

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 extent 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

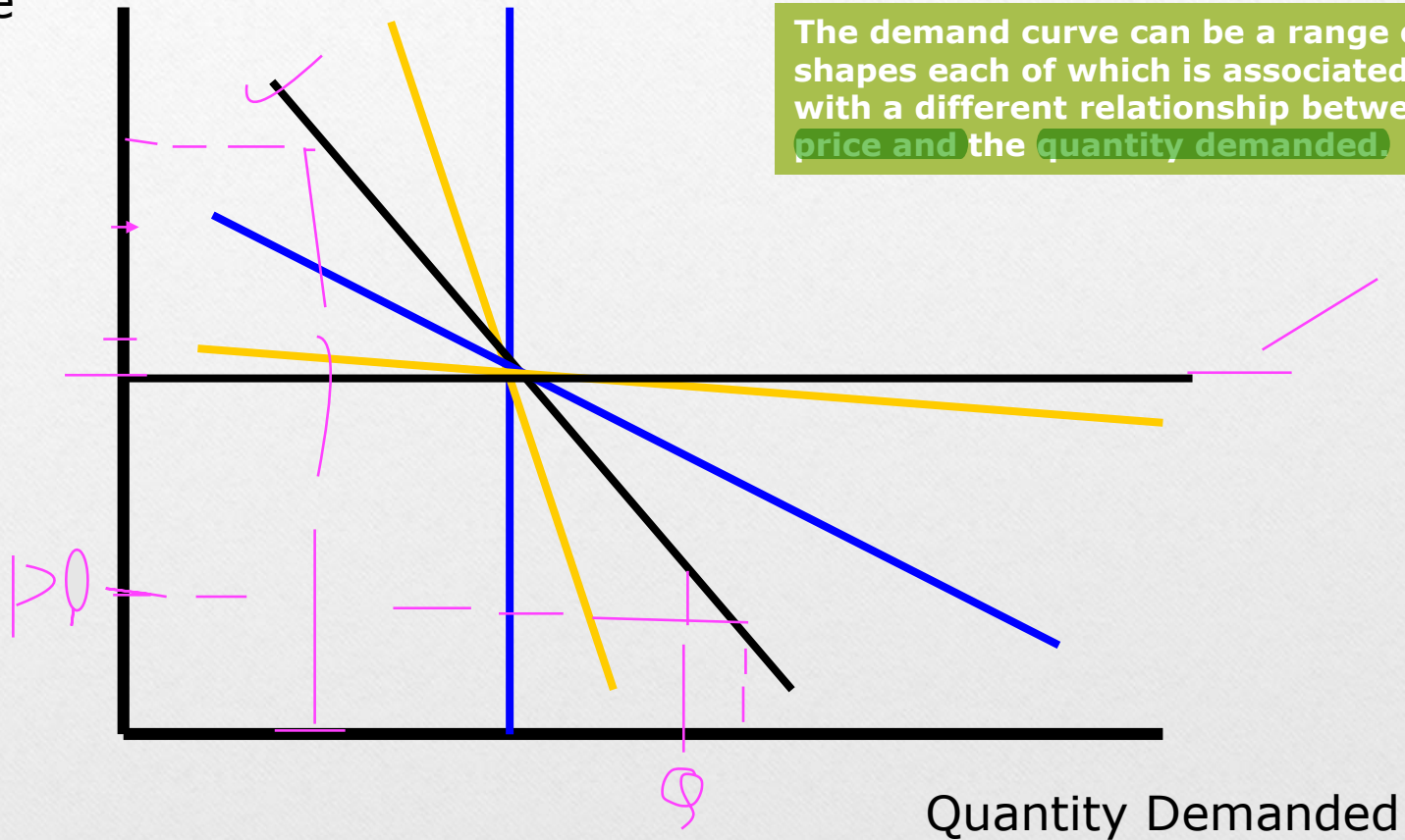
The Formula:

