

# UNISA ECS2601: MICROECONOMICS

Learning Units: 1 & 2

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*“Never do tomorrow what you can do today. Procrastination is the thief of time.”*

# Do you recall?

*What is Economics?*

*Micro-economics?*

*Macro-economics?*

*Scarcity?*

*Choices?*

*Opportunity cost?*

*Utility?*

# What is Economics?

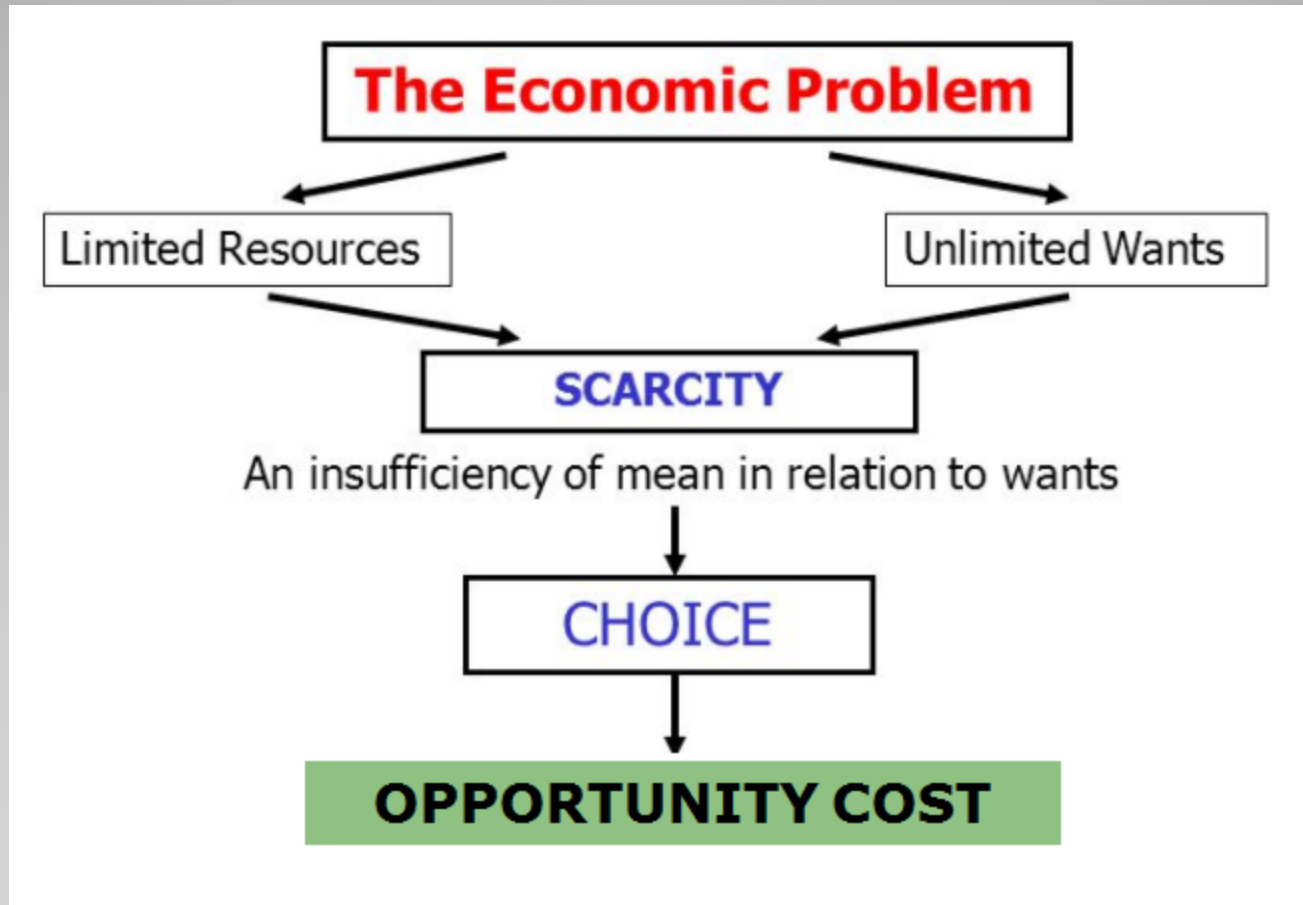
**Economics:** A study of **social science** that describes or study how individuals, business and institutions make social choices, to optimise/maximise their level of satisfaction under conditions of scarcity.

- **Microeconomics:** A branch of economics which studies the economics at
  - an individual, group or company level
  - Focuses on issues that affect individuals and companies
  - E.g. *the effects of raising input cost within a business*
- **Macroeconomics:** is the study of a national economy as a whole.

# Scarcity, Choice and Opportunity cost

- We live in a world with limited/ scarce resources.
  - E.g. Time, water, electricity, clean air
- But individuals/society have unlimited wants and/or needs
- Because of limited resources people have to make choices
- Therefore there is always a trade-off in life
- Given such trade-off individuals have to make optimal decisions/choices
- Decisions to have more "X" for less "Y"
- Thus the cost of this decision is an Opportunity cost
  - Which is the value of next best alternative - given up
  - E.g. If you attend Economics class today, it means you forgo the opportunity (i.e. time) to watch TV
    - <https://youtu.be/yw6wB7haSu8>

# The Economic Problem



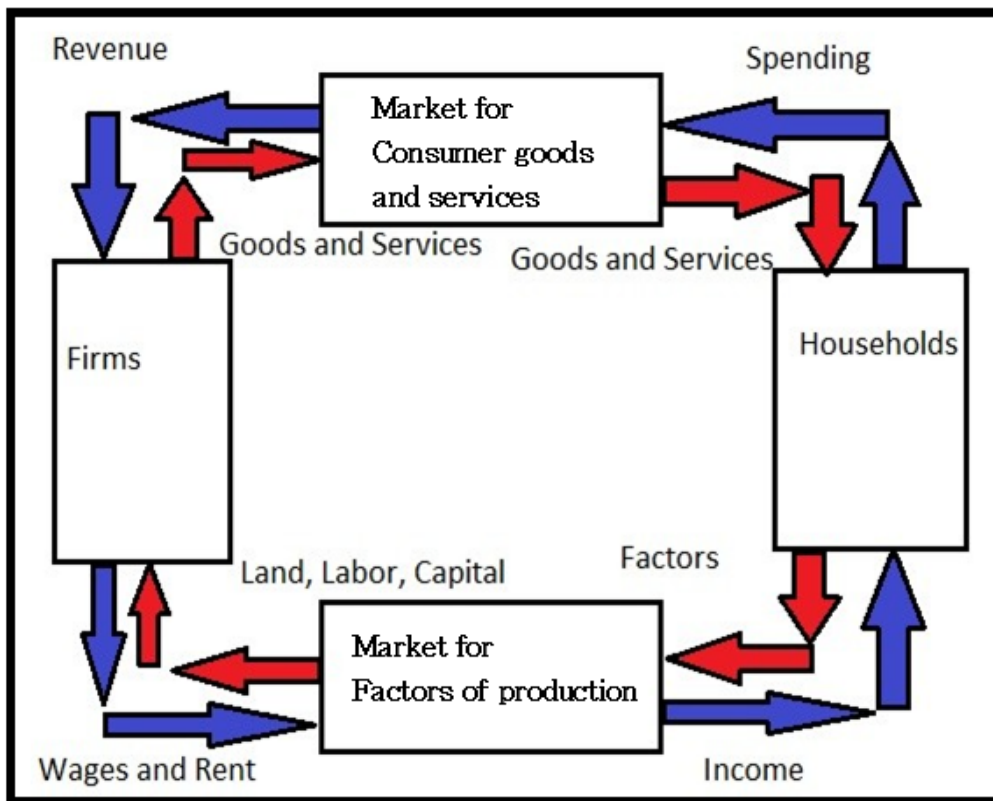
# Elasticity

- Elasticity is a measure of magnitudes/ responsiveness or sensitivity.
- When two variables are related, one often wants to know how sensitive or responsive the dependent variable is to changes in the independent variable(s).
- In economics there are many causal-effect relationships which raise similar questions.
  - For example; how responsive is price of bond to changes in the interest rate?
  - How responsive is personal spending to changes in government tax rate?
  - How responsive is the demand for cars to changes in personal income?
- Elasticity can therefore, be defined as *a percentage change in a dependent variable given 1% change in relevant independent variable changes by one percent.*

$$\text{Elasticity} = \frac{\% \text{ change in dependent variable}}{\% \text{ change in independent variable}}$$

# Economic circular flow

- You may recall the interaction between households and firms – given by circular flow.



- Households sell their factors of production to firms.
- Firms use these factors to produce goods and services that are sold in the goods market to households who use their income to buy the goods and services.
- In the goods markets firms thus determine the supply (S), while households determine the demand (D).

Source: <http://www.macrobasics.com/chapters/chapter2/lesson21/>

# Theory of consumer

- The elasticity of demand further develop our understanding of demand by showing to us the extent of how consumers react to adjustment in price.
- How would the demand changes given changes in consumer behaviour.
- Therefore, the theory of consumer behaviour describes
  - how consumers buy different goods and services.
  - how a consumer allocates income in relation to the purchase of different commodities and
  - how price affects his or her decision.
- There are two theories that seek to explain consumer behaviour.
  - 1) The Utility Theory of demand
    - Assumes that satisfaction can be measured;
    - Law of Diminishing Marginal Utility
  - 2) The Indifference Preference Theory
    - consumer's taste and preferences in explaining consumer behaviour
- Consumer Behaviour-Assumptions
  - a) Rational Consumer
  - b) Budget Constraints
  - c) Consumer Preferences
- Consumer equilibrium refers to the combination of goods that will give the highest level of satisfaction to a consumer that is within his purchasing power.



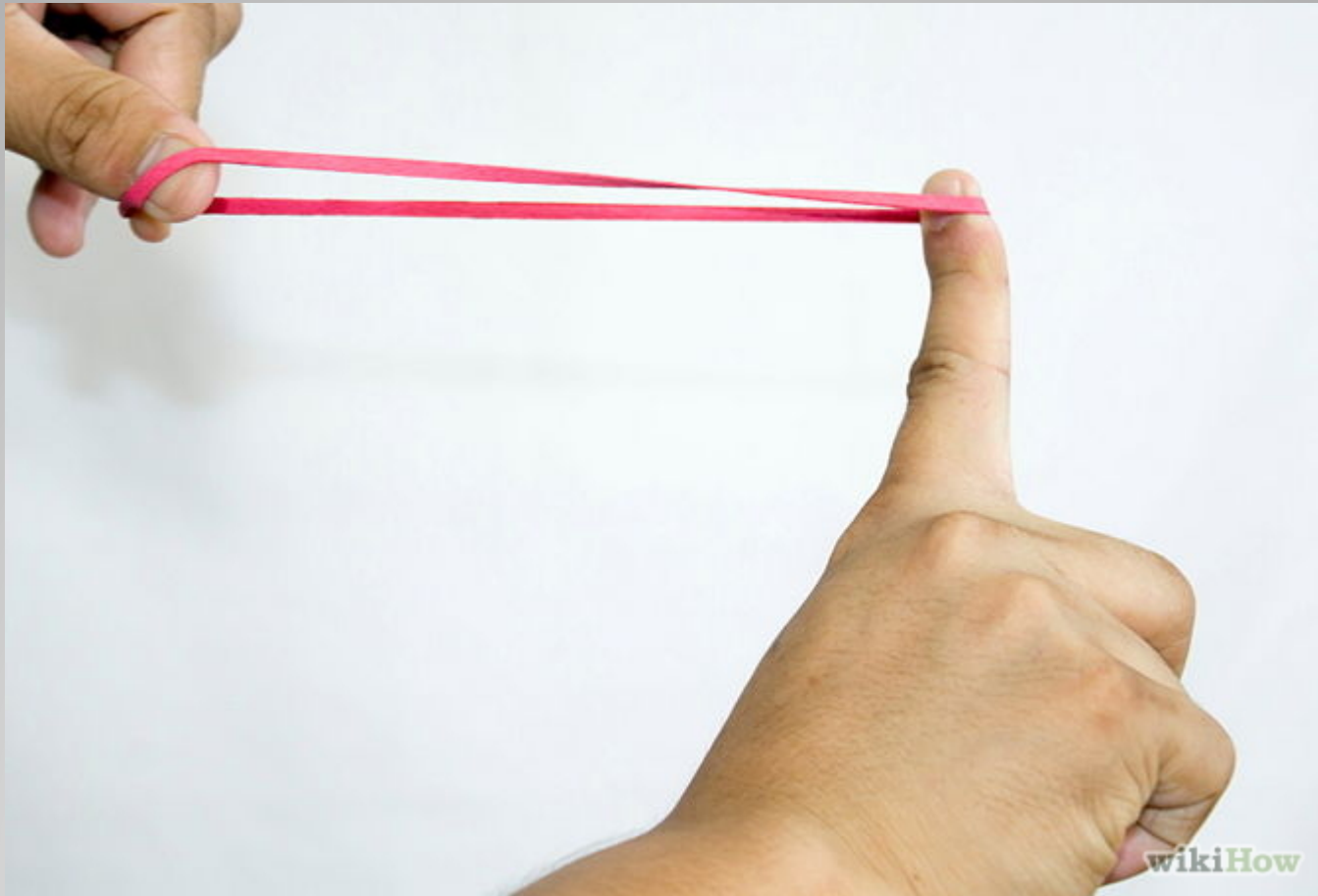
# LEARNING UNIT 2



# LEARNING UNIT 2:



**Elasticity**



# What is Elasticity

Elasticity is a measure of magnitudes/ responsiveness or sensitivity.

- When two variables are related, one often wants to know how sensitive or responsive the dependent variable is to changes in the independent variable.
- In economics there are many cause-effect relationships which raise similar questions.

## elasticity

*used to determine how changes in product demand and supply relate to changes in consumer income or the producer's price*

- Elasticity can therefore, be defined as *a percentage change in a dependent variable if the relevant independent variable changes by one percent.*

$$\text{Elasticity} = \frac{\% \text{ change in dependent variable}}{\% \text{ change in independent variable}}$$

# PRICE ELASTICITY OF DEMAND

You may recall the Law of demand *which states that as the price of a good falls, the quantity demanded rises.*

- But by how much will the quantity demanded rise? To answer this question, we must know how sensitive demand is to price.
- To measure the responsiveness of the quantity demanded to change in price, we use a measure called *Price elasticity of demand (PED)*
- To determine the price elasticity of demand, we compare the percentage change in the quantity demanded with the percentage change in price. This can be written as:

$$e_p = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P} = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

*Note; 100 cancel out*

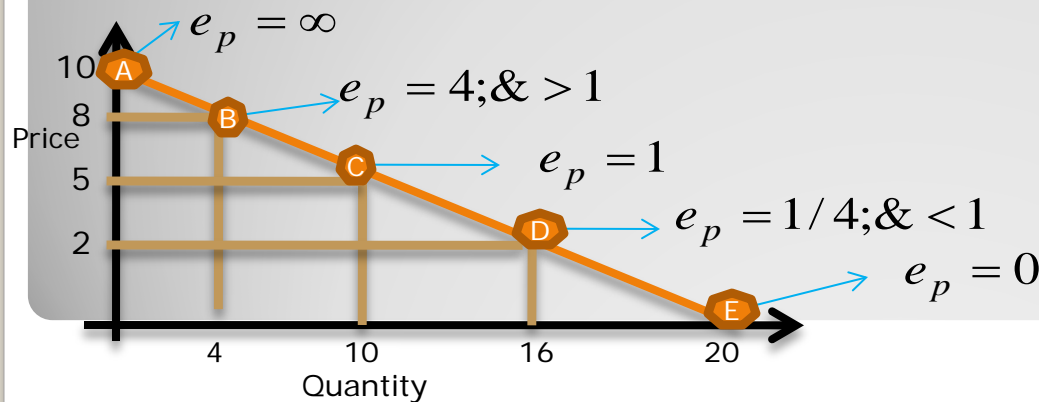
# PRICE ELASTICITY OF DEMAND

## ❖ Calculating PED

Quantity	$Q_2 - Q_1$	Price	$P_2 - P_1$	PED
1		125		
2	1	100	-25	$(1/-25) \times (125/1) = -5$
4	2	50	-50	$(2/-50) \times (100/2) = -2$
5	1	10	-40	$(1/-40) \times (50/4) = -0.3$

*Note:  $Q_2$  and  $P_2$  represent new quantity and price levels; whereas  $Q_1$  and  $P_1$  represent the original points*

## ❖ PED at different points along a linear demand curve



*The line through A, B, C, D and E represents a linear demand curve. The price elasticity of demand is different at each point along the curve, varying from infinity ( $\infty$ ) where it meets the price axis, to zero where it meets the quantity axis.*

# PRICE ELASTICITY OF DEMAND

## ❖ ARC elasticity

**NB:** The elasticity coefficient calculated by comparing points on the demand curve is called arc elasticity. To calculate this we use the average of two quantities and the average of the two prices as a basis for calculating the percentage change. Formula;

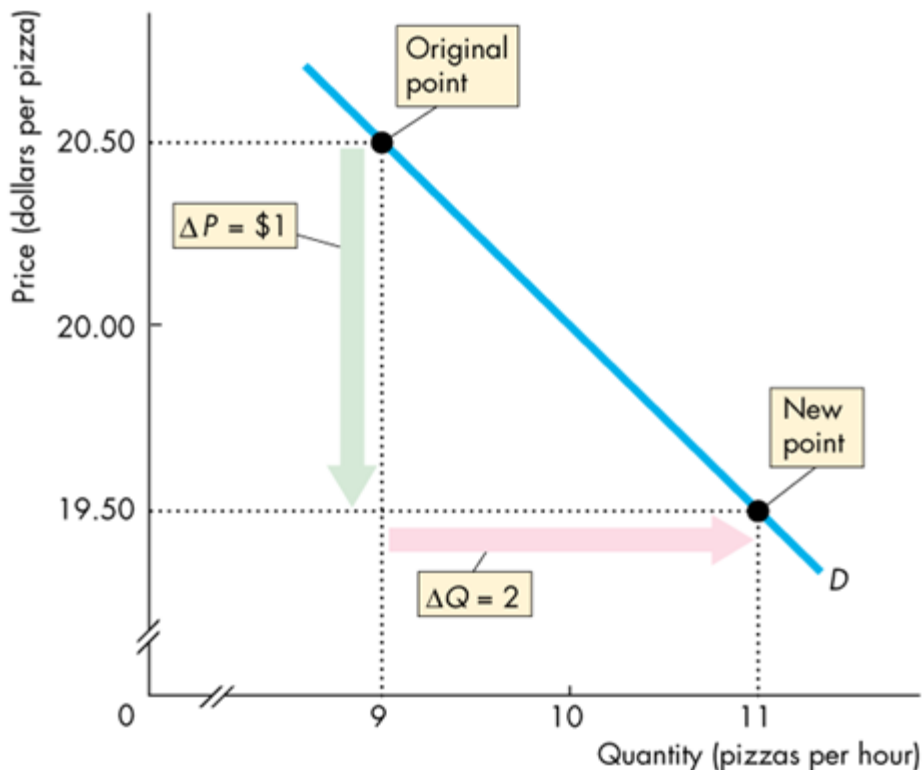
$$e_p = \frac{(Q_2 - Q_1) / [(Q_1 + Q_2) / 2]}{(P_2 - P_1) / [(P_1 + P_2) / 2]}$$

This can be simplified to;

$$e_p = \frac{(Q_2 - Q_1) / (Q_1 + Q_2)}{(P_2 - P_1) / (P_1 + P_2)}$$

# PRICE ELASTICITY OF DEMAND

## Calculating ARC elasticity



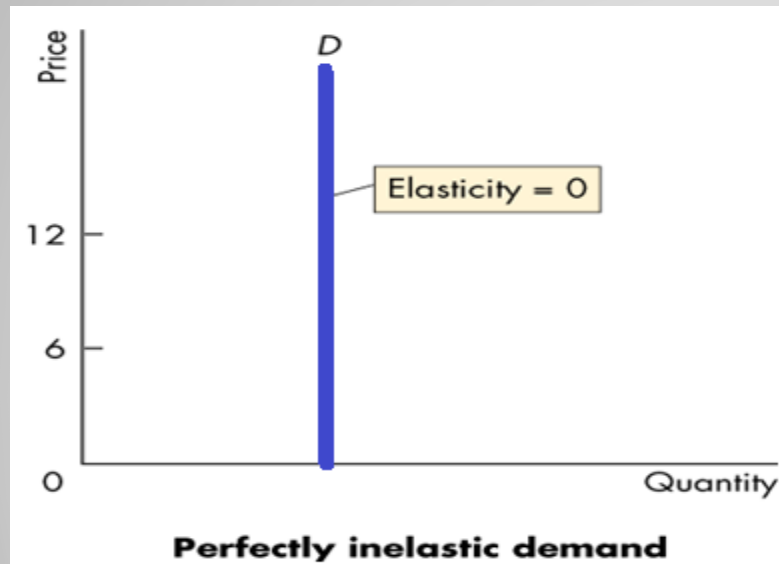
$$\begin{aligned}e_p &= \frac{(Q_2 - Q_1)/(Q_1 + Q_2)}{(P_2 - P_1)/(P_1 + P_2)} \\&= \frac{(11 - 9)/(9 + 11)}{(19.50 - 20.50)/(20.50 + 19.50)} \\&= \frac{0.1}{0.025} \\&= 4 \quad \text{Remember YOU we ignore the negative sign}\end{aligned}$$



## CATEGORIES OF PRICE ELASTICITY OF DEMAND

### a) Perfectly Inelastic demand [PED=0]

If the quantity demanded doesn't change when the price changes, the price elasticity of demand is zero and the good as a **perfectly inelastic demand**.



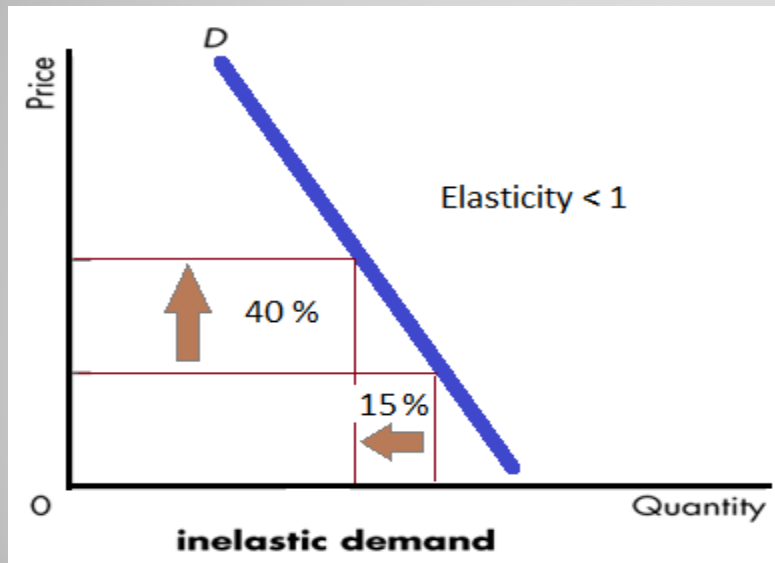
This implies that quantity demanded is not sensitive to price

NB: The demand curve is vertical.

# CATAGORIES OF PRICE ELASTICITY OF DEMAND

## b) Inelastic demand [ $0 < PED < 1$ ]

If the percentage change in the quantity demanded is smaller than the percentage change in price, the price elasticity of demand is *less* than 1 and the good has **inelastic demand**.

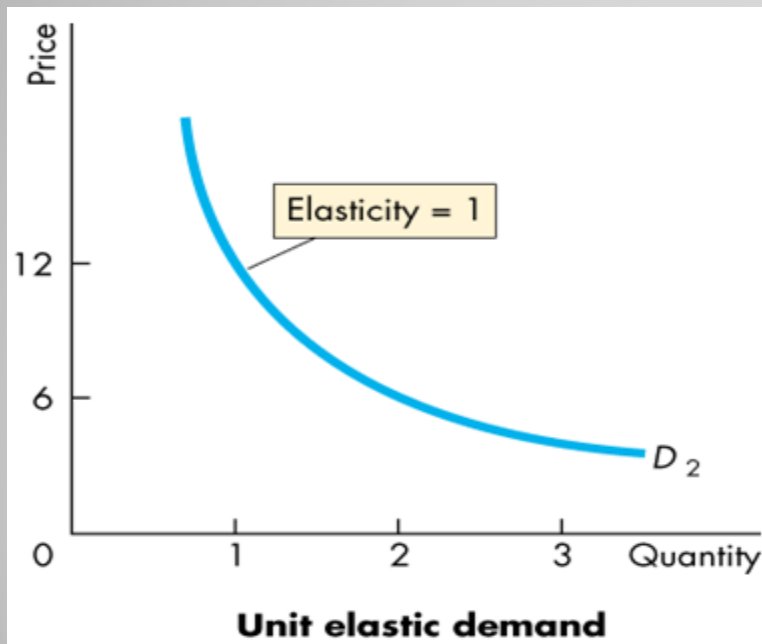


NB: The steeper the demand curve the elasticity decreases to zero.

## CATAGORIES OF PRICE ELASTICITY OF DEMAND

### c) Unit/Unitary elastic demand [ $PED=1$ ]

If the percentage change in the quantity demanded equals the percentage change in price.

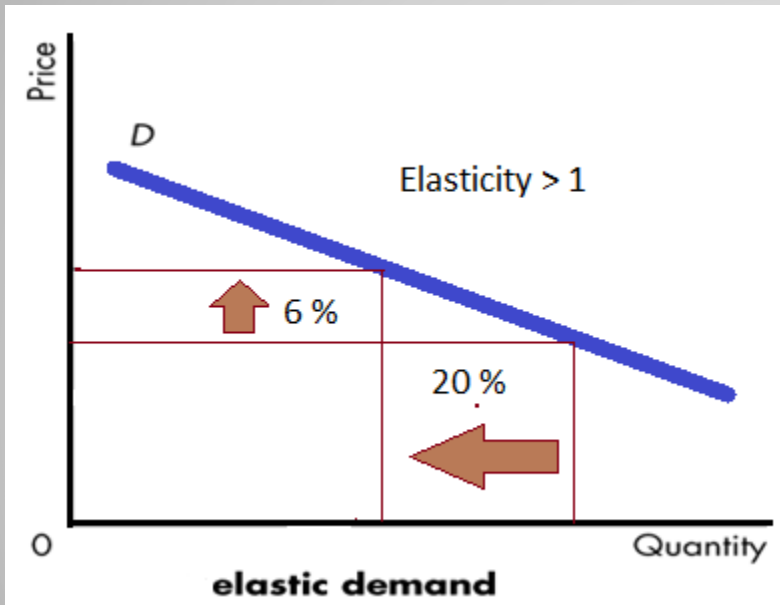


NB: demand curve with ever declining slope.

# CATAGORIES OF PRICE ELASTICITY OF DEMAND

## d) Elastic demand [ $1 < PED < \infty$ ]

If the percentage change in the quantity demanded is greater than the percentage change in price, the price elasticity of demand is *greater* than 1 and the good has **elastic demand**.



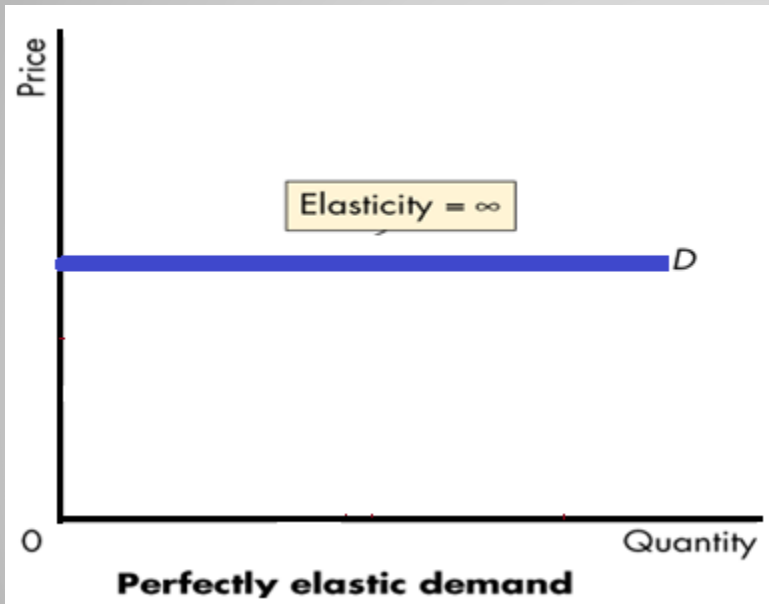
This implies that quantity demanded is sensitive to price

NB: The flatter the demand curve (shifting closer to be horizontal) the elasticity increases above one.

## CATAGORIES OF PRICE ELASTICITY OF DEMAND

### e) Perfectly Elastic demand [ $PED = \infty$ ]

If the % change in the quantity demanded is infinitely large when the price barely changes, the price elasticity of demand is infinite and the good has a **perfectly elastic demand**.



NB: A horizontal demand curve.

# Factors That Influence the Elasticity of Demand

- ❖ **The elasticity of demand for a good depends on:**
  - ❖ The proportion of income spent on the good
  - ❖ The closeness of substitutes and/or complementarity
  - ❖ The time elapsed since a price change
- ❖ **Other demand elasticities**
  - ❖ Income elasticity of demand
  - ❖ Cross Price-elasticity of demand

# income elasticity of demand

*a measure of the responsiveness of the demand for a particular good or service, as a result of a change in income of the target market or 'ceteris paribus'*

**ceteris paribus**

*with all other factors held constant*

# INCOME ELASTICITY OF DEMAND

❖ Measures the responsiveness of the quantity demanded to changes in income.

❖ The formula can be given by:

$$\text{IED} = \frac{\% \text{ change in quantity demanded}}{\% \text{ change in consumer's income}}$$

$$E_I = \frac{\Delta Q_y}{Q_y} \div \frac{\Delta I}{I} = \frac{\Delta Q_y}{\Delta I} \times \frac{I}{Q_y}$$

❖ A positive income elasticity of demand means that an increase in income is accompanied by an increase in the quantity demanded. Vice versa.

◦ Goods with a positive IED are called **normal goods**.

• Normal goods are further classified as luxury or essential goods

• If the IED is  $>1$ , the good is called a **luxury good** (e.g. Car, TV etc )

• If the IED is positive but  $<1$ , the good is called an **essential good** (e.g. Bread, Tomatoes, onions, etc)

◦ Goods with a negative IED are called **inferior goods** (e.g. salt)



# CROSS PRICE-ELASTICITY OF DEMAND

- ❖ The **cross elasticity of demand** is a measure of the responsiveness of demand for a good to a change in the price of a *substitute* or a *complement* good when other things remaining the same.
- ❖ The formula can be given by:

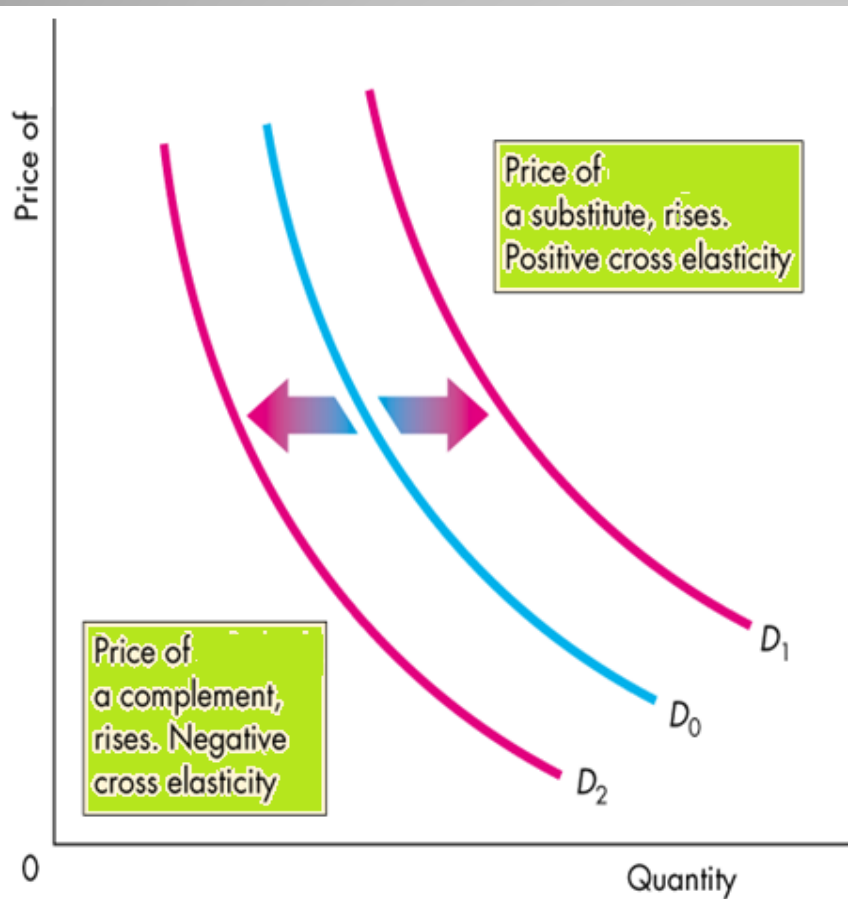
$$\text{CED} = \frac{\% \text{ change in quantity demanded of product A}}{\% \text{ change in the price of product B}}$$

$$Ed_{yx} = \frac{\Delta Q_y}{Q_y} \div \frac{\Delta P_x}{P_x} = \frac{\Delta Q_y}{\Delta P_x} \times \frac{P_x}{Q_y}$$



When two goods are unrelated (car and butter) the CED = zero.

# CROSS PRICE-ELASTICITY OF DEMAND



- ❖ In the case of **substitutes** (e.g. tea and coffee) the CED is positive ( $>0$ ), since a change in the price of one product will lead to a change in the same direction in the quantity demanded of the substitute product.
- ❖ In the case of **complements** (e.g. tea and sugar) the CED is negative ( $<0$ ), since a change in the price of one product will lead to a change in the opposite direction in the quantity demanded of the complementary product.

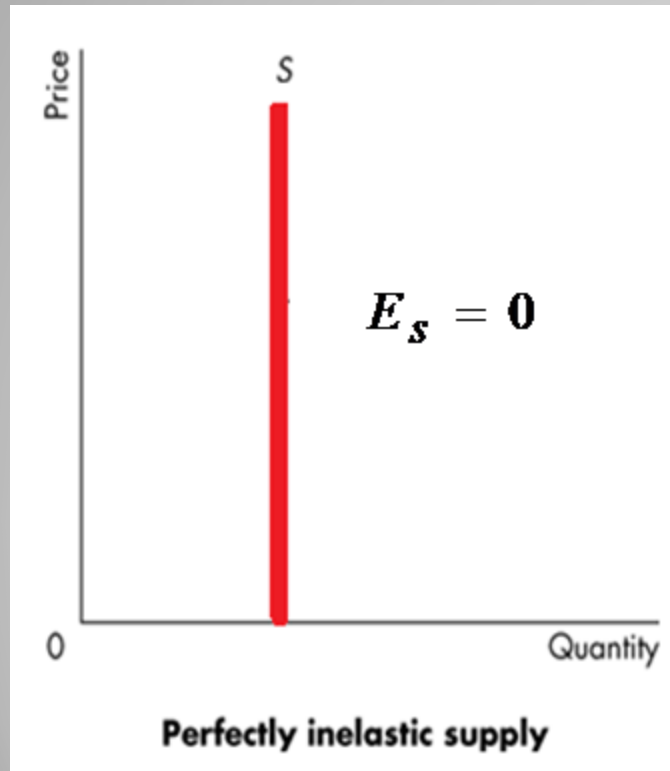
# PRICE ELASTICITY OF SUPPLY

- ❖ The **elasticity of supply** measures the responsiveness of the quantity supplied to a change in the price of a good when all other influences on supplier remain the same.
- ❖ General formula for PES

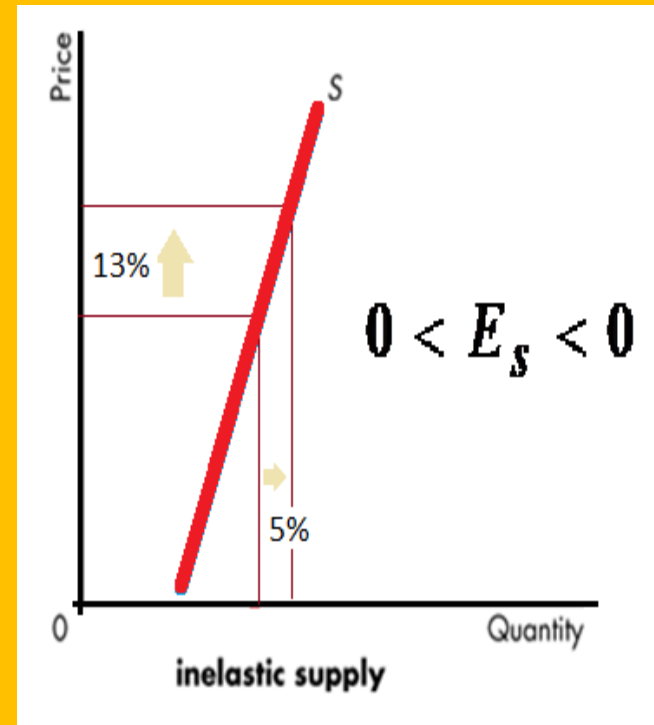
$$E_s = \frac{\% \text{ change in quantity supplied of a product}}{\% \text{ change in price of the product}}$$

# CATEGORIES OF PRICE ELASTICITY OF SUPPLY

## a) Perfectly inelastic supply

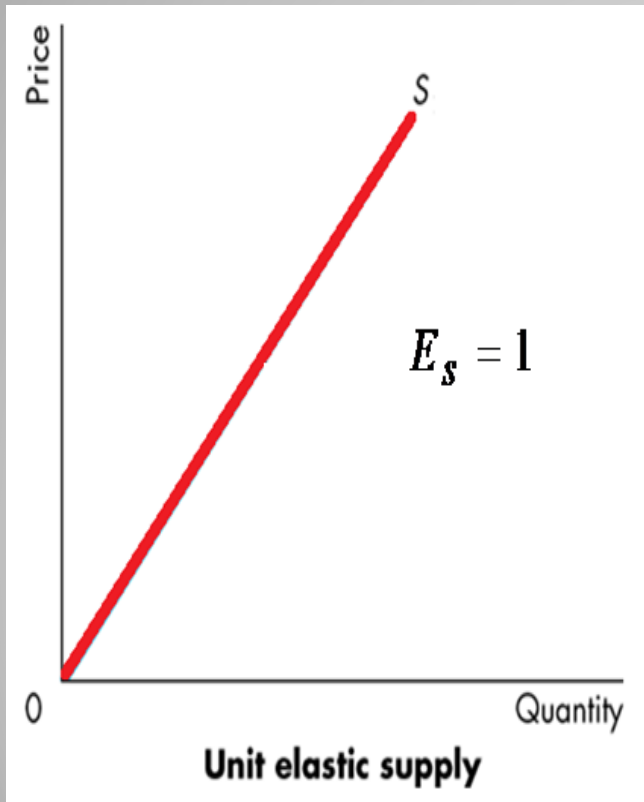


## b) Inelastic supply

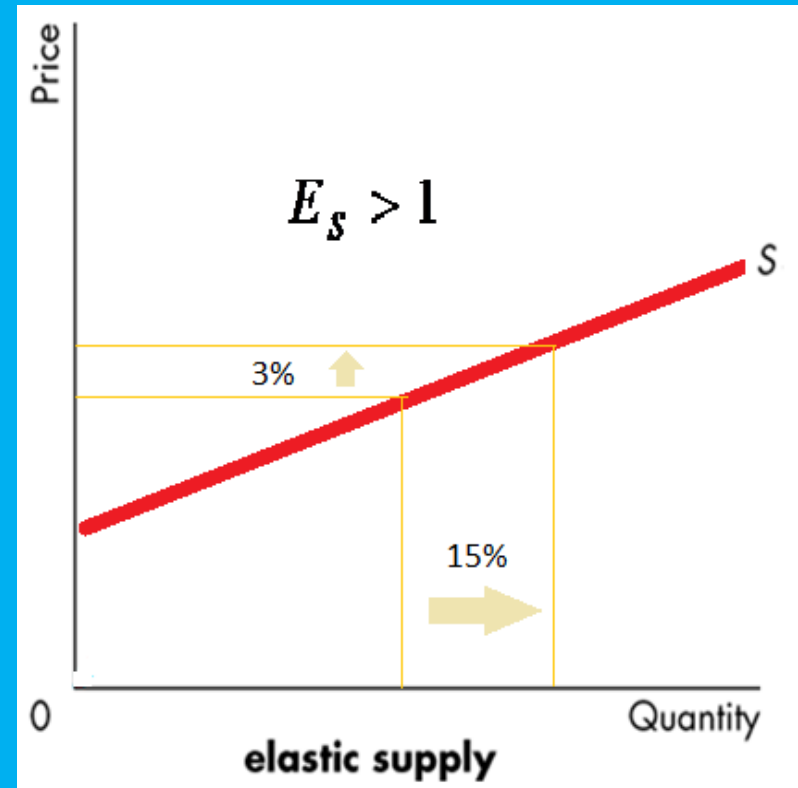


# CATEGORIES OF PRICE ELASTICITY OF SUPPLY\_

c) Unit/ unitary elasticity of supply

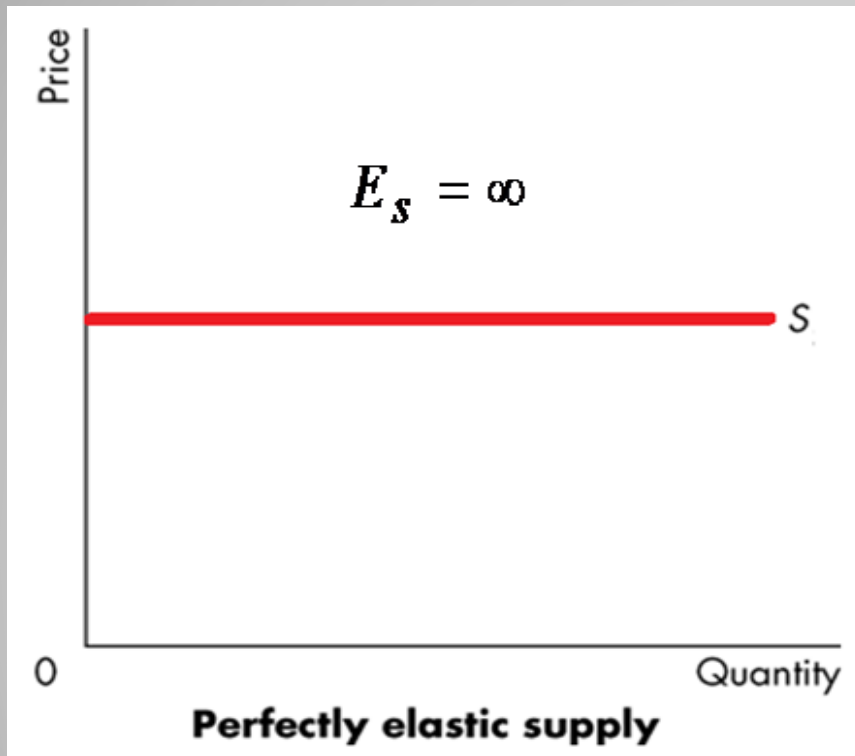


d) Elastic supply



## CATEGORIES OF PRICE ELASTICITY OF SUPPLY\_

### e) Perfectly elastic supply



## Factors That Influence the Elasticity of Supply

❖ The elasticity of supply depends on:

a) Resource substitution possibilities

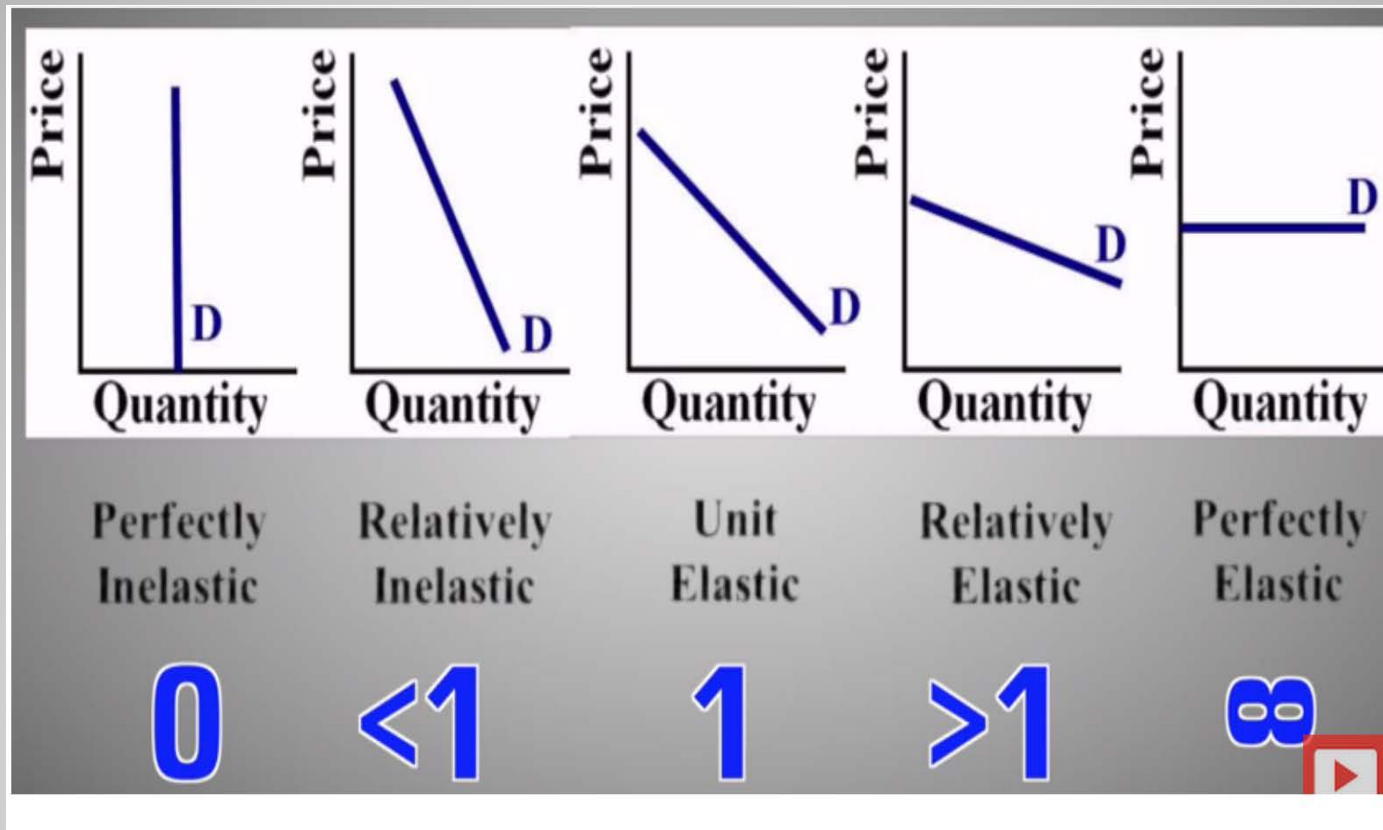
- The easier it is to substitute among the resources used to produce a good or service, the greater is its elasticity of supply.

b) Time frame for supply decision

- The more time that passes after a price change, the greater is the elasticity of supply.

