Chapter Two
Theory of Demand and Supply

2.1 Theory of demand

In our day-to-day life we use the word demand in a loose sense to mean a desire of a person to purchase a commodity or service. But in economics it has a specific meaning, which is different from what we use it in our day to day activities.

Demand implies more than a mere desire to purchase a commodity. It states that the consumer must be willing and able to purchase the commodity, which he/she desires. His/her desire should be backed by his/her purchasing power. Demand, thus, means the desire of the consumer for a commodity backed by purchasing power. These two factors are essential. If a consumer is willing to buy but is not able to pay, his/her desire will not become demand.

More specifically, **demand** refers to various quantities of a commodity or service that a consumer would purchase at a given time in a market at various prices, given other things unchanged (ceteris paribus). The quantity demanded of a particular commodity depends on the price of that commodity.

Law of demand: This is the principle of demand, which states that , price of a commodity and its quantity demanded are inversely related i.e., as price of a commodity increases (decreases) quantity demanded for that commodity decreases (increases), ceteris paribus.

Demand schedule (table), demand curve and demand function

Demand schedule A demand schedule states the relationship between price and quantity demanded in a table form.

Table 2.1 Individual household demand for orange per week

Combinations	A	B	C	D	E
Price per kg	5	4	3	2	1
Quantity demand/week	5	7	9	11	13

Demand curve is a graphical representation of the relationship between different quantities of a commodity demanded by an individual at different prices per time period.

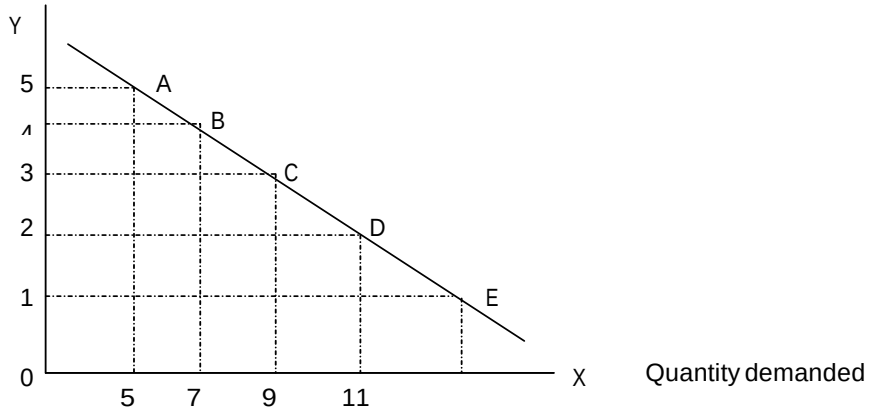


Figure 2.1: Individual demand curve

In the above diagram prices of oranges are given on OY axis and quantity demanded on OX axis. For example, when the price per kilogram is birr 1 the quantity demanded is 13 kilograms. From the above figure you may notice that as the price declines quantity demanded increases and vice-versa.

Demand function is a mathematical relationship between price and quantity demanded, all other things remaining the same. A typical demand function is given by:

Qd=f (P)

Where Qd is quantity demanded and P is price of the commodity, in our case price of orange.

Example: Let the demand function be Q = a+ bP

$b = \frac{\Delta q}{\Delta p}$ (E.g. moving from point A to B on figure 2.1 above)

$b = \frac{7-5}{4-5} = -2$ (Where b is the slope of demand curve)

