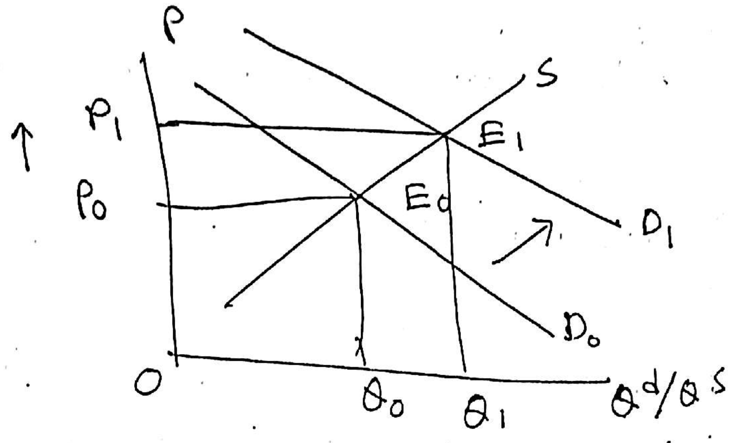
Elasticity

Self



Here, At E_0 point,

Equilibrium Quantity demanded is Q_0
" " supplied is Q_0
" price is P_0

— suppose your income increases and demand curve shifts outward. That is demand increase. We move to a new equilibrium point E_1

At E_1 point,

Equilibrium price is P_1
EqM Quantity demanded Q_1
" " supplied Q_1

So, we can say, As price increases from P_0 to P_1, Quantity demanded & supplied increases from Q_0 to Q_1.

Here we quantify the amount Exactly.

But in elasticity analysis, we discuss in percentage form. That we say how much percentage increase in price leads to how much percentage increase or decrease in Quantity demanded or supplied.

— Here, through elasticity analysis, we see, does the price rise by a large amount and the quantity decrease by a little?
[অর্থাৎ কোনটা কতটুকু বাড়ল বা কমল? শতকরা পরিবর্তন কত? দাম ও চাহিদা, যোগানের পরিমানের)]

Q: What is Elasticity ?

— A measure of the responsiveness of quantity demanded or quantity supplied to a change in one of its determinants.

Q: What is price Elasticity of demand ?

— The price Elasticity of demand is a measure of the responsiveness of the quantity demanded of a good to a change in its price when all other things are equal.

Formula for price Elasticity of demand :

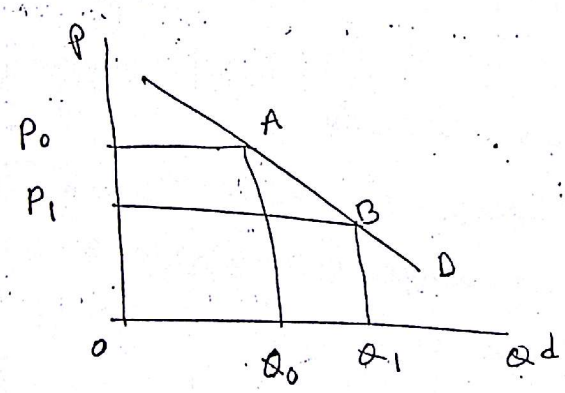
$$\text{Price Elasticity of demand } (E_d) = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

$$= \frac{\frac{\text{New } Q_d - \text{old } Q_d}{\text{old } Q_d}}{\frac{\text{New price} - \text{old price}}{\text{old price}}}$$

$$= \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}}$$

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

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



So, formula 1 $(E_d) = \left[\frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}}\right] \times 100$

Formula 2, $(E_d) = \left[\frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}\right] \times 100$

Here, ΔQ = change in Quantity demanded

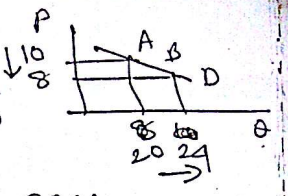
ΔP = change in Price

P_0 = initial Price

Q_0 = initial Price

~~Example:~~

Example: Suppose, Price of pen decreases from 10 to 8. and quantity demanded of pen increases from 20 to 24. Calculate Price Elasticity of demand.