# SUMMARY

## Price Elasticity of Demand





# Group Discussion

(1) Elasticity measures

- [1] the slope of a demand curve.
- [2] the inverse of the slope of a demand curve.
- [3] the percentage change in one variable in response to a 1% increase in another variable.
- [4] sensitivity of price to a change in quantity.

(2) The price elasticity of demand for a demand curve that has a zero slope is

- [1] zero.
- [2] one.
- [3] negative but approaches zero as consumption increases.
- [4] infinite.

Suppose the price of a product decreases from R40,00 to R30,00 and the quantity demanded increase from 2 000 to 2 500 units. Using arc elasticity of demand, what is the price elasticity of demand?

- 1. 0.78.
- 2. -0.69.
- 3. 1.15.
- 4. -1.29.

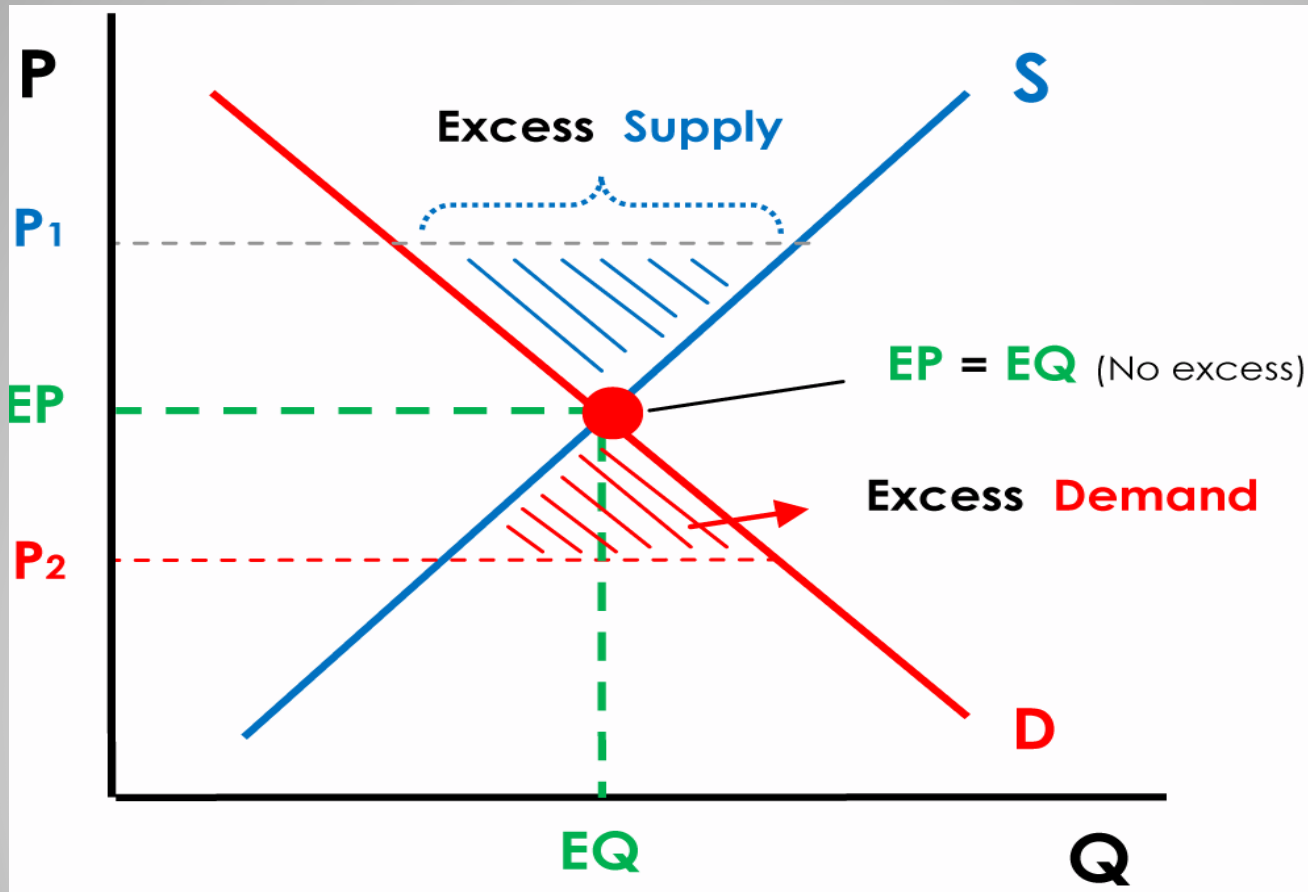
If the supply equation is given as  $Q_s = -200 + 10P$  and the price of supply changes from R40 to R50. Using the arc elasticity of supply what is the price elasticity of supply?

- 1. 0.6.
- 2. 1.8.
- 3. 0.56.
- 4. 2.0.

# Effects of government intervention – price controls

- ❑ Government intervention in the market mechanism may take place in a number of ways. Lets assume the following two price control measures:
  - ❑ **Ceiling prices (also called a "maximum price")**
    - ❑ Government regard the equilibrium market price as too high, and decide to set the price lower than the equilibrium price.
  - ❑ **Floor prices (also called a "minimum price")**
    - ❑ Government feel that the equilibrium price is too low and set a (floor) price which is above the equilibrium price

# Effects of government intervention – price controls



# Effects of government intervention – price controls

**Table SG2.3: Ceiling and floor prices**

<b>Problem</b>	<b>Government action</b>	<b>Result</b>		<b>Type</b>	<b>Example</b>
Equilibrium price too high	Set price below equilibrium price	Quantity demanded > quantity supplied	Excess demand because price is low	Ceiling price (maximum price)	Rented housing Sale of petrol
Equilibrium price too low	Set price above equilibrium price	Quantity demanded < quantity supplied	Excess supply because price is high	Floor price (minimum price)	Agricultural products

# Group Discussion 2

The S.A. Department of Agriculture is interested in analyzing the domestic market for corn. The staff economists estimate the following equations for the demand and supply curves:

$$Q_d = 1,600 - 125P$$

$$Q_s = 440 + 165P$$

Quantities are measured in millions of bushels; prices are measured in rand per bushel.

- a. Calculate the equilibrium price and quantity that will prevail under a completely free market. (4)
- b. Calculate the price elasticities of supply and demand at the equilibrium values. (4)
- c. The government currently has a R4.50 bushel support price in place. What impact will this support price have on the market? Will the government be forced to purchase corn under a program that requires them to buy up any surpluses? If so, how much (4)

# NEXT CLASS: UNIT 3 AND 4

- **UNIT 3: Consumer behaviour**

- Consumer preferences
- Budget constraints
- Consumer choice: MRS (Marginal rate of substitution)
- Revealed preference
- Marginal utility and consumer choice: Diminishing MRS

- **UNIT 4: Individual and market demand**

- Individual demand
- Income and substitution effects
- Market demand and supply
- Market equilibrium



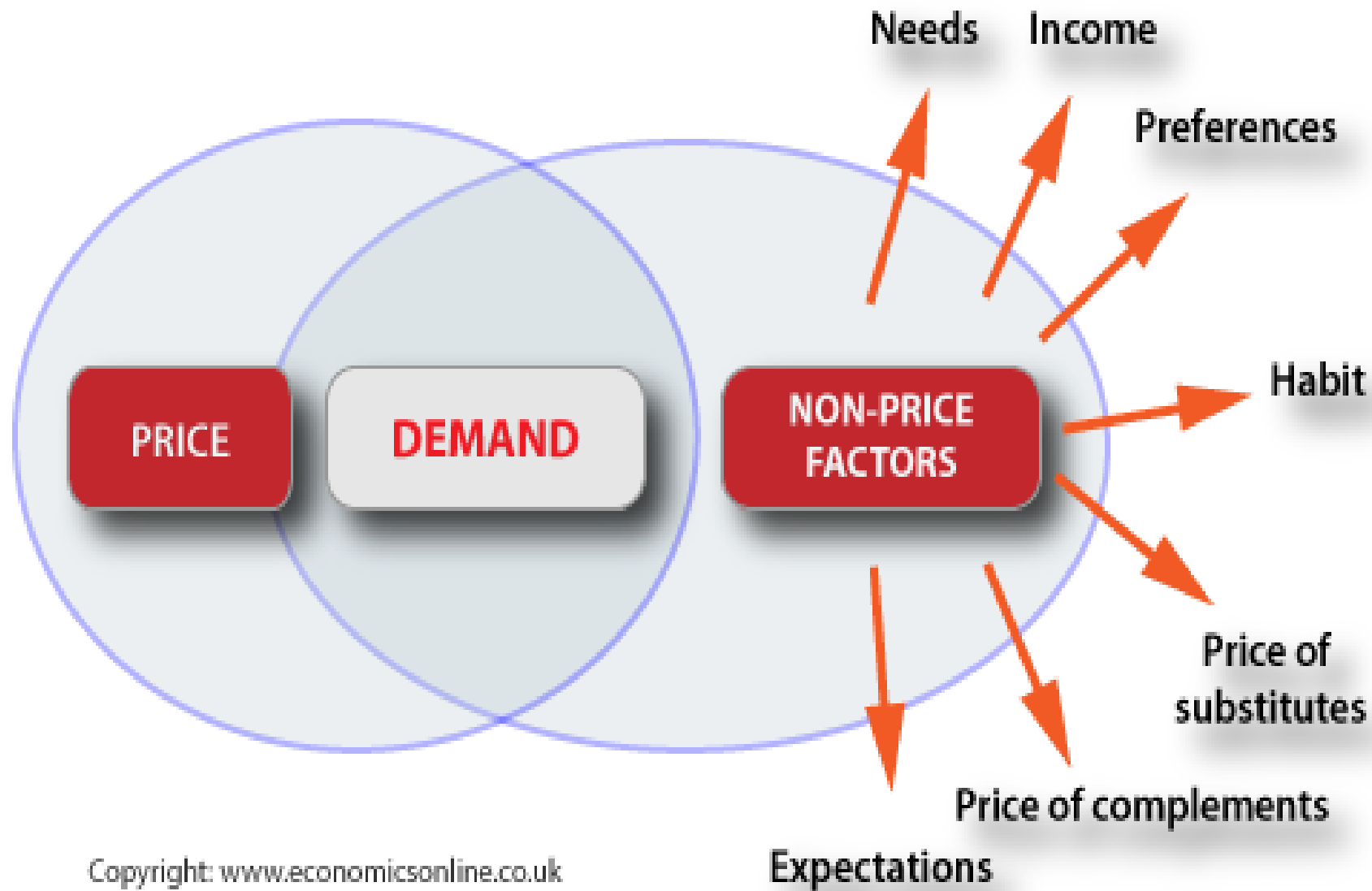
# CONSUMER BEHAVIOUR

## STUDY UNIT: 3





- How does a consumer make choices on which goods and services to buy in a situation with limited income/ budget?



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# Market Baskets/ Bundles

A list/ basket with specific quantities of goods – more than one



Market Baskets		
Market basket	Units of Food	Units of Clothing
A	20	30
B	10	50
D	40	20
E	30	40



It is assumed that a consumer prefers or make choices based on individual preferences, but with limited income

# Theory of Consumer Behavior

Describes how consumers allocate incomes among different goods and services to maximize their well-being.

This can be understood based on the following three distinct steps:

- 1) *Consumer preferences*
- 2) *Budget constraints*
- 3) *Consumer choices*

# WHAT DO WE KNOW?

- 1) Consumer Preferences
- 2) Budget Constraints
- 3) Consumer Choice
- 4) Revealed Preference
- 5) Marginal Utility and Consumer Choice



# 1

## CONSUMER PREFERENCES

- **Basic Assumptions about Preferences**

1. **Completeness:**

- Preferences are assumed to be complete.
- Consumers can compare and rank all possible baskets.
- Thus, for any two market baskets A and B, a consumer will prefer
  - A to B,
  - B to A, or
  - will be indifferent between the two (equally satisfied with either basket.)

2. **Transitivity:**

- Preferences are transitive.
- If a consumer prefers basket A to basket B and basket B to basket C, then the consumer also prefers A to C.
- Transitivity is normally regarded as necessary for consumer consistency.

3. **More is better than less:**

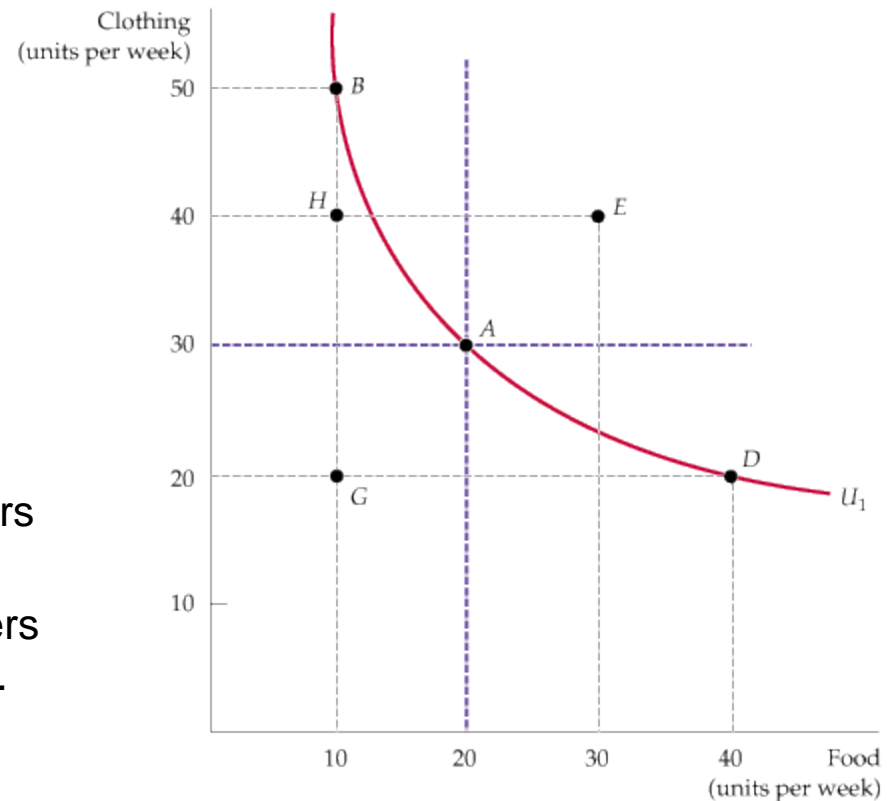
- Consumer always prefer more of any good
- Consumer are never satisfied with less.

## 1

## CONSUMER PREFERENCES\_

## An Indifference Curve

- Curve representing all combinations of market baskets that provide a consumer with the same level of satisfaction.
- $U_1$  is the indifference curve passing through all market baskets that give the consumer the same level of satisfaction.
- Basket B, A, and D
- Between A and E, a Consumer prefers basket E, which lies above  $U_1$ ,
- Between A and G, a Consumer prefers basket A, than G, which lie below  $U_1$ .





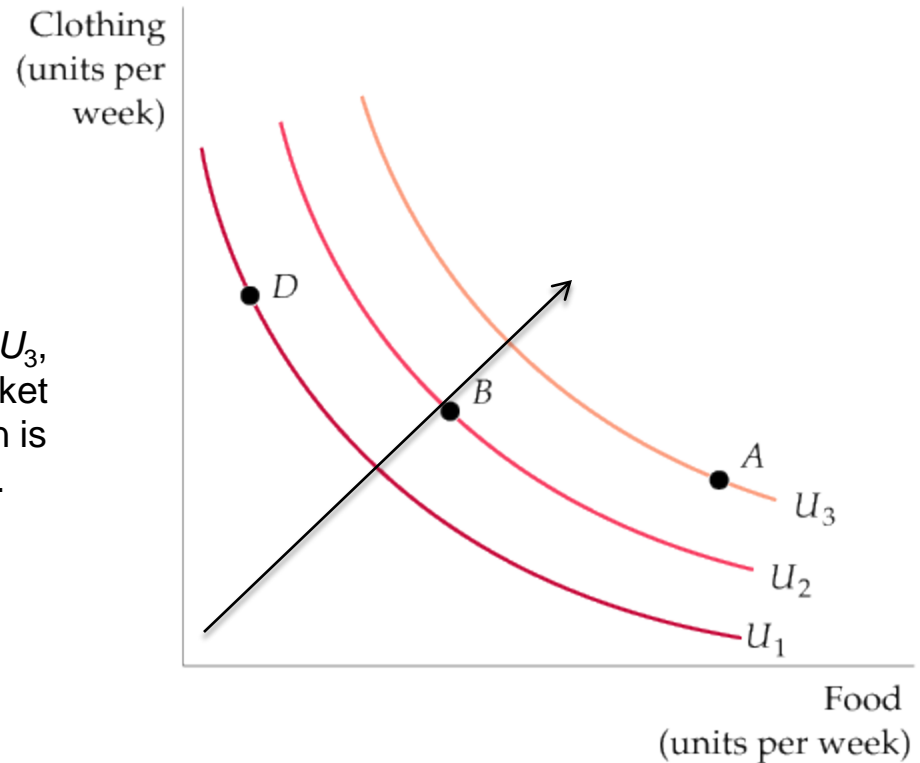
## 1

## CONSUMER PREFERENCES\_

## An Indifference Map

- Graph showing a set of indifference curves that describes consumer preferences

- An indifference map is a set of indifference curves that describes a person's preferences.
- Any market basket on indifference curve  $U_3$ , such as basket  $A$ , is preferred to any basket on curve  $U_2$  (e.g., basket  $B$ ), which in turn is preferred to any basket on  $U_1$ , such as  $D$ .

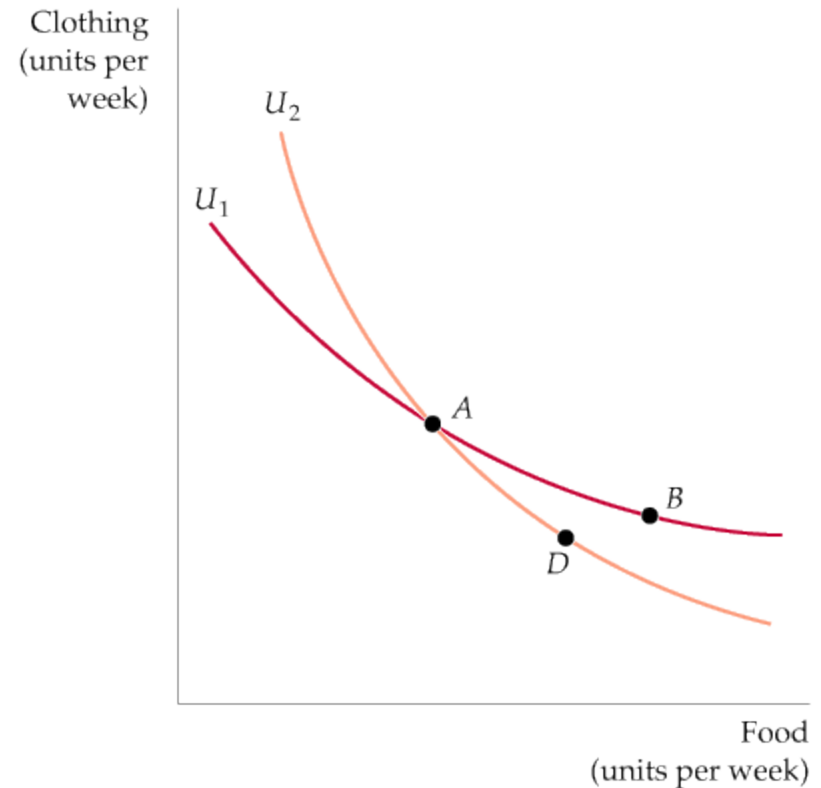


# 1

## CONSUMER PREFERENCES\_

### Indifference Curves Cannot Intersect

If indifference curves  $U_1$  and  $U_2$  intersect, one of the assumptions of consumer theory is violated.



# 1

## CONSUMER PREFERENCES\_

### The Marginal Rate of Substitution (MRS)

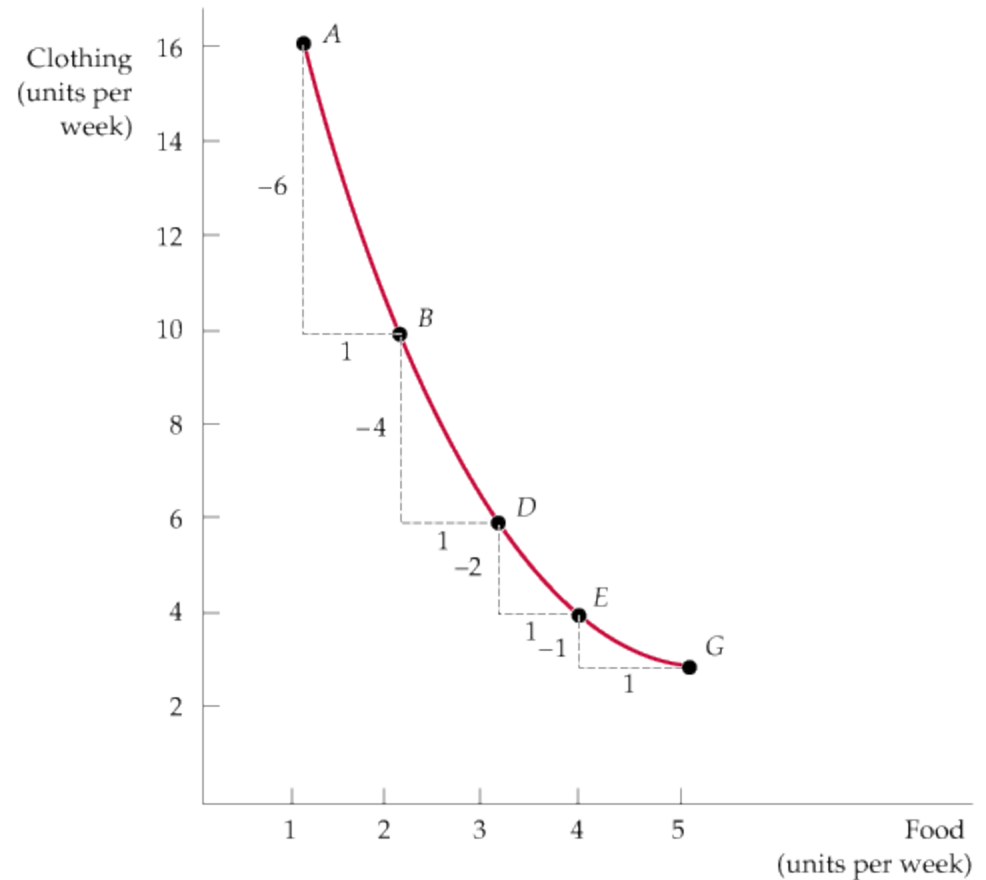
- Maximum amount of a good that a consumer is willing to give up in order to obtain one additional unit of another good.

The magnitude of the slope of an indifference curve measures the consumer's marginal rate of substitution (MRS) between two goods.

In this figure, the MRS between clothing ( $C$ ) and food ( $F$ ) falls from 6 (between  $A$  and  $B$ )

- to 4 (between  $B$  and  $D$ )
- to 2 (between  $D$  and  $E$ )
- to 1 (between  $E$  and  $G$ ).

**Convexity** The decline in the MRS reflects a **diminishing marginal rate of substitution**. When the MRS diminishes along an indifference curve, the curve is convex.



# 1

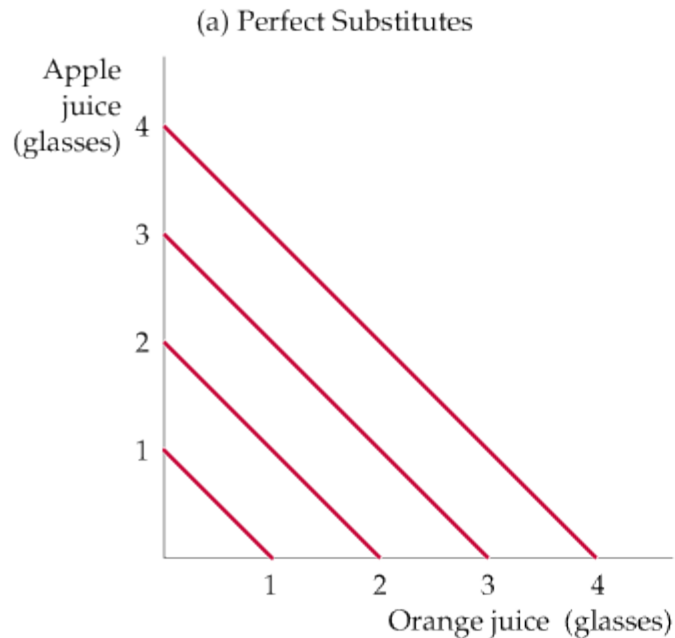
## CONSUMER PREFERENCES\_

- **perfect substitutes** Two goods for which the marginal rate of substitution of one for the other is a constant.
- **perfect complements** Two goods for which the MRS is zero or infinite; the indifference curves are shaped as right angles.

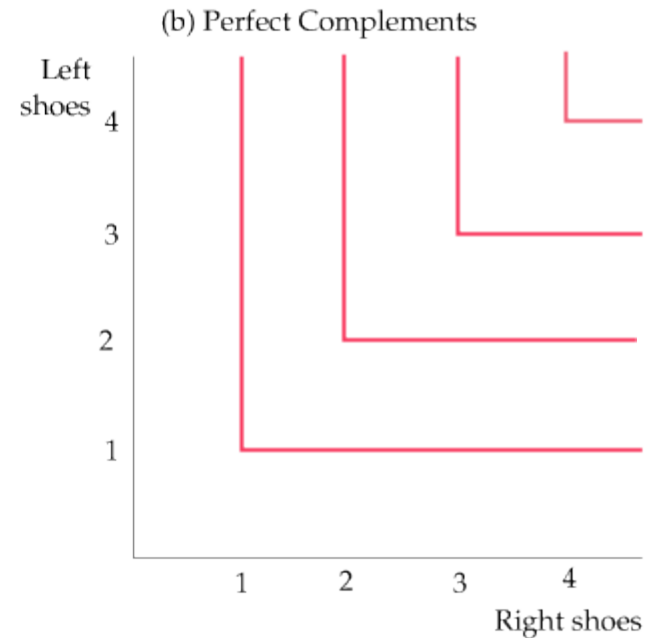
# 1

## CONSUMER PREFERENCES

### Perfect Substitutes and Perfect Complements



In **(a)**, Bob views orange juice and apple juice as perfect substitutes: He is always indifferent between a glass of one and a glass of the other.



In **(b)**, Jane views left shoes and right shoes as perfect complements: An additional left shoe gives her no extra satisfaction unless she also obtains the matching right shoe.

## 1

## CONSUMER PREFERENCES\_

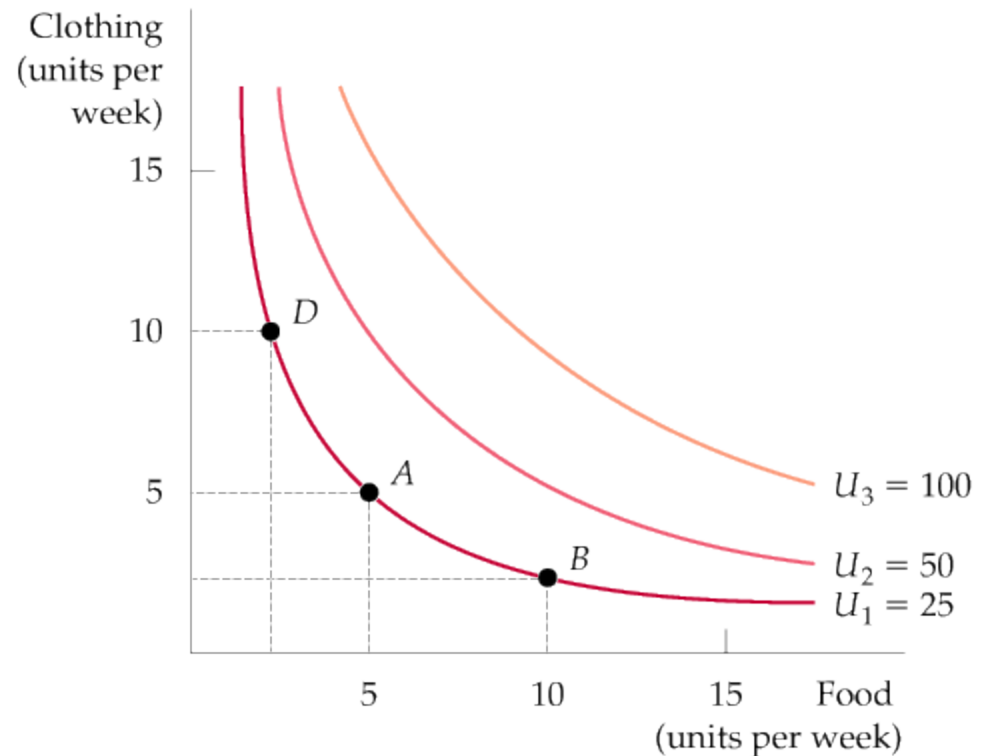
• **Utility and Utility Functions**

- **utility** Numerical score representing the satisfaction that a consumer gets from a given market basket.
- **utility function** Formula that assigns a level of utility to individual market baskets.

**Utility Functions and Indifference Curves**

A utility function can be represented by a set of indifference curves, each with a numerical indicator.

This figure shows three indifference curves (with utility levels of 25, 50, and 100, respectively) associated with the utility function  $FC$ .



## 1

## CONSUMER PREFERENCES\_

- **Ordinal versus Cardinal Utility**
  - **ordinal utility function** Utility function that generates a ranking of market baskets in order of most to least preferred.
  - **cardinal utility function** Utility function describing by how much one market basket is preferred to another.

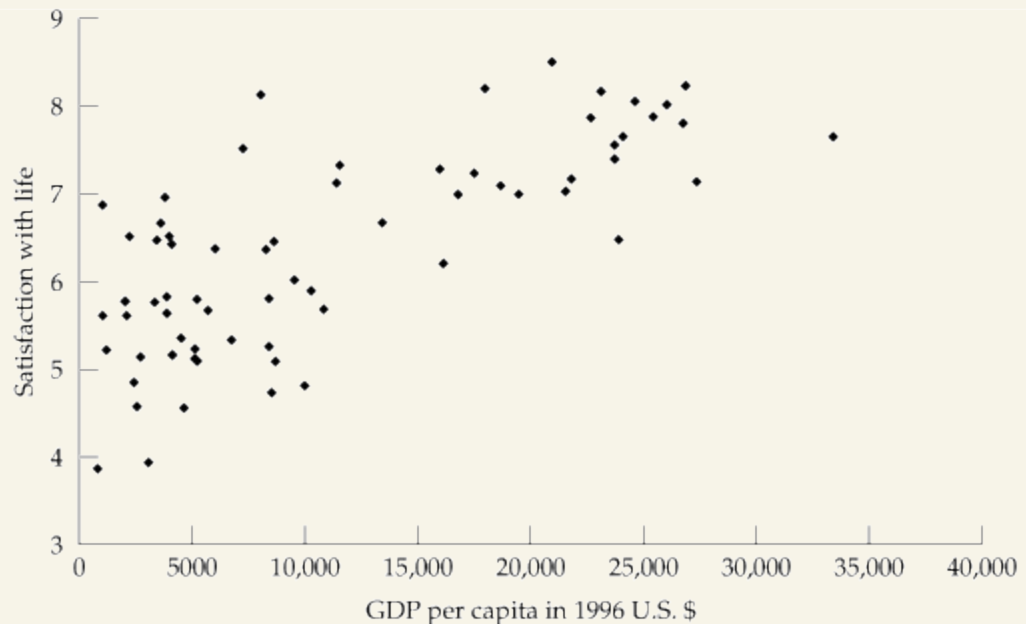
## EXAMPLE 3.2

## Can Money Buy Happiness?

Figure 3.9

## Income and Happiness

A cross-country comparison shows that individuals living in countries with higher GDP per capita are on average happier than those living in countries with lower per-capita GDP.



## 2

## BUDGET CONSTRAINTS

- **Budget constraints**

Constraints that consumers face as a result of limited incomes.

- **Budget line**

All combinations of goods for which the total amount of money spent is equal to income.

$$P_F F + P_C C = I \quad (3.1)$$

Market Baskets and the Budget Line			
Market Basket	Food ( $F$ )	Clothing ( $C$ )	Total Spending
$A$	0	40	R80.00
$B$	20	30	R80.00
$D$	40	20	R80.00
$E$	60	10	R80.00
$G$	80	0	R80.00

The table shows market baskets associated with the budget line  $F + 2C = R80$



## 2

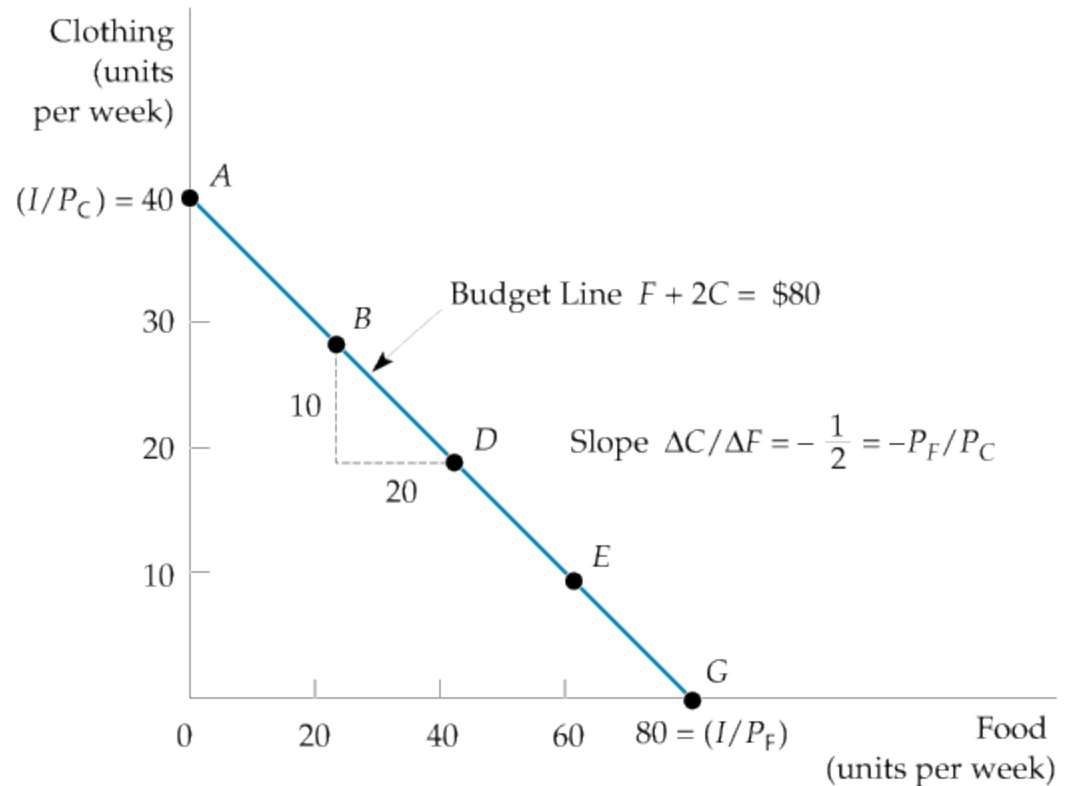
## BUDGET CONSTRAINTS

## A Budget Line

A budget line describes the combinations of goods that can be purchased given the consumer's income and the prices of the goods.

Line  $AG$  (which passes through points  $B$ ,  $D$ , and  $E$ ) shows the budget associated with an income of R80, a price of food of  $P_F = R1$  per unit, and a price of clothing of  $P_C = R2$  per unit.

The slope of the budget line (measured between points  $B$  and  $D$ ) is  $-P_F/P_C = -10/20 = -1/2$ .



$$C = (I / P_C) - (P_F / P_C)F \quad (3.2)$$

## 2

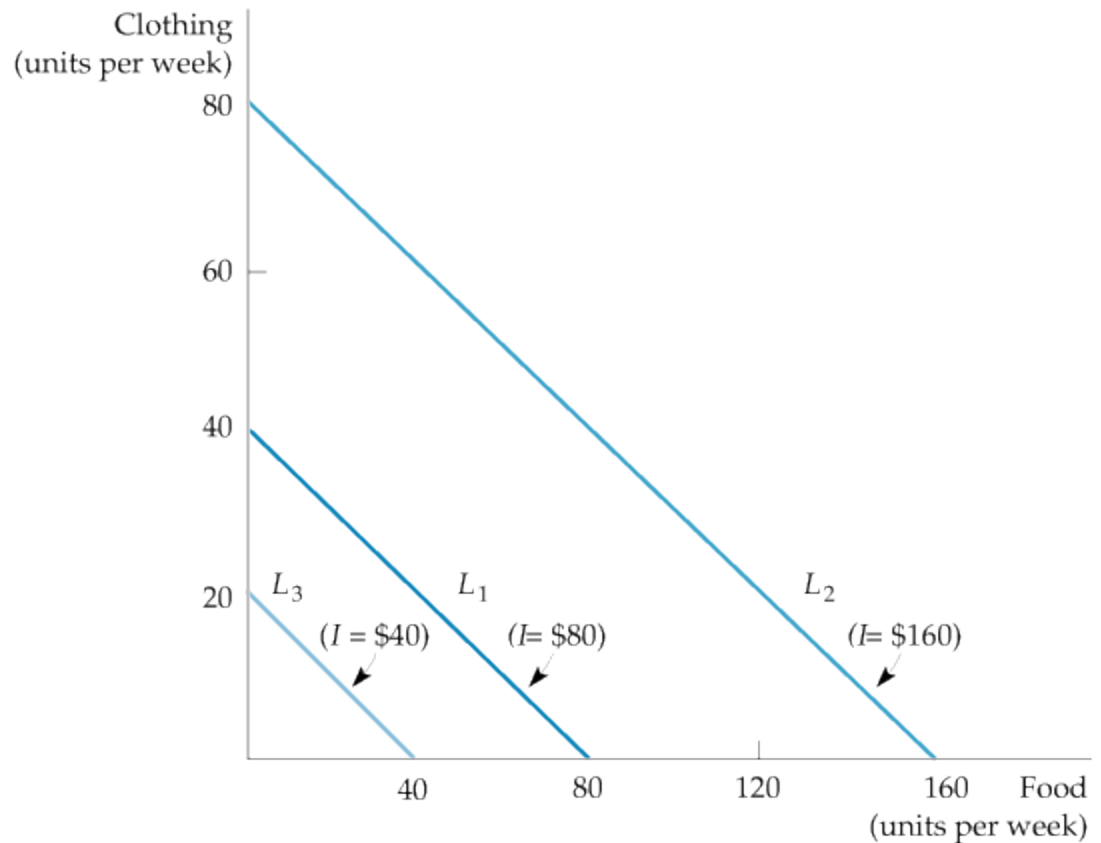
## BUDGET CONSTRAINTS

## Effects of a Change in Income on the Budget Line

**Income Changes** A change in income (with prices unchanged) causes the budget line to shift parallel to the original line ( $L_1$ ).

