Theory of Consumer Behaviour

Cardinal Approach and Utility Analysis, Total Utility and Marginal Utility

Objectives

After going through this chapter you shall be able to understand the following concepts

- Consumer Behaviour Theory- Ordinal Approach and Cardinal Approach
- Total Utility, Marginal Utility, Relationship between Total Utility and Marginal Utility
- Law of Diminishing Marginal Utility
- Utility Analysis and Consumer Equilibrium- One Good Case and Two Goods Case

Consumer- Who is a Consumer?

Anyone who purchases and consumes any goods and services for the satisfaction of his/her wants is called a consumer. A consumer spends the money available to him for purchasing different goods and services with the sole motive of attaining the highest possible level of satisfaction.

Consumer Behaviour Theory

Under the Consumer Behaviour Theory, we examine the behaviour of a rational consumer in the market of goods and services. This theory basically analysis the decision making process of a consumer. It examines how a consumer makes choice among different available goods and services with his/her fixed income and given market prices of the goods and services. In Traditional Consumer Behaviour Theory, it is assumed that a consumer has complete knowledge of all the available goods and services, their respective prices and all other relevant information required to decide among different alternatives. In other words, ***the essence of consumer behaviour theory is to analyse how a consumer chooses among different available goods and services, with his given income and prices of goods and services, in order to achieve the highest possible satisfaction level***.

It should be noted that in order to attain the highest possible level of satisfaction, a consumer must be able to compare the satisfaction derived from the consumption of various goods and services that he can purchase with his/her income. The question then arises is that how will a consumer do so. There are two approaches to answer this question- The Cardinal Approach and the Ordinal Approach.

The Cardinal Approach and the Ordinal Approach

Ordinal Approach

Ordinal Approach postulates that a consumer ***cannot measure the satisfaction*** that he/she derives from the consumption of a particular good or service. Further, it asserts that measurement of satisfaction in specific units is not required. In fact, a consumer ranks different goods and services as per his/her preferences. In other words, it asserts that a consumer takes his consumption decisions on the basis of the ranks assigned in order of his/her preferences. *(This approach is explained in the next lesson)*

Cardinal Approach

On the contrary, the Cardinal Approach postulates that it is possible for a consumer to ***measure (assign value to) the level of satisfaction*** that he/she derives from the consumption of a particular good or service. This valuation of satisfaction can be done in various ways such as, in terms of a subjective units called '***utils***', in terms of ***money*** (monetary terms) or in terms of ***sacrifice*** of other goods and services (opportunity cost).

Utility Analysis and Optimal Choice of the Consumer

Utility refers to the satisfaction that a consumer expects to derive from the consumption of a particular good. It is a subjective concept and varies from person to person and from time to time. For example, a commodity, say, apples provide different level of satisfaction to different persons. Also, the same person can derive different level of satisfaction from consumption of apples at different points of time (for example, at the time of illness the apples may provide a consumer with a higher level of satisfaction).

The concept of Cardinal Approach is based on the assumption that a rational consumer can express his/her utility in terms ***utils***. As utility can be cardinally (or numerically) expressed in terms of utils, so this approach has been named as Cardinal Approach. A util is a single unit of utility. Utils refer to the cardinal numbers that are assigned to different consumption bundles to represent the expected level of satisfaction derived from them. The numerical values are assigned by the consumer in such a manner that the more preferred consumption bundles are given higher values than the lesser preferred ones.

Important Note: It should be noted that the concept of util has no standard unit such as, centimeters, grams, kilometers, etc. A consumer himself defines utils for different consumption bundles and accordingly assigns cardinal numbers (say 1, 2, 3, etc.) to them in the order of his/her preferences.

Total Utility and Marginal Utility

Total Utility refers to the ***aggregate*** utility or summation of utility derived from the consumption of all the units of a commodity. Algebraically,

$TU = TU_1 + TU_2 + TU_3 + \ldots\ldots\ldots\ldots + TU_n$

For example, assume that a particular consumer consumes two apples one after another. The consumption of first apple provides him a satisfaction of 3 utils, while, the consumption of the second apple provides him a satisfaction of 5 utils. Thus, the Total Utility derived from the consumption of two apples is

$TU = TU_1 + TU_2$

$TU = 3\ utils + 5\ utils = 8\ utils$

Marginal Utility *(MU)*

Marginal Utility refers to the ***addition*** to the total utility due to the consumption of an additional unit of a commodity. Algebraically,

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

In the above example, the utility derived from the consumption of first apple (TU_1) is 3 utils and the utility derived from consumption of second apple (TU_2) is 5 utils. The Marginal Utility (i.e. the additional utility derived from the consumption of second apple) is

$MU_2 = TU_2 - TU_{2-1}$

$MU_2 = TU_2 - TU_1$

$MU_2 = 5\ utils - 3\ utils = 2\ utils$

Numerical Example- Schedule* 1:*

Number of Units Consumed of Commodity *X*	**Total Utility (*TU*)** (utils)	**Marginal Utility (*MU*)** $MU_n = TU_n - TU_{n-1}$ (utils)
1	50	50 – 0 = 50
2	100	100 – 50 = 50
3	130	130 – 100 = 30
4	150	150 – 130 = 20
5	160	160 – 150 = 10
6	160	160 – 160 = 0
7	150	150 – 160 = – 10

Note: Total Utility is the sum of Marginal Utility

i.e. $TU_n = MU_1 + MU_2 + MU_3 + \ldots\ldots\ldots\ldots + MU_n = \sum MU$

$TU_7 = MU_1 + MU_2 + MU_3 + .MU_4 + MU_5 + .MU_6 + MU_7 = \sum MU$

or, $TU_7 = \Sigma\{50 + 50 + 30 + 20 + 10 + 0 + (-10)\} = 150$

This implies that consumption of 7 units of the commodity *X* enabled the consumer to derive 150 utils of utility.

Relationship between Total Utility and Marginal utility

To understand the relationship between Total Utility and Marginal Utility, consider the Schedule 1 (given above). The following are points that we can analyse from the above schedule.

1. As more and more units of the commodity are consumed, the Marginal Utility derived from the consumption of each additional unit of the commodity tends to fall. With the consumption of the successive units, the Marginal Utility becomes zero and consequently becomes negative. (As per the schedule, *MU* is zero at the consumption of 6^{th} unit and becomes negative at 7^{th} unit consumed).

2. As long as *MU* derived from the consumption of additional units of the commodity is positive, *TU* continues to rise. (*MU* is positive till the consumption of the 5^{th} unit of the commodity.)

3. When *TU* becomes maximum (also known as Saturation Point), *MU* becomes zero. (*TU* is maximum at 160 utils and *MU* is zero at the 6^{th} unit.)

4. When *TU* starts falling, *MU* becomes negative.(For the consumption of 7^{th} unit, *MU* becomes negative and accordingly the *TU* falls from 160 utils to 150 utils)

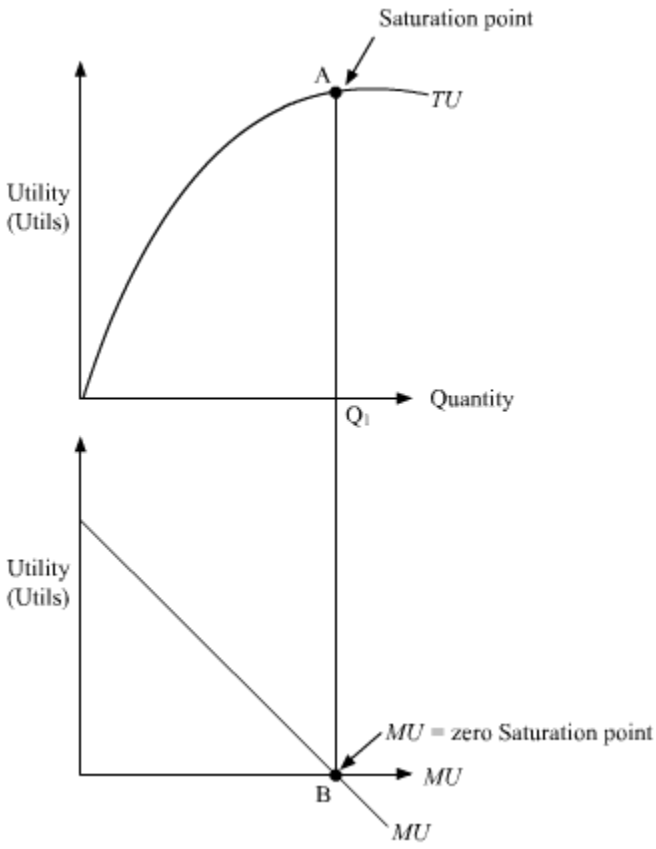
5. *MU* is derived from *TU* as:

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

and *TU* is defined as the summation of all the Marginal Utility as:

$TU_n = MU_1 + MU_2 + MU_3 + \ldots\ldots\ldots\ldots + MU_n = \sum MU$

6. Diagrammatically, the relationship between the *TU* and *MU* can be expressed as follows.



In the above figure, *TU* is the Total Utility curve, while *MU* in the lower part of the figure is the Marginal utility curve. Initially *TU* increases but at a decreasing rate. Correspondingly, the *MU* is falling. This happens till point *A*. At point A, *TU* has reached its maximum and correspondingly in the lower part *MU* becomes zero (point *B*). The point where *TU* is maximum and *MU is zero* is called the ***saturation point***. Beyond point A, *TU* falls and *MU* becomes negative.

Law of Diminishing Marginal Utility

Law of Diminishing Marginal Utility states that as a consumer consumes more and more units of a commodity at succession, then Marginal Utility derived from the consumption of each additional unit of the commodity falls.

Assumptions

The Law of Diminishing Marginal Utility is based on the following two basic assumptions.

1. ***Standard Units and Reasonable Size of Units***- A consumer consumes only standard units of the commodity. For example, a whole of an apple and not half of it. Similarly, glass of water and spoon of water.
2. ***Successive Consumption***- Consumption of the successive units of the commodity takes place continuously (i.e. without any time lag). This is because if the consumption takes

place with a time lag say of an hour or a week (i.e. consumption of one unit of the commodity takes place today and the consumption of the second unit takes place after one week) then, in the next week the consumer will start a fresh valuation of the utility without taking into consideration the utility derived from the consumption of the previous unit of the commodity in the previous week.

3. ***Homogeneous Units***- The law also assumes that the quality of the commodity remains the same throughout the process of consumption. In other words, all the units of a commodity should be homogeneous and identical in terms of shape, size, colour, quality, etc. That is, if a consumer is consuming water, then a glass of normal water should not be followed by a glass of cold water or a glass of sweet water.
4. ***Rational Consumer***- The law is applicable only if the consumer is a rational human being. That is, he should make rational consumption decisions.
5. ***No Change in Consumer's Tastes and Preferences***- There is no change in the tastes and preferences of consumers.
6. ***Utility can be measured***- The law only holds if the consumer is able to express his utility in terms of utils. That is, utility can be measured cardinally (or numerically).

Exceptions to the Law of Diminishing Marginal Utility

The Law of Diminishing Marginal Utility fails to operate in the following situations.

1. ***Money***- The Law of Diminishing Marginal Utility fails in case of earning money. Due to the greed of earning money, people tend to earn as much money as they can.
2. ***Knowledge***- The law also fails in case of acquiring knowledge. An individual feels more pleasure and derives higher level of utility with greater degree of knowledge and higher education.
3. ***Liquors and Cigarettes***- The consumption of such products like liquors and cigarettes violate the law. This is because as people tend to consume more of these product greater is the thirst (utility) for additional units.
4. ***Hobbies***- Hobbies such as jewellery collection by women, stamp collection, old coins, antiques, etc. violate the law. This is because with every additional unit, the additional utility (Marginal Utility) tends to increase.
5. ***Listening Music and Poetry***- In the initial phase, listening a good music and reading good poems again and again violate this law. However; after a certain limit, listening the same music and reading the same book again and again makes an individual bore and as a result, the Marginal Utility tends to diminish. Thus, it is only in the initial period where listening good music violates the law of Diminishing Marginal Utility.

Marginal Utility Analysis and Consumer's Equilibrium

In this section, with the help of utility analysis, we will understand how a consumer decides the quantities of various goods and services that he consumes so that he derives the maximum satisfaction and attains consumer's equilibrium. This analysis is based on certain assumptions which are as follows.

Assumptions of the Utility Analysis

1. Utility is a cardinal measure i.e. it can be measured in exact numeric units for example, 2 utils.
2. Consumer's income and prices of the commodities are assumed to be given and constant.
3. Marginal Utility of Money (MU_M) is constant i.e. even as the consumer spends more and more units of money, the Marginal Utility derived from each additional rupee spent remains constant.
4. Utilities of different commodities are independent of each other. In other words, the utility derived from one unit of a good does not affect the utility derived from the other goods. This implies that utility is additive. That is, the utility derived from different goods can be added together in order to ascertain the total sum of utilities derived from all goods consumed.
5. The consumer is a rational consumer. That is, he should always aim at maximisation the utility derived.
6. The price of the commodity remains the same.

Consumer Equilibrium in Case of a Single Commodity

In case of a single commodity, a consumer attains equilibrium when the utility derived from each additional unit of the rupee spent on the commodity becomes equal to the Marginal Utility of Money. In other words the consumer attains equilibrium when,

Marginal Utility of a Rupee spent on the commodity = Marginal Utility of Money

Marginal Utility of a Rupee spent on the commodity

As a consumer derives satisfaction by consuming commodities, in the similar sense, he derives utility by spending money. Therefore, the utility that is derived from the additional unit of rupee spent on the commodity is called Marginal Utility of a Rupee spent on that commodity. In other words, it refers to the utility derived from each additional unit of the rupee spent on the purchase of the commodity. Algebraically,

$$\text{Marginal Utility of Rupee} = \frac{MU_x}{P_x}$$

where,

MU_x represents Marginal Utility of commodity x

P_x represents price of commodity x

Marginal Utility of Money

Marginal utility of money refers to the valuation of an unit of rupee for a consumer. It is a subjective concept and the consumer himself defines the marginal utility of money. The marginal utility of money is assumed to be constant in the Utility Analysis.

Consumer Equilibrium

As we know a consumer attains equilibrium where the marginal utility of a rupee spent on the commodity becomes equal to the marginal utility of money. Thus, according to the utility analysis, in case of a single commodity, a consumer attains consumer equilibrium, when:

$$\frac{MU_x}{P_x} = MU_m$$

Numerical Example*:*

Let us understand the consumer equilibrium analysis with the help of the following numerical example.

Let us suppose that for a consumer the marginal utility of money (MU_m) is 5 utils and the price of a commodity *x* (P_x) = Rs 5

Now, consider the Marginal Utility Schedule for the commodity *x* (MU_x)

Units of Commodity *x* (units)	***MU*$_x$** (utils)
1	30
2	28
3	25
4	20
5	10
6	2
7	– 5

From the schedule, we can observe that the consumer is at equilibrium when he is consuming 3 units of the commodity *x.* This is because of the equality between Marginal Utility of a Rupee spent on the good and Marginal Utility of the Money. That is,

$$\frac{MU_x}{P_x} = MU_m \qquad \textbf{Consumer's Equilbrium Point}$$

At 3 units of commodity *x*,

MU_x = 25, P_x = 5 and MU_m = 5

$$\Rightarrow \frac{MU_x}{P_x} = \frac{25}{5} = MU_m = 5$$

Let us now consider what will happen ***if the consumer consumes less than 3 units of x***? For consuming less than 3 units, the Marginal Utility of a Rupee spent on *x* is greater than the Marginal Utility of Money i.e.

$$\frac{MU_x}{P_x} > MU_m$$

For example, at 2 units of *x*,

$MU_x = 28$, $P_x = 5$ and $MU_m = 5$

$$\Rightarrow \frac{MU_x}{P_x} = \frac{28}{5} = 5.6$$

$5.6 > 5$

Hence,

$$\frac{MU_x}{P_x} > MU_m$$

This implies that the consumer pays Rs 5, which is lesser than the worth of the commodity (Rs 5.6). Thus, the consumer would consume additional units of the commodity *x*, till he finds the equality between the both (The equality happens only at the equilibrium).