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

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



PED and Elasticity Coefficient

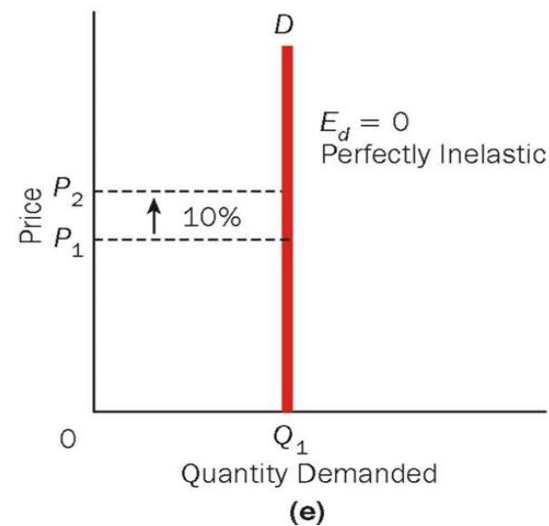
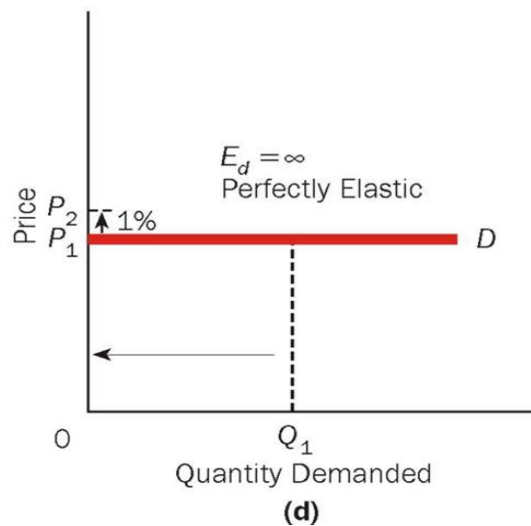
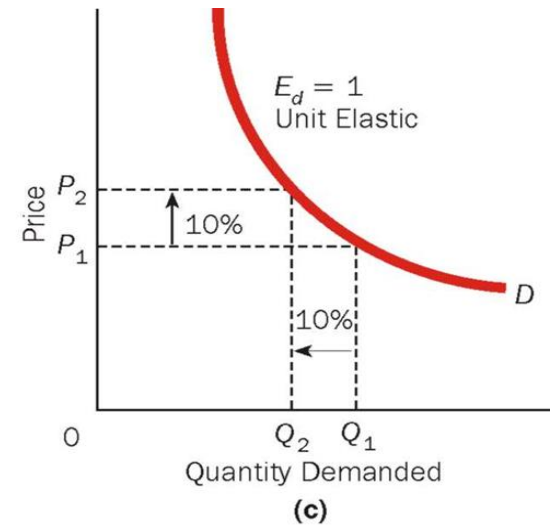
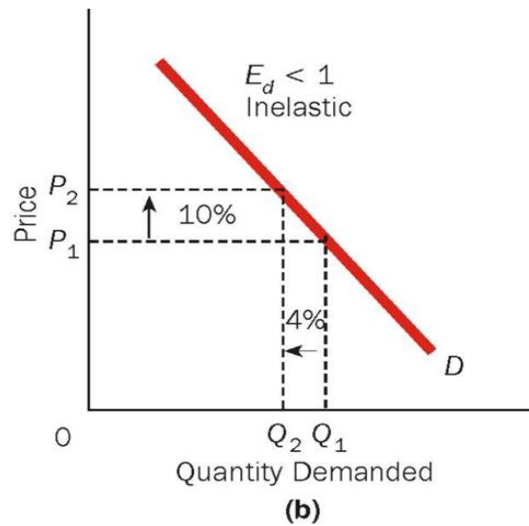
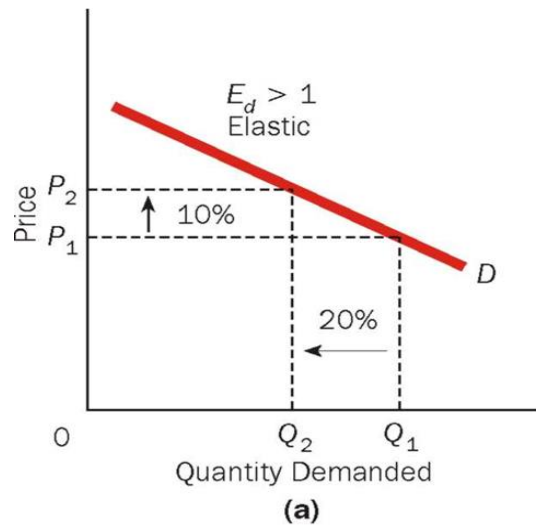
- ($|E_d| > 1$): Elastic Demand \Rightarrow Luxury goods
- ($|E_d| < 1$): Inelastic Demand \Rightarrow Necessary goods
- ($|E_d| = 1$): Unit Elastic Demand
- ($|E_d| = \infty$): Perfectly Elastic Demand
- ($|E_d| = 0$): Perfectly Inelastic Demand

