Elasticity of demand and supply

The concept of elasticity was given by Prof. Marshall in his book 'Principles of Economics'.

Elasticity of demand

The elasticity of demand refers to the percentage change in demand for a commodity with respect to the percentage change in any of the factors affecting demand for that commodity.

The elasticity of demand = percentage change in demand/percentage change in a factor affecting demand

Out of various determinants of demand (the price of the commodity, price of related goods, the income of the consumer, tastes and preferences, the role of future expectations, etc.), there are 3 quantifiable determinants of demand:

1. Price of the given commodity
2. Price of the related goods
3. Income of the consumer

In simple terms, elasticity means responsiveness. The higher the elasticity of demand, higher is the degree of responsiveness of demand for a commodity with reference to any of the 3 quantitative factors mentioned above.

Price is the most important determinant of demand. So, price elasticity of demand is sometimes shortened as 'Elasticity of demand' or 'Demand elasticity' or simply 'Elasticity'.

Price elasticity establishes a quantitative relationship between quantity demanded for a commodity and its price, keeping all other factors constant.

Higher the numerical value of elasticity, larger is the effect of a price change on the quantity demanded.

For certain goods, a change in price leads to a greater change in demand, whereas in some cases, there is a small change in demand due to change in price. For example, if prices of 2 commodities 'x' and 'y' rises by 10% and their demands fall by 20% and 5% respectively, the commodity 'x' is said to be more elastic as compared to commodity 'y'. This leads to giving different degrees of price elasticity of demand.

we have three dimensions of elasticity of demand:

1. Price elasticity of demand

It refers to the percentage change in quantity demanded of a commodity with respect to the percentage change in the price of the given commodity.

$$Ed = (-)\frac{\text{\% Change in quantity demanded of a good}}{\text{\% Change in price of the good}} = (-)\,\Delta q / \Delta p \times p / q$$

Δq = q1-q = Change in quantity, Δp = p1-p = Change in Price

Or Ed = q1-q / p1-p × p / q

Where,
P = Initial Price, q = Initial quantity, q1 = Final quantity, p1 = final price

Note: The negative sign used in the formula denotes the negative relationship between price & demand and if the Elasticity of demand is a negative number like -1, -2, etc. Then though Mathematically, -1 > -2 | But in the context of elasticity, -2 > -1. That is, we ignore the minus sign so that we can compare the coefficients of ed easily.

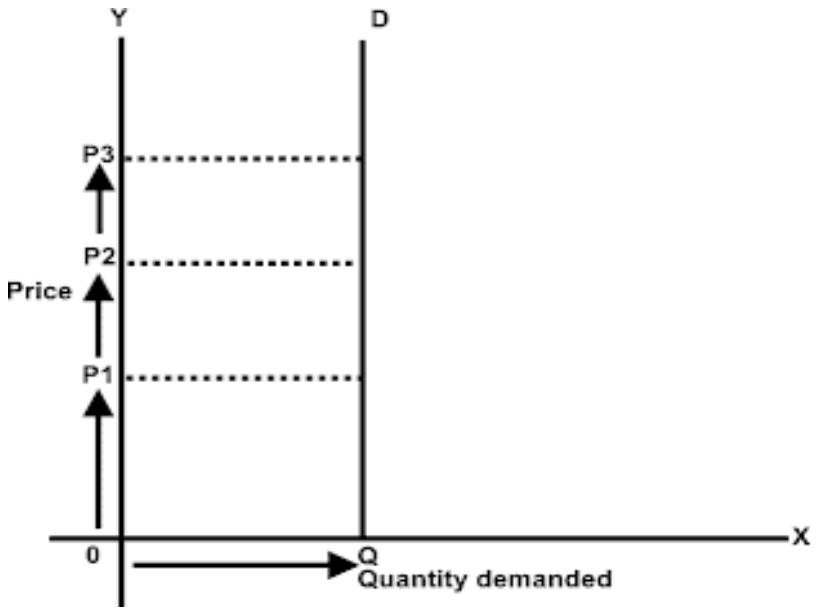
Degrees of price elasticity of demand

1. **Perfectly elastic demand**: When there is an infinite demand at a particular price and demand becomes zero with a slight increase in the price, then demand for such a commodity is said to be perfectly elastic. In this case ed= ∞ The demand curve is a horizontal straight line parallel to X-axis.