To find the value of a or the intercept substitute the price at point A or B

So, 7= a-2(4), a = 15

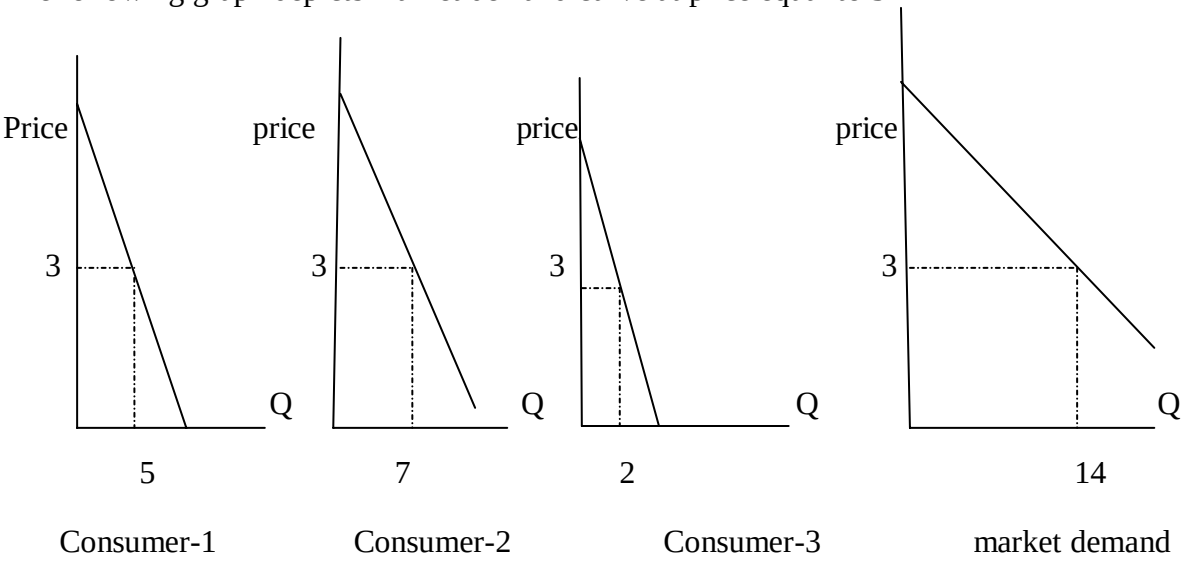
Therefore, Q=15-2P is the demand function for orange in the above numerical example.

Market Demand: The market demand schedule, curve or function is derived by horizontally adding the quantity demanded for the product by all buyers at each price.

Price	Individual demand			Market demand
	Consumer-1	Consumer-2	Consumer-3	
8	0	0	0	0
5	3	5	1	9
3	5	7	2	14
0	7	9	4	20

Table 2.2: Individual and market demand for a commodity

The following graph depicts market demand curve at price equal to 3



Numerical Example Suppose the individual demand function of a product is: P=10 - Q /2 and there are about 100 identical buyers in the market. Then the market demand function is given by: P= 10 - Q /2 ↔ Q /2 =10-P ↔ Q= 20 - 2P and Qm = (20 – 2P) 100 = 2000-200P

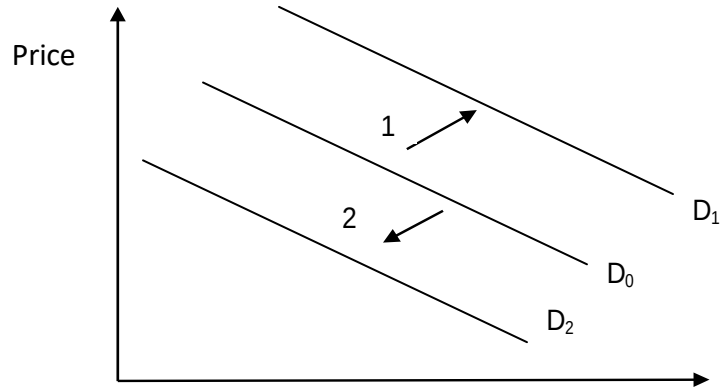
Determinants of demand

The demand for a product is influenced by many factors. Some of these factors are:

I. Price of the product
II. Taste or preference of consumers
III. Income of the consumers
IV. Price of related goods
V. Consumers expectation of income and price
VI. Number of buyers in the market

Changes in demand: a change in any determinant of demand—except for the good's price causes the demand curve to shift. We call this a change in demand. If buyers choose to purchase more at any price, the demand curve shifts rightward—an increase in demand. If buyers choose to purchase less at any price, the demand curve shifts leftward—a decrease in demand.

Figure 2.3: Shift in demand curve



When demand increases, demand curve shifts upward (D_1) while a decrease in demand shifts demand

Now let us examine how each factor affect demand.

I. Taste or preference

When the taste of a consumer changes in favor of a good, her/his demand will increase and the opposite is true.

II. Income of the consumer

Goods are classified into two categories depending on how a change in income affects their demand. These are normal goods and inferior goods.

