

CHAPTER

6

Describing Supply and Demand: Elasticities

Chapter Goals

- Use *elasticity* to describe the responsiveness of quantities to changes in price and distinguish five elasticity terms.
- Explain the importance of substitution in determining elasticity of supply and demand.
- Relate price elasticity of demand to total revenue.
- Define and calculate income elasticity and cross-price elasticity of demand.
- Explain how the concept of *elasticity makes supply* and demand analysis more useful.

Price Elasticity: Demand

Price elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price.

$$E_D = \frac{\% \text{ change in Quantity Demanded}}{\% \text{ change in Price}}$$

This tells us exactly how quantity demanded responds to a change in price.

Elasticity is independent of units.

Price elasticity of demand is always expressed as a positive number.

Price Elasticity: Demand

Demand is **elastic** if the percentage change in quantity is *greater than* the percentage change in price.

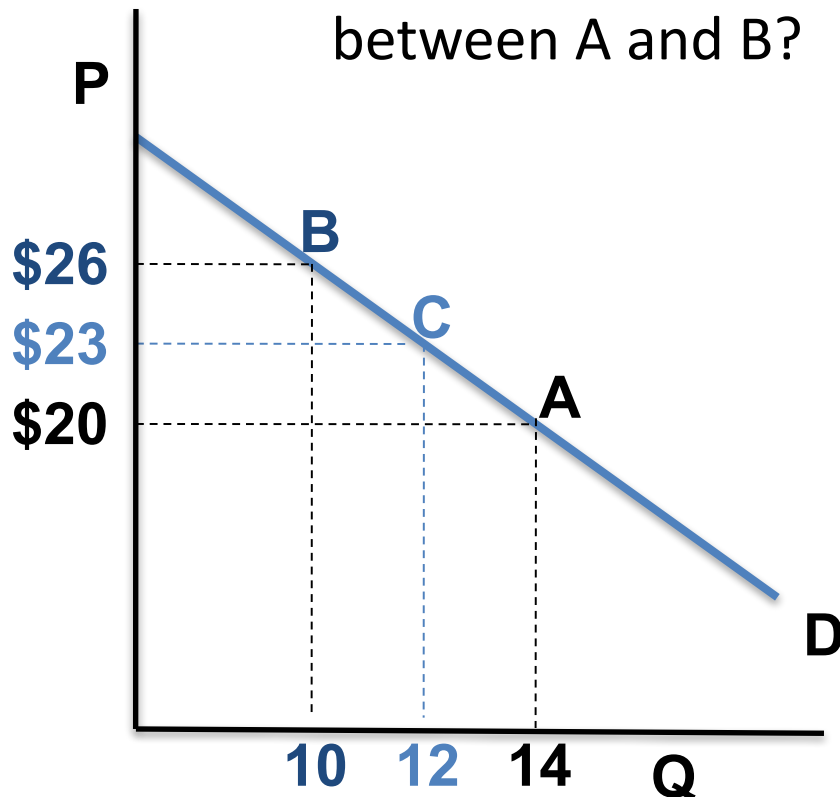
Elastic demand is when $E_D > 1$.

Demand is **inelastic** if the percentage change in quantity is *less than* the percentage change in price.

Inelastic demand is when $E_D < 1$.

Calculating Elasticities: Price Elasticity of Demand

What is the price elasticity of demand between A and B?



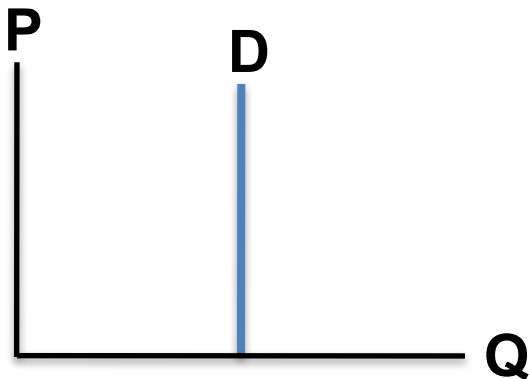
Point	Price	Quantity Demanded
A	\$20	14
B	\$26	10

$$\begin{aligned}
 E_D &= \frac{\% \Delta Q}{\% \Delta P} = \frac{\frac{Q_2 - Q_1}{\frac{1}{2}(Q_2 + Q_1)}}{\frac{P_2 - P_1}{\frac{1}{2}(P_2 + P_1)}} \\
 &= \frac{\frac{10 - 14}{\frac{1}{2}(10 + 14)}}{\frac{26 - 20}{\frac{1}{2}(26 + 20)}} = \left| \frac{-.33}{.26} \right| = 1.27
 \end{aligned}$$

