Elasticity

ECO101: Principles of Microeconomics

BRAC University

Elasticity – the concept

- The responsiveness of one variable to changes in another
- When price rises, what happens to demand?
- Demand falls
- BUT!
- How much does demand fall?

Elasticity – the concept

- If price rises by 10% - what happens to demand?
- We know demand will fall
- By more than 10%?
- By less than 10%?
- **Elasticity measures the <u>extent</u> to which demand will change**

Elasticity

- 4 basic types used:
- Price elasticity of demand (PED)
- Price elasticity of supply (PES)
- Income elasticity of demand (YED)
- Cross price elasticity (XED)

Price Elasticity of Demand

- A measure of the responsiveness of quantity demanded to changes in price.
- Measured by dividing the percentage change in the quantity demanded of a good by the percentage change in its price.
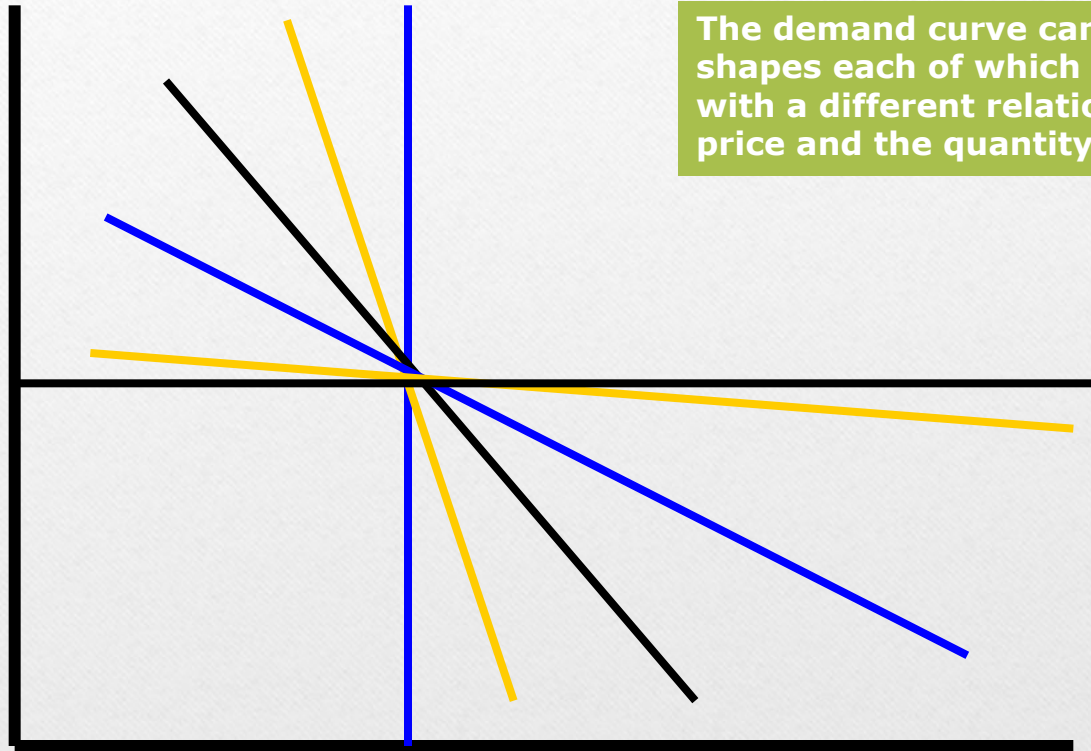
PED Definition

The Formula:

$$Ped = \frac{\%\ Change\ in\ Quantity\ Demanded}{\%\ Change\ in\ Price}$$

Note: PED has – sign in front of it; **because as price rises demand falls and vice-versa** (inverse relationship between
price and demand), hence we consider the absolute value of PED.

Elasticity

Price

The demand curve can be a range of shapes each of which is associated with a different relationship between price and the quantity demanded.

Quantity Demanded

PED and Elasticity Coefficient

- $(|E_d| > 1)$: Elastic Demand   => Luxury goods

- $(|E_d < 1)$: Inelastic Demand   => Necessary goods

- $(|E_d| = 1)$: Unit Elastic Demand

- $(|E_d| = \infty)$: Perfectly Elastic Demand

- $(|E_d| = 0)$: Perfectly Inelastic Demand

Summary

Elasticity Coefficient	Responsiveness of Quantity Demanded to a Change in Price	Terminology
$E_d > 1$	Quantity demanded changes proportionately more than price changes: $\%\Delta Q_d > \%\Delta P$.	Elastic
$E_d < 1$	Quantity demanded changes proportionately less than price changes: $\%\Delta Q_d < \%\Delta P$.	Inelastic
$E_d = 1$	Quantity demanded changes proportionately to price change: $\%\Delta Q_d = \%\Delta P$.	Unit elastic
$E_d = \infty$	Quantity demanded is extremely responsive to even very small changes in price.	Perfectly elastic
$E_d = 0$	Quantity demanded does not change as price changes.	Perfectly inelastic