When the income of R80 (on  $L_1$ ) is increased to R160, the budget line shifts outward to  $L_2$ .

If the income falls to R40, the line shifts inward to  $L_3$ .



## 2

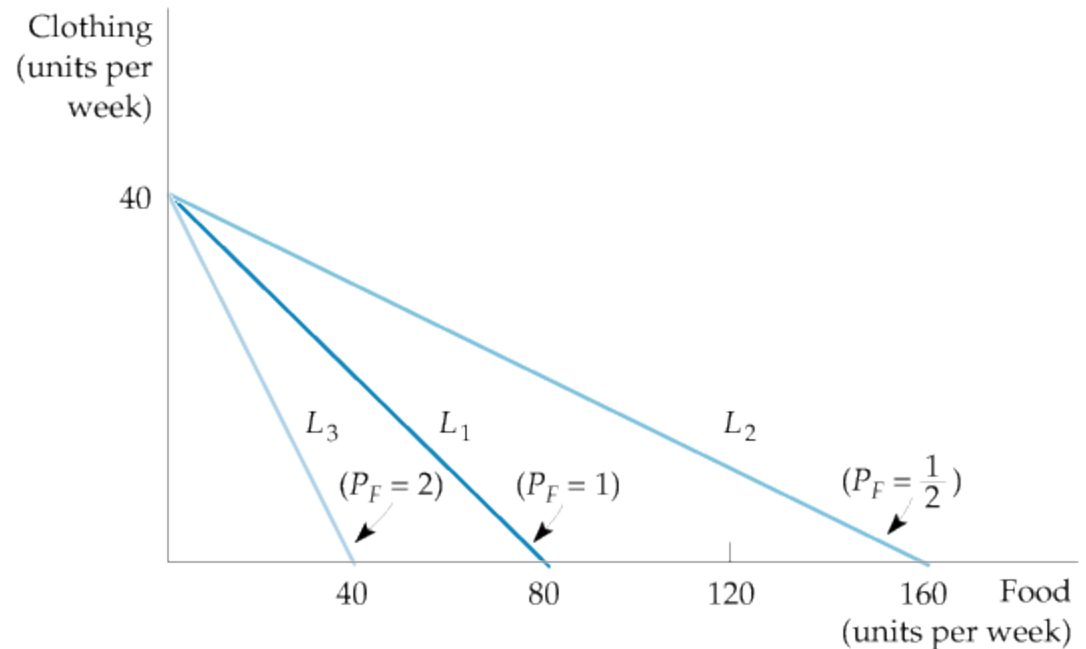
## BUDGET CONSTRAINTS

## Effects of a Change in Price on the Budget Line

**Price Changes** A change in the price of one good (with income unchanged) causes the budget line to rotate about one intercept.

When the price of food falls from R1.00 to R0.50, the budget line rotates outward from  $L_1$  to  $L_2$ .

However, when the price increases from R1.00 to R2.00, the line rotates inward from  $L_1$  to  $L_3$ .



## 3

## CONSUMER CHOICE

## Maximizing Consumer Satisfaction

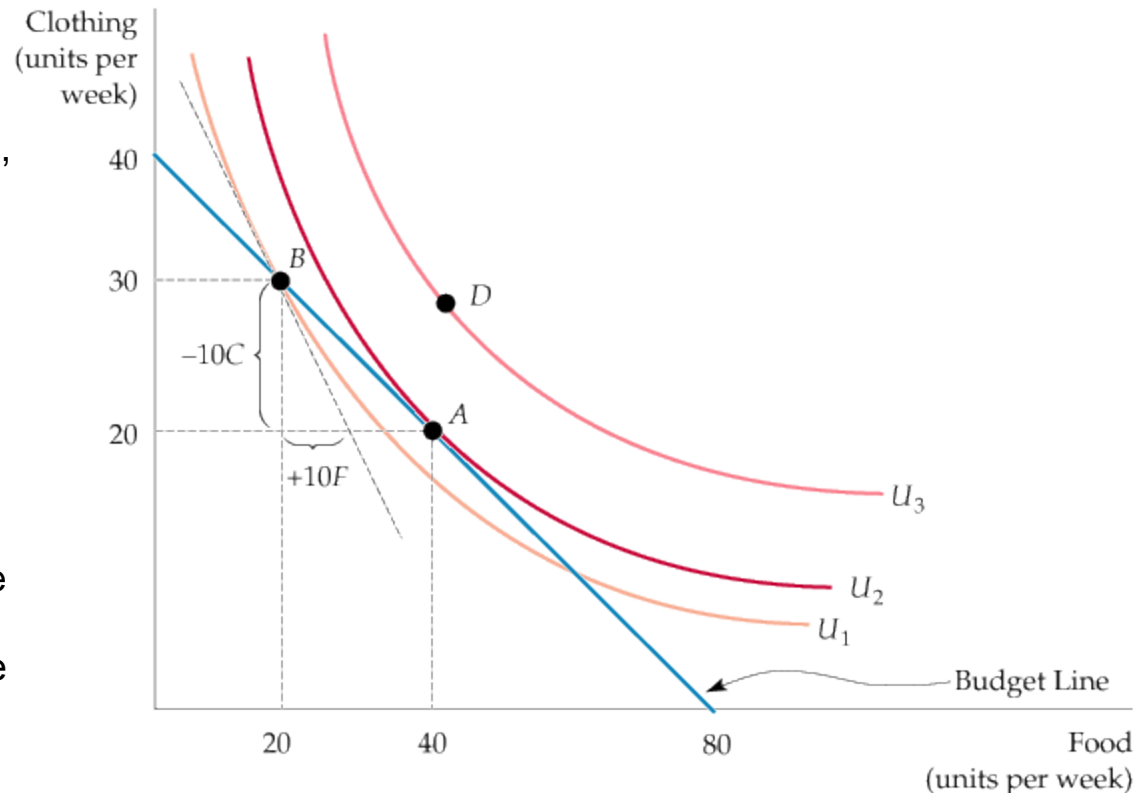
The maximizing market basket must satisfy two conditions:

- *It must be located on the budget line.*
- *It must give the consumer the most preferred combination of goods and services.*

A consumer maximizes satisfaction by choosing market basket A. At this point, the budget line and indifference curve  $U_2$  are tangent.

No higher level of satisfaction (e.g., market basket D) can be attained.

At A, the point of maximization, the MRS between the two goods equals the price ratio. At B, however, because the MRS [ $-(-10/10) = 1$ ] is greater than the price ratio ( $1/2$ ), satisfaction is not maximized.



## 3

## CONSUMER CHOICE

Satisfaction is maximized (given the budget constraint) at the point where

$$\text{MRS} = P_F / P_C \quad (3.3)$$

- **marginal benefit** Benefit from the consumption of one additional unit of a good.
- **marginal cost** Cost of one additional unit of a good.

The condition given in equation (3.3) illustrates the kind of optimization conditions that arise in economics. In this instance, satisfaction is maximized when the **marginal benefit**—the benefit associated with the consumption of one additional unit of food—is equal to the **marginal cost**—the cost of the additional unit of food. The marginal benefit is measured by the MRS.

## 3

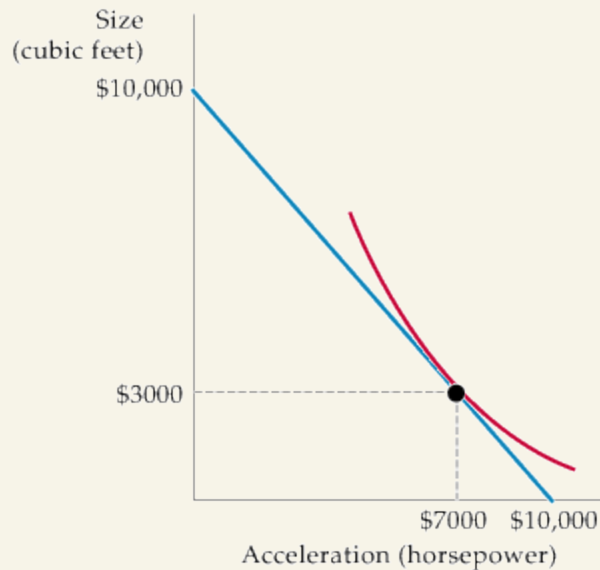
## CONSUMER CHOICE

## EXAMPLE 3.3

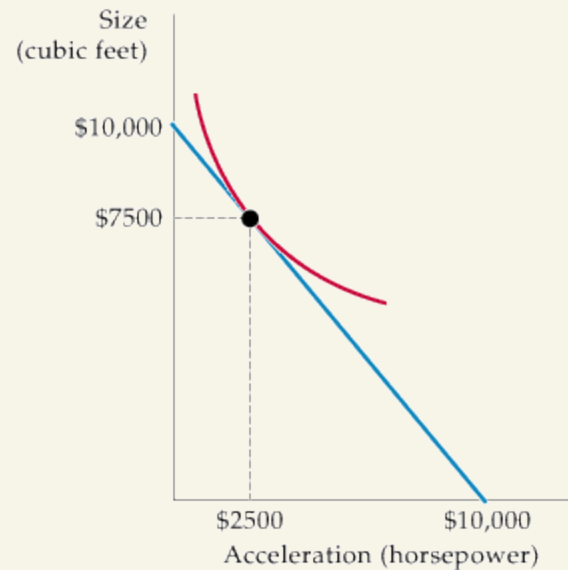
## Designing New Automobiles (II)

Figure 3.14

## Consumer Choice of Automobile Attributes



(a)



(b)

The consumers in **(a)** are willing to trade off a considerable amount of interior space for some additional acceleration. Given a budget constraint, they will choose a car that emphasizes acceleration. The opposite is true for consumers in **(b)**.

# 3

## CONSUMER CHOICE

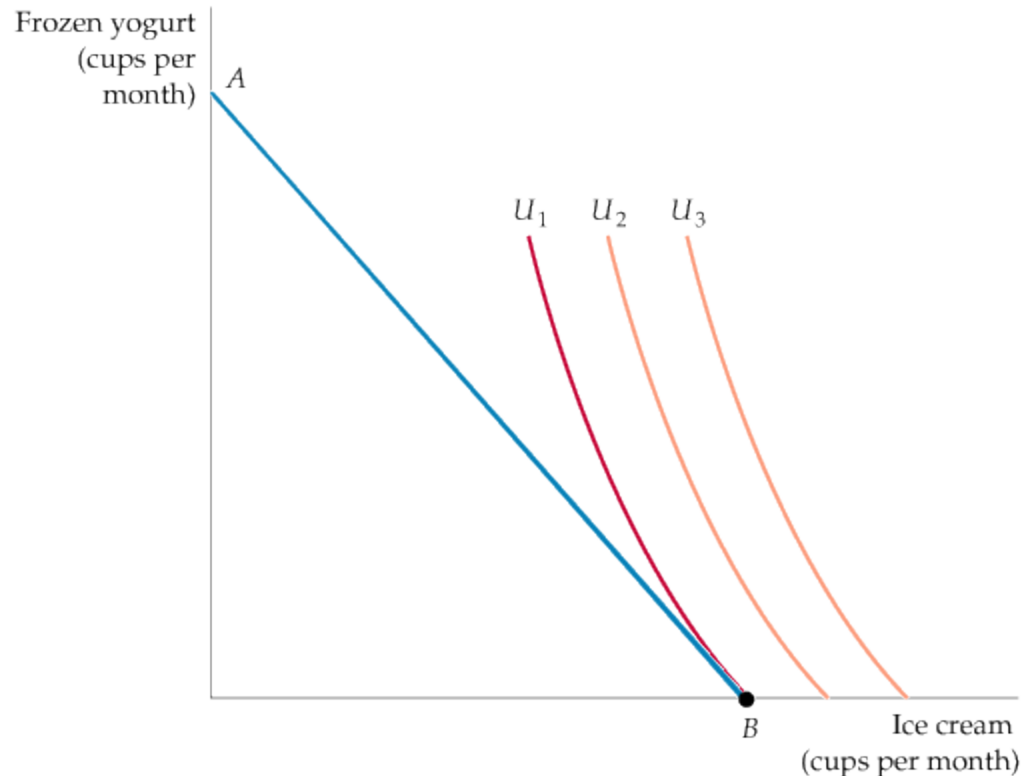
### A Corner Solution

- Situation in which the marginal rate of substitution of one good for another in a chosen market basket is not equal to the slope of the budget line.

When the consumer's MRS is not equal to the price ratio for all levels of consumption, a corner solution arises.

The consumer maximizes satisfaction by consuming only one of the two goods.

Given budget line  $AB$ , the highest level of satisfaction is achieved at  $B$  on indifference curve  $U_1$ , where the MRS (of ice cream for frozen yogurt) is greater than the ratio of the price of ice cream to the price of frozen yogurt.



## 4

## REVEALED PREFERENCE

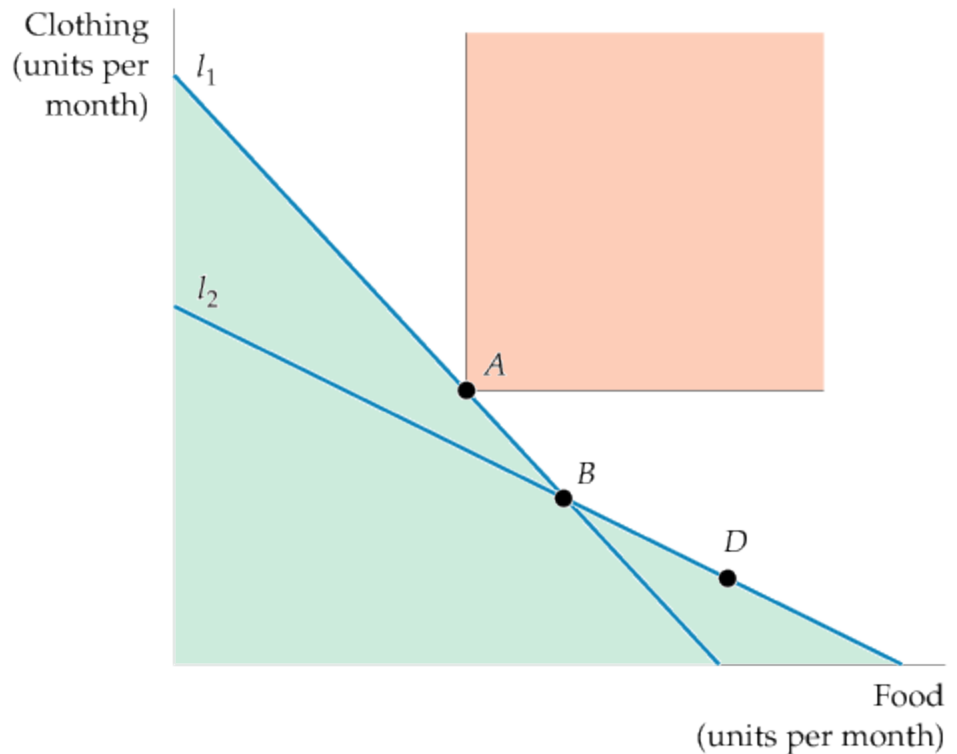
*If a consumer chooses one market basket over another, and if the chosen market basket is more expensive than the alternative, then the consumer must prefer the chosen market basket.*

**Revealed Preference:  
Two Budget Lines**

If an individual facing budget line  $l_1$  chose market basket  $A$  rather than market basket  $B$ ,  $A$  is revealed to be preferred to  $B$ .

Likewise, the individual facing budget line  $l_2$  chooses market basket  $B$ , which is then revealed to be preferred to market basket  $D$ .

Whereas  $A$  is preferred to all market baskets in the green-shaded area, all baskets in the pink-shaded area are preferred to  $A$ .





## 4

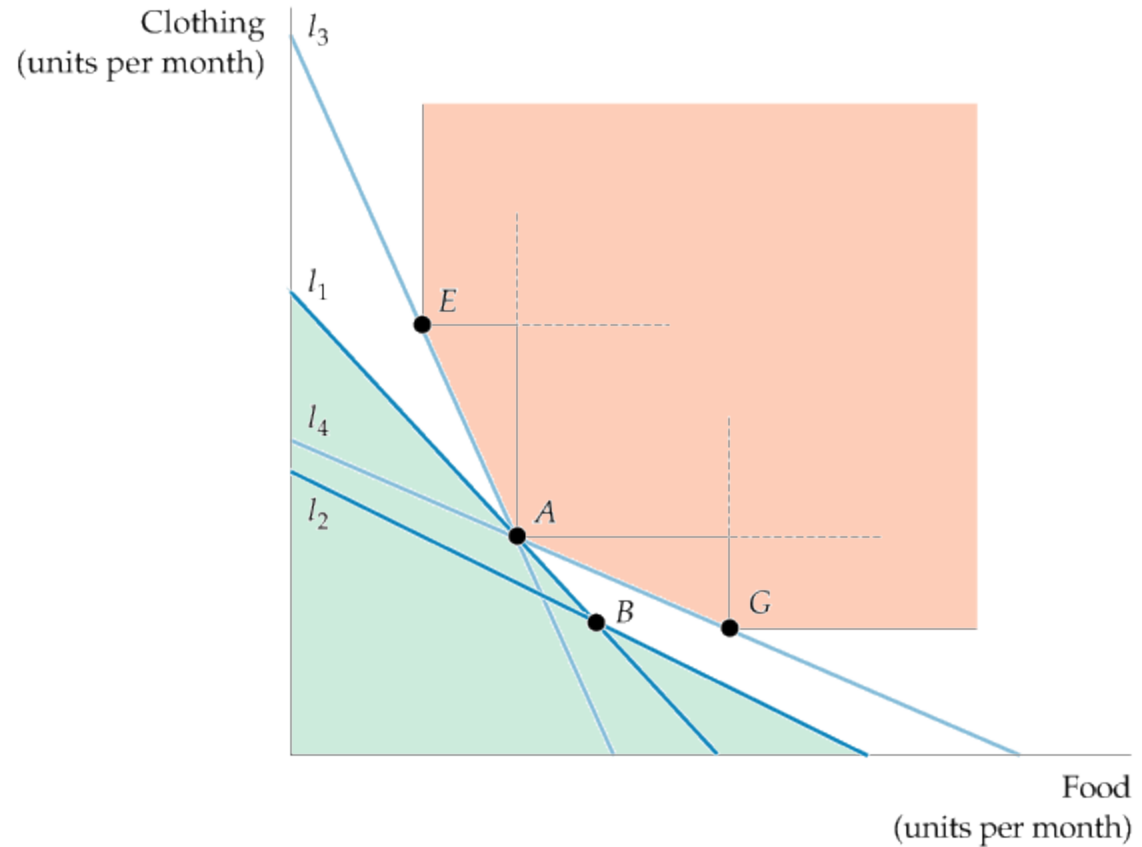
## REVEALED PREFERENCE

**Revealed Preference:  
Four Budget Lines**

Facing budget line  $l_3$  the individual chooses  $E$ , which is revealed to be preferred to  $A$  (because  $A$  could have been chosen).

Likewise, facing line  $l_4$ , the individual chooses  $G$  which is also revealed to be preferred to  $A$ .

Whereas  $A$  is preferred to all market baskets in the green-shaded area, all market baskets in the pink-shaded area are preferred to  $A$ .



## 4

## REVEALED PREFERENCE

## EXAMPLE 3.5

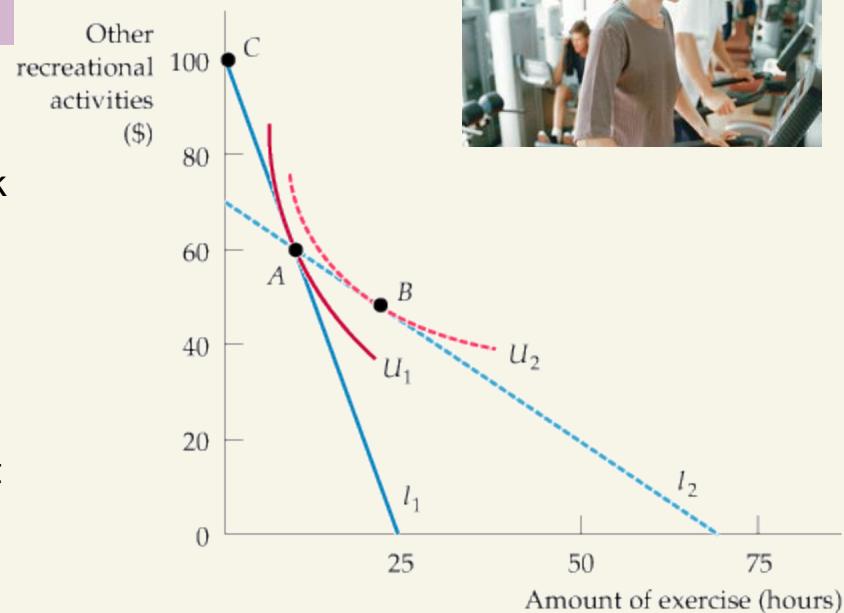
## Revealed Preference for Recreation

## Revealed Preference for Recreation

When facing budget line  $I_1$ , an individual chooses to use a health club for 10 hours per week at point  $A$ .

When the fees are altered, she faces budget line  $I_2$ .

She is then made better off because market basket  $A$  can still be purchased, as can market basket  $B$ , which lies on a higher indifference curve.



- **Marginal utility (MU)** Additional satisfaction obtained from consuming one additional unit of a good.
- **Diminishing Marginal Utility** Principle that as more of a good is consumed, the consumption of additional amounts will yield smaller additions to utility.

$$0 = MU_F(\Delta F) + MU_C(\Delta C)$$

$$-(\Delta C / \Delta F) = MU_F / MU_C$$

$$MRS = MU_F / MU_C \quad (3.5)$$

$$MRS = P_F / P_C \quad (3.6)$$

$$MU_F / MU_C = P_F / P_C$$

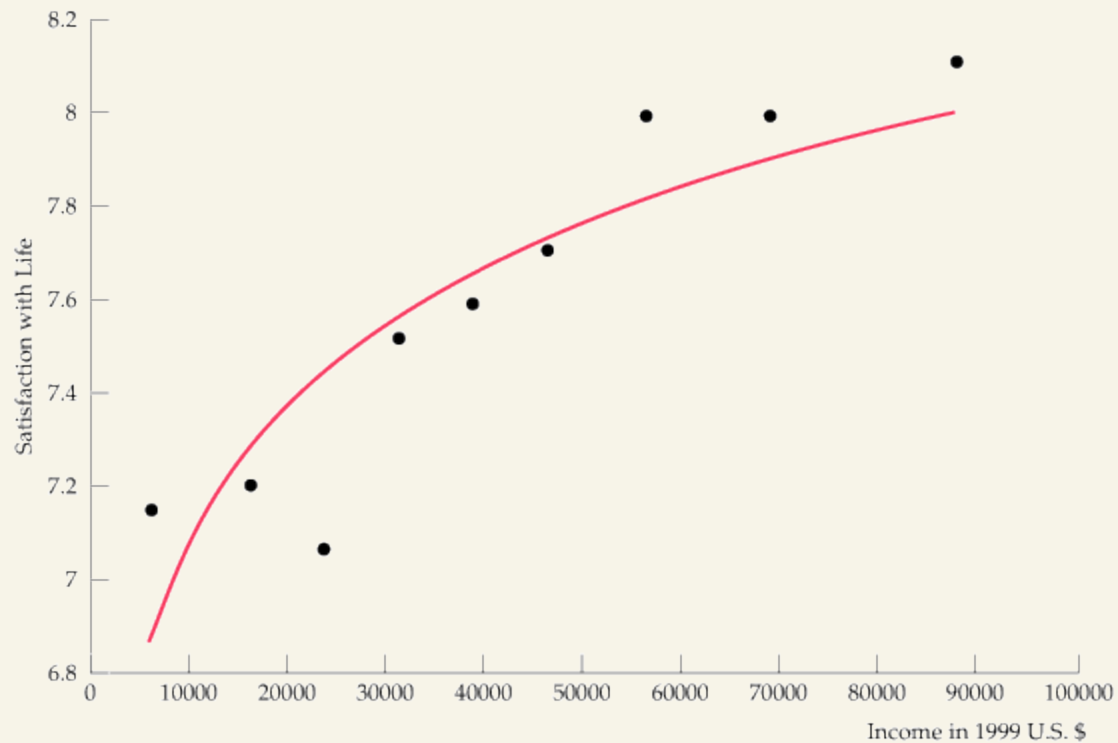
$$MU_F / P_F = MU_C / P_C \quad (3.7)$$

- **equal marginal principle** Principle that utility is maximized when the consumer has equalized the marginal utility per dollar of expenditure across all goods.

## 5

## MARGINAL UTILITY AND CONSUMER CHOICE

## Marginal Utility and Happiness



A comparison of mean levels of satisfaction with life across income classes in the United States shows that happiness increases with income, but at a diminishing rate.

## 5

## MARGINAL UTILITY AND CONSUMER CHOICE

## EXAMPLE 3.7

## Gasoline Rationing

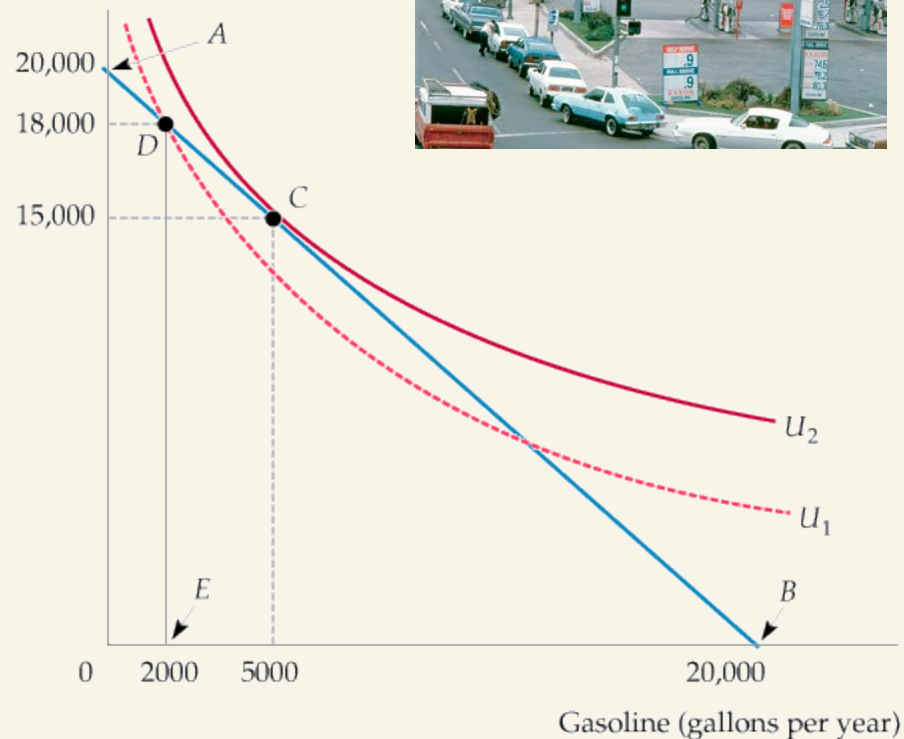
**Inefficiency of Gasoline Rationing**

When a good is rationed, less is available than consumers would like to buy. Consumers may be worse off. Without gasoline rationing, up to 20,000 gallons of gasoline are available for consumption (at point *B*).

The consumer chooses point *C* on indifference curve  $U_2$ , consuming 5000 gallons of gasoline.

However, with a limit of 2000 gallons under rationing (at point *E*), the consumer moves to *D* on the lower indifference curve  $U_1$ .

Spending  
on other  
goods (\$)



## 5

## MARGINAL UTILITY AND CONSUMER CHOICE

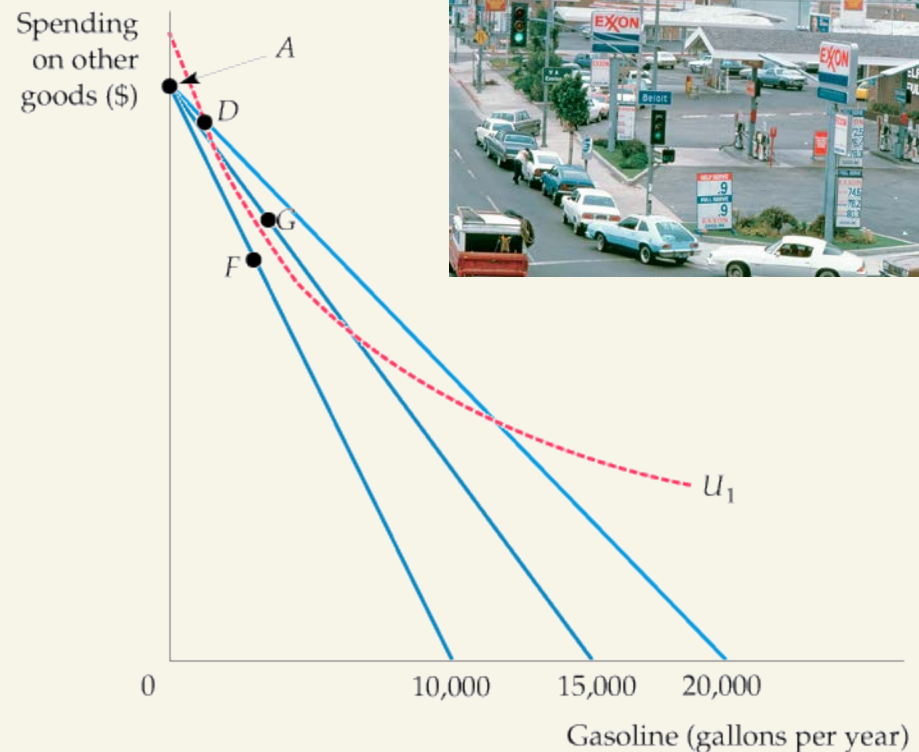
## EXAMPLE 3.7

## Gasoline Rationing (continued)

## Comparing Gasoline Rationing to the Free Market

If the price of gasoline in a competitive market is \$2.00 per gallon and the maximum consumption of gasoline is 10,000 gallons per year, the woman is better off under rationing (which holds the price at \$1.00 per gallon), since she chooses the market basket at point  $F$ , which lies below indifference curve  $U_1$  (the level of utility achieved under rationing).

However, she would prefer a free market if the competitive price were \$1.50 per gallon, since she would select market basket  $G$ , which lies above indifference curve  $U_1$ .





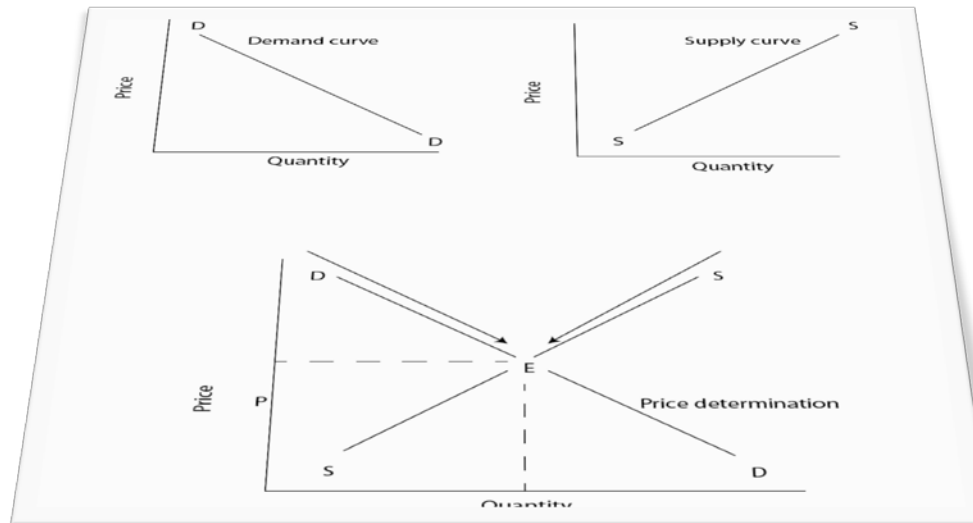
# UNISA ECS2601: MICROECONOMICS

Study Unit: 4

By. E. Ramathuba



# STUDY UNIT 4: INDIVIDUAL AND MARKET DEMAND



*based on the work done by Fernando, Quijano & Yvonn Quijano (2002)*

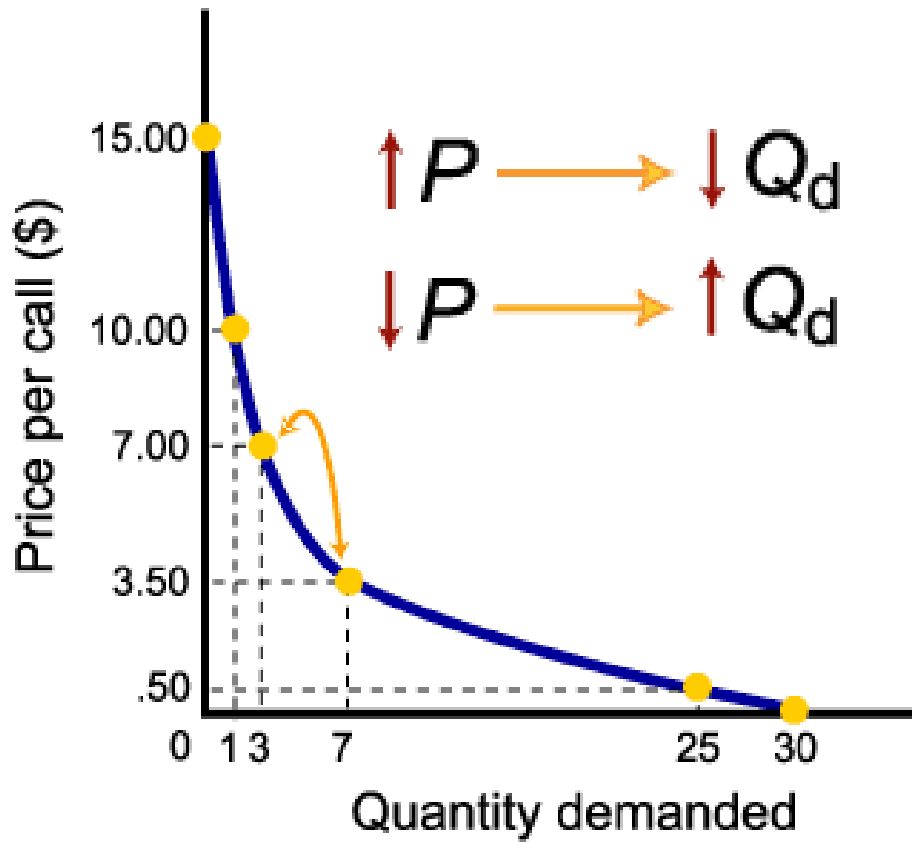
# Demand

**1.1. Quantity demanded** is the amount (number of units) of a goods and services that a potential individuals/households are willing and able to buy.

## **1.2. Determinants of Household Demand**

- The *price of the product* in question.
- The *income* available to the household.
- The household's amount of *accumulated wealth*.
- The *prices of related products* available to the household.
  - ✦ *Complementary products*
  - ✦ *Substitute product*
- The household's *tastes and preferences*.
- Size of *household*. The bigger the size the higher the demand
- The household's *expectations* about future income, wealth, and prices.

# The Law of Demand



- The *law of demand* states that there is a negative, or inverse, relationship between price and the quantity of a good demanded and its price.



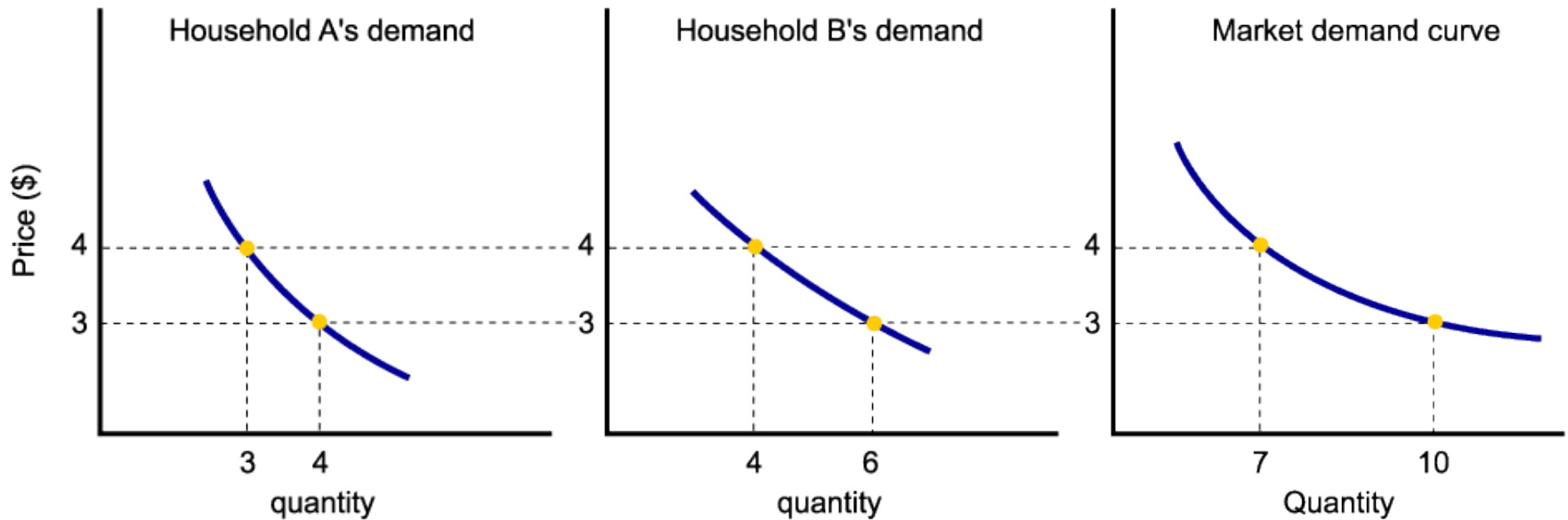
demand curves  
slope downward.

# From Individual Demand to Market Demand

- Demand for a good or service can be defined for an *individual household*, or for a group of households that make up a *market*.
- *Market demand* is the sum of all the quantities of a good or service demanded per period by all the individuals/households buying in the market for that good or service.

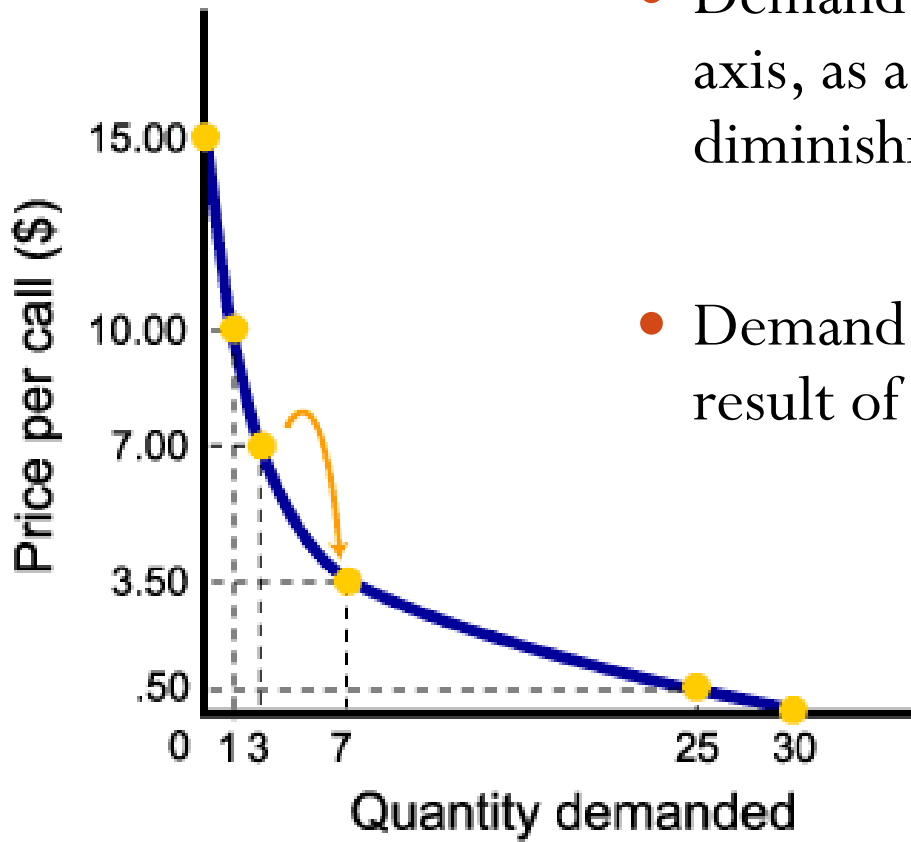
# From Individual Demand to Market Demand

- Assuming there are only two individuals in the market, market demand is derived as follows:



# Other Properties of Demand Curves

- Demand curves intersect the quantity ( $X$ )-axis, as a result of time limitations and diminishing marginal utility.
- Demand curves intersect the ( $Y$ )-axis, as a result of limited incomes and wealth.