On the other hand, for consumption of ***more than 3 units*** of *x*, the Marginal Utility of a Rupee spent on the commodity is lesser than the Marginal Utility of Money, i.e.

$$\frac{MU_x}{P_x} < MU_m$$

For example, at 4 units of *x*,

$MU_x = 20$, $P_x = 5$ and $MU_m = 5$

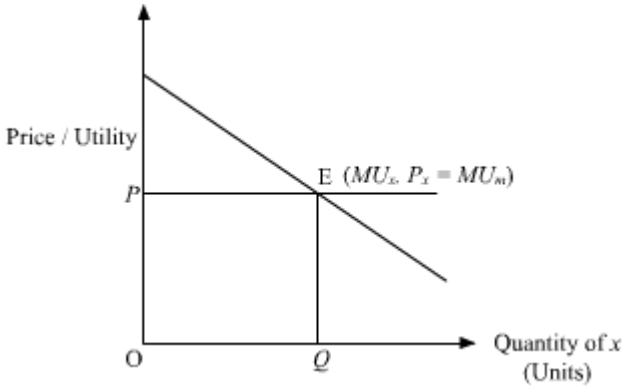
$$\Rightarrow \frac{MU_x}{P_x} = \frac{20}{5} = 4$$

$$\frac{MU_x}{P_x} < MU_m$$

$\Rightarrow 4 < 5$

This implies that the consumer pays Rs 5, which is higher than the worth of the commodity (Rs 4). Thus, the consumer would reduce consumption of the commodity *x*, till he finds the equality between the both at the equilibrium.

Diagrammatically, the equilibrium is depicted as:



In the figure, the quantity of commodity *x* is represented on the *x*-axis, while, the price and the utility are represented on the *y*-axis. MU_m curve is a horizontal straight line (parallel to the *x*-axis) representing constant Marginal Utility of Money. MU_x curve is downward sloping representing diminishing Marginal Utility of *x*. The consumer attains consumer's equilibrium at point *E*, where, the Marginal Utility of a Rupee spent on *x* is equal to the Marginal Utility of Money.

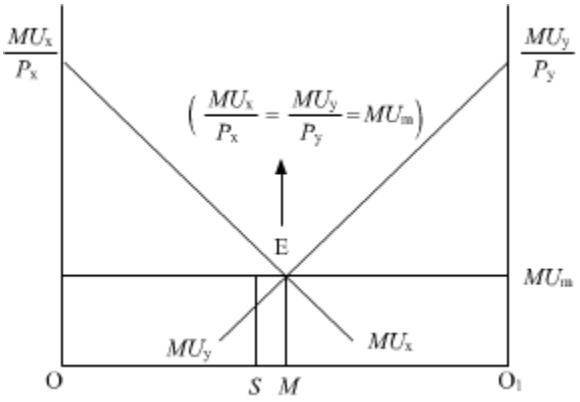
Consumer's Equilibrium in Case of Many Commodities- Two Goods Case

In case of many commodities, the Consumer's Equilibrium is given in accordance with the ***Law of Equi-Marginal Utility***.

Law of Equi-Marginal Utility states that a consumer allocates his expenditure on various commodities in such a manner that the utility derived from each additional unit of the rupee spent on each of the commodities is equal. Algebraically, this is represented the following equality.

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \ldots \frac{MU_m}{P_n} = MU_m$$

Diagrammatically, the consumer's equilibrium in case of two commodities is represented as:



In the above figure, OO_1 represents the total income of a consumer. MU_x and MU_y represent the Marginal Utility curves of commodity *x* and commodity *y*, respectively. The point *E* represents the point of consumer's equilibrium, where:

$$\frac{MU_x}{P_x}=\frac{MU_y}{P_y}=MU_m$$

At this point, *OM* amount of income is spent on commodity *x* and the remaining amount of income MO_1 is spent on commodity *y*.

Suppose, instead of point *M*, the consumer is at point *S*, where he spends *OS* amount of income on commodity *x* and SO_1 amount of income on commodity *y*. At point *S,* however;

$$\frac{MU_x}{P_x}>\frac{MU_y}{P_y}$$

Thus, the consumer would increase his consumption of commodity *x* till the equality is achieved. That is, in other words, when he reaches point *E*, where the equilibrium is restored by the equality between the marginal Utilities of each commodities.

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

Numerical Example

Let us understand the concept of Consumer's Equilibrium in case of two commodities with the help of the following numerical example. Let us suppose that for a consumer the Marginal Utility of Money (MU_m) is 5 utils and the price of commodity *x* (P_x) is Rs 5, while, the price of another commodity *y*, (P_y) is also Rs 5

Consider the following Marginal Utility Schedule for commodity *x* (MU_x) and commodity *y* (MU_y)

Units of *x* (units)	***MU*$_x$** (utils)	***MU*$_y$** (utils)
1	30	35
2	28	32
3	25	28
4	20	25
5	10	12
6	2	3
7	– 5	– 1

As per the schedule, the consumer strikes equilibrium when he is consuming 3 units of commodity *x* and 4 units of commodity *y*. At such a consumption combination, the Marginal Utility of a Rupee spent on the commodity *x* $\left(\frac{MU_x}{P_x}\right)$ is equal to the Marginal Utility of a Rupee spent on the commodity *y* $\left(\frac{MU_y}{P_y}\right)$, which in turn is equal to the Marginal Utility of Money (MU_m).

That is,

Marginal Utility of a Rupee spent on commodity *x* = Marginal Utility of a Rupee spent on commodity *y* = Marginal Utility of Money

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$$

$$\Rightarrow \frac{MU_x}{P_x} = \frac{MU_Y}{P_Y} = \frac{25}{5} = 5 = MU_m$$

Introduction to Consumer's Budget: Budget Set, Budget Line, Changes in the Budget Line

Objectives

After going through this chapter you shall be able to understand the following concepts.

- Concept of Consumer Preferences
- Consumer's Budget: Budget Set, Budget Line
- Changes in Budget Line

Consumer's Budget

Another important aspect of consumer's preferences is the ***consumer's budget***. We know that a consumer purchases various goods and services with the sole aim of maximising his/her level of satisfaction. However, this maximising behaviour of the consumer is

constrained by his limited income. With only a limited income a consumer cannot purchase all that he/she wants.

The availability of consumption bundles to a consumer depends mainly on the following two factors.

1. Price of goods and services (P)
2. Income of the consumer (M)

Given the income of the consumer and the prices of the goods and services, a consumer can purchase only those combinations of goods and services such that his total expenditure on the goods and services is less than or equal to his income.

Budget Set

A budget set represents those combinations of consumption bundles that are available to the consumer given his/her income level and at the existing market prices. In other words, it represents those consumption bundles that the consumer can purchase using his/her money income (M).

Let x_1 be the amount of good 1
x_2 be the amount of good 2
P_1 be the price of good 1
P_2 be the price of good 2

$\begin{cases} P_1x_1 \Rightarrow \text{The amount of money spent on good 1} \\ P_2x_2 \Rightarrow \text{The amount of money spent on good 2} \end{cases}$

Based on the above variables, the budget set or the consumption bundles available to the consumer will be governed by the following inequality condition:

$$P_1x_1 + P_2x_2 \leq M \quad \Rightarrow \quad \text{Budget constraint}$$

Note: The use of ≤ sign in the constraint, implies that the total amount spent on two goods together should be less than or equal to his/her given income level. In other words, a particular consumption bundle is available or affordable to a consumer if the total money spent on both the goods is less than or equal to the total available money income.

For example, consider a consumer who has an income (M) of Rs 100. He wants to purchase two goods, good 1 and good 2. Good 1 costs (P_1) Rs 5 per unit, while good 2 costs (P_2) Rs 4 per unit. Accordingly, we can find various combinations of good 1 and good 2 that he can purchase with his income and at the existing prices of the two goods. The following schedule depicts the various possible consumption combinations:

Units of Good 1 (x_1)	Units of Good 2 (x_2)
20	0
16	5
12	10
8	15
0	25

With Rs 100 if, the consumer spends his entire income on good 1 then, he can purchase 20 units of good 1(depicted in the first row of the schedule). On the other hand, if, the consumer spends his entire income on good 2 then, he can purchase 25 units of good 2 (depicted in the last row of the schedule). Alternatively, he can purchase a combination of good 1 and good 2. For instance, he can purchase 16 units of good 1(spending 16 × 5= Rs 80) and 5 units of good 2 (spending 5 × 4= Rs 20) and so on.

In this case the budget constraint of the consumer is given as follows.

$5x_1 + 4x_2 = 100$

It represents the different combinations of two goods that are affordable and are available to a consumer given his/her level of income and the market prices of the goods.

The equation of the budget line is represented as follows.

$P_1x_1 + P_2x_2 = M$

With the help of the budget line we can also estimate the amount of income that is spent on different goods.

Let x_1 be the amount of good 1
x_2 be the amount of good 2
P_1 be the price of good 1
P_2 be the price of good 2

$\begin{cases} P_1x_1 \Rightarrow \text{The amount of money spent on good 1} \\ P_2x_2 \Rightarrow \text{The amount of money spent on good 2} \end{cases}$

The budget equation is of the following form.

$P_1x_1 + P_2x_2 = M$

Solving for x_2:

$P_2x_2 = M - P_1x_1$

$$x_2 = \frac{M}{P_2} - \frac{P_1}{P_2}x_1$$

where,

$\frac{M}{P_2}$ is the vertical intercept. It represents the amount of x_2 that the consumer can purchase if he spends his entire income on good 2.

$-\frac{P_1}{P_2}$ represents the slope of budget line. This is also called the ***price ratio***. The negative sign depicts the negative slope of the budget line from left to right.

Similarly, the above equation can be solved for x_1

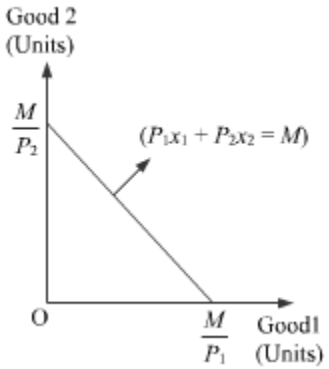
$P_1x_1 = M - P_2x_2$

$$x_1 = \frac{M}{P_1} - \frac{P_2}{P_1}x_2$$

where,

$\frac{M}{P_1}$ is the horizontal intercept and it represents the amount of x_1 that a consumer can purchase if he spends his entire income on good 1.

Based on the above information we can draw the budget line as follows.



Slope of Budget Line and its Derivation

The slope of the budget line measures the amount of good 1 that must be foregone (sacrificed) in order to obtain an additional unit of good 2. It is represented as, $-\frac{P_1}{P_2}$

Let us mathematically derive the slope of budget line.

Let x_1 be the amount of good 1
x_2 be the amount of good 2
P_1 be the price of good 1
P_2 be the price of good 2

$\begin{cases} P_1x_1 \Rightarrow \text{The amount of money spent on good 1} \\ P_2x_2 \Rightarrow \text{The amount of money spent on good 2} \end{cases}$

The budget line is of the form

$P_1x_1 + P_2x_2 = M$ (1)

Now If,

Δx_1= Change in amount of good 1

Δx_2= Change in amount of good 2

Then, the equation of the new budget line will be

$P_1(x_1 + \Delta x_1) + P_2 (x_2 + \Delta x_2) = M$

Solving,

$P_1x_1 + P_1\Delta x_1 + P_2x_2 + P_2\Delta x_2 = M$

$\underbrace{P_1x_1 + P_2\Delta x_1} + P_2x_2 + P_2\Delta x_2 = M$

Substituting the value of $P_1x_1 + P_2x_2 = M$ from equation (1):

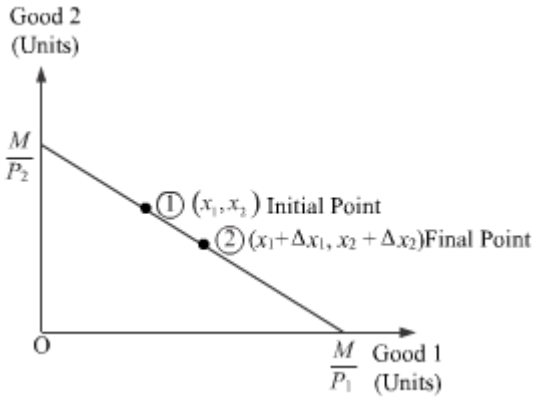
$M + P_1\Delta x_1 + P_2\Delta x_2 = M$

$P_1\Delta x_1 + P_2\Delta x_2 = 0$

Rearranging this equation:

$$\frac{\Delta x_2}{\Delta x_1} = \frac{-P_1}{P_2}$$

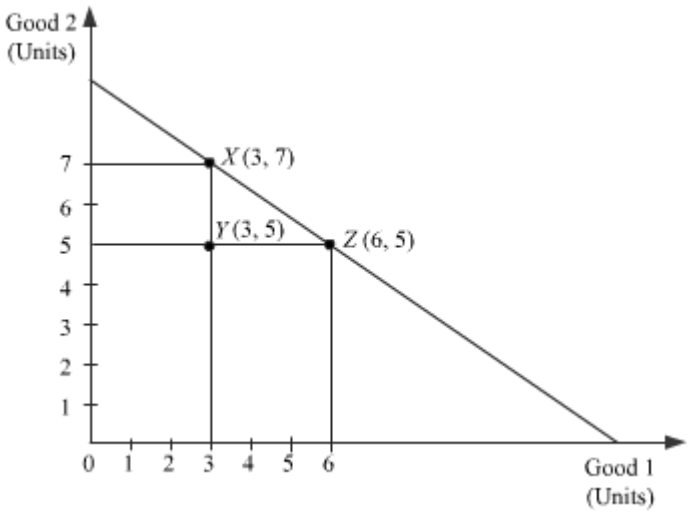
Graphically, this can be explained as follows.



Let us assume that initially the consumer is at point (1) where he/she has a consumption bundle (x_1, x_2) that costs him/her an amount equal to his/her money income. Now, if he/she wants to increase her consumption of good 1 by 1 unit i.e., from x_1 to ($x_1 + \Delta x_1$), then he/she must reduce the amount of good 2 by an amount that is equal to the price of Δx_1 i.e., P_1. In other words, for increasing the amount of good 1 by 1 unit the amount of good 2 must be reduced by $\frac{P_1}{P_2}$ units. The price ratio implies the rate of exchange or the rate at which good 1 can be substituted for good 2.

Points below the Budget Line

The consumption bundles that lie below the budget line represent those consumption bundles that leave the consumer with some unspent amount of money income. These bundles, when compared to those that lie on the budget line, will have lesser amount of atleast one of the goods and no more of the other good.



In the above graph, point *X* and point *Z* represent those consumption bundles that lie on the budget line (i.e. those combinations of the two goods on which the consumer spends the entire income). On the other hand, point *Y* lies below the budget line. We can observe that while *X* consists of 3 units of good 1 and 7 units of good 2, on the other hand, point *Y* consists of 3 units of good 1 but only 5 units of good 2. Similarly, point *Z* consists of 6 units of good 1 and 5 units of good 2. Hence, a rational consumer, preferring more of the goods than less of it, will consume on the budget line and not below it.

Changes in the Budget Set

We know that a budget line depends on the Income of the consumer (*M*) and the price of the goods and services (*P*).

Accordingly, a budget line will change under the following conditions.

