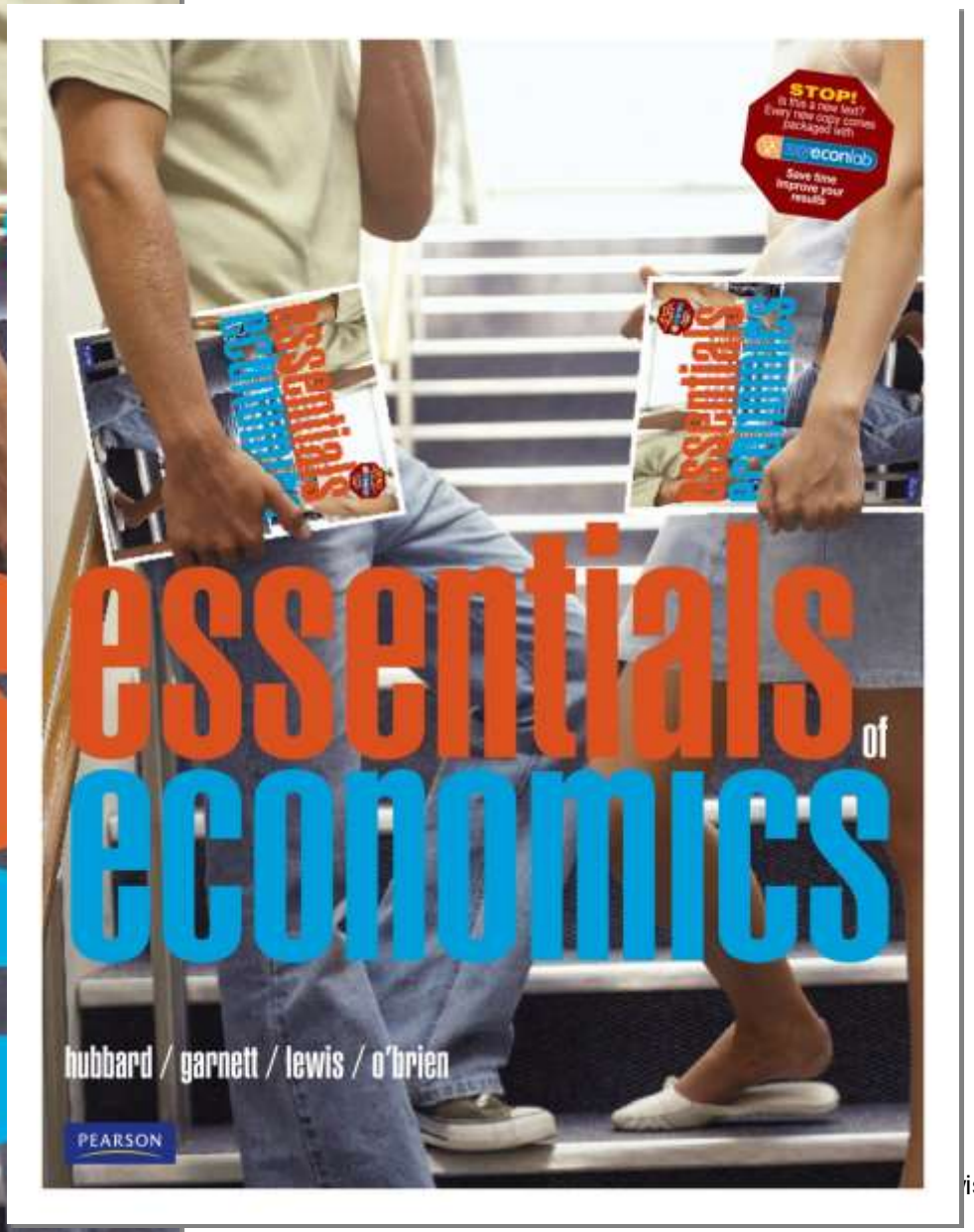
PowerPoint
to accompany



Elasticity: The Responsiveness of Demand and Supply

is and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Learning Objectives

1. Define the price elasticity of demand and understand how to calculate it.
2. Understand the determinants of the price elasticity of demand.
3. Understand the relationship between the price elasticity of demand and total revenue.
4. Define the cross-price elasticity of demand and the income elasticity of demand, and understand their determinants and how they are calculated.

Learning Objectives

5. Use price elasticity and income elasticity to analyse economic issues.
6. Define the elasticity of supply, and understand its main determinants and how it is calculated.

The price elasticity of demand and its measurement

- **Price elasticity of demand:** The responsiveness of the quantity demanded of a good to a change in its price.

- **How price elasticity is measured:** Divide the percentage change in the quantity demanded of a product by the percentage change in the product's price.

The price elasticity of demand and its measurement

$$\text{Price elasticity of demand} = \frac{\textit{Percentage change in quantity demanded}}{\textit{Percentage change in price}}$$

- **Note:** The price elasticity of demand is not the same as the slope of a demand curve.

Computing the Price Elasticity of Demand

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quatity demanded}}{\text{Percentage change in price}}$$

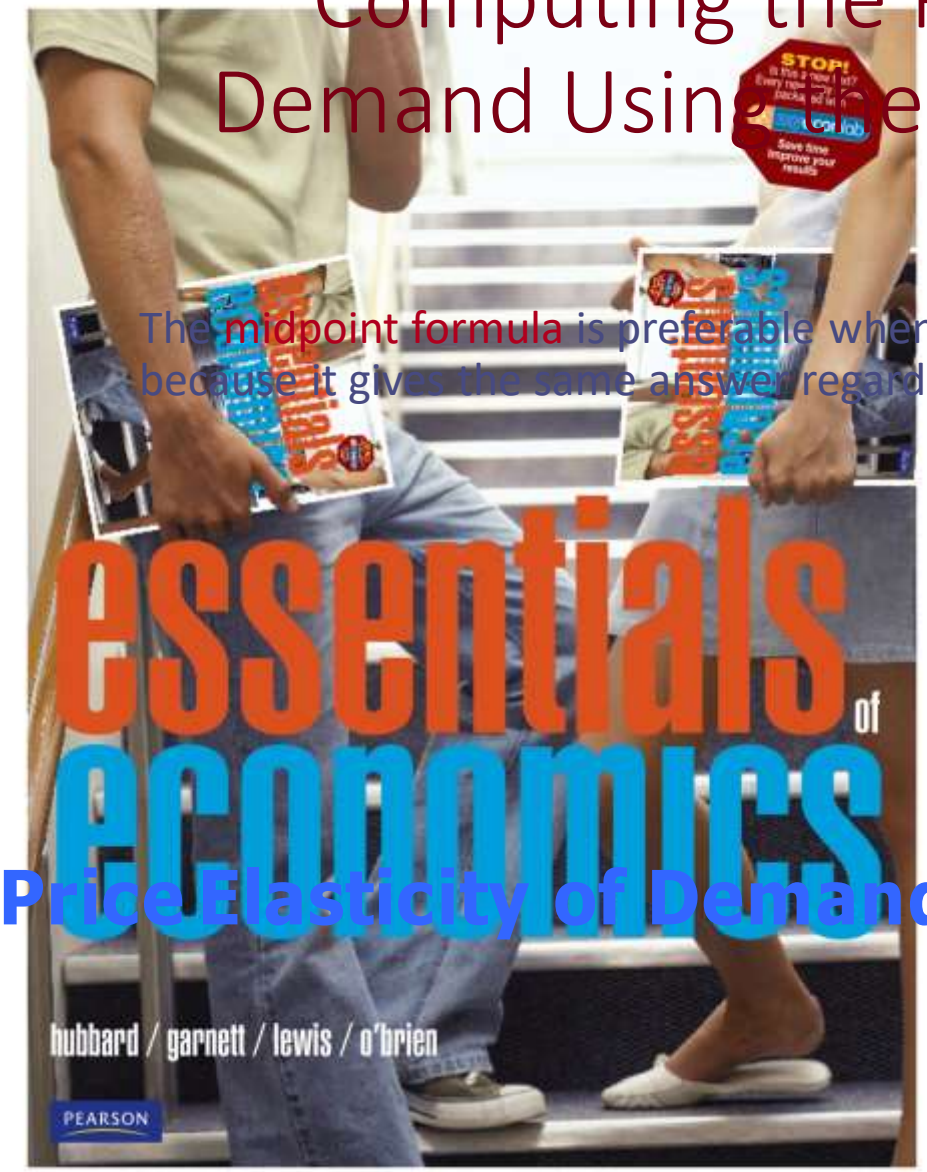
Example: If the price of an ice cream cone increases from $2.00 to $2.20 and the amount you buy falls from 10 to 8 cones then your elasticity of demand would be calculated as:

$$\frac{\frac{(10-8)}{10}\times 100}{\frac{(2.20-2.00)}{2.00}\times 100} = \frac{20 \text{ percent}}{10 \text{ percent}} = 2$$

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

PowerPoint
to accompany

Computing the Price Elasticity of Demand Using the Midpoint Formula



The midpoint formula is preferable when calculating the price elasticity of demand because it gives the same answer regardless of the direction of the change.