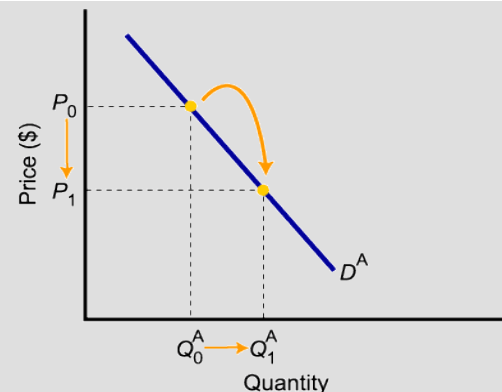


# A Change in Demand Versus a Change in Quantity Demanded

Change in price of a good or service leads to



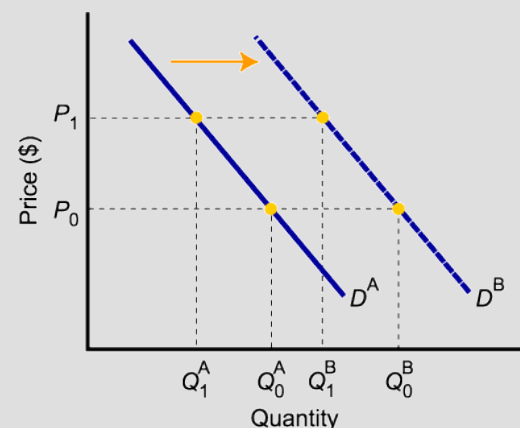
Change in *quantity demanded* (**Movement along the curve**).



Change in income, preferences, or prices of other goods or services leads to



Change in demand (**Shift of curve**).



# Related Goods and Services

- **Normal Goods** are goods for which demand goes up when income is higher and for which demand goes down when income is lower.
- **Inferior Goods** are goods for which demand falls when income rises.
- **Substitutes** are goods that can serve as replacements for one another; when the price of one increases, demand for the other goes up. **Perfect substitutes** are identical products.
- **Complements** are goods that “go together”; a decrease in the price of one results in an increase in demand for the other, and vice versa.

$\uparrow \text{income} \Rightarrow \uparrow \text{demand}$

$\uparrow \text{income} \Rightarrow \downarrow \text{demand}$

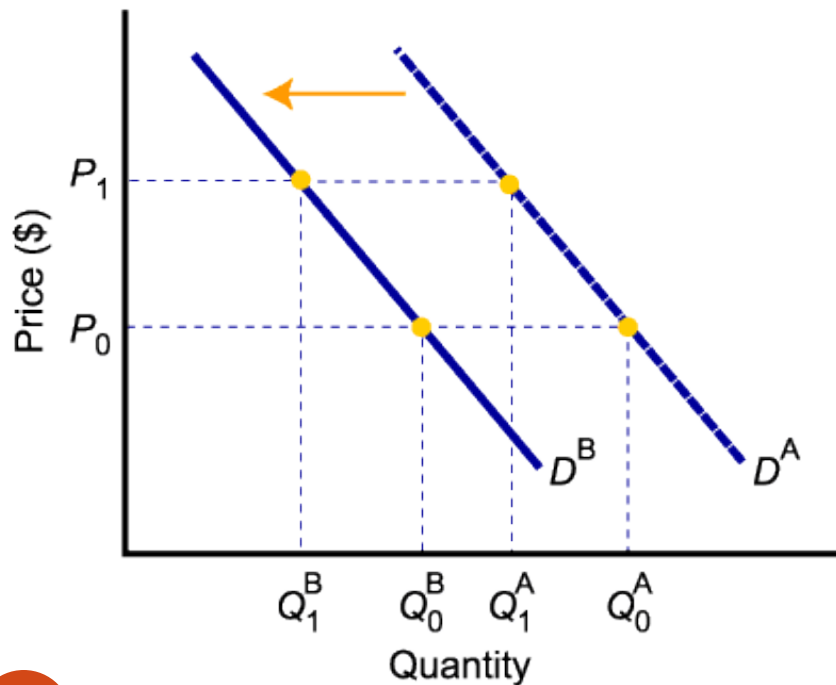
$\uparrow P_x \Rightarrow \uparrow \text{Demand for } Q_y$

$\downarrow P_x \Rightarrow \uparrow \text{Demand for } Q_y$

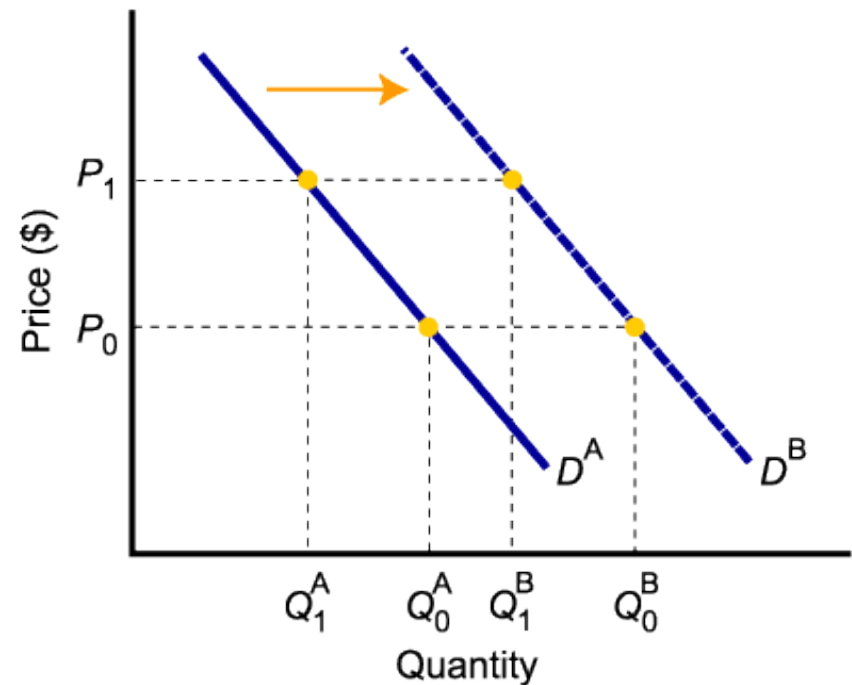


# Income Effect

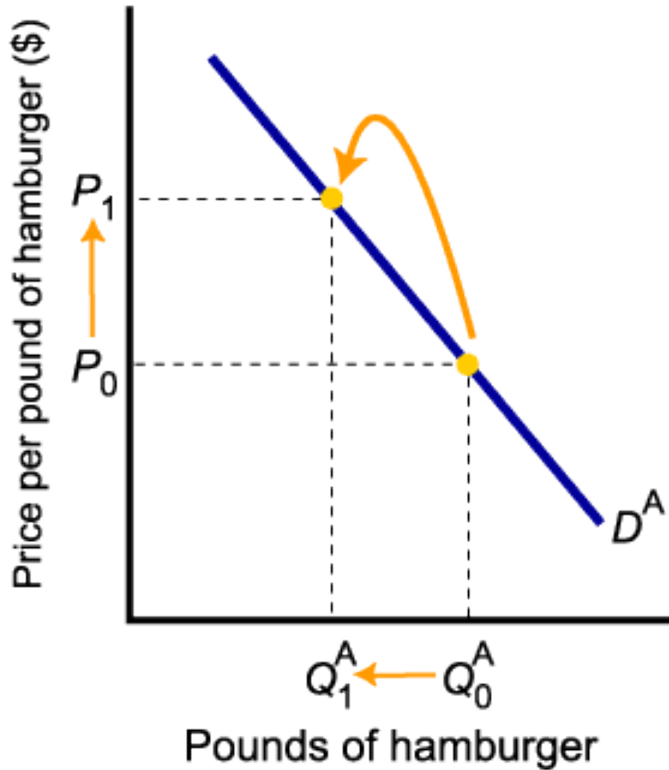
- Higher income decreases the demand for an *inferior* good



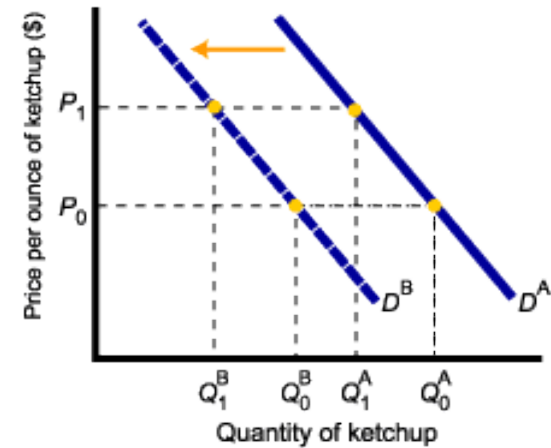
- Higher income increases the demand for a *normal* good



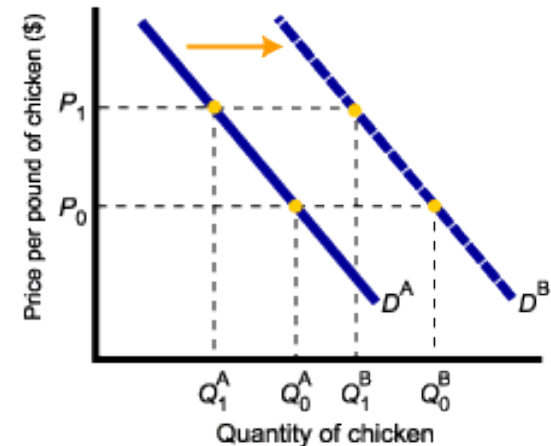
# Substitution Effect



1. Demand for complement good (ketchup) shifts left



2. Demand for substitute good (chicken) shifts right



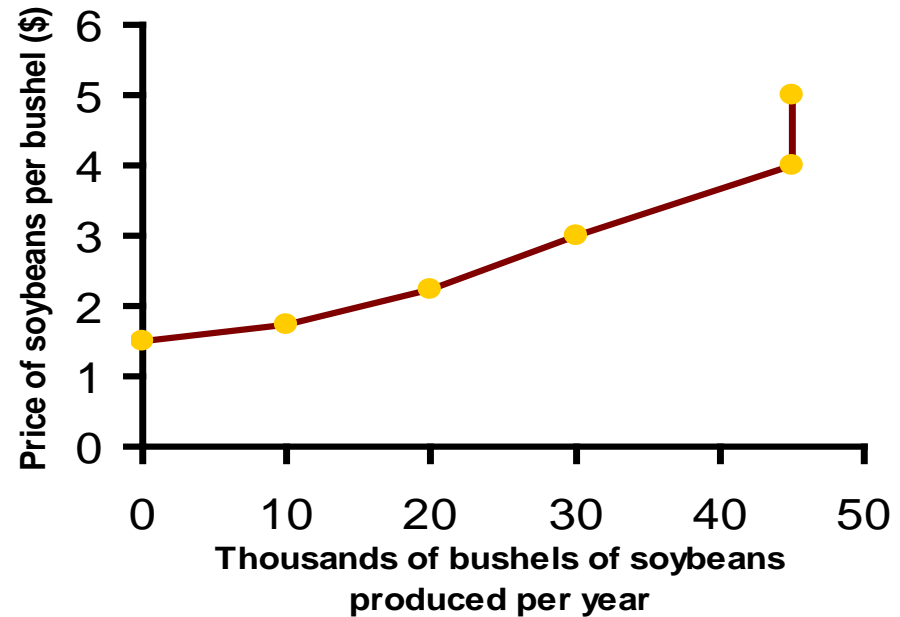
- Price of hamburger rises
- Quantity of hamburger demanded falls

# **THE SUPPLY OF GOODS AND SERVICES**

# Supply Market

- A **supply schedule** is a table showing how much of the quantities of goods or services a firms plan to sell at each possible price during a certain period.
- Lets consider the following supply schedule

Price per unit	Quantity Supplied
2	0
1.75	10
2.25	20
3.00	30
4.00	45
5.00	45

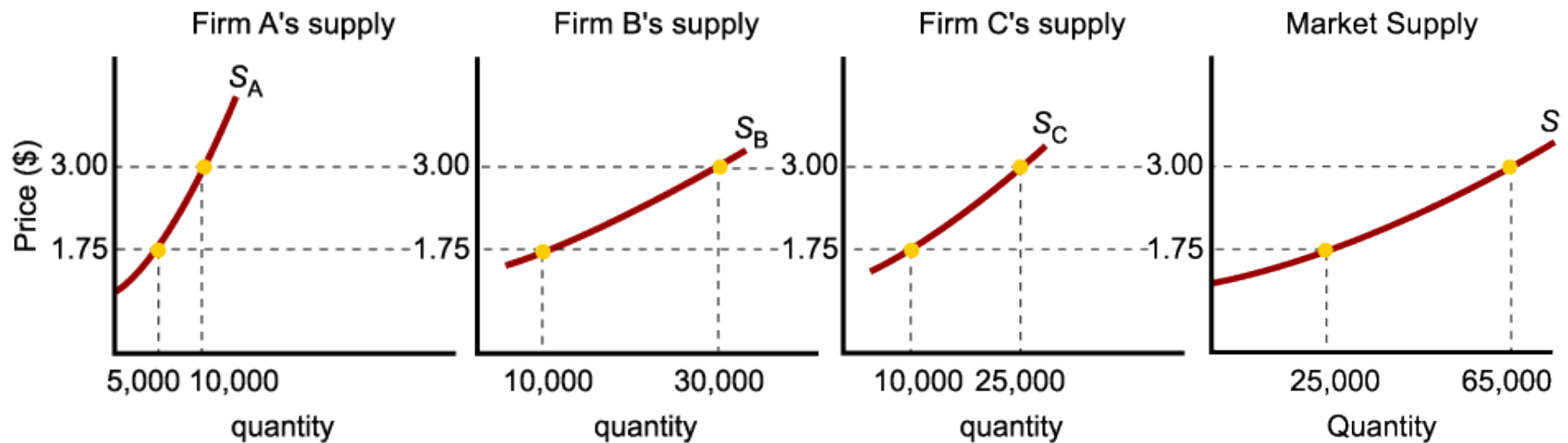


# From Individual Supply to Market Supply

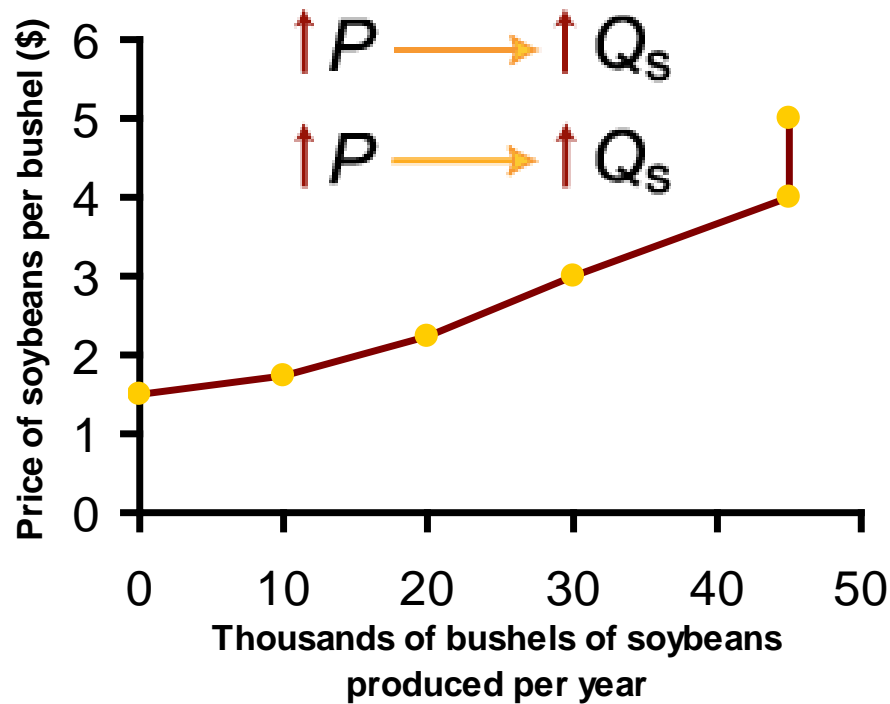
- The supply of a good or service can be defined for an individual firm, or for a group of firms that make up a market or an industry.
- *Market supply* is the sum of all the quantities of a good or service supplied per period by all the firms selling in the market for that good or service.

# Market Supply

- As with market demand, *market supply* is the horizontal summation of individual firms' supply curves.



# The Law of Supply



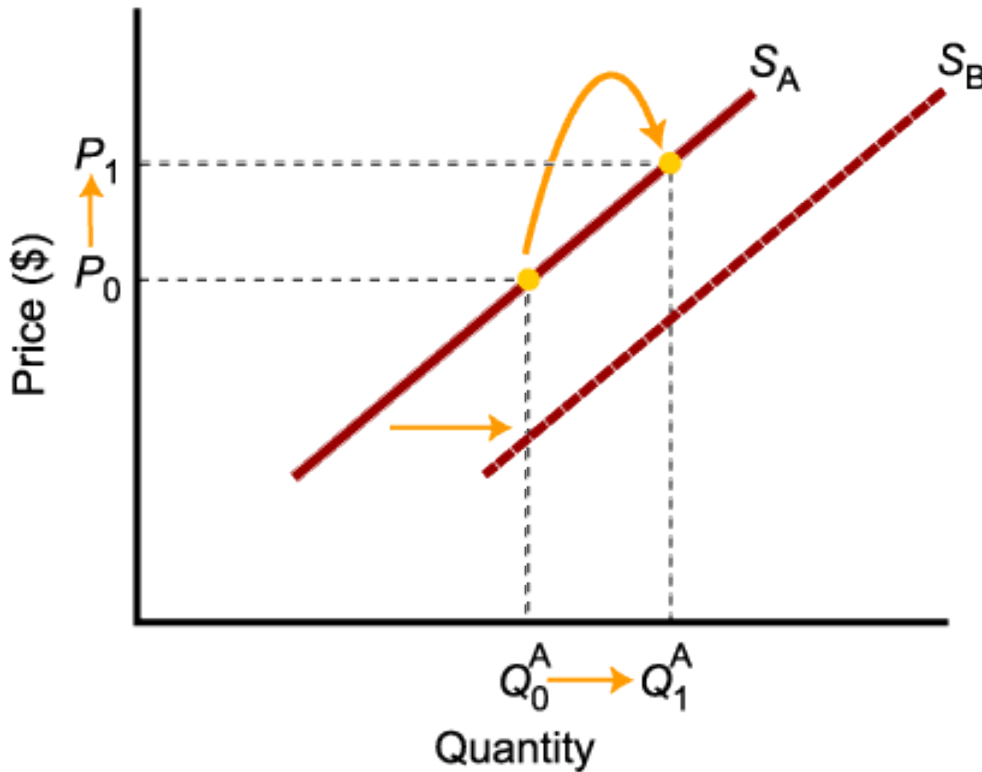
- The *law of supply* states that there is a positive relationship between price and quantity of a good supplied.
- This means that supply curves typically have a positive slope.

# Determinants of Supply

- The *price* of the good or service.
- The *cost* of producing the good, which in turn depends on:
  - ✓ The *price of factors of production or required inputs* (labor, capital, and land),
  - ✓ The *technologies* that can be used to produce the product,
- The *prices of alternative / related products*.

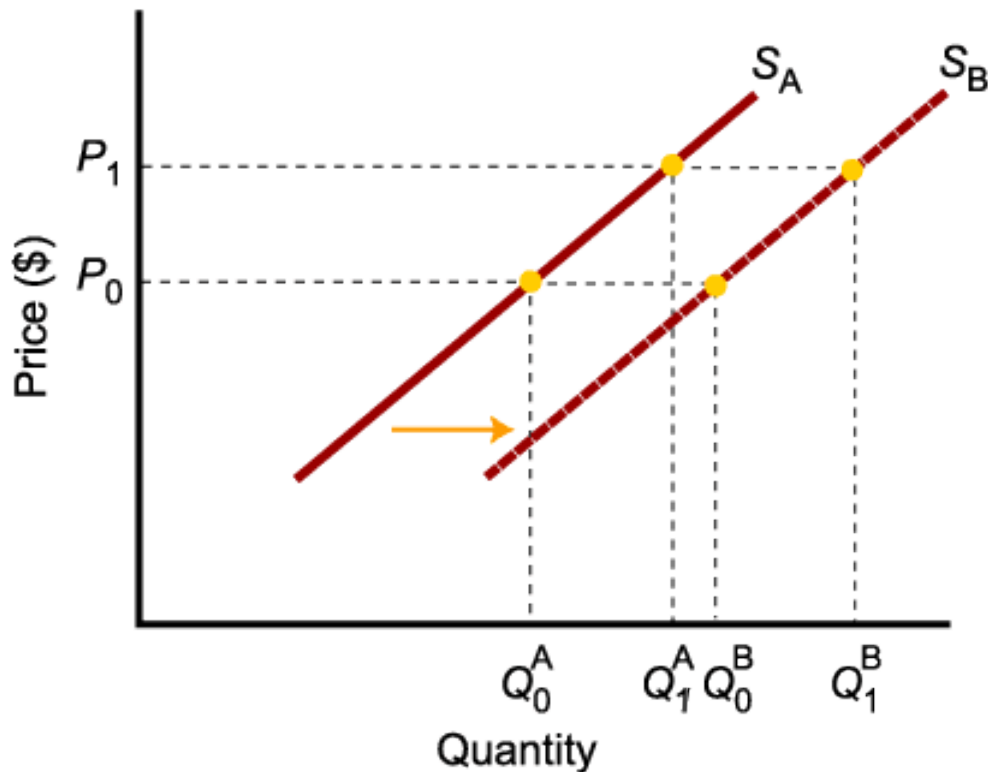


# A Change in Supply Versus a Change in Quantity Supplied



- A change in **supply** is not the same as a change in **quantity supplied**.
- In this example, a higher price causes **higher quantity supplied**, and a **move along** the demand curve.
- In this example, changes in determinants of supply, other than price, cause an **increase in supply**, or a **shift** of the entire supply curve, from  $S_A$  to  $S_B$ .

## A Change in Supply Versus a Change in Quantity Supplied



When **supply shifts** to the right, supply increases.

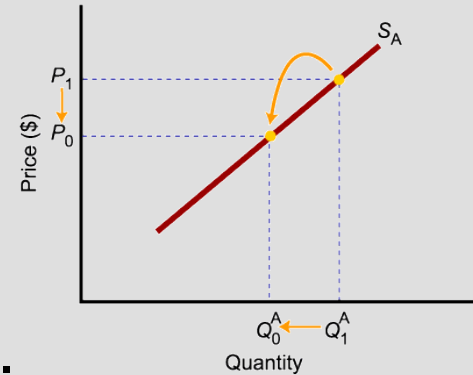
This causes **quantity supplied** to be greater than it was prior to the shift, **for each and every price level.**

# A Change in Supply Versus a Change in Quantity Supplied

Change in price of a good or service leads to



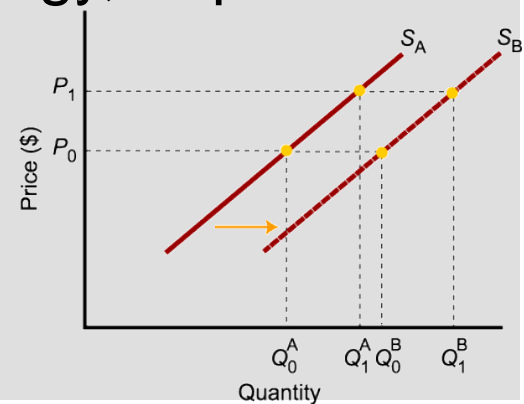
Change in *quantity supplied*  
**(Movement along the curve).**



Change in costs, input prices, technology, or prices of related goods and services leads to

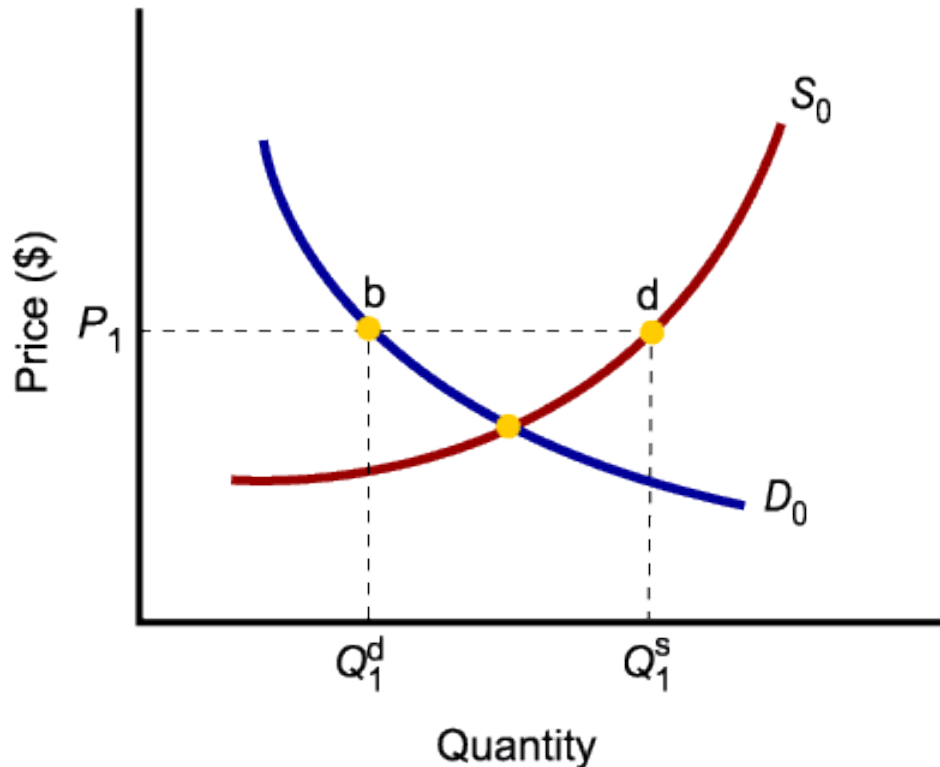


Change in supply  
**(Shift of curve).**



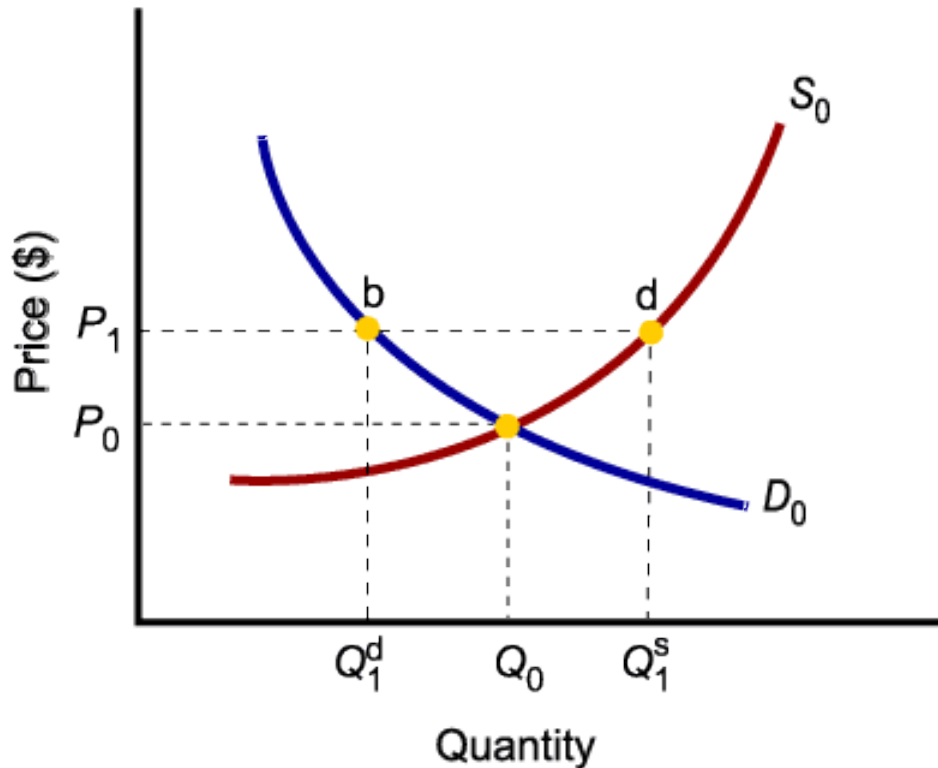
# MARKET EQUILIBRIUM

# Market Equilibrium



- The operation of the market depends on the interaction between buyers and sellers.
- An *equilibrium* is the condition that exists when quantity supplied and quantity demanded are equal.
- At equilibrium, there is no tendency for the market price to change.

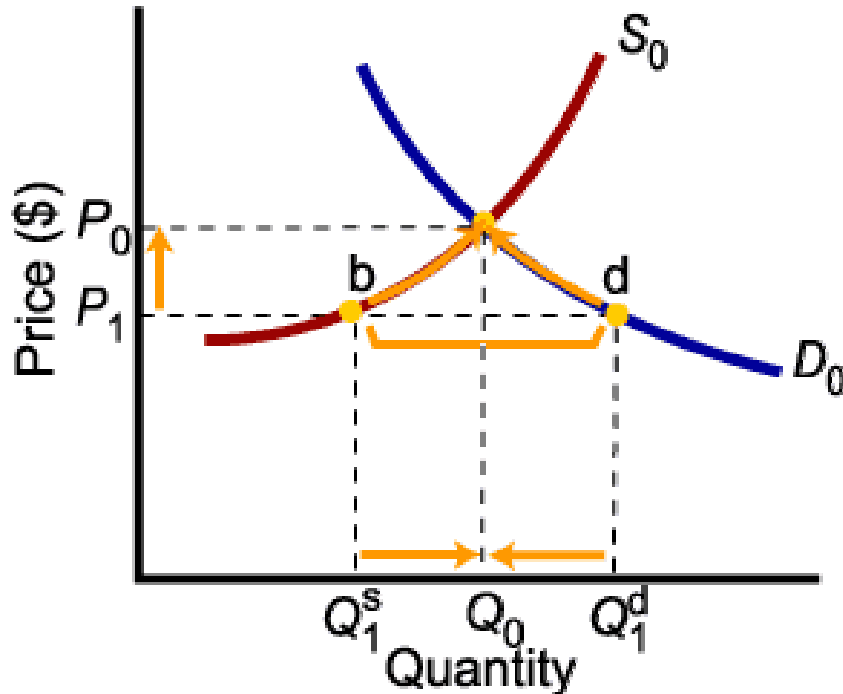
# Market Equilibrium



Only in equilibrium is quantity supplied equal to quantity demanded.

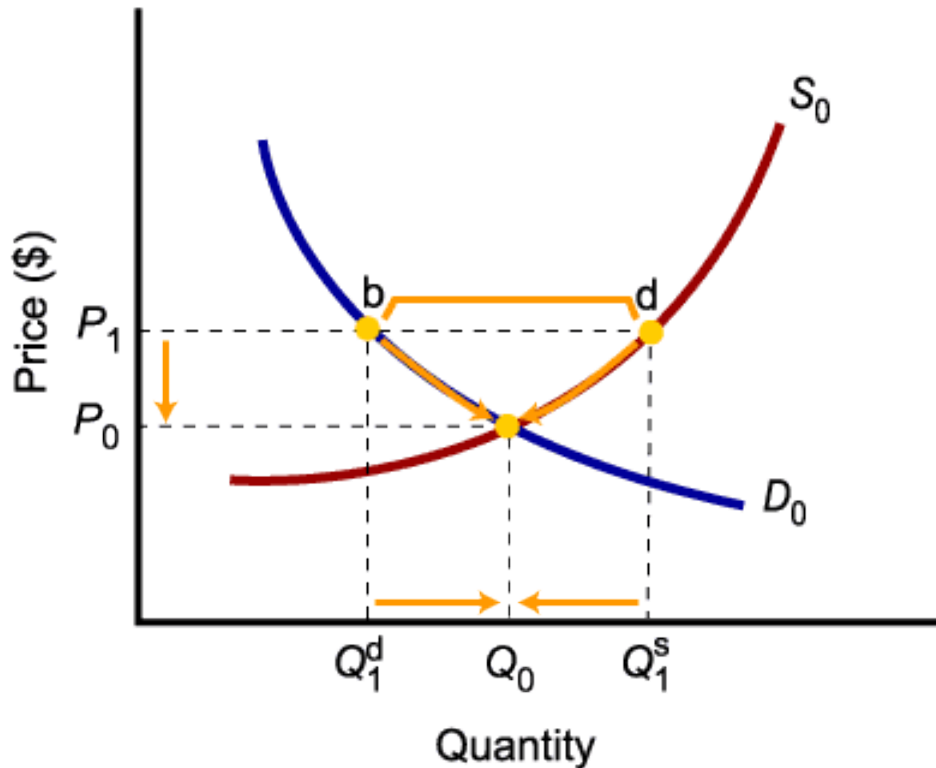
At any price level other than  $P_0$ , the wishes of buyers and sellers do not coincide.

# Market Disequilibria



- *Excess demand*, or shortage, is the condition that exists when quantity demanded exceeds quantity supplied at the current price.
- When quantity demanded exceeds quantity supplied, price tends to rise until equilibrium is restored.

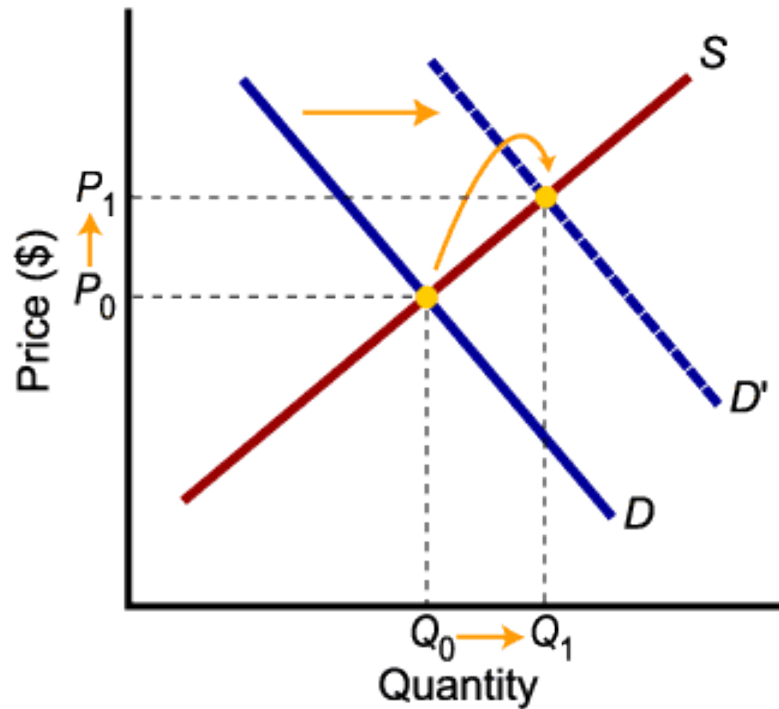
# Market Disequilibria



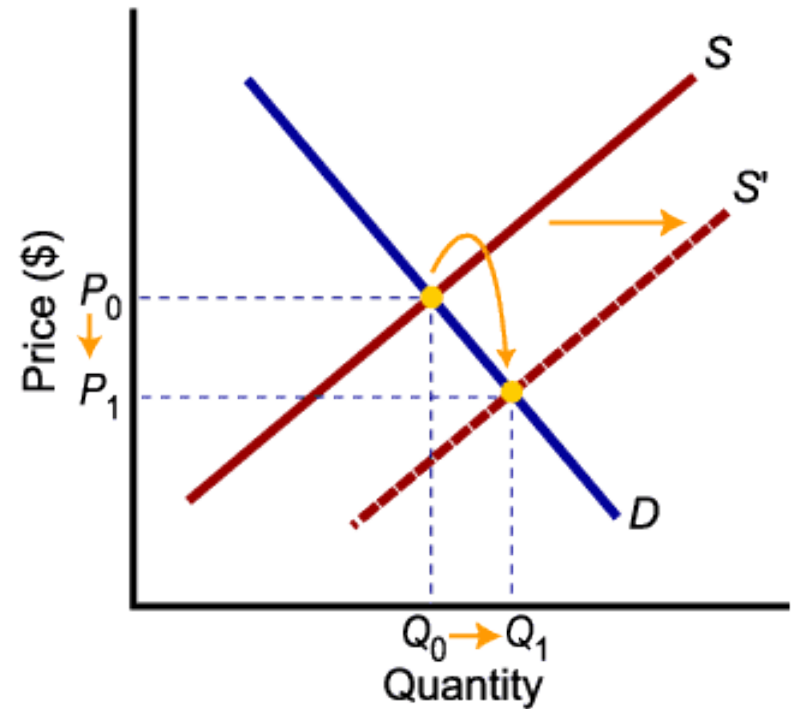
- *Excess supply*, or surplus, is the condition that exists when quantity supplied exceeds quantity demanded at the current price.
- When quantity supplied exceeds quantity demanded, price tends to fall until equilibrium is restored.



# Increases in Demand and Supply

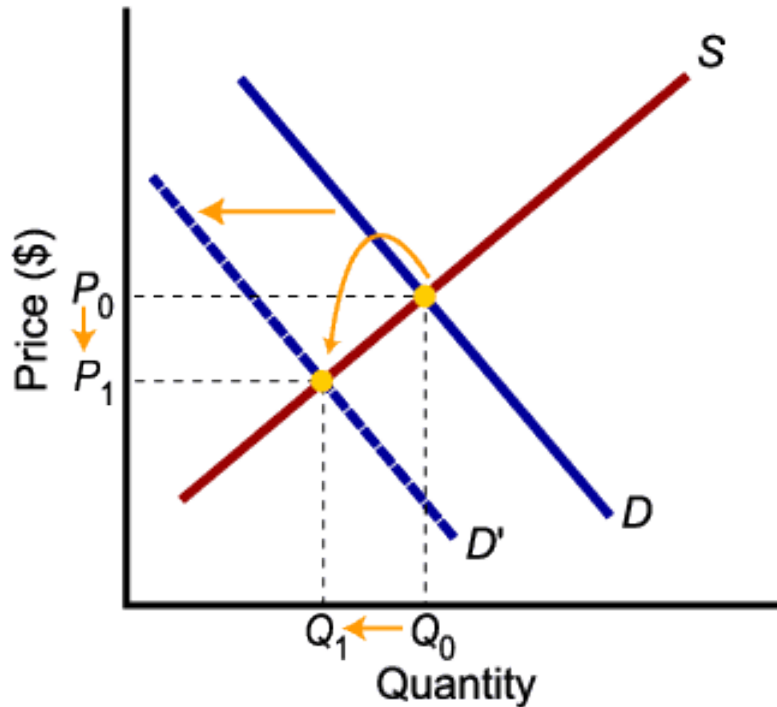


- *Higher demand* leads to higher equilibrium price and higher equilibrium quantity.

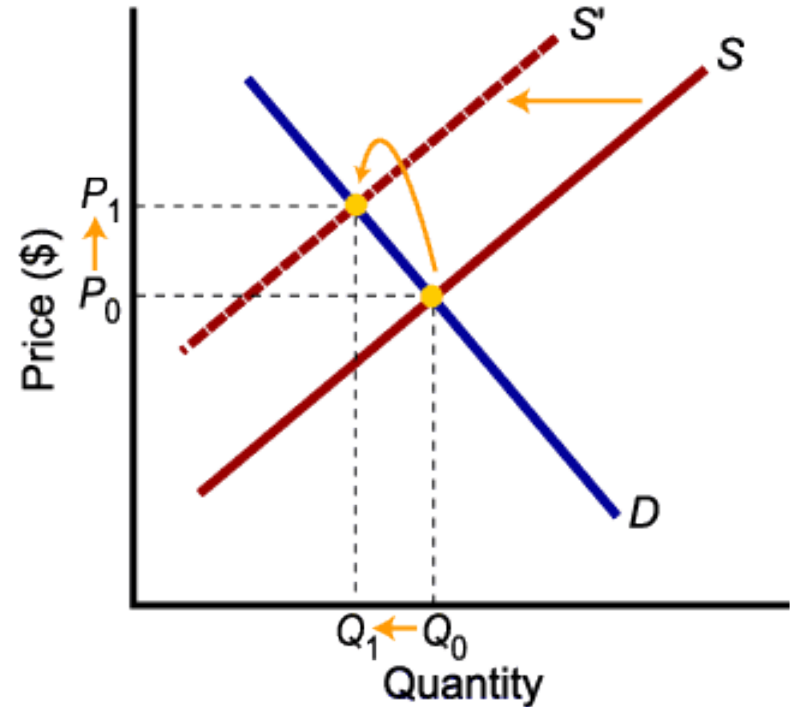


- *Higher supply* leads to lower equilibrium price and higher equilibrium quantity.

# Decreases in Demand and Supply

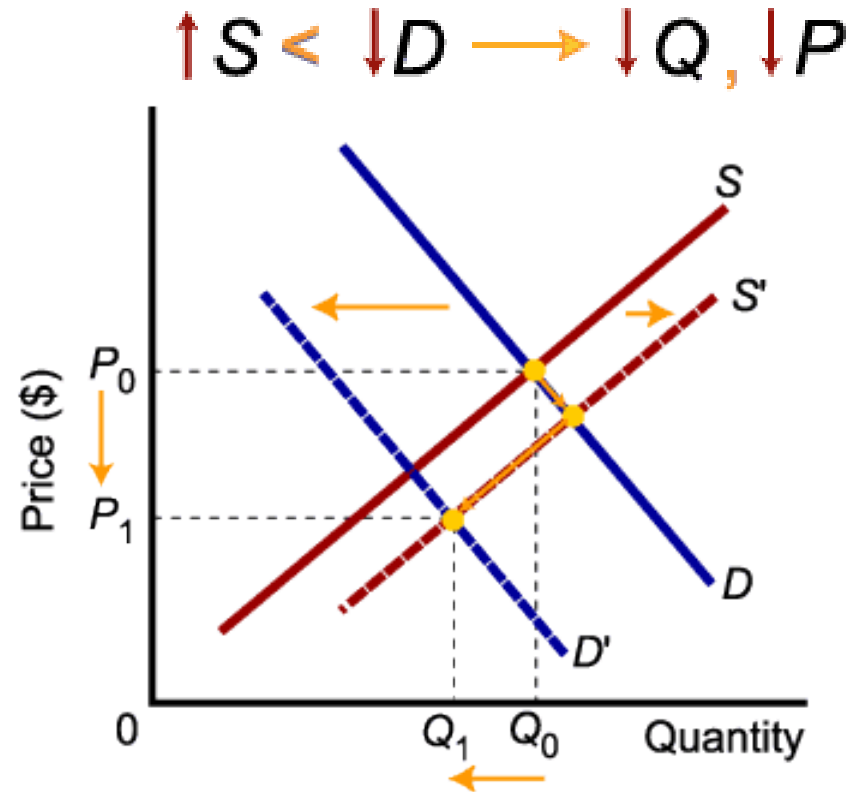
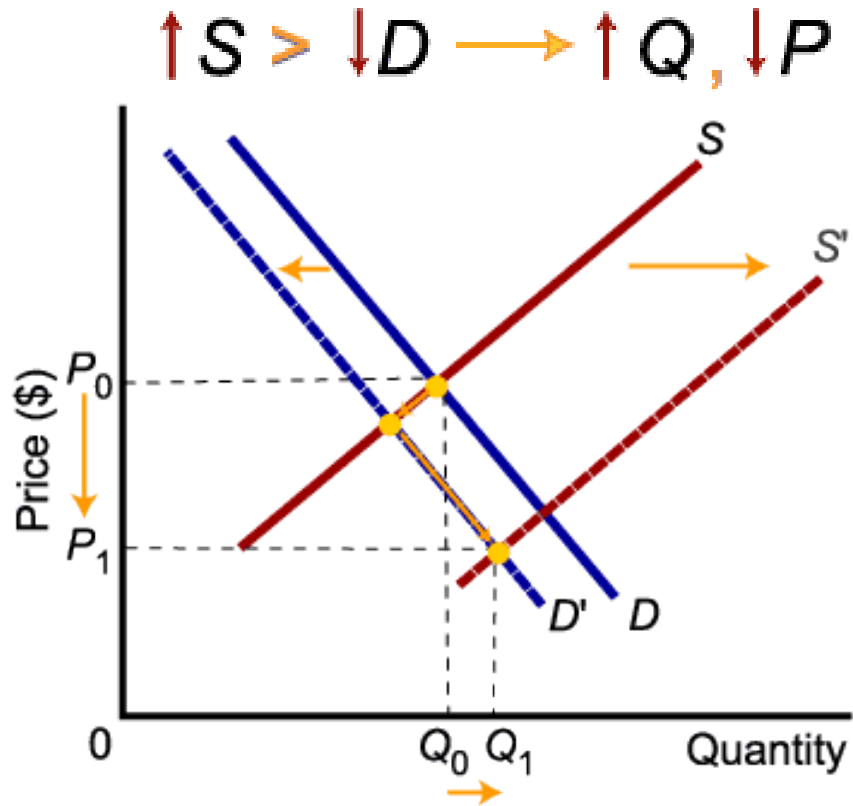


- *Lower demand* leads to lower price and lower quantity exchanged.



