal commodities'. The case where there is an inverse relationship between the quantity demanded of a commodity and the income of the consumer is termed, as a case of an inferior commodity.

If the income of the consumer increases by 10 per cent, quantity demanded will fall by 23.8%.

The plus and minus sign alongwith  $Y_{ed}$  assume great significance. Suppose:

- $Y_{ed} = +1.8$ , we can assume that the commodity in question is a normal good.
- $Y_{ed} = -1.8$ , we can assume that the commodity in question is an inferior good.
- $Y_{ed} = 0$ , we can assume that there is no relationship between the income of the consumer and the quantity demanded of the commodity (eg- Bare necessities of life).

### 4.2.3 Price Cross Elacity of Demand

The cross-elasticity of demand is the relative responsiveness of quantity demanded of a given commodity. It is the proportional or percentage change in the quantity demanded of a commodity say X divided by the proportional

or percentage change in the price of related commodity say Y. Let us use symbols to represent cross-elasticity of demand ( $C_{ed}$ ) where C stands for cross and ed for elasticity of demand. Thus,  $C_{ed}$  is:

$$C_{ed} = \frac{\text{Proportional change in quantity demanded of commodity X}}{\text{Proportional Change in price of commodity Y}}$$

$$= \frac{\frac{\Delta D_x}{D_x}}{\frac{\Delta P_y}{P_y}}$$

$$= \frac{\Delta D_x}{D_x} \times \frac{P_y}{\Delta P_y}$$

$$= \frac{\Delta D_x}{\Delta P_y} \times \frac{P_y}{D_x}$$

Where  $\Delta D_x$ , is the change in quantity demanded of commodity X,  $\Delta P_y$  is the change in price of commodity Y,  $P_y$ , is the original price of commodity Y and  $D_x$  is the original demand of commodity X. Cross-elasticity of demand can be illustrated with the help of an illustration.

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

### Illustration 3

Price of Tea in Rs.	Quantity Demanded of Coffee in Grams.
20	200
19	150

Suppose we have tea as one commodity whose price is Rs. 20 per 1000 grams which falls to Rs. 19, given the law of demand quantity demanded of tea may rise from 500 grams to 600 grams a week. Now coffee is a substitute of tea. If price of coffee remains unchanged, quantity demanded of coffee may fall from 200 grams to 150 grams. It has happened because quantity demanded of tea has increased from one packet to two packets. We can easily realize that the fall in the price of tea from Rs. 20 per packet to Rs. 19 per packet has reduced the quantity demanded of coffee from 200 grams to 150 grams.

The change in quantity demanded of coffee is  $150 - 200 = -50$  the change in price of tea is  $19 - 20 = -1$ , original quantity demanded of coffee is 200 grams and the original price of tea is Rs. 20. Thus price cross-elasticity of demand ( $C_{ed}$ ) is:

$$C_{ed} = \frac{\Delta D_X}{\Delta P_Y} \times \frac{P_Y}{D_X}$$

where X is coffee and Y is tea. Thus

$$C_{ed} = \frac{-50}{-1} \times \frac{20}{200} = 5$$

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

Let us now consider the case of complements. Take an example. Suppose we have car as one commodity whose price is Rs. 80,000 per car and its price falls to 75,000 per car. The quantity demanded of cars for the community may rise from 1,000 to 1,100 cars, given the operation of the law of demand. Suppose, the price of petrol remains the same say Rs. 8 per litres. The quantity demanded of petrol may rise from 5,000 litres a month to 5,500 litres a month because the quantity demanded of cars has increased from 1000 to 1100 cars. We can see that the fall in the price of cars from Rs. 80,000 per car to Rs. 75,000 per car has increased the quantity demanded of petrol from 5,000 litres a month to 5,500 litres a month.

Price cross-elasticity of demand is illustrated with the help of a numerical example. This is shown in Illustration 4

#### Illustration 4

Price of Cars in Rs.	Quantity Demanded of Petrol in Litres
80,000	5,000 litres
75,000	5,500 litres

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

$$C_{ed} = \frac{\Delta D_X}{\Delta P_Y} \times \frac{P_Y}{D_X}$$

Where X is petrol and Y is Car.

$$C_{ed} = \frac{500}{-5000} \times \frac{80,000}{5,000}$$

$$= -1.6$$

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

In short, if we are told:

- i) Cross elasticity coefficient between two commodities is plus, we should know that the two commodities are substitutes (as Pepsi and Coke, or Samsung and Apple Tablets), and
- ii) Cross elasticity coefficient between two commodities is negative, we should know that the two commodities are complementary goods (as motorbike and petrol, cell phone and sim card, hair die and shampoo, etc.)

### Check Your Progress A

- 1) What is meant by price elasticity of demand?  
.....  
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.....
- 2) What is the difference between price elasticity of demand and income elasticity of demand?  
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.....  
.....
- 3) Distinguish between price elasticity of demand and cross-elasticity of demand.  
.....  
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.....  
.....  
.....

- 4) When is the co-efficient of income elasticity of demand and cross elasticity of demand negative?

.....

.....

.....

.....

- 5) Under what situation the co-efficient of price elasticity of demand positive?

.....

.....

.....

.....

- 6) State whether the following statements are **True** or **False**.

- i) The income elasticity of demand is always positive.
- ii) The co-efficient of cross-elasticity of demand is always negative.
- iii) When price elasticity of demand is determined income of the consumer is assumed to be changing.
- iv) In the case of substitute commodities, the co-efficient of cross elasticity of demand is negative.
- v) In the case of complementary commodities, the co-efficient of price cross elasticity of demand is positive.
- vi) In the case of 'inferior commodities', the co-efficient of price elasticity of demand is positive.
- vii) In the case of 'normal commodities' the co-efficient of price elasticity of demand is positive.
- viii) When income elasticity of demand is found out, price of the commodities is also allowed to change.

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### 4.3 MEASUREMENT OF PRICE ELASTICITY OF DEMAND

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

- 1) **Point Method:** The main point to remember about this method is that it is employed only when the changes in price and quantity demanded are very small.
- 2) **Outlay Method:** The outlay method to measure price elasticity of demand is used whenever the changes in price and demand are not small. Another point to remember about the outlay method is that it cannot help us to find out the co-efficient of price elasticity of demand. It only helps us to distinguish three situations:

- i) whether the price elasticity of demand is one or unity,
  - ii) whether the price elasticity of demand is more than one or more than unity and
  - iii) whether the price elasticity of demand is less than one or less than unity.
- This method can be explained with the help of numerical example. Study Illustration 5, 6 and 7 for this purpose.

#### Illustration 5

Price (In Rs.)	Quantity (In Units)	Demand of a Commodity Outlay (In Rs.)
5	20	$5 \times 20 = 100$
4	25	$4 \times 25 = 100$

#### Illustration 6

Price (In Rs.)	Quantity (In Units)	Demand of a Commodity Outlay (In Rs.)
5	20	$5 \times 20 = 100$
4	22	$4 \times 22 = 88$

#### Illustration 7

Price (In Rs.)	Quantity (In Units)	Demand of a Commodity Outlay (In Rs.)
5	20	$5 \times 20 = 100$
4	30	$4 \times 25 = 120$

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

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



In illustration 6 with the fall in price of the commodity from Rs. 5 to Rs. 4, the total money spent on the commodity or outlay falls from Rs. 100 to Rs. 88. It is a situation of less than unity price elasticity of demand.

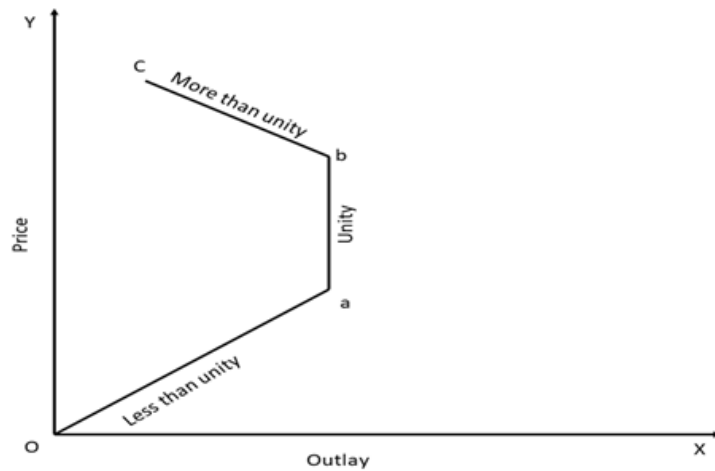


Figure 4.2: Elasticity of Demand

Finally, illustration 7 with the fall in price of the commodity from Rs. 5 to Rs. 4, the total money spent on the commodity or outlay rises from Rs. 100 to Rs. 120. It is a case in which price elasticity of demand is more than unity. This method is also explained with the help of Figure 4.2.

On the X-axis outlay is measured and on the Y-axis the price of the commodity is measured. From  $O$  to  $a$ , we have case of less than unity because there is a direct relationship between the price of the commodity and outlay. Between  $a$  and  $b$  the price elasticity of demand is unity because the outlay remains the same with the change in the price of commodity. Finally, between  $b$  and  $c$ , the price elasticity of demand is more than unity because there is an inverse relationship between price of the commodity and the outlay. Thus, when the price of the commodity rises and outlay also rises, it is also a case in which elasticity of demand is less than unity. Similarly, when the price rises and the outlay remains the same, it is also a case when price elasticity of demand is equal to unity. Finally, as the price of the commodity rises and the outlay falls, it is also a case when price elasticity of demand is more than unity.

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

In Figure 4.3 (a),  $P_{ed}$  at point  $K = Kb/AK$

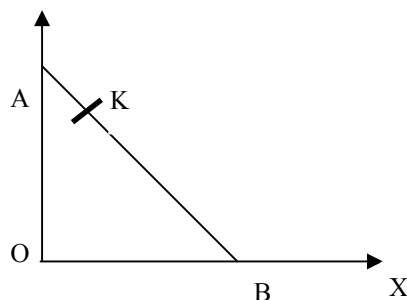


Figure 4.3 (a): Elasticity of Demand

And since  $KB > KA$ , the result will be more than 1. We will say  $P_{ed}$  at Point K is more than unit elastic. We can use the same method to estimate price elasticity at different points, as shown in Figure 4.3 (a).

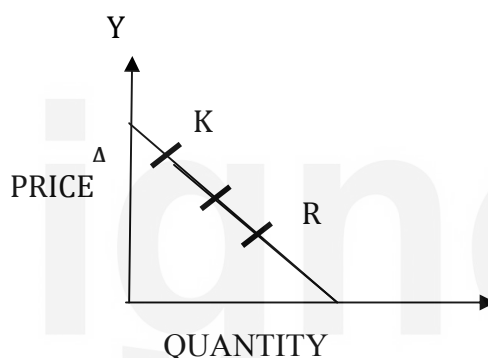


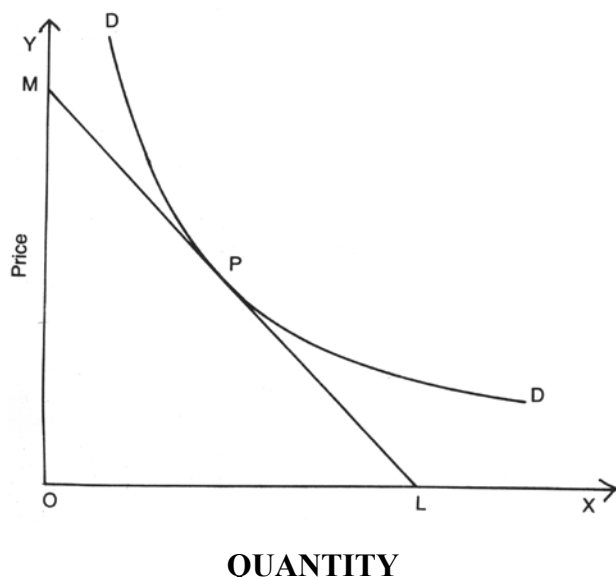
Figure 4.3(b)

It would be seen from Figure 4.3(b), that

1. at point B,  $P_{ed} = \text{zero}/AB = \text{zero}$  i.e. perfectly inelastic demand
2. at point R,  $P_{ed} = BR/AB = \text{more than zero, but less than one}$ , i.e.  $P_{ed}$  is less than unit elastic.  $P_{ed}$  will be  $>1$  on the entire length of the curve from the point B till it reaches the point T.
3. at point T,  $P_{ed} = BT/AT = 1$ , i.e., demand is equal to unity at the middle point of the demand curve.
4. At point K,  $P_{ed} = BK/AK > 1$ , i.e. demand is more than unity.
5. At point A,  $P_{ed} = BA/\text{Zero}$ , i.e.  $P_{ed}$  is infinity.

#### Point method in a Curvi-linear demand curve

The method remains the same when we want to measure price elasticity on a curvi-linear curve. This is illustrated in Fig. 4.4

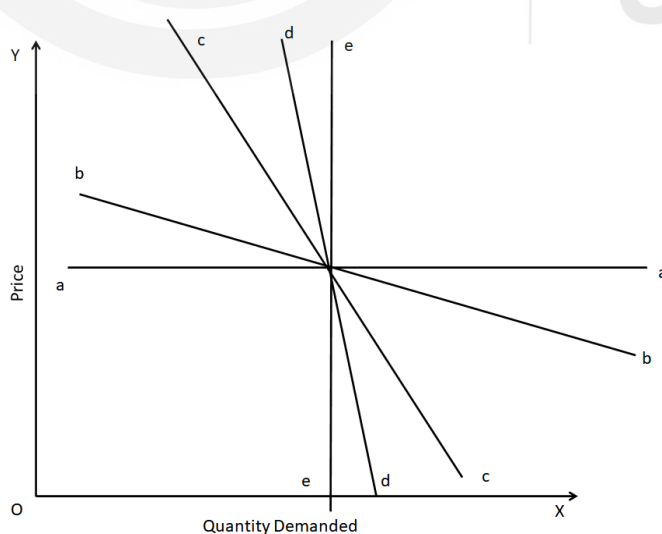


**Figure 4.4: Point Method to find out Elasticity**

In Figure 4.4, quantity demanded of the commodity is measured on X-axis and on the Y-axis price of the commodity is measured. DD is the demand curve. Suppose we are interested to find out the price elasticity of demand at point P on the demand curve. Then, draw a tangent to the demand curve at P which cuts the X-axis at L and Y-axis at M. The price elasticity of demand is given by  $LP/PM$ . If point P happens to be at the middle of L and M, then,  $LP = PM$  or price elasticity of demand is equal to unity. If P happens to be nearer to L than M, then LP will be less than PM or the price elasticity of demand is less than unity. Finally, if P happens to be nearer to M than L then LP is more than PM or the price elasticity of demand is more than unity.

#### Price Elasticity of Demand and the Demand Curves

Looking at demand curves we can also get an idea of the nature of the demand curve whether it is elastic, inelastic, more elastic, perfectly elastic or perfectly inelastic. Look at the Figure 4.5



**Figure 4.5: Point Elasticity of Demand and the Demand curves**

As usual price is measured on Y-axis and the quantity demanded is measured on X-axis. The line  $ee$  represents a case of perfectly inelastic demand since the change in price of the commodity does not bring about any change in quantity demanded of the commodity. The line  $oa$  represents case of perfectly elastic demand since at a given price so we can demand as much as we like. The line  $dd$  is highly inelastic since it is nearer to perfectly inelastic demand curve or because a given change in price brings about a small change in quantity demanded. The line  $bb$  is highly elastic since it is nearer to perfectly elastic line or because a given change in price brings about relatively a big increase in quantity demanded of the commodity. The line  $cc$  is moderately elastic. We can make a few generalizations looking at figure 4.5. The less steep is the demand curve more elastic it tends to be or the steeper is the demand curve less elastic it tends to be.

### A Case of Unit Price Elastic Demand Curve

Using the outlay method discussed in 4.6, we can have a case of unitary price elastic demand curve. Look at Figure 4.6.

On X-axis quantity demanded of the commodity is measured and as the Y-axis it is the price of the commodity which is measured.  $DD$  is the demand curve. At point  $a$  on the demand curve at  $OP_0$ , price  $OQ_0$ , quantity is demanded. The total money spent on the commodity or outlay is  $OP_0 \times OQ_0$

which is geometrically equal to the area of the rectangle which has sides equal to  $OP_0$  and  $OQ_0$ . This area is given by  $OQ_0 \times P_0$ . Now, if price of the commodity falls to  $OP_1$ , at which quantity demanded is  $OQ_1$ , which is given by point  $b$  on the demand curve, then outlay is given by  $OQ_1 \times P_1$ . If the outlay at  $a$  which is  $OQ_0 \times P_0$ , is equal to outlay at  $b$  which is  $OQ_1 \times P_1$ , then price elasticity of demand at point  $a$  and  $b$  is unit. If all such rectangles are constructed whose area is equal to each other, then the curve drawn joining all such points gives us a demand curve which has the same price elasticity of demand throughout the curve. Such a curve is known as a demand curve which has unitary price elasticity of demand. Such a demand curve is also referred to as 'Rectangular Hyperbola'.

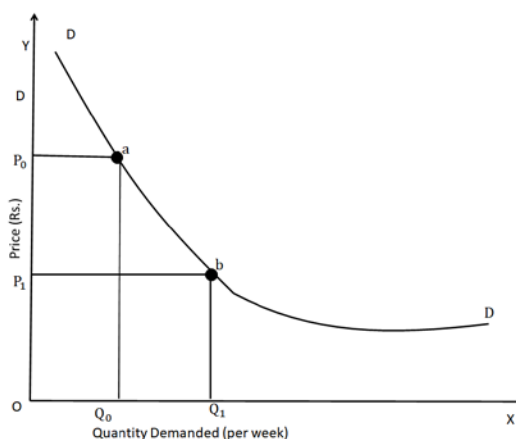


Figure 4.6 : Unit Price Elasticity of Demand

## 4.4 DETERMINANTS OF PRICE ELASTICITY OF DEMAND

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

- 1. Nature of the Commodity:** The commodities are normally divided into three categories (i) necessities, (ii) comforts, and (iii) luxuries, if the commodity happens to be a necessity price elasticity of demand will be less. Take the case of wheat. Even if the price of wheat rises people will not be able to reduce much the quantity demanded of wheat and therefore, the demand for wheat is relatively less elastic. In the case of comforts, the change in price makes the consumer change the quantity demanded relatively more and so it is more elastic. As regards luxuries, since they are purchased by people who have higher income the demand does not change much with change in price and thus tend to be less price elastic.
- 2. Number of Substitutes:** Commodities with few and poor substitutes – wheat and salt, for example, will always tend to have low price elasticity of demand. Commodities with many substitutes – wool, for which cotton and synthetics can be substituted for example, will have relatively high price elasticity of demand.
- 3. Number of uses of a commodity:** The greater the number of possible uses of a commodity, the greater its price elasticity of demand will be. Thus a commodity, such as coal - which can be used in producing power generation, domestic purposes and industrial purposes - will have higher price elasticity of demand than a commodity with only one or a very few uses – butter, for instance.
- 4. Price level of a commodity:** The level of price will also have an impact on price elasticity of demand. A commodity like a box of matches which has a very low price will have less price elasticity of demand. A commodity like car which has a very high price will also tend to have less price elasticity of demand since it is demanded by persons who have very high incomes. A medium price commodity like fan will have relatively more price elasticity of demand.

There can be so many other factors which can also be incorporated in the list. The most important point to remember is that the factors affecting price: elasticity of demand are to be taken together before we can finally say whether or not the price elasticity of demand of a commodity is high or low.

### Tabulation of the Different Factors that Affect Elasticity of Demand

	<i>Tend Towards elasticity</i>	<i>Tend Towards Inelasticity</i>
1.	Long period	Short period
2.	Availability of substitutes	Lack of substitutes
3.	Luxuries, comforts	Necessities

4.	Large proportion of expenditure	Small proportion of expenditure
5.	Perishable goods	Durable goods
6.	Multi-purpose goods	Single-use goods
7.	Substitute goods	Complementary goods
8.	Low income	High income
9.	Normal price range	Extremely high or low price
10.	Normality	Habit
11.	Urgent want	Postponable want
12.	Recurring demand	Non-recurring demand

## 4.5 IMPORTANCE OF PRICE ELASTICITY OF DEMAND

The price elasticity of demand is very important in a number of policy decisions. It is especially useful for government policies relating to individual commodity markets. Some of the important fields in which the importance of price elasticity of demand can be realized are discussed below:

1. **Price fixation by a monopolist:** The monopolist is always interested in charging a higher price from the consumer. If he comes to know that the price elasticity of demand of a commodity is low, he would fix up a higher price for the commodity. He would not be able to charge a very high price for a commodity whose price elasticity of demand is relatively higher.
2. **Price support programme of the government:** Normally, the price elasticity of demand of agricultural commodities like wheat, rice etc, is relatively less. This implies that a given increase in supply say because of better monsoon will lead to a relatively more fall in price. This would reduce the income of the farmer. The government in order to protect the interest of the farmers can announce what is called price support programme such that the price of the commodity will not be allowed to fall below a particular level. Obviously, this would lead to a situation where the quantity supplied will be more than the quantity demanded of a commodity at the price announced by the government.

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

3. **Incidence of indirect taxes:** A government imposes indirect taxes on the commodities. Whenever an indirect tax is imposed, the burden of this tax

is borne partly by the consumer and partly by the producer himself. The share of burden of an indirect tax borne by the consumer and the

producer depends **upon**  $= \frac{\text{Price elasticity of Supply}}{\text{Price elasticity of demand}}$

For example, a situation where Price elasticity of demand the demand curve is perfectly inelastic, irrespective of the shape of the supply curve, the whole burden of the indirect tax will be borne by the consumer, on the other hand if the demand curve is perfectly elastic the whole burden of the indirect tax will be borne by the producer or the supplier. The situations between two will be decided by the ratio of price elasticity of supply to price elasticity of demand.

### Time to Play Game!

Arrange the following elasticity coefficients in ascending order, *i.e.*, smaller value first, next higher value and so on.

$$e_p = 0$$

$$e_p = -1.5$$

$$e_p = -1.4$$

$$e_c = +0.1$$

$$e_c = -0.2$$

$$e_y = -0.3$$

$$e_y = +0.5$$

where  $e_p$  = price elasticity of demand.

$e_c$  = cross elasticity of demand,

$e_y$  = income elasticity of demand.

Pick up the correct answer among the following:

(a) The lowest value is zero and the highest value is -1.5.

(b) The lowest value is -1.5 and the highest value is +0.5.

(c) The lowest value is zero and the highest value is 0.5.

(d) The first highest and the second highest values are zero and 0.5 respectively.

**Ans.(a)**

### Check Your Progress B

1. What is the point method to measure price elasticity of demand?  
.....  
.....
2. Explain the outlay method taking a numerical example.  
.....  
.....
3. Show that the price elasticity of demand is not the same throughout the demand curve.  
.....  
.....
4. What is meant by price elastic demand and price inelastic demand?  
.....  
.....
5. When does the demand curve have unity price elasticity of demand?  
.....  
.....
6. Explain three factors on which the price elasticity of demand of a commodity depends.  
.....  
.....
7. Explain the use of price elasticity of demand in price support programme of the government.  
.....  
.....
8. State whether the following statements are **True** or **False**.
  - i) If price of a commodity increases and outlay falls it is a case of less than unity price elasticity of demand.
  - ii) Using outlay method, we can never have unity elasticity of demand.
  - iii) The price elasticity of demand of a curved demand curve is always unity.
  - iv) Less steep a demand curve, more is the price elasticity of demand.
  - v) Nature of the commodity does not influence the price elasticity of demand.
  - vi) Less are the substitutes, more is the price elasticity of demand.



vii) Price support programme is the situation where the price of a commodity is not allowed to fall below the level what has been announced by the government.

viii) Less price elastic a demand curve, given the supply curve, more is the burden of an indirect tax on the consumer.

9 Fill in the blanks with the appropriate words provided in the brackets

i) Outlay method is used when the changes in price and demand are .....(small/large)

ii) When price of the commodity rises and outlay also rises this case is known as elasticity of demand having .... (less than unity/more than unity)

iii) If the number of possible uses of a commodity is greater, its price elasticity of demand will be ..... (lesser/greater)

iv) The government announce ceiling price .....

(to protect the consumer's interest/to earn profit)

v) The burden of indirect tax is borne partly by the consumer and ..... by the producer. (partly/wholly)

## 4.6 LET US SUM UP

The concept of elasticity of demand is the responsiveness of demand to a given change in an independent variable such as the price of the commodity in question, income of the consumer, price of a commodity related to the commodity in question.

Price elasticity of demand is the responsiveness of demand to a given proportional change in the price of the commodity. Income elasticity of demand is the responsiveness of the demand of the commodity to a given change in the income of the consumer. Price cross-elasticity of demand is the responsiveness of demand to a given change in the price of the commodity other than the commodity in question. The other commodity can be a substitute or a complement to the commodity in question. Normally, the co-efficient of price elasticity of demand is negative. But the co-efficient of income and price cross-elasticity of demand may be positive or negative.

Price elasticity of demand can be measured by the point method which is used whenever the changes in price and quantity demanded are very small. Outlay method is employed to determine the direction of price elasticity of demand which may be unity, more than unity or less than unity. Geometrical method is employed to find out price elasticity of demand at a given point on the demand curve. We can have a demand curve which may have the same price elasticity of demand throughout the demand curve. Such a curve is called 'Rectangular Hyperbola'. The nature of the commodity-necessity, comfort or luxury-the number of substitutes of the given commodity, the number of uses to which the commodity can be put and the price level of the

commodity are sources of the factors on which the price elasticity of demand of a commodity depends.

The concept of price elasticity of demand can be put to a number of uses. It helps the government to fix the support price or the ceiling price of a commodity. It can also help the monopolist to fix the price of the commodity. Further, it helps us to find out what share of an indirect tax will be borne by the consumer.

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## 4.7 KEY WORDS

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**Ceiling Price:** It is a price fixed up by the government for a commodity above which the price cannot rise.

**Complementary Commodity:** It is the commodity whose demand is directly related to the demand of the commodity in question.

**Dependent Variable:** A variable which changes only with the change in the independent variable.

**Elasticity of Demand:** It quantifies the relationship between the quantity demanded of commodity and the price of the commodity or income of the consumer or price of another commodity which is related to the commodity in question.

**Floor Price:** It is a price fixed up by the government for a commodity below which the price cannot fall.

**Income Elasticity of Demand:** It is the responsiveness of demand to a given proportional change in the income of the consumer.

**Independent Variable :** A variable which can change independently.

**Indirect Tax:** It is imposed by the government the incidence of which can be shifted to a person other than on whom is imposed.

**Monopolist:** A producer who controls the whole supply of a commodity.

**Outlay:** It is the total money spent on the purchase of a commodity at a given price.

**Cross-Elasticity of Demand:** It is the responsiveness of demand to a given proportional change in the price of the commodity related to the commodity in question

**Price Elasticity of Demand:** It is the responsiveness of demand to a given change in the price of the commodity.

**Rectangular Hyperbola:** It is a curve in which any rectangular drawn has the same

**Substitute Commodity:** It is the commodity whose demand is inversely related to the demand of the commodity in question.

## 4.8 ANSWERS TO CHECK YOUR PROGRESS

### Check your progress A

6. i) False, ii) False, iii) True, iv) False, v) False,  
vi) False, vii) True, viii) False.
8. i) False, ii) False, iii) False, iv) False,  
v) False, vi) False, vii) True, viii) True.
9. i) large, ii) less than unity, iii) greater,  
iv) to protect the consumer's interest. v) partly.

## 4.9 TERMINAL QUESTIONS

- 1) Explain the concept of price elasticity of demand, income elasticity of demand and price cross-elasticity of demand.
- 2) Discuss the outlay method to find out price elasticity of demand.
- 3) Explain the case of unitary elastic demand curve.
- 4) Explain the cross-elasticity of demand of a substitute and a complement.
- 5) What are the main determinants of price elasticity of demand?
- 6) Explain some uses of the concept of price elasticity of demand.

**Note: These questions will help you to understand the unit better. Try to write answers for them. But do not submit your answers to the University. These are for your practice only.**

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## **UNIT 5      LAW OF SUPPLY AND ELASTICITY OF SUPPLY**

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### **Structure**

- 5.0 Objectives
- 5.1 Introduction
- 5.2 The Concept of Supply
- 5.3 The Law of Supply
  - 5.3.1 The Supply Function
  - 5.3.2 The Supply Schedule
  - 5.3.3 The Supply Curve
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- 5.4 Changes in Supply versus Changes in Quantity Supplied
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- 5.5 Elasticity of Supply
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  - 5.5.2 Supply Curves with Different Elasticities of Supply
  - 5.5.3 Determinants of Elasticity of Supply
- 5.6 Let Us Sum Up
- 5.7 Key Words
- 5.8 Answers to Check Your Progress
- 5.9 Terminal Questions

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### **5.0 OBJECTIVES**

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After studying this unit, you should be able to:

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

## 5.1 INTRODUCTION

In the previous unit you have learnt the effect of increase in inputs to total production. In this unit you will study how does a producer respond to production of a commodity with a given increase in price of that commodity. You will also learn the law of supply, supply function, supply schedule and supply curve. You will also be acquainted with the various determinants of supply of a commodity and the concept of elasticity of supply and its determinants.

## 5.2 THE CONCEPT OF SUPPLY

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

- 1) The supply of a commodity is stated in quantitative terms as the desired quantities.
- 2) The supply of a commodity is always with reference to the price at which the desired quantity is supplied. For example, to say that producers of blankets are supplying one thousand blankets does not carry any economic meaning. At the same time, if it is stated that producers supply one thousand blankets at a price of Rs 500 per blanket, “supply” will start conveying economic meaning.
- 3) The supply is always measured as a flow or expressed with reference to a unit of time which may be a day, a week, a fortnight, a month, or a year or any other period of time.

Let us take an example. Consider the statement: “Producers supplied 1,000 blankets at a rate of Rs 500 per blanket during December 2020”. This statement mentions the quantity supplied, the price per unit at which the quantity is supplied and also the period during which the quantity is supplied. So, it is a complete statement about the supply of a commodity.

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

**Table 5.1 : Differences between Concept of ‘Stock’ and ‘Supply’**

Stock	Supply
1. It implies the volume of a commodity which can be brought into the market for sale at short notice (i.e. ‘Stock’ is a potential supply).	It implies the quantity of a commodity which is actually brought into the market for sale.
2. The stock or inventories of a commodity include:	Market sale of the commodity is only a part of the total stock.