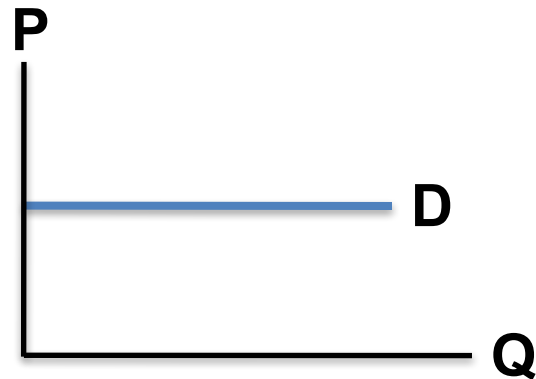
Elasticity Is Not the Same as Slope

Elasticity is not the same as slope, but, the steeper a curve is at a given point, the less elastic demand or supply.

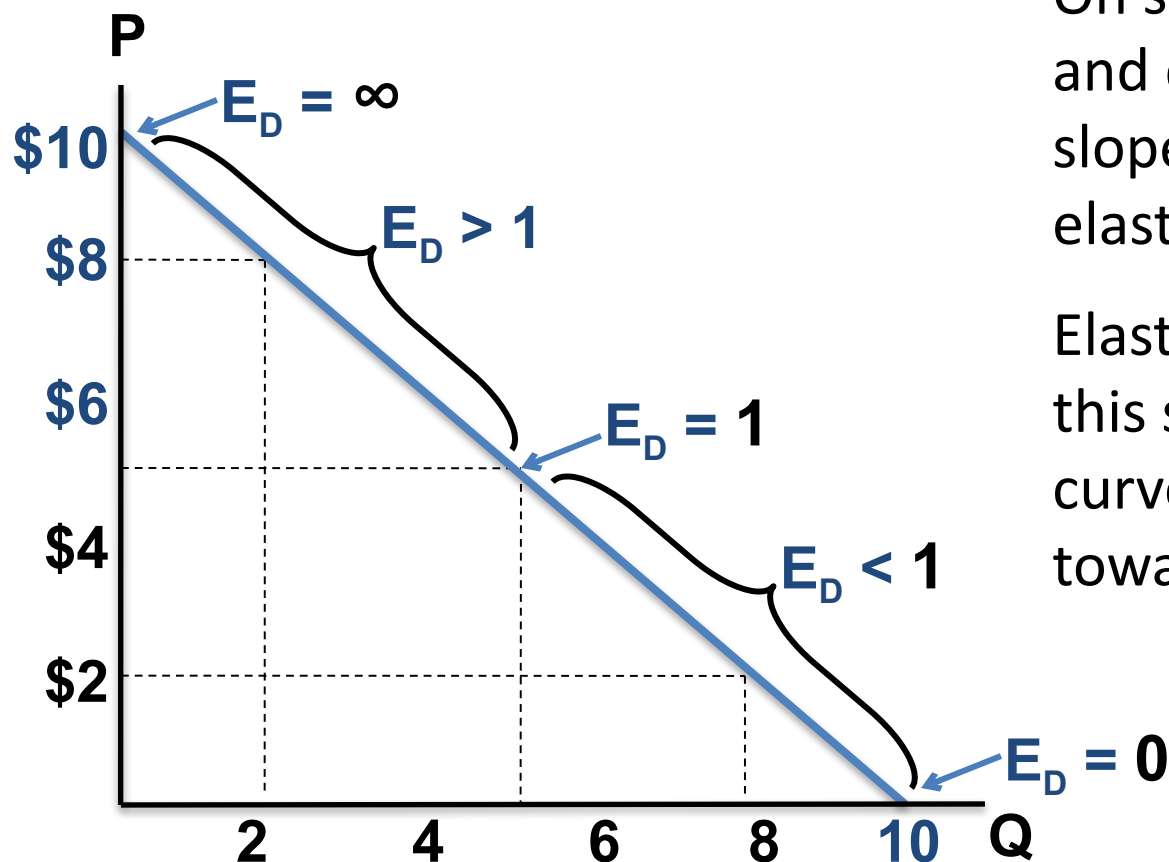
This curve is **perfectly inelastic**, meaning that Q does not respond at all to changes in price, $E_D = 0$.



This curve is **perfectly elastic**, meaning that Q responds enormously to changes in price, $E_D = \infty$.