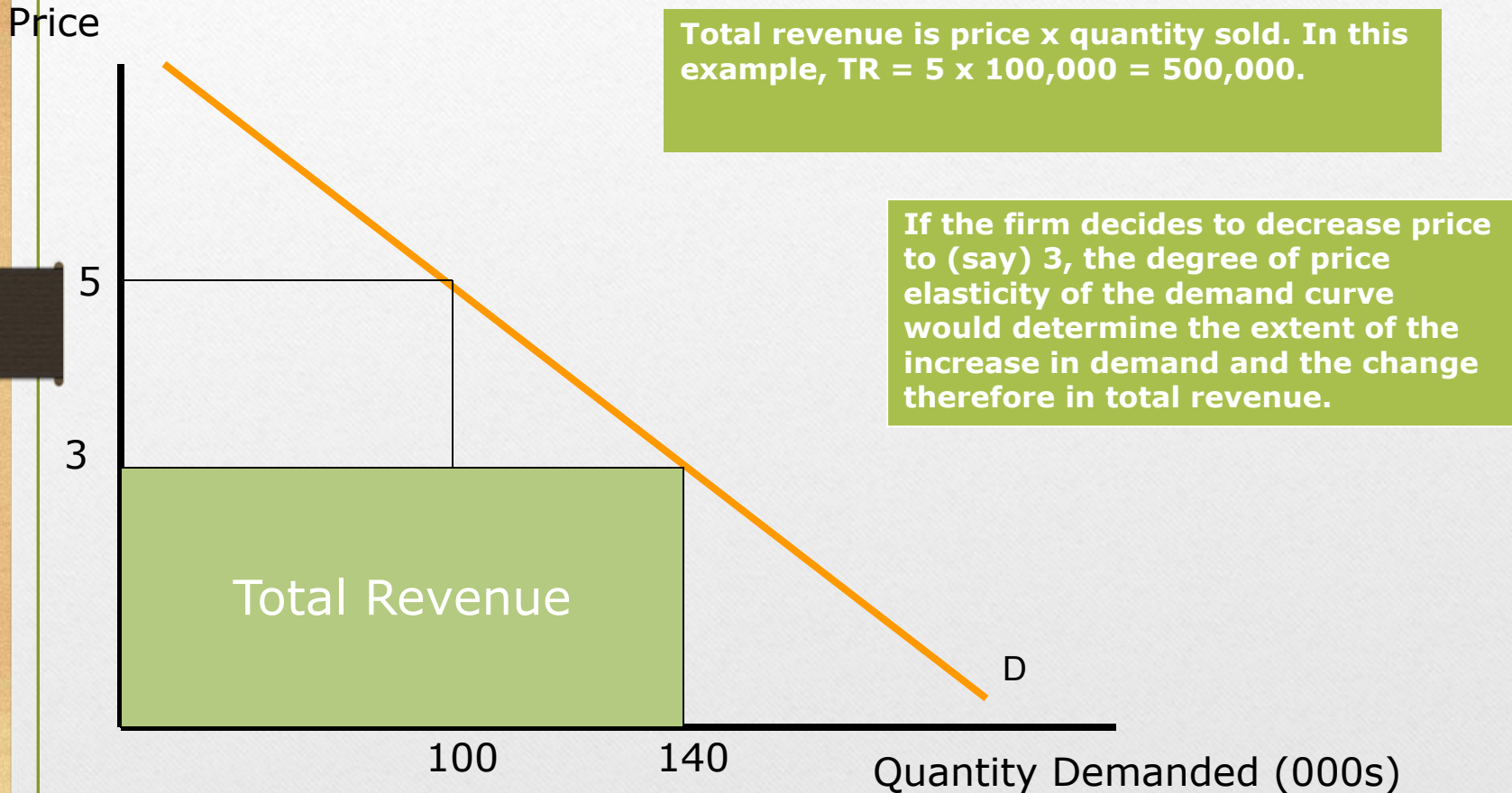Note: Consider absolute value of the coefficient