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

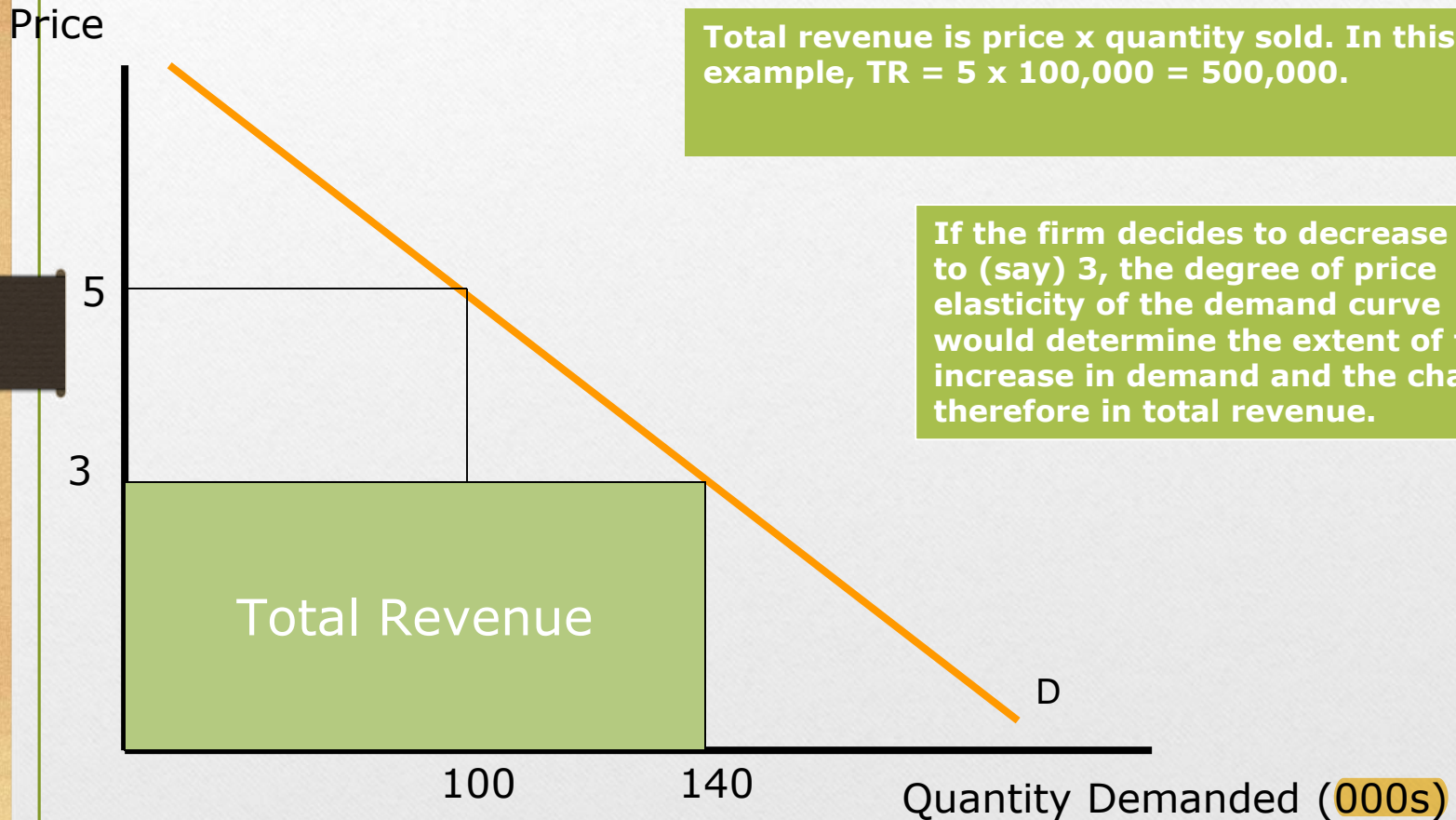
Graphical Representation



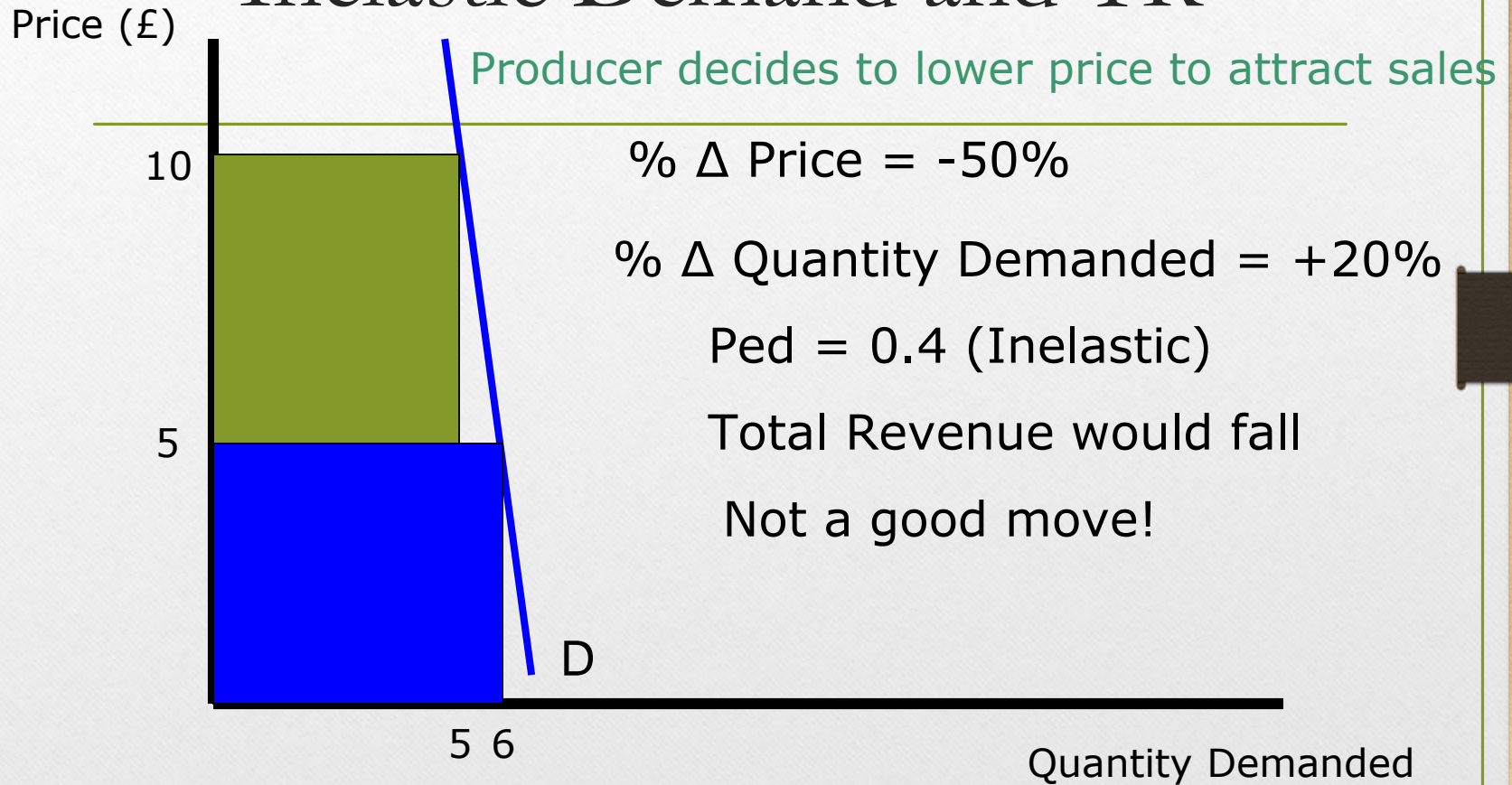
Price Elasticity of Demand and Total Revenue

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

Elasticity and TR



Inelastic Demand and TR



Elasticity and TR

- If demand is price elastic:

