

Cross Elasticity of Demand

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Cross Elasticity of Demand

Definition

It is the ratio of proportionate change in the quantity demanded of Y to a given proportionate change in the price of the related commodity X.

It is a measure of relative change in the quantity demanded of a commodity due to a change in the price of its substitute/complement. It can be expressed as:

$$C_e = \frac{\text{proportionate change in the quantity demanded of Y}}{\text{Proportionate change in the price of X}}$$

Cross Elasticity of Demand

- Cross elasticity may be infinite or zero if the slightest change in the price of X causes a substantial change in the quantity demanded of Y.
- It is always the case with goods which have perfect substitutes for one another.
- Cross elasticity is zero, if a change in the price of one commodity will not affect the quantity demanded of the other.
- In the case of goods which are not related to each other, cross elasticity of demand is zero

Cross Elasticity of Demand

Definition:

The cross elasticity of demand is the proportional change in the quantity of X good demanded resulting from a given relative change in the price of a related good Y

The cross elasticity of demand is a measure of the responsiveness of purchases of Y to change in the price of X

Cross Elasticity of Demand - Types

1. Positive:

When goods are substitute of each other then cross elasticity of demand is positive. In other words, when an increase in the price of Y leads to an increase in the demand of X. For instance, with the increase in price of tea, demand of coffee will increase.

2. Negative:

In case of complementary goods, cross elasticity of demand is negative. A proportionate increase in price of one commodity leads to a proportionate fall in the demand of another commodity because both are demanded jointly.

3. Zero:

Cross elasticity of demand is zero when two goods are not related to each other. For instance, increase in price of car does not effect the demand of cloth

Measurement of Cross Elasticity of Demand

Measurement of Cross Elasticity of Demand:

$$\begin{aligned} EC &= \frac{\text{Percentage change in quantity demanded of Good - X}}{\text{Percentage change in the price of Good - Y}} \\ &= \frac{\frac{\text{Change in quantity demanded of X}}{\text{Original Quantity of X}}}{\frac{\text{Change in Price of Y}}{\text{Original Price of Y}}} \times 100 \\ &= \frac{\frac{\Delta Q_x}{Q_x}}{\frac{\Delta P_y}{P_y}} = \frac{\Delta Q_x}{Q_x} \times \frac{P_y}{\Delta P_y} \end{aligned}$$

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

Where

P_y = Original price of good-Y

ΔP_y = Change in price of good-Y

Q_x = Original quantity demanded of X

ΔQ_x = Change in the quantity demanded of X

Cross Elasticity of Demand

Significance of Cross Elasticity of Demand:

- The study of the concept cross elasticity of demand plays a major role in forecasting the effect of change in the price of a good on the demand of its substitutes and complementary goods.
- Therefore, it helps in deciding the price of a good by determining the change in the demand of its substitutes and complementary goods.

Cross Elasticity of Demand

Significance of Cross Elasticity of Demand:

- Apart from this, cross elasticity of demand helps in determining the nature of relationship between two goods whether they are substitutes, complementary to each other or totally different from each other.
- In addition, it also enables an organization to anticipate the intensity of monopoly and extent and type of competition in the market.

Cross Elasticity of Demand

Examples

1. In simple terms, cross elasticity would be positive for substitutes. For example, the quantity demanded for coffee has increased from 500 units to 550 units with increase in the price of tea from Rs. 8 to Rs. 10. Calculate the cross elasticity of demand and state the type of relationship between coffee (X) and tea(Y).

Solution:

$$Q_{X1} = 550 \text{ units}$$

$$Q_X = 500 \text{ units}$$

$$P_{Y1} = \text{Rs. } 10$$

$$P_Y = \text{Rs. } 8$$

$$\text{Therefore, } \Delta Q_X = Q_{X1} - Q_X = 550 - 500 = 50 \text{ units}$$

$$\text{Similarly, } \Delta P_Y = P_{Y1} - P_Y = \text{Rs. } 2$$

$$\text{Now } E_c = 50 / 2 \times 8 / 500 = 0.4$$

The cross elasticity of “demand is positive; therefore, X and Y are substitutes.

Cross Elasticity of Demand

Examples

2. The cross elasticity of demand would be negative for complementary goods. For example, the quantity demanded for X decreases from 220 to 200 units with the rise in prices of Y from Rs. 10 to 12.

solution

$$Q_{X1} = 200 \text{ units}$$

$$Q_X = 220 \text{ units}$$

$$P_{Y1} = \text{Rs. } 12$$

$$P_Y = \text{Rs. } 10$$

$$\text{Therefore, } \Delta Q_X = Q_{X1} - Q_X = 200 - 220 = -20 \text{ units}$$

$$\text{Similarly, } \Delta P_Y = P_{Y1} - P_Y = \text{Rs. } 12 - \text{Rs. } 10 = \text{Rs. } 2$$

$$\text{Now } E_c = -20 / 2 \times 12 / 200 = -0.6$$

The cross elasticity of demand is negative; therefore, X and Y are complementary to each other.

Cross Elasticity of Demand

Examples

3. 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 apples and oranges.

Cross Elasticity of Demand

Examples

4. The Company producing torches and batteries is analyzing the cross-price elasticity of the two goods. The demand for torches was 10,000 when the price of batteries was Rs. 10 and the demand rose to 15,000 when the price of batteries was reduced to Rs. 8.

Solution-

Percentage change in quantity of torches

$$= (15000 - 10000)/(15000 + 10000)/2 = 5000/12500 = 40\%$$

Percentage change in price of batteries

$$= (8 - 10)/(10 + 8)/2 = -2/9 = -22.22\%$$

$$\text{Now } E_c = 40\%/-22.22\% = -1.8$$

Since the cross-price elasticity of demand of torches and batteries is negative, thus these two are complementary goods.