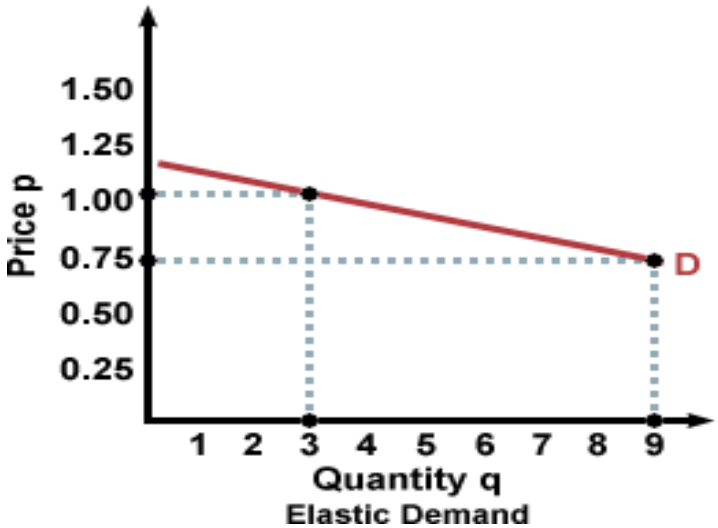
2. **Perfectly inelastic demand**: When there is no change in demand with a

change in price, then demand for such a commodity is said to be perfectly inelastic. In this case, ed= 0 and the demand curve is a vertical straight line parallel to Y-axis.

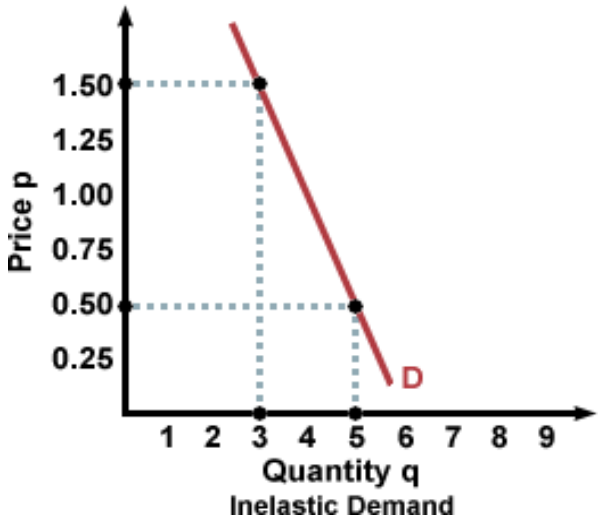
In simple words, there is no change in the quantity demanded for the commodity.



3. **Highly elastic demand**: When the percentage change in quantity demanded is more than the percentage change in the price of the commodity, then the demand for the commodity is said to be highly elastic. In this case ed >1. The highly elastic demand curve is flatter and the slope is inclined more towards the X-axis.

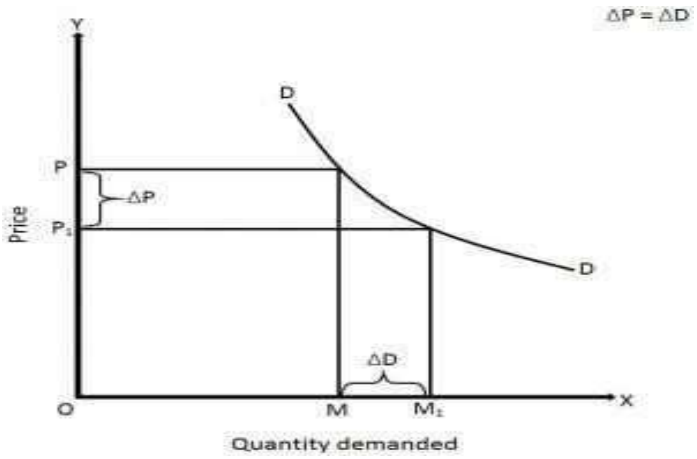


4. **Less elastic demand:** When the percentage change in quantity demanded of a commodity is less than the percentage change in the price, the demand is said to be less elastic or inelastic. In such case, ed < 1. The less elastic demand curve is steeper and its slope is inclined more towards Y-axis. Necessary commodities like salt, vegetables, medicines usually have inelastic demand.