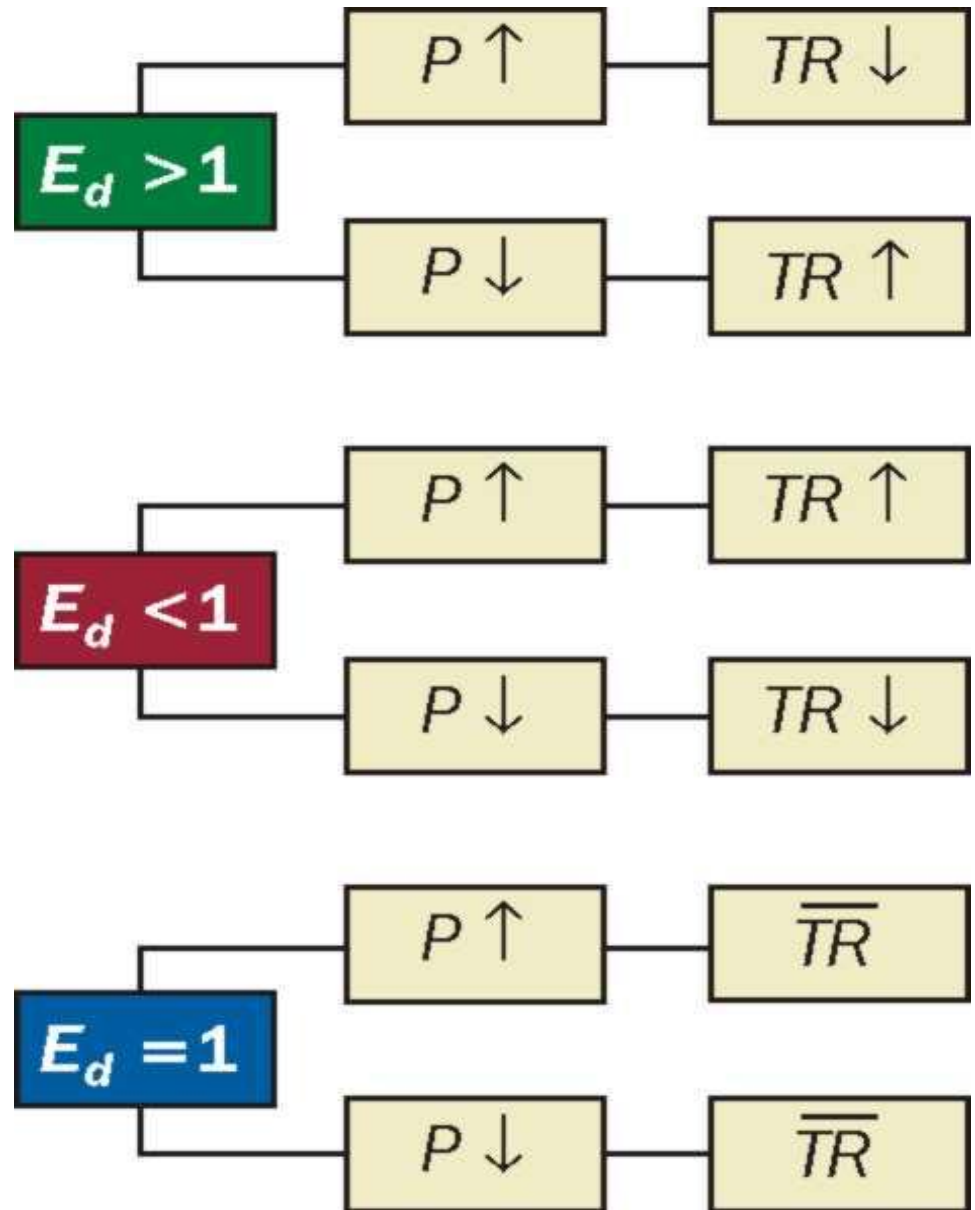
- Increasing price would **reduce** TR
($\% \Delta Q_d > \% \Delta P$)
- Reducing price would **increase** TR
($\% \Delta Q_d > \% \Delta P$)

- If demand is price inelastic:

- Increasing price would **increase** TR
($\% \Delta Q_d < \% \Delta P$)
- Reducing price would **reduce** TR ($\% \Delta Q_d < \% \Delta P$)

