

# Basics of Economics

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## 1 Elasticity

When supply decreases, the equilibrium price rises and the equilibrium quantity decreases. The amount that the price and quantity increase and decrease depends on the **responsiveness** of the quantity demanded of a good to a change in its price.

### 1.1 Price Elasticity of Demand

One candidate for a measure of the responsiveness is the slope of the demand curve. If the demand curve is flat, then the quantity decreases by a lot in response to a relatively small increase in the price. If the demand curve is steep, then the quantity decreases by a relatively small amount in response to a relatively large increase in the price. Since the responsiveness depends on the slope, we want a units free measurement when comparing it.

$$E_P = \frac{\% \Delta Q}{\% \Delta P}$$

The elasticity in demand is equal to the percentage change in quantity demanded over the percentage change in price.

$$\% \Delta Q = \frac{Q_{new} - Q_{old}}{Q_{average}} \times 100$$

$$Q_{average} = \frac{Q_{new} + Q_{old}}{2}$$

$$\% \Delta P = \frac{P_{new} - P_{old}}{P_{average}} \times 100$$

$$\begin{aligned}
P_{average} &= \frac{P_{new} + P_{old}}{2} \\
E_P &= \frac{\frac{Q_{new} - Q_{old}}{Q_{average}} \times 100}{\frac{P_{new} - P_{old}}{P_{average}} \times 100} = \\
&\frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \times \frac{P_{average}}{Q_{average}} \\
&\frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \times \frac{\frac{P_{new} + P_{old}}{2}}{\frac{Q_{new} + Q_{old}}{2}} \\
&\frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \times \frac{P_{new} + P_{old}}{Q_{new} + Q_{old}}
\end{aligned}$$

### 1.1.1 Practice Problem

Suppose you have been hired by the government to figure out a tax that will reduce cigarette smoking by 25%. After a careful study, you decide that the price elasticity of demand for cigarettes is  $E = -0.5$ . What tax do you recommend to the government?

$$E_P = -0.5 = \frac{\% \Delta Q}{\% \Delta P} = \frac{-25}{\% \Delta P}$$

$$\% \Delta P = \frac{-25}{-0.5} = 50$$

50% tax on cigarettes.

### 1.1.2 Ranges of Price Elasticity

- Elasticity can range from 0 to  $\infty$ .
- Demand can be elastic (very responsive).  $|E_P| > 1$
- Demand can be inelastic (not very responsive).  $|E_P| < 1$
- Demand can be unit elastic.  $|E_P| = 1$

$$E_P \in \left( -\infty, -1 \right) : \text{Elastic}$$

$$E_P \in \left( -1, 0 \right] : \text{Inelastic}$$

### 1.1.3 Practice Problem: $|E| > 1$

The percentage change in Q is greater than the percentage change in P. For example, if the prices of movies increase from \$20 to \$30, and the demand decreases from 1000 to 500.

$$E_P = \frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \times \frac{P_{new} + P_{old}}{Q_{new} + Q_{old}}$$
$$E_P = \frac{500 - 1000}{30 - 20} \times \frac{30 + 20}{500 + 1000}$$
$$= \frac{-500}{10} \times \frac{50}{1500} = -\frac{5}{3}$$
$$|E_P| = \frac{5}{3}$$

### 1.1.4 Factors that Influence the Elasticity of Demand

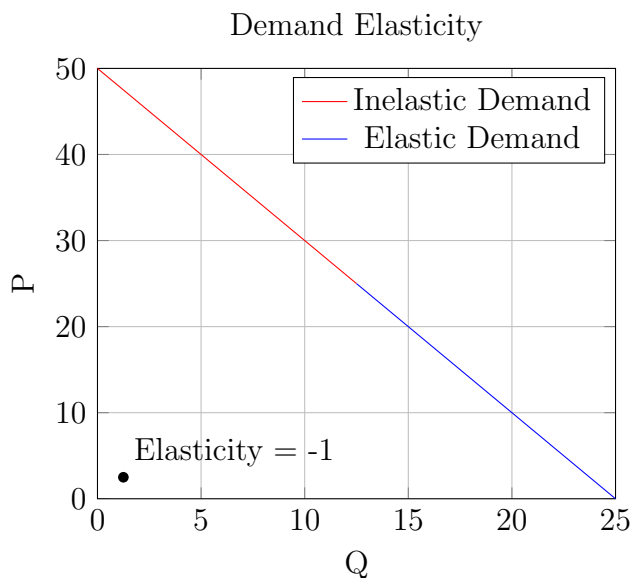
The elasticity of demand can change depending on different factors.

