Module 3

Elasticity of Demand and Supply.

From the law of demand and supply, we learned that the quantities of goods and services that sellers are ready to supply and the buyer are ready to demand are determined by several factors. In economics, we use the concept of elasticity to study the responsiveness of buyers and sellers in purchasing and selling of various goods and services in different quantities, based on the changes in their determinants. The notion of elasticity relates to price, income, and cross elasticities.

1) Price Elasticity of Demand

Meaning of Price Elasticity of Demand

Price elasticity of demand measures how much the quantity demanded of a commodity responds to a change in the price of that commodity. It can be computed as the percentage change in quantity demanded divided by the percentage change in price.

Generally, demand for a good is said to be elastic if the quantity demanded responds substantially to changes in the price. If the responds to changes in price is very slight, the elasticity of demand is said to be inelastic.

There is no well established factors that determine elasticity of demand. However, some of the following factors may potentially determine the the strength of responsiveness or elasticity.

1- Availability of Substitutes.

Generally, it is observed that goods with close substitutes reflect more elasticity [high elasticity]. For example, margarine is a close substitute for butter. A small increase in the price of margarine will lead to an increase in the quantity demand for butter by a large amount [assuming that price of butter is held fixed].

By contast, ~~the~~ the esticity of commodities with no close substitutes will be inelastic. Petroleum products are the best examples for such commodities. Since, there is no close substitute, the price elasticity of such commodities will be less elastic.

2- Necessities Vs luxuries

The elasticity of demand for necessities tends to be inelastic. For example, even the consultancy charge (price) for a medical doctor increases, people do not necessarily reduce consultation since healthcare is a necessary services. On the other hand, people tend to ~~be~~ be more elastic towards luxurious commodities. It is because, luxury commodities are ~~sensiti~~ sensitive to price change.

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3- Time horizon

Goods tend to have more elastic demand over longer time horizons. A classical example is gasoline. When the price of gasoline increases, the demand for gasoline declines only slightly in the short term. In the longer time, the demand will decline substantially as people switch to more fuel efficient vehicles and move to convienient places for stay.

Measurement of price elasticity of demand

The price elasticity of demand can be calculated as the ratio of the percentage change in quantity demanded of a commodity to the percentage change in the price. It may be expressed as follows.

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

Example:-

A 5 percent increase in price of a commodity lead reduce the consumption of the commodity by ~~20~~ 5 percent. the price elasticity of demand will be as follows.

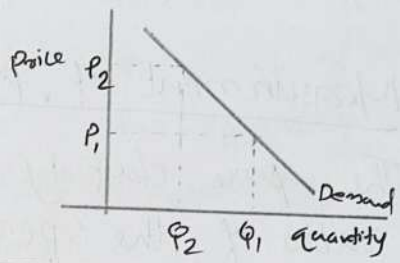
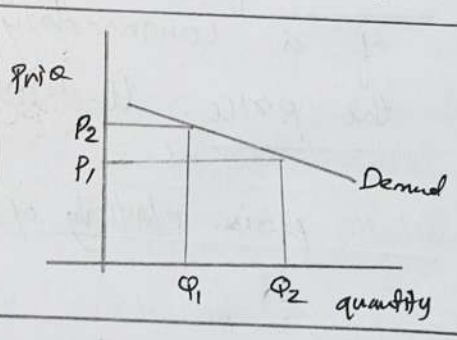
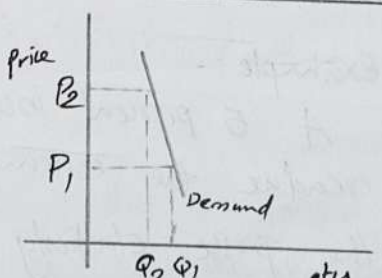
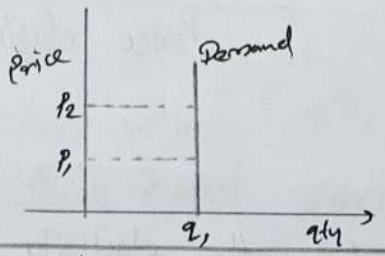
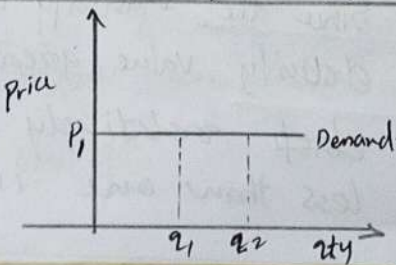
$$\text{Price elasticity of demand} = \frac{5 \text{ Percent}}{5 \text{ Percent}}$$

$$= 1.$$

Since the elasticity is 1, it is called unit elasticity. Any elasticity value greater than one is considered as ~~elasti~~ relatively elastic whereas any elasticity value less than one is considered as relatively inelastic.