Percentage change in Quantity demanded $= \frac{(24-20)\text{ unit}}{20} \times 100$

$= \frac{4}{20} \times 100 = 20\%$

Percentage in price $= \frac{(8-10)\text{TK.}}{10\text{ TK.}} \times 100 = \frac{-2}{10} \times 100 = -20\%$

So, Price Elasticity of demand $= \frac{\%\ \Delta \text{ in } Q_d}{\%\ \Delta \text{ in } P} = \frac{20\%}{20\%} = -1$

That is if price increases by 100%, quantity demanded decreases by 100%.

Another Example: $Q^d = 100 - 5P$ | $Q^s = -20 + 5P$ | Eqm Price = 12, Quantity demanded & supplied = 40

Here, $\frac{\Delta Q}{\Delta P} = -5$

So, $E_d = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = -5 \cdot \frac{12}{40} = -\frac{60}{40} = 1.5 \times 100 = 150\%$

That is if Price increases by 100%, Quantity demanded by 150%

TYPES OF ELASTICITY Measurment of Price Elasticity: Total outlay Method used by Alfred Marshall. Based on this method Elasticities are divided into five types.

i) Perfect inelasticity ($e=0$)
ii) Perfect elasticity ($e=\infty$)
iii) elastic demand ($e_d > 1$)
iv) Inelastic demand ($e_d < 1$)
v) unit elasticity ($e_d = 1$)

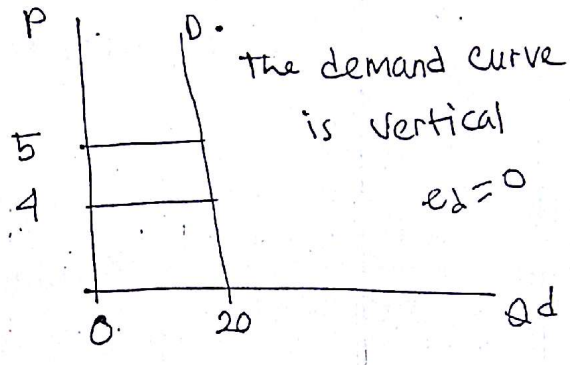
i) $E_d = 0$ Perfectly inelastic demand : (সম্পূর্ণ স্থিতিস্থাপক)

If Price changes but quantity demanded does not change then price elasticity of demand is zero ($E_d = 0$). Then the good is said to have a perfectly inelastic demand.

example : ~~Insulin~~ Insulin

$$E_d = \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}} = \frac{\frac{20-20}{20}}{\frac{4-5}{5}}$$

$$= \frac{0}{-1/5} = 0$$



The demand curve is vertical

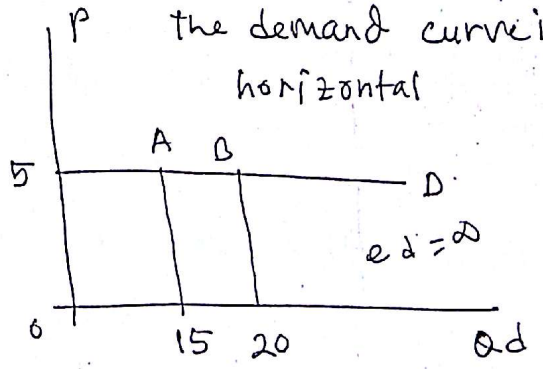
$e_d = 0$

ii) Perfectly elastic demand : (সম্পূর্ণ স্থিতিস্থাপক $e = \infty$)

For a small ~~increase~~ change in price, there is infinitely large percentage change in quantity demanded. If a good has such elasticity, the goods is said to have ~~infini~~ perfectly elastic demand.

$$E_d = \frac{\frac{20-15}{15}}{\frac{5-5}{5}} = \frac{\frac{5}{15}}{0} = \frac{\frac{1}{3}}{0}$$

$$= \infty$$



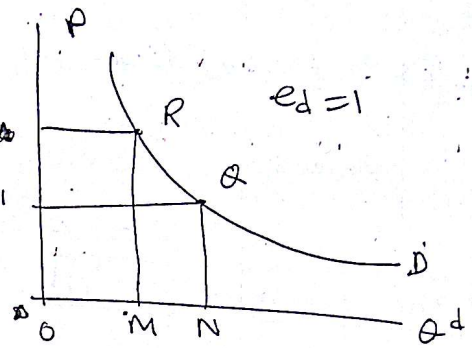
the demand curve is horizontal

$e_d = \infty$

Example : Soft drink from two campus machines located side by side.