- *Lower supply* leads to higher price and lower quantity exchanged.

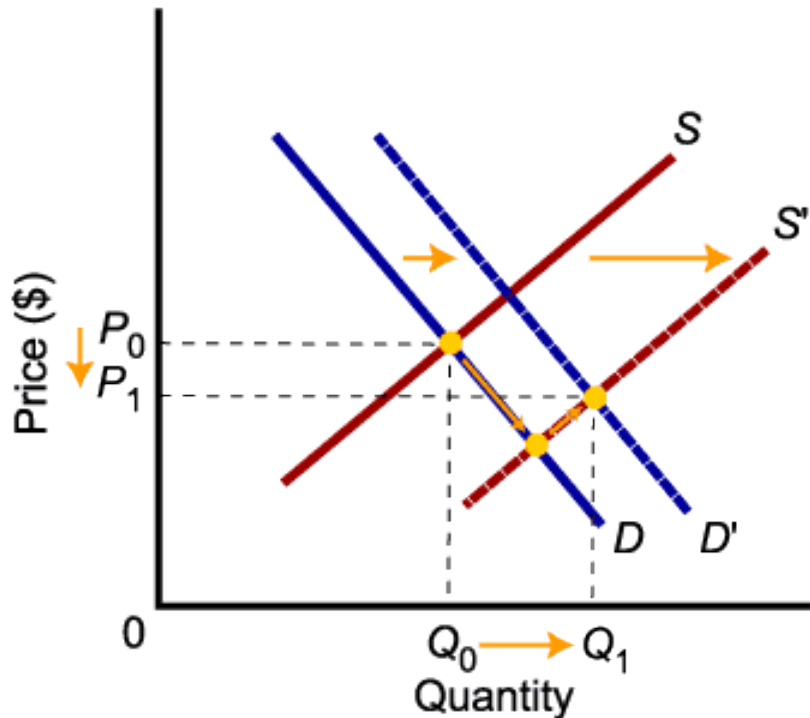
# Relative Magnitudes of Change



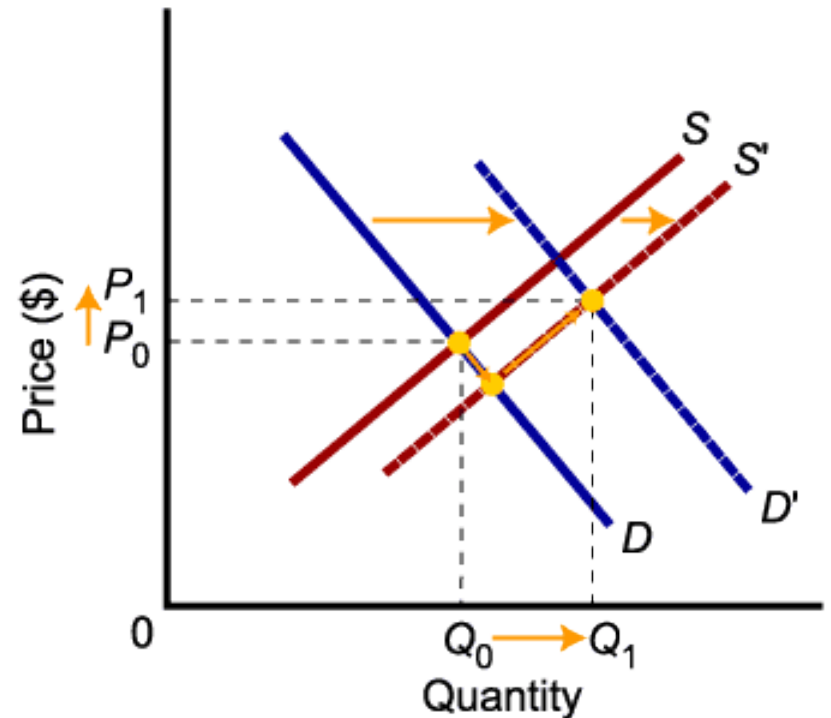
NB: The relative magnitudes of change in supply and demand determine the outcome of market equilibrium.

# Relative Magnitudes of Change\_

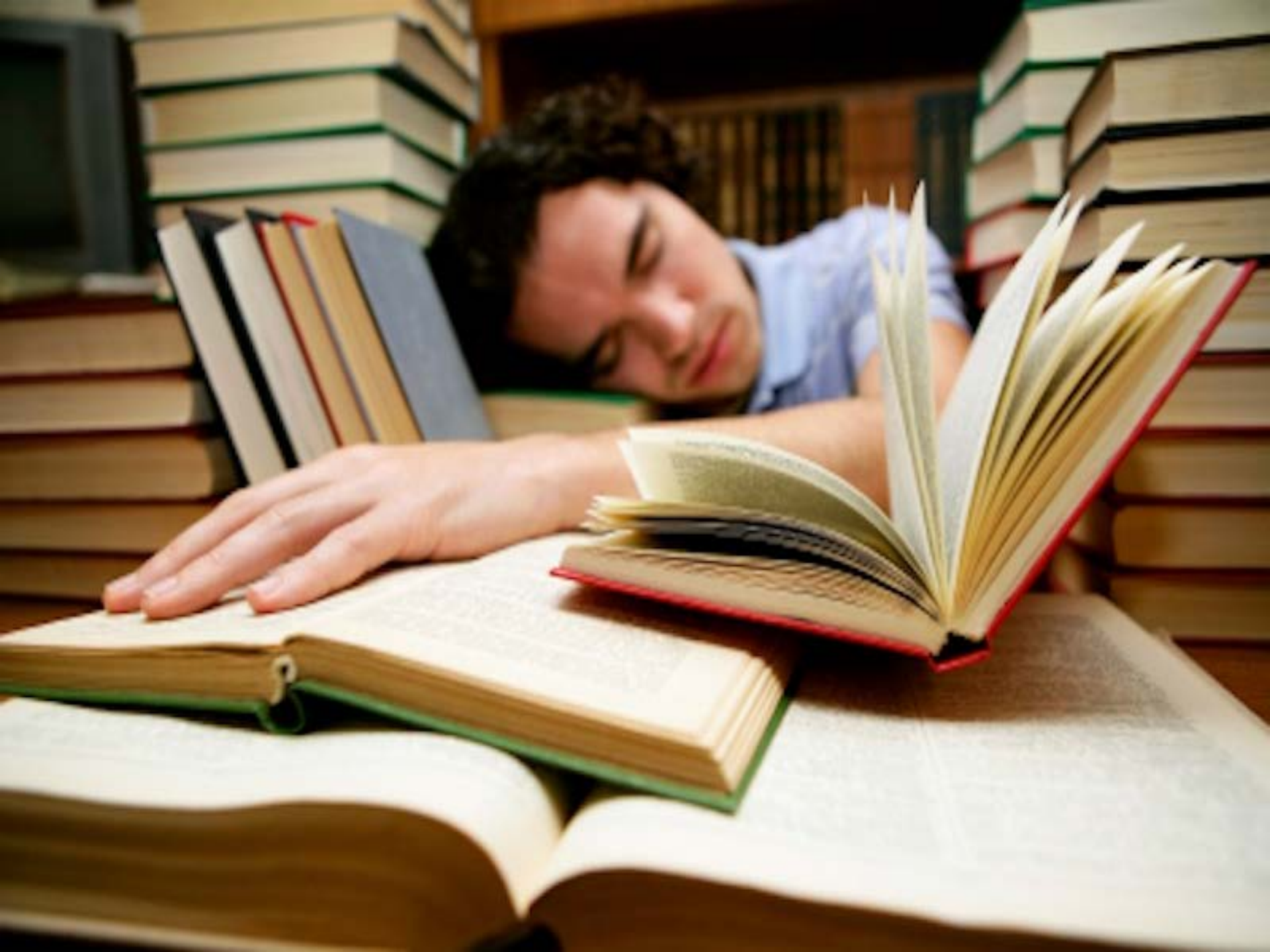
$\uparrow S > \uparrow D \rightarrow \uparrow Q, \downarrow P$



$\uparrow D > \uparrow S \rightarrow \uparrow Q, \uparrow P$



- When supply and demand both increase, quantity will increase, but price may go up or down.



# THE PRODUCTION

## STUDY UNIT: 6



# WHAT DO WE KNOW?

- 1) The Technology of Production
- 2) Production with One Variable Input (Labor)
- 3) Production with Two Variable Inputs
- 4) Returns to Scale



# Production

The **theory of the firm** describes how a firm makes **cost-minimizing** production decisions and how the firm's resulting **cost varies with its output**.

- **The Production Decisions of a Firm**

The production decisions of firms are similar to the purchasing decisions of consumers, and can likewise be understood in three steps:

1. Production Technology
2. Cost Constraints
3. Input Choices

# 1. THE TECHNOLOGY OF PRODUCTION

**Factors of production** (inputs into the production process)

- labor, capital, and materials etc.

## The Production Function

- Function showing the highest output that a firm can produce for every specified combination of inputs.

$$q = F(K, L)$$

- Therefore,
  - *Both Inputs and outputs are flows.*
  - *From above equation it is assumed that **technology is given***

**Production functions describe what is *technically feasible* when the firm operates *efficiently*.**

# 1. THE TECHNOLOGY OF PRODUCTION\_

## The Short Run versus the Long Run

- **Short run**
  - Period of time in which quantities of one or more production factors cannot be changed.
- **Fixed input**
  - Production factor that cannot be varied.
- **Long run**
  - Amount of time needed to make all production inputs variable.

## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

### *Average and Marginal Products*

- **Average product**
  - Output per unit of a particular input
- **Marginal product**
  - Additional output produced as an input is increased by one unit.

**Average product of labor**  
= Output/labor input  
=  $q/L$

**Marginal product of labor**  
= Change in output/change in labor input  
=  $\Delta q/\Delta L$

## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)

**Table 1: Production with One Variable Input**

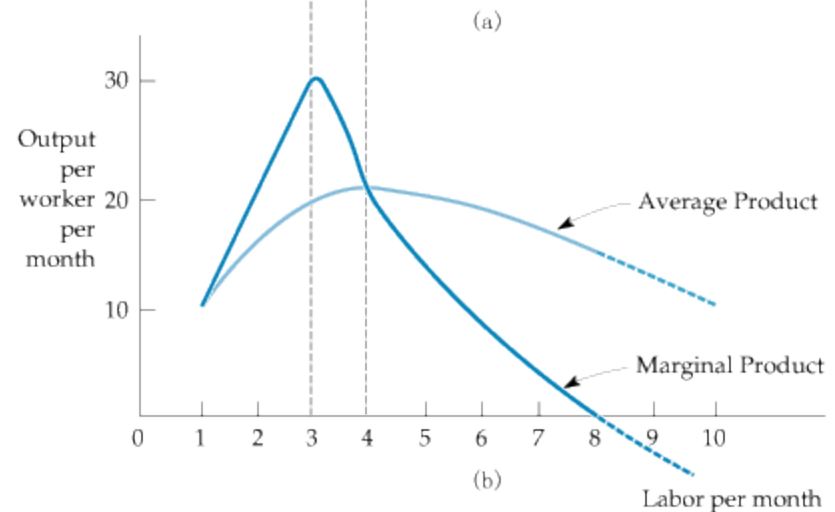
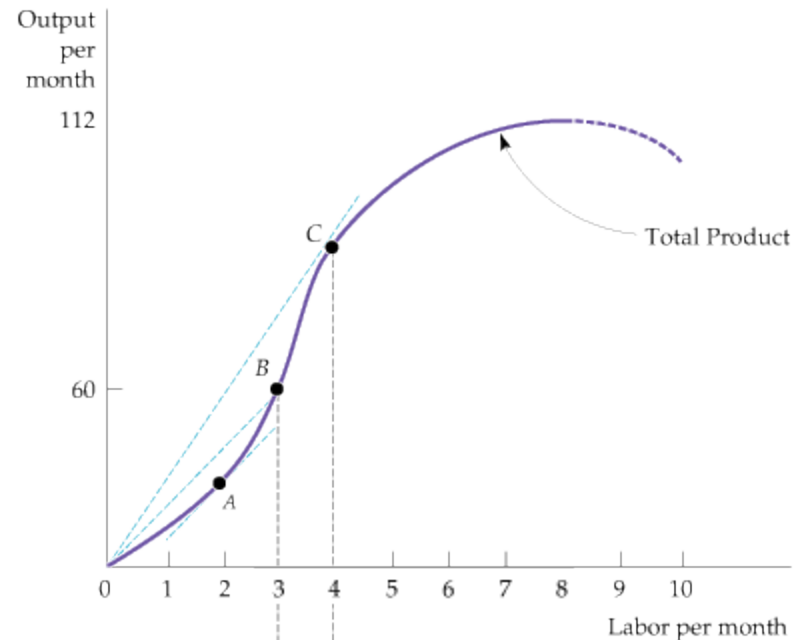
Amount of Labor ( $L$ )	Amount of Capital ( $K$ )	Total Output ( $q$ )	Average Product ( $q/L$ )	Marginal Product ( $\Delta q/\Delta L$ )
0	10	0	—	—
1	10	10	10	10
2	10	30	15	20
3	10	60	20	30
4	10	80	20	20
5	10	95	19	15
6	10	108	18	13
7	10	112	16	4
8	10	112	14	0
9	10	108	12	-4
10	10	100	10	-8

## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

- The Slopes of the Product Curve

### Production with One Variable Input

- The total product curve in **(a)** shows the output produced for different amounts of labor input.
- The average and marginal products in **(b)** can be obtained (using the data in Table 1) from the total product curve.
- At point **A** in **(a)**, the marginal product is 20 because the tangent to the total product curve has a slope of 20.
- At point **B** in **(a)** the average product of labor is 20, which is the slope of the line from the origin to **B**.
- The average product of labor at point **C** in **(a)** is given by the slope of the line **OC**.

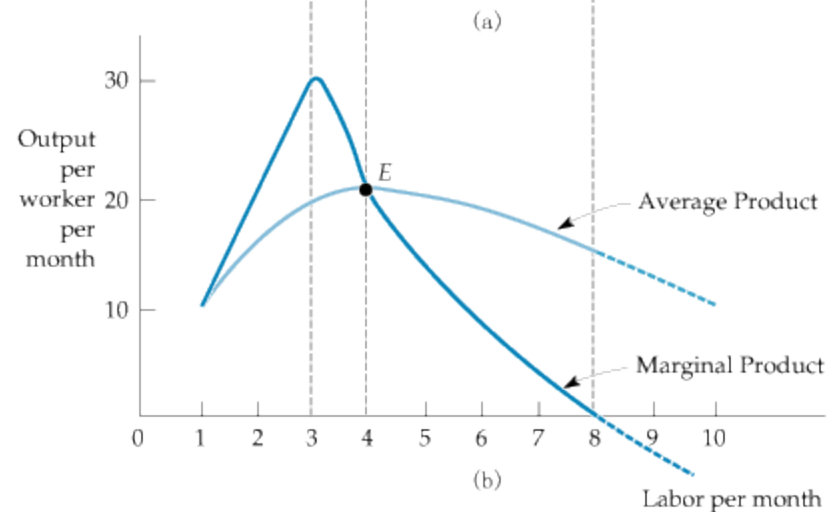
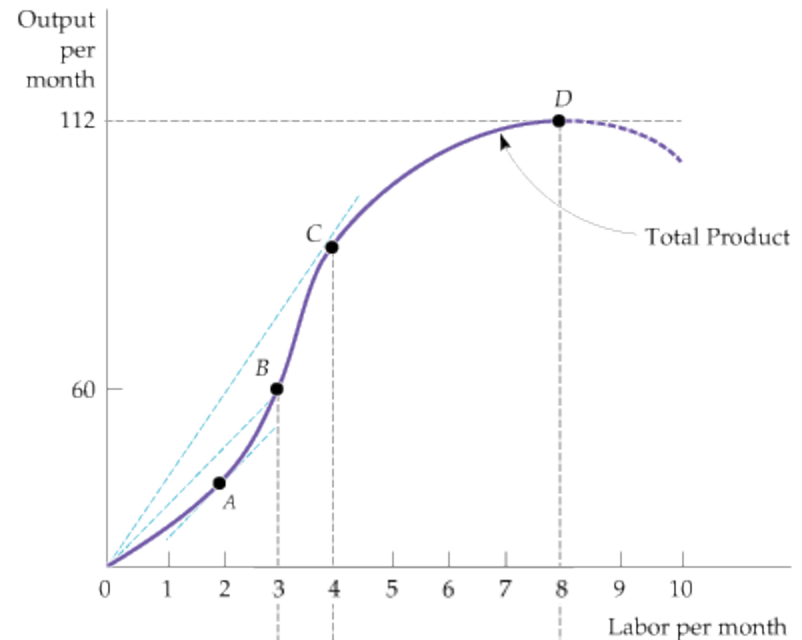


## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

- **The Slopes of the Product Curve**

### Production with One Variable Input (continued)

- To the left of point **E** in **(b)**, the Marginal product is above the Average product and the average is increasing; to the right of **E**, the Marginal product is below the Average product and the average is decreasing.
- As a result, **E** represents the point at which the Average and Marginal products are equal, when the Average product reaches its maximum.
- At **D**, when Total output is maximized, the slope of the tangent to the total product curve is 0, as is the Marginal product.



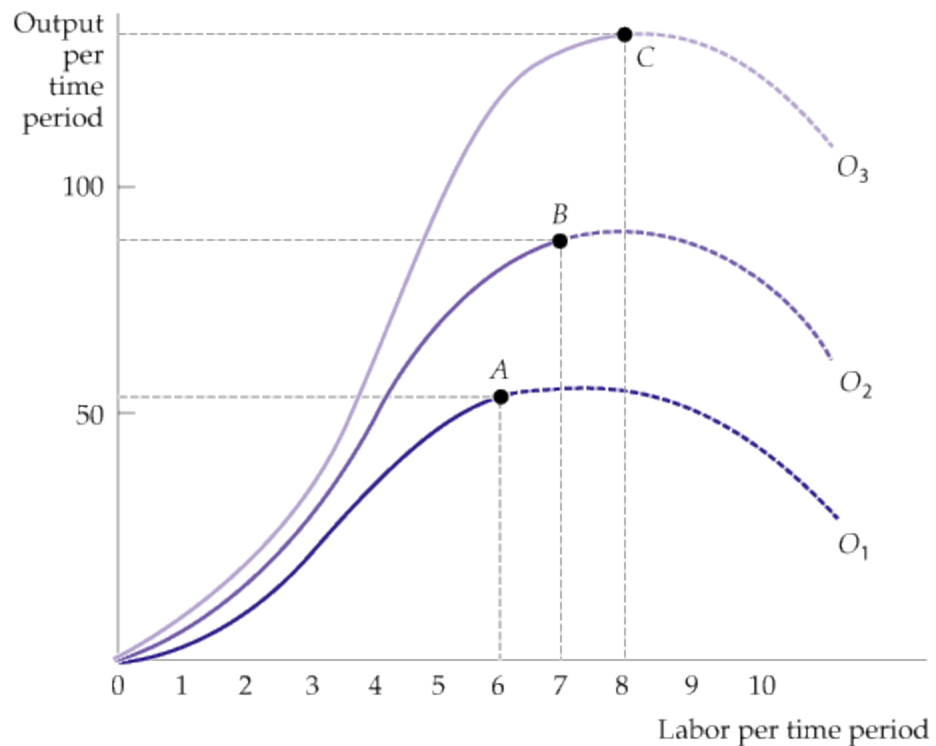
## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

- **The Law of Diminishing Marginal Returns**

- Principle that as the use of an input increases with other inputs fixed, the resulting additions to output will eventually decrease.

### The Effect of Technological Improvement

- Labor productivity (output per unit of labor) can increase if there are improvements in technology, even though any given production process exhibits diminishing returns to labor.
- As we move from point A on curve  $O_1$  to B on curve  $O_2$  to C on curve  $O_3$  over time, labor productivity increases.





## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

### Labor Productivity

- Average product of labor for an entire industry or for the economy as a whole.

### Productivity and the Standard of Living

- **Stock of capital**
  - Total amount of capital available for use in production.
- **Technological change**
  - Development of new technologies allowing factors of production to be used more effectively.

## 2. PRODUCTION WITH ONE VARIABLE INPUT (LABOR)\_

### Example: Labour productivity and standard of living

**TABLE 2: Labor Productivity in Developed Countries**

	UNITED STATES	JAPAN	FRANCE	GERMANY	UNITED KINGDOM
	<b>Real Output per Employed Person (2006)</b>				
	<b>\$82,158</b>	<b>\$57,721</b>	<b>\$72,949</b>	<b>\$60,692</b>	<b>\$65,224</b>
Years	<i>Annual Rate of Growth of Labor Productivity (%)</i>				
1960-1973	2.29	7.86	4.70	3.98	2.84
1974-1982	0.22	2.29	1.73	2.28	1.53
1983-1991	1.54	2.64	1.50	2.07	1.57
1992-2000	1.94	1.08	1.40	1.64	2.22
2001-2006	1.78	1.73	1.02	1.10	1.47

The level of output per employed person in the United States in 2006 was higher than in other industrial countries. **\$82,158**

But, until the 1990s, productivity in the United States grew on average less rapidly than productivity in most other developed nations.

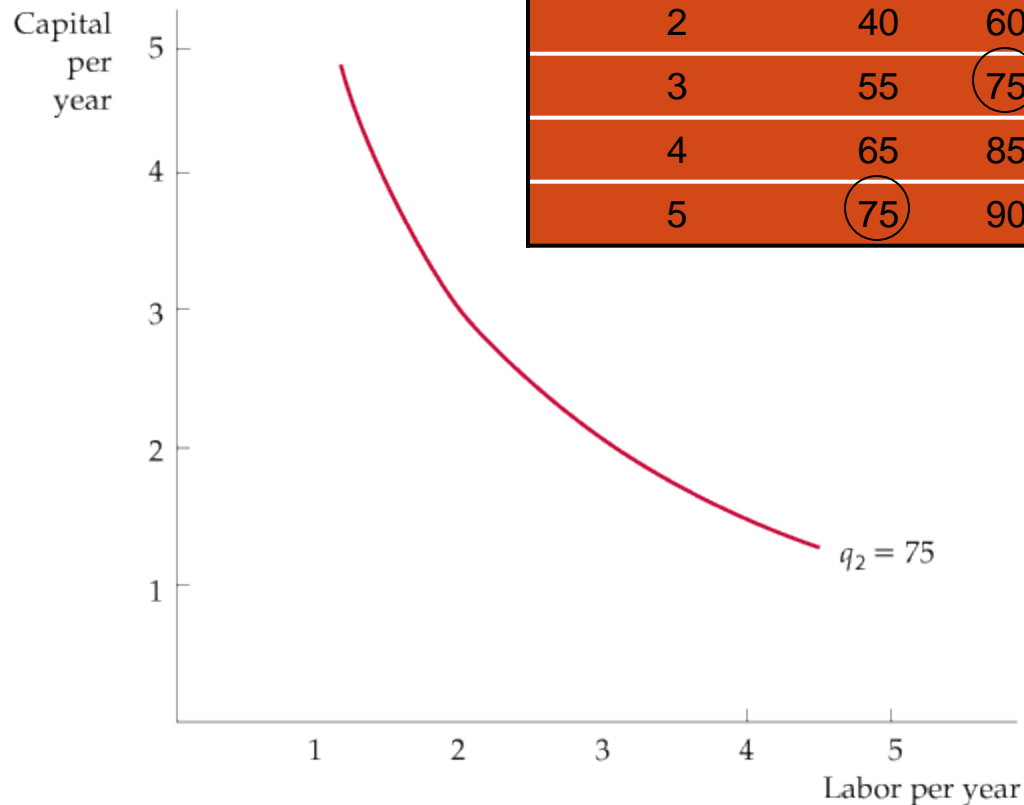
Also, productivity growth during 1974–2006 was much lower in all developed countries than it had been in the past.

## 2. PRODUCTION WITH TWO VARIABLE INPUTS

- Isoquants

TABLE 3: Production with Two Variable Inputs

		LABOR INPUT				
Capital Input	1	2	3	4	5	
1	20	40	55	65	75	
2	40	60	75	85	90	
3	55	75	90	100	105	
4	65	85	100	110	115	
5	75	90	105	115	120	



- **isoquant** Curve showing all possible combinations of inputs that yield the same output.

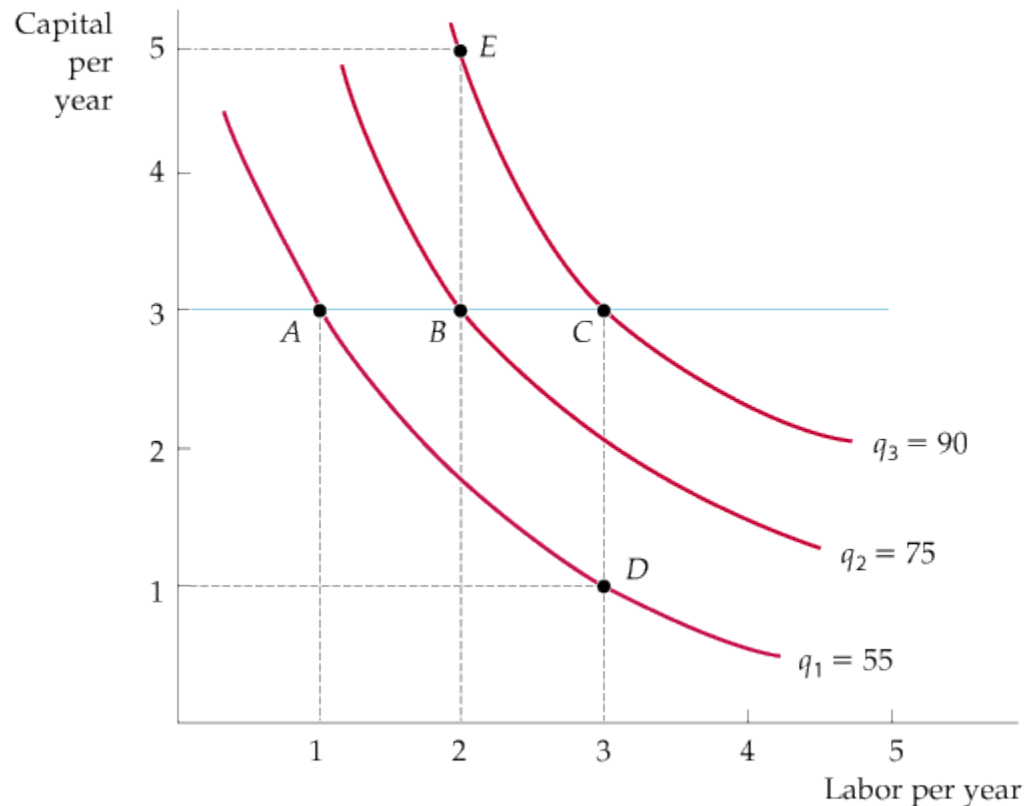
## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

### Isoquants

- Graph combining a number of isoquants, used to describe a production function

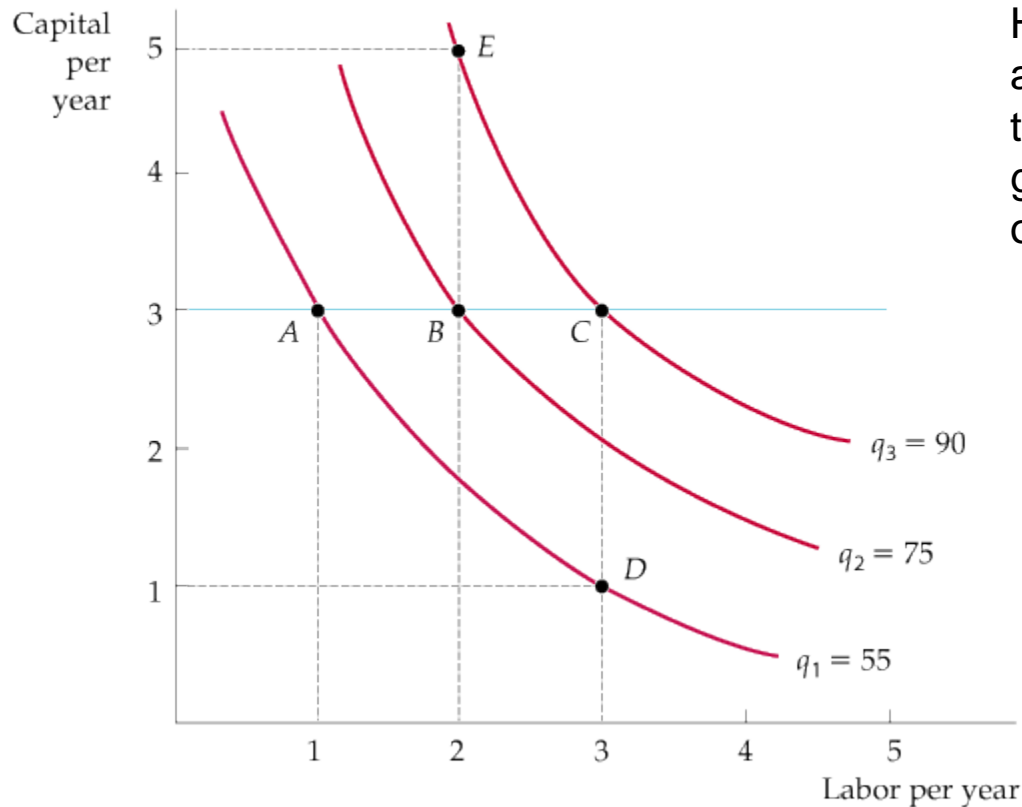
#### Production with Two Variable Inputs

- A set of isoquants, or *isoquant map*, describes the firm's production function.
- Output increases as we move from isoquant  $q_1$  (at which 55 units per year are produced at points such as  $A$  and  $D$ ),
- to isoquant  $q_2$  (75 units per year at points such as  $B$ ) and
- to isoquant  $q_3$  (90 units per year at points such as  $C$  and  $E$ ).



## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

- Diminishing Marginal Returns



Holding the amount of capital fixed at a particular level—say 3, we can see that each additional unit of labor generates less and less additional output.

## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

- Substitution Among Inputs

- **Marginal Rate of Technical Substitution (MRTS)**

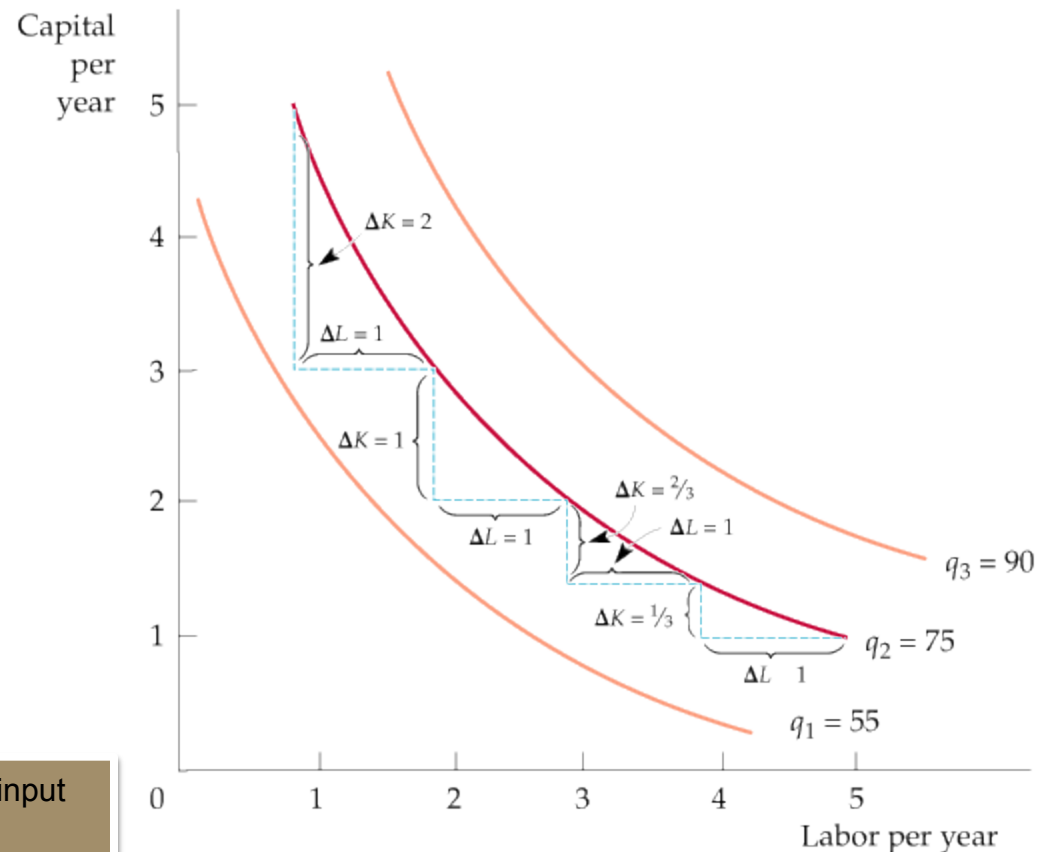
- Amount by which the quantity of one input can be reduced when one extra unit of another input is used, so that output remains constant.

### Marginal Rate of Technical Substitution

- Like indifference curves, isoquants are downward sloping and convex.
- The slope of the isoquant at any point measures the marginal rate of technical substitution—the ability of the firm to replace capital with labor while maintaining the same level of output.
- On isoquant  $q_2$ , the MRTS falls from 2 to 1 to  $2/3$  to  $1/3$ .

$$(MP_L)/(MP_K) = -(\Delta K / \Delta L) = \text{MRTS}$$

$$\begin{aligned} \text{MRTS} &= - \text{Change in capital input/change in labor input} \\ &= - \Delta K / \Delta L \text{ (for a fixed level of } q) \end{aligned}$$

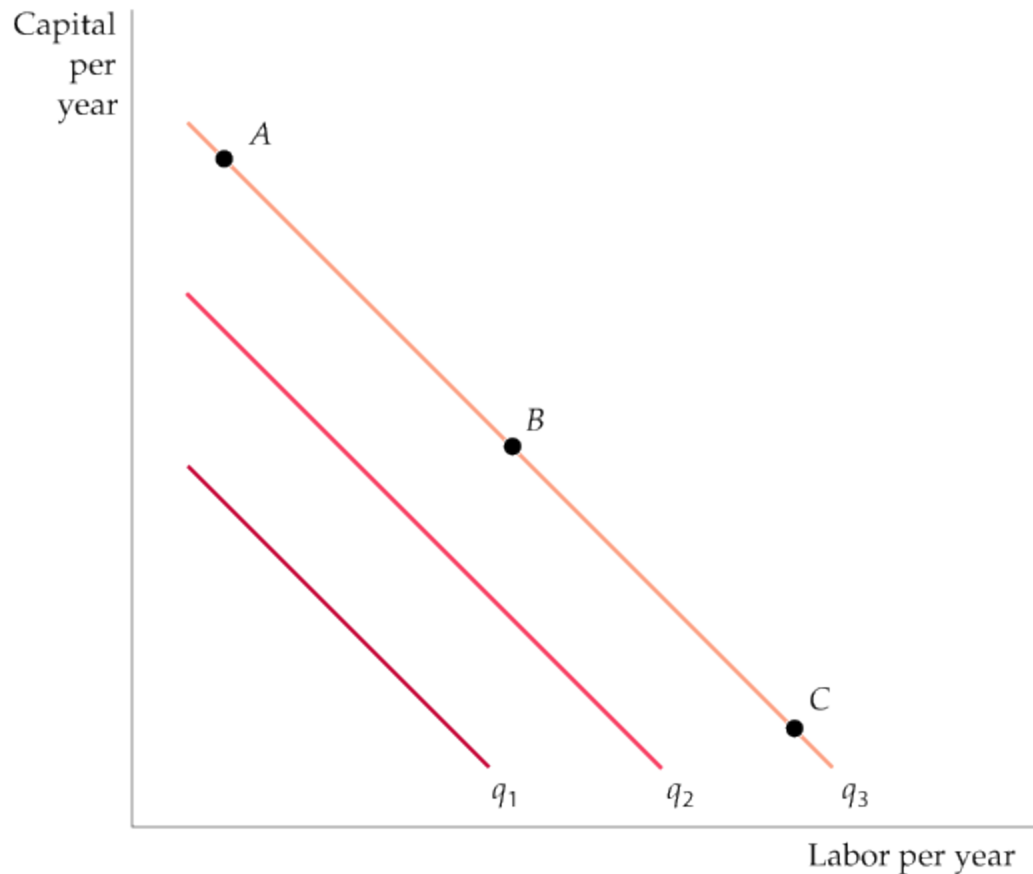


## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

- **Production Functions—Two Special Cases**

### Isoquants When Inputs Are Perfect Substitutes

- When the isoquants are straight lines, the MRTS is constant.
- Thus the rate at which capital and labor can be substituted for each other is the same no matter what level of inputs is being used.
- Points *A*, *B*, and *C* represent three different capital-labor combinations that generate the same output  $q_3$ .



## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

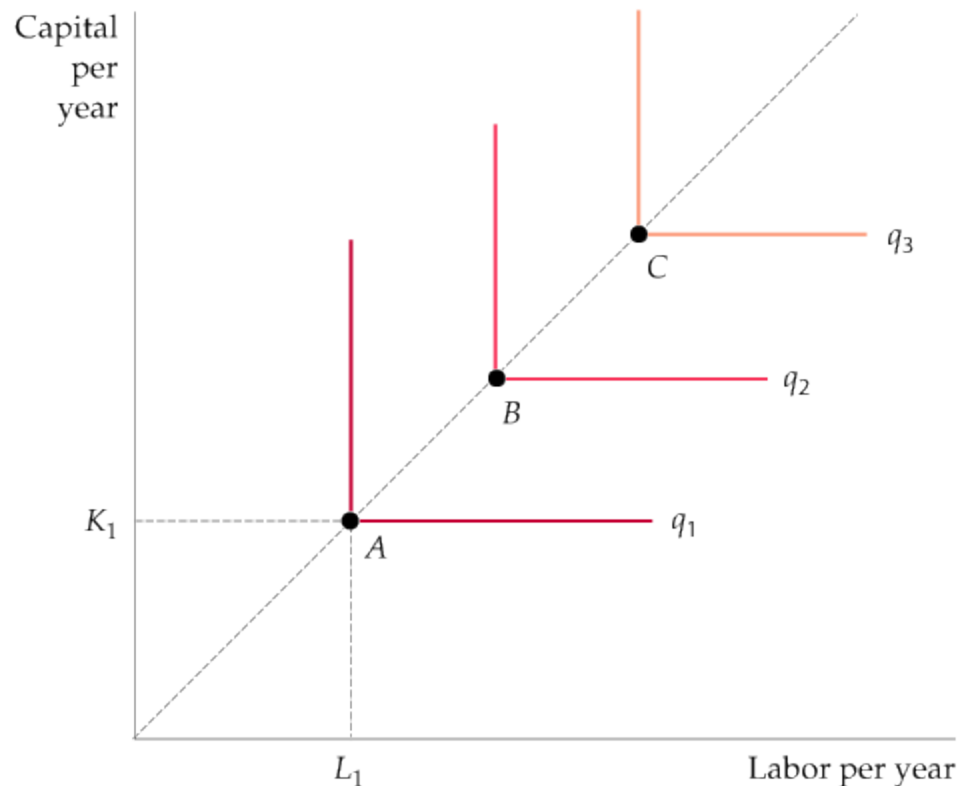
### • Production Functions—Two Special Cases

#### • Fixed-proportions production function

- Production function with L-shaped isoquants, so that only one combination of labor and capital can be used to produce each level of output.
- The fixed-proportions production function describes situations in which methods of production are limited.

#### Fixed-Proportions Production Function

- When the isoquants are L-shaped, only one combination of labor and capital can be used to produce a given output (as at point  $A$  on isoquant  $q_1$ , point  $B$  on isoquant  $q_2$ , and point  $C$  on isoquant  $q_3$ ).
- Adding more labor alone does not increase output, nor does adding more capital alone.



