


Consumer Economics L.2

Elasticity of Demand

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Elasticity of Demand

The law of demand explains that demand will change due to a change in the price of the commodity. But it does not explain the rate at which demand changes to a change in price. **The concept of elasticity of demand measures the rate of change in demand.**



The concept of elasticity of demand was introduced by **Alfred Marshall**. According to him “the elasticity of demand in a market is great/small according as the amount demanded increases much/little for a given fall in price, and diminishes much/little for a given rise in price”.

Types of Elasticity of Demand

There are three types of elasticity of demand:

1. **Price** elasticity of demand;
2. **Income** elasticity of demand; and
3. **Cross**-elasticity of demand

Price elasticity of demand

“The degree of responsiveness of quantity demanded to a change in price is called price elasticity of demand

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

Symbolically,

$$e_p = \frac{\Delta Q / Q}{\Delta P / P} = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$$

Δ - change
 P - price
 Q - quantity

Measurement of price elasticity of demand

Important methods for calculating price elasticity of demand are:

- 1) **Percentage** method
- 2) **Point** method or slope method
- 3) **Total outlay** method
- 4) **Arc** method

1. Percentage method

This is measured as the relative change in demand divided by relative change in price (or) percentage change in demand divided by percentage change in price

Formula is
$$e_p = \frac{\% \Delta q}{\% \Delta p}$$

For example,
the price of rice rises by 10% and the demand for rice falls
by 15%

Then $e_p = 15/10 = 1.5$

This **means that** the demand for rice is elastic.

And If the demand falls to 5% for a 10% rise in price, then
 $e_p = 5/10 = 0.5$. This means that the demand for rice is
inelastic.

There are five measures of elasticity:

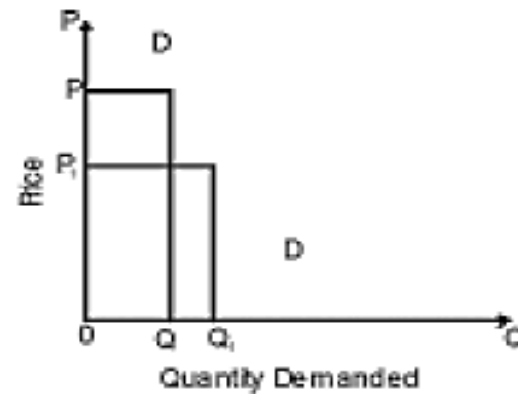
- a) **Elastic** demand, if the value of elasticity is **greater than 1**
- b) **Inelastic** demand, if the value of elasticity is **less than 1**
- c) **Unitary** elastic demand, if the value of elasticity is **equal to 1**.
- d) **Perfectly inelastic** demand, if the value of elasticity is **zero**.
- e) **Perfectly elastic** demand, if the value of elasticity is **infinity**.