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

is and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Computing the Price Elasticity of Demand

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

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 the your elasticity of demand, using the midpoint formula, would be calculated as:

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

The price elasticity of demand and its measurement

- **Elastic demand:** Demand is elastic when the percentage change in quantity demanded is greater than the percentage change in price.

- The price elasticity is greater than one in absolute value.

The price elasticity of demand and its measurement

- **Inelastic demand:** Demand is inelastic when the percentage change in quantity demanded is less than the percentage change in price.

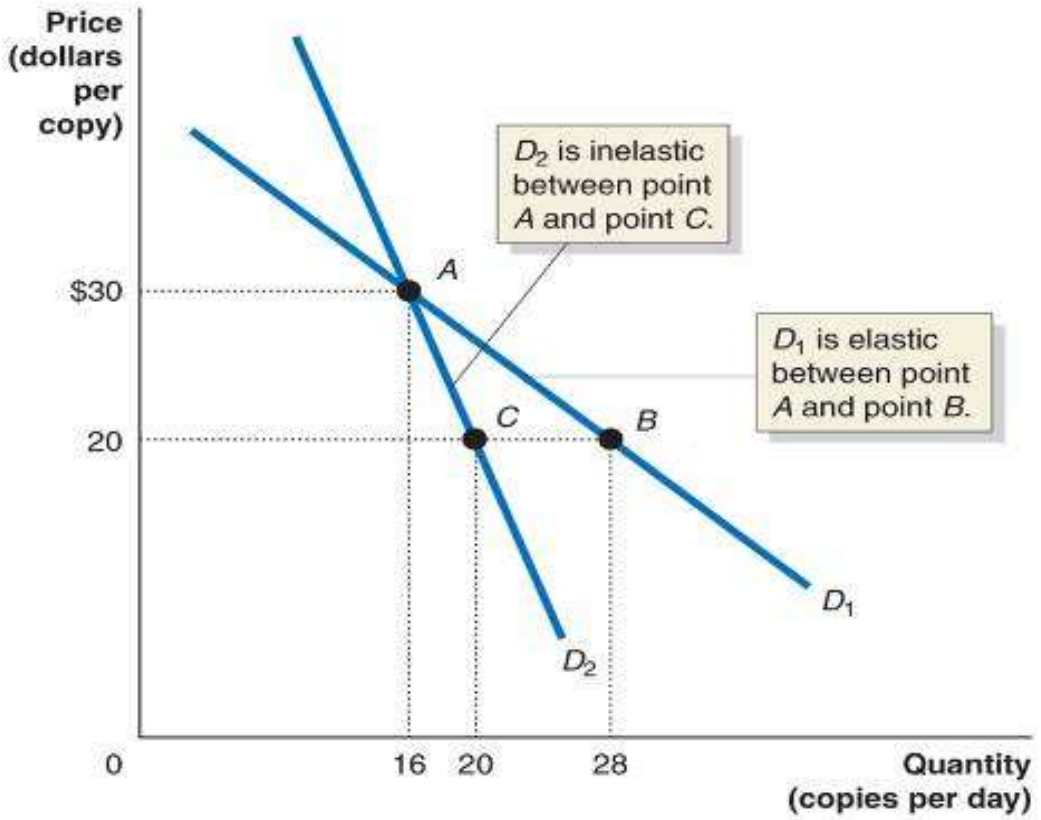
- The price elasticity is less than one in absolute value.

The price elasticity of demand and its measurement

- **Unit elastic demand:** Demand is unit elastic when the percentage change in quantity demanded is equal to the percentage change in price.

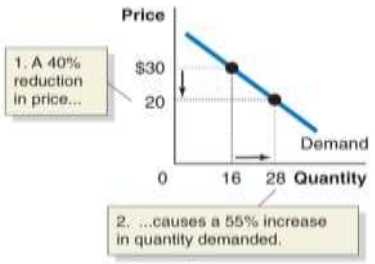
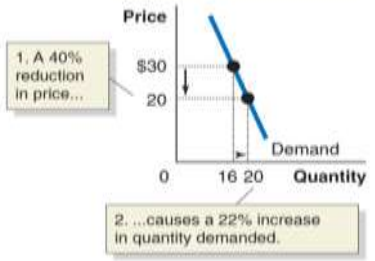
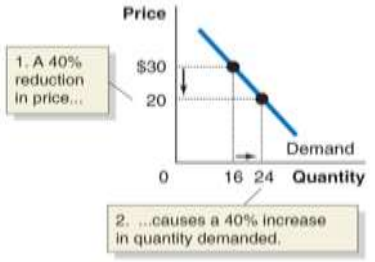
- The price elasticity is equal to one in absolute value.

Elastic and inelastic demand curves: Figure 4.1



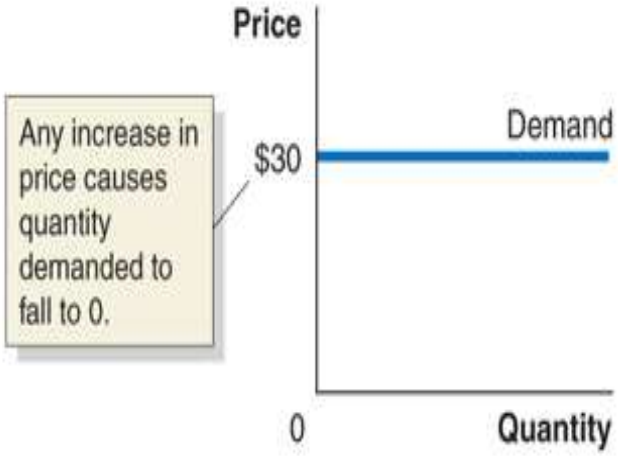
Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Summary of the price elasticities of demand: Table 4.1

elastic	greater than 1	
inelastic	less than 1	
unit-elastic	equal to 1	

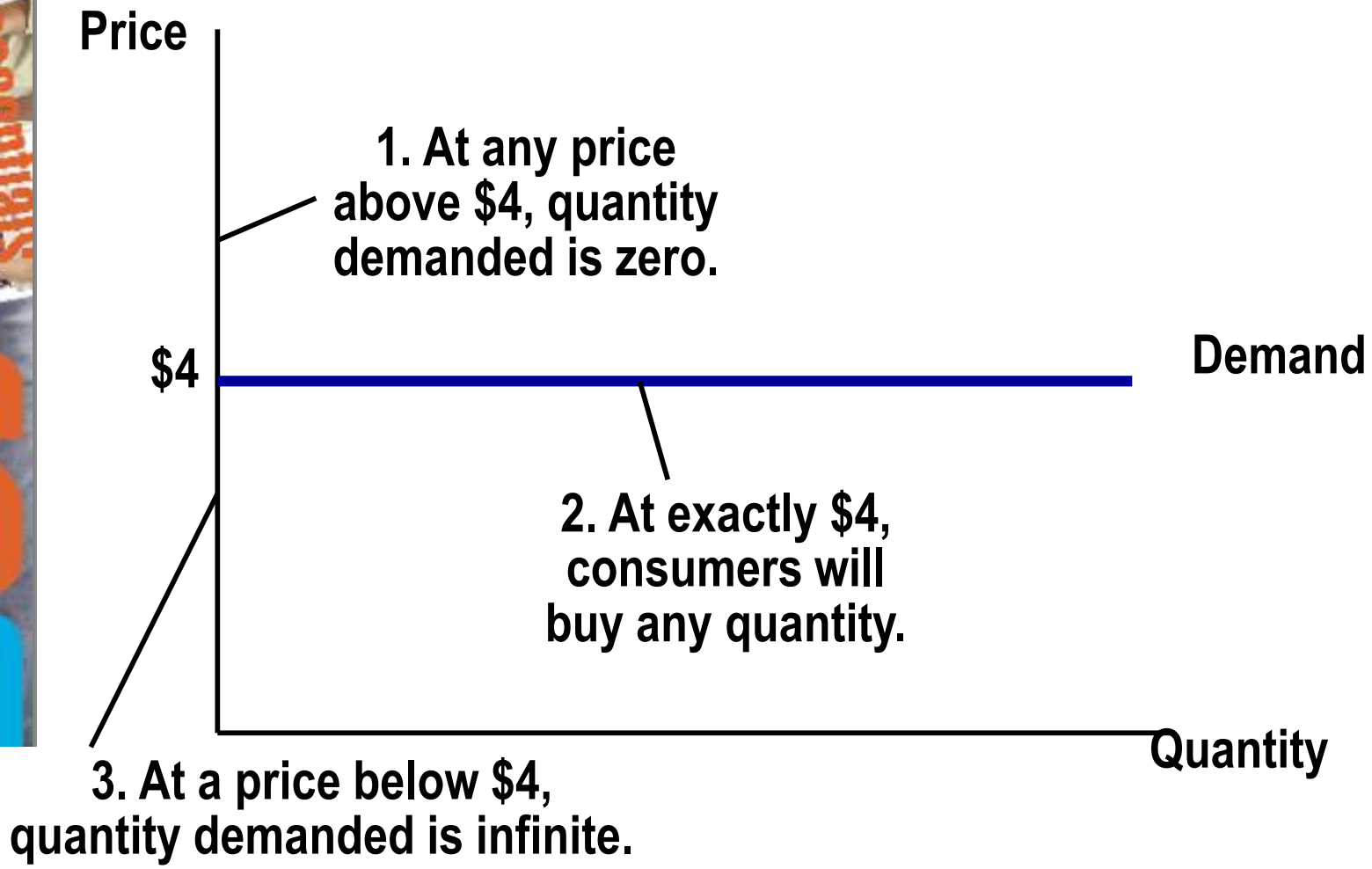
Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Summary of the price elasticities of demand: Table 4.1, continued

