

Elasticities
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Elasticities help us answer questions about the direction and the size of change of economic variables. We have: price elasticity of demand, income elasticity of demand, cross price elasticity.

Price elasticity of demand It is a measure of how sensitive demand is to percentage changes in price. PED tells us the percentage change in quantity demanded for a 1% change in price.

$$PED = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \frac{P}{Q} = \frac{1}{\text{slope}} \frac{P}{Q}$$

A high elasticity means that quantity is very sensitive to price changes. That is, a 1% change in price will induce a >1% change in quantity demanded. A low elasticity means that quantity demanded is not sensitive to price changes. That is, a 1% change in price will effect in a <1% change in quantity demanded. NO UNITS. ALWAYS NEGATIVE IF DEMAND DECREASING.

Calculating PED. Consider two points on the demand curve for rice: $P = 4, Q = 100\text{lbs}$; $P = 2, Q = 400\text{lbs}$. Calculate elasticity using the midpoint formula

$$PED = \frac{\left(\frac{400-100}{1/2(400+100)}\right)}{\left(\frac{4-2}{1/2(4+2)}\right)} = \left(\frac{300}{250}\right) / \left(\frac{2}{3}\right) = 1.8$$

Interpretation: a 1% increase in price causes a 1.8% decrease in quantity demanded. What determines PED?

- availability of close substitutes
- tastes
- importance in buyers budget
- time horizon: short run/long run

Example.

Take demand given by $P = 36 - Q$. Using the point formula, calculate PED at prices equal to:

- 35 : $Q = 1, PED = \text{slope} \frac{P}{Q} = -1 \frac{35}{1} = -35$
- 18 : $Q = 18, PED = -1$
- 3 : $Q = 33, PED = -\frac{3}{33} = -\frac{1}{11}$.

Why do we care about PED?

Look at Total Expenditure, $TE = PQ$.

$$\frac{\Delta TE}{TE} = \frac{\Delta P}{P} + \frac{\Delta Q}{Q} = \frac{\Delta P}{P} \left(1 + \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}}\right) = \frac{\Delta P}{P} (1 + PED) = \frac{\Delta P}{P} (1 - |PED|).$$

Income elasticity of demand Income is a non-price factor that can shift the demand curve. IED tells us what's the percentage change in demand caused by a 1% increase in income. We will use only the midpoint formula.

$$IED = \frac{\frac{\Delta Q}{\frac{1}{2}(Q_{old}+Q_{new})}}{\frac{\Delta I}{\frac{1}{2}(I_{old}+I_{new})}}$$

Depending on income elasticity of demand, we classify goods as: normal goods, inferior good, luxury goods, necessities.

$IED \geq 0$ then normal. cars, computers,...

$IED < 0$ then inferior. spam, ramen soups,...

$IED > 1$ then luxury. jewelry

$|IED| \leq 1$ then necessity. water

Cross price elasticity The price of other goods influences the position of the demand curve. CPE tells us how much the quantity demanded of good 1 changes as a result of a 1% change in price of good 2. Again, we will use only the midpoint formula:

$$CPE = \frac{\frac{\Delta Q_1}{\frac{1}{2}(Q_{1old}+Q_{1new})}}{\frac{\Delta P_2}{\frac{1}{2}(P_{2old}+P_{2new})}}$$

If $CPE < 0$ then the two goods are complements: cars and gasoline; peanut butter & jelly.

If $CPE > 0$ then the two goods are substitutes: glasses and contacts.

If $CPE = 0$ then the two goods are unrelated: hot-dogs and sailboats.