

ECON 101: Principles of Economics I

Lecture Note 5

University of Michigan at Ann Arbor

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Lecture 5 Elasticity

Monday, September 19, 2022 12:25 PM

Defining and measuring elasticity

Elasticity: Percentage change in one variable resulting from a 1% increase in another (percentage means relative change)

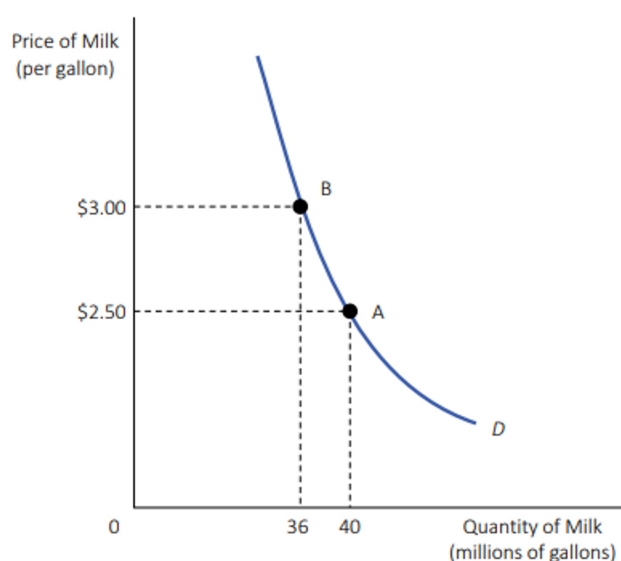
Price elasticity of demand: the percentage change in quantity demanded of a good resulting from a 1% increase in its price

$$\% \text{ Change in quantity Demanded} = \frac{\Delta Q_D}{Q_D} \times 100$$

$$\% \text{ Change in Price} = \frac{\Delta P}{P} \times 100$$

$$\text{Price Elasticity of demand} = \frac{\% \text{ Change in Quantity Demanded}}{\% \text{ Change in Price}}$$

Demand for milk



The price elasticity of demand for milk

$$\% \text{ change in quantity demanded} = \frac{36-40}{40} \times 100 = -10\%$$

$$\% \text{ change in price} = \frac{3.00-2.50}{2.50} \times 100 = 20\%$$

$$\text{Price elasticity of demand for milk} = \frac{-10\%}{20\%} = -0.5$$

The midpoint method

$$\% \text{ change in } X = \frac{\text{Change in } X}{\text{Average value of } X} \times 100$$

$$\text{Average value of } X = \frac{\text{Starting value of } X + \text{Final value of } X}{2}$$

$$\text{Price of elasticity of demand} = \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2} \times 100}{\frac{P - P_1}{P + P_2} \times 100}$$

$$\% \text{ change in Quantity demanded} = \frac{36-40}{\frac{40+36}{2}} \times 100 = -10.52\%$$

$$\% \text{ change in Price} = \frac{3.00-2.50}{\frac{2.50+3.00}{2}} \times 100 = 18.18\%$$

$$\text{Price of elasticity of demand for milk} = \frac{-10.52\%}{18.18\%} = -0.58$$

Some estimated price elasticities of demand

Inelastic Demand	Price Elasticity
Eggs	-0.1
Beef	-0.4
Stationery	-0.5
Gasoline	-0.5

Inelastic:
Price Elasticity of Demand
between 0 and -1

Unit-elastic:
Price Elasticity of Demand = -1

Elastic Demand	Price Elasticity
Housing	-1.2
Restaurant Meals	-2.3
Airline Travel	-2.4
Foreign Travel	-4.1

Elastic:
Price Elasticity of Demand
between -1 and $-\infty$

Extreme elasticity: Perfectly inelastic demand

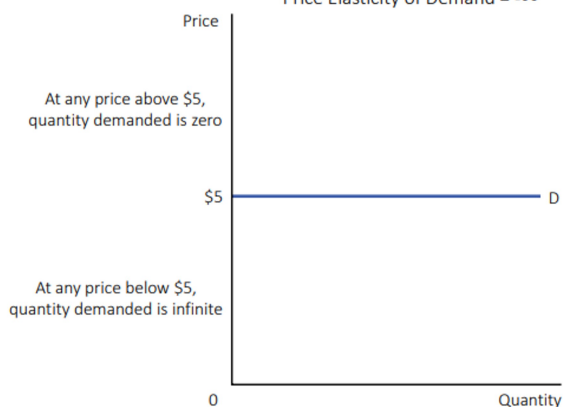
Perfectly Inelastic Demand:
Price Elasticity of Demand = 0



Buy the good not matter what is the price

Extreme elasticity: Perfectly elastic demand

Perfectly Elastic Demand:
Price Elasticity of Demand = $-\infty$



What factors affect the price elasticity of demand?