Unit Elasticity ($E_d = 1$) : If the percentage change in the quantity demanded equals the percentage change in the price, then price elasticity is 1 and the good is said to have unit elastic demand.

Example : Here the demand curve is rectangular hyperbola. Every points on the rectangular hyperbola demand curve has same elasticity. Why ?



(আয়তাকার অতিভুজ (rectangular hyperbola) সমকোণাকৃতি হলে যেরূপ আয়তক্ষেত্রের প্রত্যেকটির ক্ষেত্রফল পরস্পরের সমান হবে বলে যেরূপ অতিভুজ রেখার সকল বিন্দুতে একের সমান হবে। তবে আয়তাকার অতিভুজ রেখার দোষ নাম হবে সকল বিন্দুতে elasticity same থাকবে)

At point R

area = $OP_0 \times OM$

= OMP_0R

At point Q

area = $OP_1 \times ON$

= $ONQP_1$

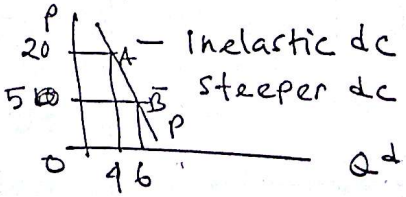
Here $OMP_0R = ONQP_1$

Both area at both point are in same quantity

iv Inelastic demand : ($0 < e_d < 1$)

(একক অপেক্ষা কম স্থিতিস্থাপক)

Here the percentage change in quantity demanded is less than percentange change in price.



$$E_d = \frac{\frac{6-4}{4}}{\frac{5-20}{20}} = \frac{\frac{2}{4}}{-\frac{15}{20}}$$

$$= -\frac{2}{4} \cdot \frac{4}{3} = -\frac{2}{3} = .67$$

$$\frac{\frac{10-20}{20}}{\frac{6-4}{4}} = \frac{\frac{2}{4}}{-\frac{10}{20}}$$

$$= -\frac{\frac{1}{2}}{\frac{1}{4}} = -\frac{1}{2} \times \frac{4}{1}$$

That is if price increases by 100%, Quantity demanded ~~increases~~ decreases by 67 percent.

Example: Necessary food item. (eg. oil, salt, chillis)

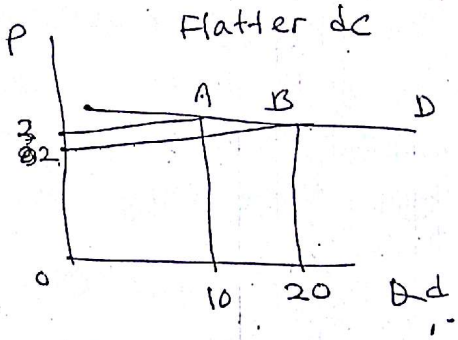
Elastic demand ($E_d > 1$) percentage change in demand is greater than percentage change in price.

$$E_d = \frac{\frac{20-10}{10}}{\frac{2-3}{3}} = \frac{\frac{10}{10}}{-\frac{1}{3}} = -1 \times 3/1$$

$$= -3 \times 100$$

$$= -300\%$$

That is if price increases by 100%, Quantity demanded decreases by 300%.

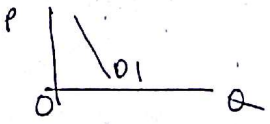


Factors that influence the Elasticity of Demand:

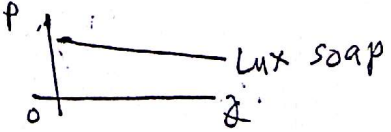
The elasticity of demand for a good depends on

i) closeness of substitutes: The closer the substitutes for good, the more elastic is the demand for it.

ex- oil or raw materials for chemicals has no close substitutes. so, their demand curves are inelastic



- necessities has rarely ~~so~~ substitutes. (steeper dc)
- luxurious goods has close substitute (Flatter dc)



ii) proportion of income spent on the good:

Other things remaining the same, the greater proportion of income spent on a good, the more elastic is the demand for it.

example: Demand for housing & chewing gum.