Summary

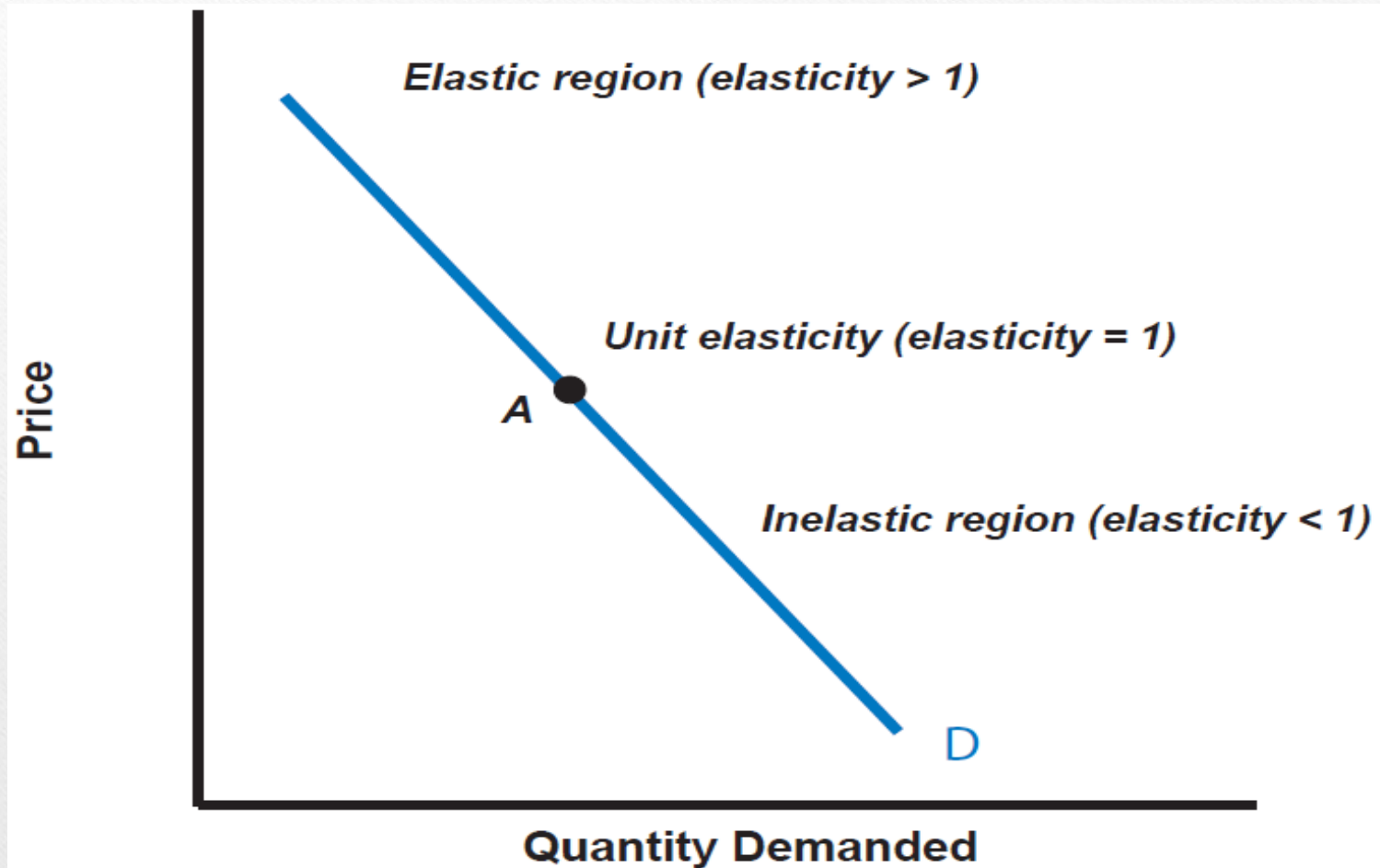
Elasticities, Price
Changes and Total
Revenue



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?

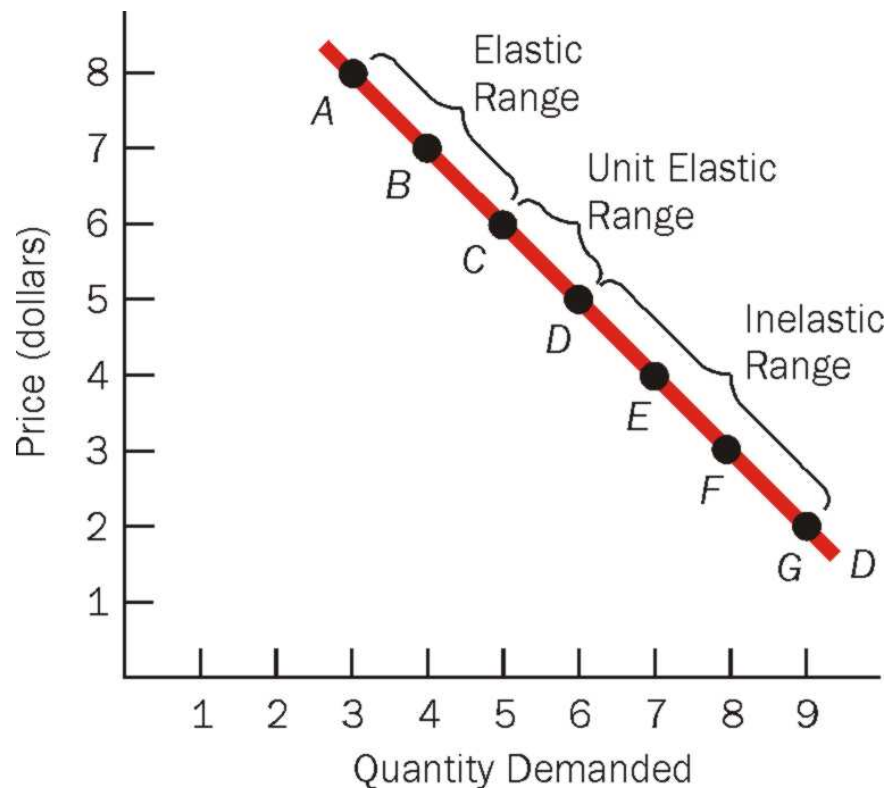
Elasticity Varies Along a Straight-Line Demand Curve



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 \Rightarrow **Luxury goods**
- $(|E_d| < 1)$: Inelastic Demand \Rightarrow **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.