1. If money income of the consumer changes
2. If price of any of the goods (P_1, P_2) changes

Change in the Budget Line due to Change in the Money Income of the Consumer

Let us suppose a consumer consumes two goods x_1 and x_2 with prices P_1 and P_2 respectively, i.e.

Let x_1 be the amount of good 1
x_2 be the amount of good 2
P_1 be the price of good 1
P_2 be the price of good 2

$\begin{cases} P_1x_1 \Rightarrow \text{The amount of money spent on good 1} \\ P_2x_2 \Rightarrow \text{The amount of money spent on good 2} \end{cases}$

The budget line is of the form

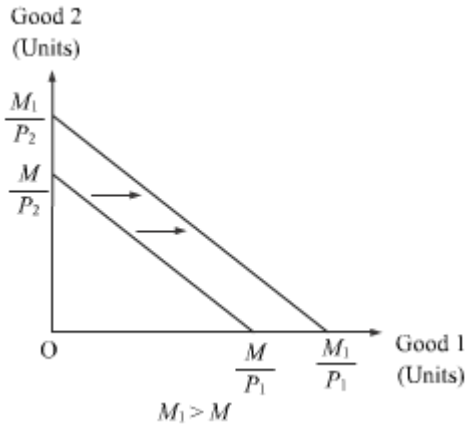
$P_1x_1 + P_2x_2 = M$

Now suppose the ***money income increases*** from *M* to *M´*, then the new budget line will be

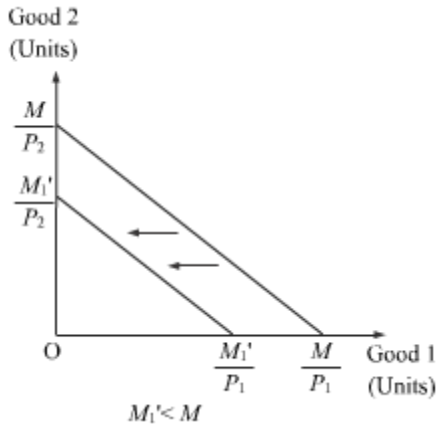
$$\overline{P}_1x_1 + \overline{P}_2x_2 = M'$$

$$x_2 = \frac{M'}{\overline{P}_2} - \frac{\overline{P}_1}{\overline{P}_2}x_1 \qquad (3)$$

Observe that this new budget line has an increased vertical intercept i.e., $\frac{M'}{P_2}$. The slope of the budget line, i.e., $\left(\frac{P_1}{P_2}\right)$ remains constant as the price ratio is unchanged. This implies that the consumer can purchase more of both the goods with the same prices. With such a change ***the budget line shifts parallely outwards*****.**



As against this if, the ***money income of the consumer falls*****,** the new budget line will have a decreased vertical intercept. This implies that the consumer will now be able to purchase less of both the goods with the same prices. With such a change the ***budget line shifts parallely inwards***.



$M' > M$	Increased vertical intercept	Slope unc
$M' < M$	Decreased vertical intercept	Slope unc

where,

M represents the initial money income with the consumer and *M´* represents the changed income with the consumer (increase or decrease in income).

Numerical Example

Let us understand this with the help of the following numerical example.

Let the initial budget set of the consumer is represented as,

$P_1x_1 + P_2x_2 = M$

where, P_1 = Rs 20, P_2 =Rs 10 and M = 100

If, the consumer spends the entire income on x_1, the quantity demanded of $x_1 = \frac{M}{P_1} = \frac{100}{20} = 5$

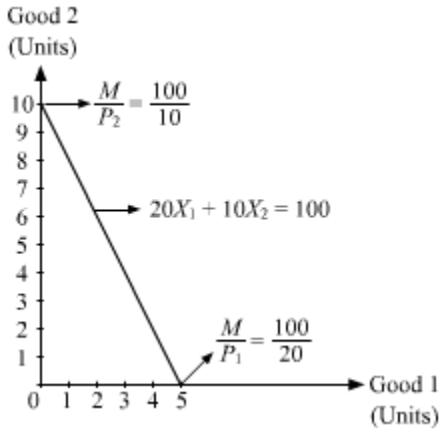
This represents the horizontal intercept.

Similarly, if the consumer spends the entire income on x_2 , the quantity demanded of

$$x_2 = \frac{M}{P_2} = \frac{100}{10} = 10$$

This represents the vertical intercept.

The budget line can be represented graphically as follows.



Now, suppose other things remaining constant, the money income increases from Rs 100 to Rs 200. With the change in money income, the horizontal and the vertical intercept changes.

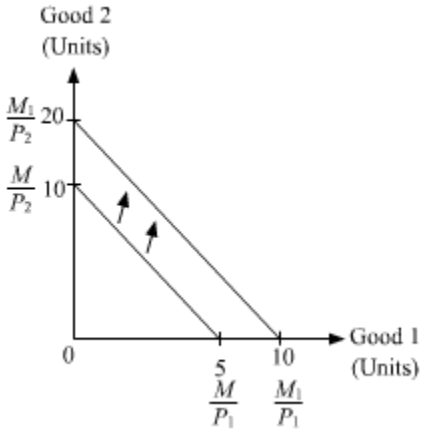
Horizontal intercept $= \frac{M'}{P_1} = \frac{200}{20} = 10$

Vertical intercept $= \frac{M'}{P_2} = \frac{200}{10} = 20$

Since the prices have not changed, therefore the slope of the budget line remains the same

slope $= -\frac{P_1}{P_2} = -\frac{20}{10} = -2$ (constant)

This suggests that the slope of budget line remains the same and the budget line shifts parallely outwards.

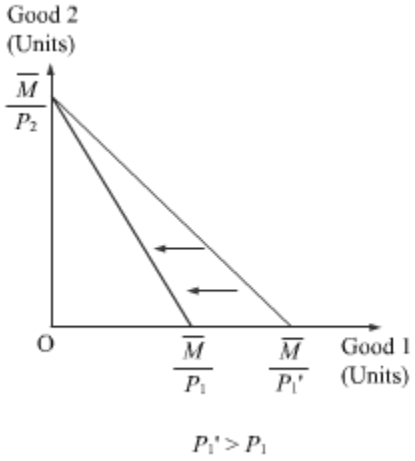


Change in Budget Line due to Change in the Price of Good 1

Let us suppose, ***the price of good 1 increases*** from P_1 *to* P_1' with money income and price of good 2 remaining constant.(i.e. $\overline{M}$ and $\overline{P_2}$), then the new budget line will be represented as follows.

$$x_2 = \frac{\overline{M_1}}{\overline{P_2}} - \frac{P_1'}{\overline{P_2}} x_1$$

Since P_1 has increased, the consumer will now be able to purchase a lesser amount of good 1 with his given income. In other words, if the consumer spends his entire income on good 1 then, he will now be able to purchase a lesser amount of good 1. This implies that the horizontal intercept falls. Also, with the increase in the price of good 1, the price ratio i.e. the slope of the budget line increases.



With an increase in the price of the good 1, the budget line pivots inwards around the same vertical intercept. The slope of the new budget line will increase and it will become steeper.

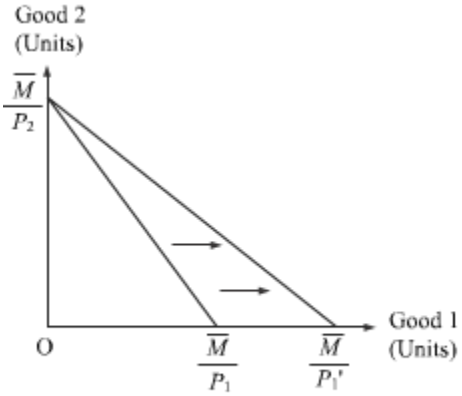
Let us now consider the reverse case.

Let us suppose now ***the price of good 1 decreases*** to P_1'. With money income and price of good 2 remaining constants ($\overline{M}$ and $\overline{P}_2$), the new budget line will be represented as follows:

$$x_2 = \frac{\overline{M_1}}{\overline{P}_2} - \frac{P_1'}{\overline{P}_2} x_1$$

Since P_1 has decreased, the consumer will now be able to purchase a greater amount of good 1 with his given income. In other words, if the consumer spends his entire income on good 1, then, he will now be able to purchase a greater amount of good 1. This implies that horizontal intercept rises. Also, with the decrease in the price of good 1 the price ratio i.e. the slope of the budget line falls.

With a decrease in the price of good 1, the budget line pivots outwards around the same vertical intercept. The slope of the new budget line will decrease and it will become flatter.



$P_1' < P_1$

If $P_1' > P_1$	Budget line will be steeper	Pivot inwards around the same vertical intercept
If $P_1' < P_1$	Budget line will be flatter	Pivot outwards around the same vertical intercept

where, P_1 represents the initial price of good 1 and P_1' represents the changed price of good 1(increase or decrease in price)

Let us understand the concept with the help of the following numerical example.

Let, the initial budget set of the consumer is represented as

$P_1x_1 + P_2x_2 = M$

where, P_1 = Rs 20, P_2 = Rs 10 and M = Rs 100

If the consumer spends the entire income on x_1, the quantity demanded of $x_1 = \frac{M}{P_1} = \frac{100}{20} = 5$

This represents the horizontal intercept.

Similarly, if the consumer spends the entire income on x_2, the quantity demanded of

$x_2 = \frac{M}{P_2} = \frac{100}{10} = 10$

This represents the vertical intercept.

Now suppose, other things remaining constant price of good 1 (P_1) increases from Rs 20 to Rs 25.

Thus, the horizontal intercept changes

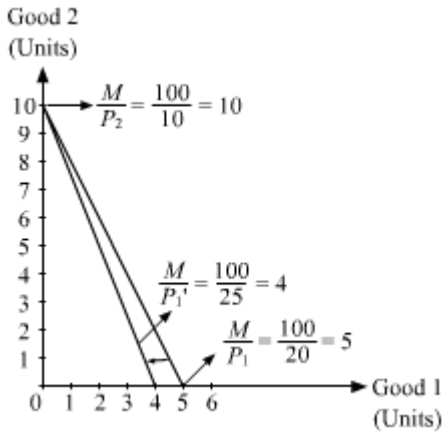
$$= \frac{M}{P_1} \text{ to } \frac{M}{P_1'}, = \frac{100}{25} = 4$$

This suggests that, as the price of good 1 increases, the consumer is able to purchase a lesser quantity of good 1 with the given income.

Also, with the change in price the slope of budget line increases.

$$-\frac{P_1'}{P_2} = -\frac{25}{10} = -2.5$$

Thus, the slope of budget line increases i.e. it becomes more steeper. With such a change the budget line pivots inwards along the horizontal axis with the same vertical intercept.



Change in budget line due to change in price of good 2

Let us suppose that ***the price of good 2 increases*** to P_2' with money income and price of good 1 remaining constant ($\overline{M}, \overline{P_1}$). The new budget line will be represented as follows:

$$x_1 = \frac{\overline{M}_1}{\overline{P}_1} - \frac{P_2'}{\overline{P}_1} x_2$$

Since P_2 has increased, the consumer will now be able to purchase a lesser amount of good 2 with his given income. In other words, if the consumer spends his entire income on good 2, then, he will now be able to purchase a lesser amount of good 2. This implies that the

vertical intercept falls. Also with the increase in the price of good, the price ratio i.e. the slope of the budget line falls.

Thus, with an increase in the price of good 2, the budget line pivots inwards around the same horizontal intercept. The slope of the new budget line will fall and it will become flatter.

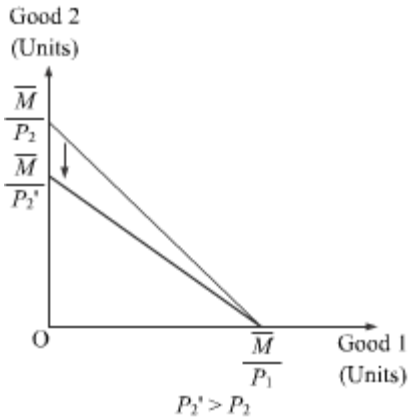
Let us now consider the reverse case.

Let us suppose now ***the price of good 2 decreases*** to P_2' with money income and price of good 1 remaining constants (i.e. $\overline{M}, \overline{P}_1$). The new budget line will be represented as follows:

$$x_1 = \frac{\overline{M}_1}{\overline{P}_1} - \frac{P_2'}{\overline{P}_1} x_2$$

Since P_2 has decreased, the consumer will now be able to purchase a greater amount of good 2 with his given income. In other words, if the consumer spends his entire income on good 2, then, he will now be able to purchase a greater amount of good 2. This implies that vertical intercept rises. Also, with the decrease in the price of good 2 the price ratio i.e. the slope of the budget line rises.

Thus, with a decrease in the price of good 2, the budget line pivots outwards around the same horizontal intercept. The slope of the new budget line will increase and it will become steeper.



If $P_2' > P_2$	Budget line will be flatter	Pivot inwards around the same horizontal intercept
If $P_2' < P_2$	Budget line will be steeper	Pivot outwards around the same horizontal intercept

where, P_2 represents the initial price of good 1and P_2' represents the changed price of good 1(increase or decrease in price).

Numerical Example

Let us understand this more clearly with the help of an example.

Consider again the example given above.

Suppose now other things remaining constant, if the price of good 2 (P_2) increase from Rs 10 to Rs 20.

Thus, now the vertical intercept becomes

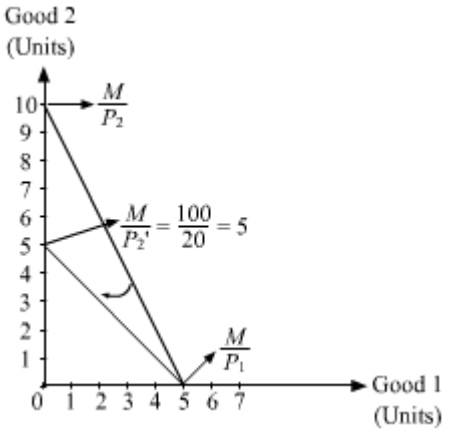
$$= \frac{M}{P_2'} = \frac{100}{20} = 5$$

This implies that as the price of good 2 increases, the consumer is now able to purchase a lesser quantity of good 2 with the given income.

Again the slope of budget line changes

$$-\frac{P_1}{P_2'} = -\frac{20}{20} = -1$$

Thus, the slope of budget line falls and it becomes flatter. The new budget line will pivot inwards along the same horizontal intercept.



Thus, we can sum up our analysis by saying that the budget line depicts the purchasing power of the consumers. It changes due to the changes in the prices of either of the goods and/or changes in the money income of the consumers. In the former case, the budget line will pivot inwards or outwards and the slope will change (flatter or steeper). However, in the latter case, it will shift outwards or inwards with the same slope. The concept of the

budget line is very important while considering the consumer equilibrium in the subsequent chapter.

Ordinal Approach - Indifference Curve Analysis, Marginal Rate of Substitution, Optimal Choice and Consumer Equilibrium

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Ordinal Approach of Consumer's Behaviour Theory
- Preferences of Consumer and its Assumptions
- Indifference Curve and its Properties
- Indifference Map
- Consumer Equilibrium and Optimal Choice

Introduction

In the previous chapters we have studied the concept of Cardinal Approach of Consumer's Behaviour theory. The Cardinal theory is based on the idea that a particular consumer can measure (assign values to) the level of satisfaction that he/she derives from the consumption of a particular good or service. The consumer can express his/her measured satisfaction either in terms of utils, in terms of money or in terms of sacrifice of the other goods and services (opportunity cost). In this chapter, we will study the Ordinal Approach of the Consumer Behaviour Theory. This theory is based on the Indifference Curve Analysis suggested by Professor Hicks and R.G.D. Allen. In the latter part of the chapter, we will explore the consumer's equilibrium with the help of the indifference curve and the budget line. While, the budget line depicts his/her budget and the purchasing power, the indifference curve depicts his/her preferences. This chapter starts with the basic assumptions for the consumer’s preferences and concludes with the juxtaposing of the budget line and the indifference curve on the same graph to find the optimum bundle where the consumer shall attain his/her equilibrium.