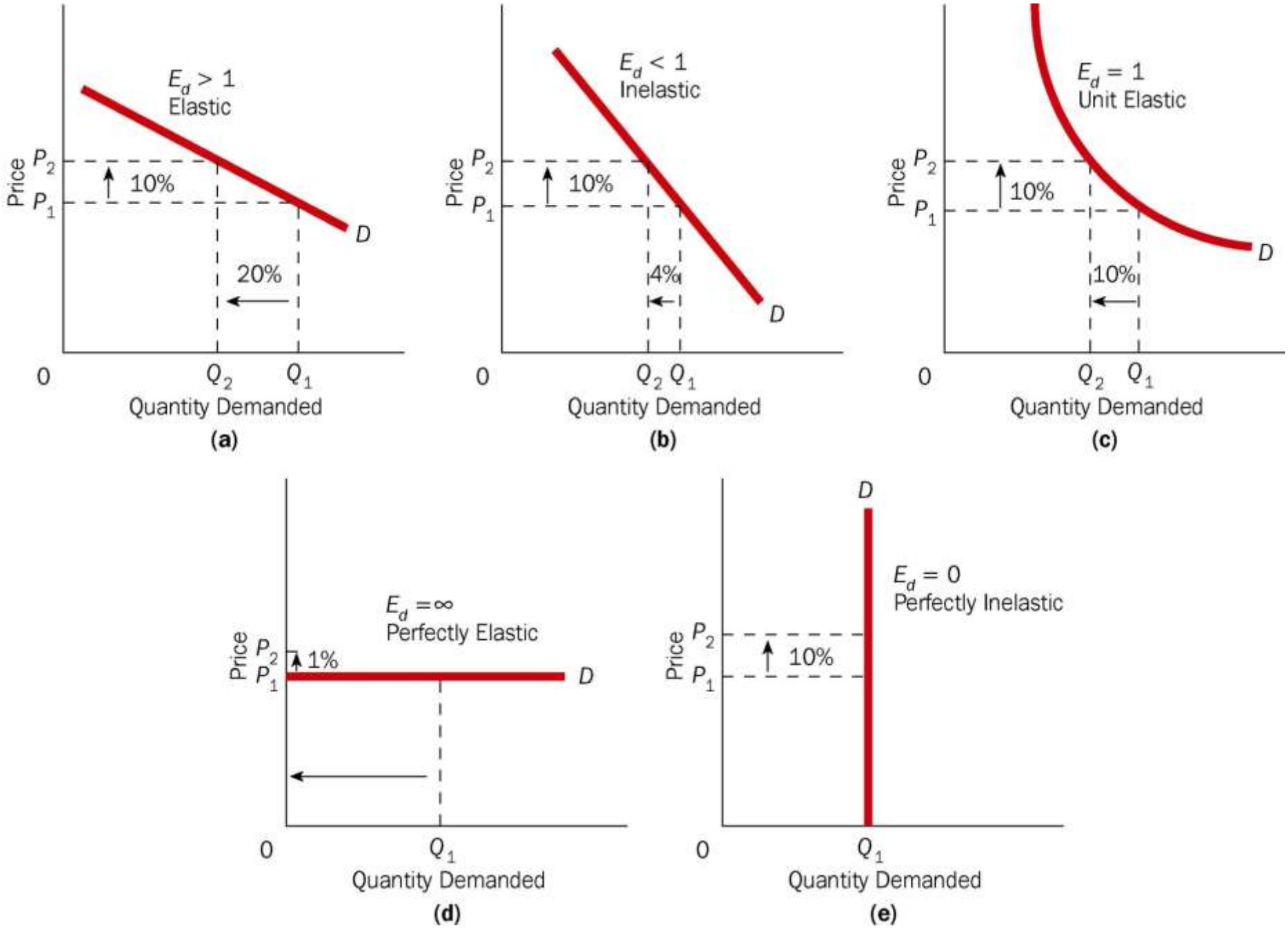
perfectly elastic	equal to infinity	
perfectly inelastic	equal to 0	

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Perfectly Elastic Demand
- Elasticity equals infinity



Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia


$E_d > 1$
Elastic
Price
P_2
P_1
10%
20%
D
0
Q_2
Q_1
Quantity Demanded
(a)
$E_d < 1$
Inelastic
10%
4%
(b)
$E_d = 1$
Unit Elastic
10%
10%
(c)
$E_d = \infty$
Perfectly Elastic
1%
(d)
$E_d = 0$
Perfectly Inelastic
10%
(e)

SOLVED PROBLEM

Measuring elasticity of demand

- A study conducted by the Australian Medical Association suggests that every 10 per cent increase in the price of cigarettes is associated with a 5 per cent decrease in the quantity of cigarettes demanded.

  a) Use the figures from this study to calculate the price elasticity of demand for cigarettes.

  b) On the basis of your findings, does this suggest that increasing the price of cigarettes will substantially decrease smoking.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

SOLVED PROBLEM

Measuring elasticity of demand

Solving the problem:

- STEP 1: Review the material. The problem is about calculating elasticity of demand which is covered on pages 97 – 98 of the text. It is not necessary to use the midpoint formula given on page 99, as the question provides the percentage change in price and the resulting percentage change in quantity demanded.

SOLVED PROBLEM

Measuring elasticity of demand

Solving the problem:

- STEP 2: Answer (a) using the following formula:

$$\text{Price elasticity of demand} = \frac{\textit{Percentage change in quantity demanded}}{\textit{Percentage change in price}}$$

SOLVED PROBLEM

Measuring elasticity of demand

Solving the problem:

- STEP 2: Insert the percentage changes from the question into the formula:

$$Elasticity = \frac{0.05}{0.10} = 0.5$$

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

SOLVED PROBLEM

Measuring elasticity of demand

Solving the problem:

- STEP 3: Answer (b) on the basis of the answer to (a).
- We find that price elasticity of demand for cigarettes is less than one, or inelastic. This is not unexpected. Cigarette smoking is a difficult habit to give up. An increase in price alone is insufficient to induce people to break this habit.

What determines price elasticity of demand?

Determinants of price elasticity of demand:

1. Availability of close substitutes.
2. The length of time involved
3. Necessities versus luxuries
4. Definition of the market
5. Share of expenditure on the good in the consumer's budget.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

MAKING THE CONNECTION 4•1

The price elasticity of demand for breakfast cereal

- **What happens when the price of cereal rises?**
- Changes in the quantity demanded for particular brands versus changes in the quantity demanded for the market as a whole.

What determines price elasticity of demand?

- **Total revenue:** the total amount of funds received by a seller of a good or service.