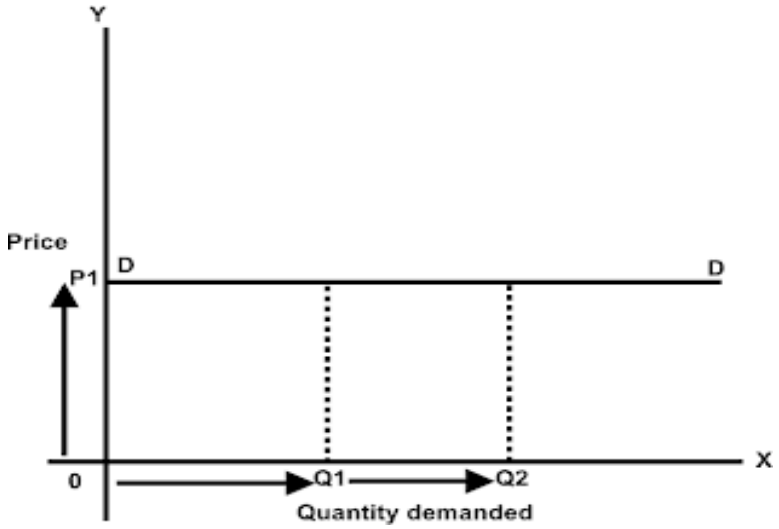


5. **Unitary elastic demand:** When the percentage change in quantity demanded is equal to the percentage change in price, then demand for such a commodity is said to be unitary elastic. In this case, ed = 1 and the demand curve is a rectangular hyperbola.

A rectangular hyperbola is a curve under which the total area at all the points will be the same.



Note that, the flatter the demand curve, more is the elasticity (less is the slope), Steeper the demand curve, less is the elasticity (more is the slope)



Methods of Calculating Price Elasticity of Demand

- **Percentage or Proportionate Method**: Elasticity is measured as the ratio of % change in quantity demanded to % change in price
- **Geometric or Point Method**: It measures elasticities at different points on a demand curve
- **Total Expenditure Method**: It examines how the total expenditure incurred on a good changes with a change in the price of the good.
- **Arc-Elasticity Method:** It measures the elasticity between two points on a curve- using a mid-point between two curves.

Question-1: What can you say about the nature of the elasticity of demand, when price rises from Rs 10 to Rs 12 and QD falls from 50 units to 45 units?

a. Inelastic
b. Elastic
c. Unitary Elastic
d. Perfectly Inelastic

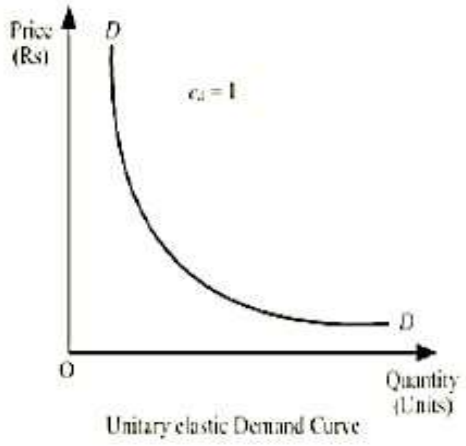
Ans: (b. Elastic)

Geometric / Point Method

Elasticity is measured at ***different points on a demand curve***. A demand curve can either be

Rectangular hyperbola or unitary elastic demand curve

Elasticity at every point along the demand curve is equal to 1

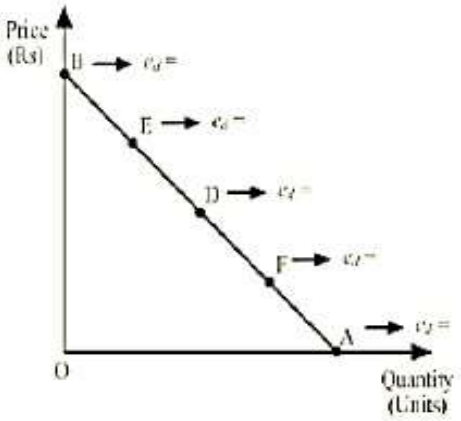


Unitary elastic Demand Curve

Straight line demand curve

Elasticity at any point on a demand curve is given by following formula

$$e_d = \frac{\text{Lower Segment (LS)}}{\text{Upper Segment (US)}}$$



Total Expenditure Method (Given by Marshall)