Note: Since price and quantity demand are negetively associated, the elasticity is sometimes reported as negetive numbers. But generally, the negetive sign is dropped.

Price elasticity of demand may be unity, greater than unity, less than unity, zero or infinite. These fives cases can be presented as follows.

	Types of Elasticity	Elasticity value	Graphical Model.
i	Unit elastic	$E_p = 1$	
ii	Greater than unit elasticity	$E_p > 1$	
iii	Less than unit elasticity	$E_p < 1$	
iv	Perfectly Inelastic demand	$E_p = 0$	
v	Perfectly elastic demand	$E_p = \infty$	

i- Percentage method [Also known as Proportionate Method]

The price elasticity of demand can be measured using percentage method. We consider the percentage change in quantity demanded and price to measure elasticity. According to this method price elasticity can be measured using the following formula.

$$E_p = \frac{\% \text{ change in qty demanded}}{\% \text{ change in price}} = \frac{\frac{\Delta q}{q}}{\frac{\Delta P}{P}}$$

$\frac{\Delta q}{q} \times 100$

Δ = change
P = original price
q = original qty

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

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

Numerical example

Combination	Price of commodity X	quantity of Commodity X
A	6	0
B	5	10
C	4	20
D	3	30
E	2	40
F	1	50
G	0	60

Now, we consider two cases.

i- Consumer is moving from D to F.

ii- Consumer is moving from F to D.

In the case 1, when consumer move from D to F, the elasticity will be

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

$$= \frac{(50-30)}{(1-3)} \times \frac{3}{30} = \frac{20}{-2} \times \frac{3}{30} = \frac{60}{-60} = -1$$

It is unit estisticity.

In the second case, when consumes move from F to D, the elastisity will be

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

$$= \frac{(30-50)}{(3-1)} \times \frac{1}{50} = \frac{-20}{2} \times \frac{1}{50} = \frac{-20}{100} < 1$$

The elasticity is less than unitary.

Elasticity is different based on the direction that the consumer move. This difference is due to the use of a different base is percentage changes in each case.

ii - Total outlay or Expenditure Method

In this method, elasticity is measured based on the total expenditure incurred by the consumers. To find the elasticity, we ~~as~~ first estimate the Total Expenditure (TE).

$$TE = P \times Q$$

P = price
Q = Quantity.

Elasticity will be unity, when there is no change in the total expenditure. ~~Elasticity~~ If the total expenditure increases with a fall in price (and vice versa) the demand is said to be elastic. On the contrary, if the total expenditure decreases with a ~~rise~~ fall in price (and vice versa), the demand is said to be inelastic

A simple numerical example of these cases are provided below.

Price	Quantity demanded	Total Expenditure	Type of Elasticity
10	10	100	Elastic demand
9	12	108	
8	15	120	
7	30	210	unitary elastic
6	35	210	
5	42	210	
4	46	184	Inelastic demand
3	49	147	
2	51	102	

iii - Geometric or Point Method

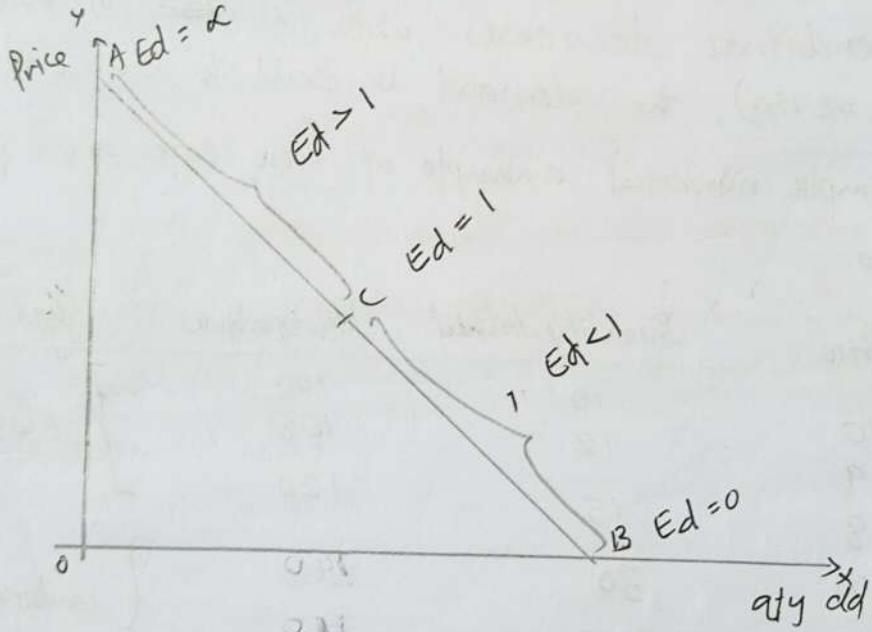
This method was devised by Prof: Alfred Marshall.