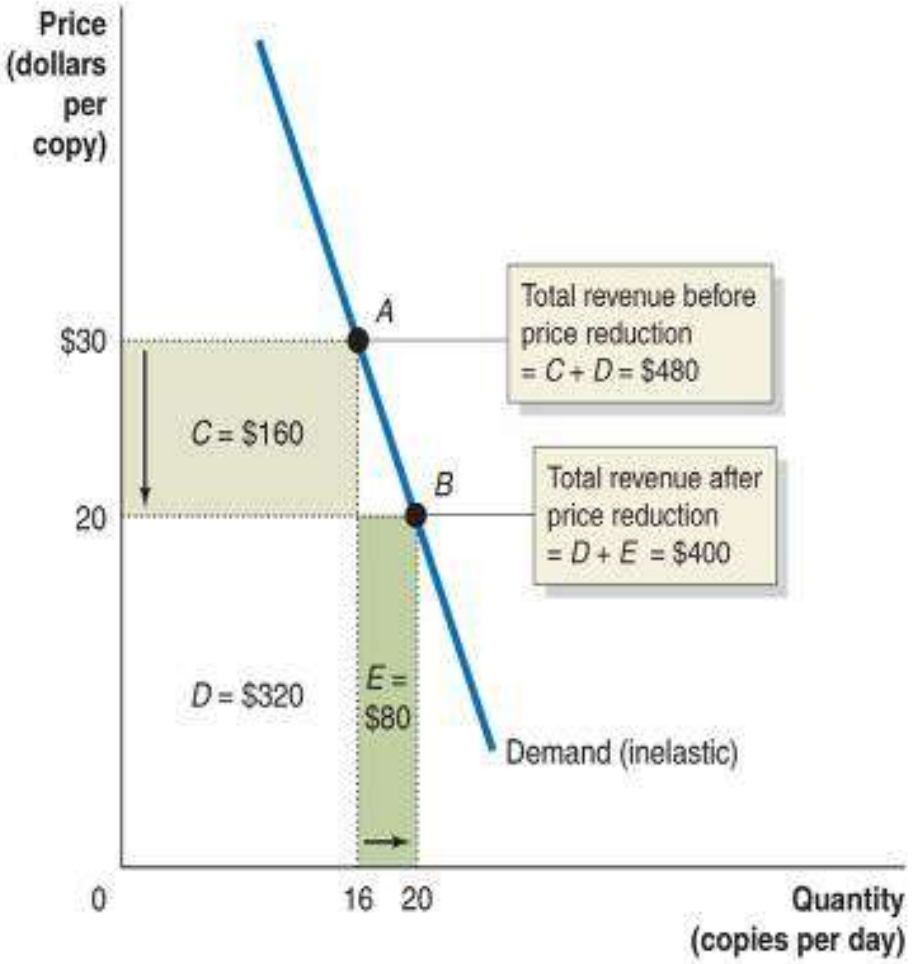
- Total revenue is found by multiplying price per unit by the number of units sold.

The relationship between price elasticity and total revenue

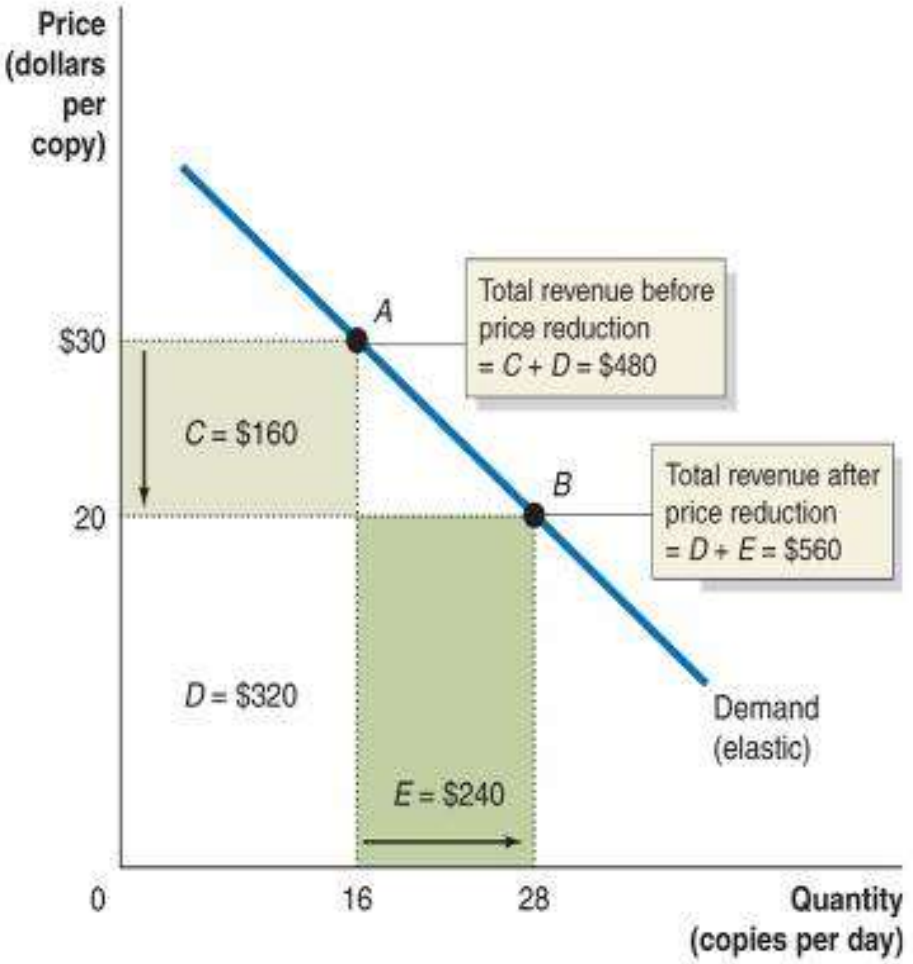
- When demand is price inelastic:
  - A decrease in price leads to a decrease in total revenue.
  - An increase in price leads to an increase in total revenue.
- When demand is price elastic:
  - A decrease in price leads to an increase in total revenue.
  - An increase in price leads to a decrease in total revenue.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