Throughout the chapter it is assumed that a consumer faces a choice between only two goods i.e. good 1 and good 2

Ordinal Approach

Ordinal Approach postulates that a consumer ***cannot measure the satisfaction*** that he/she derives from the consumption of a particular good or service. Further, it asserts that measurement of satisfaction in specific units is not required. In fact, a consumer ranks different goods and services as per his/her preferences. In other words, it asserts that a consumer takes his consumption decisions on the basis of the ranks assigned in order of his/her preferences.

Preliminary Notations

The following are some of the notations that are used throughout the chapter.

1. x_1 denotes the amount of good 1 consumed

2. x_2 denotes the amount of good 2 consumed

3. $x_1$and x_2 are assumed to be variables as their values depend on various factors such as prices, tastes and preferences and the income of a consumer.

4. If $x_1$and x_2 represent the amount of good 1and good 2 consumed, then (x_1, x_2) represents the consumption bundle, which denotes the amount of good 1 and good 2 consumed together.

5. $0 < x_1, x_2$, i.e., x_1 and x_2 are assumed to be either positive or equal to zero.

Preferences of Consumer: Assumptions

The following are the general assumptions made about the preferences of a consumer for the goods.

1. *Tastes and Preferences*- A consumer's choice for his/her consumption bundle depends on his/her tastes and preferences for various bundles.

2. *Rationality*- A consumer is assumed to be rational. The sole motive of the consumer is to maximise the level of satisfaction. Thus, the consumer will always choose the best bundle among all the available bundles.

3. *Well-defined Preferences*- A consumer is assumed to have well-defined preferences for all the possible bundles, i.e. the consumer exactly knows his choices and preferences.

4. *Comparison*- A consumer can compare any two consumption bundles and can accordingly either prefer one consumption bundle over another consumption bundle or be indifferent towards both (indifferent means that for the consumer both the commodities are equally good).

5. *Ranking*- It is assumed that a consumer can rank the consumption bundles in order of their preferences. In other words, the consumer can rank the consumption bundles from the most preferred ones to the least preferred ones. However, if any two or more consumption bundles are given the same rank by the consumer, then the consumer is said to be indifferent towards those bundles.

6. *Monotonic Preferences*: A consumer is assumed to have *monotonic* preferences. Consumer's preferences are said to be monotonic if, he/she prefers those consumption

bundles which have *at least more of one good and no less of the other good* than other consumption bundles.

For example, consider two consumption bundles, bundle *A* (3, 5) and bundle *B* (3, 2), then, according to the assumption of monotonic preferences, a consumer will prefer bundle *A* over bundle *B*. This is because bundle *A* has more units of good 2 (i.e.5 units as compared to only 2 units in bundle *B*) and no less of good 1.

7. *Substitution between Goods**:*** If the preferences are monotonic, then a consumer can be indifferent between any two bundles only *if the bundle consisting of more of one good has a lesser amount of the second good as compared to the other bundle*.

For example, consider two consumption bundles- Bundle *A* (5, 8) and Bundle *B* (3, 10). In this case, the consumer can be indifferent between Bundle *A* and Bundle *B*. This is because Bundle *A* has more of good 1 but less of good 2 than bundle *B*. This implies that the consumer cannot clearly prefer one bundle over the other and hence, can be indifferent between the two.

Algebraically, let there be two consumption bundles as *A* (x_1, x_2) and *B* ($x_1 + \Delta x_1$, $x_2 + \Delta x_2$).

In this case, the consumer can be indifferent between the two bundles A and B

If $\Delta x_1 > 0$, ***and*** $\Delta x_2 < 0$	***OR***	***If*** $\Delta x_1 < 0$ ***and*** $\Delta x_2 > 0$

In the first case, if, $\Delta x_1 > 0$ and $\Delta x_2 < 0$, then this implies that the Bundle *B* has more of good 1 but less of good 2 than Bundle *A*. Thus, the consumer can be indifferent between the two bundles. As against this, in the second case, if, $\Delta x_1 < 0$ and $\Delta x_2 > 0$, then this implies that the Bundle *B* has less of good 1 but more of good 2 than Bundle *A*.

The rate of substitution between good 2 and good 1 can be defined as the amount of good 2 that the consumer is ready to forego or substitute for an additional unit of good 1. In other words, it represents the cost of good 1 that the consumer is ready to pay in terms of good 2.

Algebraically, it is represented as follows $\left|\frac{\Delta x_2}{\Delta x_1}\right|$.

8. *Diminishing Rate of Substitution*- If a consumer prefers a consumption bundle that has comparatively more of good 1 and less of good 2, then according to the diminishing rate of substitution, the amount of good 2 a consumer is ready to give up for an additional unit of good 1 declines or diminishes with successive increase in the amount of good 1. In other words, if the consumer consumes more and more of good 1, then his/her willingness to sacrifice good 2 for additional units of good 1 will go on diminishing i.e. as the amount of good 1 increases, the rate of substitution between good 1 and good 2 falls.

9. *Consistency of Preferences*- A consumer is assumed to be consistent in his/her preferences. Consistency in preferences implies that if a consumer prefers good 1 over good 2 in one period of time, then he/she will not prefer good 2 over good 1 in any other time period. In other words, it is assumed that the consumer has the same preferences across all time periods.

10. *Transitivity of Preferences*- Transitivity of preferences implies that if, a consumer prefers good 1 over good 2 and prefers good 2 over good 3, then he/she would also prefer good 1 over good 3, i.e.

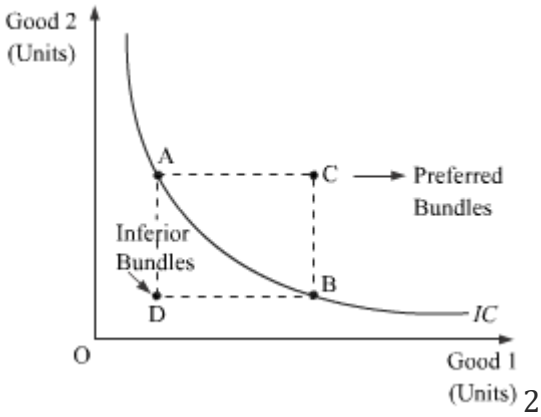
if, Good 1> Good 2 and Good 2> Good 3

Then, according to transitivity of preferences

Good 1 > Good 3

Indifference Curve

Indifference curve is a curve that depicts various combinations of two goods that provides a consumer with the same level of satisfaction. In other words, it shows those combinations of two goods between which the consumer is indifferent.



In the above figure, *IC* is the Indifference Curve. Each bundle on the *IC* shows those combinations of two goods that yield the consumer the same level of satisfaction. For

example, in the figure, Bundle *A* and Bundle *B* are on the same *IC*. Thus, the two consumption bundles provide the consumer with the same level of satisfaction.

Let us now consider the ***points that lie above the IC*** (such as point *C*). The points that lie above the *IC* represents those consumption bundles that contain more of at least one of the good and no less of the other good. For example, in the figure, bundle *C* contains more of good 1 and the same amount of good 2 as compared to bundle *A*. Similarly, bundle *C* contains more of good 2 and the same amount of good 1 as compared to bundle *B*. Thus, according to the assumption of monotonic preferences, the consumer would prefer bundle *C* over bundle A as well as over bundle *B*.

Thus, it can be said that the ***bundles that lie above the IC will be the more preferred bundles than the bundles that lie on or below the IC.***

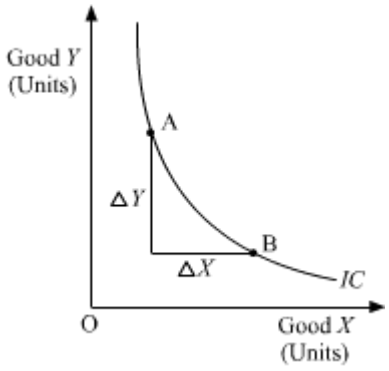
On the other hand, consider ***the points that lie below the IC*** (such as point *D*).The points that lie below the *IC* represents those consumption bundles that contain less of atleast one of the good and no more of the other. For example, in the figure, bundle *D* contains less of good 2 and the same amount of good 1 as compared to bundle *A*. Similarly, bundle *D* contains less of good 1 and the same amount of good 2 as compared to bundle B. Thus, according to the assumption of monotonic preferences, bundle *D* is inferior to both bundle A as well as bundle *B*.

Thus, it can be said that the ***bundles that lie below the IC will be inferior to the bundles that lie on or above the IC.***

Properties of Indifference Curve

1. ***Indifference curves are downward sloping to the right***: Downward slope of the indifference curve to the right implies that a consumer cannot simultaneously have more of both the goods. An increase in the quantity of one good is associated with the decrease in the quantity of the other good. This is in accordance with the assumption of monotonic preferences.

2. ***Slope of IC***: The Slope of an *IC* is given by the ***Marginal Rate of Substitution (MRS)***. Marginal rate of substitution refers to the rate at which a consumer is willing to substitute one good for each additional unit of the other good.

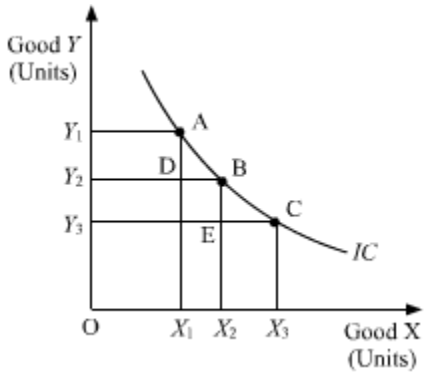


At point A:

$$\text{Slope of indifference curve } (MRS) = \frac{\Delta Y}{\Delta X}$$

i.e. MRS shows the rate at which the consumer is willing to sacrifice good *Y* for an additional unit of good *X*.

3. ***Shape of Indifference Curve***: As we move down along the Indifference curve to the right, the slope of *IC* (MRS) decreases. This is because as the consumer consumes more and more of one good, the marginal utility of the good falls. On the other hand, the marginal utility of the good which is sacrificed rises. In other words, the consumer is willing to sacrifice less and less for each additional unit of the other good consumed. Thus, as we move down the *IC*, MRS diminishes. This suggests the ***convex*** shape of indifference curve.



In the above figure, *IC* is the Indifference Curve.

At point A,

$$MRS_{xy} = \frac{AD}{DB}$$

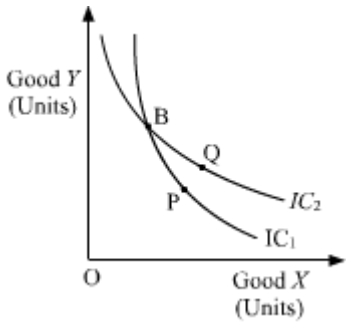
At point B,

$$MRS_{xy} = \frac{BE}{EC}$$

$$\frac{BE}{EC} < \frac{AD}{DB}$$

MRS at *B* < *MRS* at *A,* so *MRS* has fallen.

4. ***Two indifference curves never cross each other***: Let us understand this property of *IC* with the help of a diagram.



Suppose, there are two indifference curves IC_1 and IC_2 that intersect each other at point *B*.

We can observe that point *B* and point *P* lie on the same indifference curve, IC_1. This implies that the consumer must be indifferent between the two consumption bundles *B* and *P*. Similarly, point *B* and point *Q* lie on the same indifference curve, IC_2. This implies that the consumer must also be indifferent between the two consumption bundles *B* and *Q*. i.e.

B (*X*,*Y*) ~ *P* (X,Y) and *B* (*X*,*Y*) ~ *Q* (*X*,*Y*)

By the axiom of transitivity, the above analysis implies that a consumer must be indifferent between bundle *P* and bundle *Q* i.e.

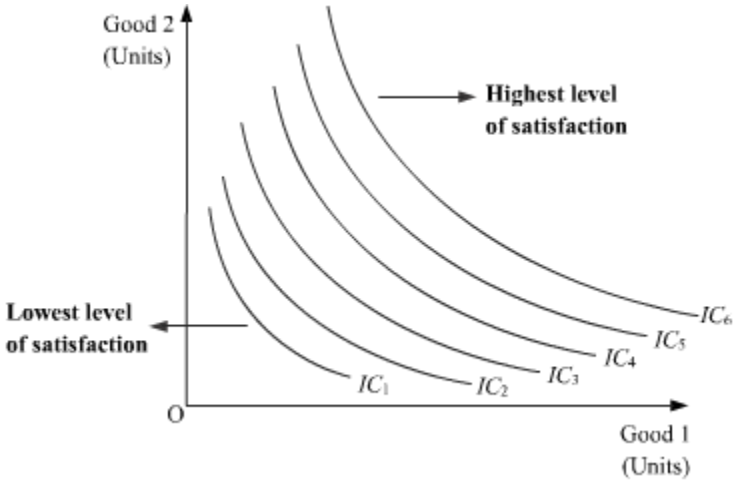
P (*X*,*Y*) ~ *Q* (*X*,*Y*)

However, this is not possible because bundle *P* and bundle *Q* lie on different *IC*. Hence, the two consumption bundles cannot provide the consumer the same level of satisfaction. Thus, it can be concluded that two *IC* cannot cross each other.

Indifference Map

Indifference map is a family or collection of indifference curves that depicts the different levels of satisfaction and preferences of a consumer. Each indifference curve in an indifference map depicts a particular level of satisfaction.

Higher *IC* denotes higher level of satisfaction and lower IC denotes lower level of satisfaction.



The above figure depicts an Indifference Map comprising of six indifference curves (from IC_1 to IC_6). As the consumer moves farther away from IC_1 to higher indifference curves the level of satisfaction derived by the consumer increases. IC_6 depicts the highest level of satisfaction. On the other hand, IC_1depicts the lowest level of satisfaction.

Optimal Choice of Consumer and Equilibrium

We know, a consumer always aims at maximising his/her utility or satisfaction level. A rational consumer, with well defined preferences, will always choose the best bundle among all the bundles available to him, given his/her money income and the prices of the goods and services. In other words, a consumer always tries to attain the highest possible *IC* given his/her budget set.

Recall, that consumption bundles that lie below the budget line leave the consumer with some unspent income. As compared to this the consumption bundles that lie on the budget line will have more of at least one of the goods and no less of the other. In other words, the consumption bundles that lie on the budget line will be more preferred than those that lie below the budget line. As against this, the consumption bundles that lie above the budget line are unaffordable (i.e. the consumer cannot purchase those bundles with his given money income).

From this analysis it can be inferred that the ***optimum bundle for the consumer must lie on the budget line***. The question now arises is where exactly on the budget line.

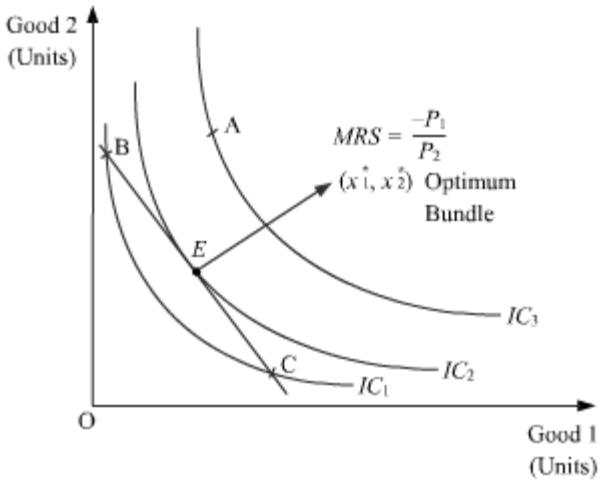
A consumer attains ***equilibrium at the point where the budget line is tangent to the indifference curve***. This optimum point is characterised by the following equality.