Using this approach elasticity along a linear demand curve can be measured. Please Note that, the slope of a linear demand curve is constant, but its elasticity is not constant.

The elasticity of demand for a linear demand curve can be estimated using the following formula.

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

An illustration is shown in the following figure.



→ On a linear demand curve like above, at point 'c' the elasticity of demand will be equal to 1.

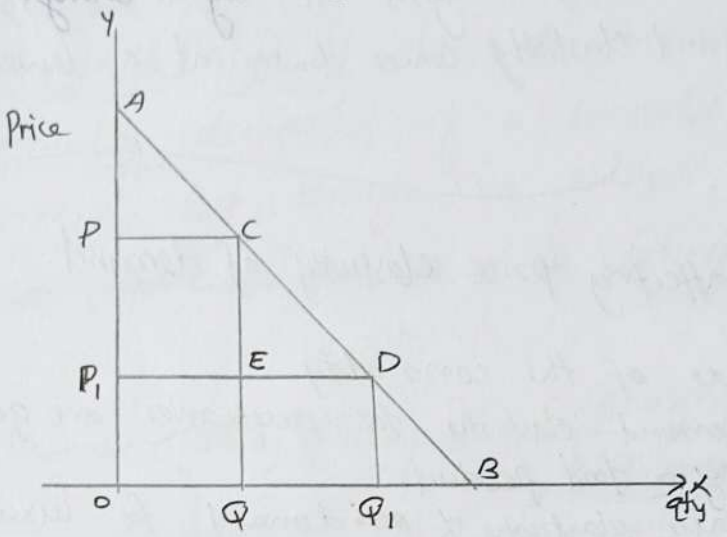
→ Elasticity of demand will be zero and infinity at points B and A, respectively.

→ Demand will be elastic on any point between A and C.

→ Demand will be inelastic on any point between C and B.

Proof for the Elasticity Equation $\left[\frac{\text{lower Segment}}{\text{upper Segment}}\right]$ used under geometric/Point method.

→ we consider the following linear demand curve.



Elasticity of demand is -

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

$$= \frac{ED}{CE} \times \frac{CQ}{PC} \quad -(1)$$

$\Delta Q = QQ_1 = ED$

$\Delta P = PP_1 = CE$

$P = OP = CQ$

$Q = OQ = PC$

$\Delta CED = \Delta CQB$ [The ratio of sides of similar triangle are equal]

$$\frac{ED}{CE} = \frac{QB}{CQ}$$

based on equation (1), $\frac{ED}{CE}$ can be replaced by $\frac{QB}{CQ}$.

$$\frac{QB}{CQ} \times \frac{CQ}{PC} = \frac{QB}{PC}$$

$\Delta APC = \Delta CQB$

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$\therefore \frac{QB}{PC} = \frac{CB}{AC}$ → lower Segment

→ upper Segment.

Note:- This linear approach offers an important lesson. i.e., elasticity is higher at a higher price and elasticity comes down at a lower price.

Factors affecting price elasticity of demand.

i- Nature of the commodity
- demand elasticity for necessaries are generally inelastic.
- eg:- food products.
- Price elasticity of ~~pro~~ demand for luxuries are generally elastic.

ii- Substitutes.
- commodities having substitutes have more elastic demand.

iii- Variety of Uses/Alternative Uses.
- commodities that can be used for variety of uses ~~are~~ have more elastic.

iv - Deferred consumption
- If consumption of a commodity can be postponed, such commodities will be more elastic.

v - Income groups :- generally elasticity will be higher for population from lower income class.

vi- level of price - generally commodities with high price will be more elastic.

vii- Habits: Elasticity for habituated products will be less elastic (eg:- coffee)

viii - Joint demand: If two commodities are consumed jointly, Elasticity for second commodity depends on the elasticity of first.