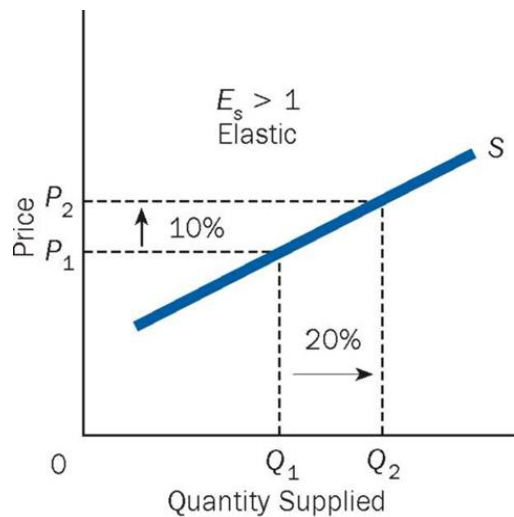
PES Definition

The Formula:

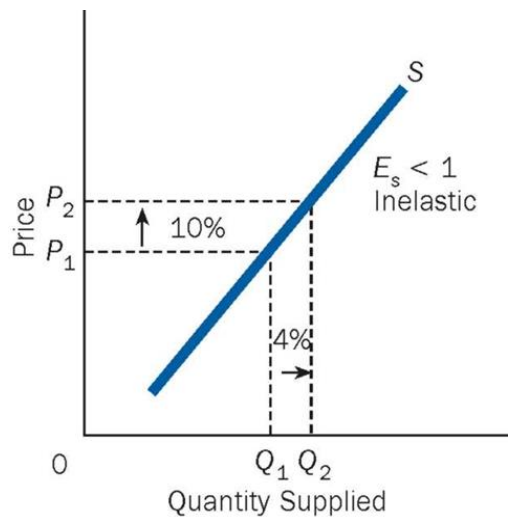
$$\text{PES} = \frac{\% \text{ Change in Quantity Supplied}}{\% \text{ Change in Price}}$$

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

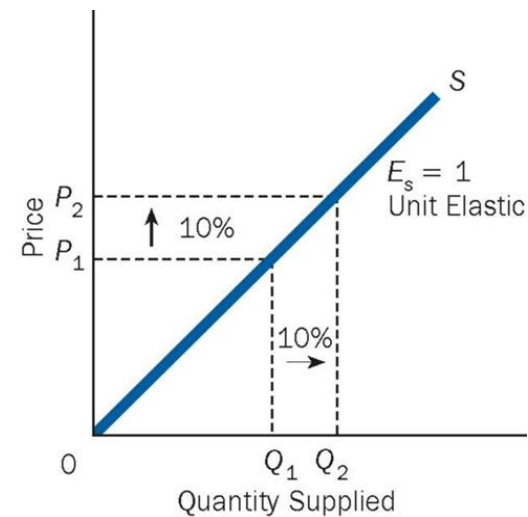
Price Elasticity of Supply



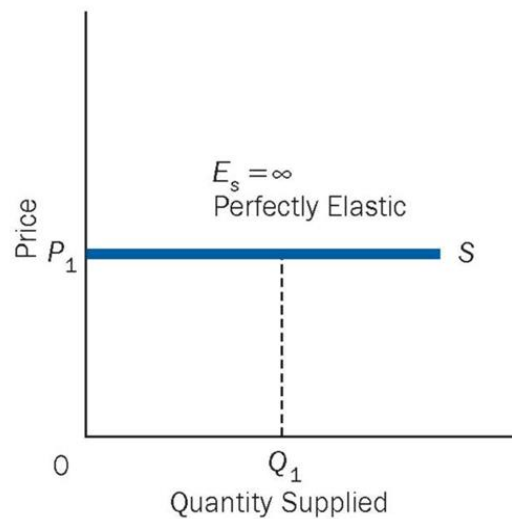
(a)