- ***Normal Goods*** are goods whose demand increases as income increase.
- ***Inferior goods*** are those whose demand is inversely related with income. In general, inferior goods are poor quality goods with relatively lower price and buyers of such goods are expected to shift to better quality goods as their income increases.

❖ However, the classification of goods into normal and inferior is subjective and it is usually dependent on the socio-economic development of the nation.

III. Price of related goods

Two goods are said to be related if a change in the price of one good affects the demand for another good.

There are two types of related goods. These are substitute and complimentary goods.

- ***Substitute goods*** are goods which satisfy the same desire of the consumer. For example, tea and coffee or Pepsi and Coca-Cola are substitute goods. If two goods are substitutes, then price of one and the demand for the other are directly related.
- ***Complimentary goods,*** on the other hand, are those goods which are jointly consumed. For example, car and fuel or tea and sugar are considered as compliments. If two goods are complements, then price of one and the demand for the other are inversely related.

IV. Consumer expectation of income and price

Higher price expectation will increase demand while a lower future price expectation will decrease the demand for the good.

V. Number of buyer in the market

Since market demand is the horizontal sum of individual demand, an increase in the number of buyers will increase demand while a decrease in the number of buyers will decrease demand.

Elasticity of demand

In economics, the concept of elasticity is very crucial and is used to analyze the quantitative relationship between price and quantity purchased or sold. Elasticity is a measure of responsiveness of a dependent variable to changes in an independent variable. Accordingly, we have the concepts of elasticity of demand and elasticity of supply.

Elasticity of demand refers to the degree of responsiveness of quantity demanded of a good to a change in its price, or change in income, or change in prices of related goods. Commonly, there are three kinds of demand elasticity: price elasticity, income elasticity, and cross elasticity.

i. Price Elasticity of Demand

Price elasticity of demand means degree of responsiveness of demand to change in price. It indicates how consumers react to changes in price.

- The greater the reaction the greater will be the elasticity, and the lesser the reaction, the smaller will be the elasticity.
- Price elasticity of demand is a measure of how much the quantity demanded of a good responds to a change in the price of that good, computed as the percentage change in quantity demanded divided by the percentage change in price.

Demand for commodities like clothes, fruit etc. changes when there is even a small change in their price, whereas demand for commodities which are basic necessities of life, like salt, food grains etc., may not change even if price changes, or it may change, but not in proportion to the change in price.

Price elasticity demand can be measured in two ways. These are point and arc elasticity.

A. *Point Price Elasticity of Demand*

This is calculated to find elasticity at a given point. The price elasticity of demand can be determined by the following formula.

$$price\ elasticity\ of\ demand\ (e_p) = \frac{percentage\ change\ in\ Qd}{percentage\ change\ in\ price} = \frac{\%\Delta Q}{\%\Delta P}$$

$$= \frac{\left(\frac{\Delta Q}{Q}\right)x100}{\left(\frac{\Delta P}{P}\right)x100} = \frac{-\left(\frac{Q2-Q1}{Q1}\right)x100}{\left(\frac{P2-P1}{P1}\right)x100} = -\frac{\Delta Q}{\Delta P}x\frac{P}{Q}$$

$$e_p = -\frac{\Delta Q}{\Delta P}\,x\frac{P}{Q} \Rightarrow Point\ price\ elasticity\ of\ demand$$

B. ***Arc Elasticity of Demand***: - The above formula for the price elasticity is applicable only for extremely small changes in the price. If the price changes appreciably large, we use the following formula, which measures the *arc elasticity of demand*:

$$ep = \frac{\Delta Q}{\Delta P}\left(\frac{P1+P2}{Q1+Q2}\right)$$

The arc elasticity is a measure of the *average* elasticity, i.e., the elasticity at the midpoint of the chord that connects the two points. It should be clear that the measure of the arc elasticity is an approximation of the true elasticity of the section.

Note that:

- ♥ Elasticity of demand is unit free because it is a ratio of percentage change.
- ♥ Elasticity of demand is usually a negative number because of the law of demand. If the price elasticity of demand is positive the product is inferior.

If the demand curve is linear $Q = b_0 - b_1P$ Its slope is $dQ/dP = -b_1$. Substituting in the elasticity formula, we obtain $e_p = -b_1 * \frac{P}{Q}$ this implies that the elasticity changes at the various points of the linear-demand curve.