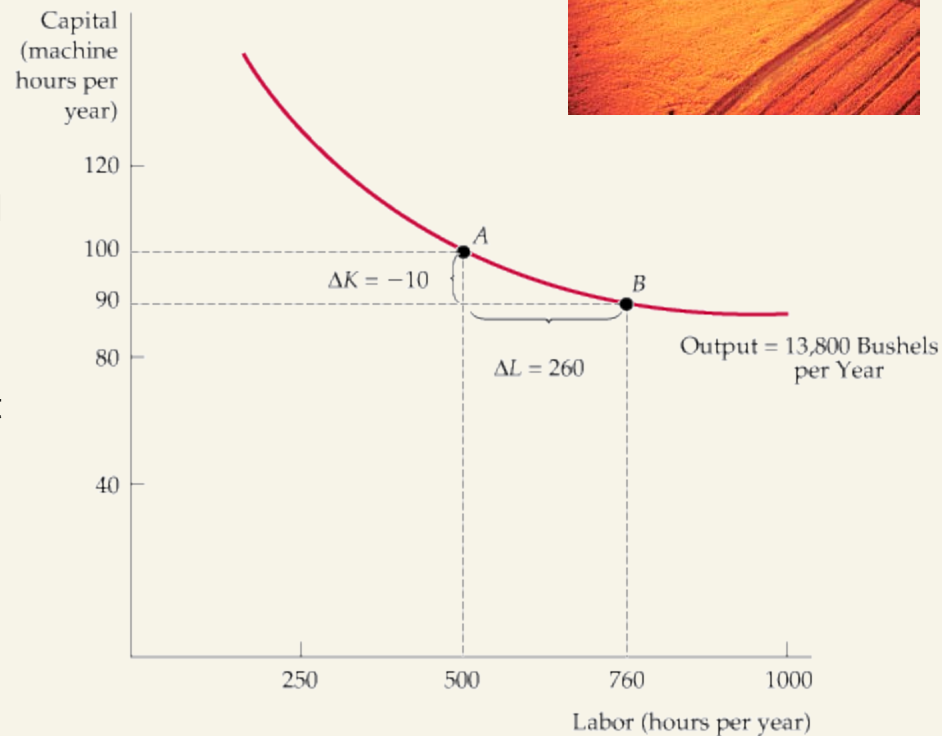


## 2. PRODUCTION WITH TWO VARIABLE INPUTS\_

### Example: Production Function of Wheat

#### Isoquant Describing the Production of Wheat

- A wheat output of 13,800 bushels per year can be produced with different combinations of labor and capital.
- The more capital-intensive production process is shown as point *A*,
- the more labor-intensive process as point *B*.
- The marginal rate of technical substitution between *A* and *B* is  $10/260 = 0.04$ .



### 3. RETURNS TO SCALE

#### Returns to Scale:

- Rate at which output increases as inputs are increased proportionately.
- Assume a Cobb-Douglas production function  $Q(K, L) = AL^\alpha K^\beta$ .

#### Different Types:

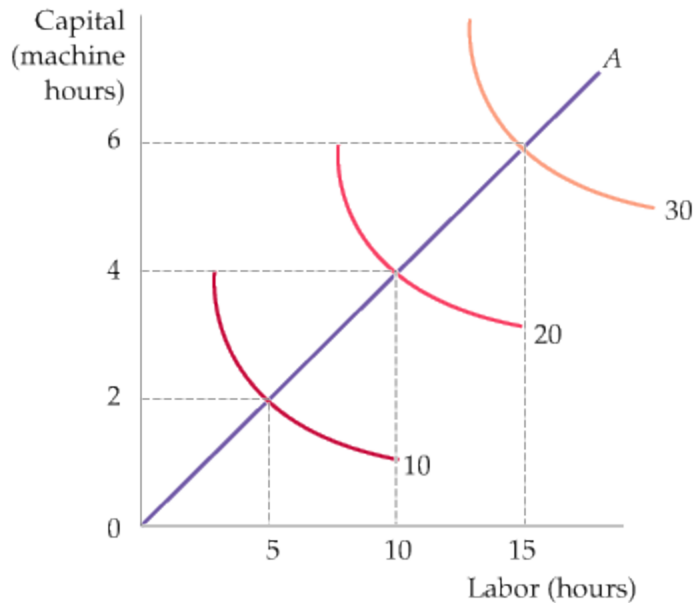
1. **Increasing returns to scale**  $\alpha + \beta > 1$ 
  - Situation in which output more than doubles when all inputs are doubled.
2. **Constant returns to scale**  $\alpha + \beta = 1$ 
  - Situation in which output doubles when all inputs are doubled.
3. **Decreasing returns to scale**  $\alpha + \beta < 1$ 
  - Situation in which output less than doubles when all inputs are doubled.

### 3. RETURNS TO SCALE\_

- Graphic Illustration of Returns to Scale

**Constant Return to Scale:**

Doubling the inputs leads to double the output

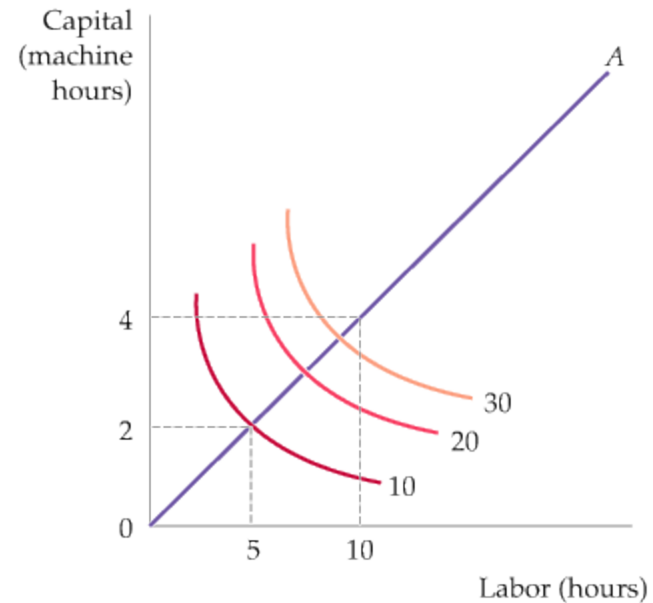


(a)

When a firm's production process exhibits **constant returns to scale** as shown by a movement along line OA in part (a), the isoquants are equally spaced as output increases proportionally.

**Increasing Return to Scale:**

Doubling the inputs leads to more than double the output



(b)

However, when there are **increasing returns to scale** as shown in (b), the isoquants move closer together as inputs are increased along the line.

# THE COST OF PRODUCTION

## STUDY UNIT: 7

$$\text{Average Total Cost} = ATC(q) \text{ or } AC(q) = \frac{TC(q)}{q}$$

$$\text{Average Fixed Cost} = AFC = \frac{TFC}{q}$$

$$\text{Average Variable Cost} = AVC(q) = \frac{TVC(q)}{q}$$

$$ATC = AFC + AVC$$

# WHAT DO WE KNOW?

- 7.1 Measuring Cost: Which Costs Matter?
- 7.2 Cost in the Short Run
- 7.3 Cost in the Long Run
- 7.4 Long-Run versus Short-Run Cost Curves

## 7.1

# MEASURING COST: WHICH COSTS MATTER?

## Economic Cost versus Accounting Cost

### **accounting cost:**

Actual expenses plus depreciation charges for capital equipment.

### **economic cost**

Cost to a firm of utilizing economic resources in production, including opportunity cost.

## Opportunity Cost

- **opportunity cost** Cost associated with opportunities that are forgone when a firm's resources are not put to their best alternative use.

## 7.1

## MEASURING COST: WHICH COSTS MATTER?

### Sunk Costs

Expenditure that has been made and cannot be recovered.

- Because a sunk cost cannot be recovered, it should not influence the firm's decisions.
- For example, consider the purchase of specialized equipment for a plant. Suppose the equipment can be used to do only what it was originally designed for and cannot be converted for alternative use. The expenditure on this equipment is a sunk cost. *Because it has no alternative use, its opportunity cost is zero.* Thus it should not be included as part of the firm's economic costs.

## 7.1

# MEASURING COST: WHICH COSTS MATTER?

## Fixed Costs and Variable Costs

- **Total cost (TC or C)**

Total economic cost of production, consisting of fixed and variable costs.

- **fixed cost (FC)**

Cost that does not vary with the level of output and that can be eliminated only by shutting down.

- **variable cost (VC)**

Cost that varies as output varies.

*The only way that a firm can eliminate its fixed costs is by shutting down.*

Shutting down doesn't necessarily mean going out of business.

- By reducing the output of a factory to zero, the company could eliminate the costs of raw materials and much of the labor. The only way to eliminate fixed costs would be to close the doors, turn off the electricity, and perhaps even sell off or scrap the machinery.



## 7.1

# MEASURING COST: WHICH COSTS MATTER?

## Fixed Costs and Variable Costs

How do we know which costs are fixed and which are variable?

- Over a very short time horizon—say, a few months—most costs are fixed. Over such a short period, a firm is usually obligated to pay for contracted shipments of materials.
- Over a very long time horizon—say, ten years—nearly all costs are variable. Workers and managers can be laid off (or employment can be reduced by attrition), and much of the machinery can be sold off or not replaced as it becomes obsolete and is scrapped.

## 7.1

# MEASURING COST: WHICH COSTS MATTER?

## Marginal and Average Cost

### Marginal Cost (MC)

**marginal cost (MC)** Increase in cost resulting from the production of one extra unit of output.

**Because fixed cost does not change** as the firm's level of output changes, marginal cost is equal to the increase in variable cost or the increase in total cost that results from an extra unit of output.

We can therefore write marginal cost as

$$MC = \Delta VC / \Delta q = \Delta TC / \Delta q$$

## 7.1

# MEASURING COST: WHICH COSTS MATTER?

## Marginal and Average Cost

### Average Total Cost (ATC)

- **average total cost (ATC)**  
Firm's total cost divided by its level of output.

- **average fixed cost (AFC)**  
Fixed cost divided by the level of output.

- **average variable cost (AVC)**  
Variable cost divided by the level of output.

$$\frac{FC}{\text{Output per Unit}}$$

$$\frac{VC}{\text{Output per Unit}}$$

## 7.1

## MEASURING COST: WHICH COSTS MATTER?

## Marginal and Average Cost

## Marginal Cost (MC)

TABLE 7.1 A Firm's Costs

Rate of Output (Units per Year)	Fixed Cost (Dollars per Year)	Variable Cost (Dollars per Year)	Total Cost (Dollars per Year)	Marginal Cost (Dollars per Unit)	Average Fixed Cost (Dollars per Unit)	Average Variable Cost (Dollars per Unit)	Average Total Cost (Dollars per Unit)
	(FC) (1)	(VC) (2)	(TC) (3)	(MC) (4)	(AFC) (5)	(AVC) (6)	(ATC) (7)
0	50	0	50	--	--	--	--
1	50	50	100	50	50	50	100
2	50	78	128	28	25	39	64
3	50	98	148	20	16.7	32.7	49.3
4	50	112	162	14	12.5	28	40.5
5	50	130	180	18	10	26	36
6	50	150	200	20	8.3	25	33.3
7	50	175	225	25	7.1	25	32.1
8	50	204	254	29	6.3	25.5	31.8
9	50	242	292	38	5.6	26.9	32.4
10	50	300	350	58	5	30	35
11	50	385	435	85	4.5	35	39.5

## 7.2 COST IN THE SHORT RUN

Wages ( $w$ ) is  
the price of  
Labour

### The Determinants of Short-Run Cost

The change in variable cost is the per-unit cost of the extra labor  $w$  times the amount of extra labor needed to produce the extra output  $\Delta L$ .

- Because  $\Delta VC = w\Delta L$ , it follows that

$$MC = \Delta VC / \Delta q = w\Delta L / \Delta q$$

The extra labor needed to obtain an extra unit of output is

$\Delta L / \Delta q = 1 / MP_L$ . therefore,

$$MC = w / MP_L$$

### Diminishing Marginal Returns and Marginal Cost

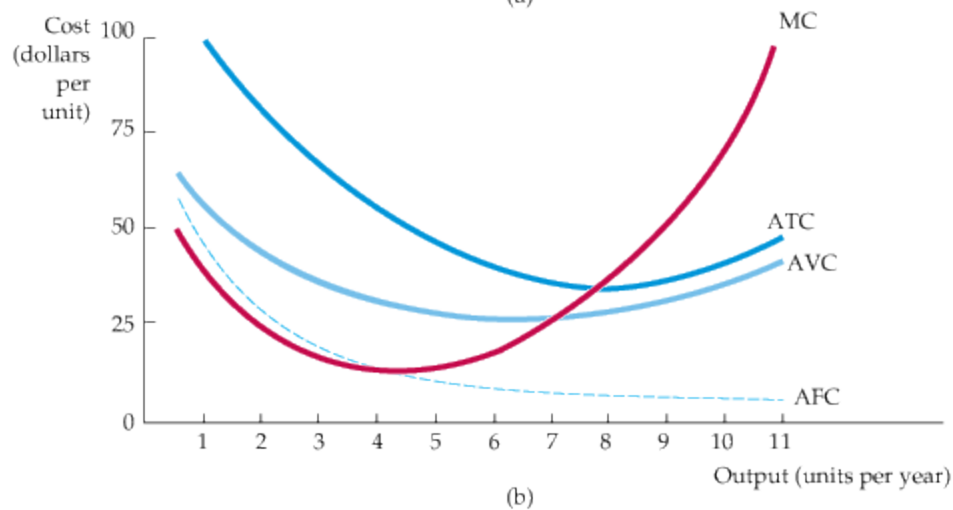
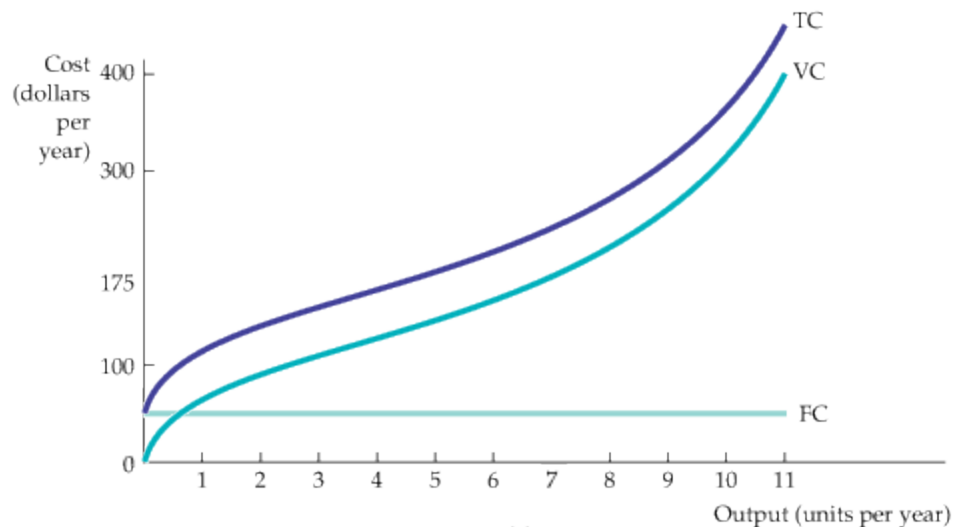
- Diminishing marginal returns means that the **marginal product of labor declines as the number of of labor employed increases.**
- As a result, when there are diminishing marginal returns, marginal cost will increase as output increases.

## 7.2 COST IN THE SHORT RUN

### The Shapes of the Cost Curves

#### Cost Curves for a Firm

- In **(a)**  $TC = FC + VC$
- In **(b)**  $ATC = AVC + AFC$
- **MC curve crosses the AVC and ATC curves at their minimum points.**



# 7.2

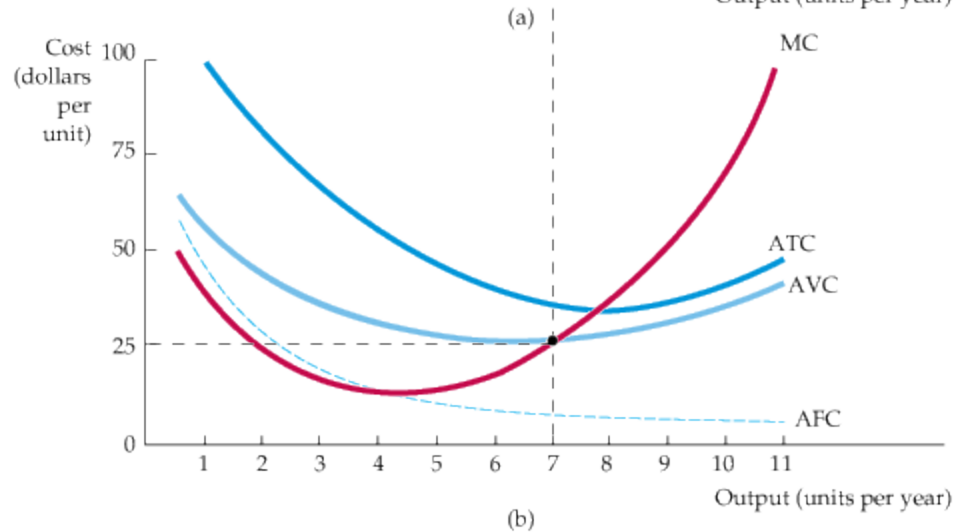
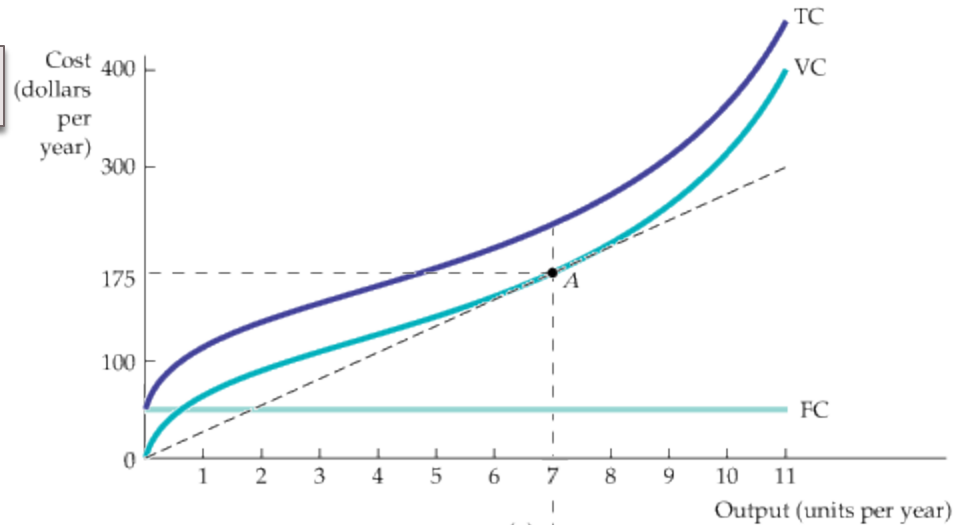
## COST IN THE SHORT RUN

### The Shapes of the Cost Curves

#### The Average-Marginal Relationship

Consider the 45 degree line drawn from origin to point A in (a).

- The slope of the line measures AVC (a total cost of \$175 divided by an output of 7, or a cost per unit of \$25).
- **At point A,**
  - the slope of the VC curve is the MC,
  - MC and VC are the tangent when output is 7.
  - $MC=AVC$  both = \$25 because AVC is minimized when output is 7.



## 7.3

## COST IN THE LONG RUN

### The Cost-Minimizing Input Choice

- We now turn to a fundamental problem that all firms face: *how to select inputs to produce a given output at minimum cost.*
- For simplicity, we will work with two variable inputs:
  - *labor (measured in hours of work per year) and*
  - *capital (measured in hours of use of machinery per year).*

User cost or rental ( $r$ ) is the price of Capital

### The Price of Capital

- The price of capital is its *user cost*,
- This can be expressed by  $r = \text{Depreciation rate} + \text{Interest rate}$ .

### The Rental Rate of Capital

- **rental rate:** Cost per year of renting one unit of capital.

If the capital market is competitive, *the rental rate should be equal to the user cost,  $r$ .*

*Why?*

- Firms that own capital expect to earn a competitive return when they rent it. *This competitive return is the user cost of capital.*
- *Capital that is purchased can be treated as though it were rented at a rental rate equal to the user cost of capital.*



## 7.3

## COST IN THE LONG RUN

### The Isocost Line

Graph showing all possible combinations of labor and capital that can be purchased for a given total cost.

Our Total cost function of producing output is given by the sum of the firm's labor cost  $wL$  and its capital cost  $rK$ :

$$C = wL + rK$$

If we rewrite the total cost equation and solve for  $K$ , we get

$$K = C/r - (w/r)L$$

It follows that the isocost line has a slope of  $\Delta K/\Delta L = -(w/r)$ , which is the ratio of the wage rate to the rental cost of capital.

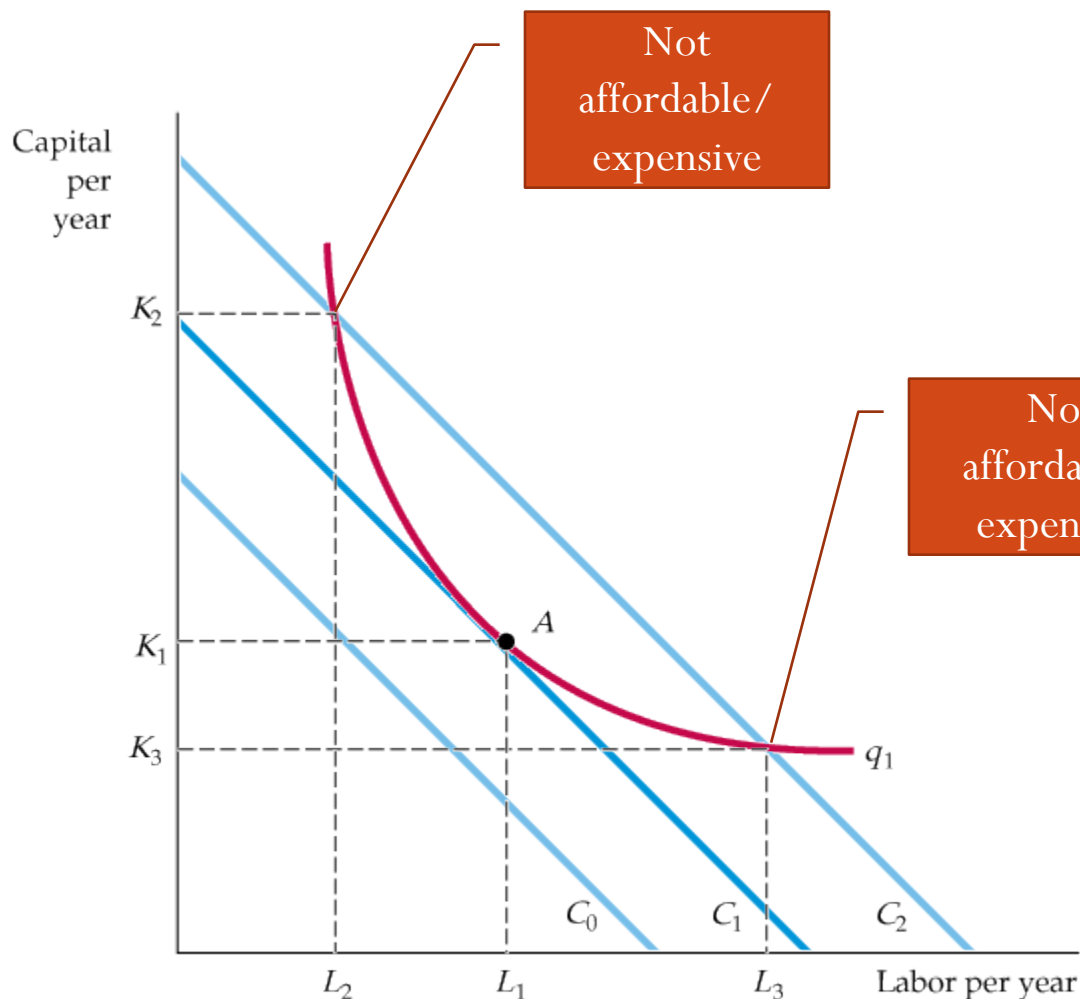
## 7.3

## COST IN THE LONG RUN

## The Isocost Line

## Producing a Given Output at Minimum Cost

- **Isocost curves** describe the combination of inputs to production that cost the same amount to the firm.
- Isocost curve  $C_1$  is tangent to isoquant  $q_1$  at  $A$  and shows that output  $q_1$  can be produced at minimum cost with labor input  $L_1$  and capital input  $K_1$ .
- Other input combinations
  - $L_2, K_2$  and  $L_3, K_3$  yield the same output but at higher cost.

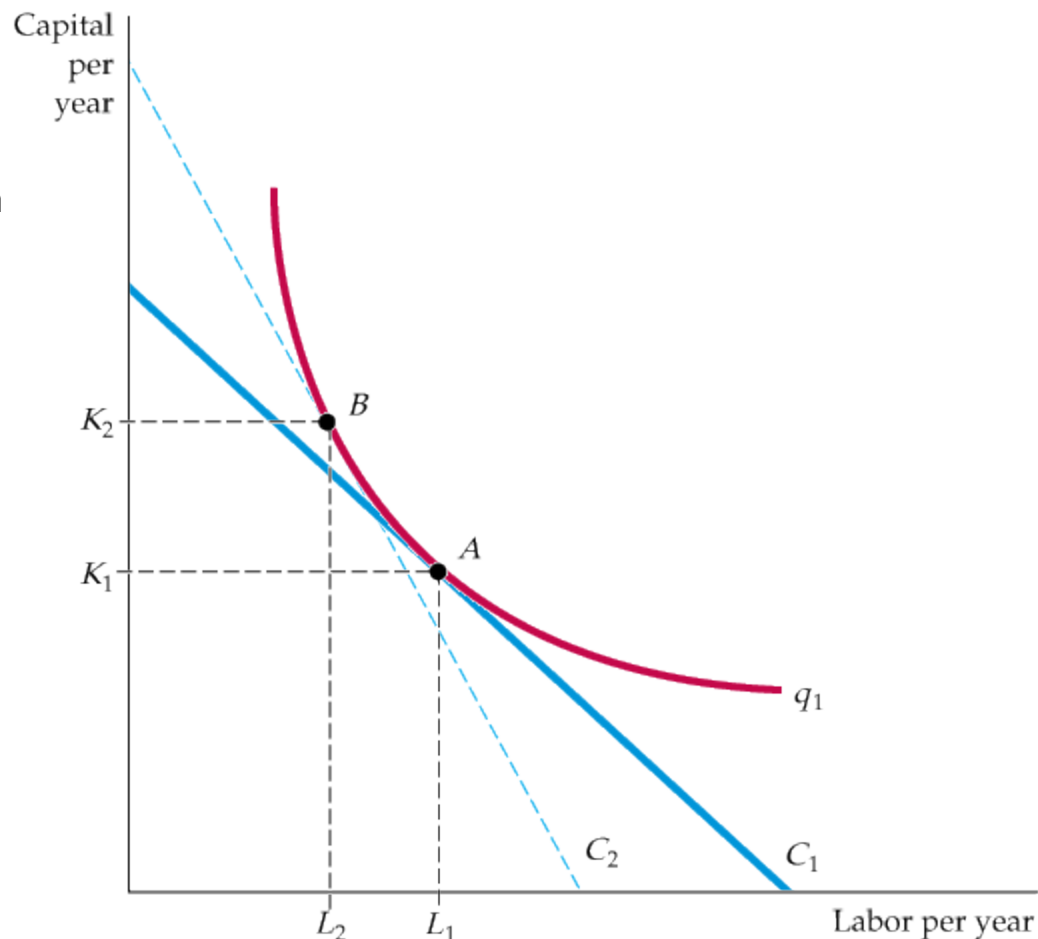


## 7.3 COST IN THE LONG RUN

### Choosing Inputs

#### Input Substitution When an Input Price Changes

- Facing an isocost curve  $C_1$ , the firm produces output  $q_1$  at point  $A$  using  $L_1$  units of labor and  $K_1$  units of capital.
- When the price of labor increases, the isocost curves become steeper.
- Output  $q_1$  is now produced at point  $B$  on isocost curve  $C_2$  by using  $L_2$  units of labor and  $K_2$  units of capital.



## 7.3

### COST IN THE LONG RUN

#### Choosing Inputs

Recall that in our analysis of production technology, we showed that the marginal rate of technical substitution of labor for capital (MRTS) is the negative of the slope of the isoquant and is equal to the ratio of the marginal products of labor and capital:

$$\text{MRTS} = -\Delta K / \Delta L = \text{MP}_L / \text{MP}_K$$

It follows that when a firm minimizes the cost of producing a particular output, the following condition holds:

$$\text{MP}_L / \text{MP}_K = w / r$$

We can rewrite this condition slightly as follows:

$$\text{MP}_L / w = \text{MP}_K / r$$

## 7.3

## COST IN THE LONG RUN

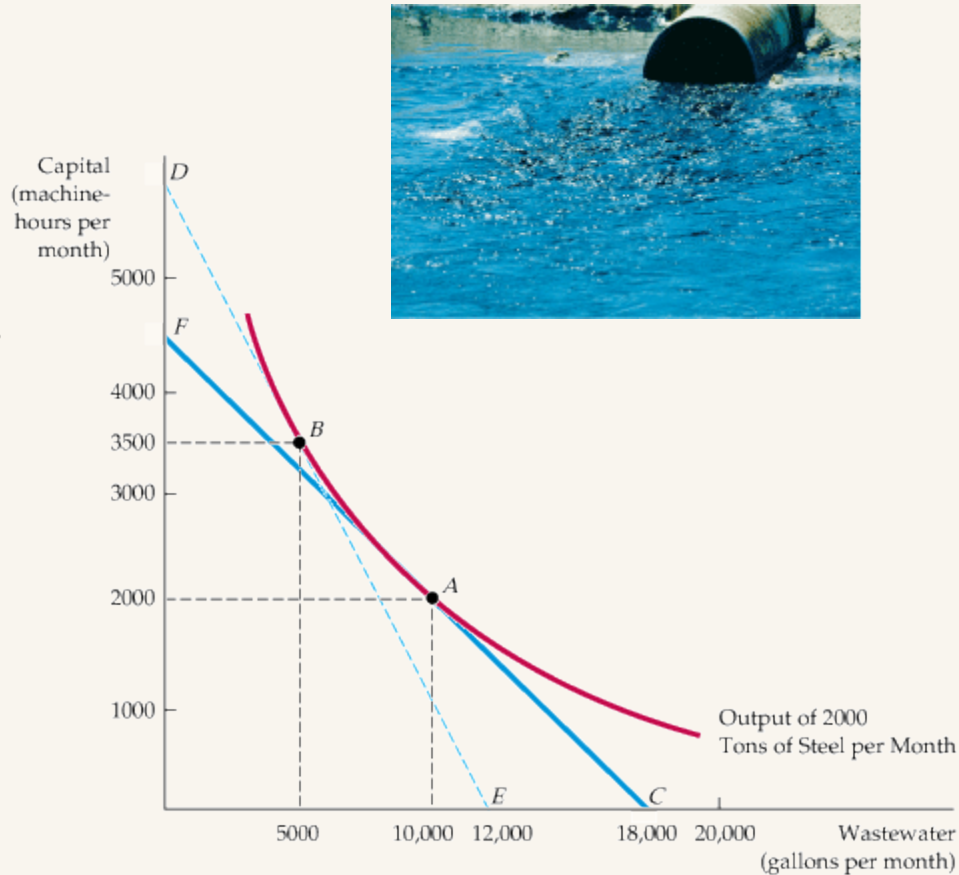
## EXAMPLE 7.4

## The Effect of Effluent Fees on Input Choices

## The Cost-Minimizing Response to an Effluent Fee

When the firm is not charged for dumping its wastewater in a river, it chooses to produce a given output using 10,000 gallons of wastewater and 2000 machine-hours of capital at *A*.

However, an effluent fee raises the cost of wastewater, shifts the isocost curve from *FC* to *DE*, and causes the firm to produce at *B*—a process that results in much less effluent.



## 7.3

## COST IN THE LONG RUN

### Cost Minimization with Varying Output Levels

- **expansion path**

Curve passing through points of tangency between a firm's isocost lines and its isoquants.

### The Expansion Path and Long-Run Costs

To move from the expansion path to the cost curve, we follow three steps:

1. Choose an output level represented by an isoquant. Then find the point of tangency of that isoquant with an isocost line.
2. From the chosen isocost line determine the minimum cost of producing the output level that has been selected.
3. Graph the output-cost combination.

## 7.3

## COST IN THE LONG RUN

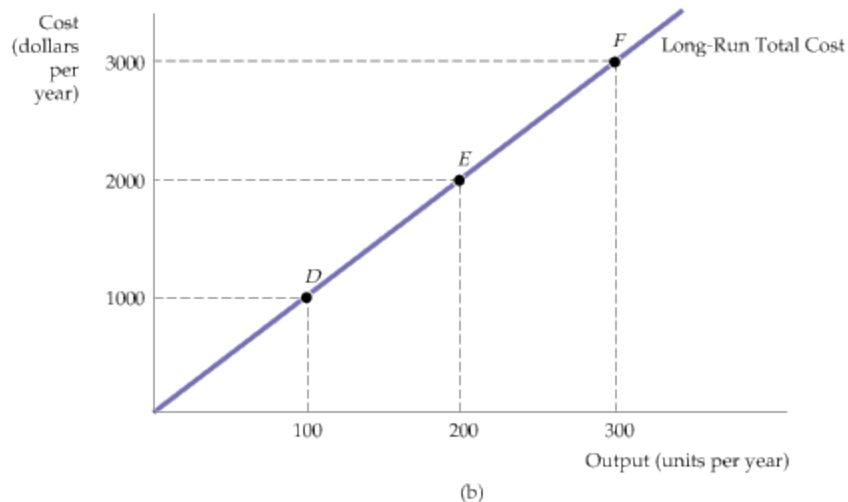
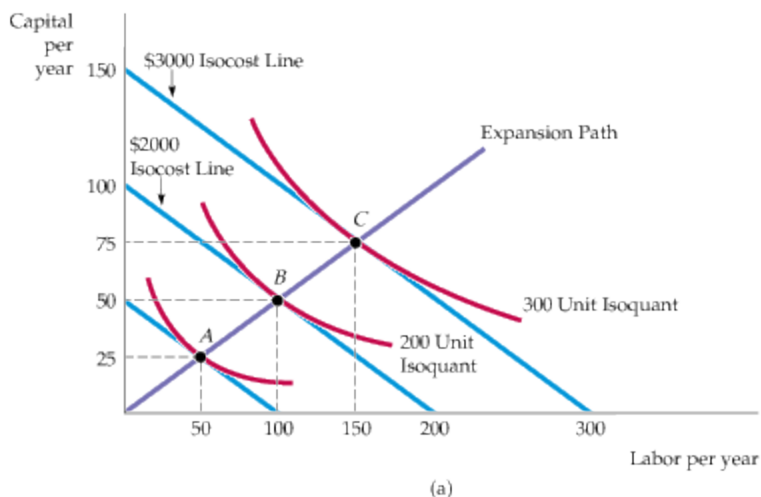
## Cost Minimization with Varying Output Levels

## A Firm's Expansion Path and Long-Run Total Cost Curve

In **(a)**, the expansion path (from the origin through points *A*, *B*, and *C*)

- illustrates the lowest-cost combinations of labor and capital that can be used to produce each level of output in the long run— i.e., when both inputs to production can be varied.

In **(b)**, the corresponding long-run total cost curve (from the origin through points *D*, *E*, and *F*) measures the least cost of producing each level of output.



## 7.4

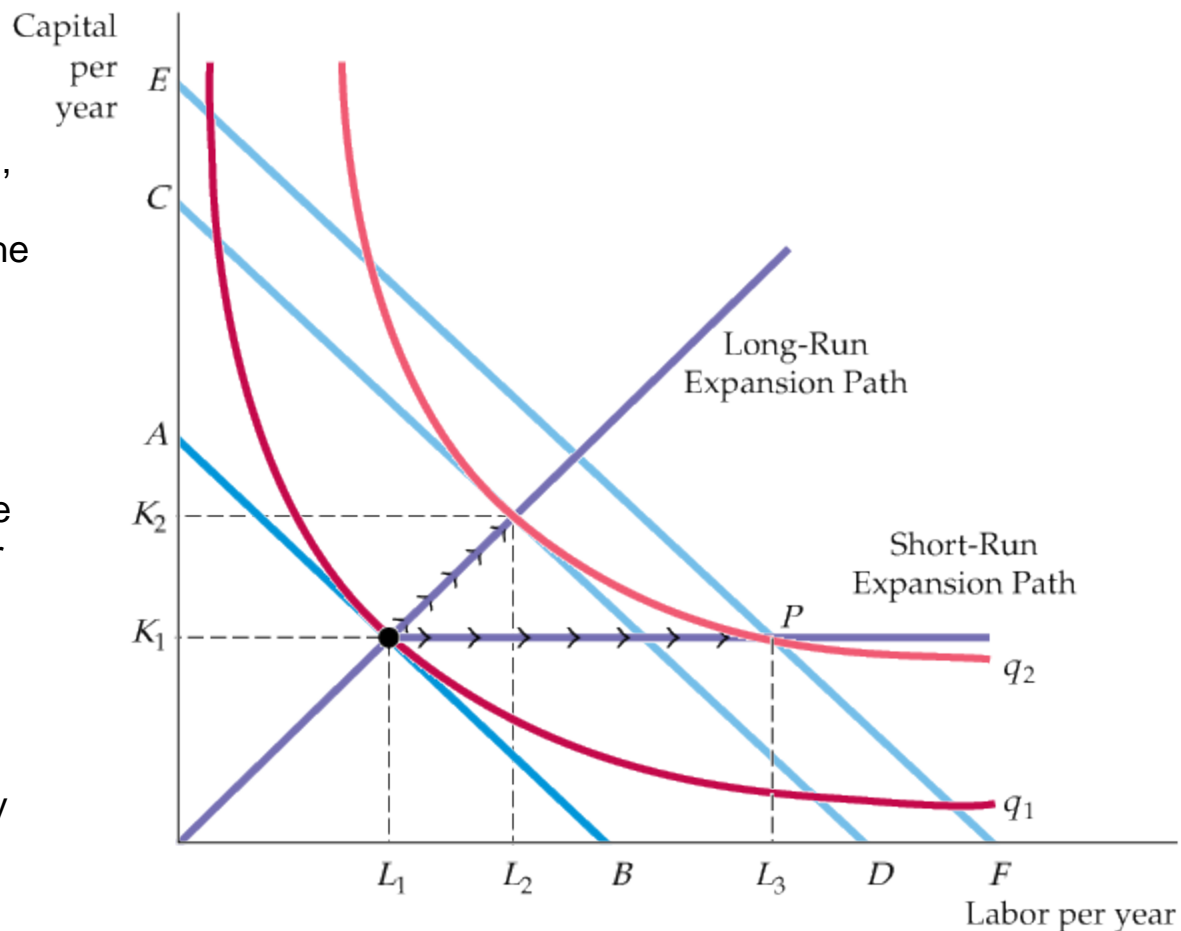
## LONG-RUN VERSUS SHORT-RUN COST CURVES

## The Inflexibility of Short-Run Production

## The Inflexibility of Short-Run Production

When a firm operates in the short run, its cost of production may not be minimized because of inflexibility in the use of capital inputs.

- Output is initially at level  $q_1$ .
- **In the short run**, output  $q_2$  can be produced only by increasing labor from  $L_1$  to  $L_3$ 
  - because capital is fixed at  $K_1$ .
- **In the long run**, the same output can be produced more cheaply by increasing labor from  $L_1$  to  $L_2$  and capital from  $K_1$  to  $K_2$ .





## 7.4

# LONG-RUN VERSUS SHORT-RUN COST CURVES

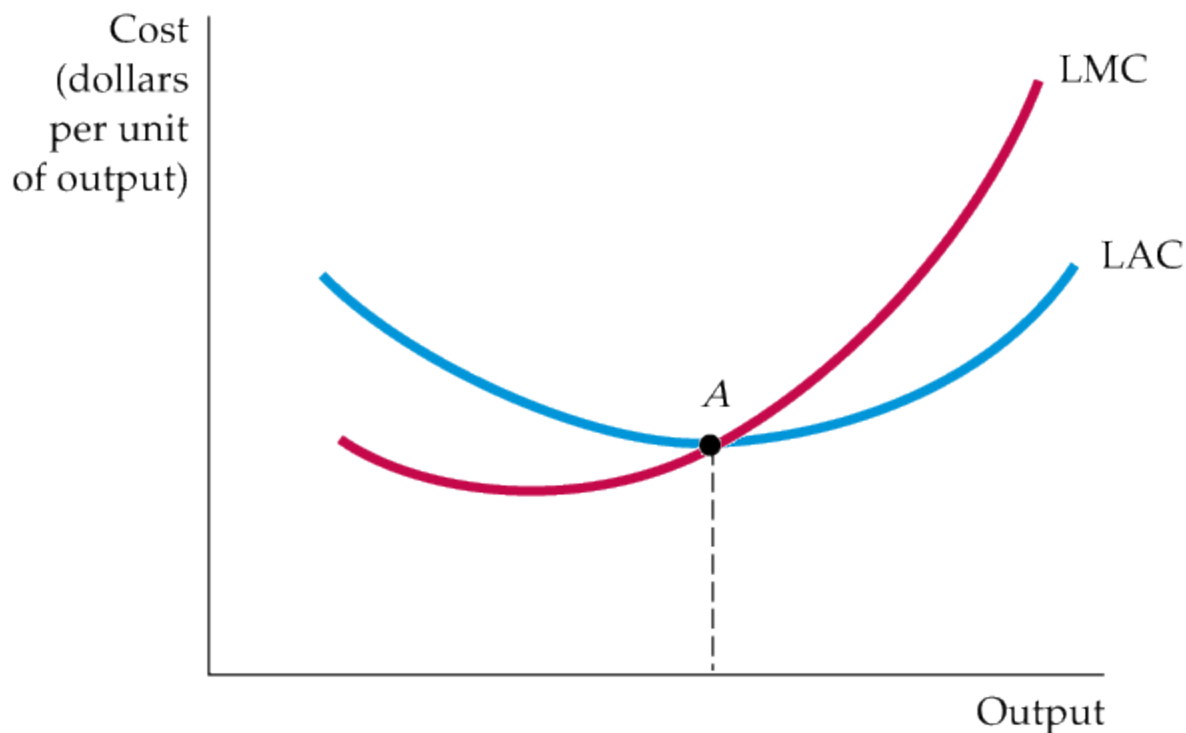
## Long-Run Average Cost

### Long-Run Average and Marginal Cost

When a firm is producing at an output at which the long-run average cost LAC is falling, the long-run marginal cost LMC is less than LAC.

Conversely, when LAC is increasing, LMC is greater than LAC.

The two curves intersect at *A*, where the LAC curve achieves its minimum.



## 7.4

# LONG-RUN VERSUS SHORT-RUN COST CURVES

## Long-Run Average Cost

- **long-run average cost curve (LAC)** Curve relating average cost of production to output when all inputs, including capital, are variable.

- **short-run average cost curve (SAC)** Curve relating average cost of production to output when level of capital is fixed.

**long-run marginal cost curve (LMC)** Curve showing the change in long-run total cost as output is increased incrementally by 1 unit.