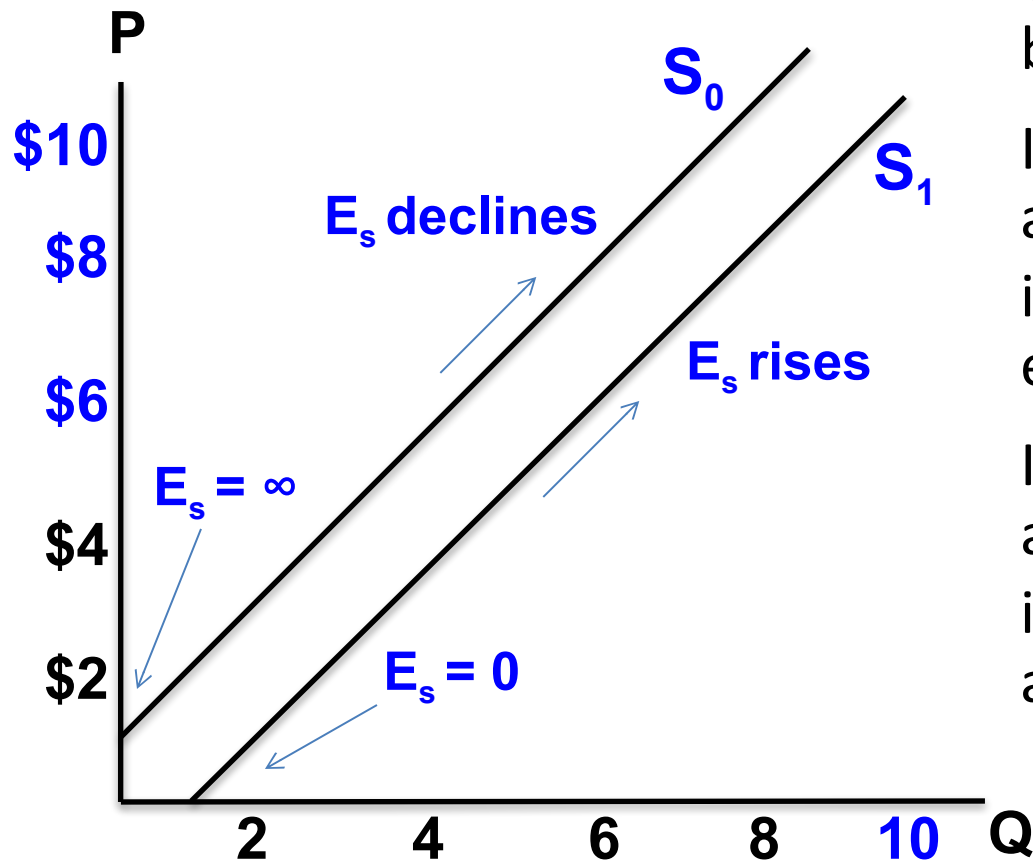
Elasticity Changes Along Straight-Line Curves (1 of 2)



On straight-line supply and demand curves, slope stays constant, but elasticity changes.

Elasticity *declines* along this straight-line demand curve as we move towards the Q axis.

Elasticity Changes Along Straight-Line Curves (2 of 2)



On straight-line supply curve, slope stays constant, but elasticity changes.

If it intersects the vertical axis (S_0), elasticity starts at infinity and declines, and eventually approaches 1.

If it intersects the horizontal axis (S_1), it starts at zero and increases, and eventually approaches 1.

Price Elasticity: Supply

Price elasticity of supply is the percentage change in quantity supplied divided by the percentage change in price.

$$E_s = \frac{\% \text{ change in Quantity Supplied}}{\% \text{ change in Price}}$$

This tells us exactly how quantity supplied responds to a change in price.

Elasticity is independent of units.

Price Elasticity: Supply

Supply is **elastic** if the percentage change in quantity is *greater than* the percentage change in price.

Elastic supply is when $E_s > 1$.