Graphical Representation
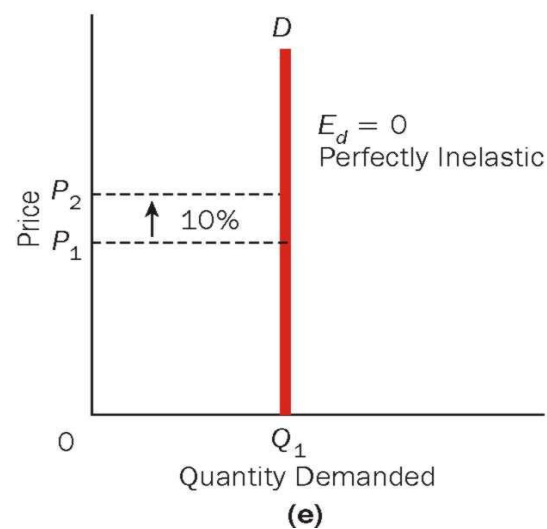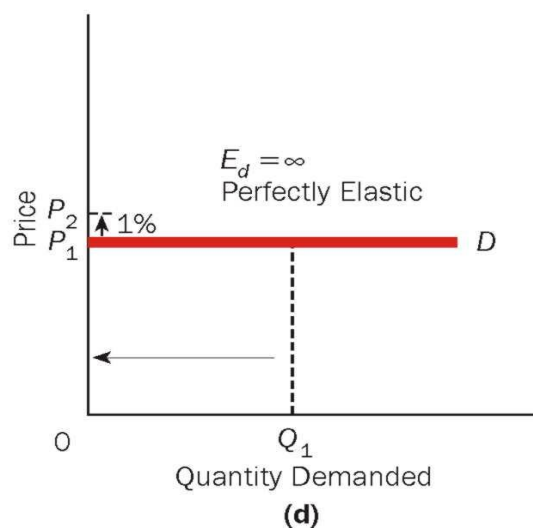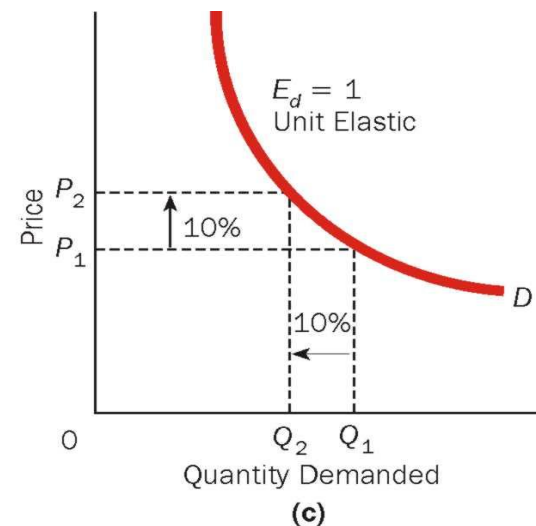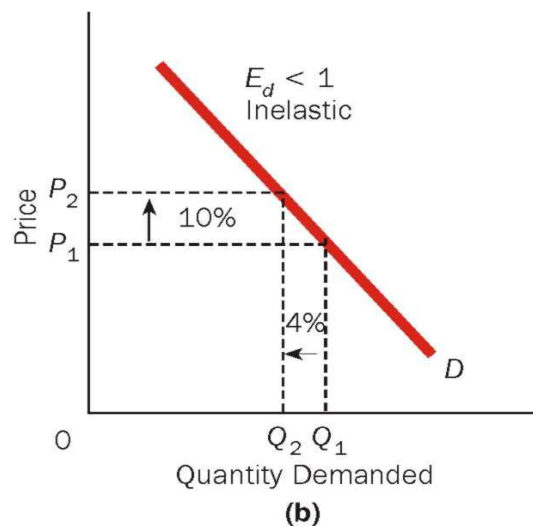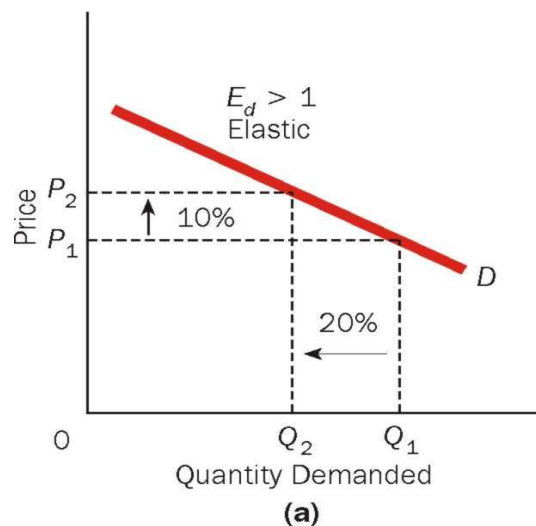
Price Elasticity of Demand and Total Revenue

- **Total Revenue (TR)** of a seller equals the price of a good times the quantity of the good sold. **i.e.**

- **TR = P x Q**

Elasticity and TR

Price

Total revenue is price x quantity sold. In this example, TR = 5 x 100,000 = 500,000.

If the firm decides to decrease price to (say) 3, the degree of price elasticity of the demand curve would determine the extent of the increase in demand and the change therefore in total revenue.

5

3

Total Revenue

D

100   140   Quantity Demanded (000s)

Inelastic Demand and TR

Price (£)

Producer decides to lower price to attract sales

10

5

5 6

D

Quantity Demanded

% Δ Price = -50%

% Δ Quantity Demanded = +20%

Ped = 0.4 (Inelastic)