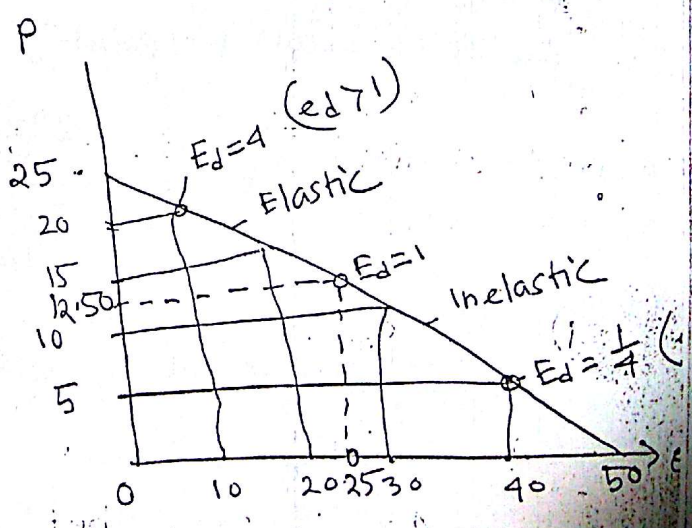
- If the price of gum rises, you consume almost as much as before. your demand for gum is inelastic.
- If apartment rent rise, demand for ~~ee~~ apartment decreases demand for housing is elastic.

iii) Time Elapsed since Price Change: The longer the time ~~has~~ that has elapsed since a price change, the more elastic is the dem

Example: The Demand for oil ~~has~~ became more elastic as more time ~~elasp~~ elapsed following the huge price hike of 400 % increase during the 1970s.

Elasticity Along a linear Demand curve:

- On a linear demand curve, demand is unit elastic at the midpoint ($e_d = 1$), elastic above the mid point ($e_d > 1$) and inelastic below the mid point.



- A demand curve ~~has con~~ (straight line) has constant slope but a varying elasticity.

At Midpoint, $P = 12.50$
$Q_d = 25$

~~if price rises to~~

~~if p from 10 to~~

if price decreases from 12.50 to 10, then

$$E_d = \frac{\frac{30-25}{25}}{\frac{10-12.50}{12.50}} = \frac{\frac{5}{25}}{\frac{2.5}{12.50}} = \frac{1}{5} \times \frac{12.5}{2.5}$$

$$= 1$$

Elasticity above Midpoint:

$$E_d = \frac{\frac{20-10}{10}}{\frac{15-20}{20}} = \frac{\frac{10}{10}}{-5/20} = -\frac{1}{1} \times \frac{20}{5} = -4$$

that is above mid point $(E_d = 4 > 1)$

Elasticity below Midpoint:

$$E_d = \frac{\frac{40-30}{30}}{\frac{5-10}{10}} = \frac{\frac{10}{30}}{-\frac{5}{10}} = -\frac{1}{3} \times \frac{2}{1}$$

$$= -2/3 = .67 \quad (e_d < 1)$$

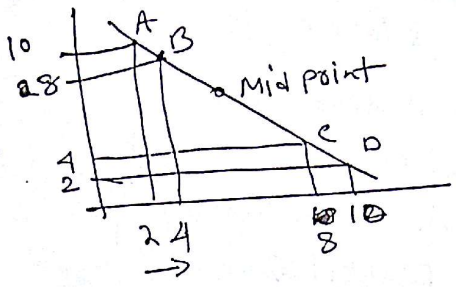
Why Elasticities along a linear or straight demand curve, varies??

1) $$e_d = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q} = \frac{1}{\frac{\Delta P}{\Delta Q}} \times \frac{P}{Q} = \frac{1}{\text{slope of demand curve}} \times \frac{P}{Q}$$

- A straight demand curve have same slope that is $\frac{\Delta P}{\Delta Q}$ or $\frac{\Delta Q}{\Delta P}$ is same but the ratio P/Q is not same. As P/Q varies, elasticities varies.

2) ^same percentage change of a smaller number is greater ~~than~~ than the same percentage change of a greater number.

$$E_d = \frac{(2 \to 4)\ 100\%\ \text{change in } Q_d}{(10 \to 8)\ 20\%\ \text{change in } P}$$



$\Rightarrow E_d > 1$

Price elasticity below ~~a~~ mid point

At C, $E_d = \frac{\frac{10-8}{10}}{\frac{2-4}{4}} = \frac{\frac{2}{10}}{-2/4} = \frac{2}{10} \times \frac{4}{2} = \frac{4}{10} = .4$

Here, $\frac{(8 \to 10)\ 20\%\ \text{change in } Q_d}{(4 \to 2)\ 100\%\ \text{change in } Q_d} = E_d < 1$

So, As our formula for price elasticity of demand considers percentage change in price & quantity demanded, the change in percentage form of a smaller number and a greater number are not same. The magnitude of change in percentage form of two different numbers matters most.