<p>a) unsold quantity of the previous period,</p> <p>b) excess of present production of the commodity over its present sale.</p>	
<p>3. The stock of a commodity depends mainly upon:</p> <p>a) the production of the commodity</p> <p>b) the procurement price of the commodity,</p> <p>c) the storage and transport costs, etc.</p>	<p>The supply of a commodity depends mainly upon the market price of that commodity.</p>
<p>4. The concept of 'stock' has no time dimension (i.e. we do not say: stock of any commodity per week or month, etc.)</p>	<p>The concept of 'supply' has a time dimension, (i.e. we usually say, the supply of a commodity per day, per week, per month, etc.)</p>
<p>5. In the case of highly perishable commodities, the 'stock' and 'supply' would almost be the same (since these items cannot be stored for a long period)</p>	<p>In the case of durable commodities, supply consists of only a part of the total stock.</p>
<p>6. The stock or inventories enable a firm to meet (temporary) an unexpected rise in market demand for the product or a sudden fall in its production</p>	<p>The supply or the actual market sale enables the firm to earn sales revenue.</p>
<p>7. The stock of any commodity helps in checking severe fluctuations of market price (say, a steep fall in the price of potatoes during a bumper crop, or a steep rise in its price during crop-failure)</p>	<p>The changes in quantity supplied during any particular period, however, depend on the fluctuations in the market price of that commodity.</p>

### Determinants of Supply

There are a number of factors which influence the supply of a commodity. It is difficult for us to analyse the effect of a simultaneous change in all the factors which influence the supply of a commodity. Therefore, normally, we think of a situation where one of the factors influencing supply changes, assuming other factors as unchanged, and then work out the effect of a change in that factor on the quantity of the commodity supplied by a producer or a group of producers. It is the same approach which was adopted in unit 3 when the law of demand was discussed where the quantity demanded of a commodity was taken to be dependent on the price of that commodity, other factors influencing demand were assumed as unchanged. Some of the important factors influencing supply or quantity supplied of a commodity can be identified as follows:

- 1) **Price of the commodity supplied:** The price of a commodity is determined by the forces of demand and supply. Any change in the price of a commodity exerts an influence on the supply of that commodity. Generally speaking, the higher the price of the commodity, the more profitable will it be to produce or supply that commodity, other things remaining unchanged. The direct relationship between price and supply of a commodity is also referred to as the 'Law of Supply'.

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

- 2) A change in the price of one factor of production will cause changes in the relative profitability of producing different commodities. This will cause producers to shift from the production of one commodity to another, and thus cause changes in the supplies of different commodities. For example, a fall in the price of land will have a larger effect on cost of production of an agricultural product and only a very small effect on the costs of producing, say televisions. In other words, cost of production and supply of that commodity will be influenced more with a change in the price of a factor of production which uses relatively more of that factor whose price has changed in relation to other factors of production.

**Price of other goods:** Other things remaining unchanged, the supply and production of a commodity will fall as the prices of other commodities rise and vice versa. This happens because normally a producer chooses that commodity for production which earns him the highest profit. For example, a producer chooses to produce, say television sets, because he can earn more profits in this line of production than in the production of any other goods. Now suppose the price of air conditioners goes up in the market. It may now be more profitable to produce air conditioners as compared to the television sets. It encourages the producer to gradually reduce the production of television sets and increase the production of air conditioners. So, a rise in the price of air conditioners tends to reduce the production and supply of television sets.

- 1) **The state of technology:** The state of knowledge changes over time and along with that the methods employed to produce a commodity also undergo a change. The increase in the knowledge about the means of production and the methods of production lead to lower costs of production of products already being produced and to a large variety of new products. For example, the electronics industry rests upon transistors which have revolutionized - production and supply of televisions along with other electronic equipments like computers. Thus, as knowledge improved supply of different commodities, in which the newer knowledge gets embodied through newer technologies, also increases.
- 2) **Goal of the producer:** The objective with which the producer undertakes production also influences the supply of the commodity. The

goal of the producer may be to maximize total profits or to maximize sales or to capture the market in the long run.

If a producer wants to earn maximum profits, he will plan to produce that quantity of output which gives him the maximum profit. It does not imply that he cannot produce more but he will not do so because producing more may reduce his profit. Now suppose that the goal of the producer is to maximize sales rather than profits. In that situation he may set a target of less than maximum profits in the short run. He will go on increasing his supply as long as his target is not adversely affected. The goal of maximization of sales is promoted by the desire of the firm to maximize profits in the long run. Similarly, if producers are reluctant to take risks, we would expect smaller production and supply of any commodity which carries more risk.

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

### 5.3 THE LAW OF SUPPLY

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

PROFIT	
= TR – TC	(1)
TR = Q. P	(2)
TC = Q.AC	(3)

A higher price would mean more profits, provided there is no change in other factors influencing the supply. Therefore, a producer will be willing to supply more if he expects to get a higher price for his product. Similarly, a producer will be willing to supply less if he expects to get a lower price for his product. So, we observe a direct relationship between the price and the quantity supplied of a commodity. This direct relationship between price and supply of a product is referred to as the 'Law of Supply'. **The law states that as the price of a commodity increases, the quantity supplied, per unit of time, of that commodity also increases and vice versa, assuming all other factors influencing supply remain constant. The law of supply holds good only on the assumption 'other factors remaining constant.'** In this direct relationship between the price and the supply of a commodity, the change in supply is caused by the change in price such that change in price is the cause and change in supply is the effect. We can state the same thing differently by saying that price is taken as an independent variable while supply is taken to



be a dependent variable. It is important to understand that the statement “Price rise leads to supply rise” is true and the statement that “Supply rise leads to price rise” is false.

### 5.3.1 The Supply Function

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

$Q_s = f(P_1, P_2, P_3, \dots, P_n, F_1, \dots, F_n, T, O, OF)$  where  $Q_s$  stands for the supply of commodity,  $P_1$  is the price of that commodity,  $P_2, P_3, \dots, P_n$  are the prices of all other commodities,  $F_1, \dots, F_n$  are the prices of all factors of production.  $T$  is the state of technology,  $O$  is the objective of the producer and  $OF$  stands for other factors influencing supply.

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

### 5.3.2 The Supply Schedule

A supply schedule shows different prices of a commodity and the quantities which a producer is willing to supply, per unit of time, at each price, assuming other factors influencing the supply to be constant. A supply schedule of a product based on imaginary data is given in Table 5.2 illustrating the relationship between price and quantity supplied as given by the law of supply.

**Table 5.2: A Supply Schedule of a Pen Producer**

Price (in Rs.) per pen	Quantity Supplied (in thousand) per month
2	25
3	40
4	50
5	60
6	70

The schedule presented in Table 5.2 shows that at a price of Rs 2 per pen the producer is willing to supply 25 thousand pens per month. And at a higher price of Rs 3 per pen he is willing to supply 40 thousand pens per month and as price of pens keep rising he is willing to supply more and more quantity of pens per month as shown in the supply schedule. This supply schedule has

been so drawn as to depict a direct relationship between price per pen and quantity supplied of pens per month.

### 5.3.3 The Supply Curve

Look at Figure 5.1, where the data from Table 5.2 has been plotted. Here price is plotted on the Y-axis and quantity supplied on X-axis.

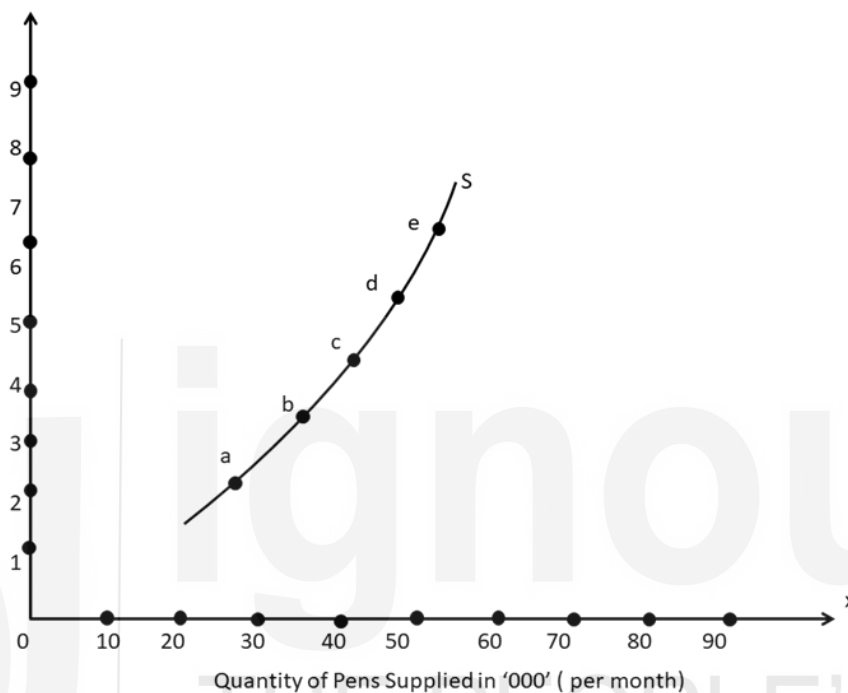


Figure 5.1: Supply Curve

The graph shows that point labelled a, for example, gives the same information that is given on the first row of the table; when the price of pens is Rs 2 per pen, 25,000 pens will be produced and offered for sale per month. Similarly, points b, c, d, and e on the graph correspond to row 3rd, 4th, 5th and 6th of table 5.1 respectively. The supply curve S is a smooth curve drawn through the five points a, b, c, d and e. This curve shows the quantity of pens that will be produced and offered for sale at each price.

In short, the supply curve for a product depicts the direct relation between the price of that commodity and the quantity producers wish to produce or sell at that price. This curve is drawn on the assumption that all other factors (other than the price of the product) that influence supply are constant (i.e. they remain unchanged). The upward slope of the supply curve indicates that the higher the price, the greater the quantity producers will supply. If the supply curve is extended to the Y-axis, it may or may not pass through O. If it passes through O, it shows that the quantity supplied is zero at zero price; if it does not pass through zero, it shows that unless the price 'rises upto a point, (indicated by a point not shown in the Figure 5.1 at which supply curve cuts the Y-axis) quantity supplied will remain zero. The upward sloping supply curve is just a diagrammatic representation of the law of supply.

### 5.3.4 Exceptions to the Law of Supply

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

1. **Non-maximisation of profits:** In some cases, the enterprise may not be pursuing the goal of maximisation of profits. In that case, the quantity supplied may increase even when price does not rise. For example, if the firm wants to maximise sales even if price remains unchanged, it may like to increase sales so that total revenue can be increased. Sometimes, the firm may be interested to maximise profits in the long run; in the short run, it may pursue some other goals. Similarly, if a firm is controlling a number of companies, it is the profits of all companies taken together which may be sought to be maximised so that for different products produced, the law of supply may not apply for each product.
2. **Factors other than price not remaining constant:** The law of supply was stated on the assumption that factors other than the price of the commodity remain constant. In reality, we notice that factors other than the price of the product may not remain constant. For example, the quantity supplied of a commodity may fall at a given price if prices of other commodities show a tendency to rise. The change in the state of technology can also bring about a change in the quantity supplied of a commodity even if the price of that commodity does not undergo a change.

#### Check Your Progress A

- 1) Fill in the blanks:
  - i) Producers supply more at a..... price than at a..... price,
  - ii) A supply curve is..... sloping.
  - iii) A supply schedule relates..... of a commodity to its..... offered for sale during the specific period of time.
  - iv) A supply curve relates..... of a commodity to the..... offered for sale during a particular period of time.
  - v) If price of a commodity..... the profit from its sale will fall, other things remaining unchanged.
  - vi) The law of supply states that the price of a commodity and its quantity supplied are..... related other things remaining unchanged.
- 2) State whether the following statements are **True** or **False**.
  - i) The law of supply states that there exists a relationship between supply of a commodity and its price.
  - ii) The law of supply states that there exists direct relationship between the price of a commodity and its quantity supplied per unit of time, other things remaining constant.

- iii) Supply refers to the quantity of a commodity offered for sale.
  - iv) Supply refers to the quantity of a commodity offered for sale at a price during a specific period of time.
  - v) Technological development in a particular field of production is likely to increase cost of production.
  - vi) New method of organizing an existing productive activity is not a technological development.
  - vii) The supply is a stock concept.
  - viii) Profit maximization can be the only objective of every firm.
- 3) What is the law of supply?
- .....
- .....
- .....
- .....
- .....
- .....
- .....
- 4) Define supply schedule and supply curve.
- .....
- .....
- .....
- .....
- .....

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## 5.4 CHANGES IN SUPPLY VERSUS CHANGES IN QUANTITY SUPPLIED

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In sections 5.2 and 5.3 of this unit, the factors influencing supply have been broadly divided into two categories: (a) the price of the commodity in question whose supply is being considered and (b) factors other than the price of the commodity. Based on this distinction between factors, we have another distinction namely, changes in quantity supplied and changes in supply. If the price of a commodity changes and there is a corresponding change in production or amount offered for sale, we call this change in quantity supplied. Similarly, if production of a commodity undergoes a change because of factors other than the price of the commodity, we call this change in supply.

### 5.4.1 Changes in Quantity Supplied

When the amount offered for sale changes on account of a change in the price of the commodity only, assuming all other factors to be constant, it is termed

as changes in quantity supplied. The changes in quantity supplied can be of two types.

- 1) When the price of a commodity falls and its quantity supplied falls provided the law of supply applies; it is termed as “**Contraction of Supply**”
- 2) When the price of a commodity rises and its quantity supplied rises, provided the law of supply applies, it is termed as “**Extension of Supply**”.

The ‘Contraction’ and ‘Extension’ of supply has been shown in the Figure 5.2.

X-axis quantity of pens supplied are measured and on Y-axis price per pen is measured. S curve is the required supply curve. Start with point a on the supply curve at which price per pen is Rs 3 and quantity supplied is 30,000 pens. As price per pen falls to Rs 2 the quantity supplied falls to 20,000 and when price of pen rises to Rs 4, the quantity supplied rises to 40,000. The fall in quantity supplied from 30,000 to 20,000 with the fall in price, from Rs 3 to Rs 2 is termed as “**Contraction of Supply**”. On the graph it is the movement from a to c on the supply curve which represents ‘**Contraction of Supply**’. Similarly, the movement from a to b on the supply curve represents ‘**Extension of Supply**’, since it implies that the quantity supplied rises from 30,000 to 40,000 with the rise in price from Rs 3 to Rs 4. Thus, changes in quantity supplied are the result of only changes in the price of the commodity in question, other things remaining unchanged.

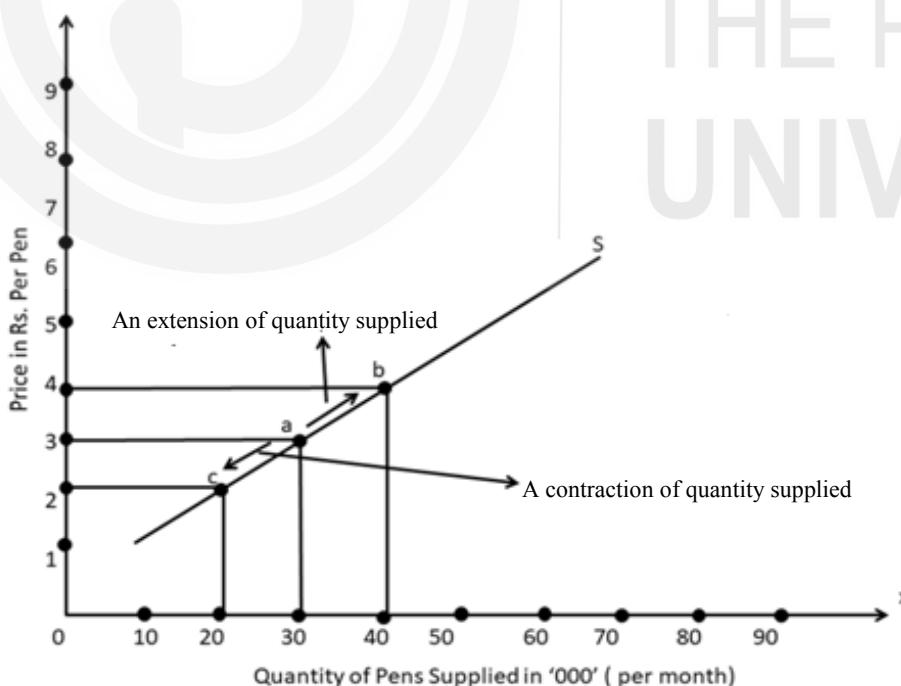


Figure 5.2 : Changes in Quantity Supplied

## 5.4.2 Changes in Supply

A change in supply means that at each price, a different quantity of a commodity will be supplied than previously. Changes in supply can be two types:

- 1) **A Decrease in Supply:** When the quantity of a commodity supplied falls, at the same price, it is referred to as a 'Decrease in Supply' which if represented in the form of a curve, implies a leftward shift of the supply curve.
- 2) **An Increase in Supply:** When the quantity of a commodity supplied increases, at the same price, it is known as an 'Increase in Supply' which amounts to a rightward shift in the supply curve.

Both types of changes in supply are shown in Fig. 5.3. In this diagram, it can be seen that as we move from point a on S curve to a' at price Rs 3, supply or quantity supplied falls from 30,000 to 20,000. Similarly, at Rs 2 price at point c on S-curve, supply was 20,000 which falls to 10,000 at point c'.

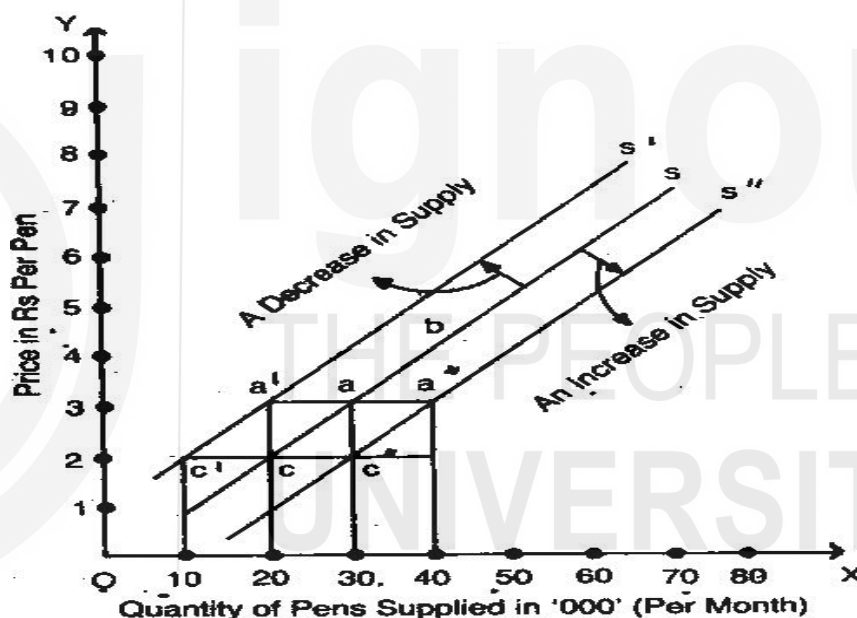


Figure 5.3 : Shifts in Supply Curve

So, if points like c', a' are joined a new supply curve labelled S' can be drawn. This shift in curve from S to S' is referred to as a '**Decrease in Supply**'.

Instead if we move from point a on S-curve to point a'', we get increase in supply from 30,000 to 40,000 at Rs 3 price. At price Rs 2, the supply increases from 20,000 to 30,000 as we move from point c to c'. If points like c'' and a'' are joined, a new supply curve S'' is arrived. The shift in supply curve from S to S'' is referred to as an '**Increase in Supply**'.

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

### 5.4.3 Why Supply Curve Shifts?

The reasons for 'Contraction' and 'Extension of supply' have already been analysed in section 5.4.1 of this unit. The reasons for the changes in supply (both increase and decrease in supply) can be stated as follows:

- 1) **Change in the prices of other commodities:** A decrease in the prices of other commodities increases the supply of the commodity in question at each price because relatively profits by supplying other products fall. An increase in the prices of other commodities decreases the supply of the commodity in question at each price.
- 2) **Change in the prices of factors of production:** An increase in the prices of factors of production used in producing the commodity tends to reduce the supply of the commodity at each price, since the cost of production rises and at the given price, profits fall. Conversely, a decrease in the prices of factors of production used in making a commodity leads to an increase in supply, at each price.
- 3) **Change in technology:** An improvement in technology normally leads to a fall in cost of production and given the price of the product, a producer tends to produce more of that commodity, at each price. Conversely loss in technical knowledge (the chances of which are meagre) will lead to a fall in supply, at each price.
- 4) **Change or expectation of change in other factors:** Sometimes, supply of a commodity may change because of the change in government policies relating to taxes or rate of interest or because of fear of war or because of changing inequalities of income and wealth which influence the demand of particular types of goods and hence making it more or less profitable to produce that commodity. Accordingly, if producers expect more profits because of change in other factors, supply increases at each price. Conversely, if producers expect less profits because of change in other factors, supply decreases at each price.

#### Check Your Progress B

- 1) State whether the following statements are **True** or **False**.
  - i) An 'extension of supply' means that at a given price, more is supplied.
  - ii) An increase' and 'extension of supply are one and the same thing.
  - iii) The quantity supplied changes because of change in technology.
  - iv) The supply increases because of a fall in price of the commodity.
  - v) A movement along the supply curve shows the operation of the law of supply.
  - vi) A shift in the supply curve leftwards indicates an increase in supply.
  - vii) A supply curve shifts because of factors other than the price of a commodity.

## 2) Distinguish between Extension of Supply and Increase of Supply.

.....

.....

.....

.....

.....

.....

.....

## 5.5 ELASTICITY OF SUPPLY

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

### 5.5.1 Concept and Measurement

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

$$E_s = \frac{\text{Percentage change in quantity supplied of commodity}}{\text{Percentage change in price of the commodity}}$$

$$= \frac{\frac{\text{Change in quantity supplied}}{\text{Original Supply}} \times 100}{\frac{\text{Change in Price}}{\text{Original Price}} \times 100}$$

$$\frac{\frac{\Delta S}{S} \times 100}{\frac{\Delta P}{P} \times 100}$$

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

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

Where S and P are the original quantity supplied and price respectively and  $\Delta S$  and  $\Delta P$  are the change in quantity supplied and change in price.



The method of measurement of the elasticity of supply can be illustrated with the help of an example from table 5.1. The price of pen rises from Rs2 to Rs 3 and the quantity supplied of pens rises from 25,000 to 40,000. Using the formula to measure elasticity of supply it is equal to 1.2 as shown below:

$$\begin{aligned}
 E_s &= \frac{\Delta s}{\Delta P} \times \frac{P}{S} \\
 &= \frac{40,000-25,000}{3-2} \times \frac{2}{25,000} \\
 &= \frac{15,000}{1} \times \frac{2}{25,000} = \frac{30}{25} = \frac{6}{5} = 1.2
 \end{aligned}$$

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

$E_s = \infty$  is a case of perfectly elastic supply.

### 5.5.2 Supply Curves with Different Elasticity of Supply

Look at Figure 5.4 which shows five cases of supply elasticity. The case of zero elasticity or perfectly inelastic supply is represented in Figure 5.4 (i) in which the quantity supplied does not change as price changes. This happens when producers insist on producing a given quantity irrespective of the price prevailing in the market. The case of infinity elasticity or  $E_s=\infty$  is illustrated in Figure 5.4 (ii), where at price P the producers are prepared to supply as much as the market demands and nothing at all is supplied at a price less than OP. A small increase in price to OP leads to supply rising from zero to an infinity.

The case of unit elasticity of supply is shown in Figure 5.4 (iii). Any straight line supply curve passing through the origin has an elasticity of supply equal to unity. This can be easily proved. Consider two triangles with sides A Q and A P and OQ and QP. They are similar and therefore the ratio of sides is equal i.e.,

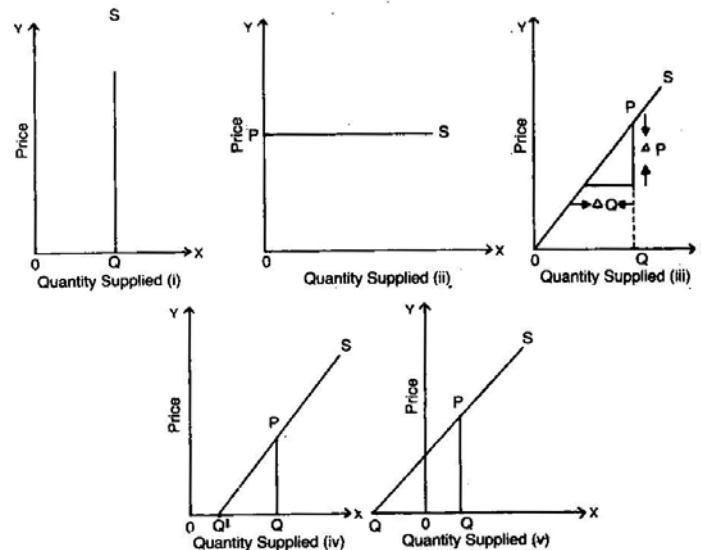


Figure 5.4 : Supply Curves with Different Elasticities of Supply

$$\frac{QP}{\Delta P} = \frac{OQ}{\Delta Q}$$

Or

$$\frac{\Delta Q}{\Delta P} = \frac{OQ}{QP}$$

Elasticity of supply given in section 5.5.1 of this units is

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

In terms of figure 5.4 (iii) elasticity of supply can be put as

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

Substituting  $\frac{\Delta Q}{\Delta P}$  by  $\frac{OQ}{QP}$  as given in (i) we have

$$= \frac{OQ}{QP} \times \frac{QP}{OQ} = 1$$

Figure 5.4 (iv) illustrates the case of elasticity of supply as being inelastic or less than unity. At point P,

$$Es = \frac{Q'Q}{PQ} \times \frac{PQ}{OQ}$$

$$= \frac{Q'Q}{OQ} \text{ or } < 1 \text{ Since, } Q'Q < OQ$$

Figure 5.4(v) illustrates the case of elasticity of supply as being elastic or more than unity. At point P  $E_s$  is

$$= \frac{Q'Q}{PQ} \times \frac{PQ}{OQ}$$

$$= \frac{Q'Q}{OQ} \text{ or } > 1 \text{ since, } Q'Q > OQ$$

Here, if a straight line supply curve from through the quantity axis, the elasticity of supply is less unit. On the other hand, if a straight line supply curve passes through the price axis, the elasticity of supply is more than unit. And if a straight line supply curve passes through the origin, the elasticity of supply is equal to unity. If the supply curve is not a straight line, it is a curvilinear supply curve in that case what we do to find out elasticity of supply at a particular point on the supply curve in the draw a tangent to the supply curve at the point and see whether the tangent passes through the origin or quantity axis or price axis. This is shown in figure 5.5.

In figure 5.5,  $s$  is the curvilinear supply curve and we are interested to find out the elasticity of supply at point P. If the segment the supply curve passes through quantity x-axis, the elasticity of supply is less than unity. In the diagram, tangent to the supply curve at point P actually passes through the origin and so it has that elasticity of supply equal to unity.

### BRAIN TEASERS

1. If the quantity supplied increases by 15 per cent in response to a 15 per cent increase in price, what is the nature of elasticity of supply?

**Ans.** The supply of the commodity would be said to be unit elastic. This can be worked out as follows:

$E_s = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$
---

$$= \frac{15\%}{15\%} = 1$$

2. If the supply elasticity coefficient is 3, what does it indicate?

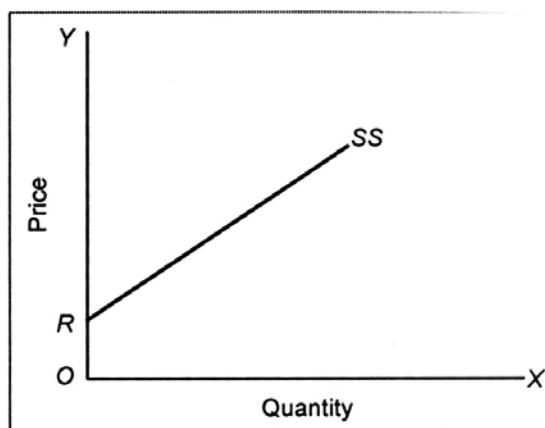
**Ans** It indicates that 1 per cent increase in price will result in a 3 per cent increase in quantity supplied.

3. If in response to a 10 per cent increase in price, quantity supplied increase by 15 per cent, what shall be the elasticity coefficient?

**Ans.** The elasticity coefficient will be  $15/10 = 1.5$ .

4. Show diagrammatically the concept of reserve price.

**Ans.** Reserve price is the minimum floor price below which the producer does not offer any quantity for sale. In Fig. OR is the reserve price.



5. When the price of a doll is Rs. 4, a doll maker supplies 8 dolls per day. If the price rises to Rs.5 per doll, he is willing to supply 10 dolls per day. Calculate the price elasticity of supply of dolls.

**Ans.**

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

Putting the given values, we get

$$E_s = \frac{2}{1} \times \frac{4}{8} = 1$$

The price elasticity of supply of dolls is unit elastic, i.e. a 25 per cent increase in price will result in a 25 per cent increase in quantity supplied.

6. A seller of potatoes sells 80 quintals a day when the price of potatoes is Rs. 4 per kg. The elasticity of supply of potatoes is known as be 2. How much quantity will this seller supply when the price rises to Rs.5 per kg?

**Ans.**

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

Putting the given values, we get

$$= \frac{2X}{1} \times \frac{4}{80}$$

$$= 0$$

$$2 = \frac{4X}{80}$$

or  $4X = 80 \times 2 = 160$

$$X = 160/4 = 40$$

i.e. the value of  $\Delta Q$  is 40. Since the price has increased, the quantity supplied will increase by 40 units. The new quantity supplied will be  $80 + 40 = 120$  quintals.

7. Price elasticity of supply of a good is Rs.5. A producer sells 500 units of this good at Rs. 5 per unit. How much will he be willing to sell at the price of Rs. 6 per unit?

**Ans.**

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

Given

$$= \frac{5X}{1} \cdot \frac{5}{500}$$

We have to find the value of  $\Delta Q$  (or  $X$ )

Solving for  $X$ , we get

$$500 \times 5 = 5X$$

$$\therefore X = 500$$

At Rs. 6, the producer would be willing to sell  $500 + 500 = 1000$  units.

8. The price elasticity of supply of a commodity is 2.5. At a price of Rs. 5 per unit, its quantity supplied is 300 units. Calculate its quantity supplied at a price of Rs. 4 per unit.

**Ans.**

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

Putting the values, we get

$$2.5 = \frac{\Delta Q}{-1} \times \frac{5}{300}$$

$$= 0$$

Let  $\Delta Q = x - 300$ .

Then,

$$2.5 = \frac{X-300}{-1} \times \frac{5}{300}$$

Rearranging, we get

Solving, we get

$$150 = \frac{X-300}{-1}$$

$$-150 = x - 300$$

$$X = -150 + 300 = 150$$

Quantity supplied = 150 units

9. At a price of ` Rs.8 per unit, the quantity supplied of a commodity is 200 units. Its price elasticity of supply is 1.5. If its price rises to Rs. 10 per unit, calculate the quantity supplied at the new price.

Ans. Let

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

Given

$$1.5 = \frac{8}{200} \times \frac{\Delta Q}{2}$$

Let  $\Delta Q = X - 200$

Then,

$$1.5 = \frac{8}{200} \times \frac{X - 200}{2}$$

Or

$$1.5 = \frac{x - 200}{50}$$

$$1.5 \times 50 = x - 200$$

or

$$75 + 200 = X$$

$$X = 275$$

The quantity supplied is 275 units.

Hence,

- (i) If a straight line supply curve passes through the quantity axis, the elasticity of supply is less than unity.
- (ii) If a straight line supply curve passes through the price axis, the elasticity of supply is more than unity.
- (iii) If a straight supply curve passes through the origin, the elasticity of supply is equal to unity.