The relationship between price elasticity and total revenue: Figure 4.2



(a) Reducing the price when demand is inelastic reduces total revenue

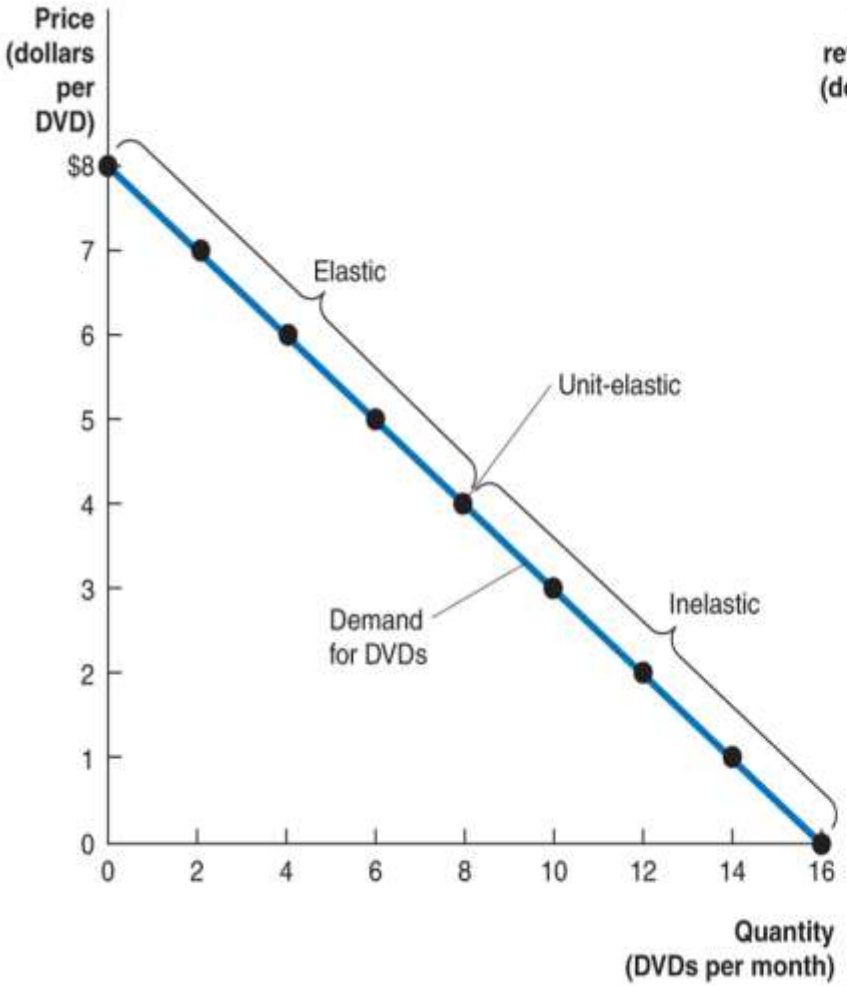


(b) Reducing the price when demand is elastic increases total revenue

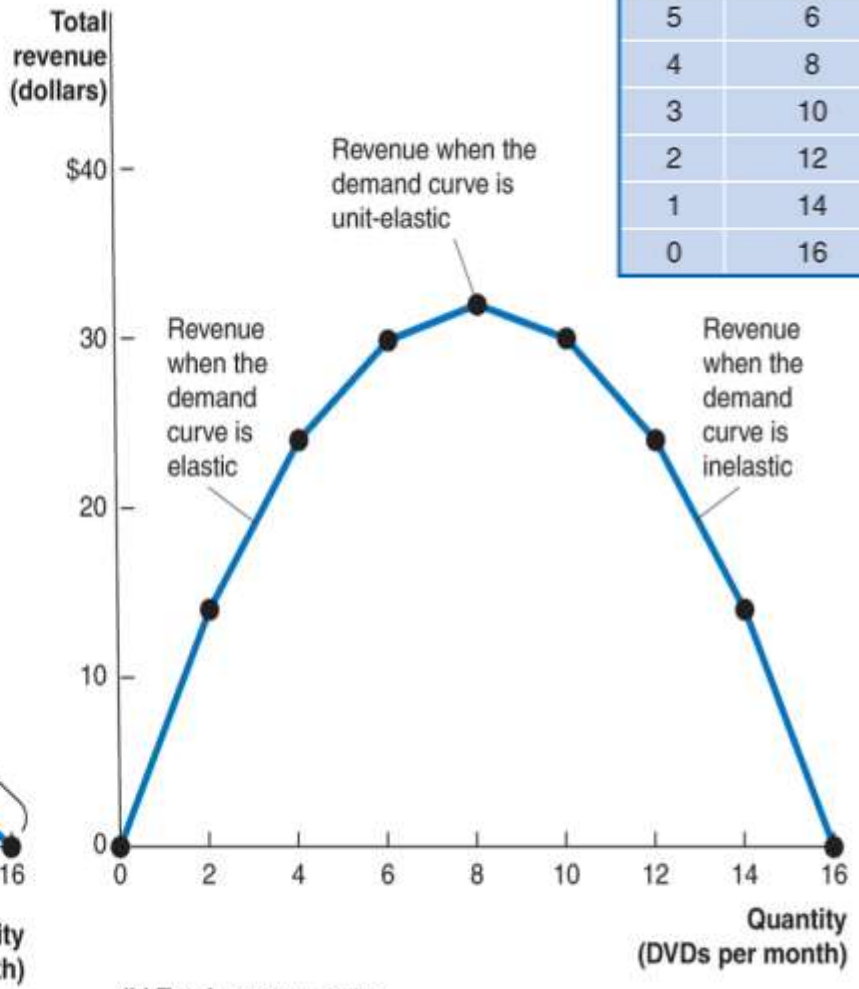
Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Elasticity is not constant along a linear demand curve: Figure 4.3

Price	Quantity demanded	Total revenue
$8	0	$0
7	2	14
6	4	24
5	6	30
4	8	32
3	10	30
2	12	24
1	14	14
0	16	0

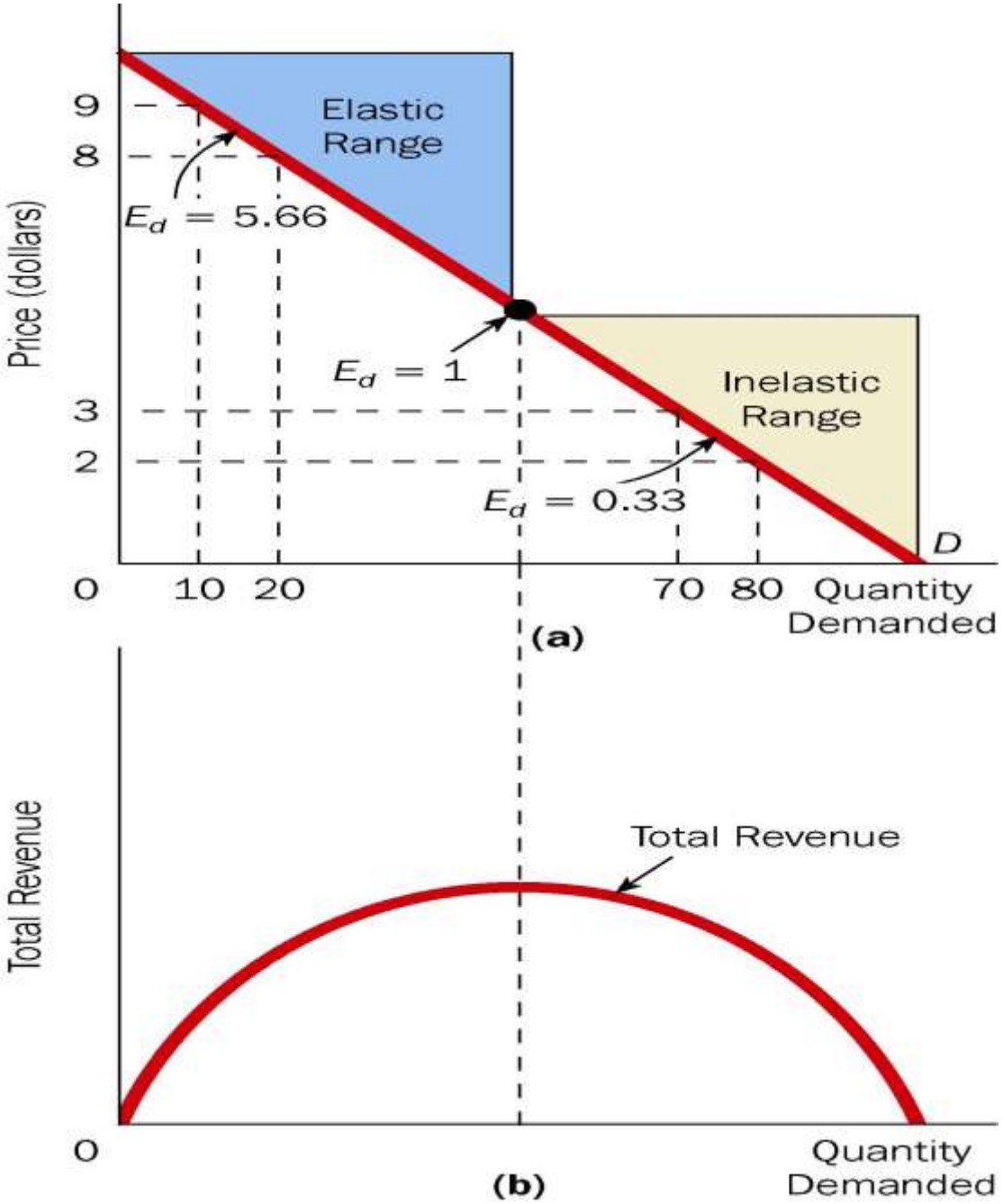


(a) Demand curve for DVDs



(b) Total revenue curve

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia



ssentials of Economics © 2010 Pearson Australia

Thomson Learning™

The relationship between price elasticity and total revenue: Table 4.2

If demand is …	Then …	Because …
elastic	an increase in price reduces revenue	the decrease in quantity demanded is proportionally *greater* than the increase in price

The relationship between price elasticity and total revenue: Table 4.2

If demand is …	Then …	Because …
elastic	an increase in price reduces revenue	the decrease in quantity demanded is proportionally *greater* than the increase in price
elastic	a decrease in price increases revenue	the increase in quantity demanded is proportionally *greater* than the decrease in price

The relationship between price elasticity and total revenue: Table 4.2

If demand is …	Then …	Because …
elastic	an increase in price reduces revenue	the decrease in quantity demanded is proportionally *greater* than the increase in price
elastic	a decrease in price increases revenue	the increase in quantity demanded is proportionally *greater* than the decrease in price
inelastic	a decrease in price reduces revenue	the decrease in quantity demanded is proportionally *smaller* than the increase in price

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

The relationship between price elasticity and total revenue: Table 4.2, continued

If demand is …	Then …	Because …
inelastic	a decrease in price reduces revenue	the increase in quantity demanded is proportionally *smaller* than the decrease in price

The relationship between price elasticity and total revenue: Table 4.2, continued

If demand is …	Then …	Because …
inelastic	a decrease in price reduces revenue	the increase in quantity demanded is proportionally *smaller* than the decrease in price
unit-elastic	an increase in price does not affect revenue	the decrease in quantity demanded is proportionally *the same* as the increase in price

The relationship between price elasticity and total revenue: Table 4.2, continued

If demand is …	Then …	Because …
inelastic	a decrease in price reduces revenue	the increase in quantity demanded is proportionally *smaller* than the decrease in price
unit-elastic	an increase in price does not affect revenue	the decrease in quantity demanded is proportionally *the same* as the increase in price
unit-elastic	a decrease in price does not affect revenue	the increase in quantity demanded is proportionally *the same* as the decrease in price

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Other demand elasticities

- **Cross price elasticity of demand:** the percentage change in the quantity demanded of one good divided by the percentage change in the price of another good.

$$\text{Cross-price elasticity of demand} = \frac{\text{Percentage change in quantity demanded of one good}}{\text{Percentage change in price of a related good}}$$

Other demand elasticities

- Cross price elasticity will be positive when the two goods are substitutes in consumption.