That is, if income increases by 100%, Quantity demanded increases by 200%.

⇒ Income Elastic demand is seen for the following goods & services:

- Airline Travel
- Movies
- Foreign Travel
- Electricity
- Restaurant meals
- local buses & trains
- Haircuts
- Automobiles
- Luxurious products. (Tv, Freeze etc,

So, The demand for a luxurious goods or service is income elastic.

ii) **Income Inelastic demand:** If the ~~demand~~ income elasticity of demand is positive but Less than 1 ($0 < Ey < 1$), demand is income inelastic.

~~That is~~ Example: $Ey = \frac{\frac{25-20}{20}}{\frac{1500-1000}{1000}} = \frac{5}{20} \times \frac{1000}{500} = \frac{1}{2}$

- If income increases by 100%, the quantity demanded increases by 50%. Income increases than Quantity demanded.

: Example:
- Tobacco
- Alcoholic drinks
- Furniture
- clothing
- Newspapers & Magazine
- Telephone
- Food.

iii) **Negative Income elasticity : $Ey < 0$**

If the income elasticity of demand is negative, the good an inferior good. When income increases, quantity demanded decreases.

More Elasticities of Demand

- A change in income changes demand. By how much will a rise in income increase the demand for a good? Income elasticity answers this question.

Income Elasticity of demand (E_I): The income elasticity of demand is a measure of the responsiveness of the demand for a good or service to a change in income when other things are unchanged.

⇒ Income Elasticity of demand = $\frac{\text{Percentage change in quantity demanded}}{\text{percentage change in income}}$

$$E_y = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta Y}{Y}} = \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{Y_1 - Y_0}{Y_0}}$$

Here,
- E_y = Income elasticity of demand
- ΔQ = change in quantity demanded
- Q = Initial demand
- Y = Initial Income
- ΔY = change in income

$$E_y = \frac{\Delta Q}{Q} \cdot \frac{Y}{\Delta Y}$$

$$E_y = \frac{\Delta Q}{\Delta Y} \cdot \frac{Y}{Q}$$

⇒ Example:

Suppose Mr. X's income increases from 1000 Tk. to Tk. 1500. As a result he demands now 25. His initial demand was 20. Calculate X's income elasticity of demand.

We know, $E_y = \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{Y_1 - Y_0}{Y_0}}$

- percentage change in Quantity demanded = $\frac{Q_1 - Q_0}{Q_0} = \frac{25 - 20}{20} = \frac{5}{20} = \frac{1}{4}$

- percentage change in income $= \frac{Y_1 - Y_0}{Y_0} = \frac{1500-1000}{1000}$

$= \frac{500}{1000} = \frac{1}{2}$

So, $E_y = \frac{\frac{1}{4}}{\frac{1}{2}} = \frac{1}{4} \times \frac{2}{1} = \frac{1}{2}$

Here, Income elasticity of demand (e_y) $= \frac{1}{2}$ indicating if income increases by 100%, quantity demanded increases by 50 percent.

Types of Income elasticity (E_y):

E_y can be positive or negative and may be greater than 1 or Less than 1.

i) Positive and greater than 1 (~~$E_y > 0$~~ $E_y > 1$)

↳ normal good & income elastic demand

ii) Positive and Less than 1 ($0 < E_y < 1$)

↳ normal good, income inelastic)

iii) Negative ($E_y < 0$)

↳ inferior good.

Detailed discussion:

i) **Income elastic demand** ($E_y > 1$):

the percentage change in quantity demanded is greater than percentage change in income.

Example: Income rises from Rs 1000 to 1500. Quantity demanded rises from 20 to 40.

So, $E_y = \frac{Q_1 - Q_0}{Q_0} = \frac{40-20}{20} = \frac{20}{20} \times \frac{1000}{500} = 2 \quad (E_y > 1)$

$\frac{Y_1 - Y_0}{Y_0}$ $\frac{1500-1000}{1000}$

That is if income increases by 100%, Quantity demanded increases by 200%.