2 - Income elasticity of Demand

Economists also study elasticity of demand using the consumption behaviour and consumer's income. The income elasticity of demand measures the changes in quantity demanded of a commodity as a response to the changes in income of the consumers. It can be calculated using the following equation.

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

or

$$\text{Income elasticity of demand} = \frac{\Delta Q}{\Delta I} \times \frac{I}{Q}$$

ΔQ = Change in demand

ΔI = change in income

I = inal income

Q = Initial quality

In general,

- ✓ For necessary commodities, income elasticity will be inelastic.
- ✓ The income elasticity for normal goods will be positive whereas income elasticity for inferior goods will be negetive.
- ✓ Income elasticity for luxuries will be more - elastic.

3- Cross Elasticity of demand

It can be also refferred as "cross-price elasticity of demand".

We learned from the theory of demand that the actual quantity demanded is dependent on the price of related goods. The cross-price elasticity of demand measures the quantity of demanded of a commodity with respect to a change in the price of related commodities. It can be measured using the following formula. Suppose there are two related goods, good B and good D.

$$\text{Cross elasticity of demand} = \frac{\%\text{ change in quantity demanded good B}}{\%\text{ change in price of good D}}$$

$$= \frac{\Delta Q_B}{\Delta P_D} \times \frac{P_D}{Q_B}$$

Cross elasticity of Substitutes.

- Cross elasticity of substitutes will be positive.
- Example: An increase in the price of tea increases the demand for coffee.

Cross elasticity of complementary goods

- Cross elasticity of complements will be negative.
- Example: Computers and software. → An increase in the price of computerers reduces the demand for software.

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Elasticity of Supply

The concept of elasticity is also applicable to supply. It measures the quantity the quantity of commodities change, as a response the change in the price of the commodity. Elasticity of supply is also measured using percentage change in quantity supplied and change in price. It can be computed using the following formula.

$$\text{Price elasticity of supply} = \frac{\% \text{ Change in the quantity supplied}}{\% \text{ Change in price}}$$

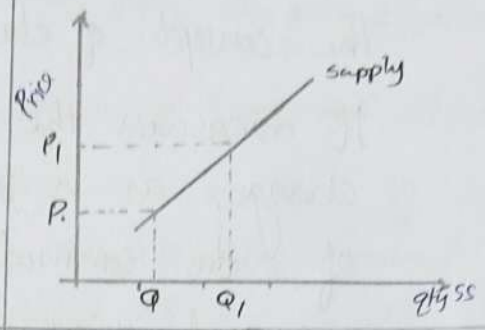
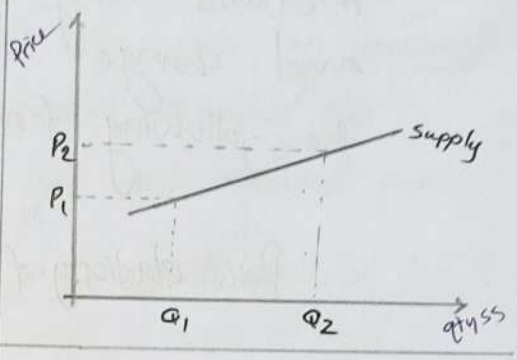
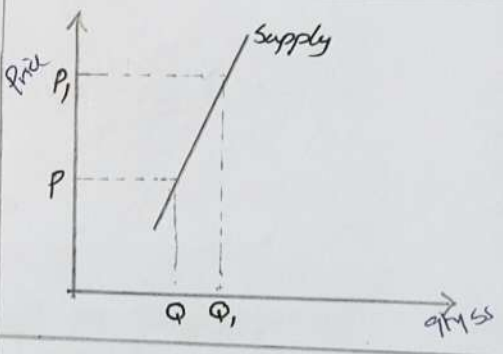
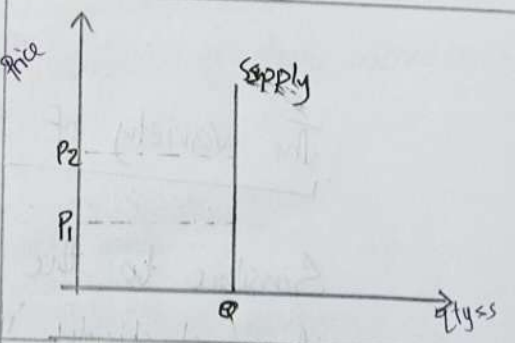
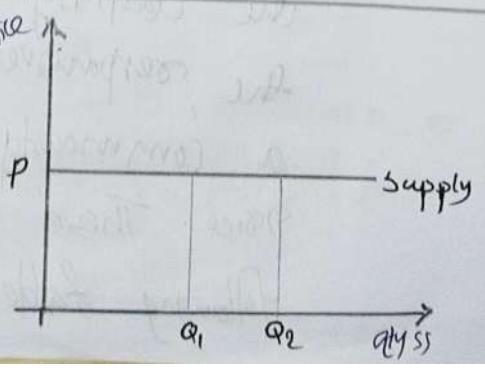
$$= \frac{\Delta q}{\Delta P} \times \frac{P}{q}$$