- Cross price elasticity will be negative when the two goods are complements in consumption.

Summary of cross-price elasticities of demand: Table 4.3

If the products are …	**Then the cross-price elasticity of demand will be …**	**Example**
substitutes	positive	two brands of printers

Summary of cross-price elasticities of demand: Table 4.3

If the products are …	**Then the cross-price elasticity of demand will be …**	**Example**
substitutes	positive	two brands of printers
complements	negative	printers and toner cartridges

Summary of cross-price elasticities of demand: Table 4.3

If the products are …	**Then the cross-price elasticity of demand will be …**	**Example**
substitutes	positive	two brands of printers
complements	negative	printers and toner cartridges
unrelated	zero	printers and peanut butter

Cross Price Elasticity

Table 3.17

Commodity	Before		After	
	Price (dollars/unit)	Quantity (units/month)	Price (dollars/unit)	Quantity (units/month)
Hamburgers (Y)	3.00	30	2.00	40
Hot dogs (X)	1.00	15	1.00	10
Mustard (jar) (Z)	1.50	10	2.00	9
Hot dogs (X)	1.00	15	1.00	12

$$e_{xy} = \frac{\Delta Q_x}{\Delta P_y} \cdot \frac{P_y}{Q_x} = \left(\frac{-5}{-1}\right)\left(\frac{3}{15}\right) = +1$$

$$e_{xz} = \frac{\Delta Q_x}{\Delta P_z} \cdot \frac{P_z}{Q_x} = \left(\frac{-3}{0.50}\right)\left(\frac{1.50}{15}\right) = -0.6$$

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

SOLVED PROBLEM

Cross price elasticities

- Would you expect the cross price elasticity between the following pairs of goods to be positive or negative? Explain your answers.

  a) Coke and Pepsi.

  b) DVD players and DVDs.

  c) Gucci sunglasses and vegemite.

SOLVED PROBLEM

Cross price elasticities

Solving the problem:

- STEP 1: Review the material. The problem is about cross price elasticities of demand, covered on 109 – 110 of the text.
- STEP 2: Solving (a). Coke and Pepsi are the classic example of two goods which are substitutes in consumption. An increase in the price of Coke would, therefore, lead to an increase in demand for Pepsi, so the cross-price elasticity would be positive.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

SOLVED PROBLEM

Cross price elasticities

Solving the problem:

- STEP 3: Solving (b). DVD players and DVDs are complements in consumption. An increase in the price of DVD players would see a decrease in demand for DVD players, and hence a decrease in demand for the complement DVDs. The cross-price elasticity between the two goods would, therefore, be negative.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

SOLVED PROBLEM

Cross price elasticities

Solving the problem:

- STEP 4: Solving (c). Gucci sunglasses and vegemite are completely unrelated goods, therefore, we would expect the cross price elasticity to equal zero.

Other demand elasticities

- **Income elasticity of demand:** A measure of the responsiveness of quantity demanded to a change in income.
- Measured by the percentage change in quantity demanded divided by the percentage change in income.

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

Summary of income elasticity of demand: Table 4.4

If the income elasticity of demand is …	**Then the good is …**	**Example**
Positive, but less than 1	normal and a necessity	milk

Summary of income elasticity of demand: Table 4.4

If the income elasticity of demand is …	**Then the good is …**	**Example**
Positive, but less than 1	normal and a necessity	milk
Positive and greater than 1	normal and a luxury	caviar

Summary of income elasticity of demand: Table 4.4

If the income elasticity of demand is …	**Then the good is …**	**Example**
Positive, but less than 1	normal and a necessity	milk
Positive and greater than 1	normal and a luxury	caviar
Negative	an inferior good	high-fat meat

Summary of income elasticity of demand: Table 4.4

(1) Income (M) ($/year)	(2) Quantity of X (units/year)	(3) Percent Change in Q_x	(4) Percent Change in M	(5) e_M
8,000	5			
		100	50	2
12,000	10			
		50	33.33	1.50
16,000	15			
		20	25	0.80
20,000	18			
		11.11	20	0.56
24,000	20			
		−5	16.67	−0.30
28,000	19			
		−5.26	14.29	−0.37
32,000	18			

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Some empirical estimates and application of elasticity

Price Elasticity of Demand		Cross Elasticity of Demand		Income Elasticity of Demand	
Commodity	e	Commodities	e_{xy}	Commodity	e_M
Beef	0.92	Beef, pork	0.28	Butter	0.42
Potatoes	0.31	Butter, margarine	0.67	Margarine	−0.20
Sugar	0.31	Cheese, butter	−0.61*	Meat	0.35
Electricity	1.20	Sugar, fruits	−0.28*	Electricity	0.20
Restaurant meals	2.27	Electricity, natural gas	0.2	Restaurant meals	1.48

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Answer

Commodity	Type of Demand	Commodities	Type of Commodities	Commodities	Type of Commodity
Beef	Inelastic	Beef, pork	Substitutes	Butter	Necessity
Potatoes	Inelastic	Butter, margarine	Substitutes	Margarine	Inferior
Sugar	Inelastic	Cheese, butter	Complements	Meat	Necessity
Electricity	Elastic	Sugar, fruits	Complements	Electricity	Necessity
Restaurant meals	Elastic	Electricity, natural gas	Substitutes	Restaurant meals	Luxury

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

4•3 MAKING THE CONNECTION

Price elasticity, cross-price elasticity and income elasticity in the market for alcoholic beverages.

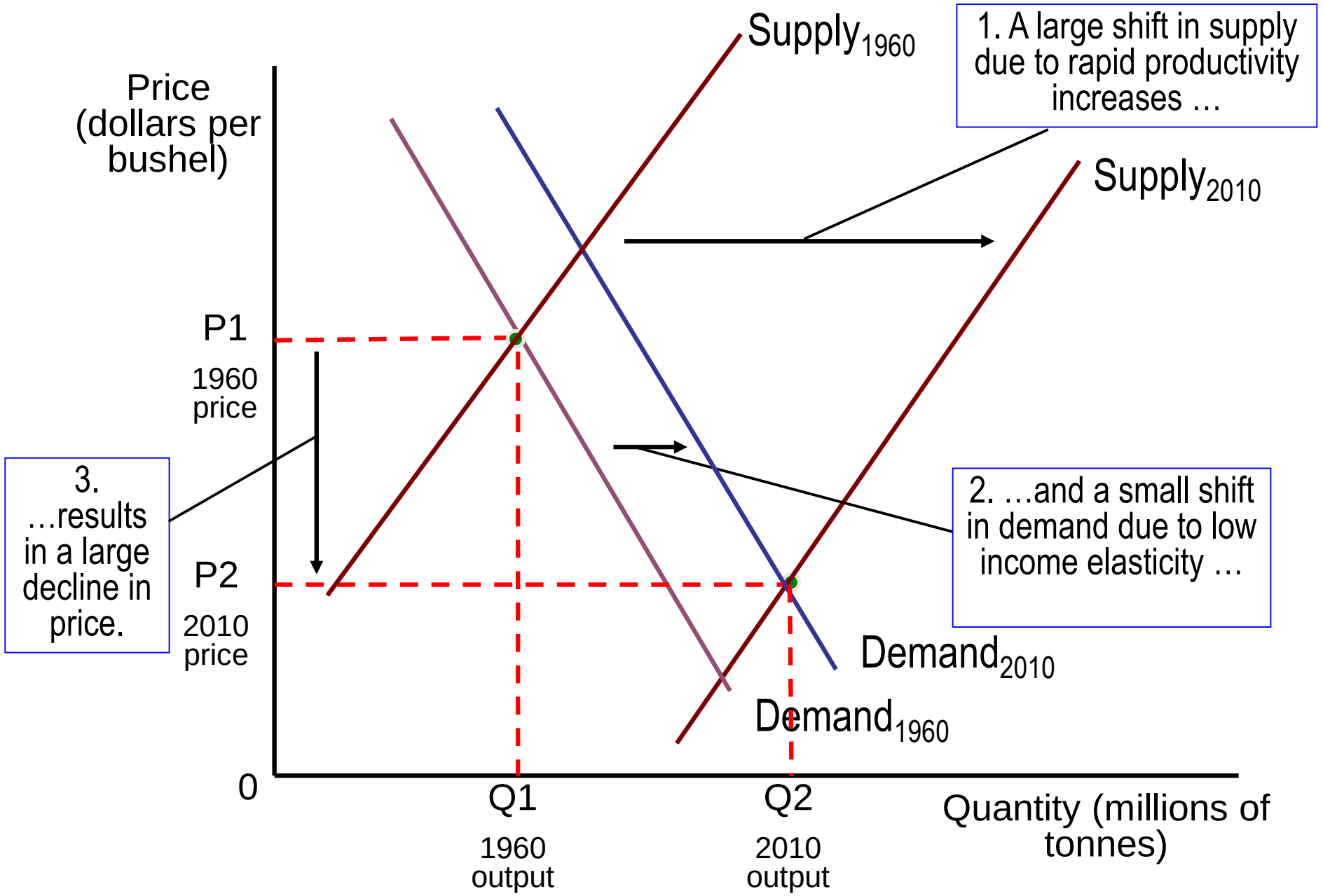
- Is wine a luxury good?