The ranges of values of elasticity are $0 \le e_p \le \infty$

1. If ep=0, the demand is perfectly inelastic ⇒ any change in price will have no effect on quantity demanded. Thus its demand curve is vertical line parallel to the price axis.
2. If ep = 1, the demand is unitary elasticity. E.g. if a 10% change in price level causes 10% change in quantity demanded, $e_p = 1=1$ ⇒ unitary elastic demand.
3. If $e_p = \infty$, the demand is perfectly elastic ⇒ a little bit change in price will change quantity demanded by infinite amount. Its demand curve is horizontal demand parallel to the quantity axis.

4. If 0<e<1, we say that the demand inelastic ⇒ e.g. if a 5% change in price level causes 3% change in quantity demanded, $ep = {}^{3\%}/_{5\%} = {}^{3}/_{5} < 1 \Rightarrow inelastic\ demand.$ Its demand curve is steep curve.
5. If 1<e<∞, the demand is elastic ⇒ e.g. if a 10% change in price level results in a 15% change in quantity demanded, $ep = \frac{15\%}{10\%} = 1.5 > 1 \Rightarrow elastic\ demand.$ Its curve is slant/less steep in its slope.

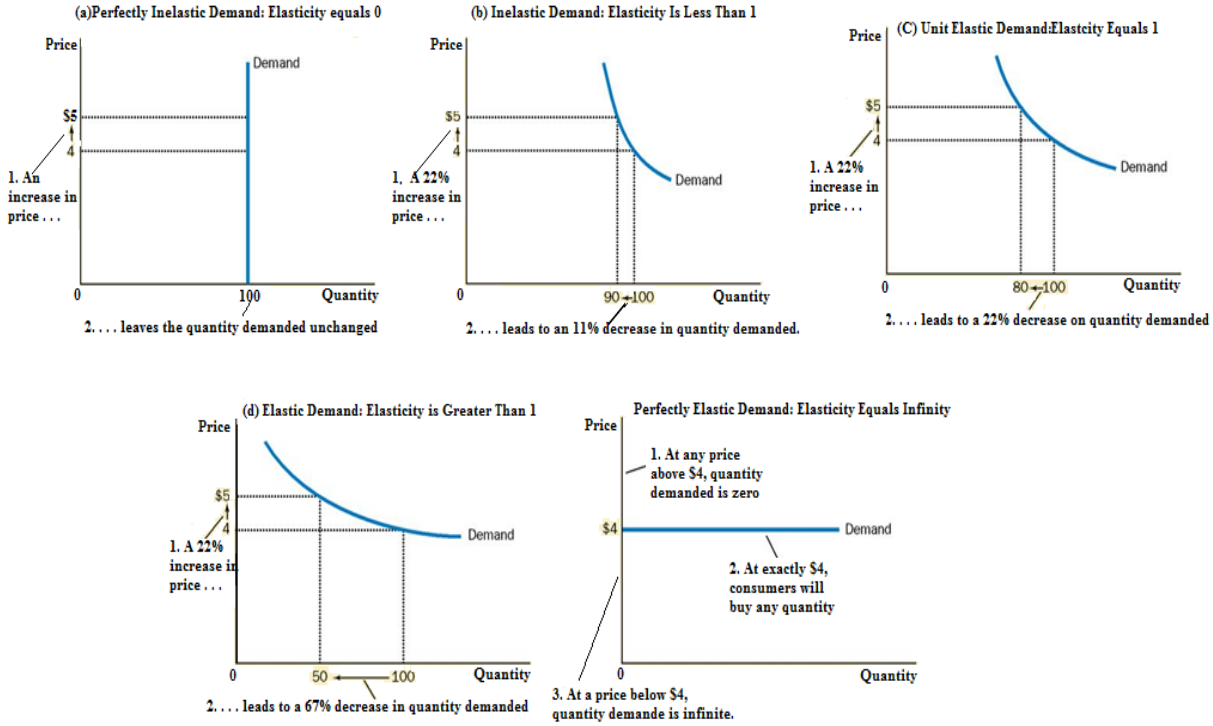
i) If ε > 1, demand is said to be elastic and the product is luxury product

ii) If 0 ≤ ε <1, demand is inelastic and the product is necessity

iii) If ε = 1, demand is unitary elastic.

iv) If ε = 0, demand is said to be perfectly inelastic.