- Whether close substitutes (in consumption) are available
 - More close substitutes, more elastic
- Whether the good is a necessity or a luxury
- Time
 - Example: Convenient store

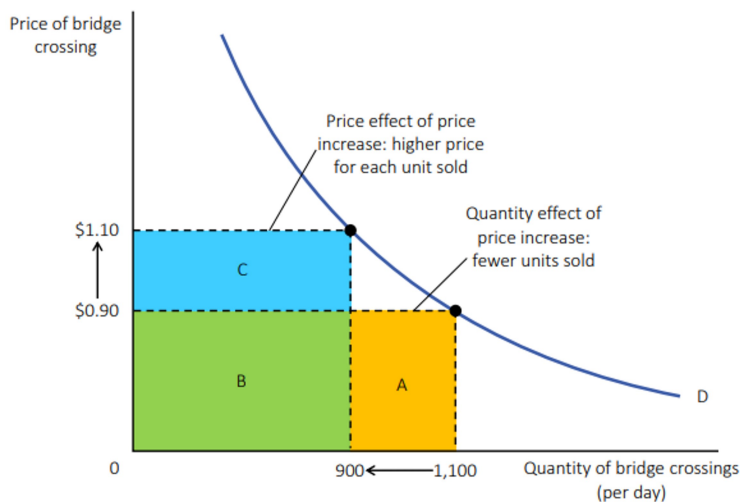
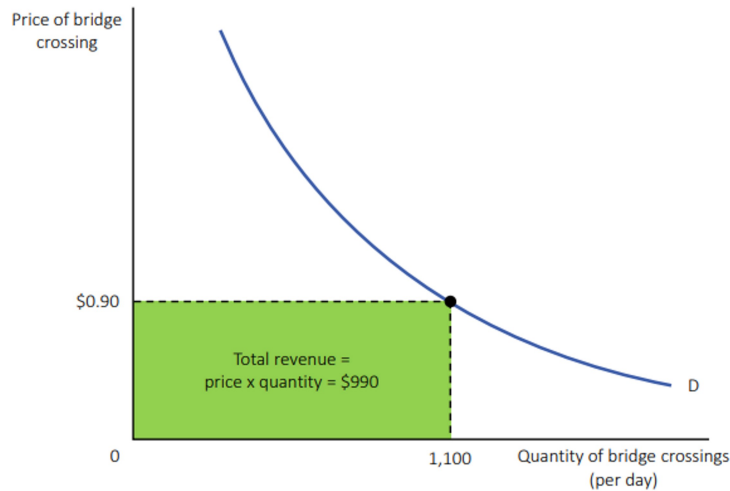
Total Revenue

Total Revenue - the total value of sales of a good or service

- Total expenditure - the total value of purchases of a good or service

$$\text{Total Revenue} = \text{Price} \times \text{Quantity}$$

Toll bridge crossing (example)

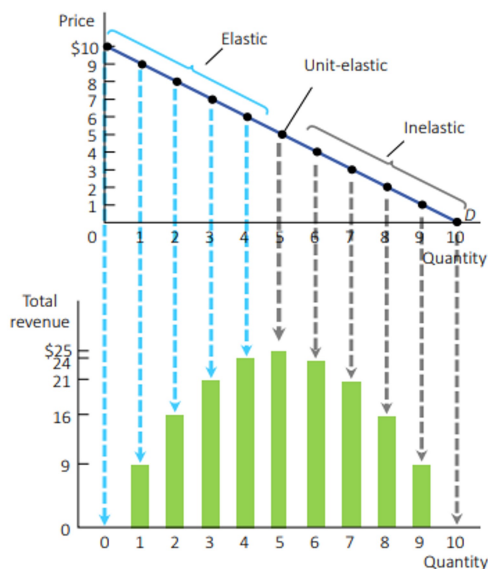


It turns out that the $\% \Delta Q$ is linked to the quantity effect and the $\% \Delta P$ is linked to the price effect.