## 7.4

# LONG-RUN VERSUS SHORT-RUN COST CURVES

## Economies and Diseconomies of Scale

- **economies of scale** Situation in which output can be doubled for less than a doubling of cost.

### **diseconomies of scale**

Situation in which a doubling of output requires more than a doubling of cost.

*Increasing Returns to Scale:*

Output more than doubles when the quantities of all inputs are doubled.

*Economies of Scale:*

A doubling of output requires less than a doubling of cost.

### Economies and Diseconomies of Scale

Economies of scale are often measured in terms of a cost-output elasticity,  $E_C$ .  $E_C$  is the percentage change in the cost of production resulting from a 1-percent increase in output:

$$E_C = (\Delta C / C) / (\Delta q / q)$$

To see how  $E_C$  relates to our traditional measures of cost, rewrite the equation as follows:

$$E_C = (\Delta C / \Delta q) / (C / q) = MC / AC$$

## 7.4

## LONG-RUN VERSUS SHORT-RUN COST CURVES

## The Relationship Between Short-Run and Long-Run Cost

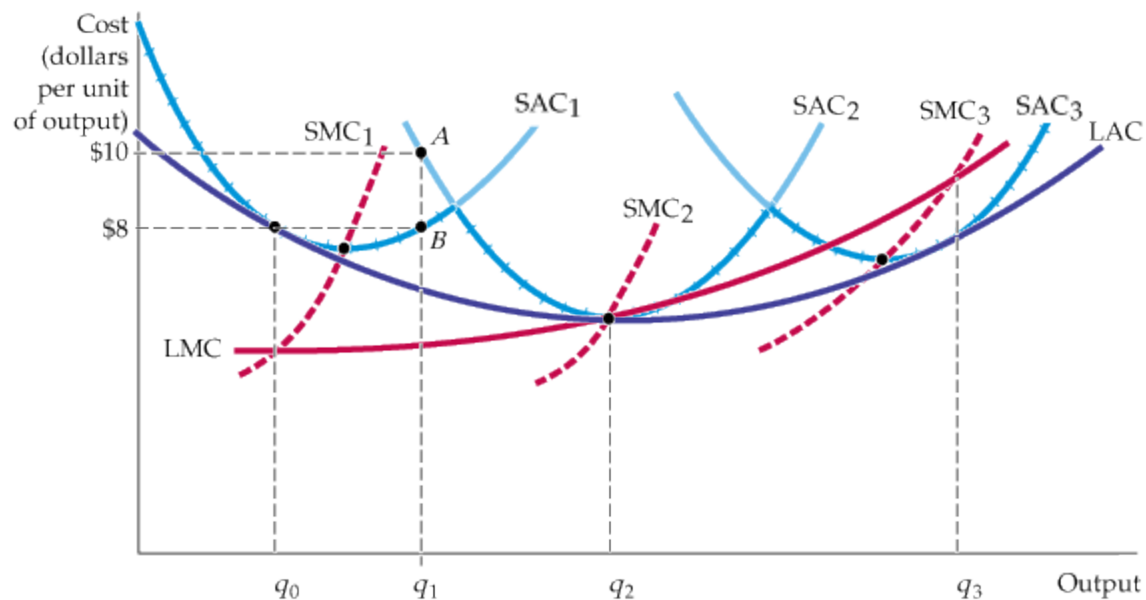
## Long-Run Cost with Economies and Diseconomies of Scale

The long-run average cost curve LAC

- is the envelope of the short-run average cost curves  $SAC_1$ ,  $SAC_2$ , and  $SAC_3$ .

With economies and diseconomies of scale,

- the minimum points of the short-run average cost curves do not lie on the long-run average cost curve.



# ECS2601 UNIT 8: PROFIT MAXIMISATION AND COMPETITIVE SUPPLY



# RECAP?

$$q = F(K, L)$$

$$AP_L = \frac{Q}{L} \quad MP_L = \frac{\Delta q}{\Delta L} = \frac{q_2 - q_1}{L_2 - L_1}$$

$$AP_K = \frac{Q}{K} \quad MP_K = \frac{\Delta q}{\Delta K} = \frac{q_2 - q_1}{K_2 - K_1}$$

$$\frac{MP_L}{MP_K} = \frac{-\Delta K}{\Delta L} = MRTS = \frac{w}{r}$$

$$\text{Average Total Cost} = ATC(q) \text{ or } AC(q) = \frac{TC(q)}{q}$$

$$\text{Average Fixed Cost} = AFC = \frac{TFC}{q}$$

$$\text{Average Variable Cost} = AVC(q) = \frac{TVC(q)}{q}$$

$$ATC = AFC + AVC$$

Suppose you are running a small business.

- What is your objective?
- What are you supposed to decide?
- What is profit?
- How can you make your maximum profit?



# WHAT DO WE KNOW?

- 8.1 Perfectly Competitive Markets and Profit Maximization
- 8.2 Marginal Revenue, Marginal Cost, and Profit Maximization
- 8.3 Choosing Output in the Short Run
- 8.4 The Competitive Firm's Short-Run Supply Curve
- 8.5 The Short-Run Market Supply Curve
- 8.6 Choosing Output in the Long Run
- 8.7 The Industry's Long-Run Supply Curve

## 8.1

# PERFECTLY COMPETITIVE MARKETS

### Basic assumptions

- ❑ Maximize Profit
- ❑ Product homogeneity
- ❑ Free entry and exit

## 8.2

## MARGINAL REVENUE, MARGINAL COST, AND PROFIT MAXIMIZATION

## Profit Maximization in the Short Run

**Profit for the firm is the** Difference between Total revenue and Total cost.

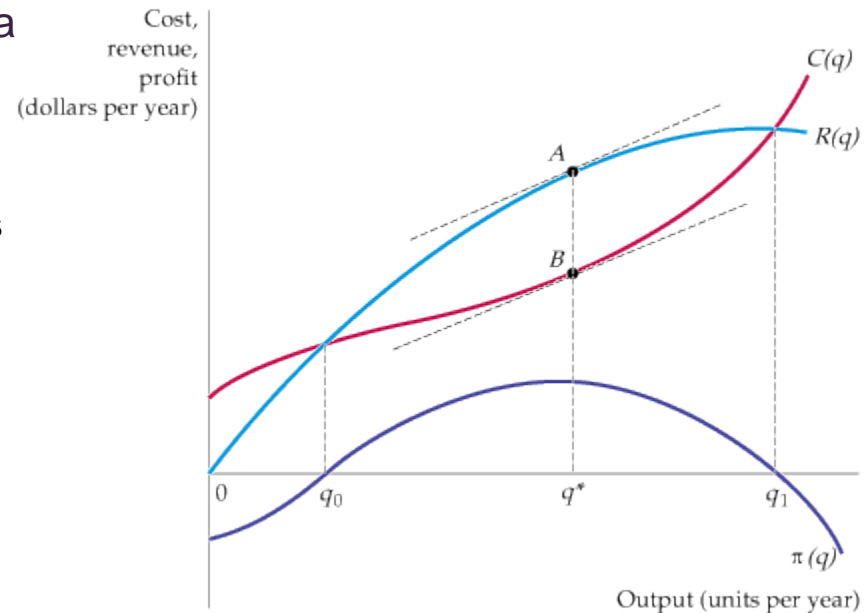
$$\pi(q) = R(q) - C(q)$$

**Marginal revenue**

- The slope of the profit curve
- Change in revenue resulting from a one-unit increase in output.
- Profit is maximized at the point at which an additional increment to output leaves profit unchanged.
- At that output, marginal revenue (the slope of the revenue curve) is equal to marginal cost (the slope of the cost curve).

$$\Delta\pi/\Delta q = \Delta R/\Delta q - \Delta C/\Delta q = 0$$

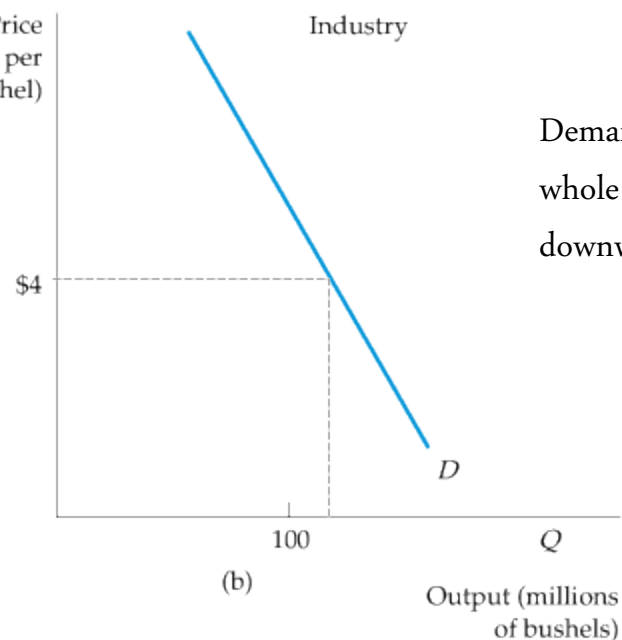
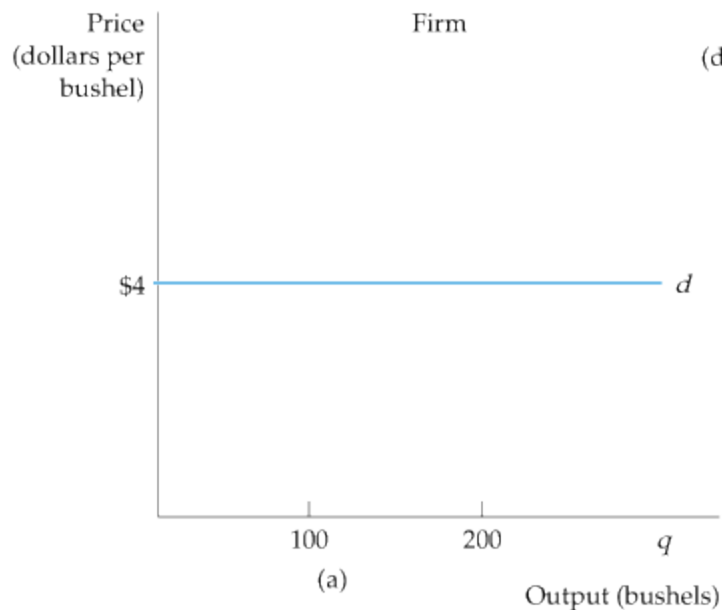
$$\text{MR}(q) = \text{MC}(q)$$



## 8.2

## MARGINAL REVENUE, MARGINAL COST, AND PROFIT MAXIMIZATION

## Demand and Marginal Revenue for a Competitive Firm



Demand curve faced by whole market is downward sloping

**Demand Curve Faced by a Competitive Firm**

- In **(a)** the demand curve facing the individual firm is perfectly elastic, even though the market demand curve in **(b)** is downward sloping.
- A competitive firm supplies only a small portion of the total industry's output. Therefore, **the firm takes the market price of the product as given**, choosing its output on the assumption that **the price will be unaffected by the output choice**.

## 8.2

# MARGINAL REVENUE, MARGINAL COST, AND PROFIT MAXIMIZATION

## Demand and Marginal Revenue for a Competitive Firm

- The demand  $d$  curve facing an individual firm in a competitive market **is both its Average Revenue curve and its Marginal Revenue curve.**
- Along this demand curve, marginal revenue, average revenue, and price are all equal.

– *Therefore  $P = MR = AR$*

## Profit Maximization by a Competitive Firm

$$MC(q) = MR = P = AR$$

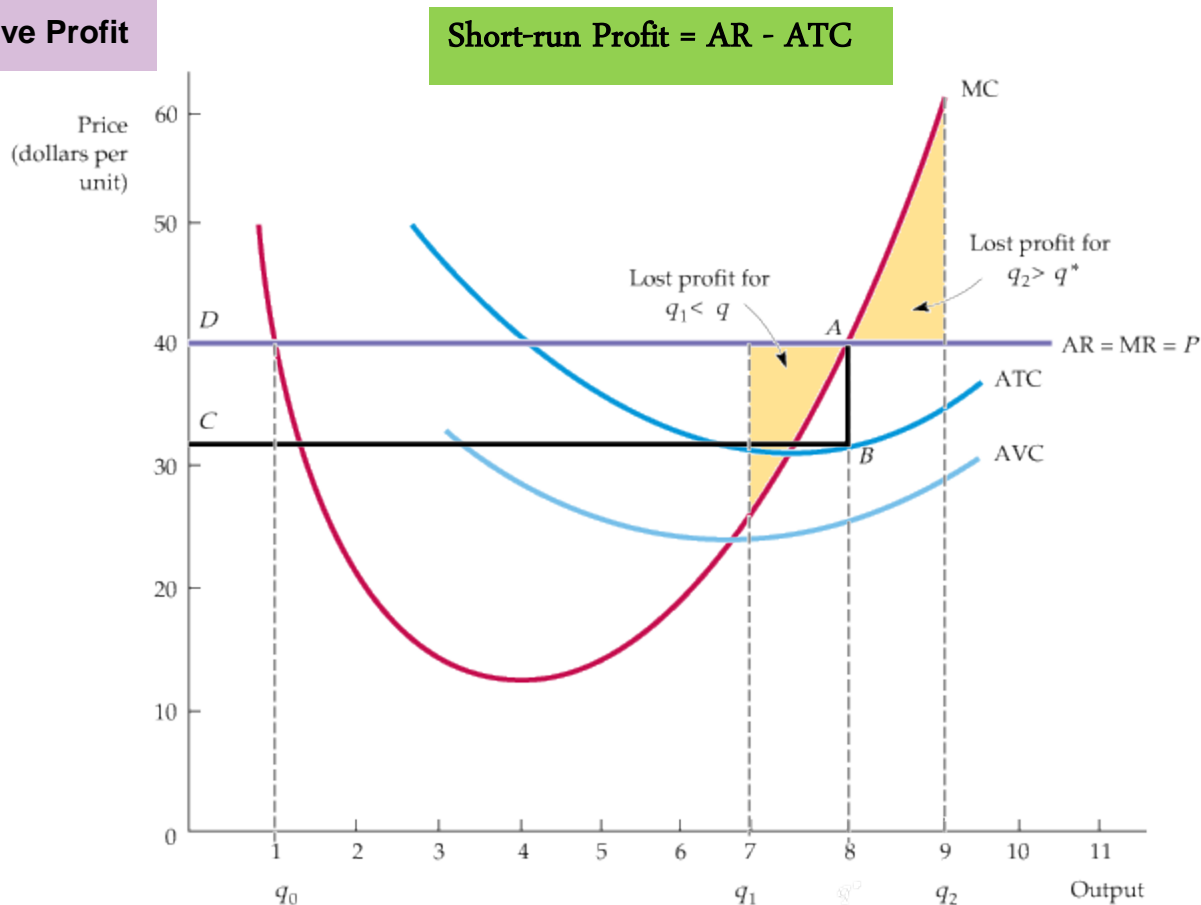
## 8.3

## CHOOSING OUTPUT IN THE SHORT RUN

## The Short-Run Profit of a Competitive Firm

## A Competitive Firm Making a Positive Profit

- In the short run, the competitive firm maximizes its profit by choosing an output  $q^*$  at which its  $MC=P=MR$  of its product.
- The profit of the firm is measured by the rectangle  $ABCD$ .
- At  $q_1$   $MR > MC$
- At  $q_2$   $MR < MC$ .



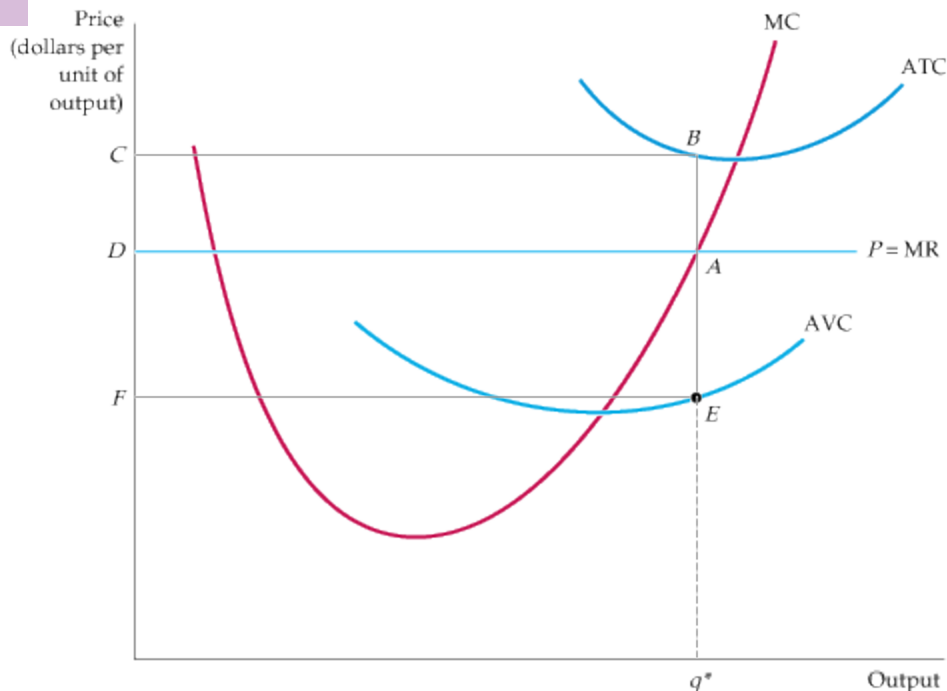
## 8.3

# CHOOSING OUTPUT IN THE SHORT RUN

## The Short-Run Profit/loss of a Competitive Firm

### A Competitive Firm Incurring Losses

- A competitive firm should shut down if price is below AVC.
- The firm may produce in the short run if price is greater than average variable cost.



### Shut-Down Rule:

- If  $AVC < P < ATC$  the firm should continue producing in the short run
- **If  $AVC > P < ATC$  the firm should shut-down.**

# Summary of Production Decisions

- ✓ Profit is maximized when  $MC = MR$
- ✓ If  $P > ATC$  the firm is making profits
- ✓ If  $P < ATC$  the firm is making losses
- ✓ If  $AVC > P < ATC$  the firm should shut-down.



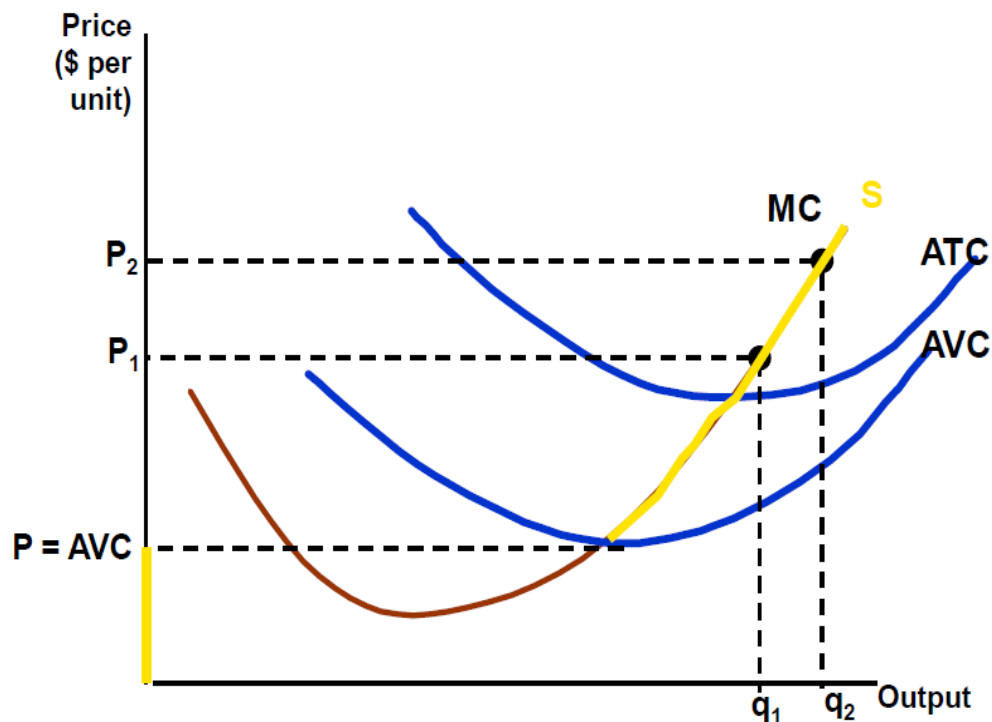
## 8.4

# THE COMPETITIVE FIRM'S SHORT-RUN SUPPLY CURVE

### The Short-Run Supply Curve for a Competitive Firm

The firm's supply curve is *the portion of the marginal cost curve for which marginal cost is greater than average variable cost.*

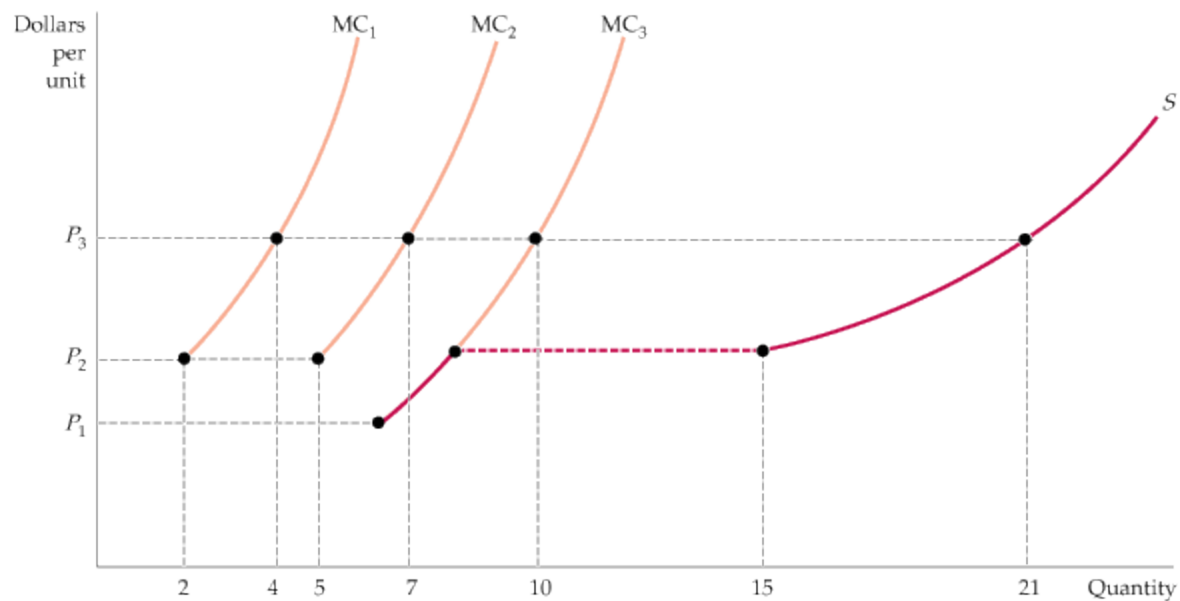
- The short-run supply curve is given by the crosshatched portion of the marginal cost curve.



## 8.5

## THE SHORT-RUN MARKET SUPPLY CURVE

- The short-run industry supply curve is the summation of the supply curves of the individual firms.

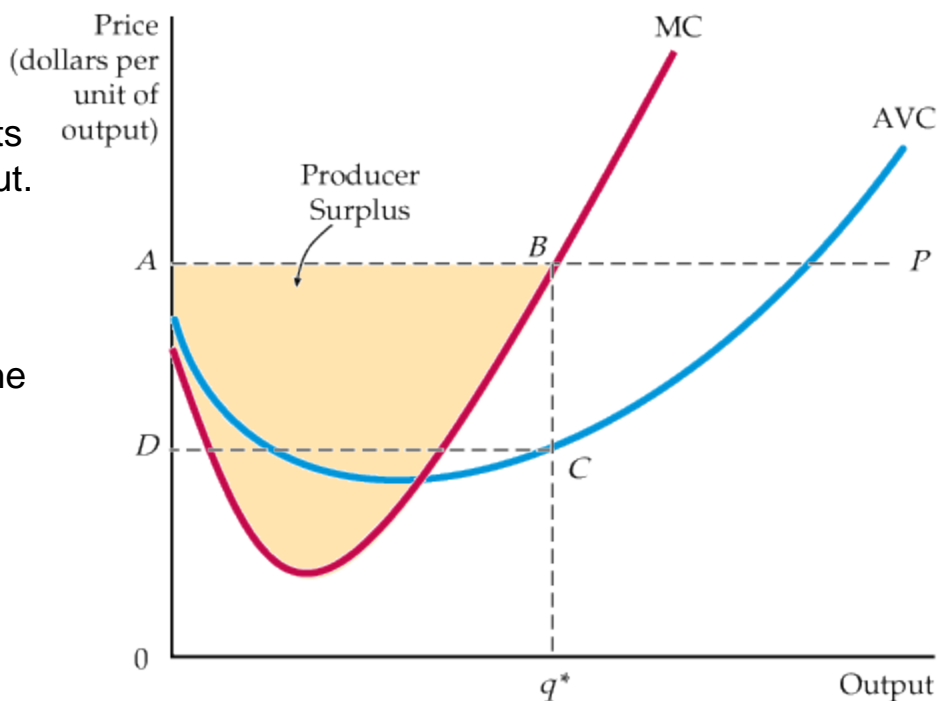


## 8.5

# THE SHORT-RUN MARKET SUPPLY CURVE

## Producer Surplus in the Short Run

- Sum over all units produced by a firm of differences between the market price of a good and the marginal cost of production.
- **Producer surplus = Revenue - VC**
- The producer surplus for a firm is measured by the yellow area below the market price and above the marginal cost curve, between outputs 0 and  $q^*$ , the profit-maximizing output.
- Alternatively, it is equal to rectangle  $ABCD$  because the sum of all marginal costs up to  $q^*$  is equal to the variable costs of producing  $q^*$ .



## 8.5

## THE SHORT-RUN MARKET SUPPLY CURVE

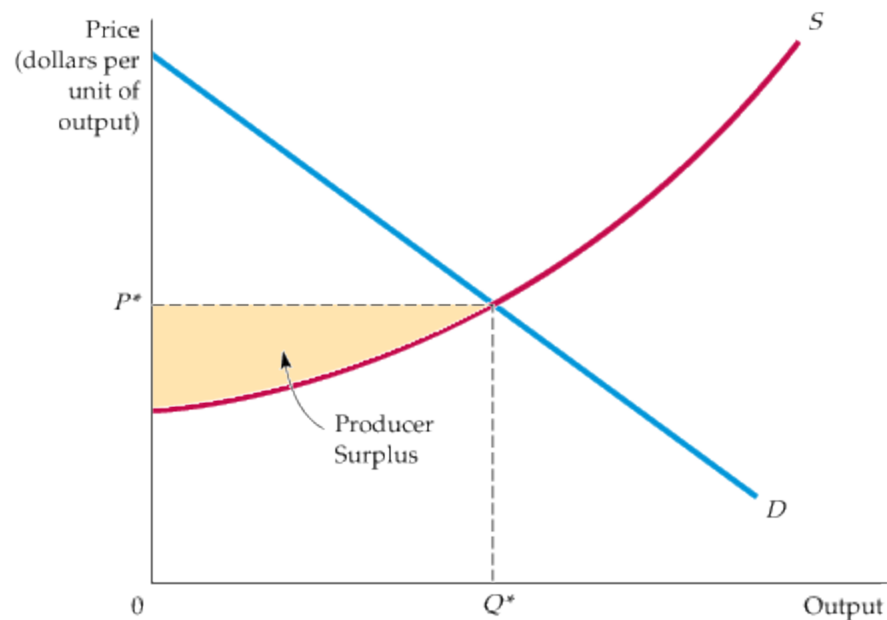
## Producer Surplus for a Market

$$\text{Producer surplus} = \text{PS} = R - \text{VC}$$

$$\text{Profit} = \pi = R - \text{VC} - \text{FC}$$

- The producer surplus for a market is the area below the market price and above the market supply curve, between 0 and output  $Q^*$ .
- When fixed cost is positive, producer surplus is greater than profit

$$\text{Profit} = \pi = R - (\text{VC} + \text{FC})$$

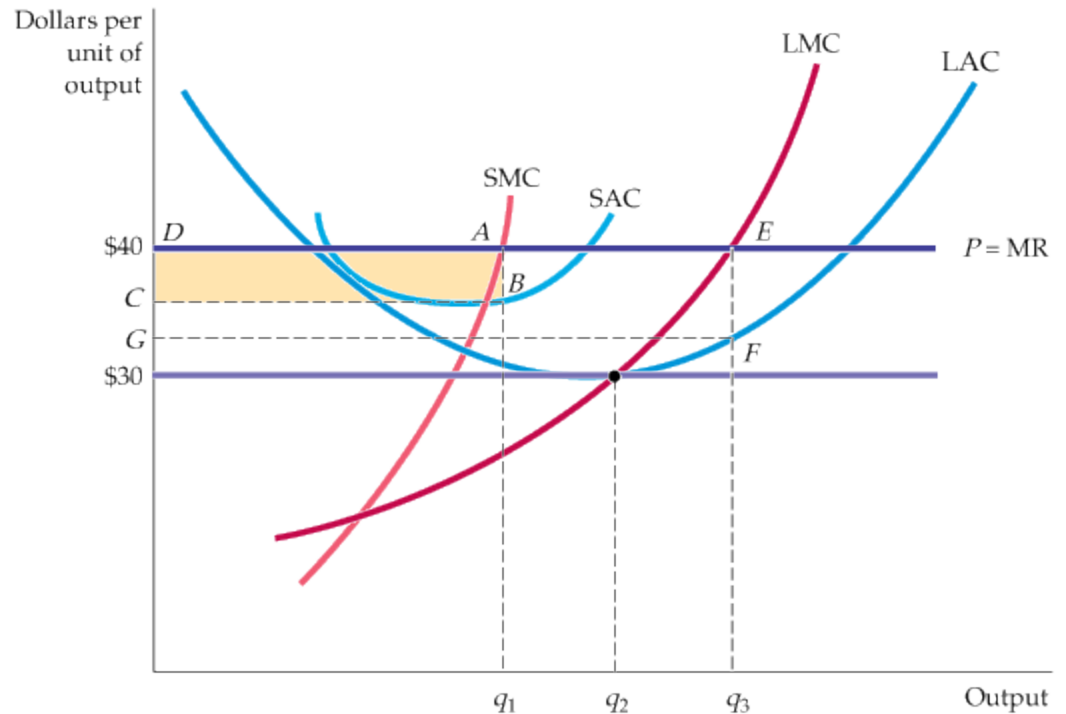


# 8.6

## CHOOSING OUTPUT IN THE LONG RUN

### Long-Run Profit Maximization

- The firm maximizes its profit by choosing the output at which price equals long-run marginal cost LMC.
- In the diagram, the firm increases its profit from  $ABCD$  to  $EFGD$  by increasing its output in the long run.



The long-run output of a profit-maximizing competitive firm is the point at which long-run marginal cost equals the price.

$$LMC = P$$

## 8.6

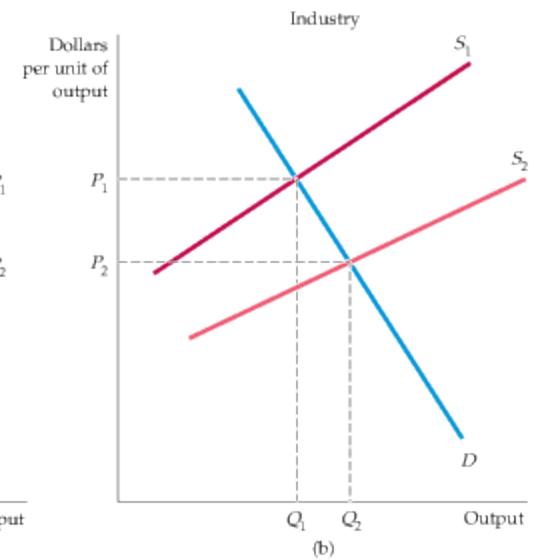
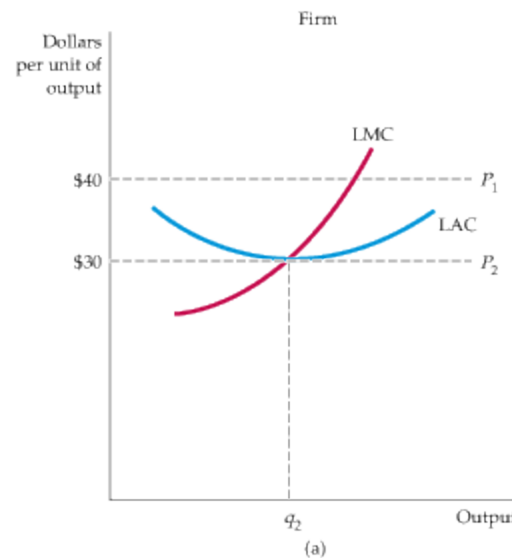
# CHOOSING OUTPUT IN THE LONG RUN

### Long-Run Competitive Equilibrium

- Profits will attract other producers.
- More producers increase industry supply which lowers the market price.
- This continues until there are no more profits to be gained in the market – zero economic profits

Positive profit encourages entry of new firms and causes a shift to the right in the supply curve to  $S_2$ , as shown in (b).

The long-run equilibrium occurs at a price of \$30, as shown in (a), where each firm earns zero profit and there is no incentive to enter or exit the industry.



## 8.6

# CHOOSING OUTPUT IN THE LONG RUN

### Long-Run Competitive Equilibrium

In a market with entry and exit, a firm enters when it can earn a positive long-run profit and exits when it faces the prospect of a long-run loss.

#### **long-run competitive equilibrium:**

- All firms in an industry are maximizing profit, no firm has an incentive to enter or exit, and price is such that quantity supplied equals quantity demanded.

**Therefore, a long-run competitive equilibrium occurs when three conditions hold:**

1. All firms in the industry are maximizing profit.
2. No firm has an incentive either to enter or exit the industry because all firms are earning zero economic profit.
3. The price of the product is such that the quantity supplied by the industry is equal to the quantity demanded by consumers.

# ECS2601 UNIT 9: ANALYSIS OF COMPETITIVE MARKETS





# WHAT DO WE KNOW?

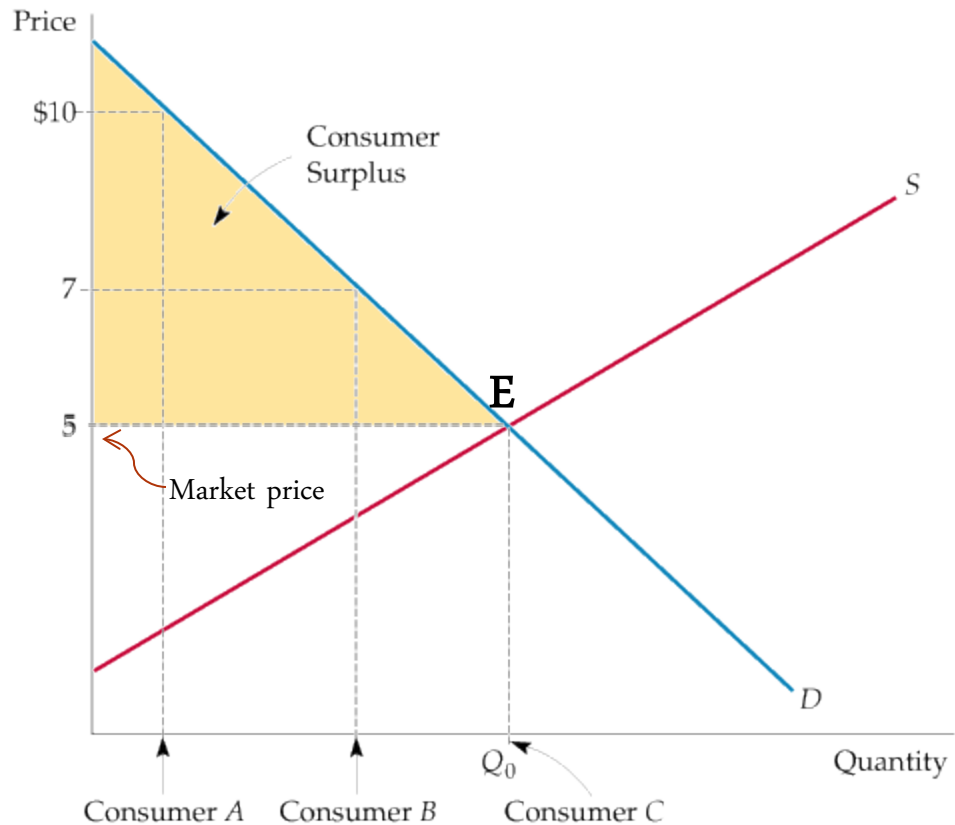
- 9.1 Evaluating the Gains and Losses from Government Policies—  
Consumer and Producer Surplus
- 9.2 The Efficiency of a Competitive Market
- 9.4 Price Supports and Production Quotas
- 9.5 Import Quotas and Tariffs

## 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

## Consumer and Producer Surplus

- Consumer *A* would pay \$10 for a good whose market price is \$5 and therefore enjoys a benefit of \$5.
- Consumer *B* enjoys a benefit of \$2,
- Consumer *C*, who values the good at exactly the market price, enjoys no benefit.
- Consumer surplus, which measures the total benefit to all consumers, is the yellow-shaded area between the demand curve and the market price.



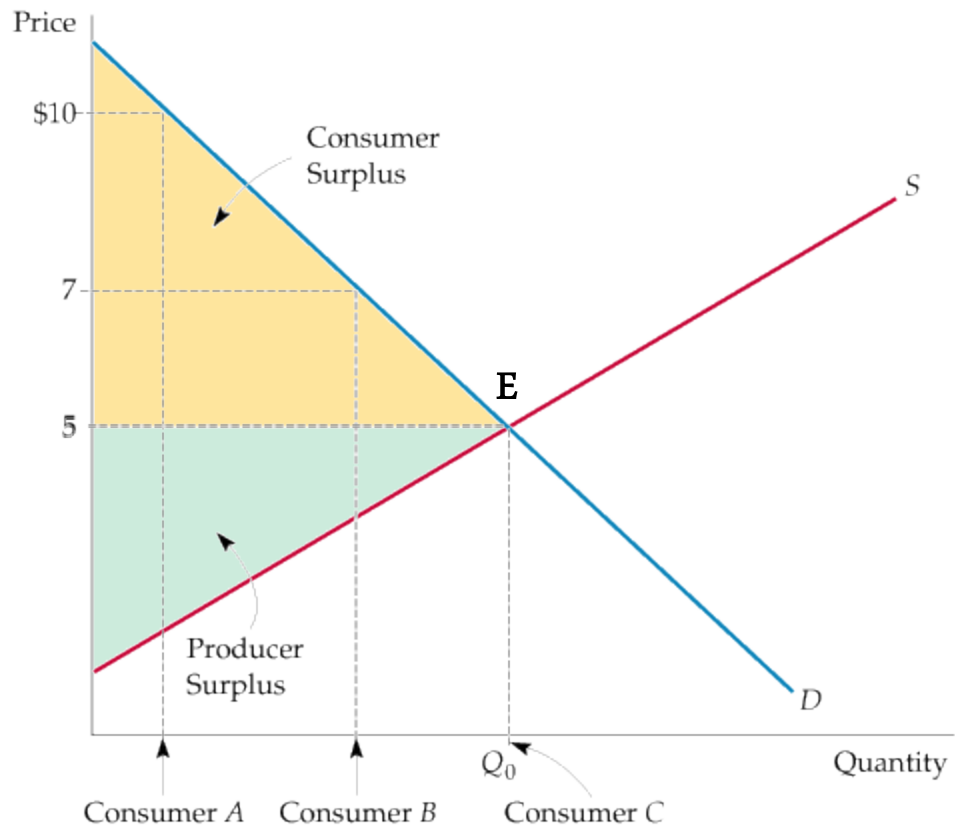
## 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

## Consumer and Producer Surplus (continued)

- Producer surplus measures the total profits of producers, plus rents to factor inputs.
- It is the green-shaded area between the supply curve and the market price.
- Together, consumer and producer surplus measure the **welfare benefit of a competitive market.**

$$CS + PS = \text{Welfare}$$



## 9.1

# EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

### **Welfare effects:**

- Gains and losses to consumers and producers.

### **Deadweight loss:**

- Net loss of total surplus (consumer plus producer) .

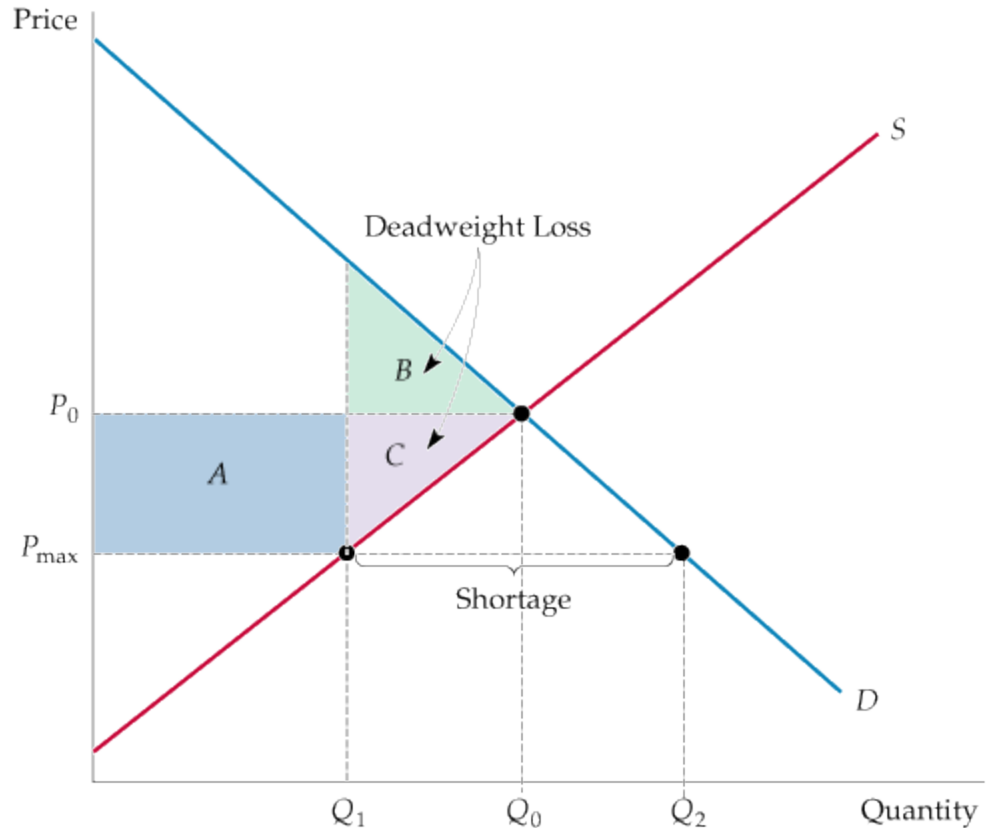
## 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

## 9.1.1. Assume government set the price below equilibrium market clearing price.

The price of a good has been regulated to be no higher than  $P_{\max}$ , which is below the market-clearing price  $P_0$ .