Slope of the *IC* = Slope of the budget line

$$\left|\frac{-dy}{dx}\right| = |MRS| = \left|\frac{-P_1}{P_2}\right|$$

Absolute value of the slope of the *IC* = Absolute value of the slope of the budget line

Graphically, the equilibrium can be depicted as follows.



In the figure given above, point *E* depicts consumer equilibrium. At this point, the budget line is tangent to the indifference curve. Observe that at this point the consumer's willingness to purchase (as given by the indifference curve) coincides with what the consumer can actually purchase (as given by the budget line). The optimum bundle is denoted by (x_1*, x_2*). This point is the optimum or the best possible point.

It should be noted that all other points lying on the budget line (such as point *B* and point *C*) are inferior to (x_1*x_2*) as they lie on a lower *IC*. Thus, the consumer can rearrange his consumption and again reach equilibrium where the marginal rate of substitution is equal to the price ratio.

For example, at point *B*, MRS is greater than the price ratio (i.e. $MRS > \frac{-P_1}{P_2}$). In this case, the consumer would tend to

move towards point *E* by giving up some amount of good 2 to increase the consumption of good 1.

Similarly, at point *C*, MRS is less than price ratio (i.e. $MRS < \frac{-P_1}{P_2}$). In this case the consumer would tend to move towards point *E* by giving up some amount of good 1 to increase the consumption of good 2.

Demand, Law of Demand, Movements and Shifts in Demand Curve and Market Demand

Objectives

After going through this chapter you shall be able to understand the following concepts

- Concept of Demand
- Demand Function
- Law of Demand
- Concept of Normal and Inferior Goods
- Movements along a Demand Curve and Shifts in Demand
- Cross Price Effect

Introduction

This chapter basically focuses on the concept of consumer demand. We all demand (need) various goods and services for the satisfaction of our wants. In this chapter, we will explore the various aspects related to demand such as, what factors affect our demand for commodities, why and how does our demand change and how are demand for different commodities related to each other.

Concept of Demand

We often think demand and desire are synonymous to each other, however; in economics, both are distinct. Desire refers to those wishes that a human being cherishes, such as, walking on moon, to be a billionaire, to buy a Rolls-Royce, etc. These wishes may not be always backed by enough finance to realise. However, when a desire is backed with sufficient purchasing power along with the consumer's readiness to spend on materialising the wish, the desire becomes demand. Thus, until and unless a consumer is having sufficient money and is willing to spend, a desire will remain a desire. On this note, let us go through the definition of demand.

Demand for a commodity refers to the quantity of a commodity that a consumer is willing and is able to purchase at a particular price at any particular point of time.

Demand and Quantity Demanded

For a consumer, demand for a particular commodity basically represents the relationship between price of the commodity and the quantity that he is willing and is able to purchase. In other words, how much quantity of a particular commodity will a consumer purchase is likely to depend on the price other things such income of the consumer, tastes and preferences etc. remaining constant (*ceteris paribus*). At this point, we can distinguish between *quantity demanded and demand*.
Demand for a commodity refers to the *various quantities* of a commodity that a consumer is willing to purchase at *various possible prices*. For example- a consumer demands 2 kg of sugar at Rs 10 per kg and 3 kg of sugar at Rs 8 per kg.
On the other hand, ***quantity demanded*** of a commodity refers to the *particular quantity* of a commodity that a consumer is willing to purchase at *a specific price* of the commodity. For example, a consumer demands 1 kg of sugar at Rs 11 per kg.

Demand Schedule

Demand Schedule is a tabular presentation of the relationship between the price of a commodity and the quantity demanded of that commodity at a particular point of time. In other words, it shows the different quantities of a commodity that a consumer is willing to purchase at different possible prices. The demand schedule can be sub-divided into the following two types.

1. Individual demand schedule
2. Market demand schedule

Individual Demand Schedule

An individual demand schedule is prepared for a particular consumer. It presents the various quantities of a particular commodity that a consumer is willing to purchase at different possible prices, at a particular point of time.

Example: Consider the following demand schedule for a commodity *X*

Price of Commodity *X* (in Rs)	Quantity Demanded of *X* (units)
10	100
15	50
20	25
25	15
30	5

A close analysis of the above schedule reveals that quantity demanded of a commodity holds a negative relationship with the price. In other words, it shows that at a higher price the quantity demanded of *X* falls and vice-versa. For example, as the price increases from Rs 10 to Rs 15, the quantity demanded falls from 100 units to 50 units.

Market Demand Schedule

We know that market for a commodity consists of a large number of consumers. The market demand schedule, unlike the individual demand schedule, shows the aggregate (total) demand for all the consumers in the market at different prices.

Example: Consider a hypothetical market that consists of only two consumers demanding a commodity *X*. The market demand schedule for *X* can be represented as:

Price of *X* (Rs)	Quantity Demanded by Consumer 1 (units)	Quantity Demanded by Consumer 2 (units)	Market Demand (units)

10	5	6	5 + 6 = 11
15	4	5	4 + 5 = 9
20	3	4	3 + 4 = 7
52	2	3	2 + 3 = 5

Demand Function

The demand for a commodity depends on different variables besides the price of that commodity. The relationship between these variables and the demand for a commodity can be expressed in a functional form known as demand function. The demand functions can be of following two types.

1. Individual demand function
2. Market demand function

Individual Demand Function

An individual demand function expresses the relationship between quantity demanded by an individual consumer and various determinants. The following are the major determinants of individual's demand for a good.

- Price of the good
- Price of the other goods- (i.e. price of substitute and complementary goods)
- Income of the consumer
- Consumer's tastes and preferences

Based on these factors, the individual demand function can be represented as:

$$D_x = f(P_x, P_y, Y, T)$$

where,

P_x represents Price of good X

D_x represents Demand for good X

P_y represents Price of other goods

Y represents Income of consumer

T represents Tastes and preferences

Determinants of Individual Demand

Let us discuss the relationship between quantity demanded and its various determinants in detail.

1. ***Price of Good X***

Other things remaining constant, as the price of a good rises (or falls), the quantity demanded of the good falls (or rises). Thus, price of a good and its quantity demanded share a negative relationship.

2. ***Price of Other Goods***

Quantity demanded of a good also depends on the price of other goods (i.e. related goods). Any two goods are considered to be related to each other, when the demand for one good changes in response to the change in the price of the other good. The related goods can be classified into following two categories.

(i) *Substitute Goods*

Substitute goods refer to those goods that can be consumed in place of each other. In other words, they can be substituted for each other. For example, tea and coffee, colgate and pepsodent, cello pens and reynolds pen, etc. In case of substitute goods, if the price of one good increases, the consumer shifts his demand to the other (substitute) good i.e. rise in the price of one good results in a rise in the demand of the other good and vice-versa.

For example, if price of tea increases, then the demand for tea will decrease. As a result, consumers will shift their consumption towards coffee and the demand for coffee will increase. (Price of tea ↑⇒ Demand for coffee ↑). It should be noted that the demand for a good moves in the same direction as that of the price of its substitute.

If P_T ***increases*** ⇒ D_T ***decreases*** ⇒ D_C ***increases*** ⇒ **Tea and coffee are substitute goods**

(ii) *Complementary goods*

Complementary goods refer to those goods that are consumed together. The joint consumption of these goods satisfies wants of the consumer. For example: Tea and sugar, ink pen and ink, printer and paper, etc.

In case of complementary goods, if the price of one good increases then a consumer reduces his demand for the complementary good as well, i.e. a rise in the price of one good results in a fall in demand of the other good and vice-versa.

For example, sugar and tea are complementary goods. Since, sugar and tea consumed together, so a rise in price of tea reduces the demand for sugar and vice-versa. It should be noted that demand for a good moves in the opposite direction of the price of its complementary goods. (Price of tea ↑ ⇒ demand for sugar ↓)

If P_T ***increases*** ↑ ⇒ D_{Tea} ***decreases*** ↓⇒ D_{Sugar} ***decreases*** ↓⇒ **Tea and sugar are complementary goods**

3. ***Income of the Consumer***

Change in the income of the consumer also affects the demand for goods. The effect of change in income on the demand depends on the type of the good.

Demand for ***normal goods*** share a ***positive*** relationship with consumer's income. As income increases the demand for normal goods also increases and vice-versa.

Demand for ***inferior goods*** (such as coarse cereals) share a ***negative*** relationship with consumer's income. As the income increases the demand for inferior goods falls and vice-versa.

Giffen goods are those goods which are highly inferior. Similar to the inferior goods, demand for Giffen goods also shares a ***negative*** relationship with the income.

Note: A good can be normal or inferior depending on the level of consumer's income. For instance, at a very low level of income, coarse cereals may be a normal good. However, for higher income level, *ceteris paribus*, coarse cereals will be an inferior good because with an increase in income, a consumer will reduce his/her consumption of inferior cereals and it will be substituted by superior cereals.

Important Statement- "All Giffen goods are inferior goods but not all inferior goods are Giffen goods".

In case of inferior goods, demand shares a ***negative*** relationship with ***price*** as well as with ***consumer's income***.
In case of Giffen goods, demand share a ***negative*** relationship with ***consumer's income*** but share a ***positive*** relationship with the ***price*** of the good.

Types of Goods	Relationship with Price	Relationship with Income
Demand for Inferior Goods	*Negative*	*Negative*
Demand for Giffen Goods	*Positive*	*Negative*

Thus, we can say that while all Giffen goods are inferior goods (because of the negative relationship between income and demand) but all inferior goods are not Giffen goods (because of the negative relationship between price and demand).

4. ***Consumer's Tastes and Preferences***

Consumer's tastes and preferences highly influence his demand for goods. Tastes and preferences include factors such as, habits, religious, customs, etc. Other things being equal, if a consumer prefers a commodity over other, then his demand for that commodity increases and vice-versa.

Market Demand Function

Similar to individual demand function, market demand function represents the relationship between the market demand of a good and its various determinants. It can be represented in the following functional form as:

$MD_x = f(P_x, P_y, Y, T, N, Y_d)$

where,

P_x represents Market Price of good X

D_x represents Market Demand for good X

P_y represents Market Price of other goods

Y represents Income of all the consumers

T represents Consumers' tastes and preferences

N represents Population size or number of consumers in the market

Y_d represents Distribution of income

Determinants of Market Demand

1. ***Market Price of Good X***

Other things remaining constant, as the market price of a good rises (or falls), the quantity demanded of the good falls (or rises). Thus, market price of a good and its quantity demanded share a negative relationship.

2. ***Market Price of Other Goods***

Quantity demanded of a good also depends on the market price of other goods (i.e. related goods). Any two goods are considered to be related to each other, when the demand for one good changes in response to the change in the market price of the other good. The related goods can be classified into following two categories.

(i) *Substitute Goods*

In case of substitute goods, if the price of one good increases, then the consumer shifts his demand to the other (substitute) good i.e. rise in the price of one good results in a rise in the demand of the other good and vice-versa.

(ii) *Complementary goods*

In case of complementary goods, if the price of one good increases then a consumer reduces his demand for the complementary good as well, i.e. a rise in the price of one good results in a fall in demand of the other good and vice-versa.

3. ***Income of the Consumer***

Change in the income of the consumer also affects the market demand for goods. The effect of change in income on the market demand depends on the type of the good.

The market demand for ***normal goods*** shares a ***positive*** relationship with consumer's income.

The market demand for ***inferior goods*** (such as coarse cereals) shares a ***negative*** relationship with consumer's income.

The market demand for Giffen goods also shares a ***negative*** relationship with the income.

4. ***Consumers' Tastes and Preferences***

Consumers' tastes and preferences highly influence the demand for goods. Other things being equal, if all the consumers prefer a commodity over other, then the market demand for that commodity increases and vice-versa.

5. ***Population Size- Number of Consumers in the Market***

The market demand for a commodity is also affected by the population size. Other things being equal, an increase in the population size increases the market demand of a commodity and a decrease in population decreases the market demand of a commodity. This is because with the change in population, number of consumers in the market changes and thus market demand change.

Besides the size of population, composition of population also influences the market demand. For example, if the population consists of more of young and teenage consumers, then the demand for goods meant for youngsters will increase.

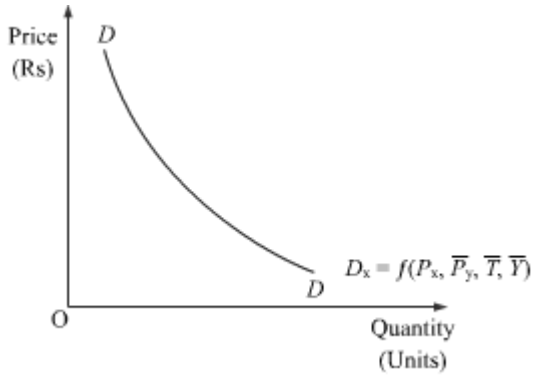
6. ***Distribution of Income***

If distribution of income in a society is fair and equal, then demand for a commodity is more compared to a situation with unequal distribution of income.

Demand Curve

It is a graphical representation of demand function i.e., the graphical representation of the relationship between the demand for a good and its price for a given income, price of related goods, tastes and preferences. The relationship between the demand for a good (D_x) and its price (P_x) is negative. This implies that demand will fall with the rise in price and vice-versa. A demand curve is drawn with the assumption of constant income, given taste and preference and constant price of the related goods. In other words, a demand curve helps us to study the one to one relationship between price of a good and its demand (assuming other factors to be constant). The function form of a demand curve is represented as:

$$D_x = f(P_x, \overline{P}_y, \overline{Y}, \overline{T})$$

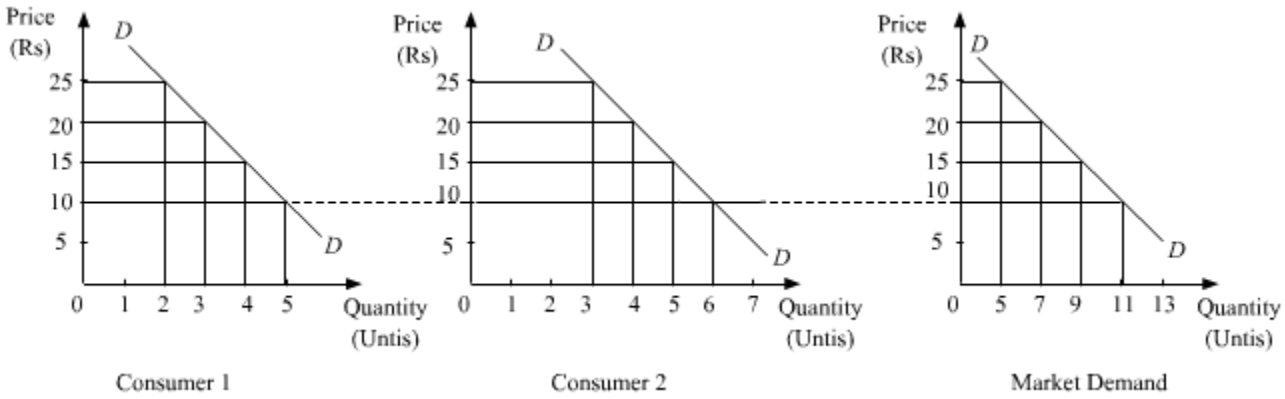


Market Demand Curve

A market demand curve shows the aggregate quantity demanded of a commodity that all the consumers in the market are willing to purchase at different possible prices. Algebraically, a market demand curve can be represented as:

$$MD_x = f(P_x, \overline{P}_y, \overline{Y}, \overline{T})$$

Graphically, a market demand curve is derived by horizontally summing up all the individual demand curve. Let us understand the derivation of the market demand curve by assuming that in a market of a good, there are only two consumers, Consumer 1 and Consumer 2.



