

Principles of Microeconomics

ECON202

Elasticity

Elasticity is a tool that is used to describe the relationship between two variables. It is defined as the percentage change in a dependent variable "caused" by a percentage change in an independent variable.

$$\text{Elasticity} = \frac{\% \Delta \text{ in a dependent variable}}{\% \Delta \text{ in an independent variable}}$$

While elasticity can be calculated and used for any two related variables there are four basic coefficients of elasticity used in principles of economics

- **"Own" price elasticity of demand** This is a measure of the percentage change in the quantity demanded "caused" by a percentage change in price. Because the demand function is an inverse relationship between price and quantity the coefficient of price elasticity will always be negative:

$$\text{Price elasticity of demand} = \frac{\% \text{ change in Quantity Demanded}}{\% \text{ change in price}}$$

- **Income elasticity**. It is used to describe how a change in buyers' income shifts the demand function for a good

$$\text{Income Elasticity} = \frac{\% \text{ change in Demand}}{\% \text{ change in Income}}$$

- **Cross elasticity** is a measure of the responsiveness of buyers of a good to changes in the prices of related goods.

$$\text{Cross elasticity} = \frac{\% \text{ change in the demand for good X}}{\% \text{ change in the price of good Y}}$$

- **Elasticity of Supply** is a measure of the responsiveness of sellers to changes in the price of a good.

$$\text{Elasticity of supply} = \frac{\% \text{ change in Quantity supplied}}{\% \text{ change in price}}$$

"Own" price elasticity of demand

The price elasticity of demand can be calculated at a specific price and quantity. This is called the point price elasticity and is different at every price. To calculate point price elasticity use the formula

$$\text{Point price elasticity} = E_P \text{ or } \varepsilon_P = \frac{\Delta Q}{\Delta P} * \frac{P_1}{Q_1}$$

$\frac{\Delta Q}{\Delta P}$ is the slope of the demand function

P_1 is the original price

Q_1 is the original quantity

The average price elasticity can be calculated between two price-quantity combinations. The average or "Arc" elasticity is calculated by the formula

$$E_P = \frac{\Delta Q}{\Delta P} * \frac{P_1 + P_2}{Q_1 + Q_2}$$

$\frac{\Delta Q}{\Delta P}$ is the slope of the demand function

P_1 is the original price, P_2 is the new price

Q_1 is the original quantity, Q_2 is the new quantity

Questions and Exercises

Given the demand function $Q = 24 - 1.5P$

1. Construct the demand function on the graph.
2. Calculate the point price elasticity at a price of \$14

$$E_p = (\Delta Q / \Delta P) * (P / Q) = (-1.5) * (14 / 3) = (-1.5) * (4.667) = -7.001$$

3. Calculate the point price elasticity at a price of \$8

$$E_p = (\Delta Q / \Delta P) * (P / Q) = (-1.5) * (8 / 12) = (-1.5) * (.667) = -1$$

4. Calculate the point price elasticity at a price of \$5

$$E_p = (\Delta Q / \Delta P) * (P / Q) = (-1.5) * (5 / 16.5) = (-1.5) * (.303) = -.455$$