v) If ε = ∞, demand is said to be perfectly elastic



Determinants of price Elasticity of Demand

The following factors make price elasticity of demand elastic or inelastic other than changes in the price of the product.

i) **The availability of substitutes:** the more substitutes available for a product, the more *elastic* will be the price elasticity of demand.

ii) **Time:** In the long- run, price elasticity of demand tends to be elastic. Because:

- ♠ More substitute goods could be produced.
- ♠ People tend to adjust their consumption pattern.

iii) **The proportion of income consumers spend for a product:-**the smaller the proportion of income spent for a good, the less price elastic will be.

iv) **The importance of the commodity in the consumers' budget:**

- ♠ Luxury goods tend to be more **elastic,** example: gold.
- ♠ Necessity goods tend to be **less elastic** example: Salt.

(ii) The Income Elasticity of Demand.

The income elasticity is defined as the proportionate change in the quantity demanded resulting from a proportionate change in Income. Symbolically we may write

$$e_y = \frac{\frac{dQ}{Q}}{\frac{\mathrm{dY}}{\mathrm{Y}}} = \frac{dQ}{\mathrm{dY}} \frac{Y}{\mathrm{Q}}$$

The income elasticity is *positive* for normal goods. A commodity is considered to be a luxury if its income elasticity is greater than unity. A commodity is a necessity if its income elasticity is small (less than unity, usually). Income elasticity is negative for the inferior goods.

The main determinants of income elasticity are:

1. **The nature of the need that the commodity covers**: the percentage of income spent on food declines as income increases (this is known as '*Engel's Law'* and has some times been used as a measure of welfare and of the development stage of an economy.)

2. **The initial level of income of a country**. For example, a TV set is a luxury in an underdeveloped, poor country while it is a 'necessity' in a country with high *per capita income*.

3. **The Time period**, because consumption patterns adjust with a time-lag to changes in income.

(iii) The Cross-Elasticity of Demand

The cross-elasticity of demand is defined as the proportionate change in the quantity demanded of x resulting from a proportionate change in the price of y. Symbolically we have

$$e_{xy} = \frac{dQ_x}{Q} / \frac{dP_y}{P_y} = \frac{dQ_x}{dP_y} * \frac{P_y}{Q_x}$$

The sign of the cross elasticity is negative if x and y are complementary goods, and positive if x and y are substitutes. The higher the value of the cross-elasticity the stronger will be the substitutability or complemetarity of x and y.

The main determinant of cross-elasticity is the nature of the commodities relative to their use. If two commodities can satisfy equally well the same need, the cross-elasticity is high, and vice-versa.

Example: Consider the following data which shows the changes in quantity demanded of good X in response to changes in the price of good Y.

Unit price of Y	Quantity demanded of X
10	1500
15	1000

Calculate the cross –price elasticity of demand between the two goods. What can you say about the two goods?

$$e_{xy} = \frac{\Delta Qx}{\Delta Py} . \frac{Py}{Qx} = \frac{1000 - 1500}{15 - 10} = -0.67$$

Therefore, the two goods are complements.

2.2 Theory of supply

Supply indicates various quantities of a product that sellers (producers) are willing and able to provide at different prices in a given period of time, other things remaining unchanged.

The law of supply: states that, ceteris paribus, as price of a product increase, quantity supplied of the product increases, and as price decreases, quantity supplied decreases. It tells us there is a positive relationship between price and quantity supplied.

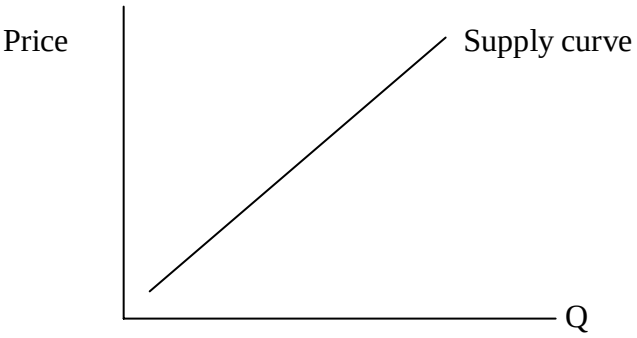
Supply schedule, supply curve and supply function

A supply schedule is a tabular statement that states the different quantities of a commodity offered for sale at different prices.