Total Revenue would fall

Not a good move!
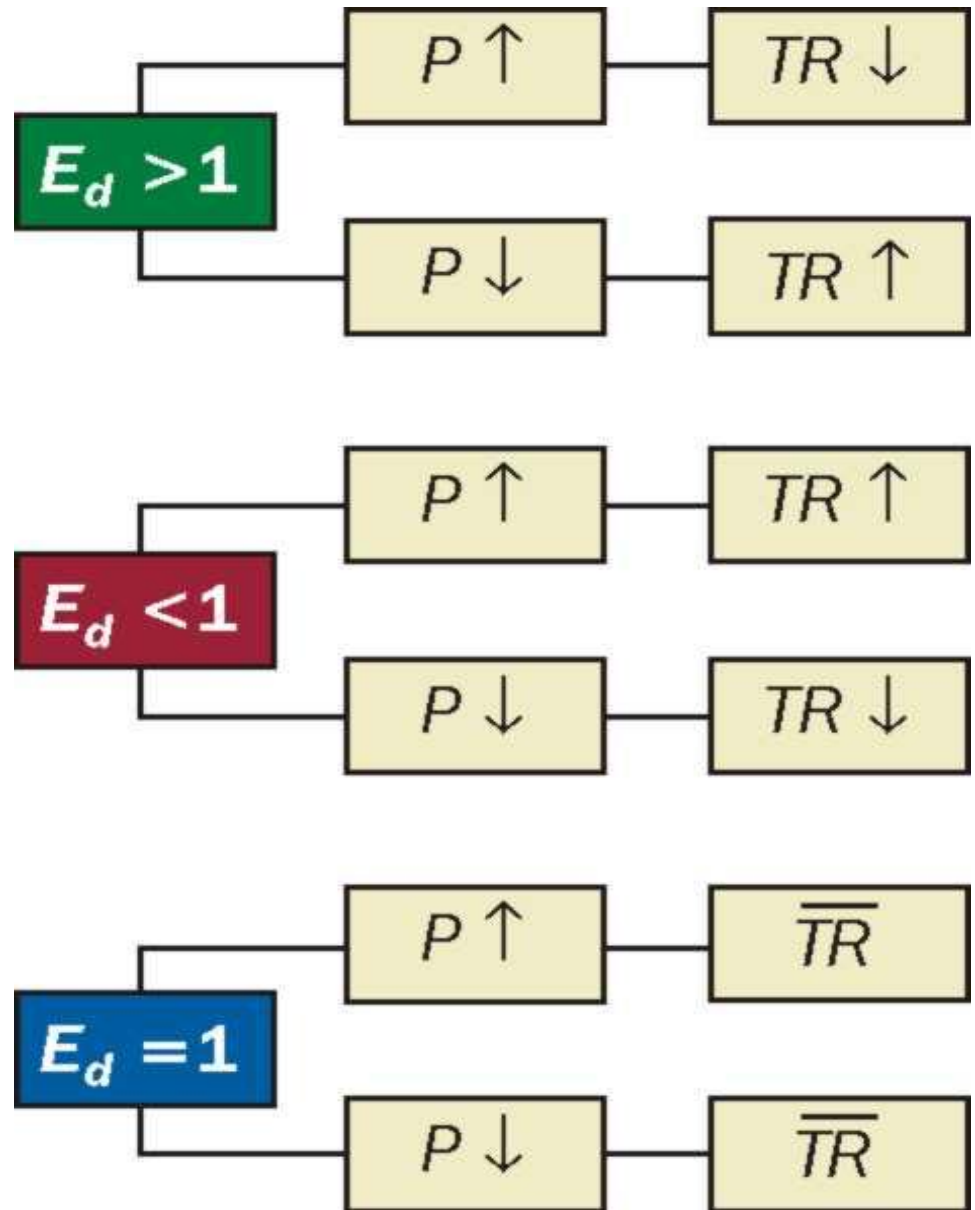
Elasticity and TR

- **If demand is price elastic:**

- Increasing price would **reduce** TR (%Δ Qd > % Δ P)

- Reducing price would **increase** TR (%Δ Qd > % Δ P)

- **If demand is price inelastic:**

- Increasing price would **increase** TR (%Δ Qd < % Δ P)

- Reducing price would **reduce** TR (%Δ Qd < % Δ P)

Summary

Elasticities, Price
Changes and Total
Revenue

Q & A

- On Tuesday, price and quantity demanded are $7 and 120 units, respectively. Ten days later, price and quantity are $6 and 150 units, respectively. What is the price elasticity of demand between the price of $6 and $7?

- What does a price elasticity of demand of 0.39 mean?

- Identify what happens to total revenue as a result of each of the following: price rises and demand is elastic; price falls and demand is inelastic; price rises and demand is unit elastic; price rises and demand is inelastic; price falls and demand is elastic.