### ELASTICITY OF SUPPLY ON A LINEAR CURVE

If supply curve is not a straight line, it is a curvilinear supply curve, in that case what we do to find out elasticity of supply at a particular point on the supply curve is to draw a tangent to the supply curve at the point and see whether the tangent passes through the origin or quantity axis or price axis. This is shown in Figure 5.5.

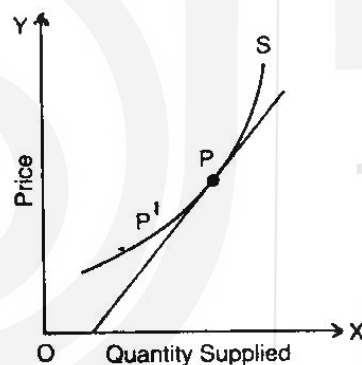
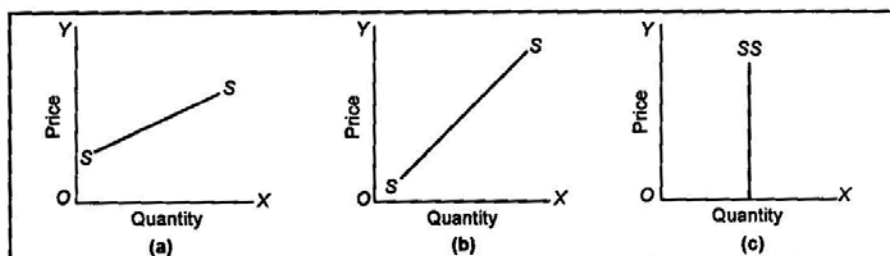


Figure 5.5 : Curvilinear Supply Curve

In Figure 5.5 S is the curvilinear supply curve and we want to find out the elasticity of supply at point P. If the tangent to the supply curve passes through quantity X-axis, the elasticity of supply is less than unity. In the diagram tangent to the supply curve at point P actually passes through the origin and so has the elasticity of supply equal to unity.

Q.1. Which of the following figures represents an equal to unit elastic supply?

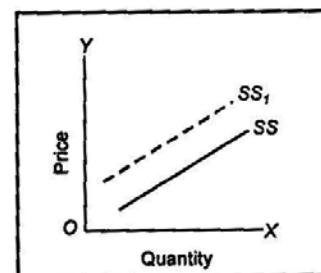


**Fig. 1**

**Ans.** Fig. 1 (b)

Q.2. Due to heavy rainfall and consequent landslides, transportation of apples from Kashmir to Delhi gets disrupted. Show the situation with the help of a supply curve.

**Ans.** Supply of apples will decrease. Supply curve will shift to the left as in Fig. 2



**Fig. 2**

Q.3. Give reasons for the following:

- (i) Variable factor proportions obtain in the short-run.
- (ii) Fixed factor proportions obtain in the long-run.

**Ans. (i)** Short-run is a period of time in which some factors are variable, and at least one factor is fixed. The level of output in a firm can be increased only by increasing the quantity of variable factors. The quantity of fixed input remains unchanged at different levels. Therefore, when variable factors are increased, whereas the quantity of fixed factor remains unchanged, the proportions between variable factors and fixed factors get changed. These are known as Variable factor proportions.

(ii) In the long-run, all the factors become variable. Therefore, when the scale of production of a firm is increased, quantity of the factors is increased in a given proportion. These are known as Fixed factor proportions.

Q.4. State with reasons if the following statements are true or false:

- (i) When the quantity of a variable input is increased from 3 units to 4 units, the total output increases from 70 units to 85 units. The marginal product of the variable input is 15 units.
- (ii) When the quantity of a variable input is increased from 4 to 6 units, the total output increases from 85 units to 105 units. The marginal product of the variable input is 20 units.
- (iii) When the marginal product of a variable input falls, total product also falls.

**Ans. (i)** *True:* Marginal product of a variable input in addition to total output due to one unit increase in variable input.

(ii) *False:* Marginal product is addition to total output due to one unit



increase in variable input. Here, total output increases by 20 units due to two units increase in variable input. Hence, marginal product is  $20/2 = 10$  units.

(iii) *False*: Total product is defined as:

$TP = MP_1 + MP_2 + \dots + MP_N$ . Thus, as long as MP is more than zero, TP keeps rising, although MP maybe diminishing.

Q.5. Giving reasons, state whether the following statements are true or false:

- (i) If marginal product rises, average product must also rise.
- (ii) If marginal product falls, average product must also fall.
- (iii) If marginal product becomes negative, average product must also become negative.

- Ans.**
- (i) *True*: Rising marginal product implies that the total product increases at an increasing rate. This pulls up the average product also.
  - (ii) *False*: There may be an intermediate stage when the marginal product may be falling, the average product keep rising. This occurs when the fixed inputs are better utilized.
  - (iii) *False*: Marginal product can be negative, but the average product can never be negative, because total product will always be a finite quantity.

Q.6. Give reasons for the following:

- (i) Even when marginal product falls, total product keeps rising.
- (ii) Total product is maximum when marginal product is zero.
- (iii) Total product begins to fall when marginal product becomes negative.

**Ans.** The reason for all (i), (ii) and (iii) is in the definition of total product (TP).

TP is the sum total of  $MP_1 + MP_2 + \dots + MP_N$ .

Q.7. Give reasons for the following:

- (i) Average Fixed Cost Curve is a Rectangular Hyperbola.
- (ii) Marginal Cost Curve is a U-shaped curve.
- (iii) While MC rises, AC can be falling for some range.

**Ans.**

- (i) Average fixed cost is defined as  $TFC \div TP$ . Total Fixed Cost is the sum total of expenses incurred on fixed inputs during the process of production. The quantity of fixed inputs remains the same at different levels of output. Hence, the TFC remains the

same at different levels of output. AFC, therefore, continuously falls as the level of output increases.

- (ii) The shape of marginal cost curve is determined by the law of variable proportions which gives us an inverted-U shape of the marginal product curve. MC curve is the mirror image of the MP curve.
- (iii) MC rises while AC may continue to fall in the range when the rate of fall in average fixed cost is more than the rate of increase in average variable cost.

Q.8. Give reasons for the following:

- (i) Demand curve displaying a perfectly competitive firm is a horizontal straight line.
- (ii) Demand curve displaying a monopolistic competitive firm is a downward sloping curve.
- (iii) Demand curve displaying a monopoly firm is less elastic than that curve facing a monopolistic competitive firm.

- Ans.**
- (i) Under perfect competition, every firm is a price-taker firm. The price is set by industry demand and supply. Therefore, every firm faces a horizontal straight line demand curve indicating that it can sell any quantity at the given price.
  - (ii) A monopolistic competitive firm has to design its own pricing strategy. It can expect to sell larger quantity at a lower price, and vice-versa. Hence, its demand curve slopes downwards.
  - (iii) A monopolist is the only producer of a good which has no near substitutes. A monopolistic competitive firm, on the other hand, produces a good that has several close substitutes. Hence, the demand curve facing a monopolistic competitive firm is more elastic than that faced by a monopoly firm.

### 5.5.3 Determinants of Elasticity of Supply

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

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

increases, a rise in price which raises profits will bring about a large increase in quantity supplied and so, the supply will be more elastic.

- 2) **Nature of the commodity:** Commodities may be classified, based on their nature, into (i) perishable and (ii) durable. Perishable products cannot be stored and thus, their supply does not respond very much to the change in their prices. So, supply of perishable products is inelastic. Durable products, on the other hand, can be stored and their supply responds to the change in their prices. The supply elasticity of durable products is relatively elastic.
- 3) **Time:** Supply of a commodity comes from its production which involves a time-lag. If the size of the plant is given and other adjustments in terms of technology etc., are not allowed, a producer cannot effectively respond to the change in price. Under such a situation i.e., in the short-run; supply of a commodity is less elastic. In the long run, when the size of the plant can be changed and technological changes are also allowed supply responds to the change in price and hence, elasticity of supply is more elastic or the supply curve becomes flatter.
- 4) **Price expectations:** Expectation of future prices also influences elasticity of supply. If the producers expect that prices in the future will not be allowed to fall below a particular level, they would not mind producing more. Further if, producers expect prices to rise in the future they may hold more stocks and may supply less quantity in the market. Supply in such a case will be inelastic. If the prices are expected to fall in the future, supply will be more elastic.
- 5) **Nature of techniques of production:** If techniques of production required to produce a commodity are simple, the producer responds to a rise in price and supplies more which makes supply more elastic. More complex and cumbersome the techniques of production required to produce a commodity, more difficult it will be for the supply to respond to rising price and, therefore, less elastic will be the supply.

### Check Your Progress C

- 1) What is elasticity of supply?

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.....

.....

- 2) List three important determinants of elasticity of supply?

.....

.....

.....

- 3) State whether the following statements are **True** or **False**.
- i) Elasticity of supply explains the reasons for the law of supply to apply.
  - ii) Elasticity of supply can be found out even if the law of supply does not apply.
  - iii) Elasticity of supply is the responsiveness of price to a given per cent change in quantity supplied.
  - iv) A case of elastic supply implies when a given per cent rise in price leads to the same percent rise in quantity supplied.
  - v) Perfectly elastic supply curve is parallel to Y-axis.
  - vi) Inelastic supply curve passes through the quantity axis.
  - vii) Elasticity of supply of a curvilinear supply curve is unity throughout the curve.
  - viii) Short run supply curve of a commodity is generally less elastic than the long run supply curve.

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## 5.6 LET US SUM UP

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

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

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

Elasticity of supply is the percentage change in amount supplied divided by the percentage change in price of the commodity. Elasticity of supply can be unity, more than unity or less than unity. In the case of perfectly inelastic supply, elasticity of supply is zero and in the case of perfectly elastic supply, elasticity of supply is infinity.

Perfectly inelastic supply curve is parallel to price axis. Perfectly elastic supply curve is parallel to quantity axis. The supply curve with unit elasticity of supply rises upwards passing through the origin. The supply curve with less than unity elasticity of supply rises upwards passing through the quantity axis. The supply curve with more than unity elasticity of supply rises upwards passing through the price axis. The elasticity of supply on a curvilinear supply curve is given by the tangent drawn on the supply curve at a point at which elasticity of supply is to be found. The determinants of elasticity of supply are the behaviour of costs as output varies, nature of the commodity, time, price expectations and nature of techniques of production.

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## 5.7 KEY WORDS

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**Change in Supply:** It is the change in quantity supplied at a given price.

**Change in Quantity Supplied:** It is the change in quantity supplied because of change in price of the commodity.

**Contraction in Supply:** The decrease in quantity supplied because of a fall in the price of the commodity.

**Curvilinear Supply Curve:** The supply curve which is not a straight line.

**Decrease in Supply:** The decrease in quantity supplied at a given price of the commodity.

**Elasticity of Supply:** The responsiveness of quantity supplied to a given percentage change in the price of the commodity.

**Elastic Supply:** The percentage change in quantity supplied is more than the percentage change in the price of the commodity.

**Extension in Supply:** The rise in quantity supplied due to a rise in the price of the commodity.

**Flow Variable:** Any variable measured over a period of time.

**Inequalities of Income:** The distribution of income among different income groups of an economy.

**Increase in Supply:** The rise in quantity supplied at a given price of the commodity.

**Inelastic Supply:** The percentage change in quantity supplied is less than the percentage change in the price of the commodity.

**Law of Supply:** It shows the direct relationship between the price of a commodity and its quantity supplied, other factors influencing supply (except price of the commodity) remaining constant.

**Perfectly Inelastic Supply:** The quantity supplied remains the same at different prices of the commodity.

**Supply:** Quantity of commodity that the sellers would be willing to sell at a price during a given period.

**Supply Function:** It is the functional relationship between different factors exercising influence on the quantity supplied.

**Supply Schedule:** A table having two columns, one showing different prices of the commodity and the other showing quantities supplied during a given period at each of these prices.

**Supply Curve:** A curve showing the relationship between price of a commodity and its quantity supplied during a given period, other factors influencing supply remaining unchanged.

**Technology:** The method employed to produce a commodity or service.

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## 5.8 ANSWERS TO CHECK YOUR PROGRESS

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### Check your progress A

1. i) higher, lower ii) upward iii) price, quantity iv) price, quantity, v) falls vi) directly
2. i) False ii) True iii) False iv) True v) False vi) False, vii) False viii) False

### Check your progress B

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

### Check your progress C

3. i) False ii) True iii) False iv) False v) False vi) True vii) False, viii) True

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## 5.9 TERMINAL QUESTIONS

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- 1) What is the meaning of the term 'Supply'? Answer with the help of an example.
- 2) Explain the various determinants of Supply of a commodity.
- 3) Explain the Law of Supply. Point out its exceptions.
- 4) Distinguish between 'Extension in supply' and 'Increase in supply'. Give examples.
- 5) Explain the significance of 'Movement along the Supply Curve' and distinguished it from 'Shift of the Supply Curve'.

- 6) Distinguish between Perfectly Elastic, Perfectly Inelastic, Unit Elastic, Inelastic and Elastic supply curves with the help of diagrams.
- 7) What are the main determinants of Elasticity of Supply of a Commodity?

**Note: These questions will help you to understand the unit better. Try to write answers for them. But do not submit your answers to the University. These are for your practice only.**



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## UNIT 6 APPLICATIONS OF DEMAND AND SUPPLY

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### Structure

- 6.0 Objectives
- 6.1 Introduction
- 6.2 Price Theory in action
- 6.3 Applying the concepts of demand, supply and elasticity
- 6.4 Government intervention
  - 6.4.1 Price ceiling
  - 6.4.2 Floor pricing
  - 6.4.3 Imposition of Taxes and subsidies
- 6.5 Pricing of Agricultural Commodities
- 6.6 Let Us Sum Up
- 6.7 Key Words
- 6.8 Answers to check your progress
- 6.9 Terminal Questions

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### 6.0 OBJECTIVES

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After studying this unit, you should be able to:

- Understand how price is determined using demand and supply and how with shift in demand and supply price also changes.
- Comprehend the application part of concept of demand, supply and elasticity.
- Discuss the government intervention in form of tools like price ceiling or price floors, imposing taxes etc. to reform the economy.
- Explain the determination of pricing of agricultural commodities.

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### 6.1 INTRODUCTION

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In the earlier unit, you covered various concepts of demand, supply, its determinants and reasons for shift and increase in demand and supply. In this unit we will understand the application of demand and supply in terms of determination of price, its applicability in market and usage of concepts like elasticity in daily life. This unit will cover the application of demand and supply for controlling the prices by government interventions in form of Price ceiling and floor pricing and imposition of tools like taxes and giving subsidies.

Application part of the demand and supply will also be explored in terms of determination of pricing of agricultural commodities.



## 6.2 PRICE THEORY IN ACTION

Rise or fall in price is affected to everyone whether he acts like producer or consumer. A consumer is keen to know if the goods and services he wants to purchase have become expensive or cheap and a producer is more concerned about price of products he produces and price of raw material he has used in production. Therefore, many renowned economist including Adam Smith, Marx, Marshall, Joan Robinson, Chamberlin and Hicks have devoted a lot of time in understanding how prices are determined and under what circumstances they are high or low.

While applying the pricing theory, two points to be taken into consideration are the shape of the demand and supply curve and the shift of the demand and supply curve along with the reason for shift and the effect of shift on the price.

In our example (figure 6.1), we take normal good like fresh curd and examine the effect on price and quantity of fresh curd with an increase in consumer income. The supply curve of fresh curd is shown as upward sloping to reflect the effect of diminishing returns and demand curve of the fresh curd is downward sloping reflecting Law of Demand. With increase in income there is rightward shift of the demand curve of fresh milk assuming it is normal good and hence shift results in increase in price and quantity of the product.

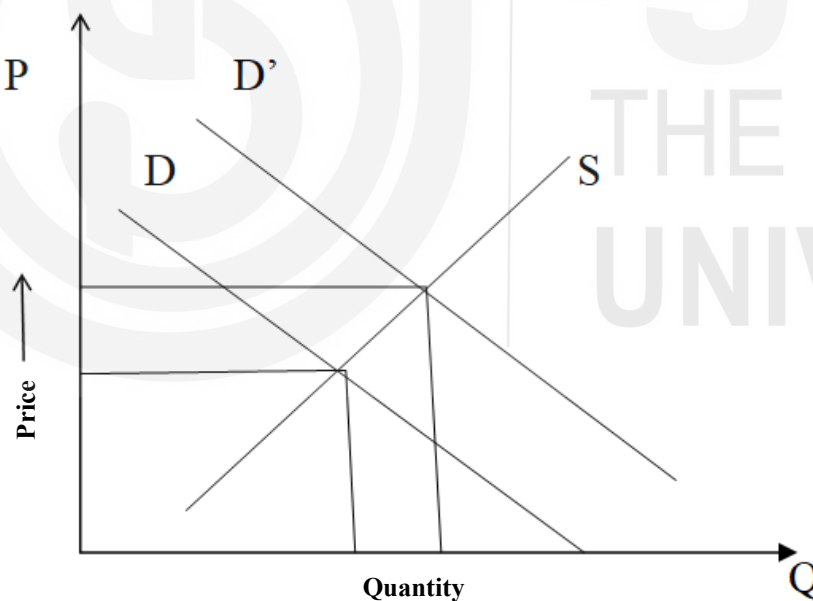
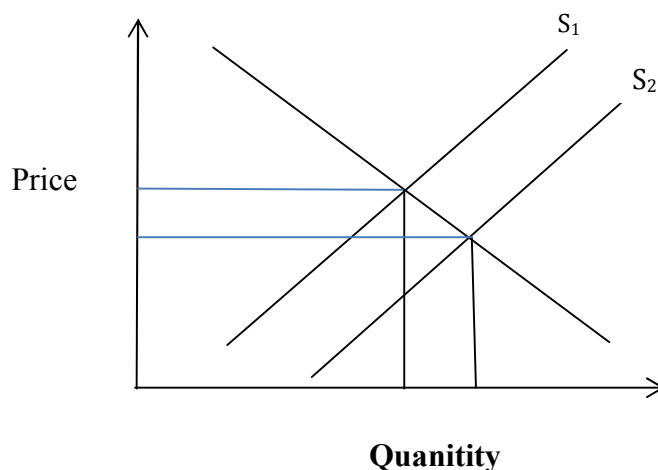


Figure 6. 1 – Shift in the Demand curve

With improvement in the technological capacity for extraction of fresh curd from the fresh milk, the cost of extraction reduces due to which, there is a downward shift in the supply curve. This results in new equilibrium being generated. With this new equilibrium, price falls and quantity increases.



**Figure 6.2 : Shift in Supply Curve**

The above explanation shows that the shape of the demand and supply curves is helpful in analyzing and determining price and quantity in most of the context. However, it is not always possible that demand curve, sloping downward, relevant to particular situation is always applicable in all situations and similarly supply curve sloping upward is always applicable in all situations. The shape of the demand curve may vary with producer or consumer, region or country wise.

### **Check your Progress A**

State the following statements are **True** or **False**

- i. Shape of demand and supply curve helps in analyzing and determining price and quantity.
- ii. Shape of demand curve always remains the same irrespective of the region or country.
- iii. Technological improvements lead to upward shift in the supply curve.
- iv. A consumer is interested to know about the price of the product while producer is concerned about price of raw material.

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## **6.3 APPLYING THE CONCEPTS OF DEMAND, SUPPLY AND ELASTICITY**

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In the previous units, we understood the concept of demand, supply and method of measuring elasticity and the types of elasticity that exist depending on the change in the determinants. In the coming section we study the application of demand, supply and elasticity in Business Decision making.

For instance, if the cost of production happening in factory is increasing, the production unit would like to pass on the burden of increase in cost on the price of the product so that it doesn't affect their profitability. However, whether the decision taken to pass the cost of production on final consumer proves to be beneficiary or not would depend on the price elasticity of

demand of the product and also price elasticity of demand for its substitutes. In other words, how demand of the product is changing in proportion to change in the price. And also by understanding how increase in price of a product has an effect on increase in demand of its substitutes even if its price has remained unchanged. Rise in the price will be of benefit only if demand of a product is less elastic and demand elasticity of substitutes is much less elastic.

To understand the application of elasticity in real world, we need to study various variables since it involves too many variables and these variables change all the time. Broadly these variables are classified into controllable and uncontrollable. Controllable products are those which are within control of the company like price of product, its advertisement expenditure, services provided and quality of the product offered. While uncontrollable are those which are beyond the control of organization and they can only base on estimates take the decisions. Let us take example of Bike Company. While estimating the demand function of its bike, following determinants of demand are taken into consideration –

- Price of Bike
- Consumer Income
- Price of substitute brands existing in market
- Advertisement expenditure

Out of the above four determinants price of bike and Advertisement expenditure are controllable factors. Suppose company as a policy decision decides to increase the bike price by 10% and advertisement expenditure by 20%. These decisions are made with the assumptions that there is increase in bike user's income by 8% per annum and no change in competitor's price. Therefore, we need to work on finding the price elasticity ( $E_p$ ), income elasticity ( $E_y$ ), advertisement elasticity ( $E_A$ ) and cross elasticity ( $E_s$ ) of demand for bike of that company.

The government decision for imposing taxes on products like alcohol, cigarettes and tobacco comes after studying the elasticity of these products. Such addictive products are price inelastic. Same kind of relationship tends to be for essential products. The detailed explanation of this is in next section of Government interferences in form of imposition of taxes.

Elasticity as concept is also applied to understand the effect of increase in price on the revenue. If demand for a good or service is price inelastic, then an increase in price will decrease sales but increase sales revenue. However, a price cut will increase both sales but decrease sales revenue.

Firms like the demand for their product if possible to be inelastic. This means that any increase in price that they put in place will have proportionately less of an effect on demand and their total revenue will rise.

If  $E_p=1$ , then revenue will not change even if prices are increased or decreased (Refer to figure 6.3). Here demand curve is rectangular hyperbola and red shaded area is equal to blue shaded area.

If  $E_p > 1$ . Then increase in price will decrease the total revenue and decrease in price will increase the total revenue (Refer to figure 6.4). Here fall in price from  $OP_1$  to  $OP_2$ , leads to more than proportionate increase in the quantity from  $OQ_1$  to  $OQ_2$  resulting in rise in total revenue.

If  $E_p < 1$ , then increase in the price will increase the total revenue and decrease in price will decrease in total revenue (Refer to figure 6.5). Here fall in the price from  $OP_1$  to  $OP_2$ , leads to less than proportionate increase in demand from  $OQ_1$  to  $OQ_2$  and hence resulting in fall in total revenue.

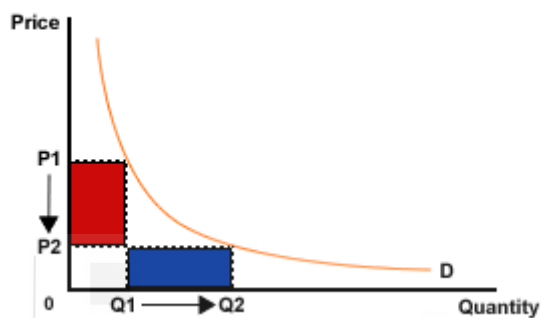


Figure 6.3: Unitary Elastic Demand

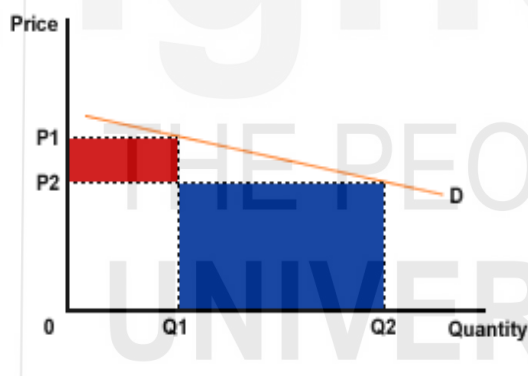


Figure 6.4 : Elastic Demand

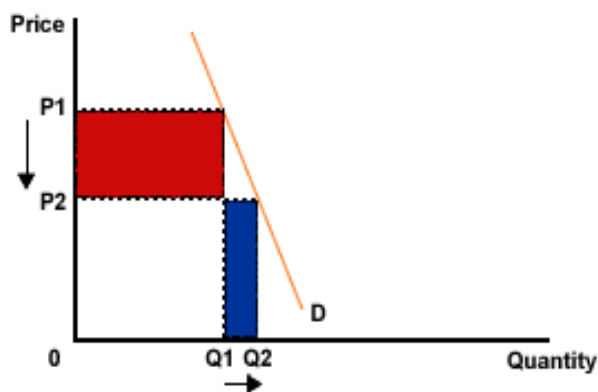


Figure 6.5: Inelastic Demand

## Check Your Progress B

Match the item in Column A with those in Column B

Column A	Column B
1. Products which are not within control of the company	a) Controllable Products
2. Price elasticity of tobacco and cigarettes	b) $E_p=1$
3. Revenue will not change even if prices are increased or decreased	c) Uncontrollable Products
4. Then increase in price will decrease TR and decrease in price will increase TR	d) Price Inelastic
5. Price of the Product	e) $E_p>1$

## 6.4 GOVERNMENT INTERVENTION

Market, if left alone, will naturally land up in equilibrium, reflecting equilibrium price where all sellers are willing and able to sell and buyers are willing and able to buy at the price determined by equilibrium. However, this scenario may not hold true in all situations. In case of contemporary mixed economy in particular, government may like to intervene with the market flows by imposing price ceiling and announcing floor price and also using tools like taxes and subsidies to reform the economy of the country.

Government may adopt two means of interfering in the free flow of economy. First, they may set maximum price limit referred to as price ceiling. This is generally applied on basic goods or they may fix lower price referred to as floor price. This is generally applicable in case of agricultural prices to assure minimum return to farmers and hence a step to protect their interest. There have been many discussions and deliberation happening currently on the decision to continue with minimum support price system in case of agricultural goods.

### 6.4.1 Price ceiling

The maximum price fixed by government beyond which producers cannot charge. Such ceilings are imposed on necessary consumer goods during emergency period like war, in order to prevent them from rising during critical period. The same can be illustrated in form of a diagram (figure 6.6). We have demand curve and supply curve intersecting at point E, resulting in OP as equilibrium price and OQ as equilibrium quantity. Now Government may take a decision to intervene, since they feel that equilibrium price charged is too high. They have fix price ceiling at  $OP_1$  which is less than the equilibrium price determined by market forces. At  $OP_1$ , the demand of good is  $OQ_1$  while supply is  $OQ_2$ , resulting in shortage of  $Q_2Q_1$ .

To tackle situation of shortage, the government may find it necessary to introduce rationing so that the limited goods may be allocated among all the buyers who want them.

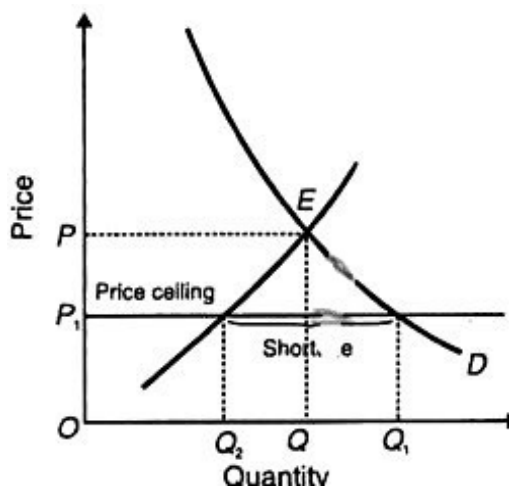


Figure 6. 6: Price Ceiling

### 6.4.2 Floor Pricing

Unlike price ceiling, floor price are generally introduced to protect interest of the sellers. Generally, the floor price sets the price above the equilibrium price. It has been seen that such tool is used for agricultural goods to support farmers. In situations when market price becomes so low that farmers are not able to protect or maintain their livelihood. The floor pricing is shown in Figure 6.7. In case of floor pricing, the price is fixed higher than the equilibrium price, which results in Supply of the good being higher than the demand. This situation results in surplus, where crops produced by farmers are more than demanded by buyers at that price.

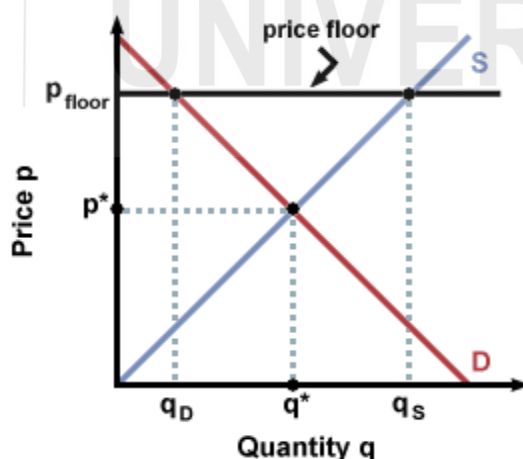


Figure 6.7: Floor Pricing

### 6.4.3 Imposition Taxes and Subsidies

Next tool for government intervention is imposition of taxes. You might have noticed that in order to discourage the sale of hazardous product like tobacco and cigarettes, government imposes high taxes on such products. However, since the sellers do not want to lose or have reduced profit margins, therefore,

sellers too pass on the added cost on to the buyers. In such cases, the supply curve of the product like tobacco and cigarettes will shift by the amount of tax vertically.

In our example, if government charges Rs10 on every pack of tobacco, and the tobacco seller wants to pass this tax on buyers, then the supply curve will shift upwards and as a result for any price the stores will sell fewer packs of cigarettes, to make up for the extra cost of the tax. Refer to Figure 6.8

In this figure D is demand curve which intersects S, the supply curve, which results in sale of OQ quantity of good at OP price. Let's assume taxes in form of excise duty is imposed (ET) on per unit of good. This leads to upward shift of the supply curve to  $S_1$  and price rises to  $OP_1$

As per the figure 6.8, the RT portion of rise is borne by buyers and the ER portion by the sellers. What portion of incidence of tax would fall on buyer and sellers would be dependent on the elasticity of demand and supply.

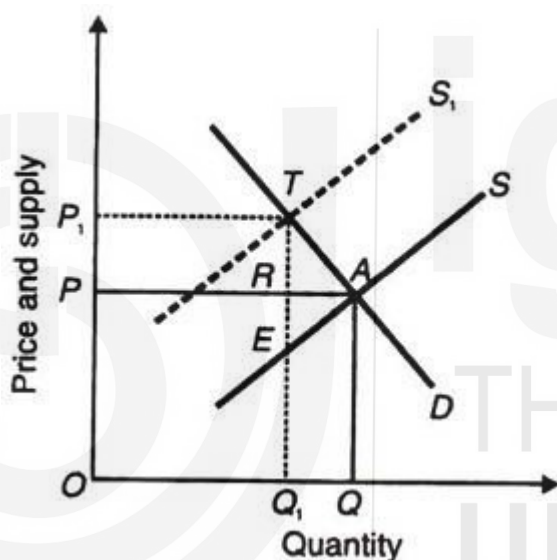


Figure 6.8: Imposition of taxes

Given the elasticity of supply, the greater the elasticity of demand for a commodity, the greater will be the incidence of the tax upon the producers and vice versa. Likewise, given the elasticity of demand, the greater the elasticity of supply, the higher will be the incidence of tax upon the buyers, and vice versa.