Price (birr per kg)	30	25	20	15	10
Quantity supplied kg/week	100	90	80	70	60

Table 2.3: an individual seller's supply schedule for butter

A supply curve conveys the same information as a supply schedule. But it shows the information graphically rather than in a tabular form.



In this diagram the quantities of oranges are measured along X axis and prices along Y axis. The supply curve slopes upward as we go from the left to the right. This means, as the price rises, more is offered for

Figure 2.5 supply curve

The supply of a commodity can be briefly expressed in the following functional relationship: S = f(P), where S is quantity supplied and P is price of the commodity.

Market supply: It is derived by horizontally adding the quantity supplied of the product by all sellers at each price.

Price per unit	Quantity supplied by seller 1	Quantity supplied by seller 2	Quantity supplied by seller 3	Market supply per week
5	11	15	8	34
4	10.5	13	7	30.5
3	8	11.5	5.5	25
2	6	8.5	4	18.5
1	4	6	2	12

Determinants of supply

Apart from the change in price which causes a change in quantity demanded, the supply of a particular product is determined by:

i) Price of inputs (cost of inputs)
ii) Technology
iii) Prices of related goods
iv) Sellers'expectation of price of the product
v) Taxes & subsidies
vi) Number of sellers in the market
vii) Weather, etc.

- Price of a commodity (P_A): causes the change in quantity supplied.
- Price of complements (P_c): Increases in price of complementary good will increase the supply for that output. E.g. tea leaf and sugar, tyre and car. If price of tyre increases, the supply for car increases along with the increase of tyre supply.
- Price of substitutes (P_s): As the price of substitute good increases the quantity supplied for that good will decline and vice versa. E.g. tea and coffee, if price of tea increases, suppliers will shift from tea production to its substitute (coffee) so, the supply for tea decreases while the supply for coffee increases.
- Cost of production (C): includes prices of factors of production and technology on use. Low prices of input and advanced technology will result increase in the quantity supplied by sellers.
- Expectation of sellers to the future price change (E): if sellers expect higher prices in the future, their current supply will decline but their future supply will increase and vice versa.

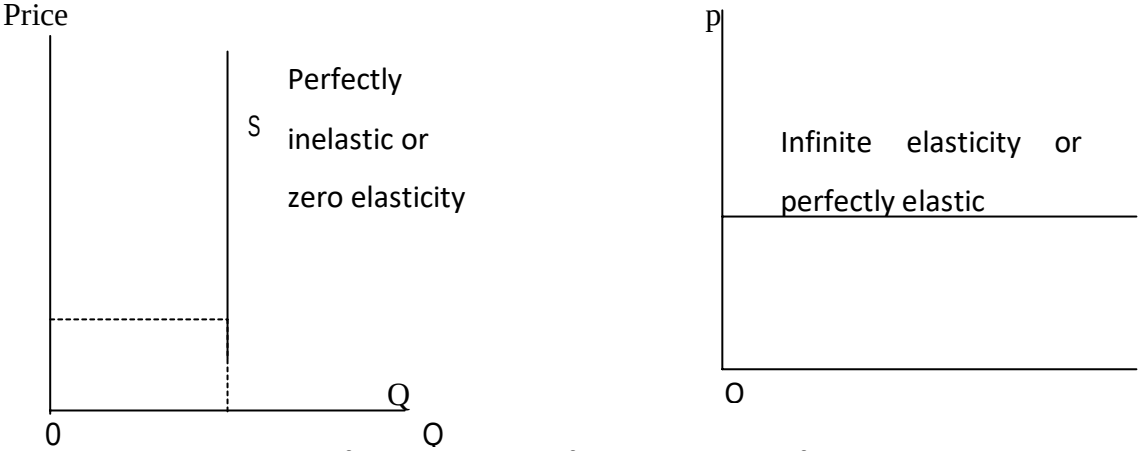
Elasticity of supply

It is the degree of responsiveness of the supply to change in price. It may be defined as the percentage change in quantity supplied divided by the percentage change in price. As the case with price elasticity of demand, we can measure the price elasticity of supply using point and arc elasticity methods. However, a simple and most commonly used method is point method.