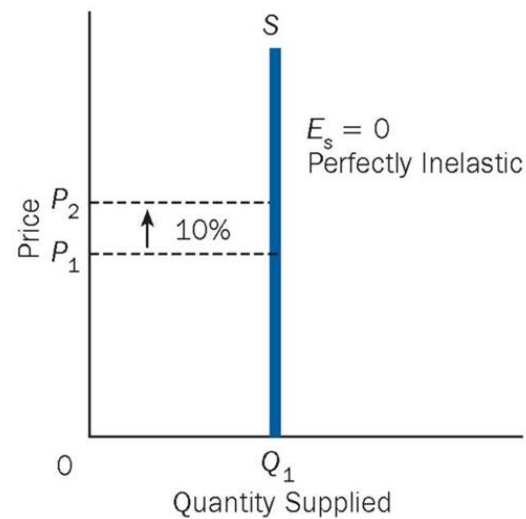
(b)



(c)



(d)



(e)

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



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



YED Definition

The Formula:

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

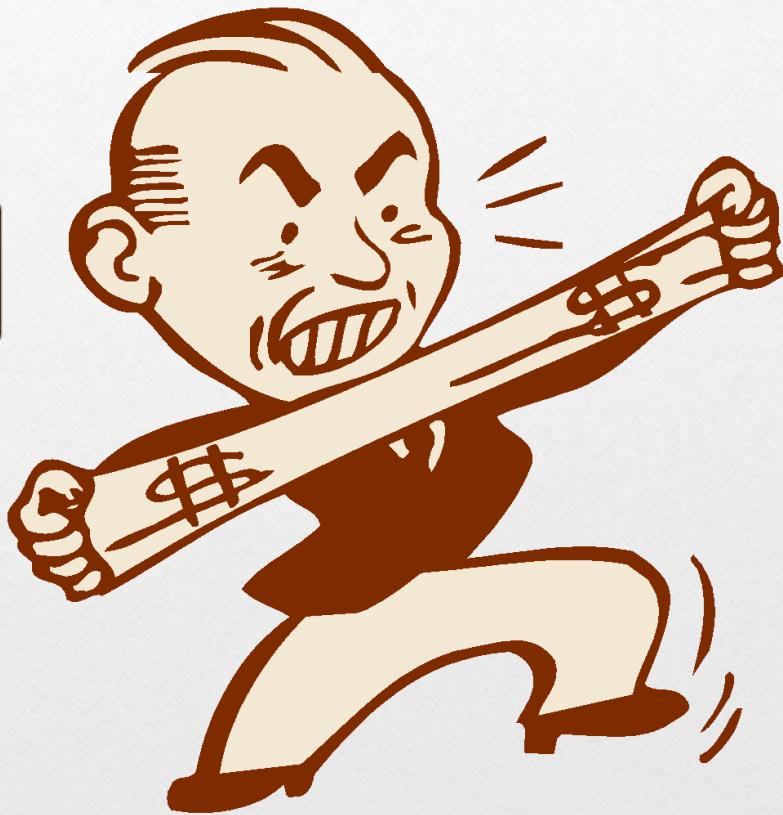
YED and sign of coefficient

- Income Elasticity of Demand:

- A positive sign denotes a normal good
- A negative sign denotes an inferior good

Note: 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
-

- **Substitute goods** – demand rises as income rises and vice versa
 $P_1 \uparrow Q_d \downarrow DD_2 \uparrow$
 $P_1 \downarrow Q_d \uparrow DD_2 \downarrow$
- **Inferior Good** – demand falls as income rises and vice versa
 $P_1 \uparrow Q_d \downarrow DD_2 \downarrow$
 $P_1 \downarrow Q_d \uparrow DD_2 \uparrow$

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 Substitute Good
- A negative sign denotes Complementary Good

Note: Direction(sign) matters, not the value

Summary of the Four Elasticity Concepts

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

Midpoint Method

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

- 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:

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

YED : Midpoint Method

$$E_y = \{(Q_1 - Q_2) / [1/2 (Q_1 + Q_2)]\} / (Y_1 - Y_2) / [1/2 (Y_1 + Y_2)]$$

Characteristics:

$E_y > 1$, Qd and income are directly related. This is a **normal** good and it is income **elastic**.

$0 < E_y < 1$, Qd and income are directly related. This is a **normal** good and it is income **inelastic**.

$E_y < 0$, Qd and income are inversely related. This is an **inferior** good.

E_y 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::

$E_y = \text{percentage change in } Q_x / \text{percentage change in } Y = (5\%) / (10\%) = 0.5 > 0$, indicating this is a normal good and it is income inelastic.