**Subsidy** – Subsidy is the grant given by government to reduce the price per unit of a product. This tool is used in order to encourage the farmers to produce more which may result in fall in price in future. This amount is received as an add on to the market price. The shift in the benefits of the subsidy from producer to buyer depends on the elasticity of demand and supply. Refer to the figure 6.9 below.

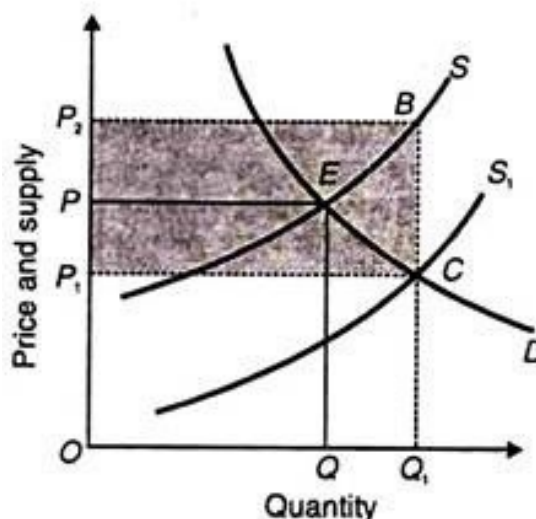


Figure 6.9: Effect of Subsidy

In figure 6.9, demand curve  $D$  intersects the supply curve  $S$ , resulting in equilibrium  $E$  and  $OP$  and  $OQ$  as equilibrium price and equilibrium quantity respectively. With supply of subsidy, the supply curve shifts towards right. The rightward shift of the supply curve results in fall in the price from  $OP$  to  $OP_1$  and rise in quantity from  $OS$  to  $OS_1$ . The new equilibrium is shown at point  $C$ . In the figure,  $BC$  refer to the subsidy provided. As a result of the subsidy, the benefits to the consumer are equal to  $PP_1$ . Now they can buy more quantity at lower price and the benefits of the produces are shown by  $P_1P_2$ .

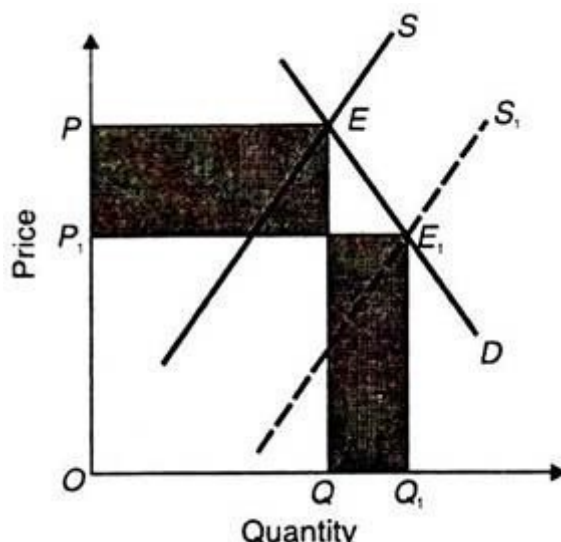
The subsidy supplied by the government is sum of consumer benefit and producer benefit shown by  $P_1P_2BC$  in figure (shaded area).

## 6.5 PRICING OF AGRICULTURAL COMMODITIES

Pricing of agricultural commodity especially in India is determined primarily by demand and supply interaction. Agricultural commodity market, being very close to perfect competition market, therefore the producer in this market is price taker and no individual farmer can affect its market supply. However, agricultural market is also termed as “**Up and Down Industry**” by famous economist Samuelson, since this kind of industry is faced with many uncertainty and instability. The product being dependent on the fluctuations in the nature, be it situation of drought, rain or good and bad weather conditions.

The determination of agricultural price is where demand ( $D$ ) and supply ( $S$ ) curve intersect each other and result in equilibrium point  $E$ , with equilibrium price as  $EP$  and equilibrium quantity as  $EQ$ . This is shown in figure 6.10 below.



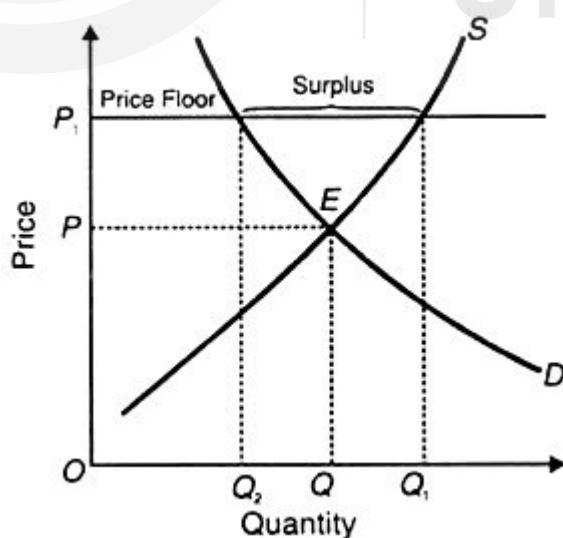


**Figure 6.10: Determination of price in agricultural commodity market**

With increase in the supply of agricultural commodity, the supply curve shifts towards right from  $S$  to  $S_1$  and since demand curve remains the same; the new equilibrium point is attained from  $E$  to  $E_1$ . Corresponding to new equilibrium point we have new equilibrium price  $P_1$ , that is reduced price. At this reduced price, the supply increases to  $OQ_1$ . The total revenue of the producer falls from  $OPEQ$  to  $OPE_1Q_1$ . Refer to Figure 6.10 shaded area.

### Agricultural Price Support

As discussed under government intervention section, government specially in developing countries like India provides price support to agricultural producers and at the same time makes sure that the consumer gets agricultural products at reasonable price. This is done by fixing minimum price or floor price.



**Figure 6.11: Agricultural Support Price**

Refer to figure 6.11, reflecting  $D$  and  $S$  as demand and Supply curve and  $OP$  and  $OQ$  as equilibrium price and equilibrium quantity respectively. At the

price floor  $OP_1$  imposed by government, the producer will be willing to sell  $OQ_1$  quantity while demand will fall to  $OQ_2$  resulting in  $Q_2Q_1$  surplus. This surplus is bought by government as buffer stock.

### Check your Progress C

1. State whether the following statements are True or False
  - i. Price Ceiling refers to the maximum price fixed by government beyond which producers cannot charge.
  - ii. Surplus is bought by government as Buffer stocks.
  - iii. Pricing of agricultural commodity especially in India is determined primarily by demand and supply interaction.
  - iv. Agricultural commodity market is close to imperfect competition.
2. Match the items in Column A with those in Column B

Column A	Column B
1. Price introduced to protect interest of the sellers	a) Equilibrium
2. Intersection of demand and supply	b) Surplus
3. Hazardous Products	c) Floor Price
4. Excess of Supply over Demand	d) Imposition of taxes
5. Agricultural market	e) Up & Down Industry

## 6.6 LET US SUM UP

In economics, the application part of demand and supply holds a lot of importance. To understand the application of important concepts like demand and supply we need to understand how different shapes of demand and supply curve and shift in the demand and supply curve effects the equilibrium price and quantity. The shift in the demand curve would depend on what kind of product it is (normal good or inferior good) along with other determinants like price of related goods, income level of people, change in taste and preferences etc. Shift in the supply curve would depend on various factors like factors of productions used, technological capacities, goal of firm etc.

Concept of elasticity of demand plays crucial role in business decision making. It helps a manager to understand the quantitative changes in demand due to a given change in variable influencing demand. For example, the decision of raising the price will be correct only if demand for a product is less elastic or demand for its substitute is much less elastic. For understanding, the application of elasticity on business decisions, various

types of elasticity like Income, price, cross and promotional elasticity need to be calculated.

While determining the price, apart from concepts of demand, supply and elasticity, usage of government tools of intervention in form of price ceiling, floor pricing, taxes and subsidies are very critical to understand. Based on the situation, kind of product and need of the hour government makes use of these tools. Generally, price ceiling is to protect the interest of the consumers and floor pricing is to protect interest of sellers. What portion of incidence of tax would fall on buyer and sellers would be dependent on the elasticity of demand and supply. Another tool subsidy, is the grant given by government to reduce the price per unit of a product. This is basically done with the aim of encouraging farmers for higher production. Many a times usage of these tools are seen while determining the price of agricultural commodity.

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## 6.7 KEYWORDS

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**Demand:** Demands for a commodity refers to the quantity of the commodity which an individual consumer is willing to and able to purchase per unit of time at a particular price

**Supply:** Supply of a commodity refers to the various quantities of the commodity which a seller is willing and able to sell at different prices, in a given market, at a point of time, other things remaining the same.

**Elasticity:** Degree of responsiveness of change in dependent variable due to one unit change in independent variable other variables held constant.

**Price Elasticity:** Degree of responsiveness of change in price of commodity due to change in any of the independent variables.

**Taxes:** Financial charge imposed or levied by government to collect revenue.

**Price ceiling:** Maximum amount a seller is allowed to charge.

**Floor Pricing:** Price fixed to ensure that market price does not fall below a level set. It is in interest of farmers or producers of the commodities.

**Equilibrium:** State or rest or balance, where demand and supply intersect.

**Revenue:** Money received, especially on a regular basis, for work or through investments.

**Cost of Production:** In economics, the cost of production is defined as the expenditures incurred to obtain the factors of production such as labor, land, and capital, that are needed in the production process of a product.

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## 6.8 ANSWERS TO CHECK YOUR PROGRESS

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**Check you progress A**

i. True ii. False iii. False iv. True

**Check you progress B**

1) c 2) d 3) b 4) e 5) a

### Check you progress C

1. i. True ii. True iii. True iv. False
2. 1) c 2) a 3) d 4) b 5) e

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## 6.9 TERMINAL QUESTIONS

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1. Explain the application of elasticity with suitable example in business decision making.
2. How the various tools of government intervention are applied while determining the price?
3. Write short note on-
  - a. Determination of price in agricultural markets
  - b. Concept of Surplus and deficit
4. The concept of elasticity is useful in revenue planning. Do you agree with the statement and why.
5. With the help of suitable diagrams illustrate the determination of price and quantity with shift in the demand and supply curve.

**Note:** These questions will help you in understanding the unit better. Try to write their answers. However, do not send them to the University because they are meant for your own practice only.

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## **UNIT 7     LAW OF DIMINISHING MARGINAL UTILITY AND EQUIMARGINAL UTILITY**

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### **Structure**

- 7.0 Objectives
- 7.1 Introduction
- 7.2 Utility
- 7.3 Total Utility, Average Utility, and Marginal Utility
- 7.4 Law of Diminishing Marginal Utility
- 7.5 Marginal Utility of Money
- 7.6 Diminishing Marginal Utility and Demand for a Commodity
  - 7.6.1 The Concept of a Demand Schedule
  - 7.6.2 The Concept of a Demand Curve
- 7.7 The Law of Equimarginal Utility
- 7.8 Consumer's Equilibrium
- 7.9 Consumer's Surplus
- 7.10 Let Us Sum Up
- 7.11 Key Words
- 7.12 Answers to Check Your Progress
- 7.13 Terminal Questions

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### **7.0 OBJECTIVES**

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After studying this unit, you should be able to:

- explain the concept of utility;
- discuss the comparative analysis of total utility, average utility and marginal utility;
- explain the law of diminishing marginal utility and its limitations;
- discuss the marginal utility of money;
- explain the demand for a commodity through diminishing marginal utility;
- analysis and discuss the law of Equimarginal utility and its limitations; and
- explain the concept of consumer surplus and its limitations.

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## 7.1 INTRODUCTION

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In the previous units, you have learnt the fundamental problems of economic system, basic economic laws and various forms of economic system. This unit deals with consumer's behaviour and the theory of demand. It lays some of the important theoretical foundations of economic reasoning and areas of investigation. You should note that (i) determination of, and (ii) changes in prices of various commodities are clearly connected with (i) demand for, and (ii) supply of those commodities. In effect, continuous interaction goes on between these three (that is, demand, supply and prices) - a process in which they all influence each other. Economists were always interested in finding out the way prices are determined, and the way they undergo a change. With that objective in view, they normally start with a smaller and simpler question, namely, the (i) determination of, and (ii) changes in the price of a single commodity. Its method of analysis and findings are then extended to cover a wider range of prices.

Now if you look at the price of a single commodity you find that it has two aspects. It is (i) paid by buyers and (ii) received by the sellers. In this Block you would have a close look at the first aspect, namely the behaviour of the buyers.

For this a beginning is made by selecting a single consumption commodity so that it is bought by consumers. (The case of a commodity which is an 'input' for production and is bought by producers is considered at a later stage. For the time being, we shall use the two terms 'consumers' and 'buyers' interchangeably). On the side of its buyers, similarly, the buyer selected for analysis is of the most common variety. That is to say, he is the 'typical' or 'representative of the buyers' in general. This is done so that the findings relating to the behaviour of the "representative" buyer can be extended and applied to the entire body of buyers. Having done so, the economists put some simple but very relevant questions like the following.

Why does a typical buyer buy a commodity? Why is he ready to pay a price for it rather than go without it? How much of this commodity will he buy at different prices? The answers to these questions are collectively known as "demand behaviour" of the typical buyer of the commodity under consideration. You should note that while formulating answers to these questions, the economists take the help of the concept of utility. This is a concept with which you are already familiar to some extent. In this Unit, you would learn a little more about it, and that would help you in understanding the behaviour of a representative buyer and put it in some useful standardized form. For example, you note the fact that on the one hand, a consumer gets some utility from the commodity bought by him and on the other hand, he loses some utility in the form of a price paid for it. Accordingly, you immediately come to the conclusion that a consumer would buy a commodity only so long as the utility paid by him in the form of price is less than (or at the most equal to) the utility of the commodity for him, so, if the price goes up, the quantity of commodity purchased is again reduced. In this manner, once you are able to put the behaviour pattern of a typical consumer in a

standardized form, you can extend it to the entire body of consumers of that commodity. You are then able to describe the manner in which its demand in the entire market shifts as its price changes.

However, before we arrive at important findings regarding the demand for a commodity, let us discuss and clarify some of the fundamentals relating to the concept of utility itself.

## 7.2 UTILITY

You are already familiar with the elements of this concept. You were told in an earlier unit that utility of a commodity is its want satisfying capacity. This statement, however, needs a good deal of clarification and quantification before it can be put to actual use in Economics. And that would also lead you to a more precise definition of the concept of utility.

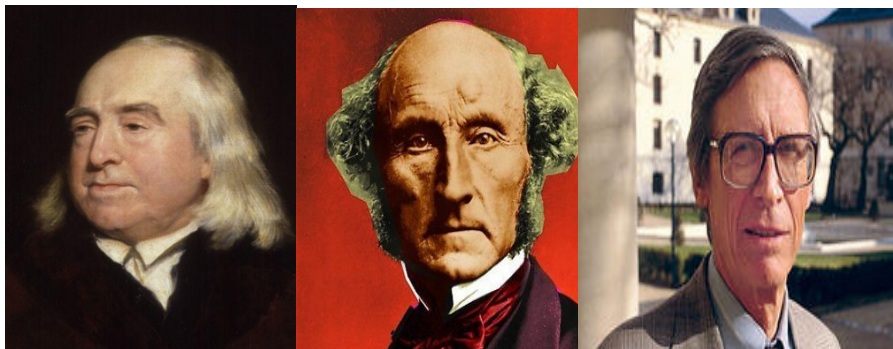
Utility of a commodity represents satisfaction which is yet to be realized by its consumer. The satisfaction is only an anticipated one, an expected one. Therefore, there is an element of uncertainty attached to it. It is obvious that satisfaction actually received need not be equal the amount expected from it. In other words, satisfaction and utility is not the same thing. Utility is expected satisfaction and satisfaction is realized utility. But you must note one very important thing. The decision of a consumer to buy (or not to buy) a commodity depends upon its utility and not satisfaction. It is the utility (expected satisfaction) that induces a buyer to pay for it and get it. Of course, a consumer's estimate of utility of a commodity may be influenced by a number of things, such as his own past experience, the experience of other buyers, publicity and other selling tactics adopted by the sellers and so on. But all said and done, it is his estimate of the utility of the commodity which finally determines whether it would be bought or not. The consumer can derive satisfaction only after he actually consumes it; but he has to buy it before consumption.

An important feature of utility of a commodity is the fact that it is not a constant thing. It varies from consumer to consumer and even for the same consumer at different times and under different circumstances. The reasons for this phenomenon are easy to see.

**Firstly**, utility of a commodity to a consumer depends upon the intensity of the want which would be satisfied with it. It is easy to see that even the same want is not felt with equal intensity by all consumers. For example, every consumer of bread in the morning is not equally hungry.

### FOR MORE CLARITY!

According to utilitarians, such as Jeremy Bentham (1748-1832) and John Stuart Mill (1806-1873), society should aim to maximise the total utility of individuals, aiming for "the greatest happiness for the greatest number of people". Another theory forwarded by **John Rawls** (1921-2002) would have society maximise the utility of the individual initially receiving the minimum amount of utility.



**Jeremy Bentham**

**J.S. Mill**

**John Rawls**

**Secondly**, utility of a commodity is the assessment of a consumer of the amount of satisfaction he expects to derive from its use. And different consumers are bound to arrive at different estimates. Utility estimated by a consumer depends upon the way he views the circumstances facing him, but there is no standard method of judging a situation and putting it in quantitative terms. Even the same consumer may view a given set of circumstances in various ways. A thirsty person, receiving a cup of water, may additionally believe that he is not going to get another drop of it for the next forty-eight hours or he may be confident that he would be able to get as much of it as he wants. For him, utility of the same cup of water would be more in the former case than in the latter.

**Thirdly**, it is unlikely that a commodity would be liked equally by all consumers. Other things being equal, the utility of eggs would be more for a person who likes them than for the one who does not. Similarly, utility of a medicine is only for the patient for whom it has been prescribed.

**Fourthly**, the set of circumstances facing a consumer keep changing. Change of season, place of residence and a lot of other things bring about a shift in the need for a commodity by the consumer causing corresponding change in its utility.

**Fifthly**, it is a recognized fact that when a commodity is continuously used to satisfy a want the intensity of the latter keeps decreasing. It means that additional units of the good being consumed yield a decreasing amount of satisfaction. Hence, its utility also falls.

Another important feature of the concept of utility relates to its measurement. You are familiar with the units in which length, volume, weight, time and other quantities are measured. As in other sciences, units of measurement have to be selected in measuring the quantities and variables used in economic analysis as well. The concept of utility also throws up the need for measuring it in some standard units. Unfortunately, in reality it is not possible to do so, because utility of a commodity represents a mental assessment, a viewpoint of the consumer regarding the extent of satisfaction that he expects to derive from it. To put it differently, it is not possible to measure utility in absolute or cardinal terms. At the most, a consumer can only tell us which of the two quantities of the same commodity has greater utility for him, or which of the two different commodities A and B or their combination has a greater utility. In other words, the consumer can only rank (arrange) utilities



in their ascending or descending order. This fact is conveyed by saying that utility can be measured only in ordinal terms and not in cardinal ones. This statement has an important implication also. Since you cannot measure, in absolute terms, the utility which a unit of commodity A has for two different consumers X and Y, you cannot say which of the two consumers derives more utility from A. In economic terminology, it is stated that it is not possible to have inter-personal comparisons of utility.

Remember, however, that at this stage of study, it will be necessary for you to assume, for the sake of simplicity of analysis, that utility can be measured in cardinal or absolute terms. Some additional simplifying assumptions including the possibility of inter-personal comparison of utility and the like would also be made by you. In the subsequent unit, however, you would be introduced to ordinal measurement of utility and an analysis of consumer behaviour would be provided on that basis.

The fact that a commodity has utility for a consumer does not mean that it is beneficial or useful for the consumer for that he ought to consume it. A commodity will have utility for the consumer so long as he believes that he can use it for satisfying some want. That way, even harmful things can have utility. Some addictive drugs are considered very harmful for the user's health, but they have a utility for the drug addicts. Smoking may be considered bad for lungs, but so many people are ready to pay for cigarettes. In Economics, therefore, the concept of utility has no ethical implications.

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### 7.3 TOTAL UTILITY, AVERAGE UTILITY AND MARGINAL UTILITY

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It would be easier for you to understand these concepts with the help of a numerical example. Suppose that other things being equal, utility derived by a consumer Mr. X, from successive bananas is shown in Table 7.1. You find from the Table, the first banana has a utility of 25 units for our consumer: the second banana has a utility of 18 units and so on. The fifth banana has a utility of only three units. The sixth banana does not bring any utility for the consumer while the seventh banana has a negative utility or disutility of two units. It means that the consumer does not expect to get any satisfaction out of the seventh banana; he thinks that it would cause dissatisfaction to him.

The utility of the last unit of a commodity acquired by a consumer is called its **Marginal Utility (MU)**. It means that while finding out MU of a commodity, it is necessary to look at the quantity of the commodity acquired by the consumer. Thus look at Table 7.1 Column 2. If the consumer buys only one banana, then MU is the utility of that banana itself, that is, 25 units. In case the consumer buys two bananas, the MU is the utility of the second banana – in this case 18 units. Similarly, with five bananas, MU of the fifth banana is 3 units, with six bananas -- MU of the sixth banana is zero, and with seven bananas, it is minus two units. (The explanation for MU falling with successive additions of bananas will be found later in this Unit).

**Total Utility (TU)** represents the sum of utilities of all the units of a commodity acquired by the consumer. In the example provided in Table 7.1, if the consumer gets three bananas, then TU is  $25 + 18 + 12 = 55$  units. The figures of TU for respective number of bananas can be read from column 4 of Table 7.1. You would note that TU is nothing but sum of successive marginal utilities and MU is nothing but the addition to TU on account of the last unit of the commodity acquired. Therefore, when MU is zero, TU remains unchanged. In our example, TU remains 65 units when sixth banana is added. Also, TU will fall if MU is negative as happens when seventh banana is added.

**Table 7.1: Utility of Bananas for the Consumer**

	<b>Marginal Utility (MU)</b>	<b>Average Utility (AU)</b>	<b>Total Utility (TU)</b>
(1)	(2)	(3)	(4)
1st Banana	25	25	25
2 <sup>nd</sup> Banana	18	21.5	43
3 <sup>rd</sup> Banana	12	18.3	55
4 <sup>th</sup> Banana	7	15.5	62
5 <sup>th</sup> Banana	3	13	65
6 <sup>th</sup> Banana	0	10.8	65
7 <sup>th</sup> Banana	-2	9	63

**Average Utility (AU)** is obtained by dividing total utility by the number of units of the commodity. In table 7.1, figures of average utility are shown in column 3. Remember that, generally, change in average utility is sale for at the most equal to) the change in MU. This happens because the addition to TU caused by MU gets spread over all the units of the commodity when we consider AU. For example, when third banana is acquired by the consumer, 12 falls from 18 to 12 units or a fall of 6 units. However, the AU falls from 21.5 to 18.3 units, or by 3.2 units. Similarly, the reduction in MU is of two units when seventh banana is acquired, but the fall in AU is by 1.8 units only.

You should note that for the first of a commodity, all the three measures of utility are identical in our example, is, 25 units.

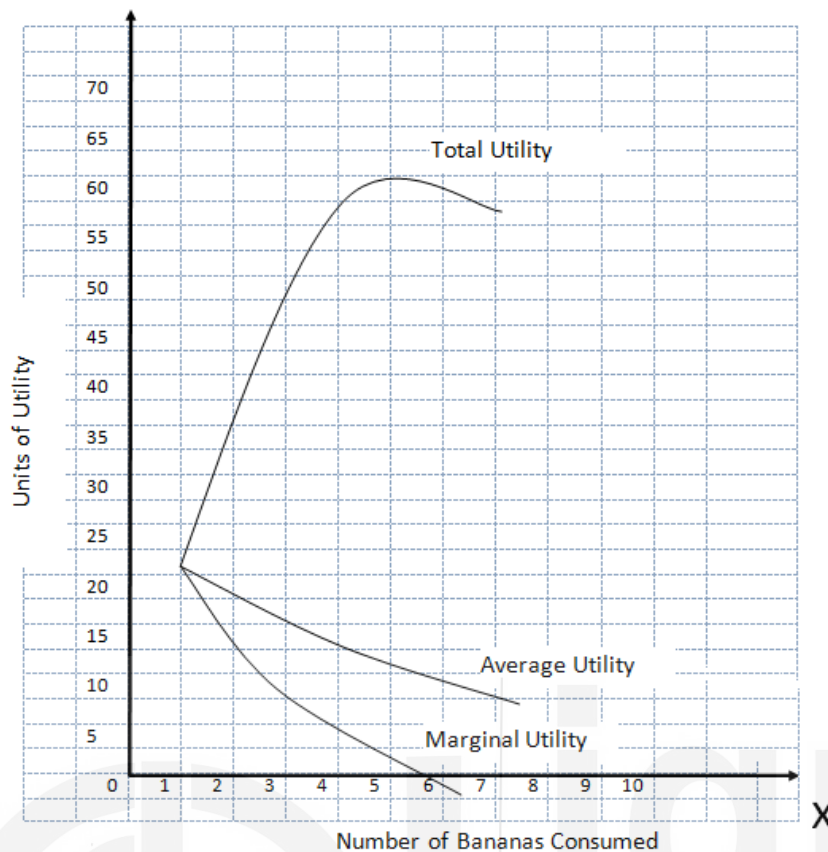


Figure 7.1: Relationship between Total utility, Average utility and Marginal utility

The total, average and marginal utilities of bananas can be represented graphically also. Look at Figure 7.1, Number of bananas is represented along X-axis and units of utility are measured along Y-axis. As expected all the three curves of utility start from the same point. While curves of average and marginal utilities keep falling throughout their length, this is not so with TU curve. It rises so long as MU is positive and MU curve lies above X-axis. When MU cuts X-axis, TU curve stops rising. And when the former goes below X-axis, the latter also starts falling.

### Check Your Progress A

- 1) State whether the following statements are **True** or **False**.
  - i) Utility is the same thing as satisfaction.
  - ii) Utility is a subjective thing.
  - iii) We can measure utility in absolute terms.
  - iv) When a commodity is used continuously for satisfying a want, its marginal utility falls.
  - v) Total utility is the sum total of marginal utilities.
  - vi) Marginal utility is the addition to total utility on account of last unit of the commodity.
  - vii) If a commodity has utility for a consumer, it must be beneficial for him to consume it.
- 2) Fill in the blanks out of the words provided.

- i) Decision of a consumer to buy a commodity depends upon its (utility/satisfaction).
- ii) Utility is a ..... quantity (constant, changing).
- iii) Utility is ..... satisfaction: satisfaction is ..... utility. (expected, realized)
- iv) Utility can be measured in .....terms only. (cardinal, ordinal)
- v) Interpersonal comparison of utility is possible if utility can be measured..... (ordinally, cardinally).

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## 7.4 LAW OF DIMINISHING MARGINAL UTILITY

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You are already familiar with an important characteristic of wants, namely, that a given want can be fully satisfied, if the process of its satisfaction is not discontinued in between. As Marshall puts it in his famous book 'Principles of Economics', "There is an endless variety of wants but there is a limit to each separate want." You also remember that utility of a commodity is its want satisfying capacity. Now put these two things together and you get an important law of economics relating to utility. As a consumer gets successive units of a commodity, other things being equal, the intensity of the want being satisfied keeps diminishing. In other words, the satisfaction which can be had by removing the want goes on falling. Each additional unit of the commodity under consideration is expected to yield less satisfaction compared with the satisfaction expected from the preceding unit. That is, marginal utility of the commodity keeps diminishing as the consumer gets additional units of it.

This fact is stated in the form of the Law of Diminishing Marginal Utility or the Law of Satiabile Wants. This law says that "the additional or marginal utility which a consumer derives from acquiring one more unit of a commodity, other things being equal, keeps decreasing with every increase in the stock of the commodity which he already has." Note that the fall in marginal utility need not be at a uniform rate. Generally, however, MU would fall very rapidly for the earlier units while it would decrease slowly for the later ones. But this need not always be so. Also note that in some cases, MU may fall to zero or become even negative if the stock of the commodity increases sufficiently. The law of diminishing marginal utility describes a basic fact and a common experience of our daily life. For example, consider the case of a person who is very thirsty and he is given cups of water one by one, to quench his thirst. Clearly, the first cup of water will yield him more satisfaction than does the second; the utility of the second cup will be greater than that of the third; and so on. Eventually, his thirst will be fully quenched and the utility of water will drop to zero. If the consumer is forced to consume one more cup of water, it can even lead to disutility. The example of bananas, presented in the form of Table 7.1 also illustrates this law.

At this stage, consider another fact relevant to the principle of diminishing marginal utility. A particular commodity can be used to satisfy one or more specified wants but not all of them. Had it been possible to use a commodity for satisfying all wants, its MU would have not fallen because human wants are unlimited and keep recurring. Their collective intensity does not fall as more of them are satisfied. It is intensity of one or some given wants that is the use of a commodity. To

#### FOR MORE CLARITY!

The law of diminishing marginal utility is at the heart of the explanation of numerous economic phenomena, including time preference and the value of goods.... The law says, first, that the marginal utility of each (homogeneous) unit decreases as the supply of units' increases (and *vice versa*); second, that the marginal utility of a larger-sized unit is greater than the marginal utility of a smaller-sized unit (and *vice versa*). The first law denotes the law of diminishing marginal utility; the second law denotes the law of increasing total utility.

put it differently, a given commodity Obeys the law of diminishing marginal utility because it cannot be perfectly substituted for other commodities (which are needed to satisfy other wants), but the entire income of a person, that is, all the commodities put together, need not obey this law.

#### Limitations

There are innumerable situations in which the law of dim cannot be applied. The limitations of the law are contained in the violation of the qualifying phrase, "other things being equal" which means that nothing should happen to increase the intensity of wants for the satisfaction of which the commodity under consideration is being used. However, other things need not remain the same, the intensity of the wants in the process of satisfaction may increase and if that happens, the law of diminishing marginal utility will get violated. Thus, the limitations of the law are nothing but the most common causes leading to an increase in the intensity of wants during the process of their satisfaction and thus causing an upward shift in the MU of the commodity. Following are the limitations of this law:

- 1 **Suitable units:** For the application of the law of diminishing marginal utility, it is necessary that the commodity should be supplied to the consumer in suitable units. Shoes, for example, should be in pairs and not in individual pieces. Wall paper for the house should be enough for at least a particular area to be covered.

Marshall mentions the case of a short concert or a holiday. Listening to music for a very short period may increase the desire to listen and enjoy it further in which case its MU may go up.

Similarly, a holiday of a very short duration may intensify the desire for it leading to an increase in its MU.

- 2 **Time-factor:** A want can recur and increase in intensity if passage of time is allowed between consumption of two units of a commodity. A person may get greater utility from the second chapati if it is consumed the next day. Similarly, a second cup of water may yield greater utility if the consumer is forced to become thirstier by delaying its availability.
- 3 **Tastes, fashion, and income:** Given enough time, these things can undergo a change and, therefore, alter the intensity of the want. However, it is not necessary that these factors would necessarily intensify it; they may even weaken it. It is well known that a change in fashion alters the acceptability of a commodity and thereby its utility. Some commodities gain in utility because more people want them and in larger quantities. As against this, some commodities go out of fashion and, therefore, lose in utility. In the same way, an individual's tastes (or preferences) can also undergo a change.