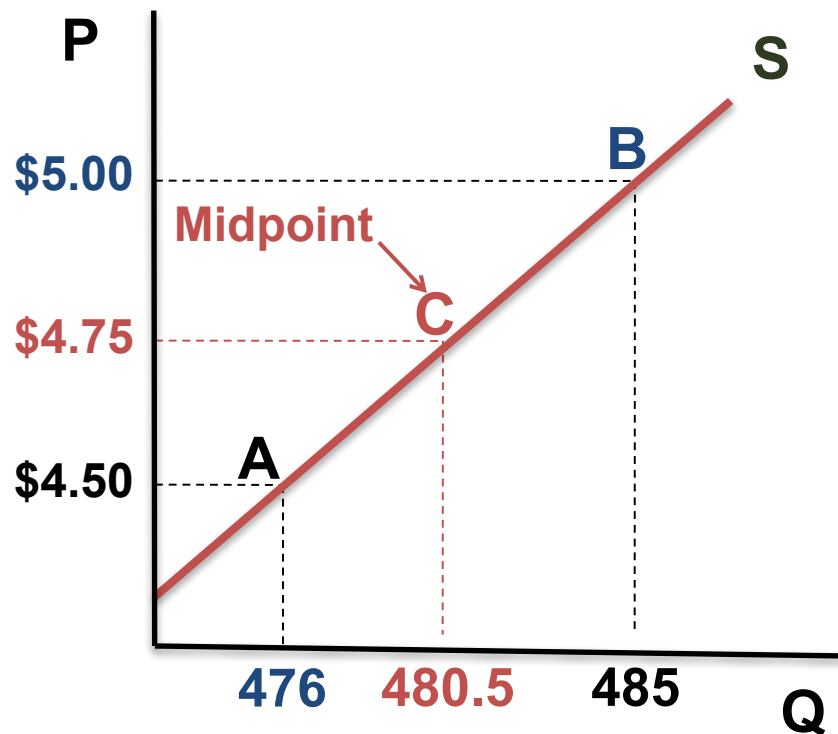
Supply is **inelastic** if the percentage change in quantity is *less than* the percentage change in price.

Inelastic supply is when $E_s < 1$.

Calculating Elasticities: Price Elasticity of Supply

What is the price elasticity of supply between A and B?

Point	Price	Quantity Supplied
A	\$4.50	476
B	\$5.00	485



$$E_s = \frac{\% \Delta Q}{\% \Delta P} = \frac{\frac{Q_2 - Q_1}{\frac{1}{2}(Q_2 + Q_1)}}{\frac{P_2 - P_1}{\frac{1}{2}(P_2 + P_1)}}$$

$$= \frac{\frac{485 - 476}{\frac{1}{2}(485 + 476)}}{\frac{5 - 4.50}{\frac{1}{2}(5 + 4.50)}} = \frac{0.0187}{0.105} = 0.18$$

Five Terms to Describe Elasticity

Five elasticity terms are:

1. **Perfectly elastic** ($E = \infty$).
2. **Elastic** ($E > 1$).
3. **Unit elastic** ($E = 1$).
4. **Inelastic** ($E < 1$).
5. **Perfectly inelastic** ($E = 0$).

Substitution and Elasticity

What makes supply or demand more or less elastic?

Substitution

The most important determinant of price elasticity is the number of substitutes for the good.

A general rule is: *The more substitutes a good has, the more elastic its supply or demand.*

If a good has substitutes, a rise in the price of that good will cause the consumer to shift consumption to those substitute goods.

Substitution and Demand

The number of substitutes a good has is affected by several factors. Four of the most important factors:

1. The time period being considered
2. The degree to which a good is a luxury
3. The market definition
4. The importance of the good in one's budget