- Jamal says, "When a seller raises his price, his total revenue rises." What is he implicitly saying?
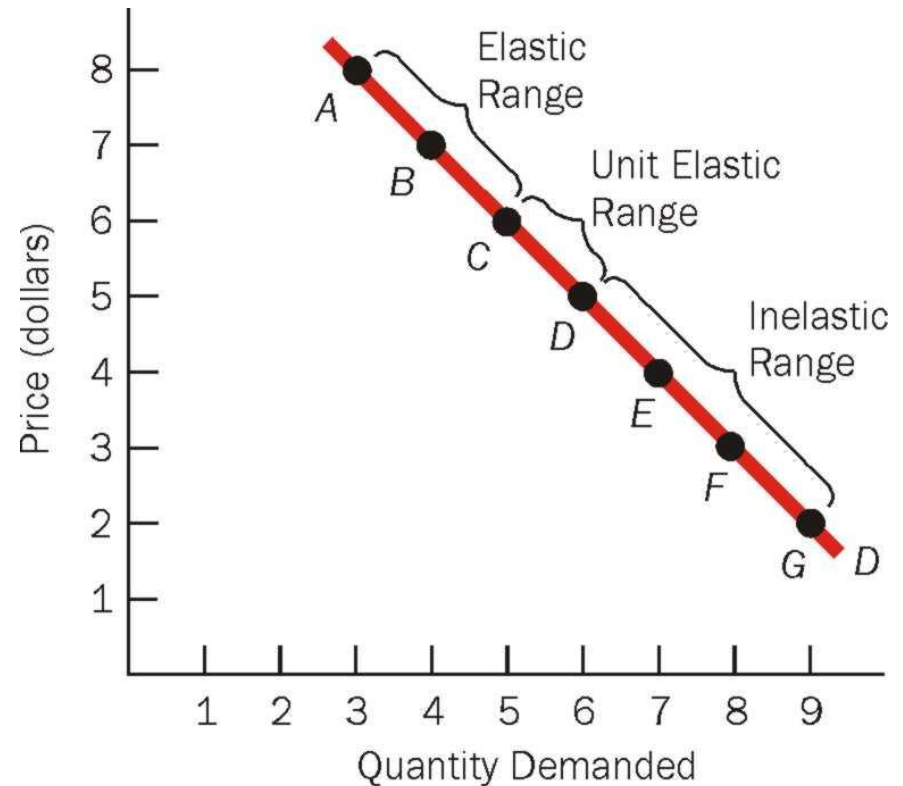
Elasticity Varies Along a Straight-Line Demand Curve
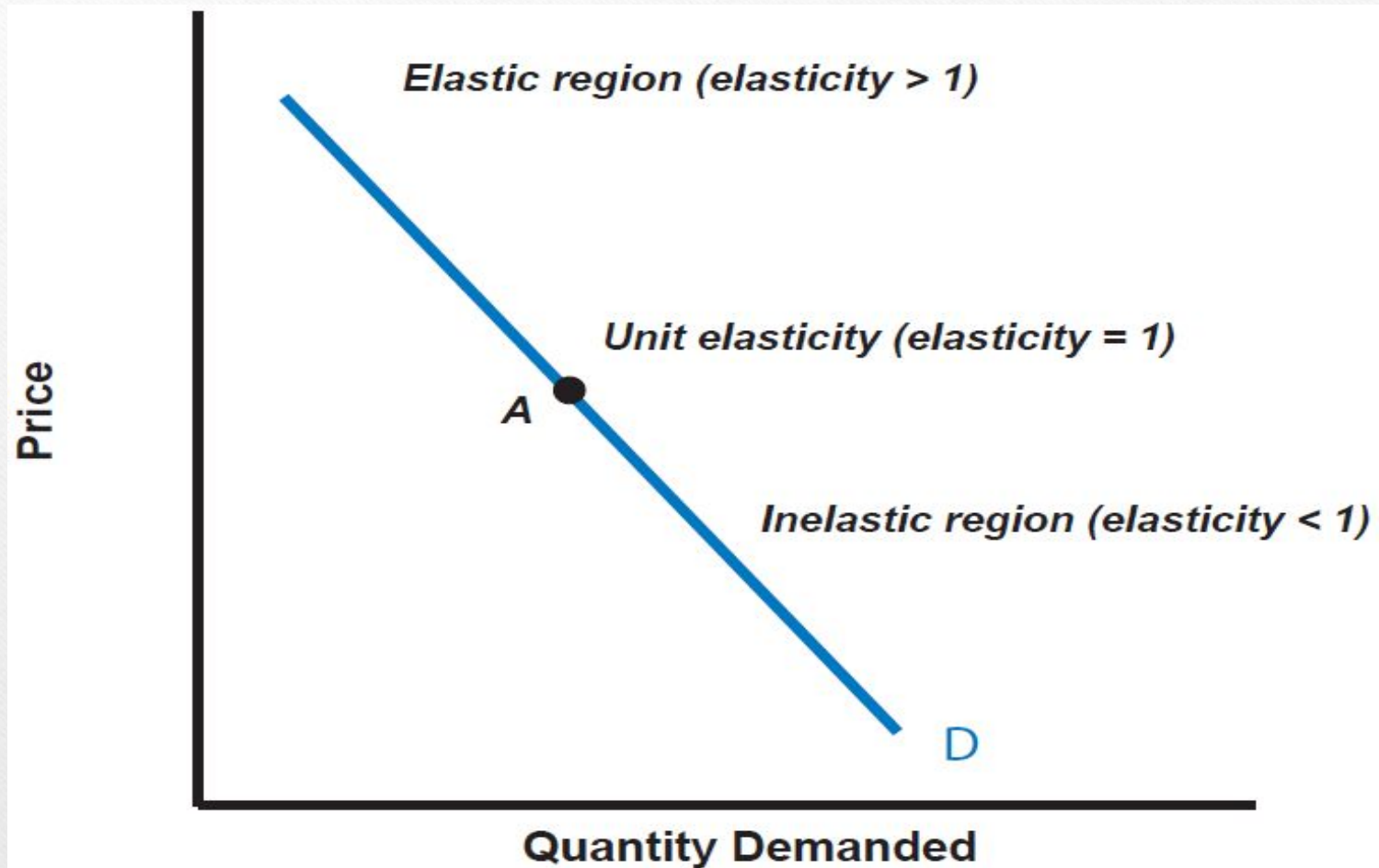
Price Elasticity of Demand Along a Straight Line Demand Curve

(1) Point	(2) Price	(3) Quantity Demanded	(4) E_d
A	$8	3	
			2.14
B	7	4	
			1.44
C	6	5	
			1.00
D	5	6	
			0.69
E	4	7	
			0.47
F	3	8	
			0.29
G	2	9	

(a)

(b)

Determinants of Price Elasticity on Demand

- **Number of Substitutes**: The more substitutes for a good, the higher the price elasticity of demand; the fewer substitutes for a good, the lower the price elasticity of demand. The more broadly defined the good, the fewer the substitutes; the more narrowly defined the good, the greater the substitutes.