LEARNING OBJECTIVE 5

Using price and income elasticity to analyse economic issues

- Elasticity and the disappearing family farm:
- Many agricultural products are characterised by rapid productivity and output growth, which has led to falling prices because:
  - the demand for agricultural products is price inelastic.
  - the income elasticity of demand for agricultural products is low.

Elasticity and the disappearing farm: Figure 4.4



Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

The price elasticity of supply

- **Price elasticity of supply:** The responsiveness of the quantity supplied to a change in price.
- Measured by dividing the percentage change in the quantity supplied of a product by the percentage change in price.

$$\text{Price elasticity of supply} = \frac{\text{Percentage change in quantity supplied}}{\text{Percentage change in price}}$$

The price elasticity of supply

- **Note:** The elasticity of supply will always be positive as price and quantity supplied always move in the same direction.

The price elasticity of supply

- Determinants of the price elasticity of supply:

1. Availability of resources.
2. Capacity of production – excess or at full capacity?
3. Time involved to change production levels.
4. Short-run or long-run

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

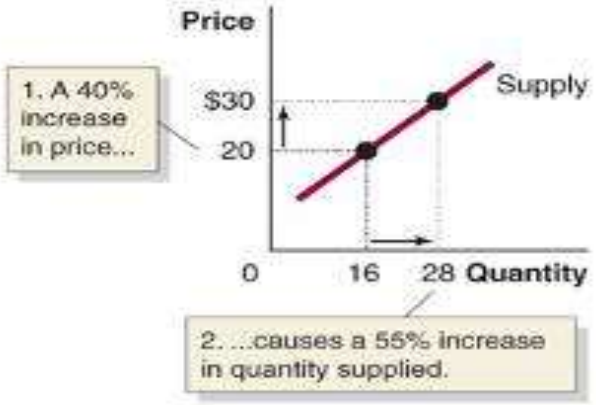
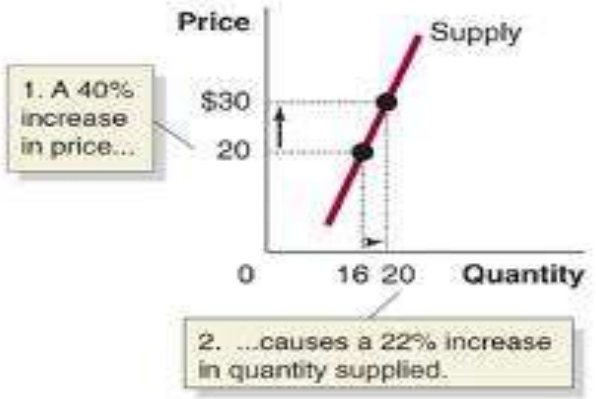
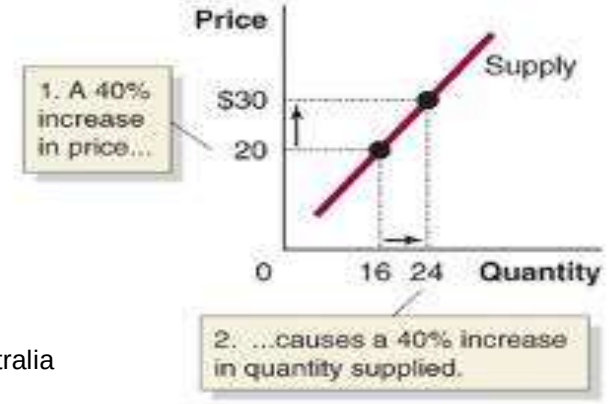
LEARNING OBJECTIVE 6

The price elasticity of supply

- **The polar cases of perfectly inelastic and perfectly elastic supply:**

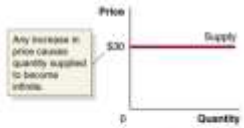
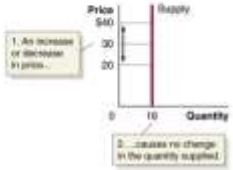
- The perfectly inelastic supply curve is a vertical line.
- The perfectly elastic supply curve is a horizontal line.

Summary of the price elasticities of supply: Table 4.5

elastic	greater than 1	
inelastic	less than 1	
unit-elastic	equal to 1	

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Summary of the price elasticities of supply: Table 4.5, continued

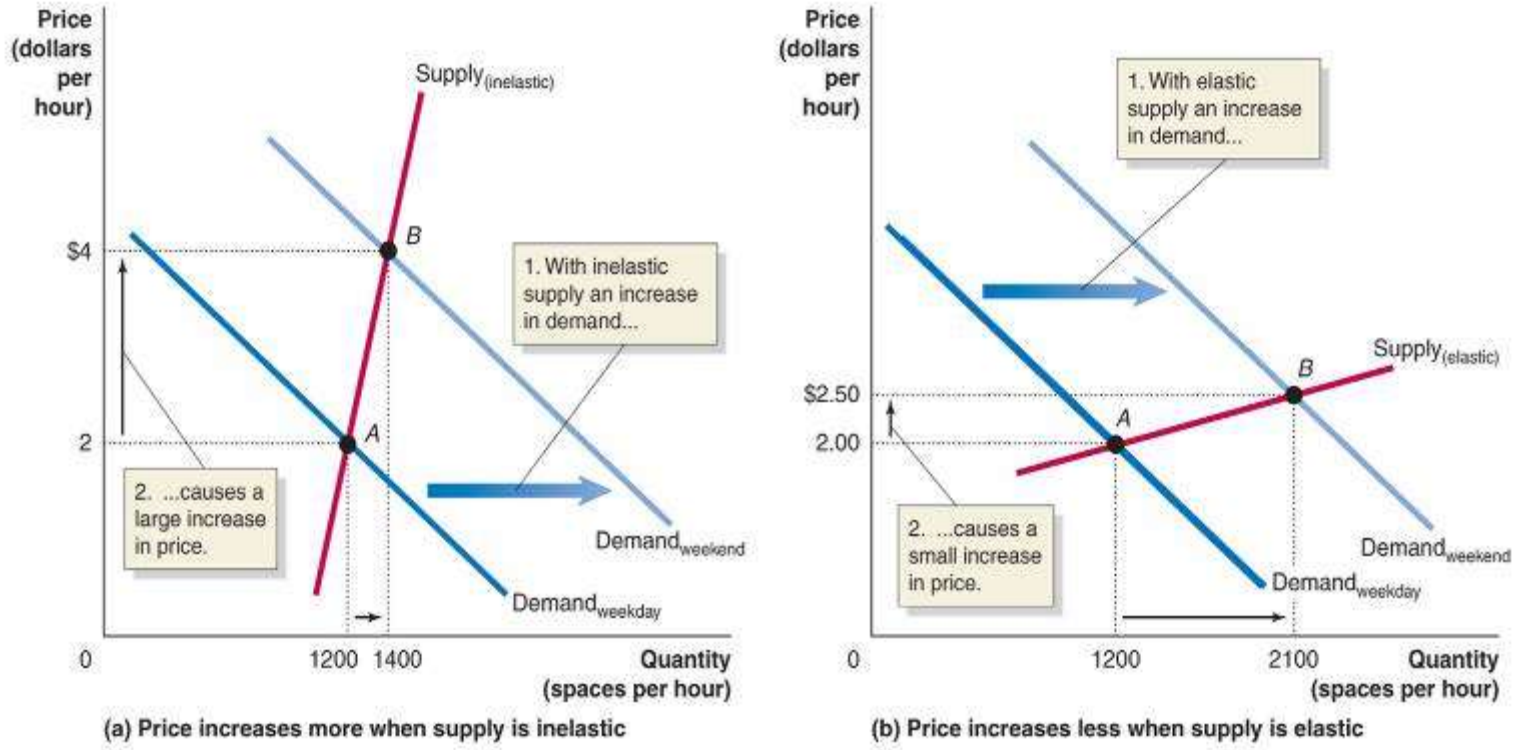
perfectly elastic	equal to infinity	
perfectly inelastic	equal to 0	

The price elasticity of supply

- **Using price elasticity of supply to predict changes in price:**

- When demand changes, the change in price depends on the elasticity of supply.