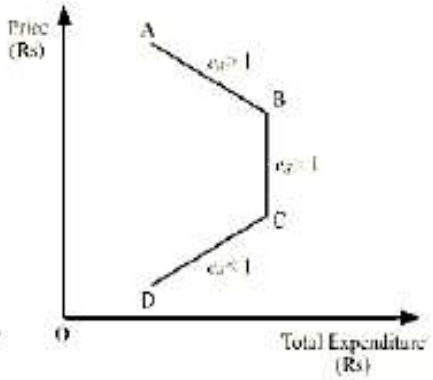
Examine how the ***total expenditure (TE)*** incurred on a good ***changes*** with a ***change*** in the ***price*** of the good.

Total Expenditure (*TE*) = Price (*P*) × Quantity Demanded (*Q*)

Situations of *TE*	Price	Total Expenditure (*TE*)	Elasticity
	$P\uparrow(\downarrow)$	*TE* remains *constant*	$e_d = 1$
	$P\uparrow(\downarrow)$	$TE\downarrow(\uparrow)$	$e_d > 1$
	$P\uparrow(\downarrow)$	$TE\uparrow(\downarrow)$	$e_d < 1$

Relationship between *TE* & Price

- $e_d > 1 \Rightarrow$ ***Negative relationship*** b/w *TE* & price
- $e_d < 1 \Rightarrow$ ***Positive relationship*** b/w *TE* & price
- $e_d = 1 \Rightarrow$ ***TE remains constant*** whether ***price rises or falls***



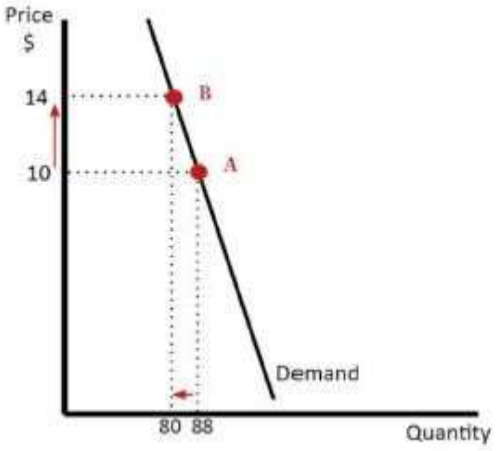
Arc-Elasticity Method

- It measures elasticity between two points on a curve- using a mid-point between two curves.