A very important factor influencing the utility of a commodity is the income of the consumer. Normally, some commodities are used mainly by the poor such as coarse grains, inexpensive clothes and so on. Accordingly, they are called 'inferior commodities' or 'poor man's commodities'. Any person whose income goes up would like to give up the consumption of such commodities and instead go in for the so called normal or superior commodities. In other words, the very change in income of a person can change the utility of a commodity for him without changing its stock.

- 4 **Anticipated availability of the commodity:** If the consumer comes to believe, rightly or wrongly, that the availability of the commodity would fall in the forthcoming time interval, its MU would go up.

For example, if a thirsty person finds, after one cup of water, that he would not get any supply for the next few days, the utility of the second cup for him will immediately go up.

- 5 **Capacity to enjoy a commodity:** It frequently happens that the capacity of a person to enjoy a particular commodity undergoes a change during its consumption. In that case, the law of diminishing MU may not hold.

Thus a person, listening to a particular song, may be able to appreciate it better with second/third hearing.

- 6 **Rare collections:** Some commodities like rare coins, paintings etc., constitute a special category of their own. Their supply is usually of non-identical items and they add to the total enjoyment of the collector more than proportionately. Their increasing stock adds to the sense of enjoyment, social price, knowledge and similar other aspects of the collector's life and thus the principle of diminishing MU lose its relevance in their case.

- 7 **Change in the availability of related commodities:** Some commodities are related to each other. Two specified commodities for example, may be jointly needed for the satisfaction of a want. They are known as complementary commodities. In that case, availability of one of them is useless to the consumer; but its availability raises the utility of the complementary commodity. You can think of a large number of cases in which the availability of one commodity increases the utility of the other. Some examples are of an electric fan and electricity, Box pen and refill, cooking fuel and uncooked food and so on.

As against complementary commodities, some commodities are substitutes of each other, that is, they are used for satisfying the same want. For example, alternative food items can be used for satisfying hunger. When the availability of a commodity increases, the ability of its substitutes falls and vice-versa.

8. **Position in relation to other persons:** Man is a social animal. Accordingly, his desire to have possessions and to consume various commodities and services is greatly influenced by his position in the society. Therefore, the utility of a commodity to the person under study changes when its availability to other members of society undergoes a change.

You should, however, remember that the limitations of the law of diminishing marginal utility, as described above, do not violate its fundamental applicability. The law still remains applicable in its essentials. These limitations only highlight the fact that very frequently the conditions attached to the law are not satisfied and the intensity of the want in the process of satisfaction goes up. However, if the assumptions of the law hold, the law itself would be a valid one.

## 7.5 MARGINAL UTILITY OF MONEY

At this stage, we are faced with an important question. Is the law of diminishing marginal utility applicable to money? Opinions differ as to what the reality is because of the following reasons.

Money represents purchasing power in general. It is used for buying everything that is sold in the market. We have seen earlier that while an individual want can be fully satisfied, all wants put together cannot be. Therefore, why should MU of money fall when a person has more of it? Some thinkers, however, do not agree with this reasoning. They appeal to the general experience of our everyday life and tell us that marginal utility of money also falls when its quantity increases. We are asked to compare the indifference with which a person having a large sum of money would not worry about losing coin. But the same person, when he has a very small amount of money with him would try to recover it. Similar other examples are given to show that money is also subject to the universal law of diminishing MU.

Marshall also believes that the law is applicable to money. However, when he develops the theory of consumer behaviour and demand, he assumes that money has a constant MU. This assumption becomes necessary because a consumer while

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## 7.6 DIMINISHING MARGINAL UTILITY AND DEMAND FOR A COMMODITY

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MU of a commodity is closely related to its demand by the consumer. An important fact of market sales is that a consumer buys all the units of a commodity of the same price. Now as a rational person (you are already familiar with the concept of rationality) the consumer wants to ensure that he does buy an additional unit of a commodity X if the utility paid by him by way of its price is less than the utility derived from its purchase, that is, if the price is less than MU. Also he must not buy that unit if the price is more than MU. If the price and MU are equal, the consumer would be indifferent and he may or may not buy that unit. In other words, the price which the consumer is ready to pay never exceeds the MU of the commodity. Accordingly, if the consumer is to buy more of a commodity, the price he is ready to pay should decrease (since the MU of a commodity falls when more of it is bought). Alternately, one can say, that if the price of a commodity falls, a situation would emerge in which MU of the commodity will exceed its price and the consumer would buy more of it.

Let us take the example of Table 7.1. Column 2 of the Table records the MU of bananas to the consumer. Let us suppose that the price of one banana is 12 units of utility. In that case while the consumer pays for 12 units of utility for the first banana, he gets 25 units of utility from it and thereby gains 13 units of utility. Similarly, the second banana brings him a gain of  $18-12=6$  units of utility. The utility of the third banana, however, is equal to its price and he may or may not buy it. On the other hand, if the price falls below 12 units of utility but remains above 7 units, the consumer would buy the third banana as well. Similarly, he would decide to buy more bananas if price falls and less of them if price rises.

*The general rule is that, given the price of the commodity, the consumer decides to buy that quantity of it which equates its MU with its price.*

In our example, it is not always possible for the consumer to exactly equate the two because MU changes by large quantities at a time. But the statement made above remains basically valid, and can be put in the form of what is known as the law of demand. This law says that "the demand for a



commodity (that is the quantity of it purchased during any given period of time) increases with a fall in its price and decreases with a rise in its price.”

The preceding discussion needs a modification.

In the market, price of a commodity is quoted, received and paid in units of money and not in units of utility. Every buyer pays the same money price (though when converted into utility, the price paid can differ from buyer to buyer). Therefore, it becomes necessary to express the behaviour of the buyer in money terms. In other words, we must be able to find out the quantity of commodity which the consumer is ready to buy at a given price and the price which he is ready to pay for a given quantity.

For that purpose, it is assumed that the marginal utility of money remains constant irrespective of the stock of money with the buyer. This enables us to state the price which the consumer is ready to pay for different quantities of the commodity under consideration!

This point will be further clarified if you look at Table 7.1 and assume that each rupee has the same MU, say 10 units, for the consumer. On that basis, the MU of bananas, expressed in rupee terms would be as shown in column 3 of Table 7.2.

**Table 7.2 : Marginal Utility of Bananas**

No. of Bananas	MU (in Units of Utility) (2)	MU (in Rupees) (3)
1	25	2.50
2	18	1.80
3	12	1.20
4	7	0.70
5	3	0.30
6	0	0.00
7	-2	(-)0.20

Thus, with 1 banana MU is Rs. 2.50; with 2 bananas, it is Rs. 1.80; and so on. It follows, therefore, if bananas are priced at 70p per piece, the consumer is ready to buy 3 bananas and may or may not buy the 4<sup>th</sup> banana. For any price less than 30p, the consumer would buy 5 bananas.

### 7.6.1 The Concept of a Demand Schedule

A demand schedule presents the behaviour of a consumer in the form of a schedule (or table). It has two columns. In the first column, alternative prices

per unit of the commodity under consideration are shown. The second column shows the corresponding quantities of the commodity which the consumer is ready to buy (per period of time) at respective prices. Table 7.3 provides a typical illustration of a demand schedule of oranges by a consumer. Each pair shows the number of oranges which the consumer is ready to buy at a given price or the maximum price which he is ready to pay for a given number of oranges. Thus, for example, when the price is 50p. per orange, the consumer is ready to buy 15 oranges. On the other hand, for buying 15 oranges, he is ready to pay not more than 50p. per orange. Note that a typical demand schedule shows increasing quantities of the commodity with falling price per unit and vice-versa.

**Table 7.3: Demand Schedule for Oranges**

<b>Price per Unit (in Rs.)</b>	<b>Demand for Oranges (number)</b>
1.00	4
0.90	5
0.80	6
0.70	8
0.60	11
0.50	15
0.40	20
0.30	24
0.20	30

### **7.6.2 The Concept of a Demand Curve**

Demand behaviour of the consumer can also be represented graphically in the form of a demand curve. A demand curve is nothing but a curve obtained by plotting all the pairs of price and quantity demanded. In Figure 7.2 DD is such a demand curve which represents the demand schedule of Table 7.3. Price per orange is measured along Y-axis and the number of oranges demanded along X-axis. If you take any point on the demand curve DD' and draw perpendiculars upon the two axes, then the perpendicular distance of the point from X-axis shows the price for

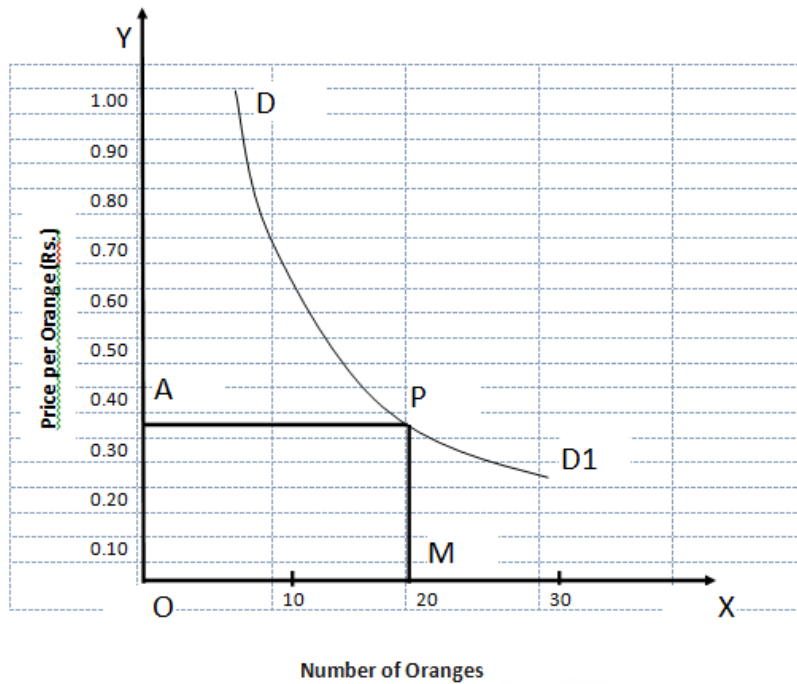


Figure 7.2: Demand Curve for oranges

orange while its perpendicular distance from Y-axis shows the number of oranges that would be bought at that price. For example, take point P on the demand curve and draw the two perpendiculars PM and PA as shown. Then PM (=OA) price per unit, the number of oranges demanded is given by OM (=AP).

Note that a normal demand curve slopes downwards from left to right because of the fact that quantities of commodity demanded and price per unit move in the opposite directions. For this reason, the demand curve is also said to have a negative slope.

### Check Your Progress B

- 1) State whether the following statements are **True** or **False**.
  - i) No want can ever be satisfied fully.
  - ii) Fall in MU of a commodity is always at a uniform rate.
  - iii) A commodity can have a negative MU.
  - iv) Anticipated availability of a commodity affects its MU.
  - v) Change in tastes, fashion and income of the consumer always increase the MU of a commodity.
  - vi) Inferior commodities are health hazards.
  - vii) For deriving a demand curve, it is assumed MU of money remains constant.
  - viii) A demand curve is a graphic presentation of demand schedule.
- 2) Fill in the blanks out of the words provided at the end.
  - i) Two commodities are ..... if the availability of one raises the utility of the other.

- ii) Two commodities are ..... of each other if the availability of one lowers the utility of the other.
- iii) With an increase in the ..... the utility of ..... commodities to the consumer decreases.
- iv) MU curve of a commodity can be used to derive its demand curve if we assume that ..... of money remains .....
- v) For a given commodity, every buyer pays the same price in terms of ..... but not in terms of .....
- vi) According to the law of demand, the amount of commodity purchased during a given period of time ..... when price and ..... when price .....

**Words:** Constant, MU, utility, rises, falls, substitutes, inferior, superior, complementary, money, decreases, increases, income:

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## 7.7 THE LAW OF EQUIMARGINAL UTILITY

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You have seen earlier that a consumer is faced with a large number of wants and all of them cannot be satisfied. The consumer, with his limited income, has to make a choice. He has to decide which wants to satisfy and which ones to leave out. Further it is not necessary that the wants selected for satisfaction must be satisfied fully. Some or all of them may be satisfied only partially. The consumer has to take a decision in this regard also.

How would the consumer proceed? How would he decide as to which wants to satisfy and how much? The answer to these questions lie in the objective with which he decides his consumption expenditure. If he is a rational person, then his objective would be to derive maximum utility from his expenditure. We shall make the assumption that he is a rational person.

You are already familiar with the behaviour pattern of a rational consumer in the context of a single commodity. There, it is assumed that for the consumer, the price of the commodity in question is fixed and he is to decide about the number of units he is to buy. In such a situation, the consumer keeps buying the commodity so long as its MU does not fall below its price.

This method of reasoning needs a modification now. While earlier it was assumed that the consumer buys a commodity, unit by unit, and spends a given amount of money for each unit purchased, now it is assumed that the consumer spends money, rupee by rupee, and gets a given quantity of whichever commodity he buys. Let us suppose that the consumer is to choose between four commodities A, B, C and D where each commodity is subject to the law of diminishing marginal utility. Then while deciding to spend the first rupee, he picks up that commodity which brings him the maximum amount of utility for the rupee spent, and he also makes sure that the MU of money does not exceed that of the commodity bought. Similarly, having spent that first rupee, the consumer finds out which commodity brings him the maximum utility for the second rupee and spends it on that, and so on.

Let us take an illustration and explain it. In Table 7.4, MU schedules of four commodities A, B, C and D are depicted.

**Table 7.4 : Marginal Utility Schedules**

MU of the Commodities				
Expenditure	A	B	C	D
1st Rupee	30	35	36	26
2nd Rupee	25	28	29	23
3rd Rupee	20	22	19	20
4th Rupee	17	18	10	17
5th Rupee	12	15	5	14
6th Rupee	8	10	2	11
7th Rupee	4	7	0	8

Thus, it is seen that the first rupee spent on A brings in 30 units of utility, the second one brings in 25 units, and so on. The seventh rupee spent on A brings in only 4 units of utility. On the other hand, successive rupees spent on commodity B bring in respectively 35, 28, 22, 18, 15, 10 and 7 units of utility. You can read the meaning of MU figures for commodities C and D also in the same manner.

Let us assume that the consumer is to spend a total of seven rupees on these commodities. On which commodity should he spend the first rupee? Clearly the answer is commodity C, since that way he gets 36 units of utility – the highest possible. Similarly, the second rupee should go to buy the commodity B (35 units of utility), the third rupee should be spent on commodity A (30 units of utility), the fourth rupee again on commodity C (29 units of utility), the fifth rupee on commodity B (28 units of utility), the sixth rupee on commodity D (26 units of utility), and the seventh rupee on commodity A (25 units of utility). If the consumer decides to spend more, then his choice between alternative commodities will follow the same rule. It, of course, should not be forgotten that MU derived from the commodity purchased with the last rupee spend must be equal to or greater than the marginal utility of the rupee spent. Thus the seventh rupee will be spent only if its MU is not more than 25 units.

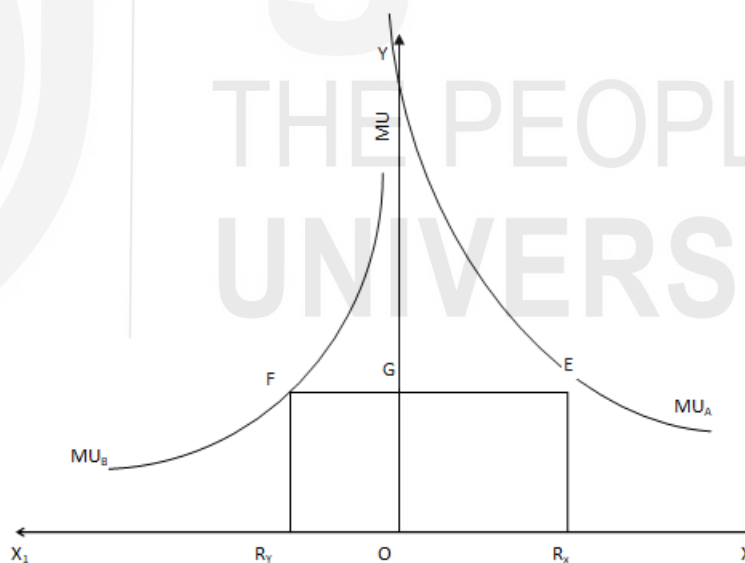
You can easily extend this illustration by assuming, for example, that the consumer has 12 rupees to spend. You would find in that case that he will spend the 12th rupee of commodity C and three rupees will be spent on each of the four commodities. Similarly the 13th rupee will go to commodity B. But what about 14th rupee? It can go to either commodity A or D. However, if he spends 15 rupees, then both A and D will be bought with 14th and 15th rupees.

Though it is always understood and seldom mentioned, you should not forget an underlying condition in this analysis. The condition is that MU of money does not exceed the MU of the commodity purchased. Thus when the

consumer spends 14 rupees, he gets a MU of 17. Therefore, he would not spend the 14th rupee if MU of money is greater than 17.

The consumer follows the behaviour pattern described above in order to get maximum possible satisfaction. He is obeying what is called the Law of Equimarginal Utility (He is trying to equate MU of different purchases with each other and with that of the money he is spending). This principle is known as the Law of Substitution, the Law of Indifference, the Law of Economy of Expenditure and the Law of Maximum Satisfaction.

The Law of Equi-marginal Utility can also be represented diagrammatically by considering a case of only two commodities (for the sake of simplicity) A and B. In Figure 7.3 MU is measured along Y-axis. The amount of money spent on commodity A is measured along X-axis from the point of origin towards right, and MU, is the corresponding MU curve of commodity A. Similarly, the amount of money spent on commodity B is measured along X-axis from the point of origin towards left and MU, is the corresponding MU curve of B. Then a straight line is drawn parallel to X-axis in such a way that the distance between its points of intersection with  $MU_A$  and  $MU_B$  equals the amount of money to be spent. Thus when the consumer spends EF amount of money, GE portion of it is spent on commodity A and FG portion of commodity B. The consumer cannot increase his total satisfaction by shifting his expenditure from one commodity to the other.



**Figure 7.3: law of Equi marginal utility**

Normally, the consumer is not able to buy a commodity for a rupee at a time. He has to buy a full unit of it or not at all. And the prices of different commodities also differ from each other. Therefore, in order to arrive at MU per rupee expenditure on a commodity, the utility of the last unit of the commodity purchased (MU of the commodity) is divided by the price of the commodity. In symbols, it would be  $MU_A / P_A$  for commodity A,  $MU_B / P_B$  for commodity B, and so on. Then, according to the law of Equimarginal Utility, the consumer tries to equate these ratios with each other and also with MU of money. In symbols,

$$\frac{MU_A}{P_A} = \frac{MU_B}{P_B} = \frac{MU_C}{P_C} \dots\dots\dots MU \text{ of Money,}$$

## Limitations

When it comes to limitations, this law is no exception to the other laws of economics.

- 1) We have assumed that the consumer is able to spend very small amounts of money on different commodities. This is not always possible. Frequently, you have to buy an item in full either because it is not sold in parts or because it is useless to buy it that way. In other words, many commodities are either technically or for economic reasons not divisible into smaller units. They have to be bought either in bulk or not at all. Accordingly, the amount of expenditure on commodity has to move in large quantities. To put it differently, many purchases are bulky (or in lumpy units) and do not allow small variations. In such cases, the consumer often fails to equate marginal utilities.
- 2) Ignorance of the consumer poses another problem. A typical consumer is not able to assess and compare variations in marginal utilities of different commodities. Very often the consumer is guided by his habits, past behaviour and behaviour of other consumers, and so on.
- 3) Another problem arises on account of the life cycle of different consumption commodities that is, the number of times they can be used. Some commodities have only one-cycle use, that is, they are consumed away in one use only. Others have multi-cyclical uses. They are usable many times over. They are referred to as consumer durables. Examples of one-cycle commodities are bread, fuel, electricity, etc. Similarly, examples of multi-cyclical commodities, include cars, scooters, utensils, clothes, shoes, etc. Thus, a problem arises in the sense that while expenditure on a consumer durable is incurred during one period, utility derived from it is spread over many time periods. It becomes very difficult for the consumer to equate the MU of the services rendered by such a variety of commodities and services in each period.
- 4) Another limitation of this law arises from the fact that many commodities are related to each other. They are either substitutes or complementary. In this law, however, they are assumed to be independent of each other. The utilities derived are assumed to be dependent on their own respective quantities and not on those of others.
- 5) It is claimed that the consumer hardly tries to compare marginal utilities of different commodities when the amount of expenditure involved is very small. In that context, the law tends to be ignored by the consumer in his behaviour pattern.
- 6) One should remember, however, that in spite of the limitations described above, the Law of Equimarginal Utility does not lose its fundamental validity. Only its application to reality loses its exactness.

## 7.8 CONSUMER'S EQUILIBRIUM

With the help of the cardinal utility analysis we will draw the consumer equilibrium. We will begin with one-commodity case and extend it to two or more commodities.

### a) One commodity

Suppose, the consumer wants to buy a good. Further, suppose price of good is Rs. 3 per unit. Let the utility be expressed in utils which are measured in rupees. We are given the marginal utility schedule of the consumer.

**Table 7.5 Marginal utility of schedule**

Quantity	Price (Rs.)	Marginal Utility (Rs.)
1	3	8
2	3	7
3	3	5
4	3	3
5	3	2

When he purchases the first unit, the utility that he gets is 8 utils worth Rs. 8. He has to pay only Rs. 3 for it. Will he buy the 1<sup>st</sup> Unit? Obviously, yes, because he gets more than what he gives. Similarly, we compare the utility received from other units with the price paid. We find that he will buy 4 Units. At the 4<sup>th</sup> Unit, MU equals price. If he buys the 5<sup>th</sup> Unit, he is a loser because the utility that he gets is 2 utils worth Rs. 2 and what he has to pay is Rs. 3. Therefore, the consumer will maximize his satisfaction by buying 4 units of this commodity. The condition for maximization of satisfaction if only one commodity is purchased is:

$$MU = \text{Price}$$

### b) Two commodities

Suppose a consumer consumes only two goods. Let these goods be X and Y. Given income and prices ( $P_x$  and  $P_y$ ), the consumer will get maximum satisfaction by spending his income in such a way that he gets the same utility from the last rupee spent on each good. This is satisfied when:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \text{MU of a rupee spent on a good}$$

In order to get maximum satisfaction this condition must be satisfied else what difference will it make.

Suppose the two ratios are:



$$\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$$

It means that per rupee  $MU_X$  is higher than per rupee  $MU_Y$ . It further means that by transferring one rupee from Y to X, the consumer gains more utility than he loses. This prompts the consumer to transfer some expenditure from Y to X. Buying more of X reduces  $MU_X$ ,  $P_X$  remaining unchanged.  $MU_X/P_X$  i.e. per rupee  $MU_X$ , is also reduced. Buying less of Y raises  $MU_Y$ .  $P_Y$  remaining unchanged it raises per rupee  $MU_Y$ . The change continues till per rupee  $MU_X$  becomes equal to per rupee  $MU_Y$ . In other words:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \text{per rupee MU}$$

### BRAIN TEASER

**Q.1.** An equal proportionate increase in supply and demand will (i) leave the equilibrium price unchanged, and (ii) increase the equilibrium quantity. Show graphically.

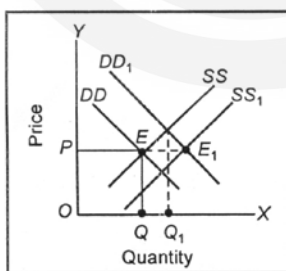
**Ans.** Fig. 1

**Q.2.** Show consumer's equilibrium with the help of cardinal analysis, if a consumer has to consume a free good (i.e., a good for which he has not to pay a price)

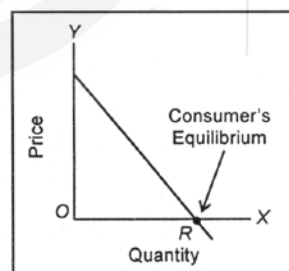
**Ans.** Fig. 2

**Q.3.** If a consumer has to pay a price for a commodity show his equilibrium situation graphically.

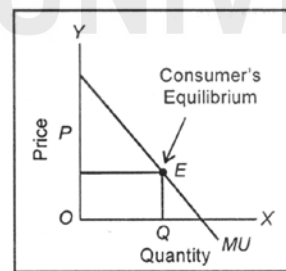
**Ans.** Fig. 3



**Fig. 1**



**Fig. 2**



**Fig. 3**

**Q.4.** If a consumer has to choose between two commodities, graphically show the determination of consumer's equilibrium.

**Ans.** Fig. 4

**Q.5.** Show the consumer's scale of preferences for two commodities, X and Y.

**Ans.** Fig. 5

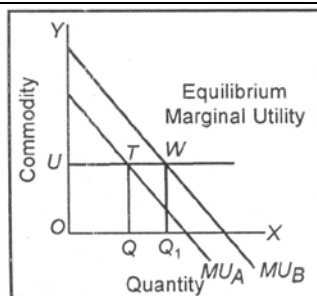


Fig. 4

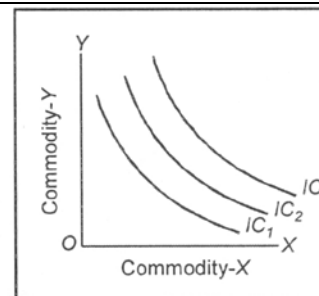


Fig. 5

**Q.6. State the consumer's equilibrium in terms of marginal utility of money.**

**Ans.** By marginal utility of money we mean the additional utility that a consumer gets when an additional rupee is spent on other available goods in general.

A consumer would consume a commodity up to the unit where *the difference between the total utility in terms of money and the total expenditure on the commodity is maximum.*

*Consumer's equilibrium with respect to the purchase of one good is attained when the difference between total utility in terms of money and the total expenditure on it is maximized.* This situation will be attained when the following condition is attained:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \text{MU of money}$$

If the marginal utility of a rupee increases, consumer's equilibrium will reach at a lower level of consumption. Hence, quantity demanded of the commodity will decrease.

In the given illustration, suppose the marginal utility of a rupee increases to 3. Then, the consumer will be in equilibrium when he consumes only one unit of the commodity.

We can generalize this condition for consumer's equilibrium when two commodities are involved as follows:

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} = \text{MU of money}$$

**Note:** There is no defined value of marginal utility of money. It varies from person to person.

## 7.9 CONSUMER'S SURPLUS

The concept of consumer's surplus was introduced by Marshall. You have seen above that every consumer to buy that quantity of a commodity for which its marginal utility (that is the utility derived from the last unit of the

commodity) and the price get equated. You would remember that every commodity obeys the law of diminishing marginal utility. As more of a commodity is acquired by the consumer, its marginal utility falls. Therefore, while the utility derived from the marginal (or last) unit of a commodity is equal to the price paid for it the utility derived from intra-marginal (or earlier) units is not. It exceeds the price. The inference is that while the consumer pays full for the utility derived from the last unit, the utility derived from earlier units is only partly paid for. The consumer gets the rest of the utility free. Take the example of MU of bananas as depicted in Table 7.2 and let us assume that the price of a banana is 7 units of utility. In that case, we can argue as follows. The consumer is ready to pay a price of 25 units of utility for the first banana rather than go without it. However, he is allowed by the market to have it by paying a price of only 7 units. Thereby he gets 18 units of utility without paying for it. This is his consumer's surplus (measured in utility terms from the first banana. Similarly, the utility derived by the consumer from the second banana is 18 units but the consumer gets it by paying only 7 units. From the second banana, therefore, he gets a consumer's surplus of 11 units of utility. In the same manner, consumer's surplus derived from the third banana is 4 units and no surplus is derived from the fourth banana. Total consumer's surplus derived in this case equals 34 units of utility.

You can see on your own that if the price of a banana is reduced to 3 units of utility, the consumer's surplus goes up. In this case, it is zero from the fifth banana but the earlier bananas yield, respectively, a consumer's surplus of 22, 15, 9 and 4 (or a total of 50) units of utility. In Marshall's words, "The excess of the price which he (the consumer) would be willing to pay rather than go without the thing over that which he actually does pay is the economic measure of this surplus satisfaction. It may be called consumer's surplus."

Thus in brief, the consumer's surplus is the excess of what the consumer is ready to pay for a commodity over what he actually pays for it. The surplus may be measured in terms of utility or in terms of money. In the explanation given earlier, the measurement runs in units of utility. Let us illustrate the concept with the help of a diagram.

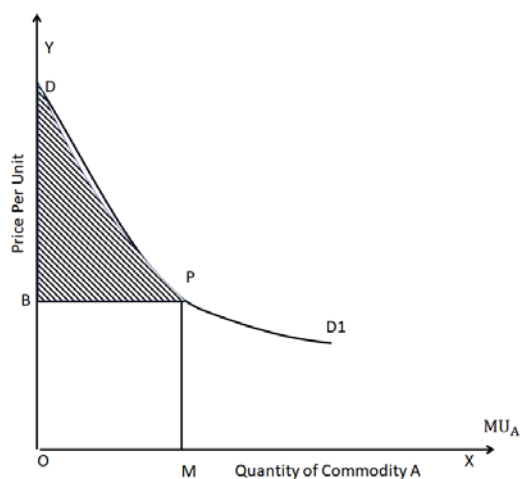


Figure 7.4 : Consumer's Surplus in Money terms

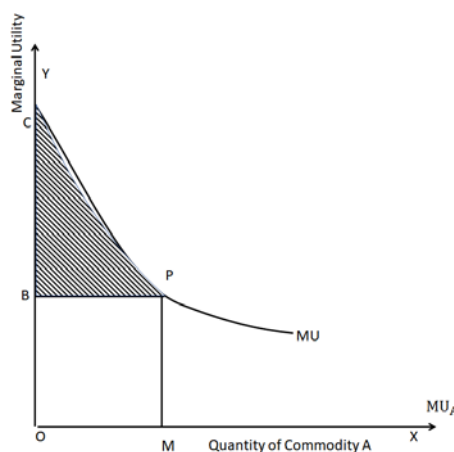


Figure 7.5 : Consumer's Surplus in Quantitative terms

In Figure 7.4, quantity of commodity A is measured along X-axis and its MU is measured along Y-axis. MU, is the marginal utility curve of the commodity A. Let us suppose that its price per unit is equal to OB. In that case the consumer buys OM quantity of the commodity at the price of PM (OB) per unit, and therefore pays a total price equal to OBPM units of utility. The total utility derived, however, is given by the area under MU curve, that is by the area OBCPM. As a result, the shaded area BCP happens to be the consumer's surplus.

The concept of consumer's surplus can be easily expressed in units of money as well. For that both MU of the commodity and its price are stated in money terms. This can be illustrated with the help of a usual demand curve. In Figure 7.5, DD is such a demand curve with quantities of the commodity measured along X-axis and the price per unit along Y-axis. Suppose, the price is OB, OBPM per unit. The consumer then buys OM units of the commodity and pays for each unit at the rate of PM. In other words, he pays a total price of OBPM amount of money. However, as the demand curve shows, for purchasing OM quantity of the commodity, he is ready to pay a total price of OBDPM rather than go without it. Therefore, his consumer's surplus is OBDPM-OBPM=the shaded area BDP amount of money.