Elasticity, Total Revenue, and Demand

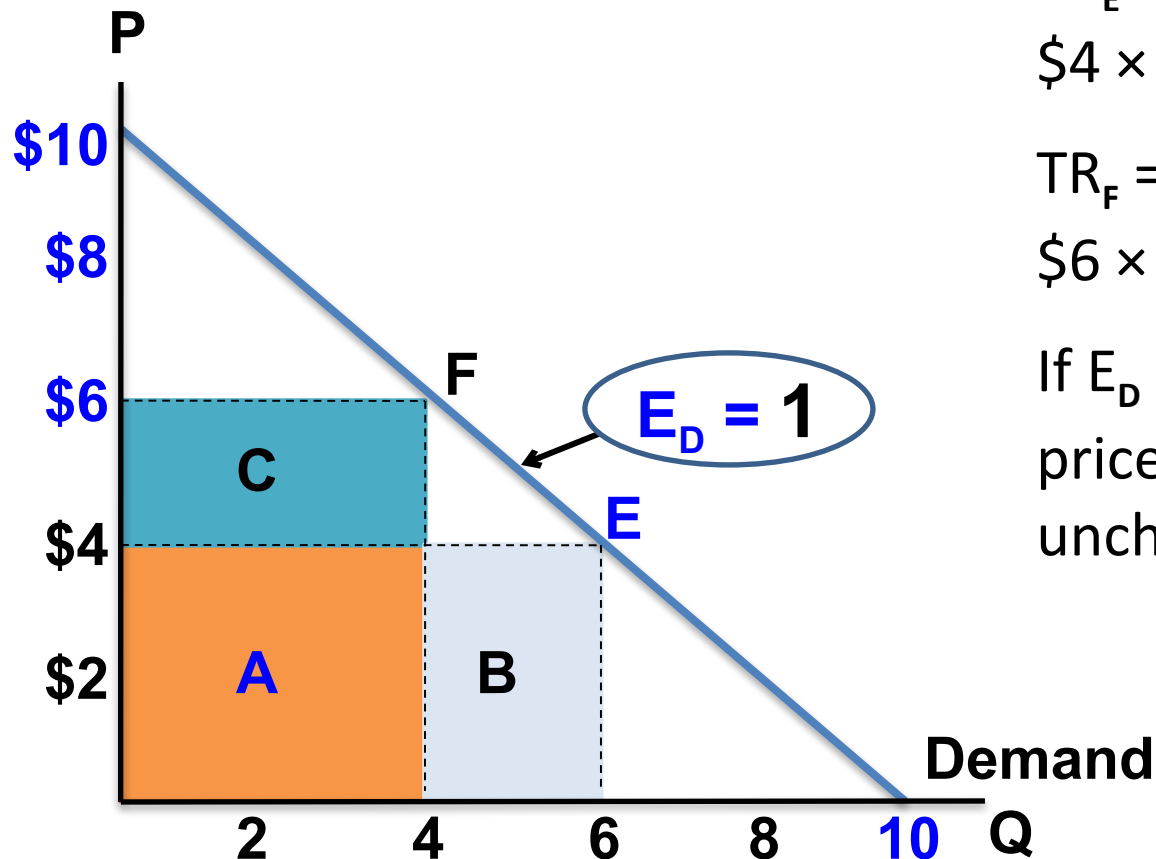
The elasticity of demand tells suppliers how their total revenue will change if their price changes.

Total revenue is price multiplied by quantity:

$$TR = (P)(Q)$$

- If $E_D > 1$, an increase in price decreases total revenue.
(Price and total revenue move in opposite directions.)
- If $E_D = 1$, an increase in price leaves total revenue unchanged.
- If $E_D < 1$, an increase in price increases total revenue.
(Price and total revenue move in the same direction.)

Application: Unit Elastic Demand



$$TR_E = P \times Q = \text{areas A} + \text{B} = \$4 \times 6 = \$24$$

$$TR_F = P \times Q = \text{areas A} + \text{C} = \$6 \times 4 = \$24$$

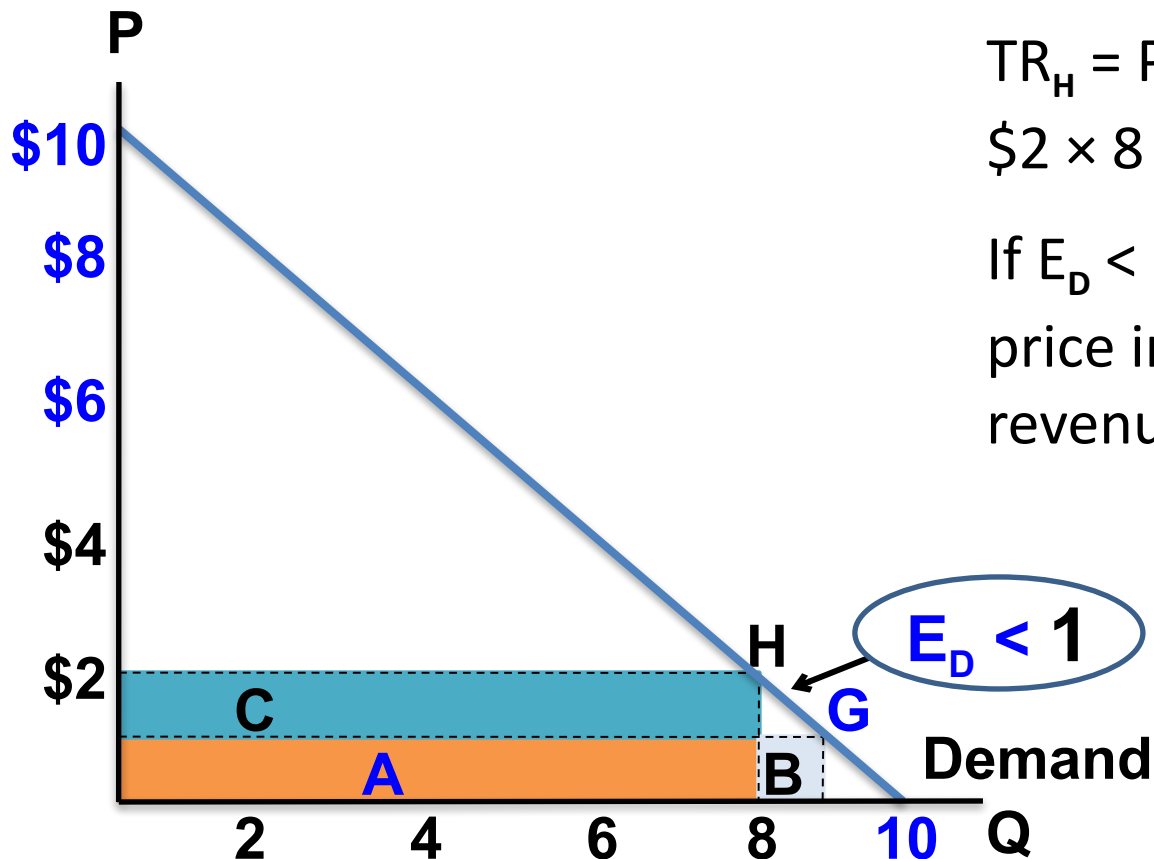
If $E_D = 1$, an increase in price leaves total revenue unchanged.