In the diagram, it can be seen that at price Rs 10, quantity demanded by Consumer 1 is 5 units and that of by the Consumer 2 at the same price is 7 units. Therefore, the market demand at price Rs 10 is 12 units i.e. 5 units + 7 units. Similarly, horizontally summing up different quantity demanded by both the consumers at different prices, we obtain the market demand in the panel (iii) of the figure.

Law of Demand

We know, demand for a commodity is a function of various factors. Price is the most important of all the factors that affect demand. Law of demand focuses on this basic relationship between price of the good and quantity demanded of the good.

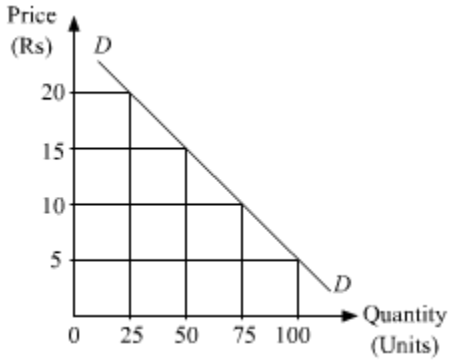
According to the *law of demand*, a consumer's demand shares an inverse relationship with the price of a good and vice-versa, *ceteris paribus* (other things being constant). In other words, if the income, price of related goods and a consumer's tastes and preferences remain unchanged, then the demand of a good moves opposite to the movement in the price of those goods.

Law of demand can be explained with the help of the following demand schedule.

Price of Commodity *X* **(Rs)**	**Quantity Demanded of *X*** **(units)**
5	100
10	75
15	50
20	25

The schedule shows that as price of the commodity *X* increases from Rs 10 to Rs 15, the quantity demanded of *X* falls from 75 units to 50 units. Thus, there is a negative relationship between demand and price.

Let us plot the above schedule on a graph. On the *x*-axis, we present the quantity demanded and on the *y*-axis, we present the price of the good. Joining the different combination of price and quantity demanded points, we get a curve *DD*. This curve is the demand curve showing the inverse relationship between price and quantity demanded.



Reasons for Downward Slope of Demand Curve

The demand curve is downward sloping from left to right. In other words, the slope of a demand curve is negative. The following are the reasons responsible for the downward slope of the demand curve.

1. *Law of Diminishing Marginal Utility*

According to this law, marginal utility derived from every additional unit of a good consumed tends to decline at the same price. Consequently, for each additional unit of the good, the consumer is willing to pay a lesser price. Thus, the consumer will increase his demand only when the price falls.

2. *Several Uses of a Good*

A commodity can be used for different purposes. For example, wheat flour can be used for making chapatis, biscuits, bread, etc. If the price of the commodity increases, then it will be used only for the important purposes, thereby, the demand for the good will reduce. On the contrary, with the fall in the price, the good will be put to various uses and consequently the demand will rise.

3. *Number of Consumers*

With a fall in the price of a good, the number of consumers demanding the good will increase and vice-versa. This is because with the fall in the price some new consumers enter the market who can now afford the good.

4. *Substitution Effect***

It implies that a rise in the price of a good makes its substitute goods relatively cheaper. This leads to an increase in demand for the substitute goods and decrease in demand for the good itself at higher prices. For example a rise in the price of coffee would make tea relatively cheaper. Thus, the consumers shift their demand towards tea and thereby demand for coffee reduces.

5. *Income Effect***

It implies that a rise in the price of a good leads to the fall in the purchasing power of the money income of the consumer and consequently leads to the decrease in the demand for good. This is because lesser of good can be purchased with the same amount of money.

*** A detailed explanation of these two terms is presented in the subsequent lesson.*

Exceptions to Law of Demand

Demand for all goods and services do not necessarily follow the law of demand. That is, there are some goods whose demand increases with a rise in their price and falls with a fall in their price. In such cases, the demand curve would slope upwards from left to right.

The following are the factors that causes exception to law of demand

1. Articles of Distinction

Some of the articles such as diamonds, jewellery, etc. are accorded high prestige and status value by the society as these are very costly. Such articles enjoy a high demand because of their high price. Demand for such articles increases with increase in their price. On the other hand, with a fall in the price these articles lose their prestige value and their demand will fall. This is because, if their price falls, then they will no longer be considered as articles of distinction and their demand will fall. This is known as ***veblan effect*** as named after Veblan.

2. Giffen goods

Giffen goods are those goods that share a negative relationship with consumer's income and a positive relationship with their price. These goods are highly inferior goods. With a fall in price of the Giffen goods, their demand falls.

3. Future Expectations

A consumer's expectations regarding future price also influence the demand. For example, an expectation of rise in the price in the future will result in rise in the quantity demanded

at present and vice versa. Such consumer behaviour can be seen in case of speculative activities.

4. *Emergency Situations*

Law of demand does not hold true in case of emergency situations such as war, curfew, natural calamities etc. In such situations, consumers purchase the commodities even at a higher price.

5. *Demonstration Effect*

Sometimes, a group of consumers in an attempt to follow the consumption behaviour of the higher income groups tends to purchase the goods consumed by the upper class, even if at a higher price. This is called Demonstration Effect.

Linear Demand Curve

A linear demand curve is a straight line negatively sloped left to right downwards.

A linear demand curve is algebraically represented as:

$$dx = \begin{cases} = a - bp & \text{Where } 0 \le p \\ = 0 & \text{If } p > \frac{a}{b} \end{cases}$$

Where,

a = Vertical intercept of the demand curve

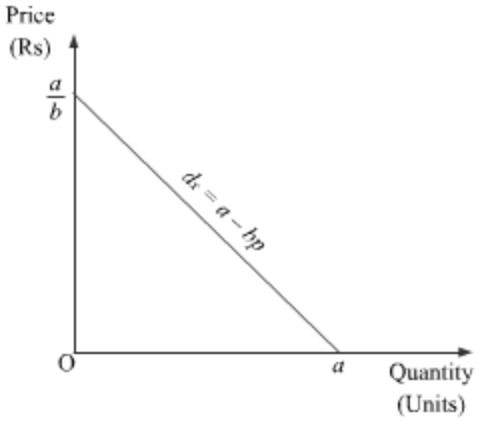
$-b$ = Slope of the demand curve

when, $P_x = 0$, $d_x = a$

and when,

$$P_x = \frac{a}{b},\ d_x = 0$$

The slope of the demand curve measures the responsiveness of change in demand with respect to the change in the price.



Movements along a Demand Curve and Shifts in the Demand Curve- Change in Quantity Demanded and Change in Demand

Change in Quantity Demanded (Graphically known as Movements along the Demand Curve)

The change in quantity demanded is associated with the change in the price of good P_x ***only***, assuming other determinants remaining unchanged. The change in the quantity demanded is graphically known as the movement along the demand curve. If the demand function is written as:

$D_x = f(P_x, P_y, Y, T)$

then, the movement along the demand curve implicitly implies that all the determinants other than the price of good (P_x) are constant and the change in D_x is totally because of the change in the price of the good (P_x), i.e.

$$D_x = f(P_x, \overline{P}_y, \overline{Y}, \overline{T})$$

The bar over the variables denotes that they are non-changing (or constant).

Movement along the demand curve are of two types:

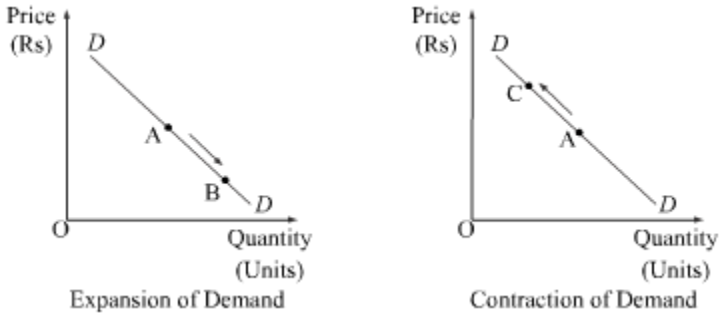
1. Expansion of demand
2. Contraction of demand

Expansion of demand

When quantity demanded of a commodity rises with a fall in the price it is called expansion of demand. In this case, there is a downward movement along the demand curve. This is represented by the movement from point A to B.

Contraction of demand

When quantity demanded of a commodity falls with a rise in the price it is called contraction of demand. In this case, there is an upward movement along the demand curve. This is represented by the movement from point A to D.



Change in Demand (Graphically known as Shifts in the Demand Curve)

If demand changes due to a change in the factors other than the price of the good, then it is called change in demand. In this case, the price of the good remains same. The change in the demand is graphically known as the shift in the demand curve. Algebraically, the shift in demand can be represented as:

$$D_x = f(\overline{P}_x, P_y, Y, T)$$

The bar over P_x denotes that the price of the good is constant.

Shift in the demand curve can be of following two types:

1. Increase in demand
2. Decrease in demand

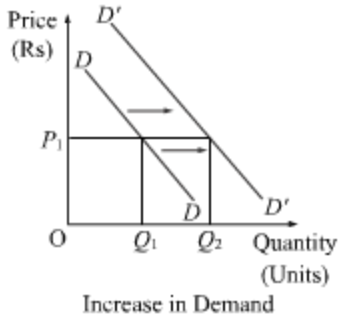
Increase in Demand

When demand for a good increases with the change in the factors other than the price of the good, then it is called increase in demand. Graphically, the increase in demand is represented by parallel rightward (outwards) shift of the demand curve.

The following are the factors that cause an increase in demand

- Increase in the income of the consumer
- Increase in the price of the substitute goods
- Change in tastes and preferences in favour of the commodity

- Expectation of price rise in future
- Increase in the total number of consumers



Increase in Demand

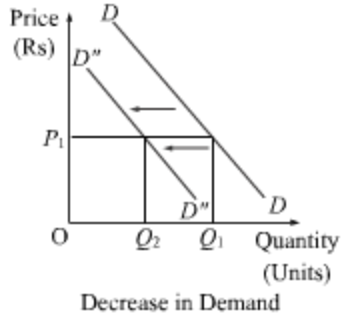
In the figure, initially at price OP_1, consumer purchases OQ_1 units of good. With the change in the other factors (say, increase in the income), the demand curve shifts parallelly outwards to *D'D'*. At the new demand curve, the consumer purchases more units of the good (OQ_2) but at the same price of OP_1.

Decrease in Demand

When demand for a good decreases with the change in the factors other than the price of the good, then it is called decrease in demand. Graphically, the decrease in demand is represented by parallel leftward (inwards) shift of the demand curve.

The following are the factors that cause decrease in demand.

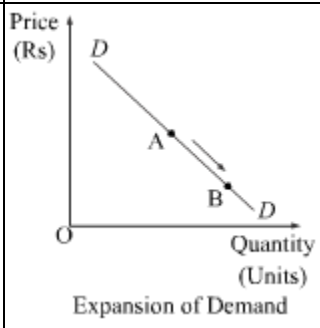
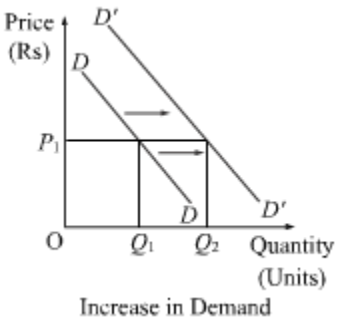
- Fall in the income of the consumer
- Fall in the price of the substitute goods
- Change in tastes and preferences in against of the commodity
- Expectation of price fall in future
- Decrease in the total number of consumers



Decrease in Demand

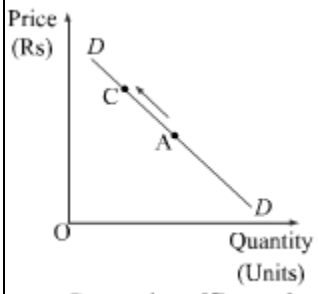
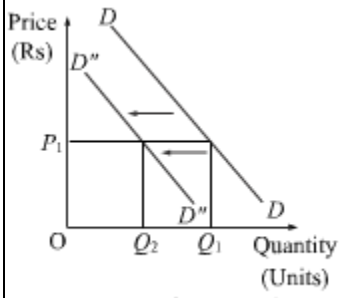
In the figure, initially at price OP_1, consumer purchases OQ_1 units of good. With the change in the other factors (say, decrease in the income), the demand curve shifts parallelly inwards to *D''D''*. At the new demand curve, the consumer purchases lesser units of the good (OQ_2) but at the same price of OP_1.

Difference between Expansion of Demand and Increase in Demand

Points of Difference	Expansion of Demand	Increase in Demand
1. Caused by	It is caused by a fall in the price of the commodity.	It is caused by factors other than change in price. namely- Increase in the income of the consumer Increase in the price of the substitute goods Change in tastes and preferences in favour of the commodity Expectation of price rise in future Increase in the total number of consumers.
2. Shown by	It is shown by a movement along the demand curve.	It is shown by a shift in the demand curve.
3. Direction of Change	In this case, there is a downward movement to the right along the demand curve.	In this case, the demand curve shifts parallely outwards.
4. Graphically	 Expansion of Demand	 Increase in Demand

Difference Between Contraction of Demand And Decrease in Demand

Points of Difference	Contraction of Demand	Decrease in Demand
1. Caused by	It is caused by a rise in the price of the commodity.	It is caused by factors other than change in price. namely- Decrease in the income of the consumer Decrease in the price of the substitute goods Change in tastes and preferences against the commodity Expectation of price fall in future

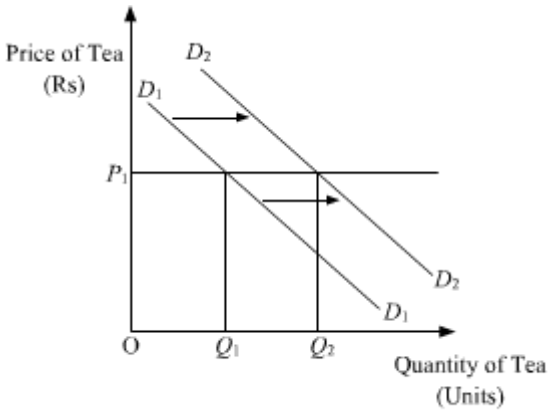
		Decrease in the total number of consumers
2. Shown by	It is shown by a movement along the demand curve.	It is shown by a shift in the demand curve.
3. Direction of Change	3. In this case, there is an upward movement to the left along the demand curve.	In this case, the demand curve shifts parallely inwards.
4. Graphically	 Contraction of Demand	 Decrease in Demand

Cross Price Effect- Substitute Goods and Complementary Goods

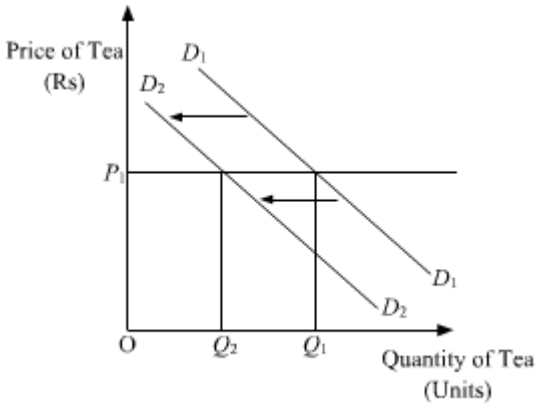
We know that when two or more goods are related, the change in price of one commodity, affects the demand for the other commodity. This is known as the ***cross price effect***. In other words, cross price effect refers to the change in demand of one commodity due to change in price of the other commodity. The related goods can be of two types: substitute goods and complementary goods. Accordingly, we study the cross price effect in case of the two related goods.

Cross price effect in case of substitute goods

Substitute goods refer to those goods that can be consumed in place of each other. For example, tea and coffee.