Graphical illustration

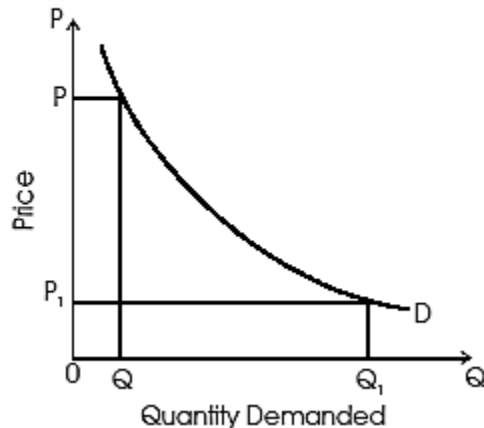
Elastic demand curve



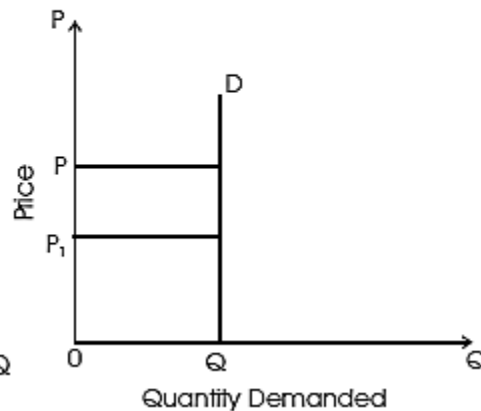
Inelastic demand curve



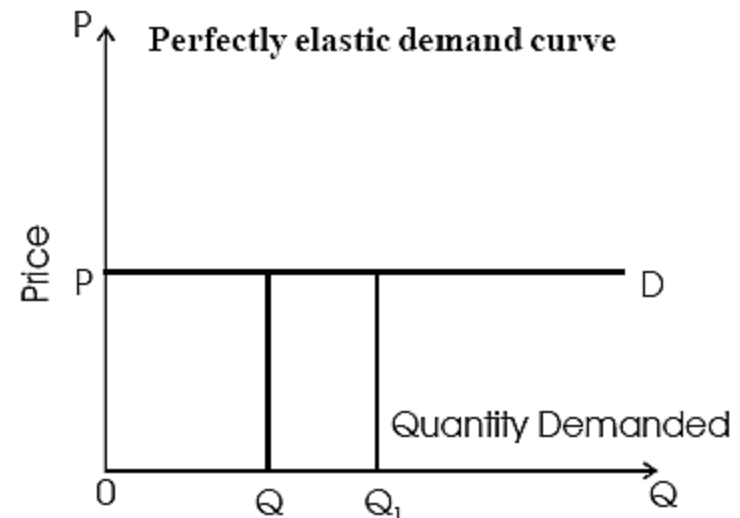
Unitary elastic demand curve



Perfectly inelastic demand curve



Perfectly elastic demand curve



Point method

We can calculate the price elasticity of demand at a point on the linear demand curve. Formula to find out E_p through point method is,

$$e_p = \frac{\text{Lower segment of the demand curve}}{\text{Upper segment of the demand curve}}$$

For example, in figure, the length of the demand curve AB is 4 cm

$$1) e_p \text{ at point e } e_p = \frac{EB}{EA} = \frac{2}{2} = 1 \therefore e_p = 1$$

2) e_p at point D = (middle point of EB portion of demand curve)

$$\frac{DB}{DA} = \frac{1}{3} = 0.3 \quad e_p < 1$$

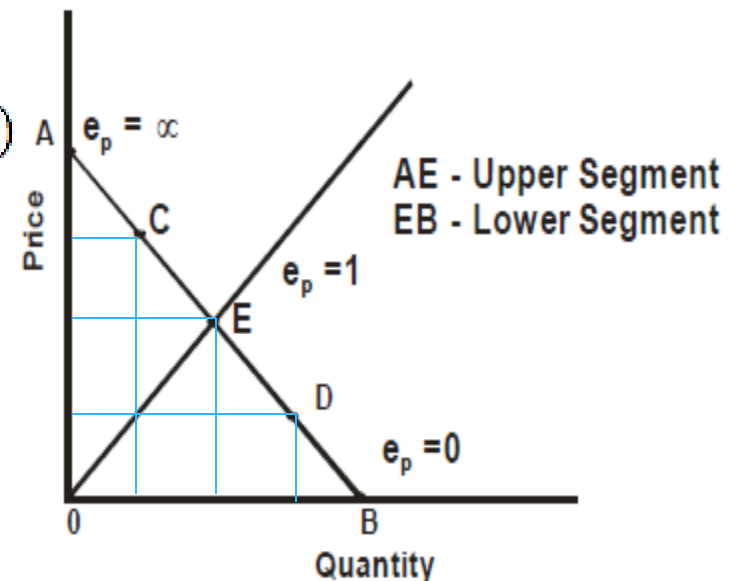
3) e_p at point c (middle point of EA portion of demand curve)

$$\therefore e_p = \frac{CB}{CA} = \frac{3}{1} = 3 \quad e_p > 1$$

$$4) e_p \text{ at point B} = \frac{0}{AB} = \frac{0}{4} = 0$$

(o by anything is zero, a mathematical principle) $\therefore e_p = 0$

$$5) e_p \text{ at point A} = \frac{AB}{0} = \frac{4}{0} = \infty$$



3. Total outlay method:

We can measure elasticity through a change in expenditure on commodities due to a change in price.

1. Demand is **elastic**, if total outlay or expenditure **increases** for a fall in price ($ep > 1$).
2. Demand is **inelastic**, if total outlay or expenditure **falls** for a fall in price ($ep < 1$).
3. Elasticity of demand is **unitary**, if total expenditure **does not change** for a fall in price ($ep = 1$).