The point price elasticity of supply can be calculated as the ratio of proportionate change in quantity supplied of a commodity to a given proportionate change in its price. Thus, the formula for measuring price elasticity of supply is:

$$es = \frac{percentage\ change\ in\ quantity\ supplied}{percentage\ change\ in\ price\ of\ the\ good} = \frac{\Delta Q}{\Delta P} * \frac{P}{Q}$$

Like elasticity of demand, price elasticity of supply can be elastic, inelastic, unitary elastic, perfectly elastic or perfectly inelastic. The supply is elastic when a small change on price leads to great change in supply. It is inelastic or less elastic when a great change in price induces only a slight change in supply. If the supply is *perfectly inelastic*, it will be represented by a vertical line shown as below. If supply is *perfectly elastic* it will be represented by a horizontal straight line as in second diagram.



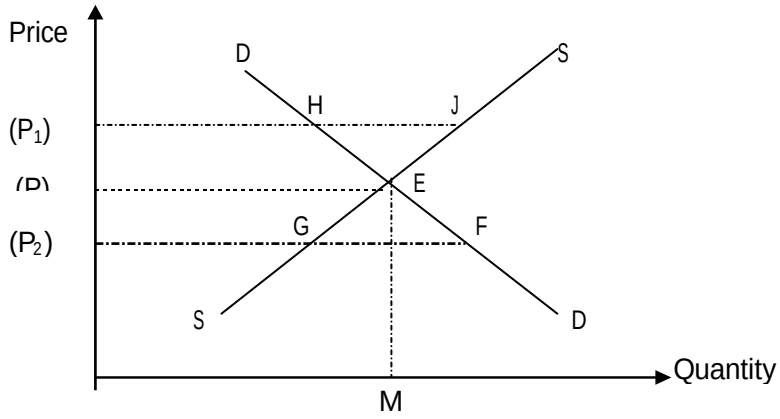
In general we do have the following types of price elasticity of supply.

- es = 0 Perfectly Inelastic Change in price does not affect supply at all
- es < 1 Less than Unit Elastic (inelastic) % change in supply is less than % change in price
- es = 1 Unit Elastic % change in supply is equal to % change in price
- es > 1 More than Unit Elastic (elastic) % change in supply is more than % change in price
- es = ∞ Perfectly Elastic Supply changes infinitely

2.3 Market equilibrium

Market equilibrium occurs when the two variables (Demand and supply) are in balance. Both buyers and sellers are satisfied at equilibrium in that nothing is left unsold and no consumer is left unsatisfied in the market. If price is higher than equilibrium price level, there will be higher supply than what is demanded; the quantity demanded is less than quantity supply. This stage is called surplus because some of what is supplied by the sellers is left in the market without being sold. This situation will create competition among sellers and thus finally results in the reduction of price for that commodity to the equilibrium level. But if the price is lower than equilibrium level, the quantity demanded will be higher than what is supplied in the market by the sellers. So, there is a shortage of goods and services in the market which creates competition in the market

among the consumers/buyers of that output. This finally pushes the price level up to the equilibrium level.



- At point ‗E' market demand equals market supply (equilibrium point)
- P is the market equilibrium (market clearing) price.
- M is the market equilibrium (market clearing) quantity.

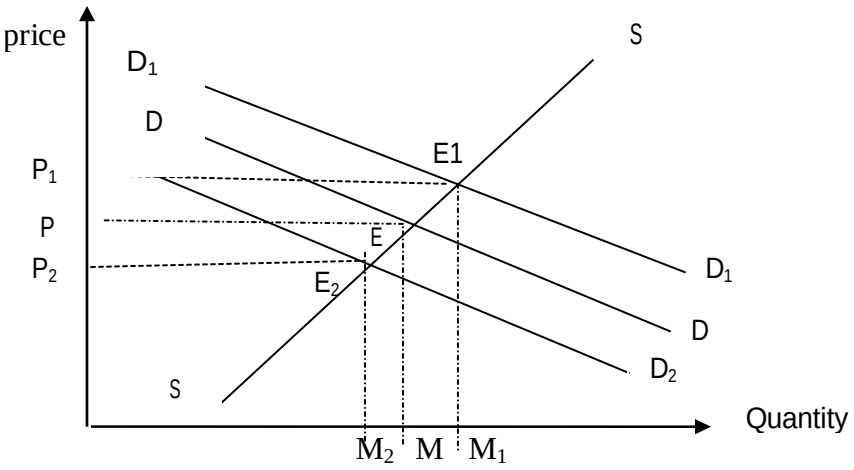
In the above graph, any price greater than P will lead to market surplus. As the price of the commodity increases, consumers demand less of the product. On the other hand, as the price of increases, producers supply more of the good. Therefore, if price increases to P1 the market will have a surplus of HJ. If the price decreases to P2 buyers demand to buy more and suppliers prefer to decrease their supply leading to shortage in the market which is equal to GF.