⇒ Income Elastic demand is seen for the following goods & services

- Airline Travel
- Movies
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ii) **Income Inelastic demand:** If the ~~demand~~ income elasticity of demand is positive but Less than 1 ($0 < E_y < 1$), demand is income inelastic.

~~That is~~ Example: $E_y = \frac{\frac{25-20}{20}}{\frac{1500-1000}{1000}} = \frac{5}{20} \times \frac{1000}{500} = \frac{1}{2}$

- If income increases by 100%, the Quantity demanded increases by 50%. Income increases than Quantity demanded.

Example:

- Tobacco
- Alcoholic drinks
- Furniture
- clothing
- Newspapers & Magazine
- Telephone
- Food.

iii) **Negative income elasticity : $E_y < 0$**

If the income elasticity of demand is negative, the good is an inferior good. When income increases, Quantity demanded decreases.

Example: suppose, Mr. X's income increases from 100 to 150. His Quantity demanded decreases from 10 to 5.

$$E_y = \frac{\frac{5-10}{10}}{\frac{150-100}{100}} = \frac{-5}{10} \times \frac{100}{50} = -1$$

(negative)

If income increases by 100%, Quantity demanded decreases by 100%.

We get negative income elasticity for inferior good.

Example of this goods are small motorcycles, potatoes, coarse cloth, local bus etc.

— Low income consumers buy these goods and spend a large percentage of their income on them. When increases, they switch to higher quality goods & services.

CROSS ELASTICITY OF DEMAND:
(চাহিদার ক্রাড়াক্রাড়ি স্থিতিস্থাপকতা)

⇒ Tea & coffiee are substitute. Bike & petrol are complementary. When the price of Tea increases, demand for coffiee increases. But how big is the influence of the price of Tea on the demand for coffiee? To know we study cross elasticity of demand.

⇒ The cross ~~price~~ elasticity of demand is a measure of the responsiveness of the demand for a good to a change in the price of a substitute or complement, other thing remaining same.

cross elasticity of demand = Percentage change in quantity demande
Percentage change in Price of a substitu or complement

Here, X & Y are two goods. They may be substitute or complementary

$$E_c = \frac{\frac{Qx_1 - Qx_0}{Qx_0}}{\frac{Py_1 - Py_0}{Py_0}}$$

$$= \frac{\frac{\Delta Q_x}{Q_x}}{\frac{\Delta P_y}{P_y}} = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x}{P_y}$$

Here, E_c = cross elasticity of deman.
ΔQ_x = change in demand of x good
Q_x = initial demand for x
ΔP_y = change in the price of y good.
P_y = Price of y good.

⇒ Cross Price elasticity can be positive or negative.

i) – positive
– Demand & Price of other good change in same direction
— two goods are substitute

ii)-Negative
– Demand and Price of other good change in opposite direction
— two goods are Complem

iii) zero
– two goods are independent (Bamboo & shoe)

Complementary : Negative cross elasticity

ii) Pen & ink are complements. suppose Price of ink increases from 100 to 150 TK. As a result, Demand for pen decreases from 20 to 10 ; Calculate cross elasticity of demand.

- Percentage change in demand for pen = $\frac{\Delta x_1 - \Delta x_0}{\Delta x_0}$

$= \frac{10-20}{20} = -\frac{10}{20} = -\frac{1}{2}$

- Percentage change in price of ink = $\frac{P_{y_1} - P_{y_0}}{P_{y_0}}$

$= \frac{150-100}{100} = \frac{50}{100} = \frac{1}{2}$

$$Ec = \frac{-\frac{1}{2}}{\frac{1}{2}} = -\frac{1}{2} \times \frac{2}{1} = -1$$

We get negative cross elasticity in case of complementary goods.

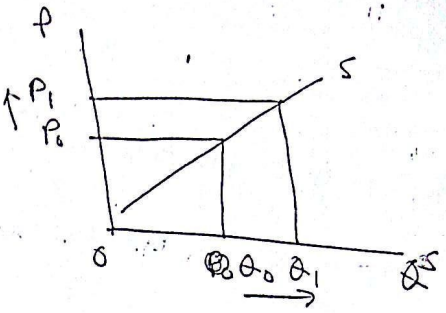
iii) **Zero cross elasticity** if one good is not dependent on other product, then we get zero cross elasticity of demand.

example : Bike & Bamboo.