The results are tabulated in Table

Changes in price	Types of elasticity of demand		
	$e_p = 1$	$e_p < 1$	$e_p > 1$
fall in price	Total outlay remains constant	Total outlay falls	Total outlay rises
rise in price	Total outlay remains constant	Total outlay rises	Total outlay falls

4) Arc method

Segment of a demand curve between two points is called an Arc. Arc elasticity is calculated from the following formula

$$\begin{aligned}E_p &= \frac{q_1 - q_2}{Q_1 + q_2} \div \frac{P_1 - P_2}{P_1 + P_2} \\&= \frac{\Delta q}{Q_1 + q_2} \div \frac{\Delta P}{P_1 + P_2} \\&= \frac{\Delta q}{Q_1 + q_2} \times \frac{P_1 + P_2}{\Delta P} \\&= \frac{\Delta q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + q_2}\end{aligned}$$

Where

ΔQ = change in quantity demanded

ΔP = change in price of the commodity

P_1 = original price

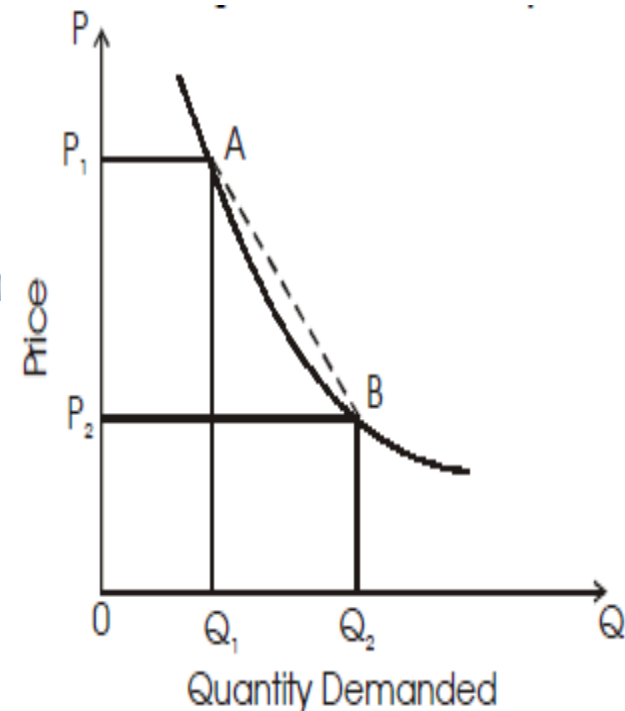
P_2 = New price

Q_1 = original quantity

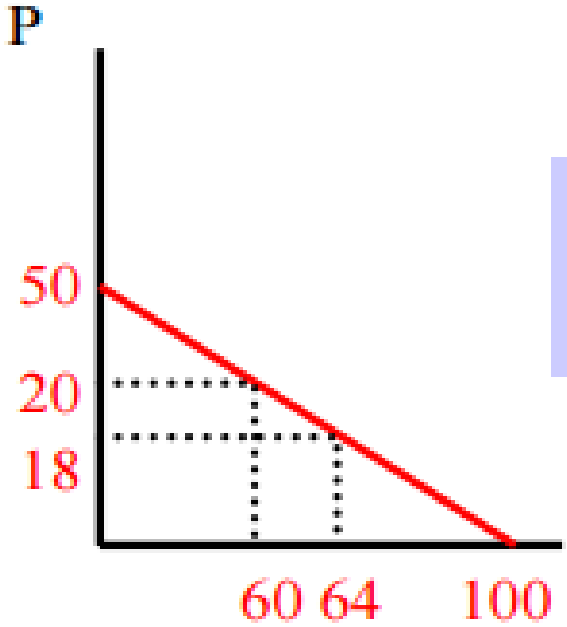
Q_2 = new quantity

Arc elasticity formula should be used when the change in price is somewhat large.

In figure, we can measure arc elasticity between points A and B on the demand curve; we will have to take the average prices of OP_1 and OP_2 and average of the two quantities demanded (original and the new).