$$\text{Mid-Point Q} = \frac{(Q1+Q2)}{2}$$

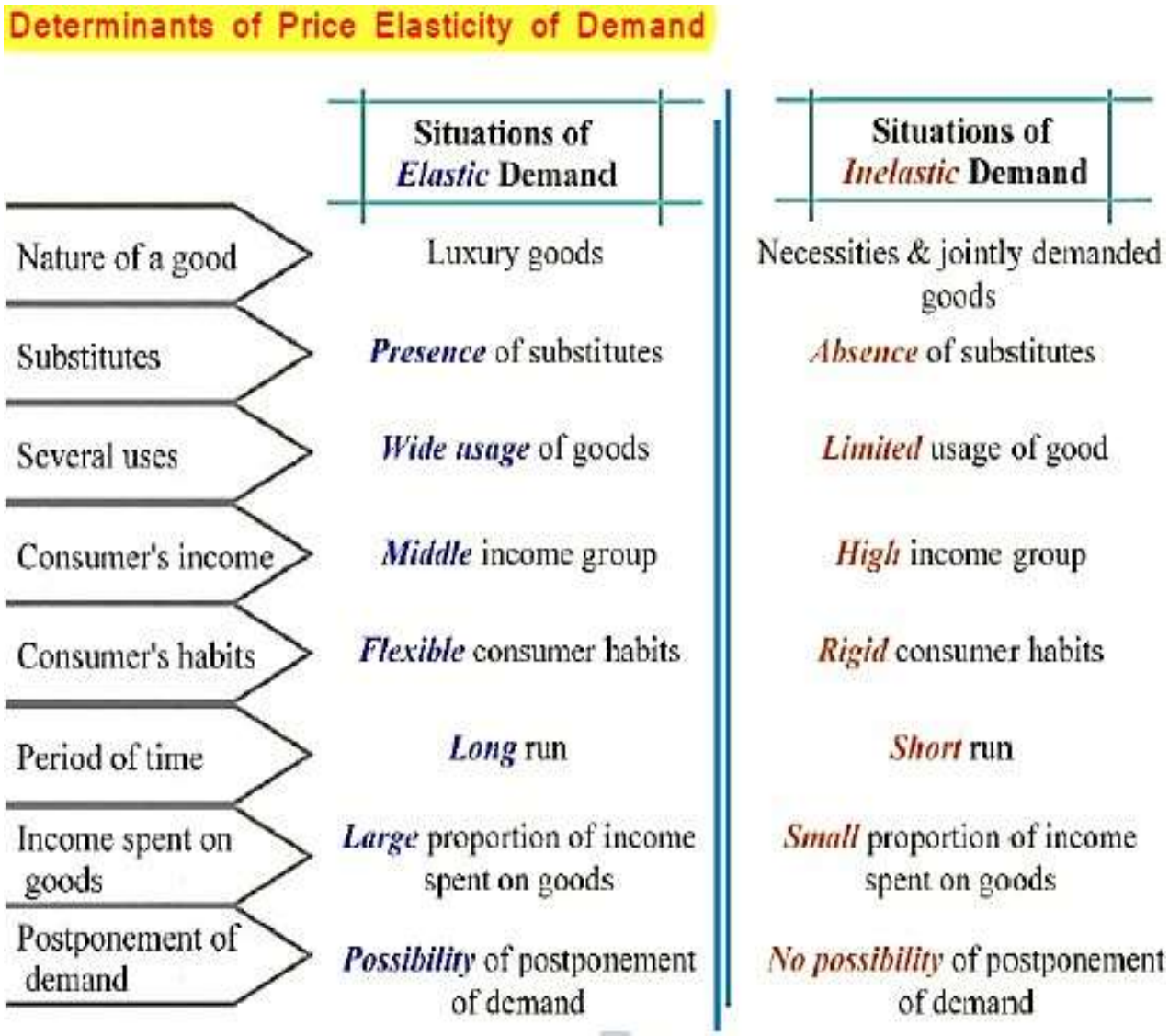
$$\text{Mid-Point P} = \frac{(P1+P2)}{2}$$

$$\text{Arc Elasticity of Demand} = \frac{\frac{(Q2-Q1)}{(Q1+Q2)}}{\frac{(P2-P1)}{(P1+P2)}}$$



Factors affecting price elasticity of demand

The elasticity of demand is different for different goods. Various factors which affect the elasticity of demand of a commodity are:



Income level

Elasticity for any commodity is generally less for higher-income groups in comparison to people with low incomes. It happens because rich people are not influenced much by changes in the price of the good, unlike poor people who have higher elasticity of demand.

Number of uses

If a commodity under consideration have several uses, its demand will be elastic. When the price of such a commodity increases, then it is generally put to only more urgent uses and as a result, its demand falls.

On the other hand, a commodity with no or few alternative uses has less elastic demand.

Habits

Commodities that have become habitual necessities for the consumer have less elastic demand. This is because the commodity has become a necessity for the consumer and he continues to buy it even in case of a price rise.

2. Cross elasticity of demand

It refers to the percentage change in quantity demanded of a commodity with respect to the percentage change in the price of a related good (substitute good or complementary good).

$$\text{Cross Elasticity of Demand} = \frac{\frac{\text{Change in quantity demanded of X}}{\text{Original quantity of X}} X100}{\frac{\text{Change in price of Y}}{\text{Original price of Y}} X\ 100}$$

$$E_c = \frac{\frac{\Delta Q_x}{Q_x}}{\frac{\Delta P_y}{P_y}} = \frac{\Delta Q_x}{Q_x} \times \frac{P_y}{\Delta P_y}$$

$$E_c = \frac{P_y}{Q_x} \times \frac{\Delta Q_x}{\Delta P_y}$$

Here P_y = Original price of good Y

ΔP_y = Change in price of good Y

Q_x = Original Quantity demanded

ΔQ_x = Change in the quantity demanded of X

Positive cross elasticity of demand (Substitute goods)

When an increase in the price of related product results in an increase in the demand

for the main product and vice versa, the cross elasticity of demand is said to be positive. Cross-elasticity of demand is positive in the case of substitute goods.