Application: Inelastic Demand

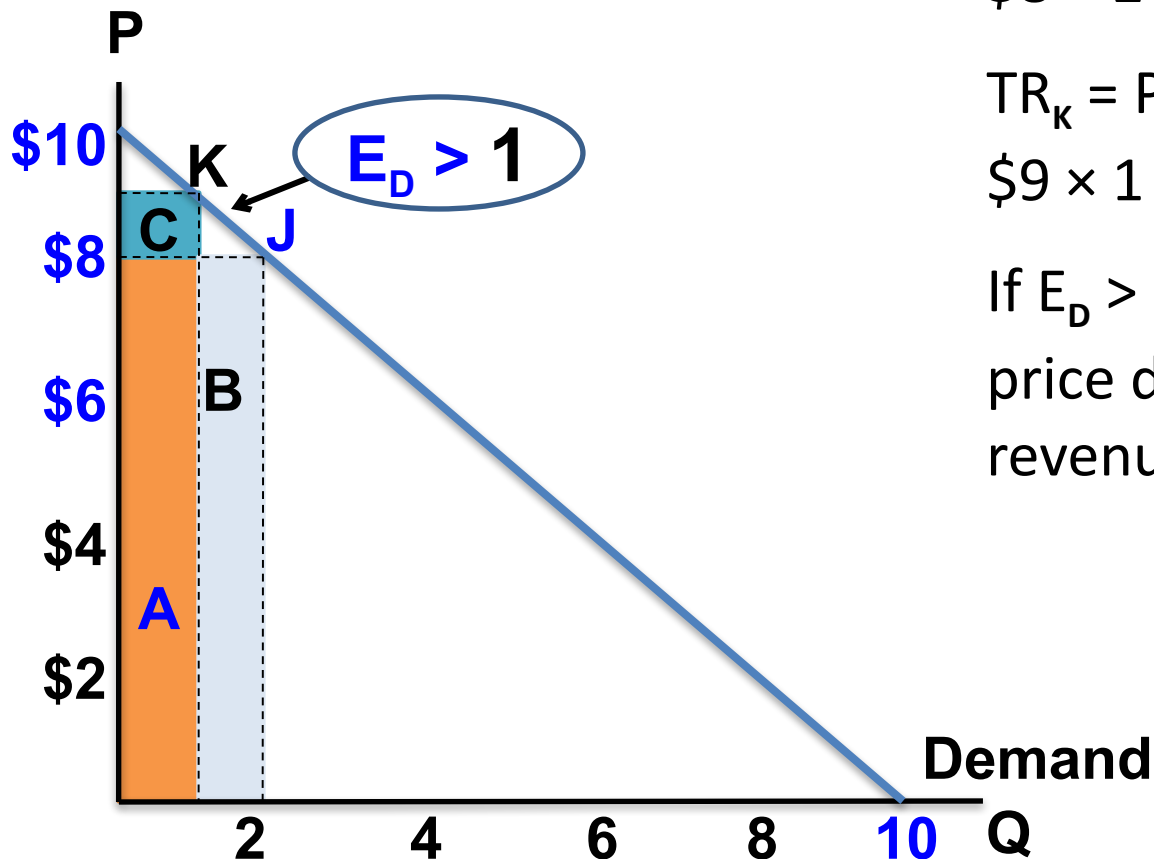
$$TR_G = P \times Q = \text{areas A} + \text{B} = \$1 \times 9 = \$9$$

$$TR_H = P \times Q = \text{areas A} + \text{C} = \$2 \times 8 = \$16$$

If $E_D < 1$, an increase in price increases total revenue.