Δq = change in qty supplied
Δp = change in price
p = initial price
q = initial quantity supplied

The variety of Supply Curves and Elasticity

Similar to the elasticity of demand, we can classify the elasticity in to five major forms, based on the responsiveness rate in quantity supplied of a commodity with respect to change in its price. These cases are summarised in the following table →

Types of Supply Elasticity

	Types of Elasticity	Value of Elasticity	Graphical Model
i	Unit elastic Supply	$E_s = 1$	
ii	Greater than unit elastic (Relatively Elastic Supply)	$E_s > 1$	
iii	Less than unit elastic (Relatively Inelastic Supply)	$E_s < 1$	
iv	Perfectly Inelastic Supply	$E_s = 0$	
v	Perfectly Elastic Supply	$E_s = \infty$	

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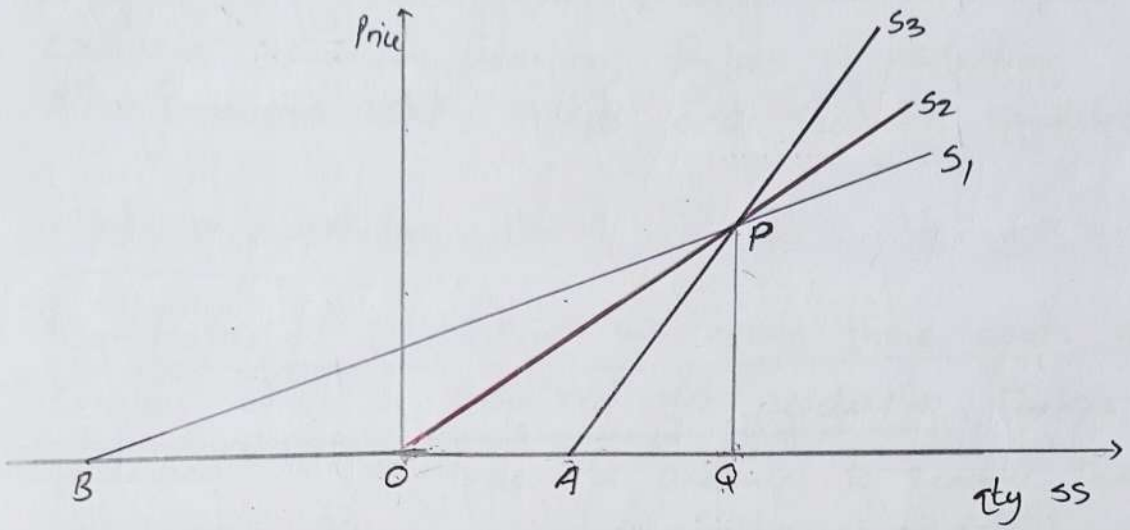
Measurement of Elasticity of Supply (Point Method)

Not included in the Syllabus

We consider the following supply curves



First, we consider supply curve S_2.

According to the elasticity of supply formula,

$$E_S = \frac{\Delta q}{\Delta p} \times \frac{P}{Q}$$

$$\frac{\Delta q}{\Delta p} = \frac{OQ}{PQ}$$

$$\frac{P}{Q} = \frac{PQ}{OQ}$$

$$= \frac{OQ}{PQ} \times \frac{PQ}{OQ} = 1 \rightarrow \text{unit elastic}$$

Similarly, on supply curve S_1.

$$E_S = \frac{BQ}{PQ} \times \frac{PQ}{QO} = \frac{BQ}{OQ}$$

$> 1 \rightarrow$ greater than unity

Finally, on the supply curve S_3.

$$E_S = \frac{AQ}{PQ} \times \frac{PQ}{OQ} = \frac{AQ}{OQ}$$

$< 1 \rightarrow$ less than unit elastic