—o—

Elasticity of supply

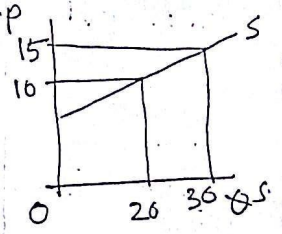
For measuring how much percentage change in quantity supplied occurs due to how much percentage change in price we use elasticity of supply.



⇒ Elasticity of supply measures the responsiveness of the quantity supplied to a change in the price of a good when other things remaining same.

$$\text{Elasticity of supply} = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price.}}$$

$$= \frac{\frac{Q_1 - Q_0}{Q_0}}{\frac{P_1 - P_0}{P_0}}$$



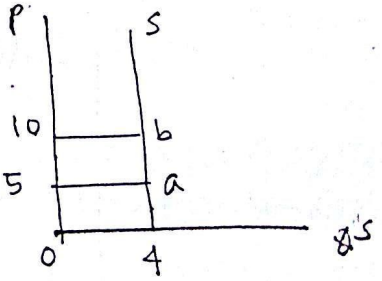
$$= \frac{\frac{30-20}{20}}{\frac{15-10}{10}}$$

$$= \frac{\frac{10^{1}2}{20_{2}}}{} \times \frac{10}{5} = 1$$

Types of supply elasticity :

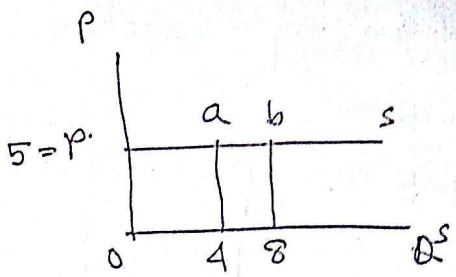
i) Zero Elasticity :

$$E_S = \frac{\frac{4-4}{4}}{\frac{10-5}{5}} = \frac{0}{\frac{5}{5}} = 0$$



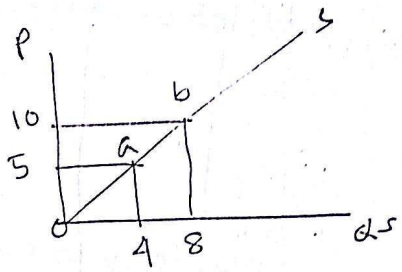
ii) Infinite elasticity of supply (E_s) : $\boxed{E_s = \infty}$

$$E_s = \frac{\frac{8-4}{4}}{\frac{5-5}{5}} = \frac{\frac{4}{4}}{0} = \infty$$



iii) unit elasticity : ($E_s = 1$)

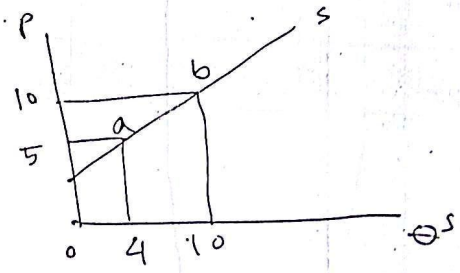
$$E_s = \frac{\frac{8-4}{4}}{\frac{10-5}{5}} = 1$$



iv) Elastic supply ($E_s > 1$) :

$$E_s = \frac{\frac{10-4}{4}}{\frac{10-5}{5}} = \frac{6}{4} \times \frac{5}{5}$$

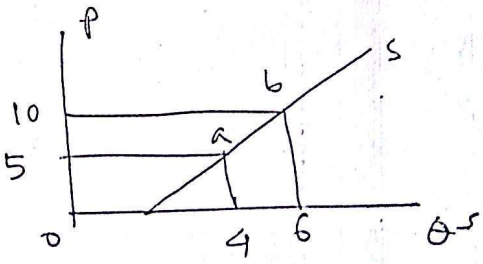
$$= \frac{30}{20} = \frac{6}{4} = \frac{3}{2} = 1.5$$



v) Inelastic supply ($E_s < 1$) :

$$E_s = \frac{\frac{6-4}{4}}{\frac{10-5}{5}} = \frac{2}{4} \times \frac{5}{5}$$

$$= \frac{1}{2}$$



⇒ Factors affecting supply elasticity (E_s) :

i) supply of factors of production
ii) reproducing capacity/ goods reproducable
iii) Durability of goods
iv) Time
v) Technology