You should note that derivation of consumer's surplus is not due to any wisdom of the consumer. It is the result of market forces which bring him an opportunity to enjoy satisfaction without paying for it. It is related on the one hand, to the demand of the consumer and on the other, to the supply of the commodity on account of which it is available at a given price. Let us elaborate this statement.

- 1) The demand situation of a commodity by the consumer under consideration determines the location and the slope of the demand curve. In case the commodity is a necessity, the demand curve tends to start from a higher point on Y-axis. It means that for the initial unit (units) of the commodity, the consumer is ready to pay a very high price rather than go without the commodity. You can think of salt and other food items as an examples of such commodities. Similarly, the slope of the demand curve is determined by the quickness with which MU of the commodity falls. If MU falls slowly, demand curve will also fall slowly and the consumer is likely to buy more of it (before MU falls enough to become equal to the price of the commodity). On the other hand, if MU falls rapidly, the demand curve also falls faster. The consumer in this case will buy a smaller quantity of the commodity. It follows that given the price of a commodity, the consumer's surplus be more if:
  - i) the demand curve starts a higher initial price which the consumer is ready to pay; and
  - ii) the demand curve has a smaller slope.
- 2) The second set of forces affecting consumer's surplus work on the supply side. In the case of a competitive market (the exact meaning of which you will learn in a later Unit) the consumer is able to buy as much of a commodity as he wants at a given price. The market allows him the

possible consumer's surplus. On the other hand, in a non-competitive situation, the price of a commodity may depend upon the quantity purchased. Here, the consumer may be forced to pay more for the initial units of a commodity. Though the average price paid by him will fall, as he purchases more (and pays less for additional units), his consumer's surplus is not as large as in the case of a fixed price. He may even be forced to pay in such a manner that he is not left with any consumer's surplus at all.

You can extend this reasoning of consumer's surplus to (i) two or more commodities, and (ii) two or more consumers even the whole market. Such an extension is not always easy and can pose many difficulties. Thus, for example, when you consider consumer's surplus from the purchase of two commodities, the total can differ from the sum of the two individual quantities. Can you see why? It is because the commodities may be substitutes or complementaries and not independent of each other. You would remember that when two commodities are not independent (that is when they are related either as substitutes or complementaries) the utility of one is affected by the quantity of the other. Moreover, this influence can be quite strong or very weak depending upon the strength of their relation. Similarly, extension of the analysis to two or more consumers poses some problems which should be kept in mind.

You should note that the concept of consumer's surplus is not just an academic exercise. Though it is difficult to measure it very exactly and though it has many difficulties when we try to extend it to the market as a whole, it has a great practical relevance. For example, the authorities know that necessities bring in larger consumer's surplus. Therefore, they should tax luxuries and comforts and avoid necessities. They should also avoid taxing those commodities on which poor people spend a larger proportion of their budgets. The businessmen, similarly, can charge higher prices for those commodities which have a 'strong' demand that is, for which the buyers are ready to pay more rather than go without.

### Check Your Progress C

- 1) State whether the following statements are **True** or **False**.
  - i) Law of Equimarginal utility depicts the behaviour of a rational consumer in maximizing his satisfaction from a given expenditure.
  - ii) A consumer always succeeds in applying the Law of Equimarginal Utility in maximizing utility in his consumption decision.
  - iii) According to Law of Equimarginal Utility, a consumer always buys the cheaper commodity.
  - iv) In the application of the Law of Equimarginal Utility, MU of a Commodity purchased can exceed the MU of money.
  - v) Different commodities must have identical MU schedules for the Law of Equimarginal Utility to apply.

- vi) According to the Law of Equimarginal Utility, a consumer spends equal amounts of money on each commodity.
- vii) Lumpy commodities are those which are bought in bigger units.
- viii) Consumer's surplus refers to those commodities which the consumer gets without paying for them.
- ix) Consumer's surplus emerges because the consumer does not pay a price equal to the utility derived from the purchased commodity.

2) Fill in the blanks:

- i) Applicability of the Law of Equimarginal Utility necessitates that the commodities are ..... (lumpy/fully divisible)
- ii) In the case of related commodities, the Law of Equimarginal Utility loses its ..... (validity/exactness)
- iii) Consumer's surplus is ..... of what the consumer is ..... pay over what he actually pays. (excess/shortfall; forced to/ready to)
- iv) Consumer's surplus is the result of .....because of which a consumer can enjoy satisfaction without paying fully for it. (an opportunity/kindness of the seller)
- v) There is normally speaking .....of consumer's surplus in necessities than in comforts. (more/less)

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## 7.10 LET US SUM UP

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The economists are interested in understanding the determination of and changes in prices in general. But they start with the price of a single commodity and find that its price is determined by an interaction between demand and supply forces.

The analysis of demand side of a single commodity is taken up with the behaviour of a single representative consumer. The consumer buys a commodity and pays a price for it because it has utility for him.

Utility is the expected satisfaction from the commodity. It is an ever changing quantity. It is a subjective thing and cannot be measured in absolute or cardinal terms. It can be measured only ordinally. For this reason, it is also not possible to have interpersonal comparisons of utility. The existence of utility does not imply that the commodity having utility is beneficial to the consumer. It may or may not be so. Utility of a commodity may be viewed in terms of total, average or marginal. Total Utility is the sum of utility derived from all the units of a commodity. Average utility is the total utility divided by the number of units of the commodity while marginal Utility is the utility of the last unit or the addition to total utility on account of the last unit of the commodity. Total utility keeps increasing only so long as marginal utility is positive.

Each commodity is subject to the law of Diminishing Marginal Utility, though in reality the law has many limitations. As far as money is concerned, opinions differ as to whether its marginal utility falls with an increase in its

quantity or not. Marshall believed that the law was applicable, though for reasons of analytical simplicity, he assumed that marginal utility of money remained constant.

Changes in marginal utility of a commodity enable us to derive the behaviour pattern of a representative consumer. By assuming that the consumer is a rational person and that marginal utility of money remains constant, it is concluded that he always tries to equate marginal utility of the commodity with its price. This leads us to derive the demand schedule of that commodity which can be represented in the form of a demand curve. The finding can be put in the form of the well-known law of demand which states that the demand for a commodity and its price are inversely related. When one falls, the other increase and vice versa. The demand curve, for this reason, slopes downwards to the right, that is, it has a negative slope.

An extension of the consumer behaviour leads us to the Law of Equimarginal Utility which is also known by other names like the Law of Maximum Satisfaction, the Law of Substitution and the Law the Indifference. This law states that when a consumer is faced with a number of commodities, he divides his total expenditure on them in such a way that the marginal utility derived from each item is equal." For two commodities, the law can also be represented in a graphical form.

The concept of consumer's surplus, introduced by Marshall, explains the fact that a buyer, in general, is ready to pay more for his purchases than he actually does. The excess of what he is ready to pay rather than go without the commodity over what he actually pays, is called the consumer's surplus. It may be expressed and measured in terms of utility or in terms of money. In the former case, use is made of MU curve. In the latter case, the demand curve is used. The amount of consumer's surplus depends upon the position and slope of the demand curve as also upon the supply conditions in the market. Though it is difficult to extend the concept of consumer's surplus to the market as a whole, it has a great practical relevance. For example, the authorities can adjust their tax structure so as to minimize the reduction in it. The sellers, on the other hand, can use the concept for increasing their profits.

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## 7.11 KEY WORDS

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**Average Utility:** It is the total utility divided by number of units of a commodity.

**Cardinal Measurement:** It is the measurement in absolute terms or numerical units.

**Consumer's Surplus:** It is that portion of utility derived from a commodity which is obtained in excess of the price paid by the consumer. In money terms, it is the excess of what the consumer is ready to pay for a commodity over what he actually pays.

**Demand Curve:** Graphic presentation of a demand schedule.

**Demand Schedule:** The tabular presentation of the amounts of a commodity which will be demanded at different specified prices.

**Disutility:** This term denotes that the consumption of the commodity under consideration leads to a loss of satisfaction and, therefore, a reduction in total utility.

**Inferior Commodities:** Those commodities which are believed to be bought by only persons with low incomes. Therefore, the consumer reduces the demand for such commodities when his income increases.

**Interpersonal Comparison of Utility:** It denotes the comparison of utility derived by two persons. This comparison is possible only under cardinal measurement of utility.

**Law of Demand:** It is a statement of a tendency that the demand for a commodity falls as its price rises and vice versa.

**Lumpy Goods:** Those commodities which cannot be purchased in small quantities (that is with a small amount of expenditure), it is also called bulky commodities.

**Law of Diminishing Marginal Utility or Law of Satiable Wants:** The principle according to which a given want can be satisfied fully and, therefore, the marginal utility of a commodity keeps falling as more of it is acquired.

**Law of Equimarginal Utility:** This law states that a rational consumer tries to distribute his total expenditure on different commodities in such a way that the marginal utilities derived, per rupee of expenditure from all commodities are equal.

**Marginal Utility:** It is the utility of the last unit of a commodity; it is addition to total utility on account of the last unit of a commodity.

**Negative Slope of a Curve:** It denotes the fact that the quantities measured along the two axes are inversely related: when one increases, the other falls.

**Ordinal Measurement:** The arrangement of utility amounts in ascending or descending order. Here between any two utility amounts, it is known which is more; but it is not known 'how much more'.

**Total Utility:** It is the sum of utility derived from all the units of a commodity consumed.

**Utility:** The want-satisfying capacity of a commodity, the expected satisfaction from a commodity.

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## 7.12 ANSWERS TO CHECK YOUR PROGRESS

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### Check your progress A

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

1. i) utility, ii) changing, iii) expected; realized, iv) ordinal, v) cardinally.



### Check your progress B

- 1 i) False, ii) False, iii) True, iv) True, v) False, vi) False, vii) True, viii) True.
- 2 i) complementary, ii) substitutes, iii) income, inferior, iv) marginal utility; constant, v) money; utility, vi) decreases; increases; falls.

### Check your progress C

- 1 i) True ii) False iii) False iv) True v) False vi) False vii) True, viii) False, ix) True.
- 2 i) fully divisible, ii) exactness, iii) excess; ready to, iv) an opportunity, v) more.

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## 7.13 TERMINAL QUESTIONS

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- 1) Distinguish among total utility, average utility and marginal utility.
- 2) State the Law of Diminishing Marginal Utility (or the Law of Satiable Wants) and its limitations.
- 3) Is the Law of Diminishing Marginal Utility applicable to money? Explain your answer.
- 4) Critically examine the Law of Equimarginal Utility.
- 5) Discuss the validity of the concept of consumer's surplus in the context of (a) single commodity (b) two or more commodities (c) two or more buyers.
- 6) Explain the concept of consumer's surplus. What are its limitations?

**Note: These questions will help you in understanding the unit better. Try to write their answers. However, do not send them to the University because they are meant for your own practice only.**

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## UNIT 8      INDIFFERENCE CURVES ANALYSIS

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### Structure

- 8.0 Objectives
- 8.1 Introduction
- 8.2 Limitations of Utility Analysis
- 8.3 A Scale of Preferences
- 8.4 Indifference Curves
- 8.5 Assumptions of Indifference Curves
- 8.6 Properties of Indifference Curves
- 8.7 Marginal Rate of Substitution
- 8.8 Consumer's Equilibrium
- 8.9 Income Consumption Curve
- 8.10 Price Consumption Curve
- 8.11 Separation of Income and Substitution Effects
- 8.12 Derivation of Consumer's Demand Curve
- 8.13 Consumer's Surplus
- 8.14 Superiority of Indifference Curves Analysis
- 8.15 Let Us Sum Up
- 8.16 Key Words
- 8.17 Answers to Check Your Progress
- 8.18 Terminal Questions

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### 8.0 OBJECTIVES

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After studying this unit, you should be able to:

- outline the shortcomings of Marshallian utility analysis of consumer's demand behaviour;
- explain the concept of a scale of preferences;
- discuss the concept of an indifference curve and its various assumptions;
- enumerate the properties of indifference curves;
- explain the concept of budget price line and its applications;
- explain the meaning and derivation of income consumption curve;
- describe the meaning and derivation of price consumption curve;
- distinguish between income effect, substitution effect and price effect;
- split-up price effect into income and substitution effects;

- derive consumer's demand curve from price consumption curve measure consumer's surplus with the help of indifference curves;
- explain the superiority of otherwise of indifference curves analysis over Marshallian utility analysis.

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## 8.1 INTRODUCTION

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In unit 7, you have learnt about the behaviour of a representative rational consumer. The analysis of his behaviour was based upon the concept of utility. With some important assumptions, you were able to put his behaviour pattern in a standardized form. You were able to state that he would reduce his demand for a commodity in response to an increase in its price and would increase the demand if the price was reduced. Similarly, you also learnt that when faced with the problem of distributing his total expenditure over a number of commodities the consumer always tried to ensure that utility received from the last rupee spend on each commodity was equal. His behaviour pattern was put in the form of Law of Equimarginal Utility which, in symbols, states that

$$\frac{MU_x}{P_x} = \frac{MY_Y}{P_Y} = \frac{MU_Z}{P_Z} = \dots\dots\dots = \text{marginal utility of money}$$

This analysis of the consumer behaviour enabled you to discover and state the law of demand and helped you in understanding a few related things. But in the process you had to make some assumptions which are highly unrealistic. As a result, findings based upon that utility analysis suffer from three defects:

- Since the analysis is based upon unrealistic assumptions, it cannot be claimed that the conclusions of the analysis depict reality. They, at times, can even be misleading.
- Utility analysis is not able to cover some important cases such as the relationship between demand and price in the case of 'inferior commodities'.
- It is not able to take into account the effect of some important forces on the demand for a commodity.

It was therefore natural for the economists to try and remove the shortcomings of the Marshallian utility analysis and bring out an improved form of analysis. This they did by developing the indifference curves. In this unit you would, learn the concept of indifference curves, their related aspects and their application to consumer's behaviour.

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## 8.2 LIMITATIONS OF UTILITY ANALYSIS

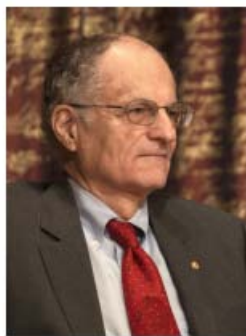
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Before taking up indifference curves analysis, you should be able to state the limitations of the utility approach in a systematic manner. Therefore, let us have a brief look at them before going to indifference curves.

- i) You are already familiar with the fact that utility is subjective. It cannot be measured in cardinal or absolute terms. It can only be expressed in ordinal terms. However, it is still assumed that utility can be measured cardinally.
- ii) Another limitations of utility analysis relates to the assumption that marginal utility of money remains constant. You have noted in unit 7 that from all observations, money obeys the law of diminishing marginal utility. Even Marshall says so. However, when it comes to demand behaviour of a consumer, it has to be assumed that marginal utility of money remains constant.
- iii) On account of the assumption of cardinal measurement of utility, the analysis can be extended to state that interpersonal comparisons of utility are also possible. In that case, you are able to say which of the two individuals, for example, A and B, gets more of utility from a given commodity and how much. On scientific grounds, however, interpersonal comparisons of utility are not possible because utility is not measurable in absolute quantities.
- iv) Utility analysis of demand cannot explain what is known as Giffin's Paradox. Giffin found that the demand for bread increased with an increase in its price. The explanation of this phenomenon lay in the fact that during Giffin's days in England, workers were very poor, Bread was their basic necessity of life and they had to spend a high proportion of their income on it. With a rise in the price of bread, a poor worker was not left with enough money to buy other articles of food which were considered 'better' and were more expensive. As a result, the poor worker had to reduce his demand for other food articles and instead consume more of bread which was still cheaper compared with them. In the same manner, economists have found that demand for a commodity is affected not only by its current price and marginal utility, but also by expected changes in its price.
- v) Marshallian utility analysis is not able to isolate the effect of changes in income of the consumer on the demand for a commodity. The fact is that demand is affected by a number of variables. And change in income is one of them. When the price of a commodity falls (rises) it means that the consumer is able to buy more (less) of other commodities put together.
- vi) Another shortcoming of Marshallian utility analysis is that it is not able to cover the case of related commodities that is commodities which are complementary or substitutes.

Indifference curves approach tries to remove some of these shortcomings of Marshallian utility approach while trying to explain the demand behaviour of 'a consumer and deriving the demand curve for a commodity.

Third approach was developed by John R. Hicks and R.G.D Allen



R.G.D.Allen



J.R.Hicks

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### 8.3 A SCALE OF PREFERENCES

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This concept is fundamental to indifference curves analysis. Here it is assumed that a consumer is confronted with a number of alternative combinations of commodities, say X and Y. It is further assumed as follows:

- i) The consumer is not able to measure utility or satisfaction in absolute units. Therefore, between any two combinations of commodities X and Y, he is only able to tell us that the utility from the first combination is more than, equal to, or less than the utility from the second combination. He is therefore able to arrange any number of combinations in ascending or descending order of preference. However, he is not in a position to tell as the amount of the difference in the utility from any two combinations.
- ii) The consumer always opts for a combination which is expected to bring him greater total satisfaction. Thus when all possible commodities of commodities under consideration (namely, X and Y) are arranged, we find that the consumer has classified all alternative combinations of commodities to separate groups such that all the combinations within each go represent the same total expected satisfaction. We find further then the groups themselves are arranged in an ascending or a descending order of utility. It is assumed that the consumer, being a rational person, will have a greater satisfaction group to a combination from satisfaction group and that he would have equal preference for that is he would be indifference between) alternative combinations from within the same group. Arrangement of all combinations in this manner is called the consumer's scale of preferences.

You should note the foregoing description of the concept scale of preferences of a consumer is based upon certain conditions or assumptions

- i) While arranging different combinations in order of preferences, the consumer does not think of the cost (or price) of acquiring those commodities. He only thinks of the expected total satisfaction from each combination.
- ii) It is implicitly assumed that the consumer concerned is capable of arranging all the alternative combinations according to their expected satisfaction. That is to say, he can formulate precise estimates of the expected satisfaction from each combination.

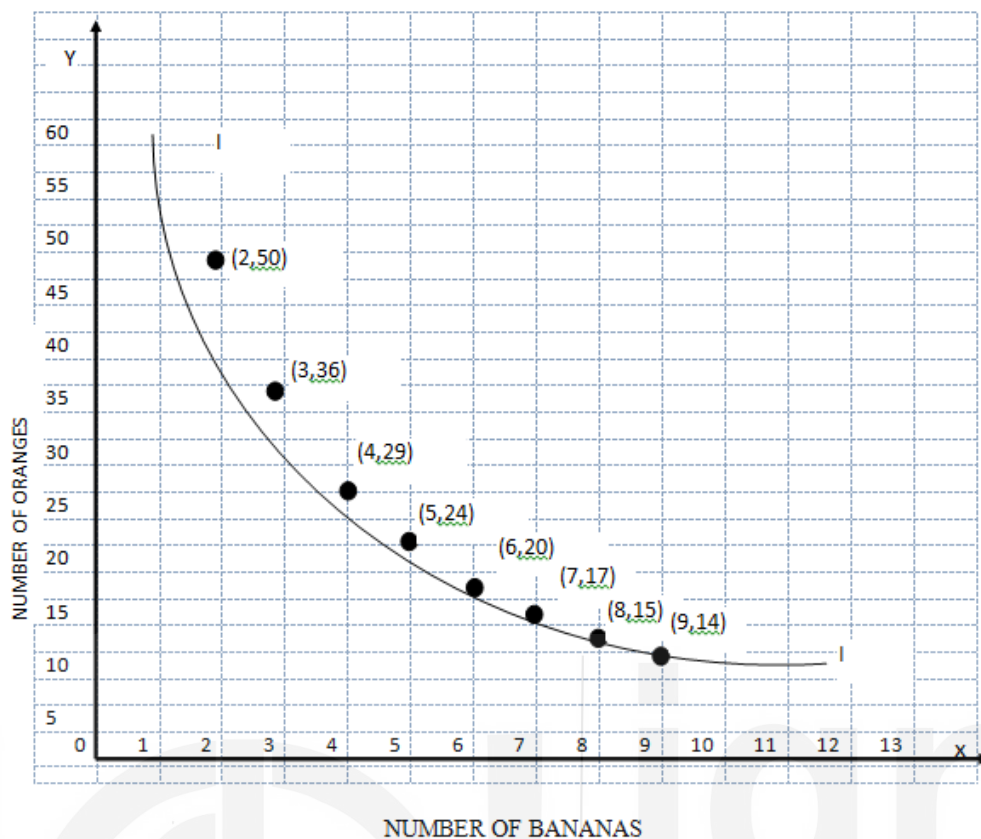
- iii) The consumer also prefers more satisfaction to the less. That way his behaviour is rational.
- iv) There is consistency in the behaviour of the consumer, for example, he prefers combination 1 to combination 2 and combination 2 to combination 3, then he would also prefer combination 1 to combination 3.

## 8.4 INDIFFERENCE CURVES

An indifference curve is a graphic and simplified way of presenting alternative combinations of commodities which, in the judgement of the consumer, are expected to yield the same total satisfaction. If such combinations are presented in the form of a table, it would be called an Indifference schedule, a graphic presentation thereof is called an Indifference curve. For simplicity and clarity, an indifference curve handles only those cases in which each group comprises of only two commodities say X and Y. Let us take an imaginary example of an indifference schedule and its corresponding indifference curve so as to understand the concept more thoroughly.

**Table 8.1 Indifference Schedule of a Consumer**

Combination Number	No. of Oranges	No. of Bananas
1	50	2
2	36	3
3	29	4
4	24	5
5	20	6
6	17	7
7	15	8
8	14	9



**Figure 8.1 Indifference Curve of the Consumer**

According to Table 8.1, the consumer in question hopes to get the same amount of total satisfaction from different combination of oranges and bananas. For example, the satisfaction from a combination of 50 oranges and 2 bananas is the same as that from 36 oranges and 3 bananas or from 29 oranges and 4 bananas and so on. The same combinations are plotted in Figure 8.1 and by joining them we get an indifference curve. You would notice a few features of indifference schedule which shall be explained later in the unit. Thus, you notice that a combination having more bananas has less oranges (or the other way round) is not at a uniform rate. Thus, for each additional banana, the consumer is ready to give up a smaller number of oranges, and similarly for each additional orange, he is ready to give up a smaller quantity of bananas. It is for this reason that

indifference curve in Figure 8.1 gets a particular shape which is not only having a negative slope (you are already familiar with the meaning of this term) but is

#### FOR MORE CLARITY!

A graph of indifference curves for an individual consumer associated with different utility levels is called an indifference map. Points yielding different utility levels are associated with distinct indifference curves and are like a contour line on a topographical map. Each point on the curve represents the same elevation. If you move "off" an indifference curve travelling in a northeast direction (assuming positive marginal utility for the goods), you are essentially climbing amount of utility. The higher you go the greater the level of utility. The non-satiation requirement means that you will never reach the "top" or a "bliss point", a consumption bundle that is preferred to all others.

also convex to the origin, that is, having a curvature towards the origin.

You have seen earlier that a consumer can classify all alternative combinations of commodities X and Y in such a way that each combination in a given group has the same total utility. A curve representing one such group is an indifference curve. It is clear, therefore, that it is possible to draw a large number of indifference curves such that each curve represents a corresponding group of combinations of X and Y with a given total utility.

A set of indifference curves derived in this manner is called an indifference map, or a system of indifference curves, or a family of indifference curves. You will learn more about an individual indifference curve and the indifference map later in the Unit.

### Check Your Progress A

1) Define Indifference Curve

.....

.....

.....

.....

.....

2) State whether following statements are **True** or **False**

- i) While utility approach to the analysis of consumer's demand behaviour assumes that he behaves rationally, the indifference curves approach does not.
- ii) Utility approach is able to take into account the income effect on demand.
- iii) Giffin's paradox says that people keep buying a commodity even when they do not need it.
- iv) Two commodities X and Y are related only if an increased demand for one is accompanied by an increase in the other.
- v) Inferior commodities are those whose demand falls with an increase in the income of the consumers.
- vi) Marshallian utility analysis is not able to cover the case of related commodities.
- vii) An indifference curve can be drawn on the assumption of cardinal measurement of utility.

3. Fill in the blanks by choosing appropriate words/phrases given in bracket at the end.

- i) An indifference curve represents alternative combinations of commodities X and Y such that total satisfaction from each combination is.....



- ii) While arranging different combinations in order of preference, a consumer.....consider the cost of acquiring commodities.
- iii) In determining his scale of preferences a consumer classifies all alternative combinations of X and Y into groups such that combinations belonging to a given group have .....
- i) A consumer, while comparing expected satisfaction from two alternative combinations of X and Y, is able to say which combination yields more satisfaction but cannot say .....  
(does not; how much more; the same; the same total satisfaction)

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## 8.5 ASSUMPTIONS OF INDIFFERENCE CURVES

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Like any other part of Economics, indifference curve analysis is also based upon certain assumptions which in turn determine their areas of strength, their applicability and their shortcomings.

- 1 It is assumed that the consumer is to choose between different combinations of only two commodities, namely X and Y. This is a very restrictive assumption because in reality the consumer deals with a large number of commodities. This restrictive assumption is made to facilitate graphic representation of indifference curves. Geometrically, we can have at the most three-dimensional diagrams, though it is far more convenient to work with two dimensions only. The economists realize the shortcomings of having indifference curves with two commodities only. Therefore, they try to overcome this problem by having one of the commodities as the composite commodity, that is a commodity which represents all the other commodities jointly in a definite proportion, or more conveniently, by 'money' which represents alternative combinations of commodity X and money such that the consumer gets the same total satisfaction from each combination.
- 2 The second assumption of indifference curves approach is that utility can be measured only ordinally. You are already familiar with this concept and, therefore, there is no need to discuss it further.
- 3 Another important assumption of indifference curves approach is that both commodities X and Y have positive marginal utilities. This implies that given any combination of X and Y, if one of the commodities is increased in quantity, the total satisfaction derived from both commodities put together would increase. Therefore, in order to keep the total utility at the same level, the quantity of the second commodity must be reduced. In other words, with every increase in the quantity of X, there must be a reduction in the quantity of Y; and with every increase in the quantity of Y, there must be a reduction in the quantity of X.
- 4 It is assumed that both X and Y obey the law of diminishing marginal utility. This is so even when one of the commodities is money. Let us suppose that new combinations are formed by adding one unit of X at a time. Because of diminishing marginal utility, the addition to total utility

would be by decreasing amounts. Therefore, the corresponding reduction in Y should also be by decreasing quantities, that is, the consumer would be ready to give up a decreasing quantity of Y for each additional unit of X. Further, since marginal utility of Y keeps increasing with its falling stock, the consumer would be ready to give up still smaller quantities of Y for each additional unit of X.

- 2 Both commodities X and Y are perfectly divisible. It means that quantities of both X and Y can be increased (decreased) in minute quantities and the corresponding changes in total satisfaction can also be very small.

## 8.6 PROPERTIES OF INDIFFERENCE CURVES

Indifference curves have some features (or properties or characteristics) which follow from the assumptions upon which indifference curve approach is based and upon which indifference curves are drawn.

1. **An indifference curve slopes downwards to the right:** That is to say, an indifference curve has a negative slope. This property shows that any increase in the amount of commodity X is accompanied by a reduction in the quantity of Y. This property is derived from the assumption that both X and Y have positive marginal utility. As a result, when there is an addition to total utility on account of more of X, there has to be an equivalent reduction in total utility through a reduction in the quantity of Y. This is illustrated in Figure 8.1.
2. **An indifference curve is convex to the origin:** It has an inward curvature towards the origin. You can understand this point by remembering the assumption that both X and Y obey the law of diminishing marginal utility.

Now look at Figures 8.2A, 8.2B, and 8.2C. In all the three cases, the indifference curve slopes downwards to the right. In all cases, it has a negative slope. But only Figure 8.2B has an indifference curve which is convex to the origin. In Figure 8.2A, the indifference curve is a straight line so that the reduction in the amount of Y is the same for each additional unit of X. This happens when both X and Y are

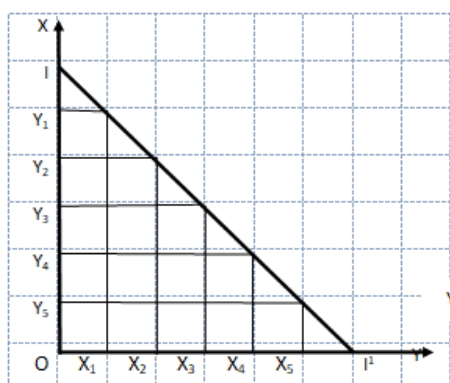


Figure 8.2 A  
A Straight Line Indifference Curve

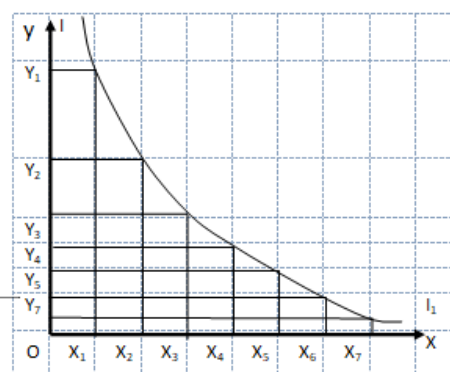


Figure 8.2 B  
A Concave to the origin Indifference

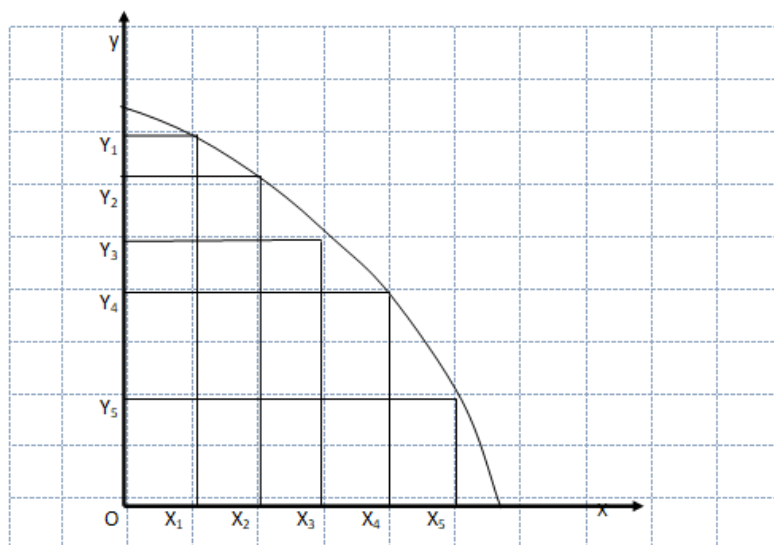


Figure 8.2 C  
A Convex to the Origin Indifference Curve

subject to constant marginal utility. In that case, each additional unit of X adds the same amount of utility to the total. Since marginal utility of Y also remains constant, the reduction needed in total utility and therefore the reduction needed in the quantity of Y also remains the same. In Figure 8.2A, the ratios are:

$$\frac{Y_1 Y_2}{X_1 X_2} = \frac{Y_2 Y_3}{X_2 X_3} = \frac{Y_3 Y_4}{X_3 X_4} \dots\dots\dots$$

As against this, in Figure 8.2B, when quantity of X is increased by one unit at a time the reduction in Y is by ever decreasing quantities ( $Y_1, Y_2, Y_3, Y_4, \dots\dots\dots$ ). This is because of diminishing marginal utility. As the stock of X with the consumer increases, its marginal utility falls and the addition to total utility is by a smaller amount. Consequently, the reduction in Y also takes place in decreasing quantities, all the more so because its marginal utility keeps increasing as its stock with the consumer decreases. In Figure 8.2B, the ratios are:

$$\frac{Y_1 Y_2}{X_1 X_2} > \frac{Y_2 Y_3}{X_2 X_3} > \frac{Y_3 Y_4}{X_3 X_4} > \dots\dots\dots$$

You can consider a third case also, that is, in which marginal utility of a commodity keeps, increasing if its stock with the consumer increases. This is a totally invalid assumption. But it is being made here only to explain the type of shape which an indifference curve will get in this case. Here we find that successive additions to X lead to a reduction in Y by increasing amounts. In Figure 8.2C:

$$\frac{Y_1 Y_2}{X_1 X_2} < \frac{Y_2 Y_3}{X_2 X_3} < \frac{Y_3 Y_4}{X_3 X_4} > \dots\dots\dots$$

It would be helpful if the above discussion is put in a symbolic form. Let  $MUX$  and  $MU_Y$  respectively denote the marginal utility of X and Y. Then the addition to total utility by a marginal addition of X (denoted by the symbol

$\Delta X$ ) would be given by the multiplication of  $MU_x$  with the quantity by which X changes, that is,

by  $MU_x \cdot \Delta X$ . Similarly, the reduction in total utility would be given by  $MU_y \cdot \Delta Y$ .