Application: Elastic Demand



$$TR_J = P \times Q = \text{areas A} + \text{B} = \$8 \times 2 = \$16$$

$$TR_K = P \times Q = \text{areas A} + \text{C} = \$9 \times 1 = \$9$$

If $E_D > 1$, an increase in price decreases total revenue.

Relationship Between Elasticity and Total Revenue

	Price Rise	Price Decline
Elastic ($E_D > 1$)	TR decreases	TR increases
Unit Elastic ($E_D = 1$)	TR constant	TR constant
Inelastic ($E_D < 1$)	TR increases	TR decreases

Income and Cross-Price Elasticity (1 of 2)

Income elasticity of demand measures the responsiveness of demand to changes in income.

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

Normal goods are those whose consumption increases with an increase in income.

Necessity: $0 < E_{\text{Income}} < 1$

Luxury: $E_{\text{Income}} > 1$

Inferior goods are those whose consumption decreases with an increase in income, $E_{\text{Income}} < 0$.

Income and Cross-Price Elasticity (2 of 2)

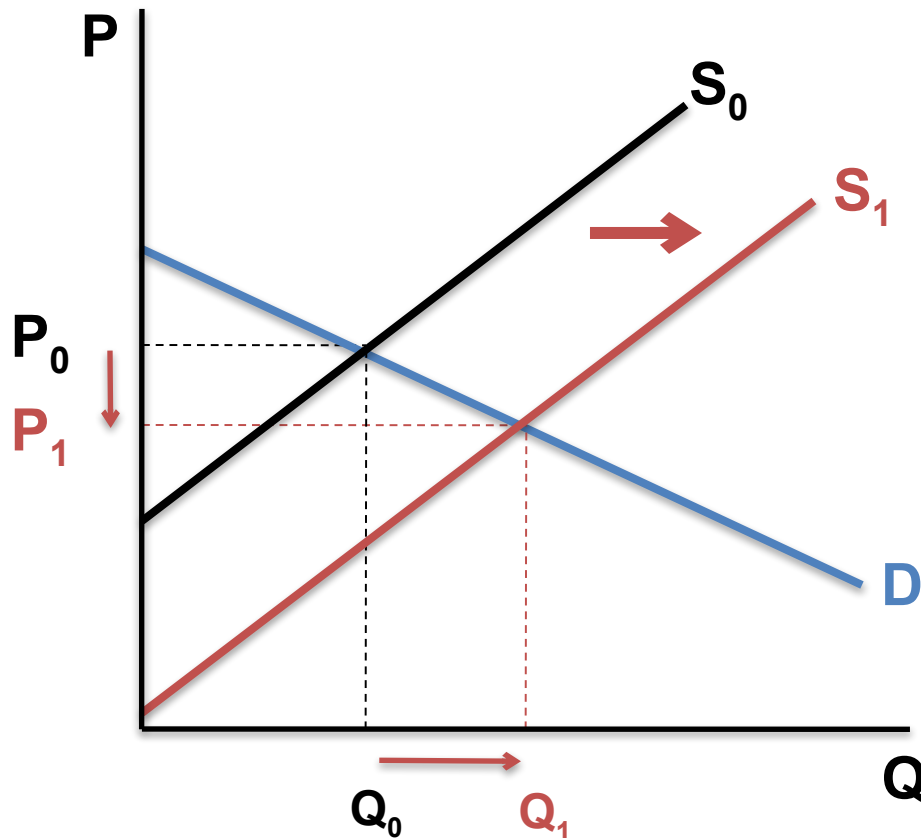
Cross-price elasticity of demand measures the responsiveness of demand to changes in prices of other goods.

$$E_{\text{cross-price}} = \frac{\% \text{ change in Demand}}{\% \text{ change in } P \text{ of related good}}$$

Substitutes are goods that can be used in place of another, $E_{\text{cross-price}} > 0$.

Complements are goods that are used conjunction with other goods, $E_{\text{cross-price}} < 0$.

