30 July 2023 07:33 PM

Elasticity of Demand (Revision)

1 Own Price Elasticity of Demand |ep|

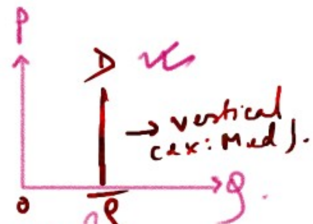
→ It is the % change in quantity demanded (Q) due to the % change in price (P).

$$e_p = \frac{\text{\% change in Quantity Demand } Q}{\text{\% change in Price } (P)}$$

$$e_p = \frac{\frac{Q_1 - Q_0}{Q_0} \cancel{\times 100}}{\frac{P_1 - P_0}{P_0} \cancel{\times 100}} = \frac{\frac{\Delta Q}{Q_0}}{\frac{\Delta P}{P_0}} = \frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0}$$

$$\boxed{e_p = \frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0}}$$

Case 1: $e_p = 0$ (perfectly inelastic demand)



$\frac{\Delta Q}{\Delta P} = 0$

→ $\Delta Q = 0$ (quantity demand remains unchanged for any change in price)

→ demand curve is vertical.

Case 2: $0 < |e_p| < 1$ → inelastic → demand is steeper.

→ $\frac{\text{\% change in } Q}{\text{\% change in } P} < 1$

→ % change in Q < % change in P

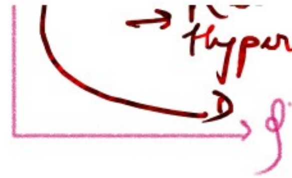
for 1% change in P, Q changes by less than 1% → less responsive to price change.

Case 3: $|e_p| = 1$ → unit elastic → Rectangular Hyperbola.

$\frac{\text{\% change in } Q}{\text{\% change in } P} = 1$

% change in Q = % change in P

or, % change in Q = % change in P
(equal change in Q and P)



Case 4: $|e_p| > 1 \Rightarrow$ Elastic $\Rightarrow$ Demand is responsive to price change

$$\frac{\%\text{ change in } Q}{\%\text{ change in } P} > 1$$

or, % change in Q > % change in P
(for 1% change in P, Quantity (Q) changes by more than 1%)
$\Rightarrow$ demand is flatter.

Case 5: $|e_p| \to \infty$ (perfectly elastic demand)

$$\frac{\Delta Q}{\Delta P} \to \infty$$

$\Rightarrow \Delta P \to 0 \Rightarrow$ for a negligible change in price, there is a drastic change in Q. $\Rightarrow$ Demand curve is horizontal.

Q1 Suppose that the quantity demanded of a good rises from 200 to 300 units when the price falls from ₹10 to ₹6. Calculate the own price elasticity of demand.

Solution:

$Q_0 = 200$ units and $P_0 = ₹10$

$Q_1 = 300$ units and $P_1 = ₹6$ $\quad e_p = \frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0}$

$\therefore \Delta Q = Q_1 - Q_0 = 300 - 200 = 100$

$\Delta P = P_1 - P_0 = 6 - 10 = -4$

$\therefore e_p = \frac{100}{-4} \times \frac{10}{200} = -\frac{5}{4} = -1.25$

or $|e_p| = 1.25$ units

$|e_p| > 1 \Rightarrow$ elastic

or $|e_p|$ ...

$|e_p| > 1 \Rightarrow$ elastic demand.

Income Elasticity of Demand:

$$e_m = \frac{\%\text{ change in Quantity Demand (Q)}}{\%\text{ change in income (M)}}$$

$$= \frac{\frac{Q_1 - Q_0}{Q_0} \times \cancel{100}}{\frac{M_1 - M_0}{M_0} \cancel{\times 100}} = \frac{\Delta Q}{\Delta M} \times \frac{M_0}{Q_0}$$

income elasticity, $\boxed{e_m = \frac{\Delta Q}{\Delta M} \times \frac{M_0}{Q_0}}$

Q2 The av... e income in an area increases from ₹ 40,000 to ₹ 44,000. Sales of fish increases by 20%. Calculate the income elasticity of demand.