$\Delta Y$ . For two combinations to be on the same indifference curve, the addition in total utility should be equal to the reduction in it, that is to say or

$$MU_x \cdot \Delta X = MU_y \cdot \Delta Y$$

Or

$$\frac{MU_x}{MU_y} = \frac{\Delta Y}{\Delta X} \dots\dots\dots(1)$$

Now look at the equation (1). The value of the ratio  $\Delta Y/\Delta X$  shows the amount of Y which the consumer is ready to give up for getting one more unit of X. If  $MU_x$  and  $MU_y$  do not change when quantities of X and Y change, the ratio  $\Delta Y/\Delta X$  does not change. The consumer continues giving up the same quantity of Y for successive additional units of X. Under these conditions, the indifference curve becomes a straight line as in Figure 8.2A. As against this, if both X and Y are subject to diminishing marginal utility, then as the stock of X goes up,  $MU_x$  falls and as the stock of Y with the consumer decreases,  $MU_y$  increases. This means that the ratio  $MU_x/MU_y$  keeps decreasing. That is, the consumer agrees to give up a decreasing quantity of Y for each additional unit of X. In this case, therefore, the indifference curve is convex to the origin as in Figure 8.2B. If on the other hand, both X and Y are subject to increasing marginal utility, then an increase in the stock of X increases its marginal utility, while a reduction in the stock of Y reduces  $MU_y$ . This leads to an increase in the value of the ratio  $MU_x/MU_y$  so that the consumer is ready to give up an increasing quantity of Y for each additional unit of X. Such a behaviour of marginal utility leads to the concavity of the indifference curve to the origin, as in Figure 8.2C. You would see that out of the three cases discussed here, the relevant property applicable to an indifference curve is that of convexity to the origin. It is neither a straight line, nor curve to the origin.

3. **No two indifference curves intersect each other:** This property of Indifference curves follows from the assumption that both X and Y have positive marginal utilities. In cases the curves intersect each other, this assumption is violated. The fact of this property can be further explained, with the help of Figure 8.3.

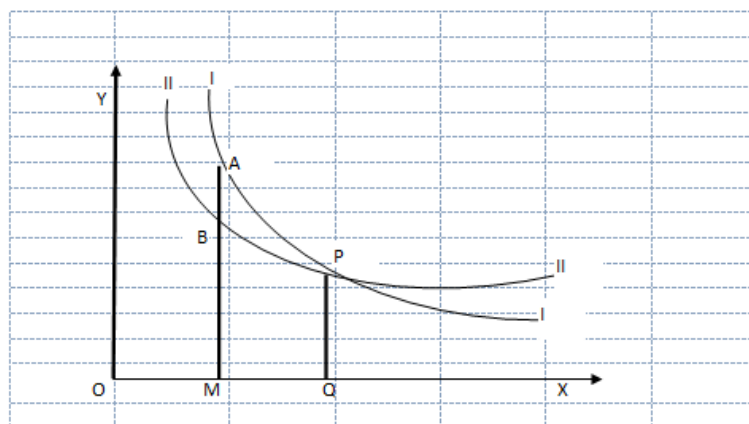


Figure 8.3 : Intersecting Indifference Curve

Let us suppose that two indifference curves I and II intersect each other at point P. Also take a point A on indifference curve I and drop a perpendicular on X axis cutting indifference curve II at point B.

Now both points P and A happen to be on the same indifference curve I, and, therefore, the combinations represented by them have the same total satisfaction.

That is to say OQ of X plus PQ of Y = OM of X plus AM of Y ... (2). Similarly, points P and B are on the same indifference curve II, so that

OQ of X plus PQ of Y = OM of X plus BM of Y ..... (3) From equations (2) and (3) it follows that OM of X plus AM of Y = OM of X plus BM of Y that is, AM of Y = BM of Y

Now two different quantities AM and BM of Y can yield the same total satisfaction only if the additional amount of Y (AB) has zero utility. This contradicts the assumption that Y has positive marginal utility. In other words, point P cannot be on two different indifference curves and therefore cannot be a point of intersection. Or to put it differently, no two indifference curves can intersect each other.

- 4 **An indifference curve is a continuous one:** It means that there are no gaps in an indifference curve. This property follows from the assumption that both X and Y are perfectly divisible and their amounts can be varied in very small quantities.
- 3 **Indifference curves are not parallel to each other:** Though no two indifference curves cut each other, they are not equidistant either. Both the vertical and horizontal distances between two successive indifference curves keep changing as we move along them. This property follows from the assumption that both X and Y obey the law of diminishing marginal utility resulting in convexity of indifference curves.
- 4 **A higher indifference curve represents greater total satisfaction:** A higher indifference curve is the one which is farther away from the origin. Compared with the curve immediately to the left (and therefore nearer the origin) of it, it has the following feature. Choose a point P on the lower indifference curve

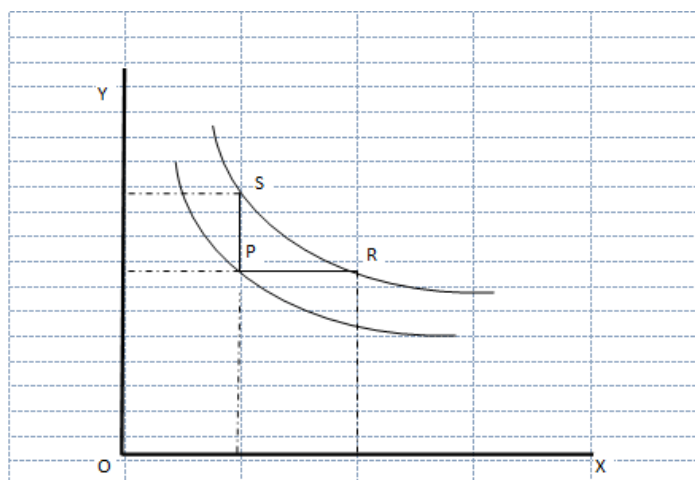


Figure 8.3A: Indifference Curve showing Greater Total Satisfaction

and move horizontally to the right and reach the higher indifference curve at point R. Then both P and R combinations contain equal quantities of commodity Y but combination R contains more of X and, therefore, has greater total satisfaction. Similarly, if you move from P vertically and reach the higher indifference curve at point S, then both combinations P and S contain equal quantities of X but combination S contains more of commodity Y and, therefore, represents greater total satisfaction. Thus it can be seen that the curve farther away from the origin has greater total satisfaction.

## 8.7 MARGINAL RATE OF SUBSTITUTION

This is a very important concept in indifference curves analysis. Marginal Rate of Substitution (MRS) of X for Y measures the rate at which the consumer is ready to give up Y for an additional unit of X. From an earlier portion of this Unit, you would recall that such a rate is nothing but  $\Delta Y / \Delta X$  which is always equal to  $MU_X / MU_Y$ . In other words, the MRS of X and Y is always equal to the ratio of marginal utility of X to that of Y. Since the two marginal utilities keep changing, therefore, MRS also keeps changing. Note that when we talk of MRS of Y for X (instead of MRS of X for Y) we refer to a situation in which the consumer acquires additional units of Y (instead of X) and gives up corresponding amounts of X (instead of Y). Accordingly MRS of Y for X is equal to  $\Delta X / \Delta Y$  and  $MU_Y / MU_X$ .

It is important to note that MRS of X for Y keeps falling as the stock of X with the consumer increases because that leads to a fall in  $MU_X$  and an increase in  $MU_Y$  and thus a fall in the ratio. Further, geometrically, MRS is represented by the slope of the tangent to the indifference curve at the relevant point of reference. The convexity of the indifference curve and falling MRS of X for Y are thus the same thing. As we move along an indifference curve from left to right (and, therefore, as the amount of X keeps increasing), we find that the slope of the successive tangents drawn keeps falling. This is illustrated in Figure 8.4. MRS of X and Y at point A is given by the slope of tangent drawn to the curve at point A, that is by the ratio  $OY_1 / OX_1$ . Similarly, MRS of X for Y at point B is given by  $OY_2 / OX_2$ , which is less than  $OY_1 / OX_2$ . MRS of X for Y at point C is still smaller and is equal to  $OY_3 / OX_3$ .



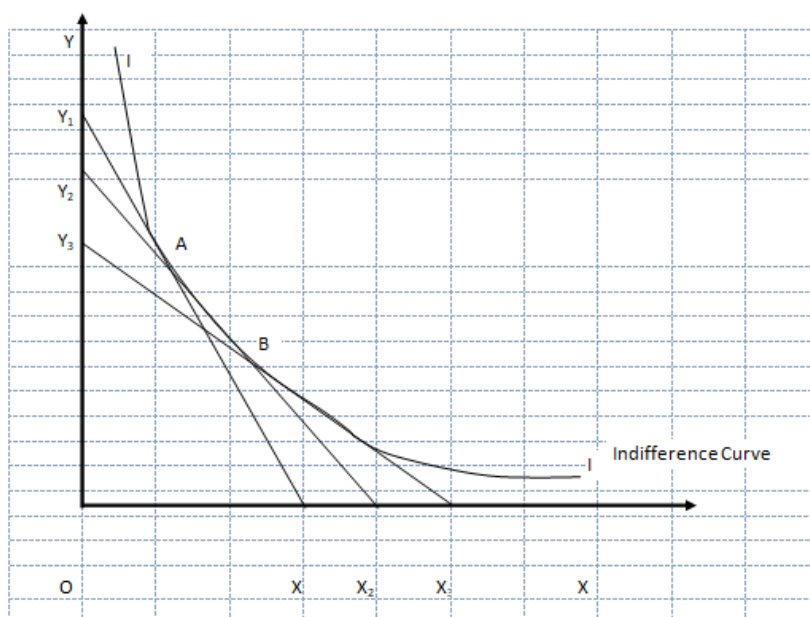


Figure 8.4 : Marginal Rate of Substitution

Table 8.2 : Calculation of MRS

Combination Number	Number of Oranges (Y)	Number of Bananas (X)	$\Delta Y$	$\Delta X$	$\Delta Y / \Delta X$	$\Delta X / \Delta Y$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	50	2	-14	1	-14	-0.07
2	36	3	-7	1	-7	-0.14
3	29	4	-5	1	-5	-0.20
4	24	5	-4	1	-4	-0.25
5	20	6	-3	1	-3	-0.33
6	17	7	-2	1	-2	-0.50
7	15	8	-1	1	-1	-1.00
8	14	9	N.A.	N.A.	N.A.	N.A.

Let us take up the indifference schedule as presented in Table 8.2 and calculate MRS. For this you would need the values of variations in X and Y (that is  $\Delta X$  and a  $\Delta Y$ ) from one combination to the next. Here  $\Delta Y$  represents that quantity of Y which the consumer is ready to give up for a  $\Delta X$ . Once such an exchange takes place, the value of  $\Delta Y$  which the consumer is ready to give up for  $\Delta X$  undergoes a change. Thus when the consumer is having combination No. 1 with 50 oranges and 2 bananas, he is ready to give up 14 oranges for one banana. Similarly, when he is having combination No. 3, he is ready to give up only 5 oranges for one banana. These quantities of oranges and bananas that is of  $\Delta Y$  and  $\Delta X$  are shown in Columns 4 and 5 respectively. The values in column (6) show the ratio  $\Delta Y / \Delta X$ , that is, MRS of X for Y. It is conventional to ignore the negative

sign of this ratio, so that MRS at this stage is written as 14 and not -14. Similarly, when the consumer has combination No. 2, his MRS of bananas for oranges is 7, and so on for other combinations.

MRS of oranges for bananas is calculated reduction in an addition in the number of oranges and a corresponding reduction in the number of bananas. The ratio in this case is  $\Delta X / \Delta Y$ . The values of successive MRS of oranges for bananas are shown in column 7 of Table 8.2. At combination No. 8, MRS of oranges for bananas is 1/1 or 1; at combination No. 7, it is -1/2 or 0.50; at combination No. 6, it is 1/3 or 0.33 and so on. Here also, you notice that the value of MRS keeps falling as the consumer gets more of oranges and less of bananas. For each additional orange, he is ready to give up a smaller quantity of bananas than before.

### Check Your Progress B

- 1) List the important properties of Indifference Curve.

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- 2) What do you mean by Marginal Rate of Substitution?

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- 3) State whether the following statements are **True** or **False**.

- i) Indifference curves approach assumes that while commodity X obeys the law of diminishing marginal utility, money does not.
- ii) In indifference curves analysis, both commodities X and Y are perfectly divisible.
- iii) While drawing an indifference curve, it is assumed that while marginal utility of one commodity is positive, that of the other is negative.
- iv) An indifference curve always slopes downwards, but it can also be concave to the origin.
- ii) Two indifference curves are always parallel to each other.
- iii) Two indifference curves can never intersect each other.
- iv) The convexity of an indifference curve towards the origin and falling MRS are the same thing expressed differently.



- v) With a straight line indifference curve MRS keeps falling as we move from left to right.
  - vi) MRS is equal to the slope of the tangent at the relevant point on the indifference curve.
- 4) Fill in the blanks with appropriate words/phrases.
- i) MRS of X for Y is defined by.....which the consumer is ready to give up, at the margin, for one additional unit of X.
  - ii) MRS of X for Y falls because both X and Y are subject to.....
  - iii) The convexity of an indifference curve-follows from the assumption that both commodities are subject to.....
  - iv) If MRS remains constant, an indifference curve would be a.....
  - v) We get a continuous indifference curve on the assumption that both commodities X and Y are.....

## 8.8 CONSUMER'S EQUILIBRIUM

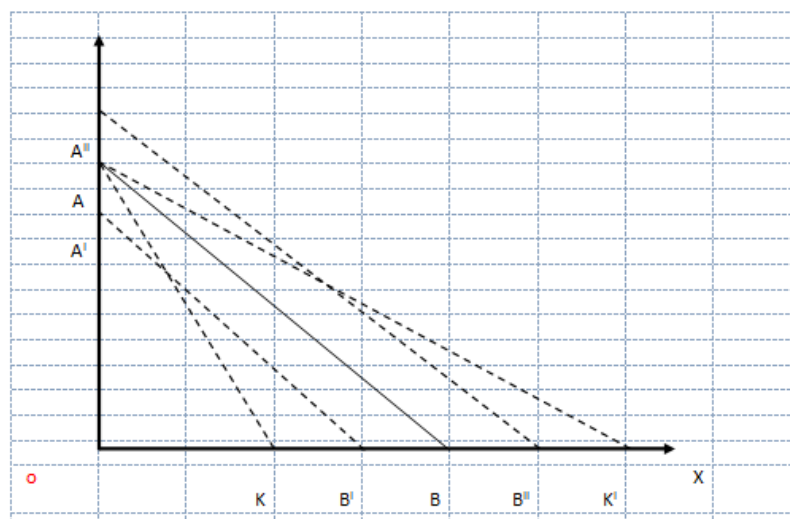
Understanding the determination of consumer's equilibrium is an important necessary step for analysing his behaviour and for deriving his demand curve for a given commodity X. The concept of consumer's equilibrium denotes the position which he tries to attain with given income and given prices, and having attained it, retains it till his income and/or prices change. The consumer's equilibrium position is read as the amount of commodity X which he would buy and the amount of Y (or money) which he would pay for it as its price and, therefore, the amount of Y (or money) which he would retain with him.

### Budget Price Line

The concept of budget price line is needed for analysing the consumer's equilibrium and is also variously known as 'price line', 'budget line' or 'budget price line'. We shall use the term budget price line or BPL.

BPL of a consumer shows different combinations of X and Y which the market permits him to have. At the one end, it represents the maximum amount of Y with no X (point A in Figure 8.5) and at the other end, the maximum amount of X, with no Y (point B in Figure 8.5). The straight line joining these two points (that is the straight line AB) is the BPL and represents all the alternative combinations of X and Y which the consumer can have. He is allowed to have as much of X as he wants (subject to the maximum of OB) by paying its price at the rate of OA OB per unit. For example, in Figure 8.6, if the consumer wants to have OM of X, he is to pay AQ of Y as its price and he is allowed to have the combination of OM of X and OQ of Y. Note that the price per unit of X is the slope of BPL.

In this connection note the following also. If the income of the consumer falls to



**Figure 8.5: Budget Price Line**

OA, the new BPL becomes A B. However, if the income of the consumer remains the same, but X becomes cheaper, the consumer would be able to buy more of it, say OK' so that the BPL will rotate at its end A and will assume the position AK. Similarly, if the price of X goes up, the consumer will be able to buy less of X, say OK and the BPL would move to the position AK. So you should remember that when income of the consumer changes but price of X does not, new BPL is parallel to the old one and has the same slope. On the other hand, if income of the consumer does not change but the price of X does, then the new BPL will change its slope. It will still start from the same old point A on Y-axis but will touch X-axis at a different point.

You should also remember that a given BPL can be tangent to one and only one indifference curve. Further it either intersects all other indifference curves, or does not touch them at all. Once a BPL intersects an indifference curve, it is bound to intersect it again because the former is a straight line while the latter is convex to the origin. In Figure 8.5, budget price line AB is tangent to indifference curve III. It intersects curves I and II and does not touch curve IV at all. If you try to draw a BPL which is a tangent to two different indifference curves, you would see that this will necessitate intersection of the two curves and you know that no two indifference curves can intersect each other.

You have learnt earlier in this unit that a higher indifference curve represents a greater total satisfaction. Therefore, the consumer, being rational, would try to reach the highest indifference curve which the market allows him to it means which the BPL allows him to). The position of maximum possible satisfaction is given by the point of tangency between BPL and an indifference curve.

Look at Figure 8.6. The BPL of the consumer is AB. The market permits him to have any combination of X and Y represented by a point on AB, C is one such point so that the consumer is allowed to have OM' of X with CM' of Y. But by moving to the right (that is, by increasing amount of X and reducing

that of Y) the consumer can move on to a higher indifference curve. For example, by choosing the combination represented by point D, he can move to indifference curve II. It is easy to see that the consumer should keep moving to the right till he reaches point P and is on indifference curve III. However, he should not move to the right of P (between P and B) because that would again push him to a lower indifference

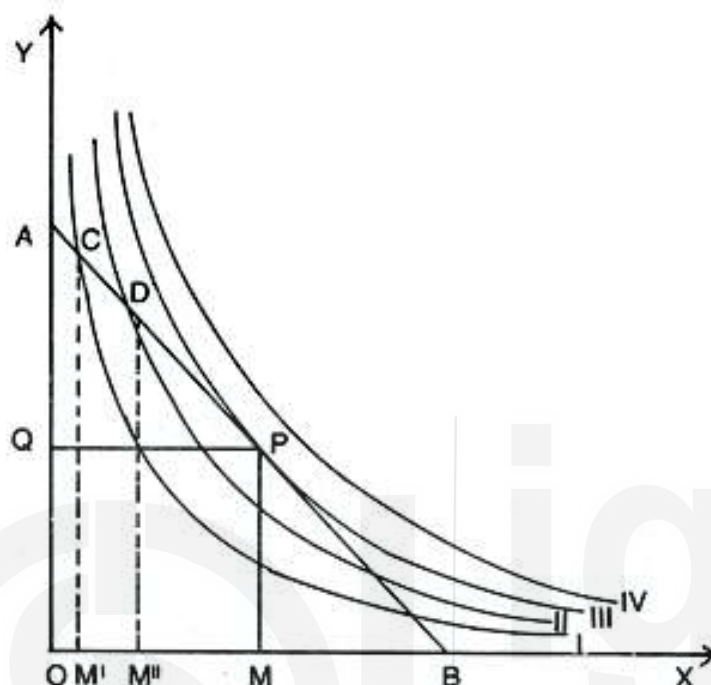


Figure 8.6: Consumer Equilibrium

curve. Note that though the consumer would very much like to move to a still higher indifference curve say No. IV, the market does not permit him to do so. Thus, we see that in equilibrium, the consumer buys OM of X and pays a price AQ for it. He is left with OM of X and PM of Y. At the point of equilibrium, MRS of X for Y and price of X are both equal. To put it differently, the slope of the BPL and that of the indifference curve are equal at the point of equilibrium.

## 8.9 INCOME CONSUMPTION CURVE

You have seen earlier that with a given price of commodity X, if the income of the consumer changes, the BPL shifts its slope and moves parallel to its original position. As the BPL shifts, every time consumer keeps reaching a new point of equilibrium given by the tangency of BPL with a new indifference curve. The locus of all such points of equilibrium is called the Income Consumption Curve (ICC). Note that ICC starts from the point of origin O. This is an equilibrium position when the income of the consumer is zero so he can have no amount of either X or Y. Further a change in the demand for X resulting from a change in the income of the consumer is called the income effect. A typical ICC is illustrated in Figure 8.7 and is  $OP_1 P_2 P_3 P_4 P_5 \dots$ . As the income of the consumer increases from  $OA_1$  to  $OA_2 \dots$  and the BPL shifts from  $A_1 B_1$  to  $A_2 B_2 \dots$  the equilibrium position shifts from  $P_1$  to  $P_2 \dots$ . Note that when equilibrium shifts from  $P_1$  to  $P_2$ , due

to a change in the income of the consumer, he buys  $OQ_2$ , instead of  $OQ_1$ , of  $X$ . The increased demand ( $Q_1, Q_2$ ) of  $X$  is the income effect when the income of the consumer increases from  $OA_1$ , to  $OA_2$ .

You should remember that ICC may or may not be a straight line. Mostly it will not be a straight line. Another important point to note is that if the commodity  $X$  is an inferior commodity, increased income beyond a point would reduce the demand for it.

As a result, the ICC would bend towards Y-axis showing that with increased income, the consumer buys less of  $X$ . In other words, in the case of inferior commodities, the income effect, beyond a point, is negative. (It is being termed negative because it is opposite of the expected effect).

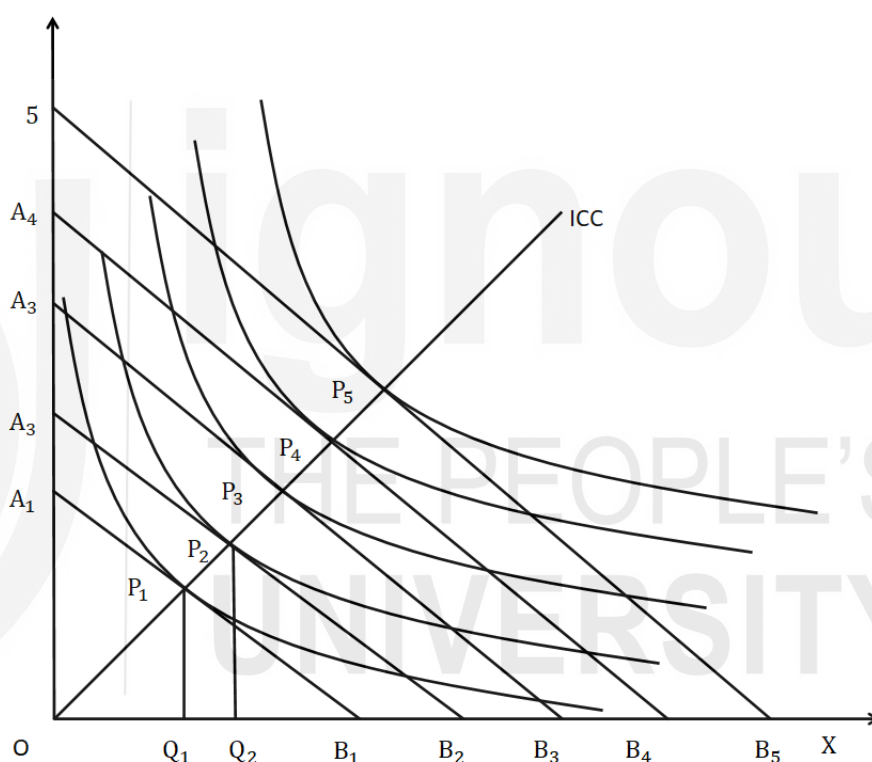
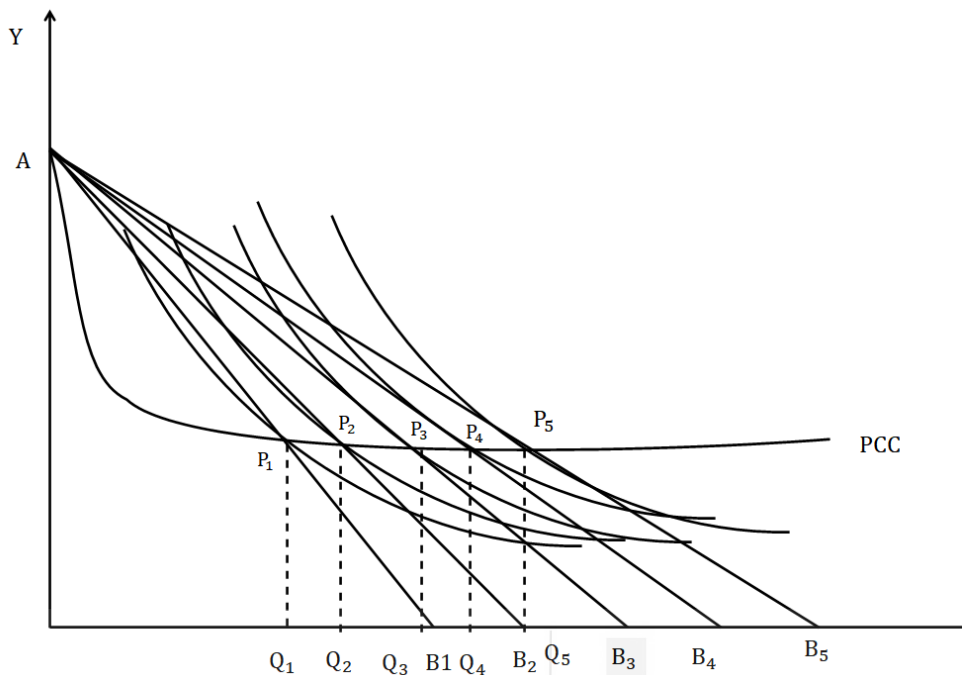


Figure 8.7 : Income Consumption Curve

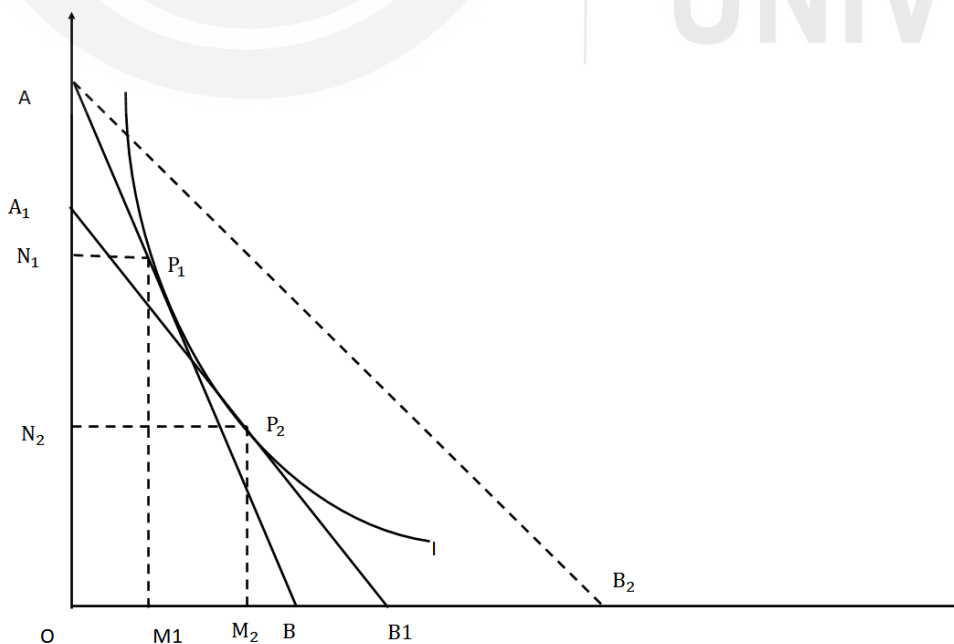
## 8.10 PRICE CONSUMPTION CURVE

Corresponding to the case of a change in the income of the consumer, we have the case of a change in the price of  $X$ . Here, as you have seen, with every change in price of  $X$ , the BPL changes its slope, but its starting point on Y-axis remains the same. With shifting BPLs, the consumer's equilibrium position also moves and the locus of all such points is called the Price Consumption Curve (or PCC). Figure 8.8 illustrates the construction of PCC. The original income of the consumer is  $OA$  with  $AB_1$ , as the BPL. The price of  $X$  per unit is  $OA/OB_1$ , and the equilibrium position is given by the point  $P_1$ .



**Figure 8.8 : Price consumption Curve**

Now suppose the price of X falls so that the consumer is able to buy  $OB_2$ , instead of  $OB_1$ . The new price of X per unit is then  $OA/OB$ , and the new BPL is  $OB_2$  with corresponding equilibrium position at point  $P_2$ . And so on for equilibrium point  $P_3$ ,  $P_4$ , etc. By joining these points, you get the PCC, note that this curve starts from point A. The reason is that if price of X rises infinitely high, the consumer will be able to buy almost nothing of X even by spending his entire income  $OA$ . The BPL would then almost coincide with Y-axis. The consumer in such a case is bound to decide that he would not buy X at such a high price and the equilibrium point would coincide with A.