**Closeness of Substitutes:** The demand for a good is elastic if a substitute for it is easy to find. The demand for a good is inelastic if substitutes are hard to find. **Necessities**, such as food or housing, generally have inelastic demand while **luxuries** generally have elastic demand. The availability of substitutes depends on type of good and how broadly or narrowly the good is defined.

**The Proportion of Income Spent on the Good:** The greater the proportion of income spent on the good, the greater the impact of a price increase on the amount that people can afford. A higher proportion spent on the good implies a more elastic demand.

**Time Elapsed Since Price Change:** More time elapsed implies more elastic demand.

### 1.1.5 Price Elasticity Along a Linear Demand Curve



### 1.1.6 Total Revenue and Elasticity

A firm that sells a product obtains revenue from the sales. The total revenue is the price of a good times the quantity sold.

$$TR = P \times Q$$

If Starbucks sells a million lattes at \$4.00 each, then they make \$40,000,000 in total revenue. If they increase the price of lattes, then the quantity demanded will go down.

## 1.2 Income Elasticity of Demand

Income elasticity is a measure of the responsiveness of the demand for a good to a change in income, *ceteris paribus*.

$$E_m = \frac{\% \Delta Q}{\% \Delta M}$$

Like price elasticity of demand, this formula can be simplified to:

$$E_m = \frac{Q_{new} - Q_{old}}{M_{new} - M_{old}} \times \frac{M_{new} + M_{old}}{Q_{new} + Q_{old}}$$

### 1.2.1 Practice Problem 1

Income rises from \$750 a week to \$1250 a week, while the quantity demanded of Kraft Dinner decreases from 7 boxes a week to 3 boxes a week. What is the elasticity?

$$\begin{aligned} E_m &= \frac{Q_{new} - Q_{old}}{M_{new} - M_{old}} \times \frac{M_{new} + M_{old}}{Q_{new} + Q_{old}} \\ &= \frac{3 - 7}{1250 - 750} \times \frac{1250 + 750}{3 + 7} \\ &= \frac{-4}{500} \times \frac{2000}{10} \\ &= -\frac{8}{5} \end{aligned}$$

### 1.2.2 Practice Problem 2

Income rises from \$750 a week to \$1250 a week, while the quantity demanded of salmon fillet rises from 1 pound a week to 2 pounds a week. What is the elasticity?

$$\begin{aligned} E_m &= \frac{Q_{new} - Q_{old}}{M_{new} - M_{old}} \times \frac{M_{new} + M_{old}}{Q_{new} + Q_{old}} \\ &= \frac{2 - 1}{1250 - 750} \times \frac{1250 + 750}{2 + 1} \\ &= \frac{1}{500} \times \frac{2000}{3} \\ &= \frac{4}{3} \end{aligned}$$

### 1.2.3 Ranges of Income Elasticity

If income elasticity is positive and greater than one, it is income elastic. If income elasticity is negative and less than minus one, it is income elastic. *A one percent increase in income results in a greater than one percent increase in quantity demanded.*

An income elasticity between -1 and 1 means that it is income inelastic.