Elasticity and total revenue ($C = \text{Price effect}$; $A = \text{Quantity effect}$)

- If demand for a good is elastic: an increase in price reduces total revenue ($|C| < |A|$)
 - Likewise, a decrease in the price will increase total revenue
- If demand for a good is inelastic: an increase in price increases total revenue ($|C| > |A|$)
 - Likewise, a decrease in the price will decrease total revenue
- If demand for a good is unit-elastic: an increase in price does not change total revenue ($|C| = |A|$)
 - Likewise, a decrease in the price will have no effect on total revenue.

Elasticity along the demand curve



Price	Quantity Demanded	Total Revenue
\$0	10	\$0
\$1	9	\$9
\$2	8	\$16
\$3	7	\$21
\$4	6	\$24
\$5	5	\$25
\$6	4	\$24
\$7	3	\$21
\$8	2	\$16
\$9	1	\$9
\$10	0	\$0

Cross price elasticity of demand

The cross price elasticity of demand between goods A and B

$$= \frac{\% \text{ Change in the Quantity Demanded of Good A}}{\% \text{ Change in the Price of Good B}}$$

$$= \frac{\frac{Q_2^A - Q_1^A}{Q_1^A + Q_2^A}}{\frac{P_2^B - P_1^B}{P_1^B + P_2^B}}$$

Goods are **substitutes** in consumption when the cross-price elasticity of demand is **positive**
 Goods are **complements** in consumption when the cross-price elasticity of demand is **negative**

Income Elasticity of demand

The income elasticity of demand

$$= \frac{\% \text{ Change in the Quantity Demanded}}{\% \text{ Change in the Income}}$$

$$= \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{Income_2 - Income_1}{Income_1 + Income_2}}$$

Normal good: the income elasticity of demand is positive

Inferior good: the income elasticity of demand is negative

Price Elasticity of Supply

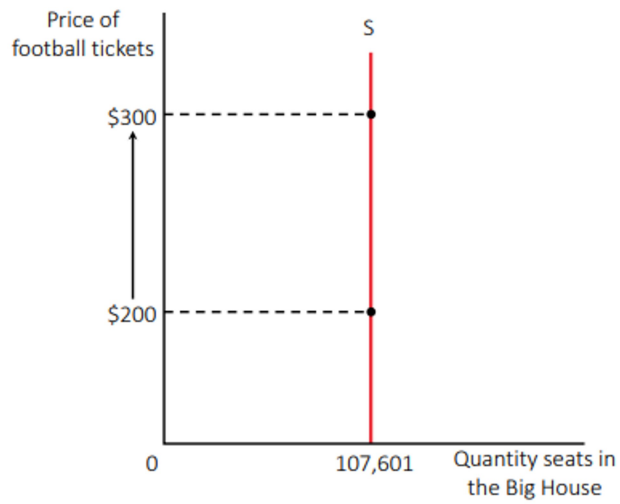
The price elasticity of supply

$$= \frac{\% \text{ Change in the quantity supplied}}{\% \text{ Change in the price}}$$

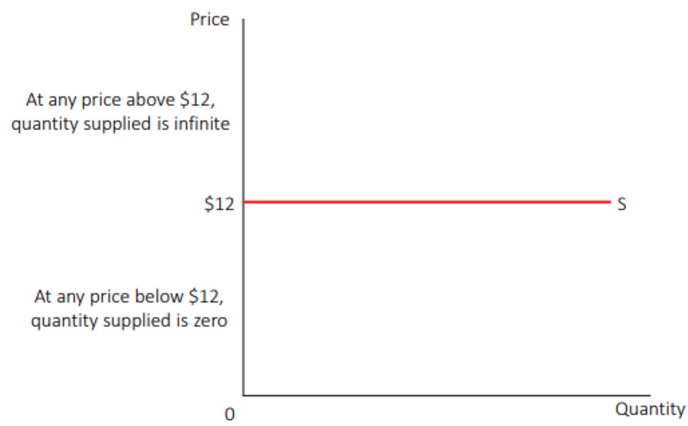
$$= \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{P_2 - P_1}{P_1 + P_2}}$$

Extreme Elasticity: Perfectly Inelastic Supply

Perfectly Inelastic Supply:
Price Elasticity of Supply = 0



Perfectly Elastic Supply: Price
Elasticity of Supply = ∞



What factors affect the price elasticity of supply?

- The availability of inputs
- Time