Shifting Supply and Elastic Demand

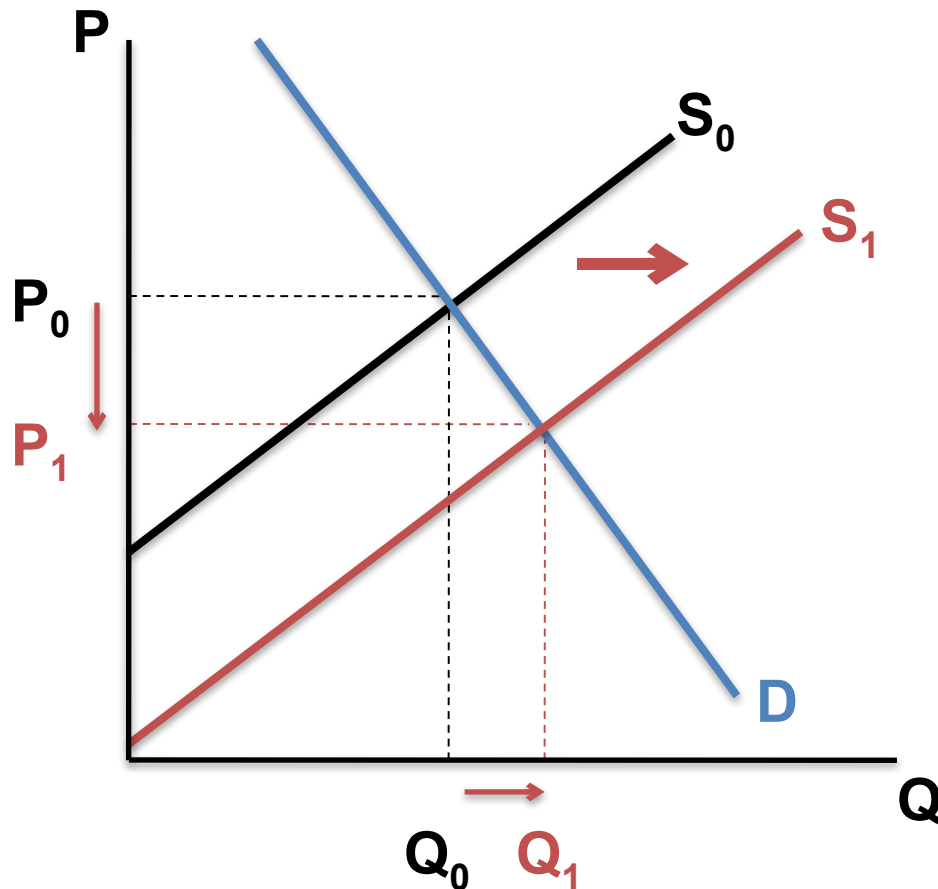


The more elastic the demand (supply), the **greater** the effect of a supply (demand) shift on quantity and the **smaller** the effect on price.

Demand is relatively elastic.

Supply shifts out and caused a greater effect on quantity than on price.

Shifting Supply and Inelastic Demand



Demand is relatively inelastic.

Supply shifts out and caused a greater effect on price than on quantity.

Chapter Summary (1 of 4)

Elasticity is percentage change in quantity divided by percentage change in some variable that affects demand (supply). The most common elasticity is price.

$$E_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

$$E_s = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

Elasticity is a better descriptor than is slope because it is independent of units of measurement.

To calculate percentage changes in prices and quantities, use the average of the end values.

Chapter Summary (2 of 4)

Five elasticity terms are *elastic* ($E > 1$); *inelastic* ($E < 1$); *unit elastic* ($E = 1$); *perfectly inelastic* ($E = 0$); and *perfectly elastic* ($E = \infty$).

The more substitutes a good has, the greater its elasticity.

Demand becomes less elastic as we move down along a demand curve.

The most important factor affecting the number of substitutes in supply is time. The longer the time interval, the more elastic is supply.

Chapter Summary (3 of 4)

Factors affecting the number of substitutes in demand are: time period, degree to which the good is a luxury, market definition, importance of the good in one's budget.

The most important factor affecting the number of substitutes for supply is time. As the time interval lengthens, supply becomes more elastic.

When a supplier raises price, if demand is inelastic, total revenue increases; if demand is elastic, total revenue decreases; if demand is unit elastic, total revenue remains constant.

Chapter Summary (4 of 4)

Other important elasticity concepts are income elasticity and cross-price elasticity of demand.

Income elasticity of demand is the percentage change in demand/percentage change in income.

Cross-price elasticity of demand is the percentage change in demand/percentage change in price of a related good.

The more elastic the demand/supply, the greater the effect of a shift on quantity and the smaller the effect on price.