**Figure 8.9 :Substitution Effect**

This brings us to the concept of substitution effect. The term substitution effect refers to the change in demand for X when income of the consumer does not change but price of X does. This point can be better understood with the help of a diagram. In Figure 8.9 the consumer had AB as his BPL. His equilibrium

position is given by point  $P_1$  which shows that he buys  $OM_1$  of X by paying  $AN_1$  out of his money income as price and retaining  $ON_1$ . Absence of a change in his real income is taken to mean that he remains on the same indifference curve even when his equilibrium position changes. In such a case, therefore, when X becomes cheaper, he is able to buy  $OB_2$ , provided his money income remains OA. However, the fall in the price of X is accompanied by an equivalent compensatory fall in his money income (from OA to OA) so that the consumer remains on the same indifference curve in his new equilibrium position ( $P_2$ ). The resulting BPL which is parallel to old BPL is called the compensatory BPL. The amount of X bought, of course, increases from  $OM_1$  to  $OM_2$ , and the increase  $M_1M_2$  is called the substitution effect. Note that while the consumer gets an additional quantity of  $M_1M_2$  of X, he loses  $N_1N_2$  amount of Y. You should remember that substitution effect on X is always positive which means that the effect is in the expected direction. In other words, a fall in price adds to the demand for X and a rise in price leads to a fall in its demand.

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## 8.11 SEPARATION OF INCOME AND SUBSTITUTION EFFECTS

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A reduction in the price of commodity X means that the consumer can buy more of it without a loss of other commodities. He can buy more of commodity X by

spending the same amount of money; or he can buy same amount of X and more of other commodities; or he can buy more of both X and other commodities. In whatever way put, it means that the real income of the consumer goes up and he can move to a higher indifference curve. Similarly, an increase in the price of X means that his real income falls and he moves to a lower indifference curve.

Thus, a fall in the price of commodity X affects its demand for two reasons:

- i) X becomes cheaper compared with other commodities; and
- ii) real income of the consumer goes up.

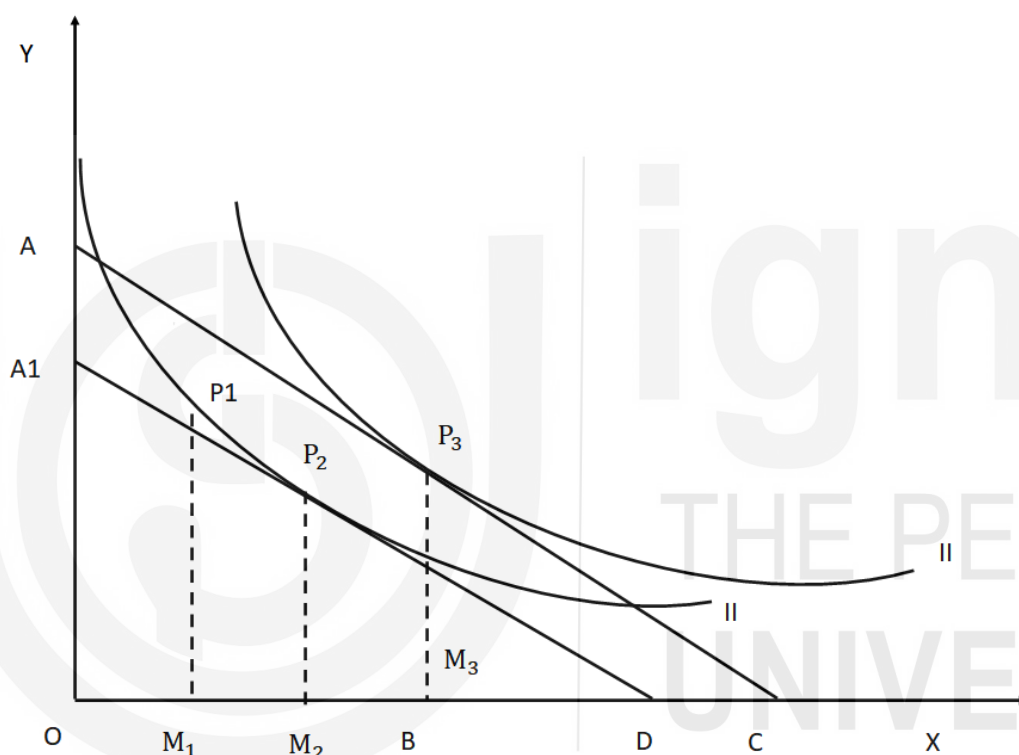
As you saw before, change in the demand of X on account of the first factor is called the substitution effect and the change in its demand on account of the second factor is called the Income Effect. The total change in demand of X is obtained by adding the two changes and is called the Price Effect.

In other words,

Price effect = Income effect  $\pm$  Substitution effect.

This would be so even when income effect is negative. You would remember that substitution effect is always positive while income effect may be positive or negative depending upon the nature of the commodity under consideration.

How can we split the change in demand for X due to a change in its price (that is the price effect) into income effect and substitution effect components? This can be done by finding out that change in demand which would have been there if the price of X had changed but the real income of the consumer had not. This would give, as you have learnt earlier, the substitution effect. The remaining change in demand of X is then the income effect because in that case the consumer is moving from one indifference curve to the other (without accompanying change in price which has already taken place.) This is illustrated in Figure 8.10.



**Figure 8.10 : Separation of Price Effect into Income and Substitution Effects**

The original equilibrium position of the consumer is given by point  $P_1$ . When the price of X falls and the BPL moves from AB to AC, the consumer reaches a new equilibrium position at point  $P_3$ . Therefore, the change in demand for X, namely  $M_1, M_3$  is the price effect. Now if the price of X had fallen but with a compensatory reduction in consumer's income, then the new BPL would be A,D and the consumer's equilibrium position would be on the same indifference curve at point  $P_2$ , and the resulting increase  $M_1, M_2$ , in demand for X would be the substitution effect. Clearly, the remaining change in demand for X, namely  $M_2, M_3$  would be the income effect. Remember that it is possible that  $M_1, M_2$ , may be equal to  $M_1, M_3$ , in which case income effect would be zero. It is also possible that the substitution effect may be greater than  $M_1, M_3$ , in which case the income effect would be negative as in Figure 8.11.

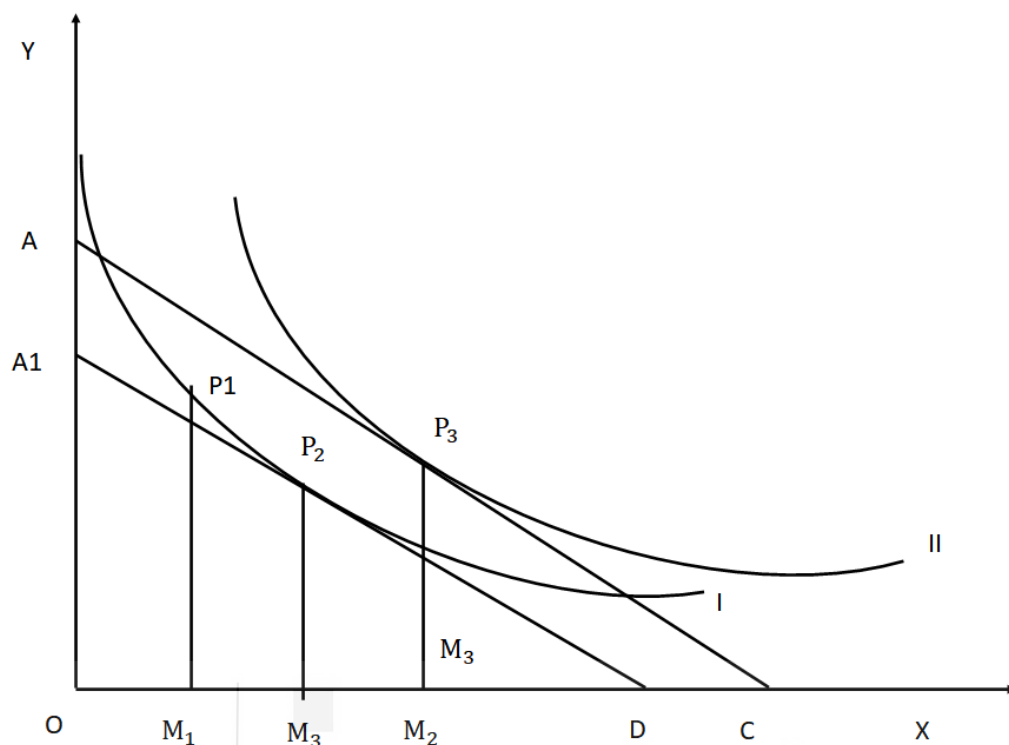


Figure 8.11 : Price Effect in Inferior Goods

### Check Your Progress C

1) Define consumer's equilibrium.

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2) What do you mean by Budget Price Line?

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3) State whether the following statements are **True** or **False**:

- i) A budget price line can be tangent to one and only one indifference curve.
- ii) Analysis of consumer's equilibrium shows that he does not necessarily reach the highest possible indifference curve.
- iii) An Income Consumption Curve is always a straight line.
- iv) An Income Consumption Curve always starts from the origin O of the graph.



- v) Income effect is the change in demand of a commodity on account of a change in income of the consumer.
  - vi) Income effect is always positive.
  - i) Substitution effect can never exceed the price effect.
  - ii) Substitution effect is always greater than price effect when the commodity under consideration is 'inferior'.
- 4) Fill in the blanks with appropriate words/phrases.
- i) Price consumption curve is a locus of the points of tangency of budget price line with indifference curves when the former shifts on account of changes in .....
  - ii) Income consumption curve is a locus of points of tangency of budget price line with indifference curves when the former shifts on account of changes in .....
  - iii) Price consumption curve and budget price line starts from the same point on ..... axis.
  - iv) Substitution effect shows the changes in demand for a commodity when its price changes but there is a ..... change in income of the consumer.

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## 8.12 DERIVATION OF CONSUMER'S DEMAND CURVE

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In a demand curve price per unit of the commodity is measured along Y-axis and the quantity demanded is measured along X-axis. Price consumption curve can be used to derive a demand curve. In Figure 8.8 when the consumer is at equilibrium point  $P_1$  he demand  $OQ_1$ , of X. This way the quantity of X demanded becomes known. For getting, the corresponding price per unit, we use the slope of the budget price line which is  $OA/OB_1$ . Similarly, from equilibrium position  $P_2$ , the quantity of X demanded is  $OQ_2$ , and the corresponding price per unit is  $OA/OB_2$ . Proceeding in the same manner, the third pair of quantity-price is  $(OQ_3, OA/OB_3)$  and the fourth pair is  $(OQ_4, OA/OB_4)$ . Once all such pairs of quantity-price are estimated, the same can be plotted in the form of a graph and a demand curve can be had by joining them.

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## 8.13 CONSUMER'S SURPLUS

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Indifference curves technique can be used for measuring consumer's surplus also. This is done in Figure 8.12. As before, let the consumer have an income  $OA$  and let his budget price line be given by  $AB$ . The equilibrium position  $P$  shows that the consumer buys  $OM$  of  $X_1$ , pays a price  $AC$  for it and retains the balance  $OC$  with himself. Now let there be an indifference curve depicting all pairs of X and Y which have the same utility as the pair zero of X plus  $OA$  of Y. Such an indifference curve has been labelled 'I' in the Figure. The diagram shows that for the consumer Zero of X plus  $OA$  of Y has

the same utility as OM of X plus  $PM_1$  of Y. That is to say, the consumer is ready to pay AD for OM of X rather than go without it. But actually he pays only AC. Thus the excess of what he is ready to pay over what he actually pays is given by  $AD - AC = CD$ . This is the consumer's surplus measured in money terms (or in terms of commodity Y).

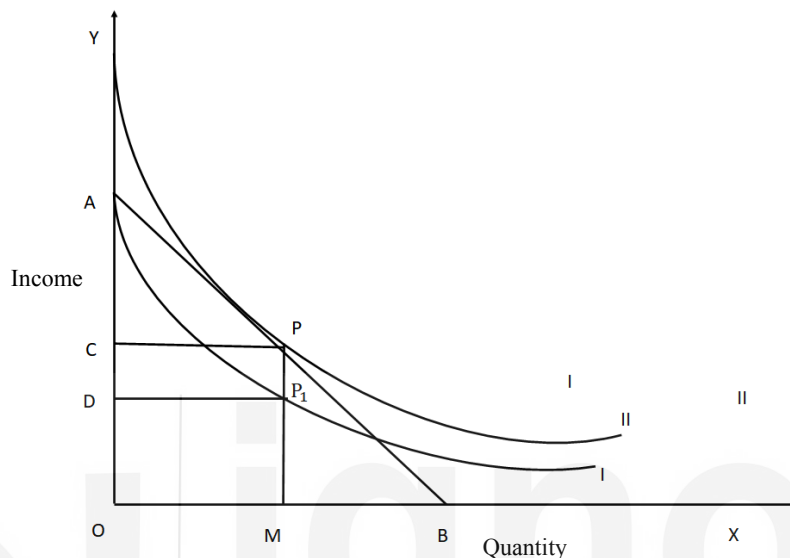


Figure 8.12: C's Surplus

### Brain Teasers

Q.1. Show determination of consumer's equilibrium with the help of an indifference map.

Ans. Fig. 1

Q.2. If the price of Y falls and the price of X rises how will it affect consumer's budget constraint assuming that money income remains unchanged. Show graphically.

Ans. Fig. 2

Q.3. If a consumer's income increases, will it lead to an increase in the level of satisfaction for the consumer? Show graphically.

Ans. Fig. 3. With increase in the level of income, consumer's indifference curve will shift upward showing a higher level of satisfaction.

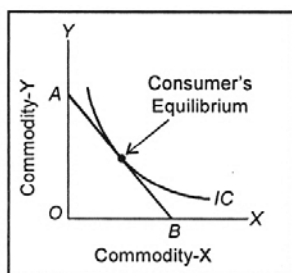


Fig. 1

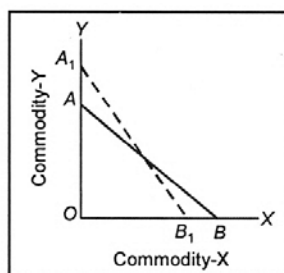


Fig. 2

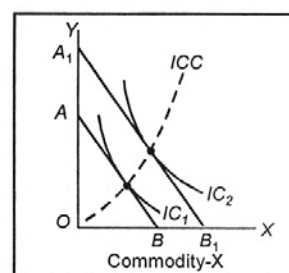


Fig. 3

Q.4. Other things being constant, a fall in the price of X alone will not have any impact on consumer's budget line. Show graphically.

**Ans.** No, consumer's budget line will change. While the intercept on Y-axis will remain the same, the intercept on X-axis will shift to the right as shown in Fig. 4.

Q.5. If the price of X falls and the price of Y rises, budget line will remain unchanged. Comment graphically.

**Ans.** No, new budget line will be CD. The original was AB, as shown in Fig. 5

Q.6. How will a simultaneous increase in consumer's income and a fall in the  $P_x$  impact the budget line?

**Ans.** Fig. 6

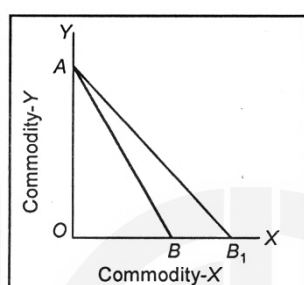


Fig. 4

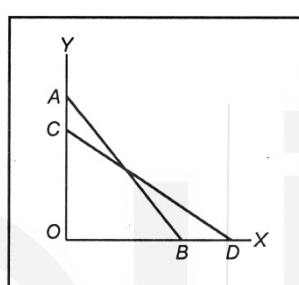


Fig. 5

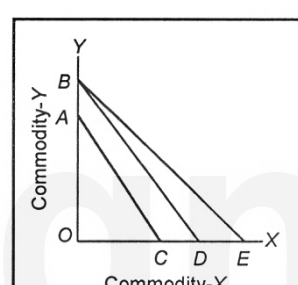


Fig. 6

## 8.14 SUPERIORITY OF INDIFFERENCE CURVES ANALYSIS

It is often maintained that indifference curves analysis is superior to the utility approach for demand analysis. This, however, is not fully true. The fact is that while indifference curves analysis avoids some unrealistic assumptions of the utility analysis, it carries some weaknesses of its own. You should also remember that both approaches draw upon some common things and are, to that extent, similar to each other. For example, both approaches assume the existence of utility and the application of the law of diminishing marginal utility. The only difference is that in utility analysis, marginal utility of money remains constant (as explained in previous unit) while in indifference curves, the assumption of constant marginal utility of money is abandoned and the analysis is conducted under diminishing marginal utility of money. Similarly, both the approaches assume that the consumer is a rational person. Both of them further assume that the consumer is able to estimate the utility of quantities of commodities over a wide horizon. That is to say, he not only knows the utility expected from the quantity of the commodities immediately available, or nearby quantities, but also of vastly different quantities.

However, indifference curves analysis still claims to be superior to that of utility analysis on the following grounds:

- 1) While utility approach assumes that utility can be measured in cardinal terms, indifference curves analysis does not.
- 2) Indifference curves analysis is able to show the effect of changes in income on demand while utility analysis cannot.
- 3) The assumption of constant marginal utility of money is dropped which makes the indifference curve analysis more realistic.
- 4) Indifference curves analysis is also able to cover the case of inferior commodities. It is able to account for and explain the fall in demand for a commodity when its price falls or when the income of the consumer goes up.
- 5) While Marshallian utility analysis assumes that utilities of two different commodities are independent of each other, in indifference curves analysis, this assumption is not needed. The cases of complementary and substitute commodities are fully covered here.

However, the superiority of indifference curves analysis ends here. It retains quite a few shortcomings which make it as unrealistic as the utility analysis, and sometimes even more so.

- 1) It must be admitted that while utility cannot be measured exactly and in quantitative terms, people do have rough ideas of its relative magnitudes based upon their experience. They do think of a certain quantity of commodity X having say, 50% more of utility than another.
- 2) The fundamental concept of diminishing marginal rate of substitution is derived from Marshallian concept of diminishing marginal utility.
- 3) Indifference curves analysis is confined to the case of only two commodities. For covering a larger number of commodities, Y has to be taken as a composite commodity represented by money such that the prices of all the commodities comprising the composite commodity increase or decrease simultaneously and by the same proportion.
- 4) Indifference curves analysis makes a highly unrealistic assumption that both X and Y are perfectly divisible. In reality, a consumer is faced by lumpy units. As a result, it is not possible to have continuous indifference curves, as also a system of closely placed large number of indifference curves.
- 5) Indifference curves analysis assumes that the consumer is able to chart out the entire indifference map. This is not possible in practice. A consumer, at the most, can tell about his preferences in the neighbourhood of his existing position.
- 6) This analysis fails to take into account the fact that the scale of preferences of an individual keeps shifting rapidly. In other words, even if the scale of preferences is chartered out, it needs continuous revision.
- 7) Indifference curves do not have the additive property when they belong to different individuals. Consequently, it is not possible to arrive at a scale of preferences of the community as a whole. All exercises and conclusions pertaining to the entire economy or at any other aggregative

level are, therefore, based upon the unscientific assumption that preferences can be added up. In that respect, utility approach is better placed because it goes by-a general opinion based upon accumulated experience and observation of people in general.

- 8) The entire indifference curves analysis is based upon theoretically formulated cause-effect relationships. There is a very little empirical (that is recorded or factual) basis of its exercises. In the same manner, this system of analysis defies collection of relevant data in a usable form.

### Check Your Progress D

- 1) State whether the following statements are **True** or **False**.
  - i) Indifference curves analysis allows us to measure consumer's surplus in money terms.
  - ii) A consumer gets consumer's surplus only if he moves from one indifference curve to the other.
  - iii) Price consumption curve is the same thing as the demand curve.
  - iv) Consumer's surplus is the amount of money left with the consumer after buying some quantity of X.
  - v) In utility analysis, utilities of two commodities X and Y are always assumed to be independent of each other.
  - vi) Scale of preferences of an individual does not shift at all.
- 2) Fill in the blanks with appropriate words/phrases.
  - i) The ..... of budget price line measures the price per unit of the commodity X.
  - ii) Utility approach cannot cover the case of commodities, while indifference curves can.
  - iii) Indifference curves approach assumes that a consumer is able to chart out his entire .....

### BRAIN TEASERS

**1. A consumer wants to consume two goods. The prices of the two goods are Rs. 4 and Rs. 5 respectively. The consumer's income is Rs. 20.**

- (i) Write down the equation of the budget line.
- (ii) How much of good 1 can the consumer consume if he spends his entire income on that good?
- (iii) How much of good 2 can he consume if he spends his entire income on that good?
- (iv) What is the slope of the budget line?

**Ans. (i)**  $4X_1 + 5X_2 = 20$ .

- (ii) Given  $P_1 = \text{Rs. } 4$ , the consumer can buy  $20/4 = 5$  units of good 1.

(iii) Given price of good 2 = Rs. 5, he can consume the maximum of  $20/5 = 4$  units of good 2.

(iv) The slope of a budget line measures the amount of change in good 2 required per unit of change in good 1 along the budget line. It is measured as follows:

$$-\frac{P_1}{P_2}.$$

In the given example,  $P_1 = \text{Rs. } 4$  and  $P_2 = \text{Rs. } 5$ . Therefore, the slope of the budget line  $= -\frac{4}{5} = -0.8$ .

## 2. How does the budget line change if the consumer's income increases to Rs. 40 but the prices remain unchanged?

**Ans.** An increase in consumer's income implies that the consumer can purchase increased quantities of both the commodities at the prevailing market prices. As a result, the consumer would be faced with a new budget line. The new budget line will shift rightwards parallel to the original budget line.

In Fig. 1, given  $M = \text{Rs. } 20$ , the budget line formed an intercept at 4 units on Y-axis and 5 units on X-axis. With the increase in  $M$  to Rs. 40, the new intercepts are formed at 8 units on Y-axis and 10 units on X-axis. The new budget line is parallel to the original line.

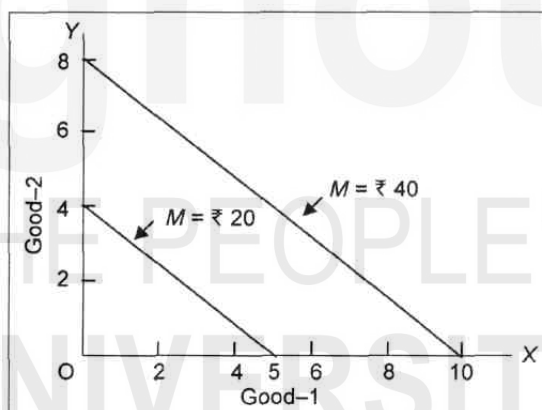


Fig. 1.

## 3. What happens to the budget set if both the prices as well as the income double?

**Ans.** If, as given,

$P_1$  changes from Rs. 4 to Rs. 8,

$P_2$  changes from Rs. 5 to Rs. 10, and

$M$  changes from Rs. 20 to Rs. 40,

then, intercepts on both X-axis and Y-axis will remain unchanged at 5 units and 4 units respectively; and the slope of the price line will remain unaffected as

$$\frac{8}{10} = \frac{4}{5}.$$

Therefore, there will be no change in the budget set and the budget line.

**4. Suppose a consumer can afford to buy 6 units of good 1 and 8 units of good 2 if he spends his entire income. The prices of the two goods are Rs. 6 and Rs. 8 respectively. How much is the consumer's income?**

**Ans.** We know,

$$M = P_1X_1 + P_2X_2$$

$$\text{Then,} \quad W = 6 \times 6 + 8 \times 8$$

$$= 36 + 64$$

$$= \text{Rs. } 100$$

$\therefore$  The consumer's income = Rs.100.

## 8.15 LET US SUM UP

The analysis of consumer behaviour based upon utility approach suffers from some basic shortcomings connected with the unrealistic assumptions upon which it is based. These limitations include measurability of utility in cardinal terms, the assumption of constant marginal utility of money, the possibility of interpersonal comparisons of utility, the inability to explain the demand behaviour for inferior commodities, the income effect and so on. Indifference curves approach tries to remove these defects.

The concept of scale of preference is fundamental to indifference curves approach. It is assumed that a consumer is able to classify all the possible combinations of the two commodities X and Y into groups such that each group contains all those combinations which have the same total satisfaction for the consumer. The consumer is also able to arrange different groups themselves in terms of more or less satisfaction.

An indifference curve is a graphic representation of a group of alternative combinations of commodities X and Y such that each combination is expected to yield the same total satisfaction to him. In a tabular form, the same set of combination is called an indifference schedule. Indifference curves are drawn on the basis of some assumptions, namely, (i) utility can be measured cardinally, (ii) there are only two commodities X and Y, (iii) commodity Y may be a composite commodity or money, (iv) both X and Y have positive marginal utilities, (v) law of diminishing marginal utility applies to both X and Y, (vi) both X and Y are perfectly divisible.

Based upon these assumptions, indifference curves acquire some properties, They are (i) an indifference curve has a negative slope, (ii) it is convex to the origin, (iii) it is continuous one, (iv) two indifference curves cannot intersect each other, (v) we can have a system of large number of indifference curves, (vi) a curve farther away from the origin has higher total utility.

MRS of X for Y is defined as the amount of Y which the consumer is ready to give up, at the margin, for an additional unit of X. It is a ratio  $\Delta Y / \Delta X$  and is also equal to  $MU_X / MU_Y$ . MRS of Y for X is similarly the amount of X which the consumer is ready to give up, at the margin, for an additional unit of Y. It is a ratio  $\Delta X / \Delta Y$  and is also equal to  $MU_Y / MU_X$ . MRS of X for Y keeps falling as the stock of X increases. Similarly, MRS of Y for X keeps falling as stock of Y increases with the consumer.

Budget price line of a consumer is a straight line depicting the alternative combinations of X and Y which the market allows the consumer to have. Its origin at the Y axis is determined by consumer's income in terms of Y and its point of contact with X-axis shows the amount of X which the consumer can buy by spending his entire income. The slope of the budget price line is equal to the price per unit of X. When income of the consumer changes, budget price line moves parallel to its original position and retains its slope. When the price of X changes, the slope of the budget price line changes with the same starting point on Y-axis. When price of X changes with a compensatory change in the income of the consumer, the budget price line shifts both its position and slope.

One budget price line can be tangent to one and only one indifference curve. The point of tangency is also the equilibrium position of the consumer. A locus of all points of tangency when the budget price line shifts on accounts of changes in the price of X is called the price consumption curve. Similarly, the locus of all points of tangency, when budget price line shifts on account of income of the consumer is called the income consumption curve. PCC starts from the starting point of the budget price line on the Y-axis. ICC curve starts from the origin O.

Demand curve for commodity X is not the same thing as the PCC. It can, however, be derived by reading the quantities demanded as shown by PCC and by taking corresponding slopes of the budget price line as the associated per unit prices.

Indifference curves also enable us to measure the consumer's surplus. For that the actual price paid is compared with the price which the consumer is ready to pay rather than go without the commodity. The difference between the two is then the consumer's surplus.

The assumptions and limitations of the utility approach and indifference curves approach can be used to compare the two approaches. It is found that while indifference curves approach tries to remove a number of shortcomings of the utility analysis, it has a number of shortcomings of its own. An important shortcoming of indifference curves is that this approach is not based upon statistical observations and cannot be used for statistical investigation.

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## 8.16 KEY WORDS

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**Composite Good (Commodity)** is one which conceptually comprises of a number of goods (commodities) (or all goods other than X) such that each



unit of it contains the same quantity of all non-X goods (commodities). Such a composite good is usually represented by money, it being the general purchasing power.

**An Indifference Curve:** Graphic representation of an indifference schedule.

**An Indifference Schedule:** It represents, in a tabular form, all the combinations of X and Y which have the same satisfaction.

**Budget Price Line (BPL):** It is a straight line showing different combinations of commodities X and Y (or of X and money) which the market permits the consumer to have with a given money income and a given price of commodity X.

**Consumer's Surplus:** The excess of what the consumer is ready to pay for a given quantity of X rather than go without it over what he actually pays.

**Compensatory Budget Price Line:** The budget price line which is obtained by a reduction in the price of X and a compensatory reduction in the income of the consumer so as to keep him on the same indifference curve.

**Giffin's Paradox:** It describes the paradoxical situation in which a rise in the price of a commodity leads to an increase in its demand. **Income Consumption Curve:** It is the locus of all points of tangency of budget price line with indifference curves when the budget price line shifts on account of changes in the income of the consumer.

**Income Effect:** The change in the demand for a commodity on account of a change in the income of the consumer without any change in the price of the commodity.

**Marginal Rate of Substitution:** MRS of X for Y is defined as the quantity of Y which the consumer is ready to give up, at the margin, for an additional unit of X. It is a ratio  $\Delta Y / \Delta X$  and is also equal to  $MU_X / MU_Y$ .

**Price Consumption Curve:** It is the locus of all points of tangency of budget price line with indifference curves when budget price line shifts on account of changes in the price of X.

**Price Effect:** The change in demand of commodity on account of a change in its price.

**Related Goods (Commodities):** Those goods (commodities) whose utility and therefore demand are not independent of each other. Such goods may be complementary or substitutes.

**Scale of Preference:** It refers to the classification of alternative combinations of X and Y into groups such that all combinations belonging to one group have the same total satisfaction, while different groups themselves are also arranged in terms of 'more' or 'less' satisfaction.

**Substitution Effect:** The change in the demand for a commodity when real income of the consumer remains the same but there is a change in the price of the commodity under consideration.

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## 8.17 ANSWERS TO CHECK YOUR PROGRESS

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### Check your progress A

2. i) False, ii) False, iii) False, iv) False, v) True, vi) True, vii) True.
3. i) the same, ii) does not, iii) the same total satisfaction, iv) how much more

### Check your progress B

- 3 i) False, ii) True, iii) False, iv) False, v) False, vi) True, vii) True, viii) False, ix) True.
- 4 i) the amount of Y, ii) diminishing marginal utility, iii) diminishing marginal utility, iv) straight line, v) perfectly divisible

### Check your progress C

3. i) True, ii) False, iii) False, iv) True, v) True, vi) False, vii) False, viii) True.
- 4 i) price of commodity, ii) income of the consumer, iii) Y, iv) Compensatory.

### Check your progress D

- 1 i) True, ii) False, iii) False, iv) False, v) True, vi) False.
- 2 i) slope, ii) inferior or related, iii) scale of preferences.

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## 8.18 TERMINAL QUESTIONS

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- 1 What are the assumptions of indifference curves approach?
- 2 State the properties of indifference curves and derive them from the assumptions upon which indifference curves are drawn.
3. What do you mean by marginal rate of substitution? Why does marginal rate of substitution of X for Y fall when quantity of X is increased?
- 4 Define the concept of price consumption curve. Where does it start from and why?
- 5 What do you mean by income consumption curve? Where does it start from and why?
- 6 Explain the attainment of equilibrium position by a consumer with the help of an indifference curve.
- 7 Show that a budget price line is tangent to one and only one indifference curve.

- 8 Diagrammatically explain the concepts of income effect, substitution effect and price effect. Also show the manner in which price effect can be split up into income and substitution effects.
- 9 Explain the concept of consumer's surplus and show the way it is measured with the help of indifference curves.
- 10 Write a short note on the claimed superiority of indifference curves analysis over utility analysis.

**Note: These questions will help you to understand the unit better. Try to write answers for them. But, do not send your answers to the University. These are for your practice only.**



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