- **Necessities Versus Luxuries**: The more that a good is considered a luxury rather than a necessity, the higher the price elasticity of demand.

- $(|E_d| > 1)$: Elastic Demand   => **Luxury goods**

- $(|E_d| < 1)$: Inelastic Demand   => **Necessary goods**

Q & A

- If there are 3 substitutes for good X and demand is inelastic, does it follow that if there are 9 substitutes for good X demand will be elastic? Explain your answer.

- Price elasticity of demand is predicted to be higher for which good of the following combinations of goods: Compaq computers or computers; Heinz ketchup or ketchup; Perrier water or water? Explain your answers.

Price Elasticity of Supply (PES)

Price Elasticity of Supply (PES)

- Measures the responsiveness of quantity supplied to changes in price.

- Defined as the percentage change in quantity supplied of a good divided by the percentage change in the price of the good.

- Supply can be classified as elastic, inelastic, unit elastic, perfectly elastic, or perfectly inelastic.
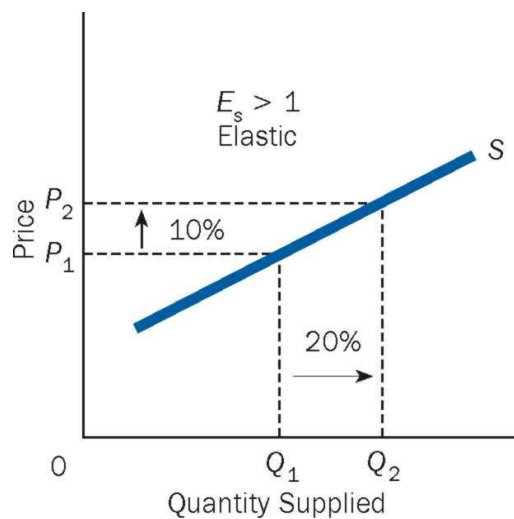
PES Definition

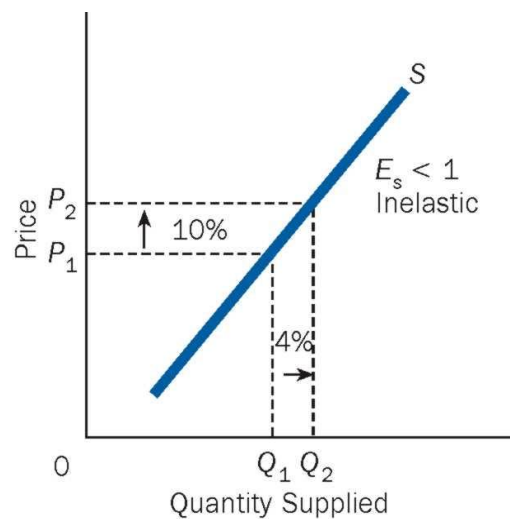The Formula:

$$PES = \frac{\% \text{ Change in Quantity Supplied}}{\% \text{ Change in Price}}$$

Note: Since price and quantity supply move in the same direction, hence no need to consider the absolute value for PES.