Increase in Price of Substitute Good



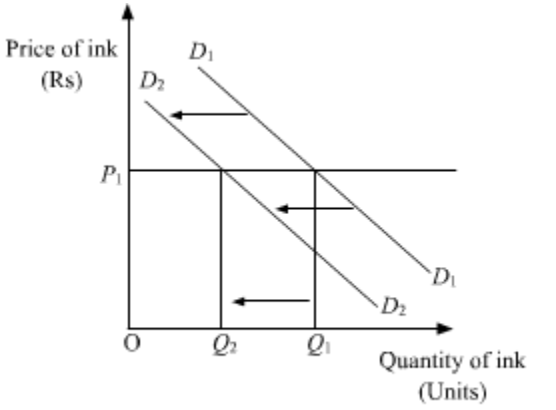
Fall in Price of Substitute Good

Let D_1D_1 be the initial demand curve for tea. Suppose, at price OP_1 the quantity demanded of tea is OQ_1. Now, if the price of the coffee (substitute good) rises, then demand for tea rises (at the same price of tea). This is because with the rise in the price of coffee, the consumers of coffee shift their demand towards tea, consequently, the demand for tea rises. This shifts the initial demand curve D_1D_1 parallely rightwards to D_2D_2. In the figure, we can see that at the same price OP_1, the demand for tea has increased from OQ_1 to OQ_2.

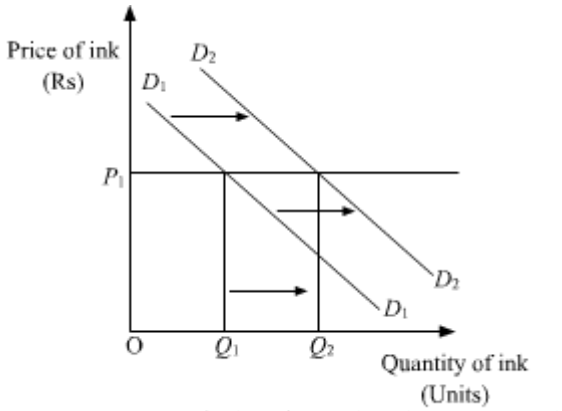
Consider now the reverse case when the price of substitute goods falls. Suppose the price of coffee falls. As a result the demand for tea falls. This is because with the fall in the price of coffee, the consumers of tea shift their demand towards coffee and the demand for tea falls. This shifts the initial demand curve of tea D_1D_1 parallely leftwards to D_2D_2. In the figure, we can see that at the same price OP_1, the demand for tea has decreased from OQ_1 to OQ_2.

Cross price effect in case of complementary goods

Complementary goods are those goods that are consumed together for the satisfaction of wants. For example, ink-pen and ink.



Increase in the Price of Complementary Good



Decrease in the Price of Complementary Good

Let D_1D_1 be the initial demand curve for ink. At price OP_1, the quantity demanded of ink is OQ_1. Now, if price of the ink-pen (complementary good) ***rises***, then demand for ink-pen will fall. As ink-pen and ink are consumed together, so the demand for ink will also fall. This shifts the initial demand curve for ink D_1D_1 parallely leftwards to D_2D_2. In the figure, we can see that at the same price OP_1, the demand for ink has decreased from OQ_1 to OQ_2.

Now assume that the price of the complementary good (price of ink-pen) ***falls***. In this case, the fall in the price of the ink-pen will result in the rise in demand for the ink-pen, which in turn will push up the demand for ink. This shifts the demand curve for ink parallely rightwards to D_2D_2. Note that due to fall in the price of the ink-pen, at the same price of OP_1, the demand for ink has increased from OQ_1 to OQ_2.

Substitution Effect and Income Effect of a Price Change

Objectives

After going through this chapter, you shall be able to understand the following concepts.

- Effect of Price Change on Demand for a Good
- Substitution and Income Effect

Introduction

This chapter focuses on the effect of the price change (fall or rise) on the demand for a good. We have learnt in the previous chapter that a fall (or rise) in the price of a good leads to increase (or decrease) in the demand for the good. This chapter bifurcates the total effect of the price change into substitution and income effect.

The increase in quantity demanded because of a fall in price consists of two components namely, Substitution Effect and Income Effect.

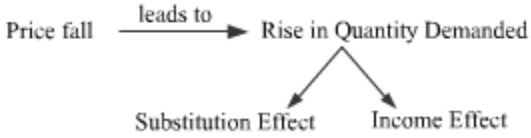
Substitution Effect

Substitution effect exists because of the change in the relative price of the good. The fall in the price of one good makes it relatively cheaper than the other good as compared to what it was before the price fall. It can be observed by the movement along the budget line.

Income Effect

It is associated with the increase in the purchasing power of a consumer due to the fall in the price of a good. The price-fall leaves the consumer with higher purchasing power, which enables him/her to buy more of a good with the same amount of money. It can be observed by the shift of the budget line.

Summarising: A price fall leads to rise in the quantity demanded of a good. The rise in the quantity demanded is regarded as the total effect of the price fall. That is, diagrammatically,



Total Effect = Substitution Effect + Income Effect

Explanation

Let us assume a situation, where consumer's income is M, prices of two goods are $P_1$and P_2 and the optimum bundle is represented by (x_1*, x_2*). Now, let the price of good 1 falls by ΔP_1. Accordingly, the new price of the good becomes $P_1 - \Delta P_1$

As the price falls, good 1 will become relatively cheaper than the good 2 and the optimum bundle will now cost lesser than the price-fall. Owing to the fall in the P_1, a consumer will now buy more of good 1 and the new budget line will pivot outwards along the same vertical intercept.

In order to observe how a consumer reacts when there is a change in the relative price, we need to adjust his/her purchasing power in such a way that he/she can just afford to the buy the original optimum bundle (x_1^*, x_2^*).

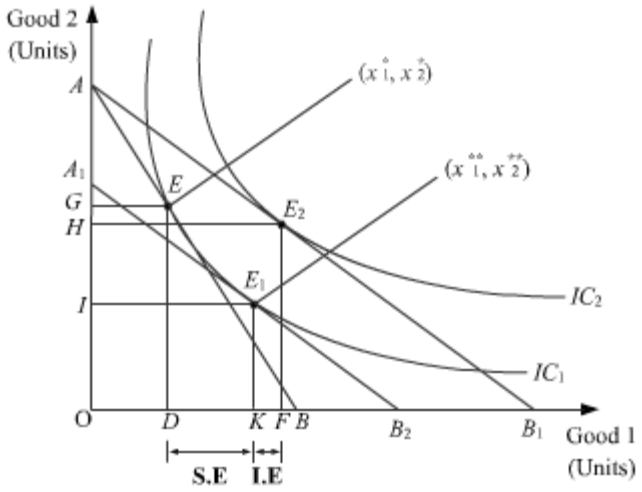
Cost of the optimum bundle (x_1^*, x_2^*) at the new prices ($P_1 - \Delta P_1$) and P_2 is given as

$$
\begin{aligned}
&= x_1^*(P_1 - \Delta P_1) + P_2 x_2^* \\
&= x_1^* P_1 - x_1^* \Delta P_1 + P_2 x_2^* \\
&= x_1^* P_1 + x_2^* P_2 - x_1^* \Delta P_1 \\
&= M - x_1^* \Delta P_1
\end{aligned}
$$

Therefore, if consumer's income is reduced by $\Delta P_1 x_1^*$ after the price fall, then his/her purchasing power is adjusted to the initial level. This makes the consumer no better-off in terms of welfare than he/she was before the price-fall. (i.e. the new consumption bundle of the consumer after the income adjustment will lie on the initial indifference curve.)

Thus, at prices ($P_1 - \Delta P_1$), P_2 and income, $\left(M - \Delta P_1 x_1^*\right)$ the consumer will purchase a new optimum bundle represented by $\left(x_1^{**}, x_2^{**}\right)$.

The adjustment of the consumer's income is depicted by the parallel leftwards shift of the new budget line A^1B^2. The new equilibrium is at point E_1 and the new optimal bundle is $\left(x_1^{**}, x_2^{**}\right)$, where he/she is consuming OK units of good 1 and lesser amount of good 2 (OI as compared to OG). Thus, after the price fall, a consumer tends to substitute good 1 for good 2. This move is represented by the movement away from the initial equilibrium point E to point E_1. At this new equilibrium point E_1, the consumer is buying more units of good 1 and fewer units of good 2. This is called the **substitution effect** (i.e. the consumer is substituting good 1 for good 2, as good 1 is relatively cheaper after the price-fall).



Now, it can also be interpreted that with a price fall, a consumer enjoys higher purchasing power (which is equivalent to an increase in income), *ceteris paribus*. This is denoted by the outward parallel shift of the initial budget line from A^1B_2 to AB^1. This enables the consumer to move to higher IC_2 from IC_1, where he/she is spending the increased purchasing power on both the goods i.e., *OH* amount of good 2 and *OF* amount of good 1. The increase in the demand for good 1 from *OK* to *OF* occurs due to the **income effect**.

Thus, the total effect of the price-fall can be represented as the addition of substitution effect and income effect. Algebraically,

Total Price Effect = Substitution Effect + Income Effect

$$DF = DK + KF$$

$$(-) = (-) + (-)$$

For Normal Goods

The total price effect for a normal good is negative, which implies that the price and the demand for the good are inversely related to each other. This inverse relationship exists because of the negative substitution effect together with the negative income effect. The negative sign of the substitution effect implies that as the price of the good 1 falls, more of good 1 is purchased in place of good 2. In addition to the negative substitution effect, the income effect for a normal good is also negative. This implies that with the fall in the price of a normal good, the real purchasing power of the consumer increases, therefore, the consumer buys more units of that good. This confirms the negative relationship between the price and quantity of a normal good. Thus, for normal goods, the *negative substitution effect* together with *negative income effect* contributes to the *negative* relationship between price and demand (i.e. negative price effect).

Total Price Effect = Substitution Effect + Income Effect

(–) = (–) + (–)

For Inferior Goods

Similar to the normal goods, the substitution effect of an inferior good is also negative. This implies that with the fall in the price of an inferior good, the consumer increases the consumption of the inferior good. But, on the other hand, the income effect of inferior goods is positive. This means that the consumer tends to reduce the consumption of the inferior good with a fall in its price. The negative substitution effect dominates the positive income effect and the total price effect remains negative. Thus, the *negative substitution effect* and the *positive income effect* results in negative price effect.

Total Price Effect = Substitution Effect + Income Effect

(–) = (–) + (+)

For Giffen Goods

The goods that are highly inferior are regarded as Giffen goods. Similar to the inferior goods, for giffen goods the substitution effect is negative and the income effect is positive. However; it should be noted that in case of Giffen goods, the income effect is more powerful and dominates the negative substitution effect. Consequently, the total price effect becomes positive due to the dominating positive income effect. The positive price effect implies that as the price of a Giffen good falls, the demand will also falls and vice-versa. These goods violate the law of demand.

Total Price Effect = Substitution Effect + Income Effect

(+) = (–) + (+)

Summary

Direction of Price Effect on Demand

Types of Goods	Price Effect =	Substitution Effect +	Income Effect
Normal Goods	Negative	Negative	Negative
Inferior Goods	Negative	Negative	Positive
Giffen Goods	Positive	Negative	Positive

1. Thus, it can be concluded that a change in the price of a good can be divided into two different effects i.e., substitution effect and income effect.

2. For all types of goods, whether normal, inferior or Giffen, the substitution effect will always be negative. The substitution effect is more powerful in case of normal and inferior goods, consequently, the total price effect remains negative.
3. For inferior goods, the income effect is positive. But as the negative substitution effect dominates the positive income effect, so the total price effect is also negative.
4. For Giffen goods, the income effect is positive and is more powerful. Consequently, the positive income effect dominates the negative substitution effect, therefore, the total price effect becomes positive.

Elasticity of Demand or Price Elasticity of Demand

Objectives

After going through this chapter you shall be able to understand the following concepts.

- Concept of Price Elasticity of Demand
- Measurement of Price Elasticity
- Factors Determining Price Elasticity of Demand
- Demand curve and Price Elasticity

Introduction

The word elasticity means flexibility or responsiveness. Accordingly, elasticity of demand refers to the responsiveness of demand to the change in its various determining factors. We know that demand for a good depends on a number of factors such as its price, income, tastes and preferences, price of the related goods. Any change in one or more of these factors leads to a corresponding change in the demand for the good. Now, the question arises by how much will the demand change in relation to a given change in the price (or any other factor). This why we need to explore the concept of elasticity of demand.

Price Elasticity of Demand or Simply Elasticity of Demand

The price elasticity of demand measures the degree of responsiveness of the demand for a good to the change in its price. It is defined as the ratio of percentage change in the demand for a good to the percentage change in its price. Algebraically,

$$e_d = \frac{\text{Percentage change in the demand for a good}}{\text{Percentage change in the price of the good}}$$

$$= -\frac{(\Delta q / q) \times 100}{(\Delta p / p) \times 100}$$

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

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

Where,

p = Initial price

q = Initial quantity

$\Delta q = (q_1 - q_2)$ = Change in quantity demanded

$\Delta p = (p_1 - p_2)$ = Change in price

Note: e_d is a negative value depicting the inverse relationship between demand and price of the good.

Elasticity of demand can take values from zero to infinity i.e **$0 < e_d < \infty$**. Based on the degree of responsiveness of demand to the price we can differentiate between three following situations.

- When the demand for a good is highly responsive to its price. In this case, the percentage change in demand is greater than the percentage change in the price and $|e_d| > 1$. In this situation the demand is said to be **elastic**
- When the demand for a good is less responsive to its price. In this case, the percentage change in the demand for a good is less than the percentage change in its price and $|e_d| < 1$. In this situation the demand is said to be **inelastic**.
- When the demand for a good responds exactly in the same amount as the change in its price. In this case, the percentage change in the demand for a good is equal to the percentage change in its price and $|e_d| = 1$. In this situation demand is said to be **unitary elastic**.

The three situations can be summarised as:

Conditions	Elasticity	Demand
Percentage Δ in demand (<) Percentage Δ in price	$\|e_d\| < 1$	Inelastic
Percentage Δ in demand (=) Percentage Δ in price	$\|e_d\| = 1$	Unitary Elastic
Percentage Δ in demand (>) Percentage Δ in price	$\|e_d\| > 1$	Elastic

Elasticity along a Linear Demand Curve

Let, the linear demand curve be $q = a - bp$

Differentiating 'q' with respect to 'p', we get:

$$\frac{dq}{dp} = -b$$

where, $\frac{dq}{dp} = \frac{\Delta q}{\Delta p}$ Represents the change in demand per unit change in price

We know that

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

Substituting the value of $\frac{\Delta q}{\Delta p}$ in this equation

$$e_d = \frac{-bp}{a - bp}$$

The table below shows the elasticity of demand at different price levels.

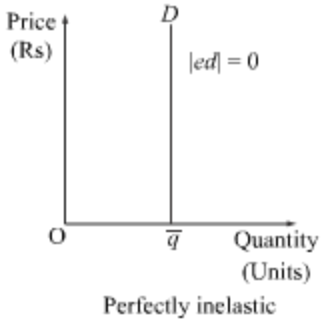
Price	Value of Elasticity	Type of Elasticity
When $P = 0$	$\|e_d\| = 0$	**Perfectly Inelastic**
$0 < P < \frac{a}{2b}$	$\|e_d\| < 1$	**Inelastic**

$P = \frac{a}{2b}$	$\|e_d\| = 1$	**Unitary Elastic**
$\frac{a}{2b} < P < \frac{a}{b}$	$\|e_d\| > 1$	**Elastic**
$P = \frac{a}{b}$	$\|e_d\| = \infty$	**Perfectly Elastic**

Constant Elasticity Demand Curves

Perfectly Inelastic Demand Curve

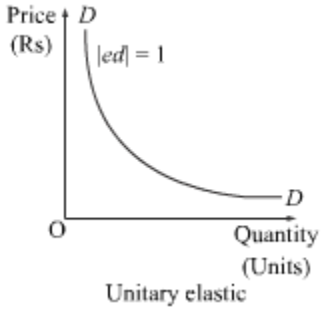
The demand curve may have constant elasticity throughout all the points on the demand curve. This can be represented as follows:



Perfectly inelastic

In the figure, the quantity demanded is independent of the price of the good, i.e. whatever may be the price, quantity demanded will remain the same (i.e. $\overline{q}$). In other words, the quantity demanded does not show any responsiveness to the changes in the price. Thus, elasticity of demand is perfectly inelastic i.e. $|e_d| = 0$.