Changes in price depend on the price elasticity of supply: Figure 4.5



Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

MAKING THE CONNECTION 4•4

Why are oil prices so unstable?

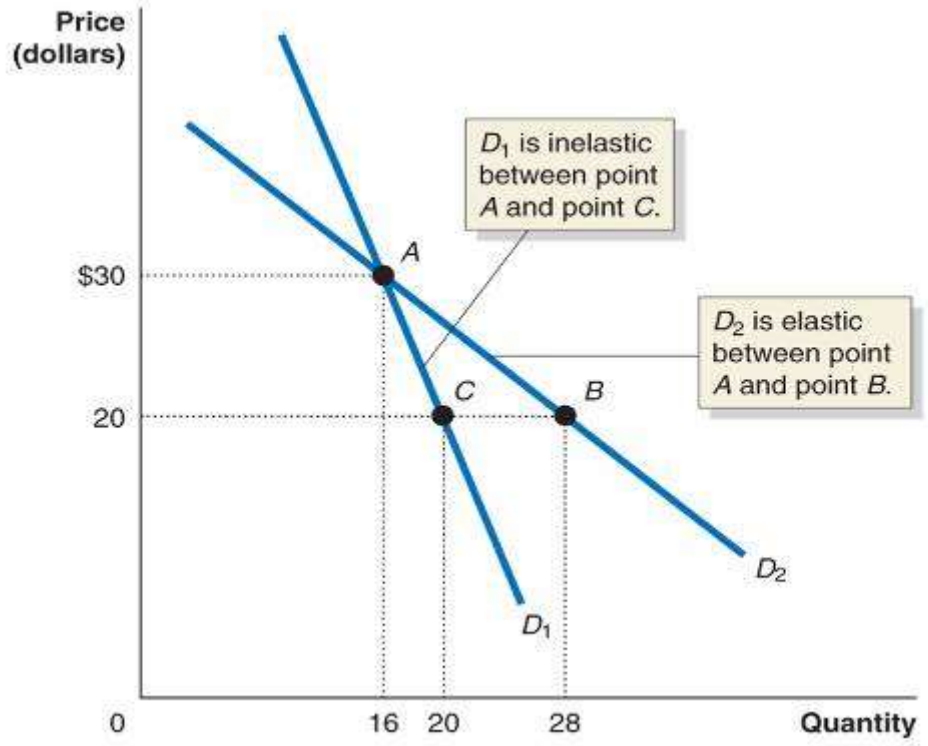
- The low price elasticity of oil supplies helps explain why oil prices fluctuate so much

An Inside Look

Do people sign up for the cheapest mobile broadband plan?

An Inside Look

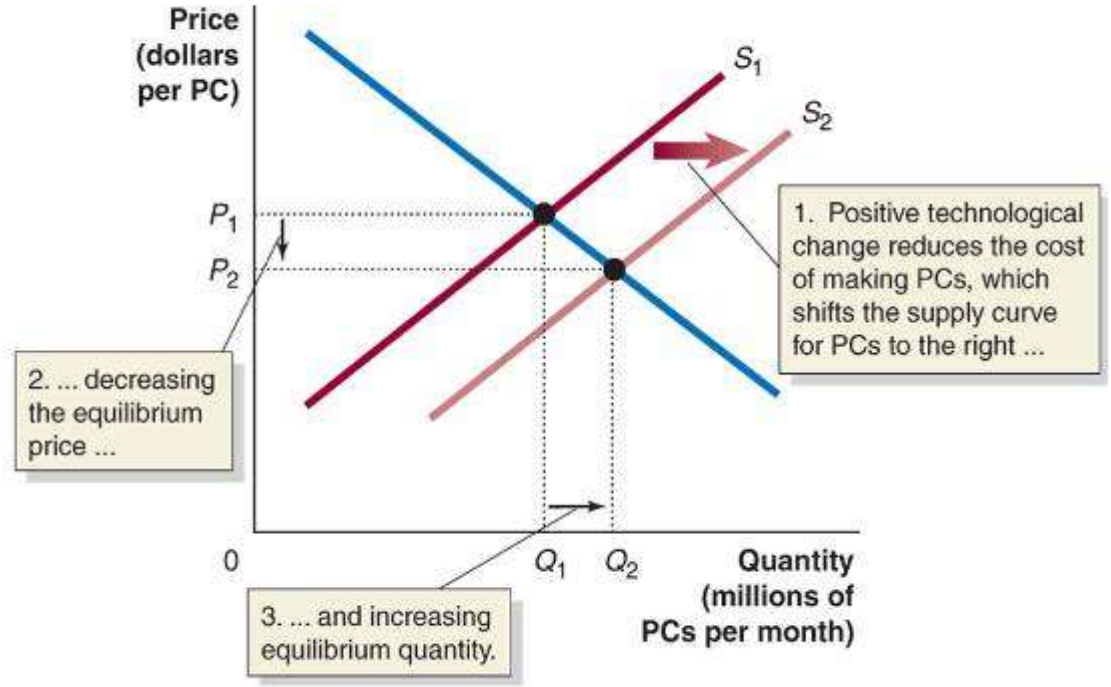
Figure 1: Potential demand curves in the mobile phone industry



Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

An Inside Look

Figure 2: A fall in the cost of PCs shifts the supply curve for PCs to the right



Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Key Terms

- Cross-price elasticity of demand
- Elastic demand
- Elasticity
- Income elasticity of demand
- Inelastic demand
- Perfectly elastic demand
- Perfectly inelastic demand
- Price elasticity of demand
- Price elasticity of supply
- Total revenue
- Unit elastic demand

Get Thinking!

Do you think that the rising costs of higher education in Australia are impacting on demand? Universities rely on overseas students for direct revenue, and domestic student numbers for funding from the Australian government. See if you can find any evidence that higher fees will lead to a decrease in the quantity of education demanded? Use websites such as the following:

www.dest.gov.au and www.abs.gov.au

Why do you think students spend more time complaining about individual courses and perhaps faculties or universities, rather than uniting to protest against higher education costs?

Check Your Knowledge

Q1. If you know the value of the price elasticity of demand, then which of the following can you compute?

a. The effect of a price change on the quantity demanded.

b. The responsiveness of the quantity supplied of a good to a change in its price.

c. The price elasticity of supply.

d. All of the above

Check Your Knowledge

Q1. If you know the value of the price elasticity of demand, then which of the following can you compute?

a. The effect of a price change on the quantity demanded.

b. The responsiveness of the quantity supplied of a good to a change in its price.

c. The price elasticity of supply.

d. All of the above

Check Your Knowledge

Q2. How do economists avoid confusion over different units of measurement in the computation of elasticities?

a. By using aggregate values rather than single values.

b. By using whole numbers rather than fractions.

c. By using percentage changes.

d. By using computer software packages.

Check Your Knowledge

Q2. How do economists avoid confusion over different units of measurement in the computation of elasticities?

a. By using aggregate values rather than single values.

b. By using whole numbers rather than fractions.

c. By using percentage changes.

d. By using computer software packages.

Check Your Knowledge

Q3. When demand is price inelastic, what is the relationship between price and total revenue?

a. They move in the same direction.

b. They move in opposite directions.

c. When price changes, total revenue remains the same.

d. They are unrelated.

Check Your Knowledge

Q3. When demand is price inelastic, what is the relationship between price and total revenue?

a. They move in the same direction.

b. They move in opposite directions.

c. When price changes, total revenue remains the same.

d. They are unrelated.

Hubbard, Garnett, Lewis and O'Brien: *Essentials of Economics* © 2010 Pearson Australia

Check Your Knowledge

Q4. Fill in the blanks: If an increase in the price of a substitute leads to _____ in quantity demanded, the cross price elasticity of demand is _____ .

a. an increase; positive.

b. an increase; negative.

c. a decrease; positive.

d. a decrease; negative.

Check Your Knowledge

Q4. Fill in the blanks: If an increase in the price of a substitute leads to _____ in quantity demanded, the cross price elasticity of demand is _____ .

a. an increase; positive.

b. an increase; negative.

c. a decrease; positive.

d. a decrease; negative.

1st In-Course Exam / 2021

Marks Distribution: 3+3+9+5

1. Explain why elasticity is not the same as slope.
2. Distinguish between point elasticity of demand and arc elasticity of demand.
3. Suppose the demand function for a product is given by

   q=500 – 10p

   I. Determine the price elasticity of this demand function
   II. Compute the price elasticity of demand (PED) when the price is Tk. 30. Comment on the value of PED.
   III. What is the percentage change in the demand if the price is Tk. 30 and the price increases by 4.5%?

4. What is the difference between normal and inferior goods? How is the income elasticity of demand for agricultural products?