Negative cross elasticity of demand (Complementary goods)

When an increase in the price of related product results in a decrease in the demand for the main product and vice versa, the negative elasticity of demand is said to be negative. In complementary goods, the cross elasticity of goods is negative.

Zero cross elasticity of demand (Unrelated Goods)

When a proportionate change in the price of a related product does not bring any change in the demand for the main product.

3. Income elasticity

It refers to the percentage change in demand for a commodity with respect to the percentage change in the income of the consumer.

$$Ey = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in income}}$$

$$= \frac{\dfrac{\text{change in quantity demanded}}{\text{initial quantity demanded}} \times 100\%}{\dfrac{\text{change in income}}{\text{initial income}} \times 100\%}$$

$$= \frac{\dfrac{Q2 - Q1}{Q1}}{\dfrac{Y2 - Y1}{Y1}}$$

$$= \frac{\Delta Q}{\Delta Y} \times \frac{Y1}{Q1}$$

- Negative Income Elasticity (Inferior) (Ey<0): When demand for a product decreases as income increases [Y↑ → QD↓].
- Zero Income Elasticity (Necessity good) (Ey=0): When any change in income of the consumer has no effect on demand for a product. Ex-demand for Salt is zero income elastic. [Y↑ → QD is unchanged].
- Positive Income Elasticity (Normal good) (1>Ey>0): When an increase in the incomeof the consumer raises the demand for a product, then the good is a normal good. [Y ↑→ QD↑]

  • Very High Positive Income Elasticity (Luxury good) (Ey>1): When an increase in the income of the consumer raises the demand for a product, then the good is a normal-luxury good. Y ↑↑ → QD ↑↑

Question 3- For a demand function, p = 16 – q - 0.5q2, then the price elasticity of demand at q = 4 is

a. +0.5

b. +0.2

c. +0.7

d. +0.3.

Ans. (+ 0.2)

Elasticity of supply (Price elasticity)

Price elasticity of supply refers to degree of responsiveness of supply of a commodity with reference to change in the price of such a commodity.

Different commodities respond differently to a given change in price. Depending upon degree of responsiveness, there are different kinds of price elasticities of supply.

$$E_s = (+)\frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}$$

OR

$$E_s = (+)\frac{\Delta Q}{\Delta P} \times \frac{P_1}{Q_1}$$

where,

$\Delta Q = Q_2 - Q_1$ = Change in quantity supplied

$\Delta P = P_2 - P_1$ = Change in the price

P_1 = Initial price

P_2 = Final price

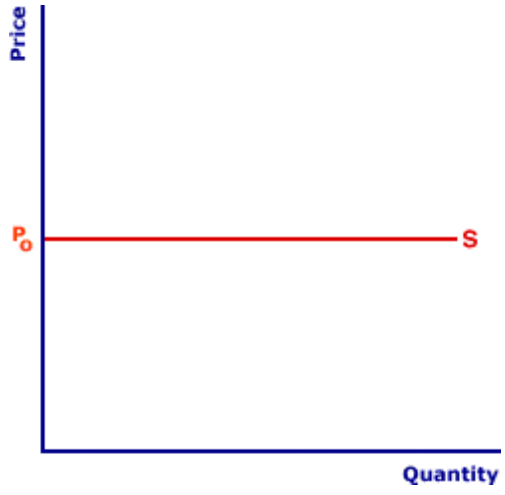
Q_1 = Initial quantity supplied

Q_2 = Final quantity supplied

1. Perfectly elastic supply

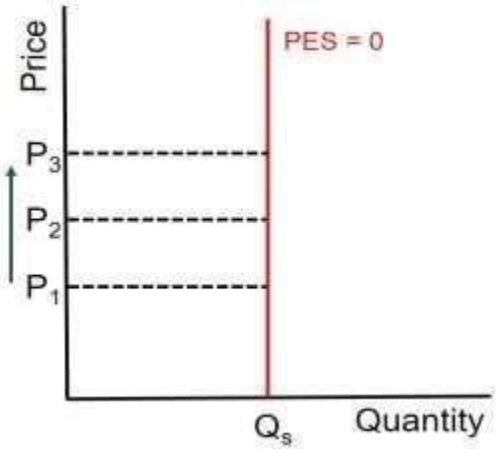
When there is infinite supply at a particular price and the supply becomes zero with a slight fall in price, then the supply is said to be perfectly elastic. In such cases, es = ∞ and the supply curve is a horizontal straight line parallel to X-axis.