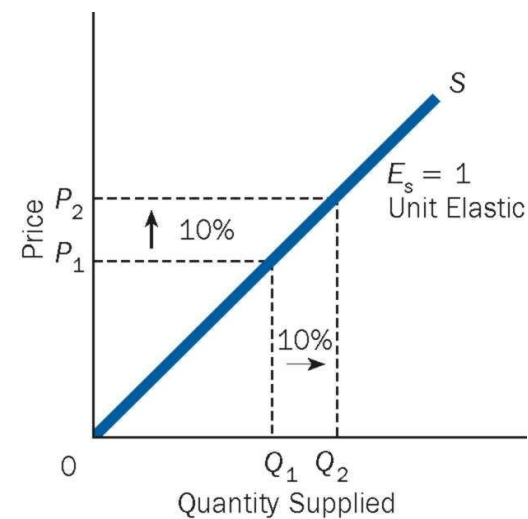# Price Elasticity of Supply

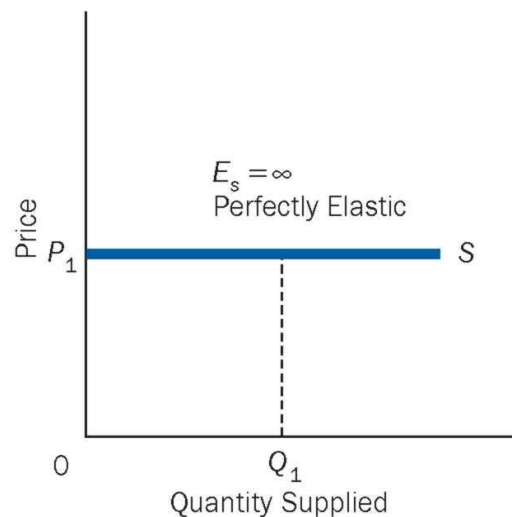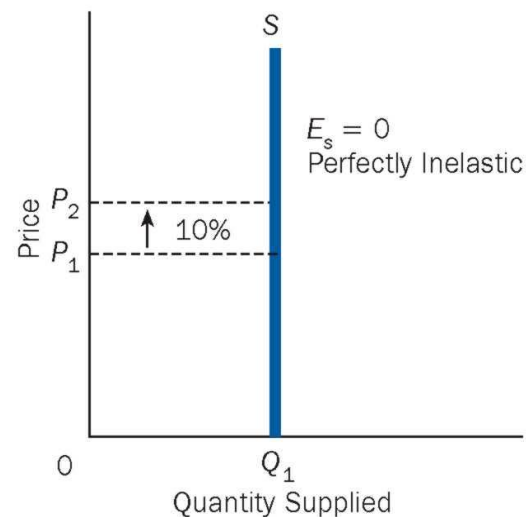# Price Elasticity of Supply and Time

- The longer the period of adjustment to a change in price, the higher the price elasticity of supply.

- Additional production takes time.

- Reducing production takes time.

Income Elasticity of Demand (YED)

Income Elasticity of Demand (YED)

- **Income Elasticity of Demand:**
  - The responsiveness of demand to changes in incomes
- **Normal Good** – demand rises as income rises and vice versa

  Y ⬆ DD ⬆
  Y ⬇ DD ⬇

- **Inferior Good** – demand falls as income rises and vice versa

  Y ⬆ DD ⬇
  Y ⬇ DD ⬆

YED Definition

The Formula:

$$YED = \frac{\% \text{ Change in Demand}}{\% \text{ Change in Income}}$$

YED and sign of coefficient

- **Income Elasticity of Demand:**

- A positive sign denotes a <u>normal good</u>
- A negative sign denotes an <u>inferior good</u>

<u>Note:</u> Direction(sign) matters, not the value

Income Elasticity of Demand

- If $E_y > 1$, demand is considered to be income elastic.

- If $E_y < 1$, demand is considered to be income inelastic.

- If $E_y = 1$, demand is considered to be unit elastic.

Q & A

- What does an income elasticity of demand of 1.33 mean?
- If supply is perfectly inelastic, what does this signify?
- Why will government raise more tax revenue if it applies a tax to a good with inelastic demand than if it applies the tax to a good with elastic demand?
- Under what condition would a per-unit tax placed on the sellers of computers be fully paid by the buyers of computers?

Cross Price Elasticity (XED)

XED Definition

The Formula:

$$\text{XED} = \frac{\text{\% Change in Demand for one good}}{\text{\% Change in price of another good}}$$

Cross Price Elasticity (XED)

- **XED measures** responsiveness of demand to changes in price of related good

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- **Substitute goods** – demand rises as income rises and vice versa   P1⬆Qd⬇DD2⬆
P1⬇Qd⬆DD2⬇

- **Inferior Good** – demand falls as income rises and vice versa   P1⬆Qd⬇DD2⬇
P1⬇Qd⬆DD2⬆

Cross Elasticity of Demand

- Measures the responsiveness in the quantity demanded of one good to changes in the price of another good.
- Defined as the percentage change in the quantity demanded of one good divided by the percentage change in the price of another good.
- This concept is often used to determine whether two goods are substitutes or complements and the degree to which one good is a complement to or substitute for another.

XED and sign of coefficient

- **Cross Price Elasticity (XED):**

- A positive sign denotes <u>Substitute Good</u>
- A negative sign denotes <u>Complementary Good</u>

<u>Note: </u>Direction(sign) matters, not the value

Summary of the Four Elasticity Concepts

Type	Definition	Possibilities	Terminology
Price elasticity of demand	$\dfrac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$	$E_d > 1$ $E_d < 1$ $E_d = 1$ $E_d = \infty$ $E_d = 0$	Elastic Inelastic Unit elastic Perfectly elastic Perfectly inelastic
Cross elasticity of demand	$\dfrac{\text{Percentage change in quantity demanded of one good}}{\text{Percentage change in price of another good}}$	$E_c < 0$ $E_c > 0$	Complements Substitutes
Income elasticity of demand	$\dfrac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$	$E_y > 0$ $E_y < 0$ $E_y > 1$ $E_y < 1$ $E_y = 1$	Normal good Inferior good Income elastic Income inelastic Income unit elastic
Price elasticity of supply	$\dfrac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$	$E_s > 1$ $E_s < 1$ $E_s = 1$ $E_s = \infty$ $E_s = 0$	Elastic Inelastic Unit elastic Perfectly elastic Perfectly inelastic

Midpoint Method

Price elasticity of demand $= \dfrac{(Q_2 - Q_1) / [(Q_2 + Q_1) / 2]}{(P_2 - P_1) / [(P_2 + P_1) / 2]}$

- Example: If the price of an ice cream cone increases from \$2.00 to \$2.20 and the amount you buy falls from 10 to 8 cones, then your elasticity of demand, using the midpoint formula, would be calculated as:

$$\dfrac{\dfrac{(10-8)}{(10+8)/2}}{\dfrac{(2.20-2.00)}{(2.00+2.20)/2}} = \dfrac{22\%}{9.5\%} = 2.32$$