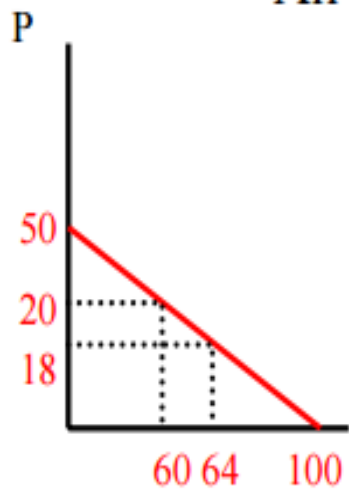


An Example



Compute the arc elasticity when P changes from 20 to 18

An Example



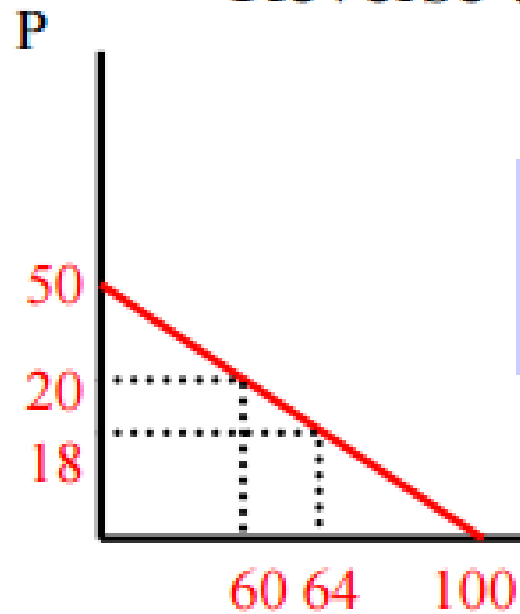
$$\eta = \frac{\frac{60 - 64}{(60 + 64)}}{\frac{20 - 18}{(20 + 18)}}$$

$$\eta = \frac{-\frac{4}{62}}{\frac{2}{19}}$$

$$\eta = \frac{\frac{60 - 64}{(60 + 64)}}{\frac{20 - 18}{(20 + 18)}}$$

$$\eta = -0.6129$$

Reverse the Calculation



Compute the arc elasticity when P changes from 18 to 20

Income elasticity of demand

Income elasticity of demand is the degree of responsiveness of demand to the change in income.

$$e_y = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Symbolically $e_y = \frac{\Delta q}{q} \div \frac{\Delta y}{y}$ where q and y stand for quantities demanded and income respectively.

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

Δ means change

Cross-elasticity of demand

Cross elasticity of demand is the ratio of percentage change in quantity demanded of a product to percentage change in price of another product.

Cross Elasticity of Demand $E_{A, B} = \frac{\% \text{ increase in quantity demanded of A}}{\% \text{ increase in price of product B}}$

$$E_{A, B} = \frac{Q_f - Q_i}{(Q_f + Q_i) \div 2} \div \frac{P_f - P_i}{(P_f + P_i) \div 2}$$

Where,

Q_f and Q_i are the final and initial quantities demanded of product A, respectively; and P_f and P_i are the final and initial prices of product B.

Cross elasticity of demand indicates whether any two products are substitute goods, complementary goods or independent goods.

Infinity - Commodity x is nearly a **perfect substitute** for commodity y

Zero - Commodities x and y are **not related**.

Negative - Commodities x and y are **complementary**.

Positive - Commodities x and y are **substitutes**

Example:

The quantity demanded of product A has increased by 12% in response to a 15% increase in price of product B.

Calculate the cross elasticity of demand and tell whether the product pair is

(a) apples and oranges, or

(b) cars and gas.

Cross elasticity of demand = % change in quantity demanded of A ÷ % change in price of B
= 12%/15% = 0.67.

Since the cross elasticity of demand is **positive**, product A and B are **substitute** goods. They are most likely apples and oranges.

Factors determining elasticity of demand

The elasticity of demand depends on

1. nature of the commodity,
2. uses of commodity,
3. existence of substitutes,
4. postponement of demand,
5. amount of money spent,
6. habits and
7. range of prices of commodity.

Importance of Elasticity of demand

- 1. Price discrimination**
- 2. Levy of taxes**
- 3. International Trade**
- 4. Determination of volume of output**
- 5. Fixation of wages for labourers**
- 6. Poverty in the midst of plenty**

Price discrimination ([Video](#))

If the demand for a product has different elasticities in different markets, then the monopolist can fix different prices in different markets.

This price discrimination is possible due to different price elasticities.

http://www.economicsonline.co.uk/Business_economics/Price_discrimination.html



Levy of taxes

The government will get higher revenue if tax is increased on goods having inelastic demand.

Conversely, the government, will get lower revenue if tax is increased on goods having elastic demand.



International Trade

Terms of trade refer to the rate at which domestic commodities are exchanged for foreign commodities. The terms of trade will be favorable to a country if its exports enjoy inelastic demand in the world market.



Determination of volume of output

Volume of goods and services must be produced in accordance with the demand for the commodity.

When the demand is inelastic, the producer will produce more goods to take the advantage of higher prices. Hence the nature of elastic and inelastic demand helps in the determination of the volume of output.



Fixation of wages for labourers

If the demand for workers is inelastic, efforts of trade unions to raise wages of the workers will be successful. On the other hand, if the demand for labour is elastic, they may not succeed in increasing the wage rate by trade union activity.

Poverty in the midst of plenty

The concept of elasticity of demand explains the paradox of poverty i.e. poverty in the midst of plenty. For example, bumper crop of food grains should bring agricultural prosperity but if the demand for food grains is inelastic, the agriculturist will be the loser if low price is paid.



thanks