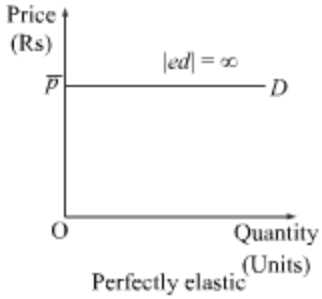
Unitary Elastic Demand Curve



Unitary elastic

In the figure, the change in the quantity demanded is equal to the change in the price of the good. Thus, $|e_d| = 1$ at every point on the demand curve.

Perfectly Elastic Demand Curve



In the figure, the price is independent of the quantity demanded, i.e. irrespective of quantity demanded, the price will remain the same (i.e. $\bar{P}$). In other words, a slight change in the price can lead to very high change in the quantity demanded. Thus, the elasticity of demand is perfectly elastic i.e. $|e_d| = \infty$.

Measurement of Price Elasticity

Price elasticity can be measured using the following three methods.

1. Geometric Method

2. Percentage/Proportionate Method*

3. Total Expenditure Method

*Note: As per the CBSE, only Percentage/Proportionate Method is in the syllabus. The other two methods have been given for knowledge purpose only.

Geometric Method/Point Method

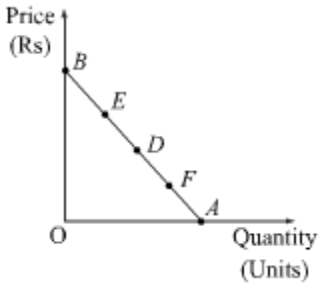
This method is also called point method of measuring elasticity. Under this method, we measure elasticity at different points on a demand curve. A demand curve can either be a straight line demand curve or a rectangular hyperbola curve. Accordingly, we study the geometric method of measuring elasticity for the two types of demand curve.

Straight Line Demand Curve

The elasticity of demand at any point on a straight line demand curve is given by the ratios of the lower segment and the upper segment of the demand curve at that point i.e.

$$e_d = \frac{Lower\ Segment}{Upper\ Segment}$$

Let us understand this with the help of a figure.



In the figure, AB is a straight line demand curve

Now consider point *D* on the demand curve. Elasticity at this point (*D*) can be calculated as:

$$e_d = \frac{Lower\ Segment}{Upper\ Segment} = \frac{DA}{DB}$$

As the point *D* lies at the middle of the demand curve, so the lower segment of point *D* (i.e. *DA*) is equal to the upper segment of point *D* (i.e. *DB*). Thus, e_d at point *D* is equal to 1.

Now, let us calculate elasticity of demand at point *B*. At this point elasticity of demand is equal to

$$e_d = \frac{Lower\ Segment}{Upper\ Segment} = \frac{BA}{Zero} = \infty$$

As against this, at point *A*, the elasticity of demand is equal to

$$e_d = \frac{Lower\ Segment}{Upper\ Segment} = \frac{Zero}{AB} = Zero$$

At point *F,* the elasticity of demand is calculated as:

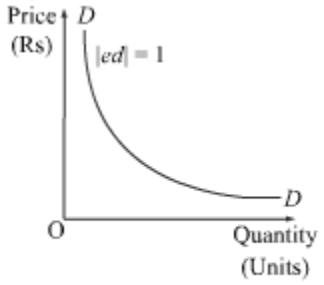
$$e_d \text{ at point } F = \frac{FA}{BF} < 1$$

At point E, the elasticity of demand is calculated as

$$e_d \text{ at point } E = \frac{EA}{EB} > 1$$

Rectangular Hyperbola Demand Curve

If the demand curve is a rectangular hyperbola (as depicted in the following figure), then elasticity at every point along the demand curve will be equal to 1. This curve is also known as ***unitary elastic demand curve***.



Unitary elastic Demand Curve

Percentage/Proportionate Method

According to this method, elasticity is measured as the ratio of percentage change in quantity demanded to the percentage change in price i.e.

$$e_d = -\frac{\text{Percentage change in the demand for a good}}{\text{Percentage change in the price of the good}}$$

$$\text{or, } e_d = -\frac{\frac{\text{Change in Demand}}{\text{Initial Demand}} \times 100}{\frac{\text{Change in Price}}{\text{Initial Price}} \times 100}$$

$$\text{or, } e_d = -\frac{\frac{Q_2 - Q_1}{Q_1} \times 100}{\frac{P_2 - P_1}{P_1} \times 100}$$

$$\text{or, } e_d = -\frac{\frac{\Delta Q}{Q_1} \times 100}{\frac{\Delta P}{P} \times 100}$$

$$\therefore e_d = -\frac{\Delta Q}{Q_1} \times \frac{P_1}{\Delta P}$$

where,

Q_2 represents final quantity demanded

Q_1 represents initial quantity demanded

ΔQ represents change in quantity demanded

P_2 represents final price

P_1 represents initial price

ΔP represents change in price

Example

Calculate the price elasticity of demand for a good *X*, when the price increases from Rs 4 to Rs 5 and accordingly, the quantity demanded falls from 5 units to 3 units.

Solution

Initial Situation	Final Situation
Initial price of *X* (P_1) = Rs 4	Final price of *X* (P_2) = Rs 5
Initial demand of *X* (Q_1) = 5 units	Final demand of *X* (Q_2) = 3 units

Therefore, the price elasticity of demand is calculated as:

$$e_d = \frac{\frac{Q_2 - Q_1}{Q_1} \times 100}{\frac{P_2 - P_1}{P_1} \times 100} = \frac{\frac{3-5}{5} \times 100}{\frac{5-4}{4} \times 100} = \frac{\frac{-2}{5}}{\frac{1}{4}}$$

$$\therefore e_d = \frac{-2}{5} \times \frac{4}{1} = -1.6$$

Total Expenditure Method

In this method of measuring elasticity, we examine how the total expenditure incurred on a good changes with a change in the price of the good. Total expenditure on a good is defined as the product of price of good and quantity demanded of the good at that price. Algebraically,

Total Expenditure = Price × Quantity Demanded

$TE = P \times Q_D$

There can be following three possible situations of total expenditure.

1. If with a rise (or fall) in the price of good, the total expenditure remains constant, then demand for the good is said to be unitary elastic i.e. $|e_d| = 1$.

2. If with a rise (or fall) in the price of a good, the total expenditure falls (or rises), then demand for the good is said to be greater than unitary elastic i.e. $|e_d| > 1$.

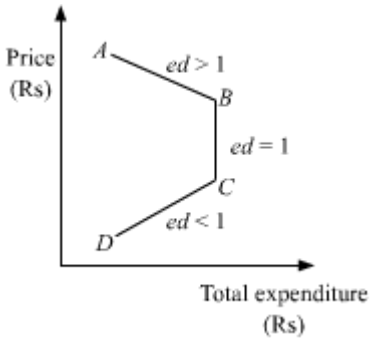
3. If with a rise (or fall) in the price of a good, the total expenditure rises (or falls), then demand for the good is said to be less than unitary elastic i.e. $|e_d| < 1$.

The three situations can be explained with the help of an example.

Price of Good	Quantity Demanded	Total Expenditure	Elasticity
Initial Rs 10 Final Rs 20	2 units 1 units	(10×2) = Rs 20 (20×1) = Rs 20	$\|e_d\| = 1$
Initial Rs 10 Final Rs 20	5 units 2units	(10×5) = Rs 50 (20×2) = Rs 40 ↓	$\|e_d\| > 1$
Initial Rs 10 Final Rs 20	5 units 4 units	(10×5) = Rs 50 (20×4) = Rs 80 ↑	$\|e_d\| < 1$

Thus, we see that in case of greater than unitary elastic demand, total expenditure shares a negative relationship with price and in case of less than unitary elastic demand, total expenditure shares a positive relationship with price.

This relationship between total expenditure and price can be presented with the help of the following diagram.



In the diagram, *AD* is the total expenditure curve. *DC* portion of the total expenditure curve shows a positive relationship between total expenditure and price of the good. Thus, this portion corresponds to less than unitary elastic demand.

The portion *AB* of the total expenditure curve shows a negative relationship between total expenditure and price. Thus, this portion corresponds to greater than unitary elastic demand.

The portion *BC* of the total expenditure curve shows that total expenditure remains constant, whether price rises or falls. Thus, this portion of the curve corresponds to unitary elastic demand.

Factors Determining the Price Elasticity of the Demand for a Good

The following are the factors that affect the elasticity of demand for a good.

1. *Nature of a Good-* The price elasticity of demand depends on the nature of a good. The goods and services can be broadly divided into three categories- Necessities, Luxuries, Jointly-demanded goods. The three types of goods have different values of elasticity as discussed below.

a. *Necessity Goods*- These goods are those goods which a consumer demands for sustaining his life. A consumer cannot reduce the consumption of these goods. For example, food is a necessity good. The demand for such goods does not change much in response to the changes in their prices. Even when the price rises the consumer cannot reduce their demand. Hence, such goods have an ***inelastic demand*** **($|e_d| < 1$).**
b. *Luxury Goods*- Luxuries are the goods which are not essential, rather, are consumed for leisure or comfort purposes. For example, air conditioner, branded garments, etc. The demand for such goods is highly responsive to changes in their prices. A rise in the price, reduces the demand for them and vice-versa. Thus, such goods have ***high price elasticity***.
c. *Jointly-demanded Goods*- Jointly-demanded goods are those goods that are demanded together. The joint consumption of such goods collectively satisfies wants. For example, sugar and tea. A rise in the price of one good does not reduce its demand if the demand for its complement good has not reduced. For example, a rise in the price of sugar will not reduce its demand if the demand for tea has not decreased. Hence, such goods have an ***inelastic demand*** **($|e_d| < 1$).**

2. Substitutes- The demand for a good that has more number of substitutes available will be relatively more elastic and **$|e_d| < 1$**. This is because a slight increase in the price will push the consumers to shift their demand away from the good to its substitutes. On the other hand, with a slight fall in price the consumers would shift their demand from the substitutes towards the good. Thus, the goods having a large number of close substitutes will have ***elastic demand***. On the contrary, if a good has no close substitutes, then it will have an ***inelastic demand***.

3. Several Uses- A commodity that can be used for different purposes (such as milk) will have an ***elastic demand***. This is because if the price of this commodity increases, then it will be used only for important purposes leading to a drastic fall in demand. Thus, the demand for such goods is highly responsive to price. On the contrary, a good that has limited usage will have ***an inelastic demand***.

4. Consumers' Income- People with very high or very low incomes have an ***inelastic demand*** as the change in the price of a good will have lower impact on the consumers'

demand for that good. On the contrary, the middle-income earners will have an ***elastic demand*** as their demand is very responsive to the prices of goods.

5. Consumers' Habits- The goods that a consumer is habituated to such as, liquor, cigarettes, etc. have an ***inelastic demand***. A change in the prices of these goods has lesser impact on their demand as the consumer is habituated to these goods and hence cannot reduce their consumption.

6. Period of Time- In the short run, the demand is ***inelastic*** as a consumer would not have the time to change his/her habits and long-time practices. However, in the long run, the demand would be ***elastic*** as he/she would get time to change his/her habits.

7. Income Spent on Goods- The goods that account for a very small proportion of a consumer's income such as, newspaper, etc. will have an ***inelastic demand***. On the other hand, the goods that account for a very large proportion of a consumer's income such as, clothes, house rents, etc. will have an ***elastic demand***.

8. Possibility of Postponement of Demand- Demand for those commodities whose consumption can be postponed will be ***price elastic***. As against this, those commodities that are urgently required and whose consumption cannot be postponed will have ***an inelastic demand***.

Relationship between Elasticity and Expenditure

Let P = Price

Q = Quantity demanded at price P;

Let the change in price be ΔP and change in quantity be ΔQ,

Therefore, the new price becomes $P + \Delta P$

and new quantity demanded at new price $(P + \Delta P) = (Q + \Delta Q)$

Therefore, Total Expenditure (E_1) at price P is

$E_1 = P \times Q = PQ$ **(i)**

Total Expenditure at new price $(P + \Delta P)$ is

$E_2 = (P + \Delta P)\ (Q + \Delta Q) = PQ + P\Delta Q + \Delta PQ + \Delta P\Delta Q$ **(ii)**

Subtracting (i) from (ii):

$(E_2 - E_1) = PQ + Q\Delta P + P\Delta Q + \Delta P\Delta Q - PQ$

$\Delta E = Q\Delta P + P\Delta Q + \Delta P\Delta Q$ **(iii)**

where,

ΔE represents Change in expenditure

$\Delta P\Delta Q$ represents Negligible amount for very small amount of ΔP and ΔQ, so the equation (iii) can be written as:

$\Delta E = Q\Delta P + P\Delta Q$

$$\text{or, } \Delta E = \Delta P\left(Q + P \times \frac{\Delta Q}{\Delta P}\right) \text{ (Taking } \Delta P \text{ as common)}$$

$$\text{or, } \Delta E = \Delta P\left[Q\left(1 + \frac{P}{Q} \times \frac{\Delta Q}{\Delta P}\right)\right] \text{ (Taking } Q \text{ as common)}$$

$$\therefore \Delta E = \Delta P\left[Q\left(1 + e_d\right)\right] \qquad \text{(iv)}$$

On the basis of the above equation **(iv)**, the relationship between the elasticity of demand and the expenditure can be drawn as:

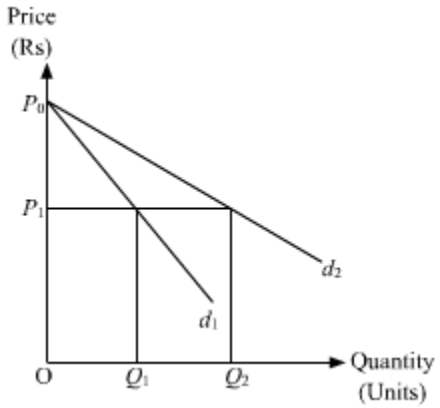
When $e_d < -1$, then $q(1 + e_d) < 0$. Thus, ΔE opposite sign of ΔP

When $e_d > -1$, then $q(1 + e_d) > 0$. Thus, ΔE and ΔP has the same sign

When $e_d = -1$, then $q(1 + e_d) = 0$ and $\Delta E = 0$

Slope of Demand Curve and Elasticity

If the two demand curves originate from the same point, then the relatively flatter curve would be more elastic than the other curve. For example, consider the diagram given below –



In the figure, the two demand curves P_0d_1 and P_0d_2 originate from the same vertical point P_0. The demand curve ***P_0d_2 is more elastic than the demand curve P_0d_1***. Now, if the price falls from OP_0 to OP_1, then according to demand curve P_0d_1 quantity demanded rises from zero to OQ_1, while, according to the second demand curve P_0d_2, the quantity demanded rises to OQ_2. Thus, for a same change in the price, the change in quantity demanded according to flatter demand curve P_0d_2 is greater than the change in the quantity demanded according to the steeper demand curve P_0d_1. Hence, ***we can conclude that falter the demand curve greater is the change in the demand due to change in price. On the other hand, steeper the demand curve lesser is the change in the demand due to the change in the price.***

Relationship between Elasticity of Demand, Slope of Demand Curve and Quantity Demanded

Elasticity of Demand	Slope of Demand Curve	Impact of Change in Price on Quantity Demand
Less Elastic	*Steeper*	*Lesser*
More Elastic	*Flatter*	*Greater*