Effects of shift in demand and supply on equilibrium

Given demand and supply the equilibrium price and quantity are stable. However, when these market forces change what will happen to the equilibrium price and quantity? Changes in demand and supply bring about changes in the equilibrium price level and the equilibrium quantity.

i) When demand changes and supply remains constant

Factors such as changes in income, tastes, and prices of related goods will lead to a change in demand. The figure below shows the effects of a change in demand and the resultant equilibrium price and quantity. DD is the demand curve and SS is the supply curve.

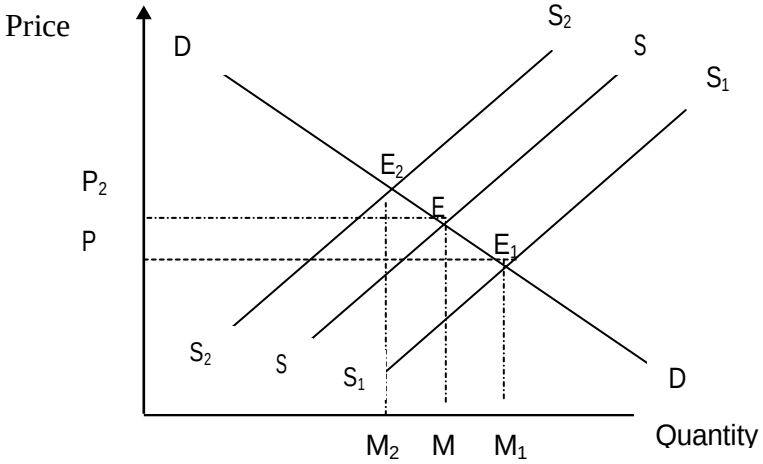


DD and SS curves intersect at point E and the quantity demanded and supplied is OM at OP equilibrium price. Given the supply, if the demand increases the demand curve will shift upward to the right. Due to a change in demand, the demand curve D1D1 intersects SS supply curve at point E1. The equilibrium price increases from OP to OP1 and the equilibrium quantity from OM to OM1. On the other hand, if demand falls, the demand curve shifts downwards to the left. Due to a change in demand, the curve D2D2 intersects the supply curve SS at point E2.

The equilibrium price decreases from OP to OP2 and the equilibrium quantity decreases from OM to OM2. Supply being given, a decrease in demand reduces both the equilibrium price and the quantity and vice versa.

ii. When supply changes and demand remains constant

Changes in supply are brought by changes in technical knowledge and factor prices. The following graph explains the effects of changes in supply.



SS and DD intersect at point E, where supply and demand are equal at OM quantity at OP equilibrium price. Given the demand, if the supply increases, the supply curve shifts to the right (S1S1). The new supply curve, which intersects DD curve at E1, reduces the equilibrium price from OP to OP1 and increases the equilibrium quantity from OM to OM1. On the contrary, when the supply falls, the supply curve moves to the left (S2S2) and intersects the DD curve at point E2 raising the equilibrium price from OP to OP2 and reducing the equilibrium quantity from OM to OM2.

III) Effects of combined changes in demand and supply

When both demand and supply increase, the quantity of the product will increase definitely.

But it is not certain whether the price will rise or fall. If an increase in demand is more than an increase in supply, then the price goes up. On the other hand, if an increase in supply is more than an increase in demand, the price falls but the quantity increases. If the increase in demand and supply is same, then the price remains the same.

When demand and supply decline, the quantity decreases. But the change in price will depend upon the relative fall in demand and supply. When the fall in demand is more than the fall in supply, the price will decrease. On the other hand, when the fall in supply is more than the fall in demand, the price will rise. If both demand and supply decline in the same ratio, there is no change in the equilibrium price, but the quantity decreases.