Solution:

$M_0 =$ ₹ 40,000

$M_1 =$ ₹ 44,000

$\therefore$ change in income $= M_1 - M_0 = 44{,}000 - 40{,}000$

$\Delta M = 4000$

$\therefore$ The percentage change in income $= \frac{\Delta M}{M_0} \times 100 = \frac{4000}{40{,}000} \times 100$

$= \frac{40}{4}\%$

$= 10\%$

change in sales $= 20\%$

$$\therefore e_m = \frac{\%\text{ change in quantity demand}}{\%\text{ change in income}}$$

$\therefore\ e_m = \dfrac{\text{\% change in demand}}{\text{\% change in income}}$

$e_m = \dfrac{20\%}{10\%} \Rightarrow e_m = 2 > 0\ (+ve)$

elastic.

Classification of goods on the basis of income elasticity

1.	Essential Goods	$e_m < 1$	less than proportionate change in sales
2.	Comforts	$e_m = 1$	equal change in sales
3.	Luxuries	$e_m > 1$	more than proportionate change in sales.
4.	Normal Goods (↑se in demand with ↑se in income)	$e_m > 0$	
5.	Inferior Goods (↑se in money, demand decreases)	$e_m < 0$	

(3) Cross Price elasticity of Demand ($E_c^{x,y}$)

⇒ % change in quantity demand of a product X due to % change in price of another product Y.

$$e_c^{x,y} = \frac{\text{\% change in demand for } X}{\text{\% change in price of } Y}$$

$$= \frac{\frac{X_1 - X_0}{X_0} \times 100}{P_y' - P_y^0 \ \ldots}$$

$$= \frac{\frac{X_1 - X_0}{X_0} \times 100}{\frac{P_y' - P_y^0}{P_y^0} \times 100}$$

$$\boxed{e_c^{x,y}} = \frac{\frac{\Delta X}{X_0}}{\frac{\Delta P_y}{P_y^0}} = \boxed{\frac{\Delta X}{\Delta P_y} \times \frac{P_y^0}{X_0}}$$

(1) Substitute Goods ⇒ Replace demand with cheaper good.

ie $\downarrow X$ $Y\uparrow$

$\uparrow P_x^0$ $\xleftrightarrow{\text{+vely related}}$ $Y\uparrow$

P_y const

change in demand for X is +vely related to change in price of Y

ie $\frac{\Delta X}{\Delta P_y} > 0$

$\therefore e_c^{x,y} > 0$ ie cross price elasticity is +ve for substitute goods.

Ex: what is the cross price elasticity of tea & coffee

(a) +ve (b) −ve (c) 0 (d) both (a) & (b)

(b) Complimentary goods ⇒ those goods which are consumed together.

$X\downarrow$ $Y\downarrow$

P_x' $P_y \uparrow$

-vely related

$\frac{\Delta X}{\Delta P_y} < 0$

ie $e_c^{x,y} < 0$

∴ cross price

Constant

ie e_c < 0

$\therefore$ cross price elasticity is negative for complimentary goods

(c) If two goods are not related

$\Rightarrow$ cross price elasticity is zero.

Arc - elasticity of Demand

$$\text{Arc elasticity of demand} = \frac{\dfrac{Q_1 - Q_0}{(Q_1 + Q_0)/2}}{\dfrac{P_1 - P_0}{(P_1 + P_0)/2}}$$

$$= \frac{\left[\dfrac{Q_1 - Q_0}{Q_1 + Q_0}\right]}{\left[\dfrac{P_1 - P_0}{P_1 + P_0}\right]}$$

$$\text{ie Arc elasticity} = \left(\frac{Q_1 - Q_0}{Q_1 + Q_0}\right) \times \left(\frac{P_1 + P_0}{P_1 - P_0}\right)$$

Q: When the price of a good falls from ₹10 to ₹8 per unit, quantity demanded increases from 1250 to 1750 units. Calculate the price elasticity of demand.