YED : Midpoint Method

$Ey = \{(Q1-Q2) / [1/2 (Q1+Q2)] \} / (Y1-Y2) / [1/2 (Y1 + Y2)]$

Characteristics:
Ey > 1, Qd and income are directly related. This is a **normal** good and it is income **elastic.**
0< Ey<1, Qd and income are directly related. This is a **normal** good and it is income **inelastic.**
Ey < 0, Qd and income are inversely related. This is an **inferior** good.
Ey approaches 0, Qd   stays the same as income changes, indicating a necessity.
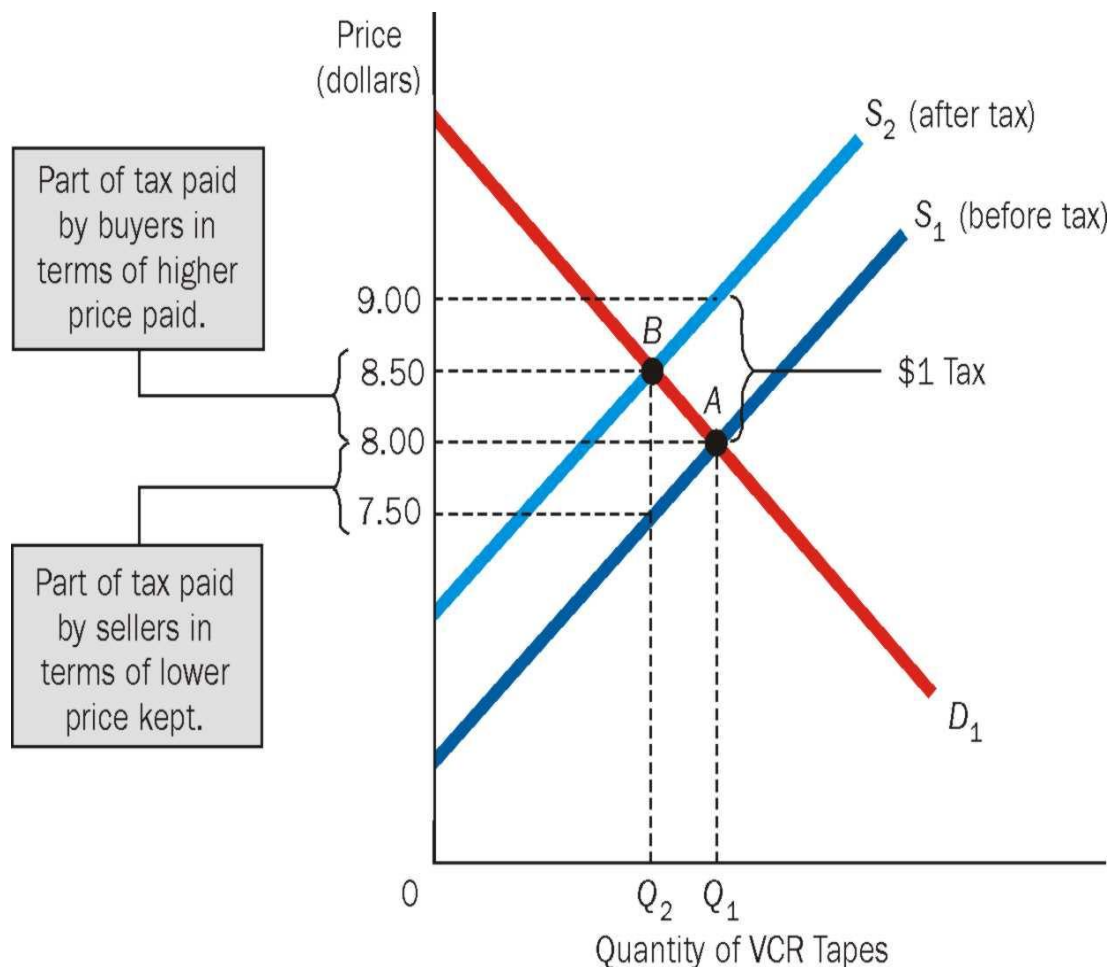
Example:
If income increased by 10%, the quantity demanded of a product increases by 5 %. Then the coefficient for the income elasticity of demand for this product is::
Ey = percentage change in Qx / percentage change in Y = (5%) / (10%) = 0.5 > 0, indicating this is a normal good and it is income inelastic.

Who Pays the Tax?

- A tax placed on the sellers of VCR tapes shifts the supply curve from S1 to S2 and raises the equilibrium price from $8 to $8.50. Part of the tax is paid by buyers through a higher price paid, and part of the tax is paid by sellers through a lower price kept.

- Tax revenues are maximized by placing the tax on the seller who faces the more inelastic demand curve.

Price (dollars)

Part of tax paid by buyers in terms of higher price paid.

Part of tax paid by sellers in terms of lower price kept.

S_2 (after tax)

S_1 (before tax)

9.00

B

8.50

A

$1 Tax

8.00

7.50

D_1

0   Q_2 Q_1

Quantity of VCR Tapes

Different Elasticities and Who Pays the Tax