In other words, there is no change in the price of the commodity.



2. Perfectly inelastic supply

When the supply does not change with change in price, then supply is said to be perfectly inelastic. In this case, es = 0 and the supply curve is a vertical straight line parallel to Y-axis.



In other words, there is no change in the quantity supplied.

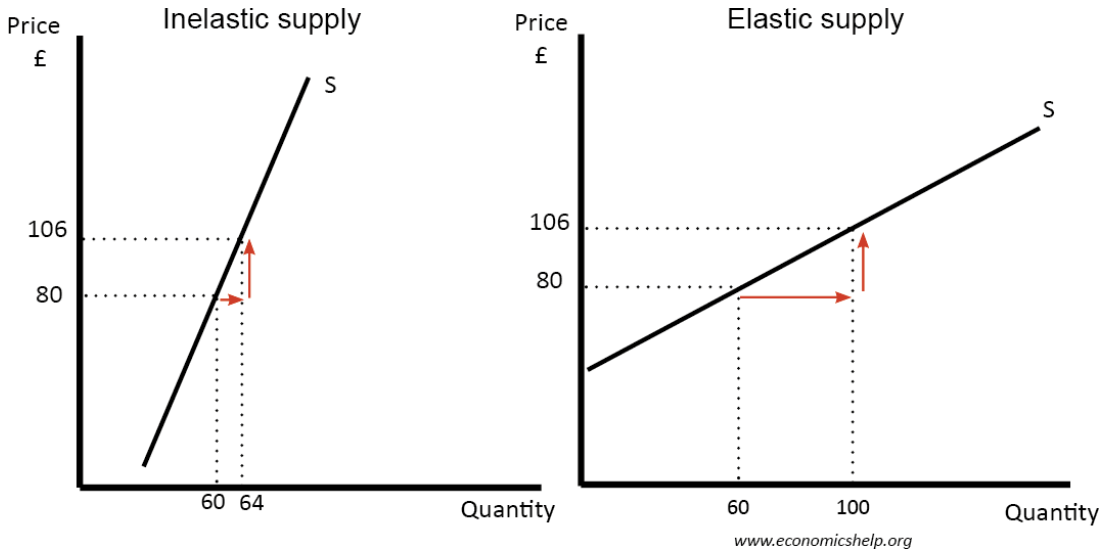
3. Highly elastic supply

When percentage change in supply is more than the percentage change in price, then supply of such a commodity is said to be highly elastic. In such case, es > 1 and supply curve has an intercept on Y-axis.

4. Less elastic supply

When percentage change in quantity supplied is less than the percentage change in price, then supply for such a commodity is said to be highly inelastic. In this case, es < 1 and the supply curve has an intercept on X-axis.

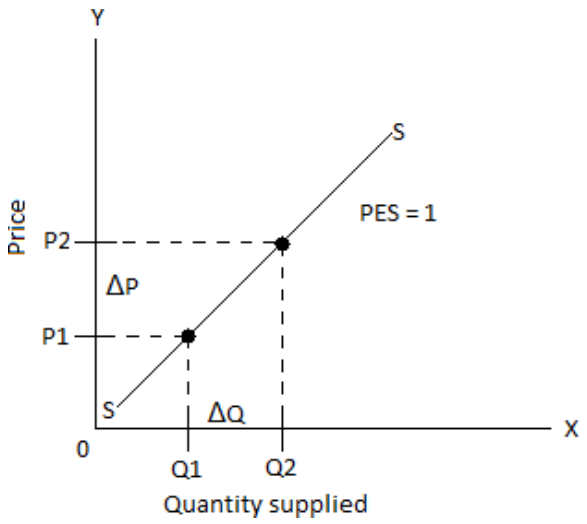
See the following figures for better understanding



5. Unitary elastic supply

When percentage change in quantity supplied is equal to percentage change in price, then supply is said to be unitary elastic and es = 1 in this case. The supply curve passes through the origin as a straight line in this case

Any straight line supply curve, passing through the origin has unitary elastic supply, irrespective of the angle it makes with the origin.



Note that, flatter is the supply curve, Higher is the elasticity.

Factors affecting Elasticity of Supply:

Commonly & easy available inputs ⇒ *Elastic supply*

Scarcely available inputs ⇒ *Inelastic supply*