5. Calculate the arc elasticity between \$8 and \$14

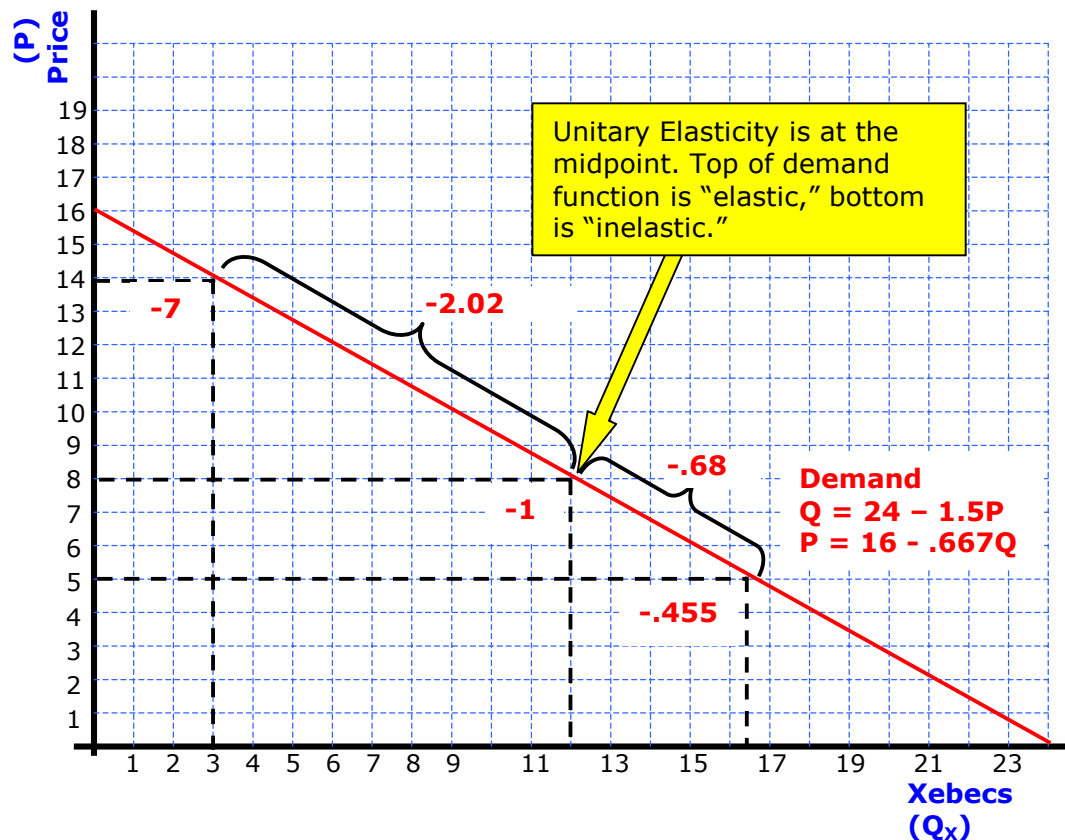
$$E_p = (\Delta Q / \Delta P) * (\Sigma P / \Sigma Q) = (-1.5) * (22 / 15) = (-1.5) * (1.467) = -2.2$$

6. Calculate the arc elasticity between \$5 and \$8

$$E_p = (\Delta Q / \Delta P) * (\Sigma P / \Sigma Q) = (-1.5) * (13 / 28.5) = (-1.5) * (.456) = -.684$$

7. Calculate the arc elasticity between \$5 and \$14

$$E_p = (\Delta Q / \Delta P) * (\Sigma P / \Sigma Q) = -1.462$$



An application of price elasticity of demand.

If the quantity demanded for milk were 100 units and the price elasticity of demand for milk was -.6 If the price of milk increased by 8%, how much would the quantity demanded change? Note, this does not imply equilibrium

$$E_p = \frac{\% \Delta Q}{\% \Delta P} = - .6 \frac{\% \Delta Q}{+ 8\%} \text{ so solving for } \% \Delta Q, (8\%)(-.6) = \% \Delta Q = - 4.8\%$$

An 8% increase in price will reduce the quantity demanded by 4.8%

Calculate the values for the values for the demand function in Table 1.

Table 1 Demand Function $Q_x = 120 - 5P_x$					
Price (P_x)	Quan (Q_x)	TR	E_p	AR	MR
\$25.00					
\$24.00	0.0	\$0.00	#DIV/0!	#DIV/0!	
\$23.00	5.0	\$115.00	-23	\$23	\$23
\$22.00	10.0	\$220.00	-11	\$22	\$21
\$21.00	15.0	\$315.00	-7	\$21	\$19
\$20.00	20.0	\$400.00	-5	\$20	\$17
\$19.00	25.0	\$475.00	-3.8	\$19	\$15
\$18.00	30.0	\$540.00	-3	\$18	\$13
\$17.00	35.0	\$595.00	-2.429	\$17	\$11
\$16.00	40.0	\$640.00	-2	\$16	\$9
\$15.00	45.0	\$675.00	-1.667	\$15	\$7
\$14.00	50.0	\$700.00	-1.4	\$14	\$5
\$13.00	55.0	\$715.00	-1.182	\$13	\$3
\$12.00	60.0	\$720.00	-1	\$12	\$1
\$11.00	65.0	\$715.00	-0.846	\$11	-\$1
\$10.00	70.0	\$700.00	-0.714	\$10	-\$3
\$9.00	75.0	\$675.00	-0.6	\$9	-\$5
\$8.00	80.0	\$640.00	-0.5	\$8	-\$7
\$7.00	85.0	\$595.00	-0.412	\$7	-\$9
\$6.00	90.0	\$540.00	-0.333	\$6	-\$11
\$5.00	95.0	\$475.00	-0.263	\$5	-\$13
\$4.00	100.0	\$400.00	-0.2	\$4	-\$15
\$3.00	105.0	\$315.00	-0.143	\$3	-\$17
\$2.00	110.0	\$220.00	-0.091	\$2	-\$19
\$1.00	115.0	\$115.00	-0.043	\$1	-\$21
\$0.00	120.0	\$0.00	0	\$0	-\$23