### 1.3 Cross Price Elasticity of Demand

Cross elasticity is a measure of the responsiveness of the demand for a good to changes in the price of a *substitute* or *complement*, ceteris paribus.

$$E_{X,Y} = \frac{\% \Delta Q_X}{\% \Delta P_Y}$$

$$E_{X,Y} = \frac{Q_X^{new} - Q_x^{old}}{P_Y^{new} - P_Y^{old}} \times \frac{P_Y^{new} + P_Y^{old}}{Q_X^{new} + Q_x^{old}}$$

#### 1.3.1 Practice Problem

When the price of Adidas increases from \$100 to \$120, the quantity demanded of Nikes increases from 1 million to 3 million per year.

$$\begin{aligned} E_{X,Y} &= \frac{3 - 1}{120 - 100} \times \frac{120 + 100}{3 + 1} \\ &= \frac{2}{20} \times \frac{220}{4} \\ &= \frac{11}{2} \end{aligned}$$

#### 1.3.2 Ranges of Cross Price Elasticity

The magnitude of the elasticity indicates how closely related the goods are. A large positive elasticity indicates the goods are closely related substitutes. A small positive elasticity indicates they are substitutes but not closely related. A small negative elasticity indicates they are complements but not closely related and a large negative elasticity indicates they are close complements.

Sign	Magnitude	
-	large	close complements
-	small	complements
+	large	close substitutes
+	small	substitutes
0	0	not related

## 1.4 Elasticity of Supply

Elasticity of Supply is a measure of the responsiveness of the quantity supplied of a good to changes in the price of the good, *ceteris paribus*. The formula follows the same form, but  $Q$  is now a quantity of supply instead of a quantity of demand.

$$E_S = \frac{\% \Delta Q}{\% \Delta P}$$
$$E_S = \frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \times \frac{P_{new} + P_{old}}{Q_{new} + Q_{old}}$$

### 1.4.1 Ranges of Elasticity of Supply

- Supply is perfectly inelastic.  $E_S = 0$
- Supply is inelastic.  $E_S \in (0, 1)$
- Supply is unit elastic.  $E_S = 1$
- Supply is elastic.  $E_S \in (1, \infty)$
- Supply is perfectly elastic.  $E_S = \infty$

### 1.4.2 Factors that Influence the Elasticity of Supply

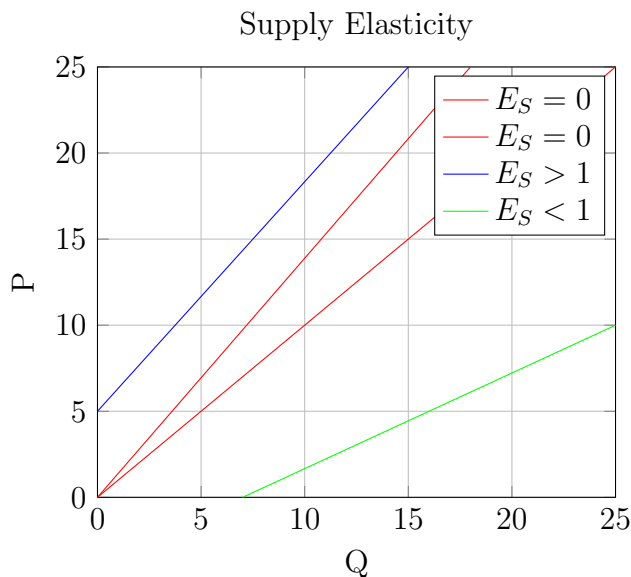
The elasticity of supply can change depending on different factors.

**Resource Substitution Possibility:** Some goods can only be produced using rare resources. These have inelastic supply curves. Other goods are produced using resources that can be used in a wide variety of production tasks.

**Time Frame for the Supply Decision:** Short run supply determines the changes to supply that can occur when some of the factors of production remain fixed. A firm can layoff or hire new workers in the short run. But it may not be able to build a larger factory. Long run supply determines the changes in supply that are possible when all factors are variable.

### 1.4.3 Elasticity Along a Linear Supply Curve

$$E_S = \frac{1}{\text{slope}} \times \frac{P_{\text{average}}}{Q_{\text{average}}}$$



Any supply curve that passes through the origin has an elasticity of 1.

You can find all my notes at <http://omgimanerd.tech/notes>. If you have any questions, comments, or concerns, please contact me at [alvin@omgimanerd.tech](mailto:alvin@omgimanerd.tech)