$P_0 = ₹10$ $\quad P_1 = ₹8$

$Q_0 = 1250$ units $\quad Q_1 = 1750$ units

Change in price, $\Delta P = P_1 - P_0$
$= 8 - 10$
$\Delta P = -2$

Change in Quantity, $\Delta Q = Q_1 - Q_0$
$= 1750 - 1250$
$\Delta Q = 500$

Q: Assume that the absolute value of

=1750 − 1250

$\Delta q = 500$

Ex: Assume that the absolute value of price elasticity of demand for a commodity is one (unity).
When the price of is ₹4, the demand is 300 units. What amount will be demanded if price falls to ₹3?

$$\therefore e_p = \frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0} = \frac{2500}{-2} \times \frac{10}{1250} = -2$$

$$\frac{\Delta Q}{\Delta P} \times \frac{P_0}{Q_0} = \frac{500}{-2} \times \frac{10}{125} = -2 \text{ (ans)}$$

We are given: $\varepsilon_p = -1$, $P_0 = 4$, $x_0 = 300$

$P_1 = 3$ $x_1 = ?$

$$\varepsilon_p = \left(\frac{x_1 - x_0}{P_1 - P_0}\right) \times \frac{P_0}{x_0}$$

$$-1 = \left(\frac{x_1 - 300}{3-4}\right) \times \frac{4}{300}$$

$$-1 = \frac{(x_1 - 300) \times 4}{-300}$$

$$-1 = \frac{4x_1 - 1200}{-300}$$

or, $+300 = 4x_1 - 1200$

or, $4x_1 = 1200 + 300$

or, $4x_1 = 1500$

or $x_1 = \frac{1500}{4} = 375$ units

$$\boxed{x_1 = 375 \text{ units}}$$

$Qd_1 = 375$ units

Ex: A rise in the price of Tea (T) from ₹50 to ₹54 has resulted in the demand for coffee (C) increasing from 100 to 104 units per month. The cross price elasticity is (a) 0.2 (b) 0.5 (c) 1.0 (d) 2.00

P^T : $P_0^T = 50$ $P_1^T = 54$

Q^C : $Q_0^C = 100$ $Q_1^C = 104$

$\Delta P^T = 54 - 50 = 4$

$\Delta Q^C = 104 - 100 = 4$

$\therefore e_C = \frac{\Delta Q^C}{\Delta P^T} \times \frac{P_0^T}{Q_0^C}$

$e_C = \frac{4}{4} \times \frac{50}{100}$

$= 0.5$ (ans)

Ex: If elasticity of demand is zero, then demand curve will be?

(a) Parallel to x-axis
(b) Parallel to Y-axis
(c) upward sloping
(d) Downward sloping.

Ex: When the demand curve is rectangular hyperbola, it represents:

(a) perfect elastic
(b) perfect inelastic
(c) unit elastic
(d) None.

Ex: A shift in the demand curve to the left may be caused by -

(demand ↓ → shift left)

Ex

may be caused by-

(a) fall in income (demand decrease -> shift left)

×(b) fall in number of substitute goods

×(c) fall in supply

×(d) fall in price of complimentary goods.

Ex: Consider the following statement:

At the point of equality between avg product and marginal product, average product is

1. max 2. min 3. const 4. rising

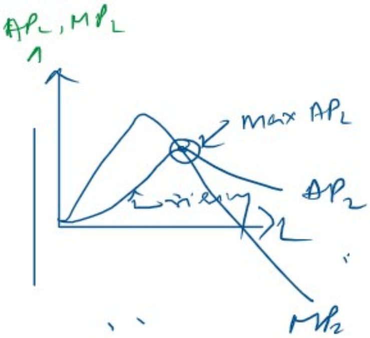
which of the above statement is true?

(a) 1 and 4

(b) 2 and 4

(c) 1 and 3

(d) 2 and 3



Ex: What is the shape of Avg fixed cost (AFC)?

Ex: A firms Negrage total cost is ₹60

its avg variable cost is ₹55.

it's avg variable cost is ₹55.

it's output = 50 units

What is total fixed cost.

$\frac{TC}{Q} = \frac{TVC}{Q} + \frac{TFC}{Q}$

$AC = 60$, $AVC = 55$, $Q = 50$

$TFC = ?$

$AC = AVC + AFC$

$60 = 55 + AFC$

$AFC = 60 - 55$

$AFC = 5$

$\frac{TFC}{Q} = 5$

or, $TFC = 5 \times Q = 5 \times 50 = 250$ units.