- The gain to consumers is the difference between rectangle  $A$  and triangle  $B$ .
- The loss to producers is the sum of rectangle  $A$  and triangle  $C$ .
- **Triangles  $B$  and  $C$  together measure the deadweight loss from price controls.**

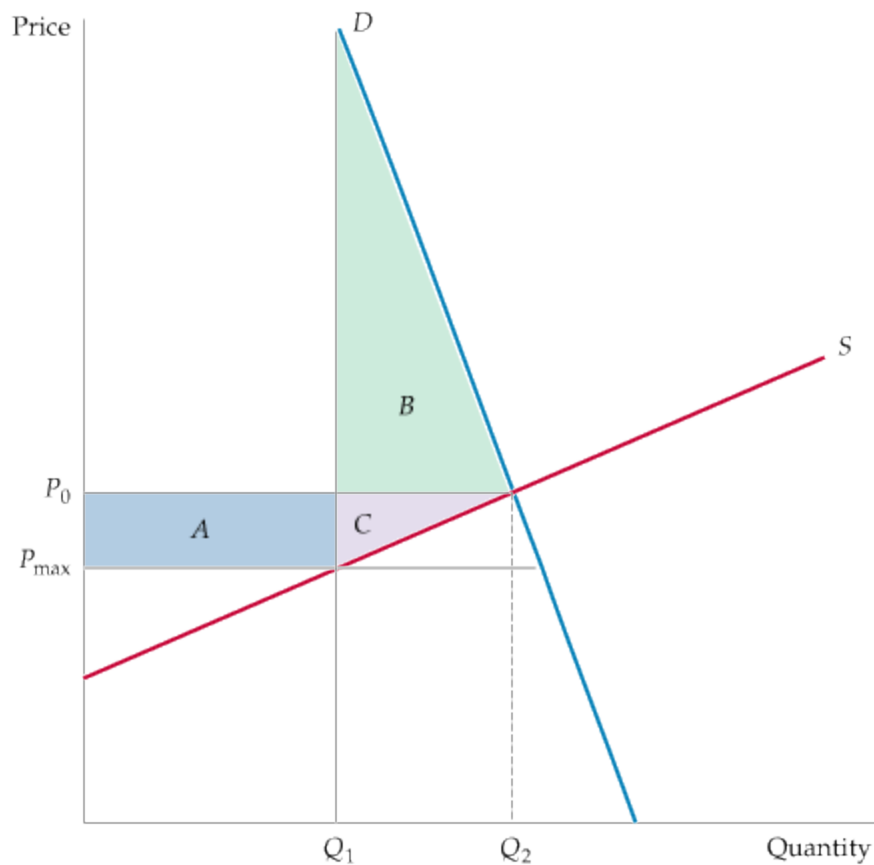


## 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

## Effect of Price Controls When Demand Is Inelastic

- If demand is sufficiently inelastic, triangle *B* can be larger than rectangle *A*.
- **In this case, consumers suffer a net loss from price controls.**



# 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

### EXAMPLE 9.1

### Price Controls and Natural Gas Shortages

#### Effects of Natural Gas Price Controls

The market-clearing price of natural gas is \$6.40 per mcf, and the (hypothetical) maximum allowable price is \$3.00.

A shortage of  $29.1 - 20.6 = 8.5$  Tcf results.

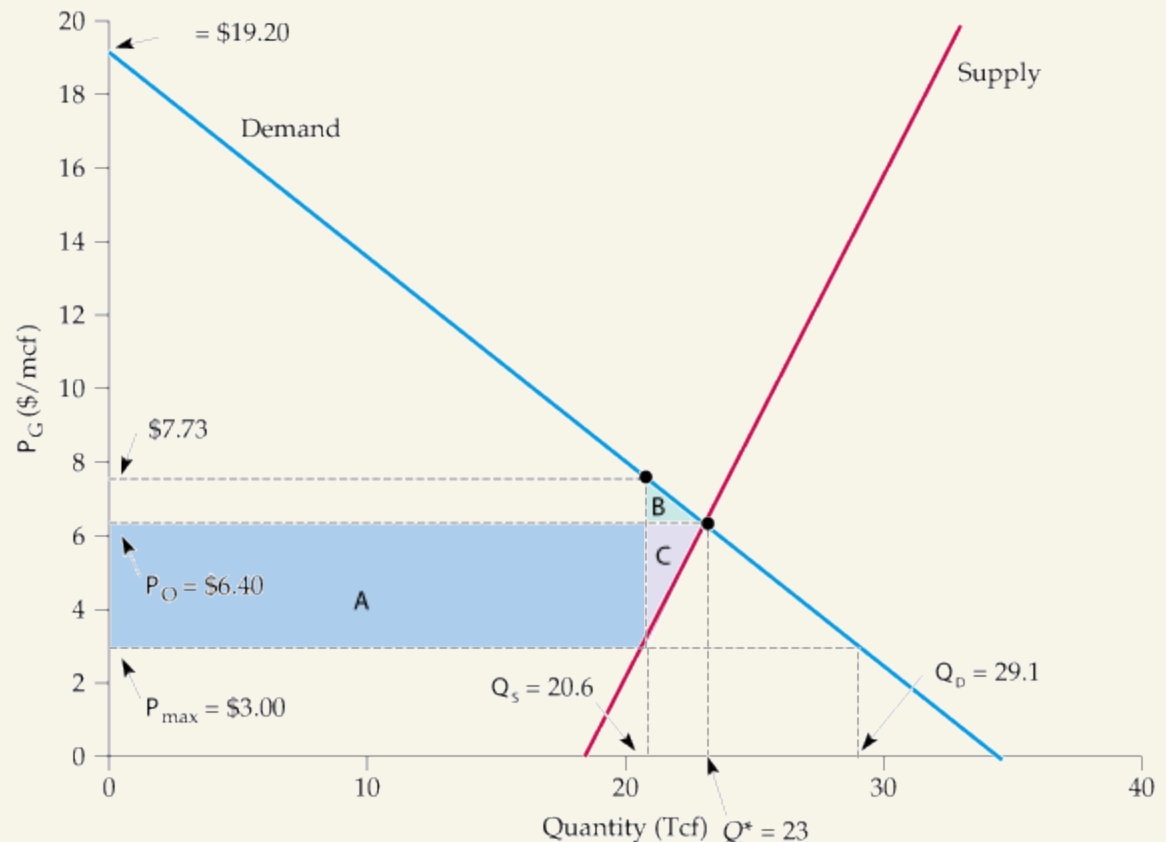
The gain to consumers is rectangle A minus triangle B,

and the loss to producers is rectangle A plus triangle C.

**The deadweight loss is the sum of triangles B plus C.**

$$\text{Supply: } Q^S = 15.90 + 0.72P_G + 0.05P_O$$

$$\text{Demand: } Q^D = 0.02 - 0.18P_G + 0.69P_O$$

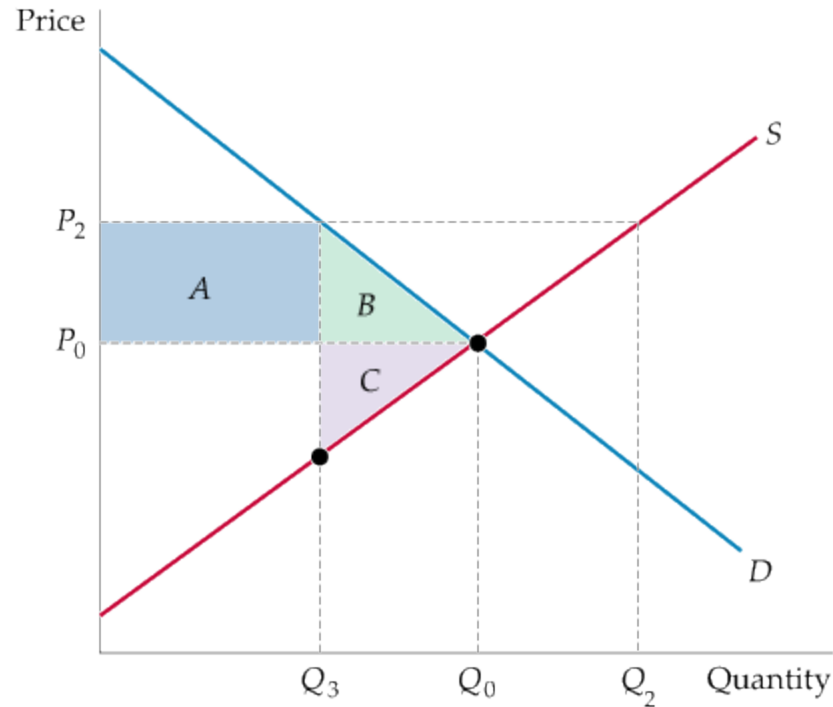


# 9.1

## EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES— CONSUMER AND PRODUCER SURPLUS

### 9.1.2. Welfare Loss When Price is Held Above Market-Clearing Level

- When price is regulated to be no lower than  $P_2$ , only  $Q_3$  will be demanded.
- If  $Q_3$  is produced, the deadweight loss is given by triangles  $B$  and  $C$ .
- At price  $P_2$ , producers would like to produce more than  $Q_3$ . If they do, the deadweight loss will be even larger.





## 9.2

# THE EFFICIENCY OF A COMPETITIVE MARKET

### **Economic efficiency:**

- Maximization of aggregate consumer and producer surplus.

### **Market Failure**

- Situation in which an unregulated competitive market is inefficient because prices fail to provide proper signals to consumers and producers.

There are two important instances in which market failure can occur:

1. *Externalities*
2. *Lack of Information*

### **Externality:**

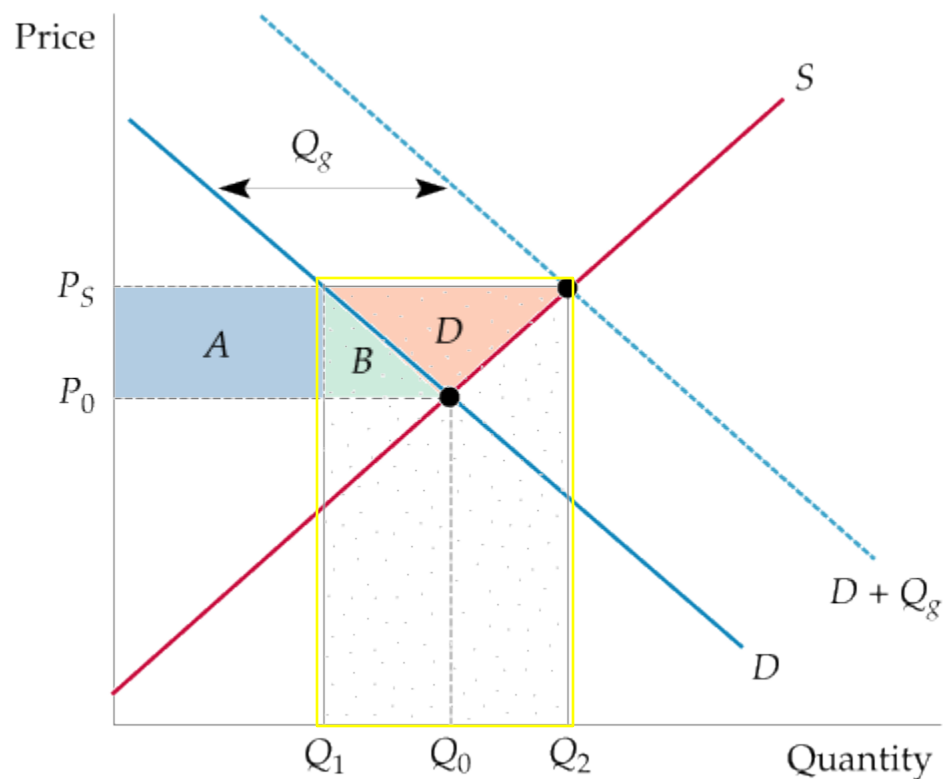
- Action taken by either a producer or a consumer which affects other producers or consumers but is not accounted for by the market price.

# 9.4

## PRICE SUPPORTS AND PRODUCTION QUOTAS

### 9.4.1. Price Supports

- Price set by government above free-market level and maintained by governmental purchases of excess supply.
- To maintain a price  $P_s$  above the market-clearing price  $P_0$ , the government buys a quantity  $Q_g$ .
- The gain to producers is  $A + B + D$ .  
The loss to consumers is  $A + B$ .
- The cost to the government is the speckled rectangle, the area of which is  $P_s(Q_2 - Q_1)$ .



$$\text{Total change in welfare: } \Delta CS + \Delta PS - \text{Cost to Govt.} = D - (Q_2 - Q_1)P_s$$

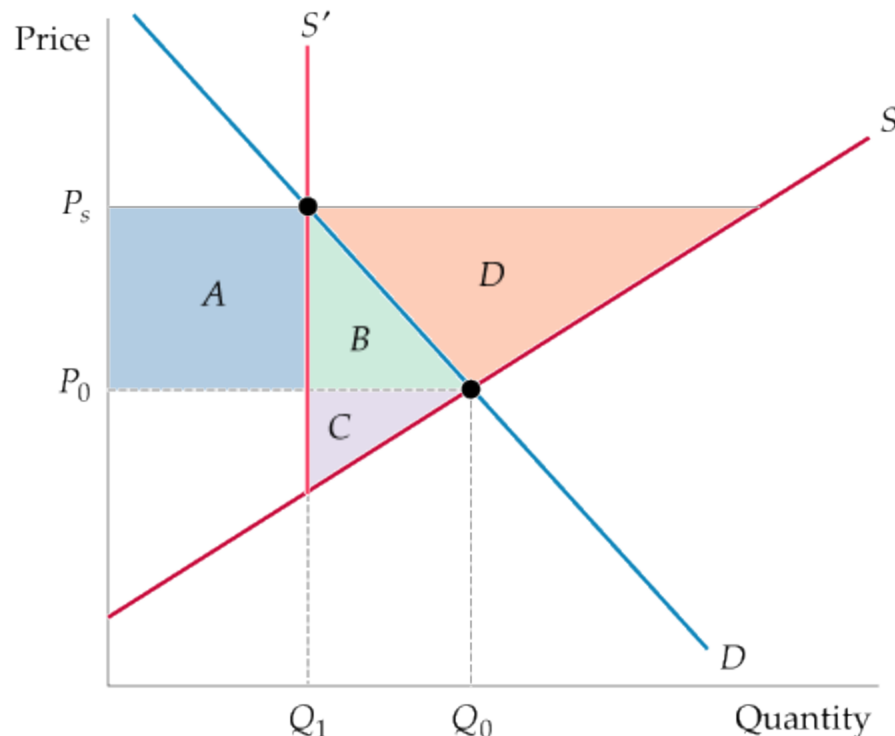
# 9.4

## PRICE SUPPORTS AND PRODUCTION QUOTAS

### 9.4.2. Production Quotas

#### Supply Restrictions

- To maintain a price  $P_s$  above the market-clearing price  $P_0$ , the government can restrict supply to  $Q_1$ , either by imposing production quotas (as with taxicab medallions) or by giving producers a financial incentive to reduce output (as with acreage limitations in agriculture).
- For an incentive to work, it must be at least as large as  $B + C + D$ , which would be the additional profit earned by planting, given the higher price  $P_s$ . The cost to the government is therefore at least  $B + C + D$ .



$$\Delta CS = -A - B$$

$$\Delta PS = A - C + \text{Payments for not producing}$$

$$\Delta \text{Welfare} = -A - B + A + B + D - B - C - D = -B - C$$

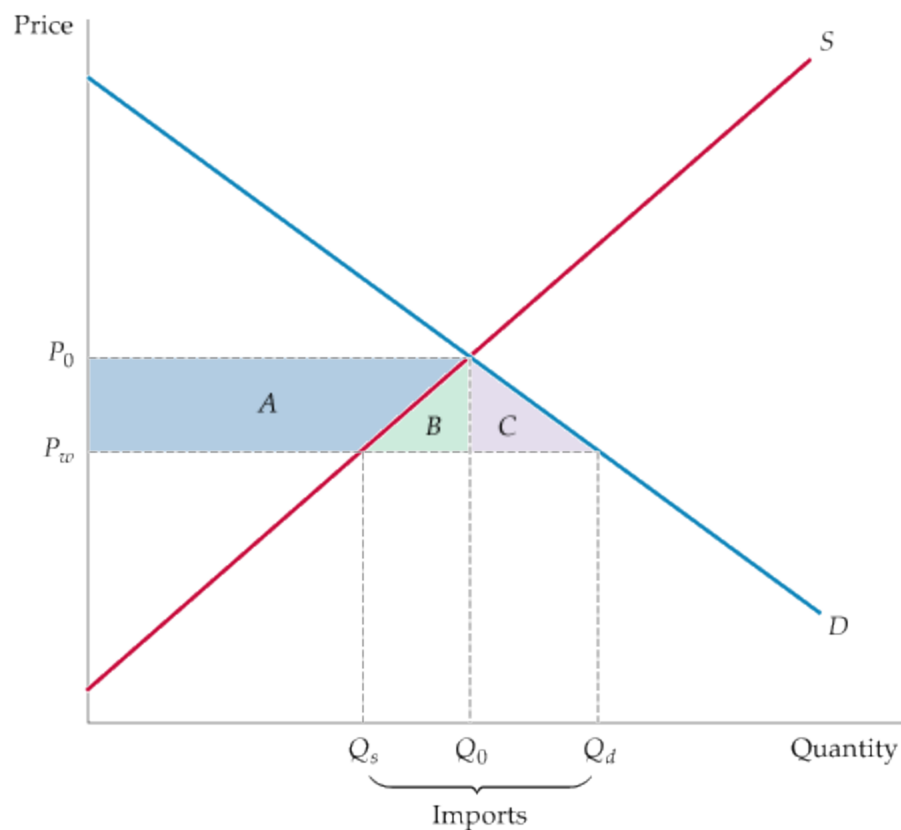
## 9.5 IMPORT QUOTAS AND TARIFFS

### Import Tariff or Quota That Eliminates Imports

**Import quota:** Limit on the quantity of a good that can be imported.

**Tariff:** Tax on an imported good.

- In a free market, the domestic price equals the world price  $P_w$ .
- A total  $Q_d$  is consumed, of which  $Q_s$  is supplied domestically and the rest imported.
- When imports are eliminated, the price is increased to  $P_0$ .
- The gain to producers is trapezoid  $A$ .
- The loss to consumers is  $A + B + C$ , so the deadweight loss is  $B + C$ .

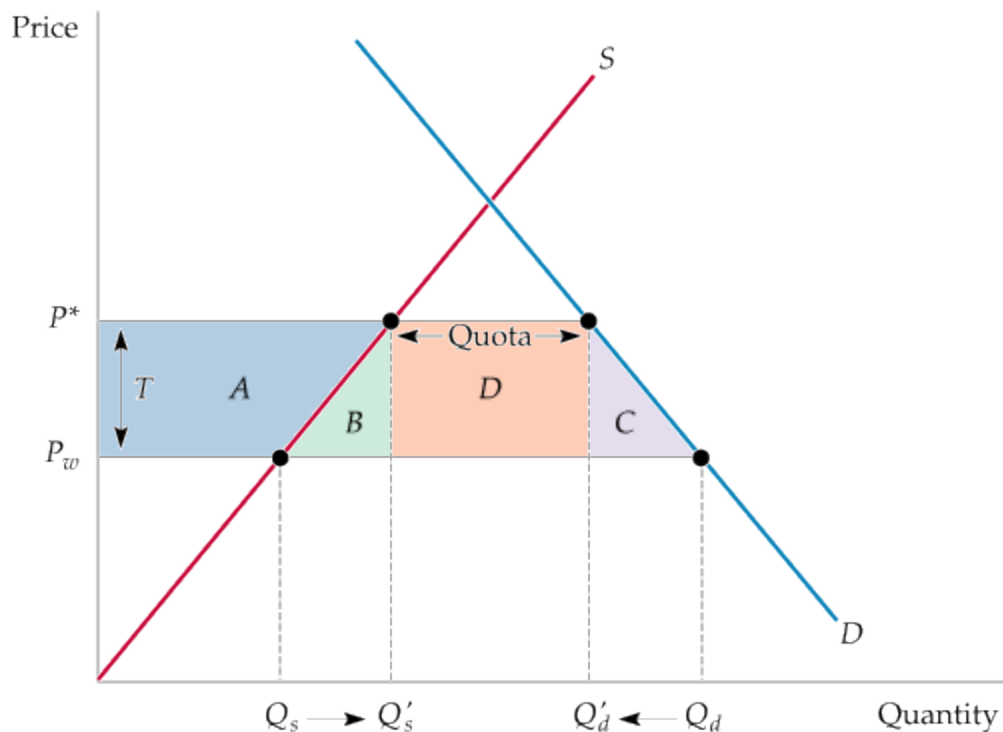


# 9.5

## IMPORT QUOTAS AND TARIFFS

### Import Tariff or Quota (General Case)

- When imports are reduced, the domestic price is increased from  $P_w$  to  $P^*$ .
- This can be achieved by a quota, or by a tariff  $T = P^* - P_w$ .
- Trapezoid  $A$  is again the gain to domestic producers.
- The loss to consumers is  $A + B + C + D$ .
- If a tariff is used, the government gains  $D$ , the revenue from the tariff. The net domestic loss is  $B + C$ .
- If a quota is used instead, rectangle  $D$  becomes part of the profits of foreign producers, and the net domestic loss is  $B + C + D$ .



# ECS2601 UNIT 10: MARKET POWER: MONOPOLY & MONOPSONY



# WHAT WE KNOW NOW?

10.1 Monopoly

10.2 Monopoly Power

10.3 Sources of Monopoly Power

10.4 The Social Costs of Monopoly Power



# RECAP: Comparisons of Industry Market Structures

Characteristics	Perfect Competition	Monopolistic Competition	Monopoly Monopsony	Oligopoly Oligopsony
Number of Buyers/Sellers (very large number, many, few, one)	Very large	Many	One	Few
Product Differentiation Very large # Many Few One (Homogeneous, Slightly Differentiated, Unique)	Homogenous	Slightly Differentiated	Unique	Homogeneous Or Differentiated
Ease of Entry/Exit (Easy, Relatively Easy, Difficult, Difficult, Closed)	Easy	Relatively Easy	Blocked or Closed	Difficult
Degree of Info Available to Competitors (Perfect, A lot, Limited, None)	Perfect	A Lot	None, unless Regulated	Limited
Influence on Price (yes or no)	No Is a Price Taker	Yes, But limited by Degree of Substitutes	Yes Price maker	Yes Price maker



---

# MARKET POWER: MONOPOLY AND MONOPSONY

## **Monopoly:**

Market with only one seller.

## **Monopsony:**

Market with only one buyer

## **Market power:**

Ability of a seller or buyer to affect the price of a good.

## 10.1 MONOPOLY

- **Key features or Characteristics**

1. One seller - many buyers
  2. One product (no good substitutes)
  3. Barriers to entry
  4. Price Maker
- The monopolist is the supply-side of the market and has complete control over the amount offered for sale
  - Monopolist **controls price** but must consider consumer demand
  - Profits will be maximized at the level of output where marginal revenue equals marginal cost:  $MR=MC$



## 10.1 MONOPOLY

- **Average Revenue and Marginal Revenue:**

The monopolist's **Average revenue**, price received per unit sold, is the **market demand curve**

**Marginal revenue** : Change in revenue resulting from a one-unit increase in output

Assume a monopolist with demand:  $P = 6 - Q$

**TABLE 10.1** Total, Marginal, and Average Revenue

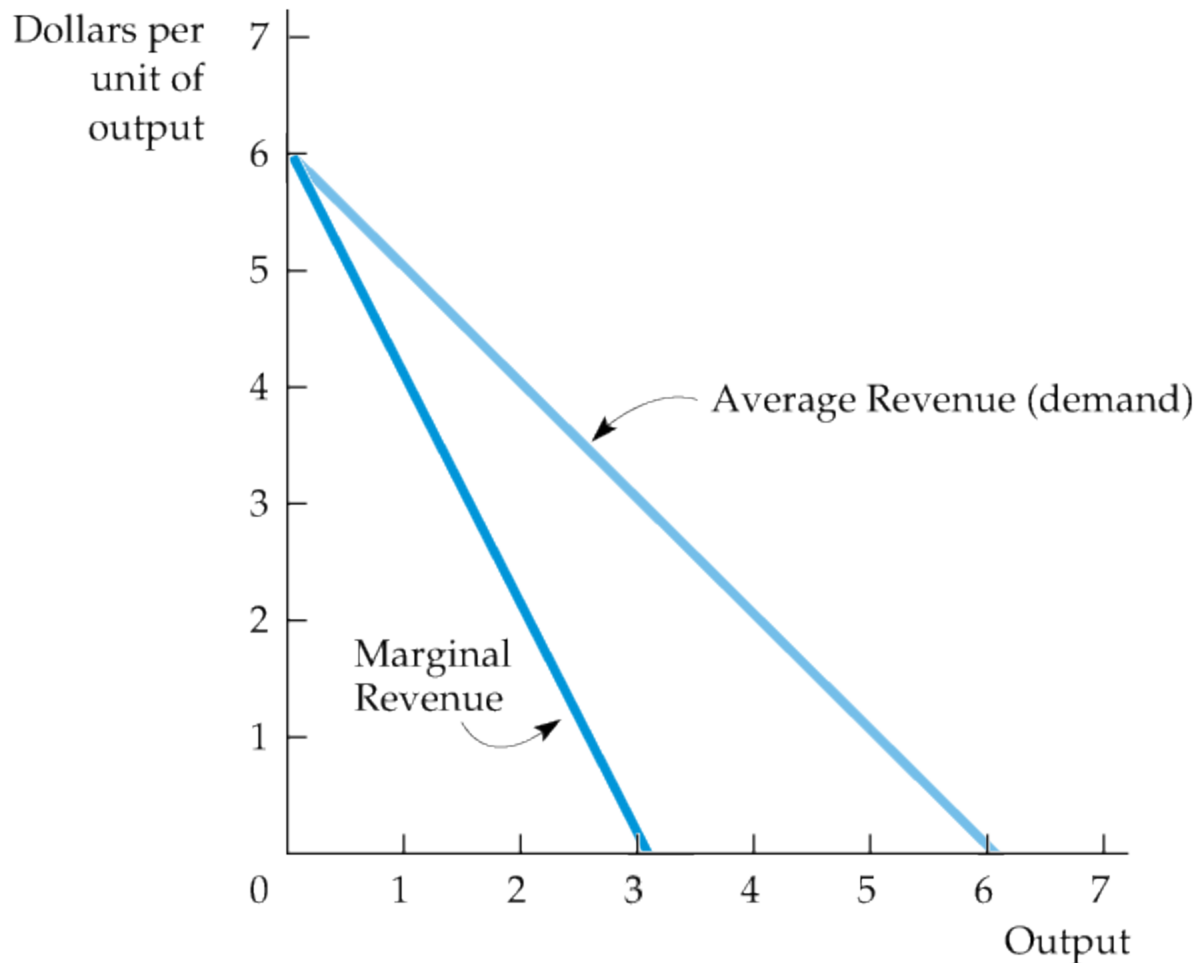
Price (P)	Quantity (Q)	Total Revenue (R)	Marginal Revenue (MR)	Average Revenue (AR)
\$6	0	\$0	---	---
5	1	5	\$5	\$5
4	2	8	3	4
3	3	9	1	3
2	4	8	-1	2
1	5	5	-3	1

- When the price is \$6, Revenue is zero and nothing is sold.
- At lower prices, revenue increases as quantity sold increases
- When demand is downward sloping, the price (average revenue) is greater than marginal revenue

✓ **For sales to increase, #Price must fall**

# 10.1 MONOPOLY

## Average and Marginal Revenue



Average and marginal revenue are shown for the demand curve  $P = 6 - Q$ .

### Observations

1. To increase sales the price must fall
2.  $MR < P$
3. Compared to perfect competition
  - No change in price to change sales
  - $MR = P$

## 10.1 MONOPOLY

- **The Monopolist's Output Decision**

$Q^*$  is the profit maximization output level.

Profit  $\pi$  is the difference between revenue and cost, both of which depend on  $Q$ :  $\pi(Q) = R(Q) - C(Q)$

Profit maximization function will be:

$$\Delta\pi / \Delta Q = \Delta R / \Delta Q - \Delta C / \Delta Q = 0$$

Thus the profit-maximizing condition is that

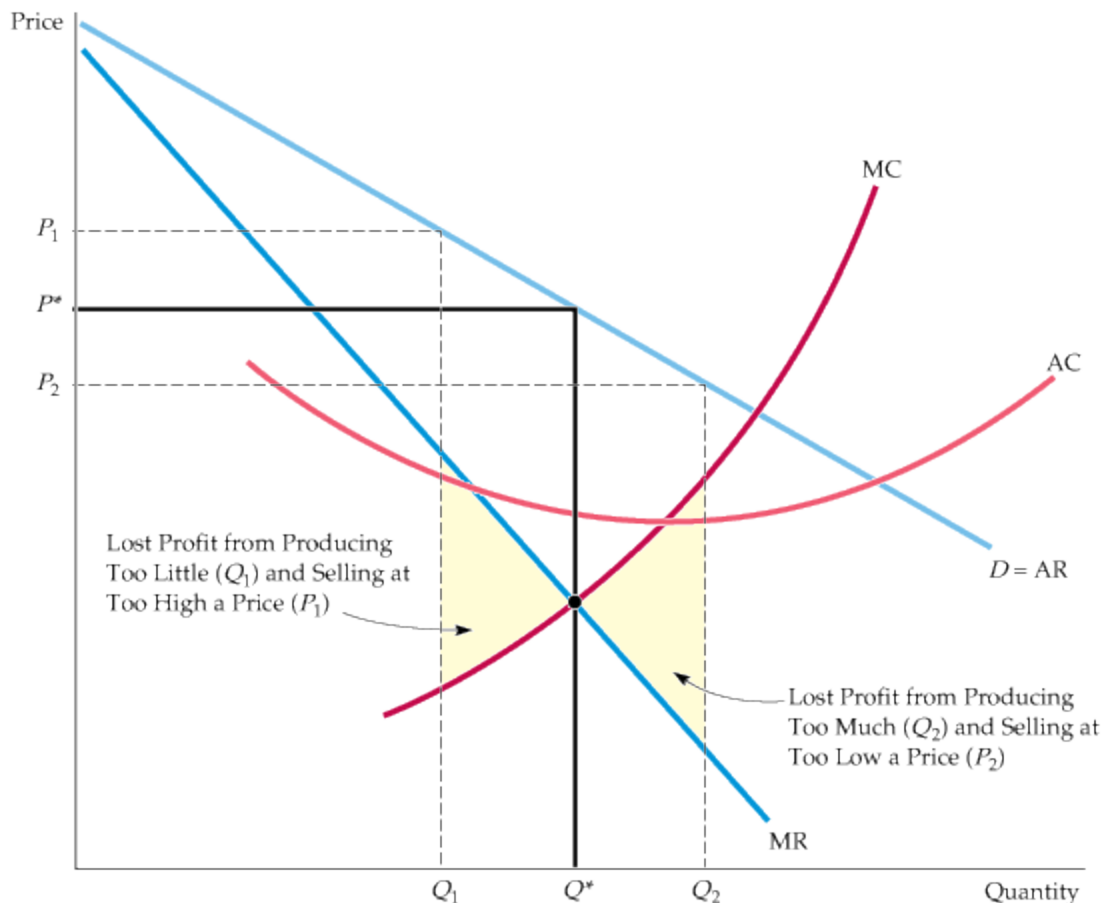
$$MR - MC = 0, \text{ or } MR = MC$$

# 10.1 MONOPOLY

## • The Monopolist's Output Decision

- $Q^*$  is the output level at which  $MR = MC$ .
- If the firm produces a smaller output—say,  $Q_1$ —it sacrifices some profit because the extra revenue that could be earned from producing and selling the units between  $Q_1$  and  $Q^*$  **exceeds the cost of producing them**.
- Similarly, expanding output from  $Q^*$  to  $Q_2$  would reduce profit because the **additional cost would exceed the additional revenue**.

Profit Is Maximized When  $MR=MC$



At output levels **below**  $MR = MC$ , the decrease in revenue is greater than the decrease in cost ( $MR > MC$ )

At output levels **above**  $MR = MC$ , the increase in cost is greater than the decrease in revenue ( $MR < MC$ )

# 10.1 MONOPOLY

## Example of Profit Maximization

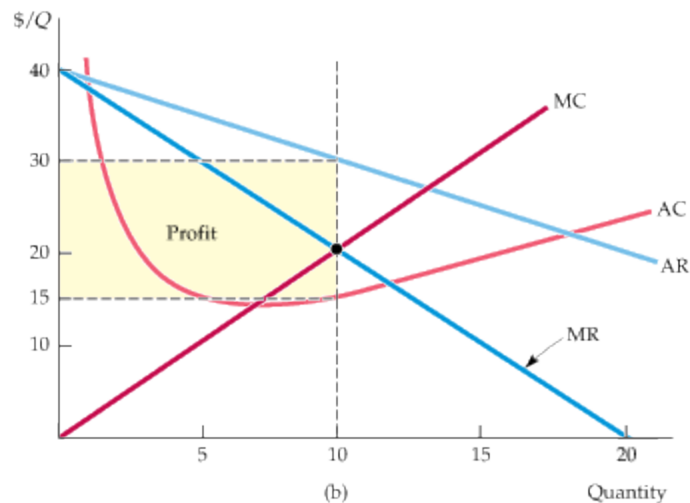
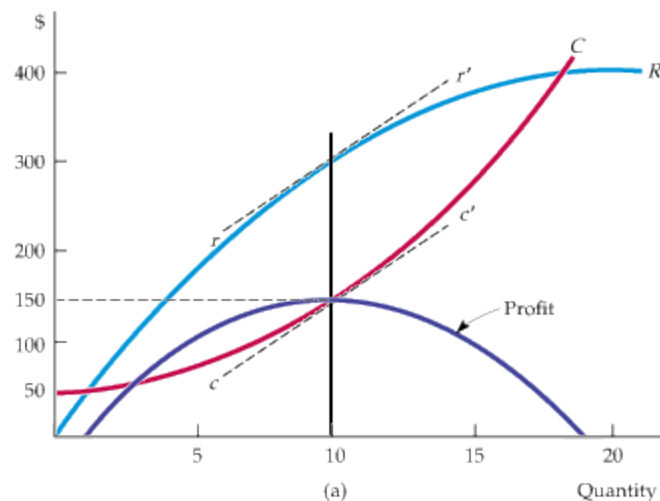
Part (a) shows total revenue  $R$ , total cost  $C$ , and profit, the difference between the two.

Part (b) shows average and marginal revenue and average and marginal cost.

When profits are maximized, slope of  $rr'$  and  $cc'$  are equal:  $MR=MC$

$Q^* = 10$  is the profit-maximizing output, the point where  $MR=MC$

- The profit per unit is \$15, the difference between average revenue and average cost.
- Because 10 units are produced, Profit =  $(P - AC) \times Q = (\$30 - \$15)(10) = \$150$



# 10.1 MONOPOLY

## Shifts in Demand

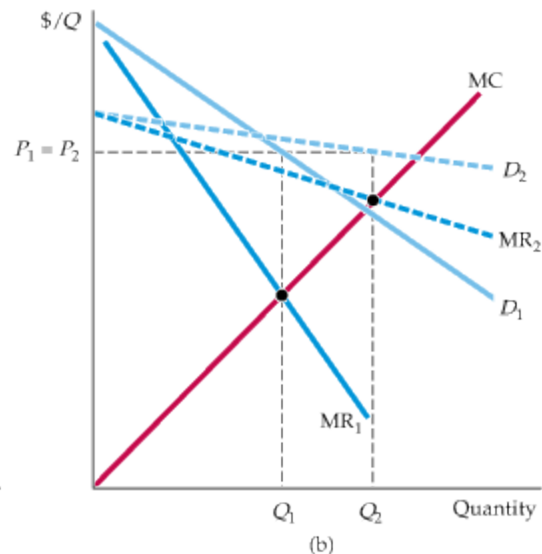
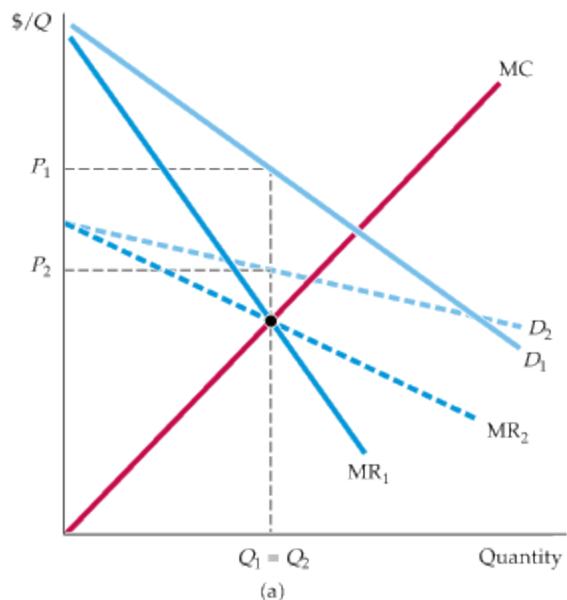
Shifting the demand curve shows that a monopolistic market has no supply curve—i.e., there is no one-to-one relationship between price and quantity produced.

### Shift in demand leads to change in price but same quantity:

- In (a), the demand curve  $D_1$  shifts to new demand curve  $D_2$ . But the new marginal revenue curve  $MR_2$  intersects marginal cost at the same point as the old marginal revenue curve  $MR_1$ .
- The profit-maximizing output therefore remains the same, although price falls from  $P_1$  to  $P_2$ .

### Shift in demand leads to change in quantity but same price

- In (b), the new marginal revenue curve  $MR_2$  intersects marginal cost at a higher output level  $Q_2$ .
- But because demand is now more elastic, price remains the same.



### Shifts in demand lead to

- Changes in price with no change in output
- Changes in output with no change in price
- Changes in both price and quantity

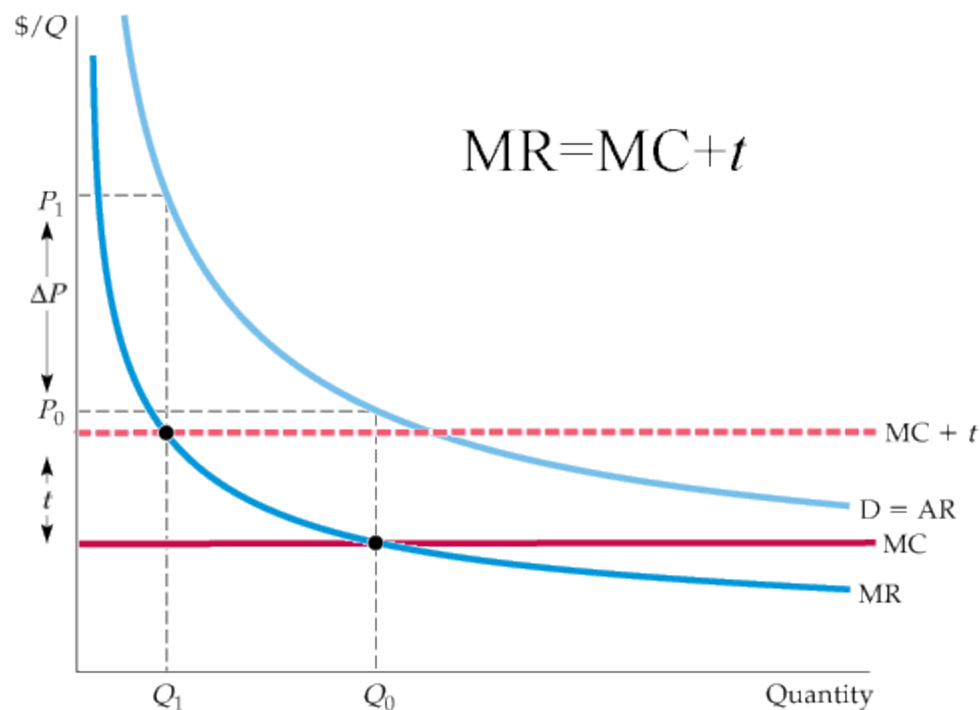


# 10.1 MONOPOLY

## Effect of Excise Tax on Monopolist

In competitive market, a per-unit tax causes price to rise by less than tax: burden is shared by producers and consumers. Under monopoly, price can sometimes rise by more than the amount of the tax.

- Assume a tax  $t$  per unit, the firm's effective marginal cost is increased by the amount  $t$  to  $MC + t$ .
- In this example, the increase in price  $\Delta P$  is larger than the tax  $t$ . Increase in  $P$ :  $P_0$  to  $P_1 > \text{tax}$
- The amount the price increases with implementation of a tax **depends on elasticity of demand**
- Price may or may not increase by more than the tax
- In a competitive market, the price cannot increase by more than tax
- **Profits for monopolist will fall with a tax**



# 10.1

## MONOPOLY

### The Multiplant Firm

Suppose a firm has two plants. What should its total output be, and how much of that output should each plant produce?

For some firms, production takes place in more than one plant, each with different costs. Firm must determine how to distribute production between both plants

- 1. Production should be split so that the MC in the plants is the same*
- 2. Output is chosen where  $MR=MC$ . Profit is therefore maximized when  $MR=MC$  at each plant.*

## 10.1 MONOPOLY

### The Multiplant Firm

We can also derive this result algebraically. Let  $Q_1$  and  $C_1$  be the output and cost of production for Plant 1,  $Q_2$  and  $C_2$  be the output and cost of production for Plant 2, and  $Q_T = Q_1 + Q_2$  be total output. Then profit is

$$\pi = PQ_T - C_1(Q_1) - C_2(Q_2)$$

Firm should increase output from each plant until the additional profit from last unit produced at Plant 1 equals 0

$$\frac{\Delta\pi}{\Delta Q_1} = \frac{\Delta(PQ_T)}{\Delta Q_1} - \frac{\Delta C_1}{\Delta Q_1} = 0$$

is *marginal cost* at  
Plant 1,  $MC_1$

$$MR - MC_1 = 0$$

$$MR = MC_1$$

# 10.1

## MONOPOLY

### The Multiplant Firm

Similarly, we can set incremental profit from output at Plant 2 to zero,

$$MR=MC_2$$

Putting these relations together, we see that the firm should produce so that

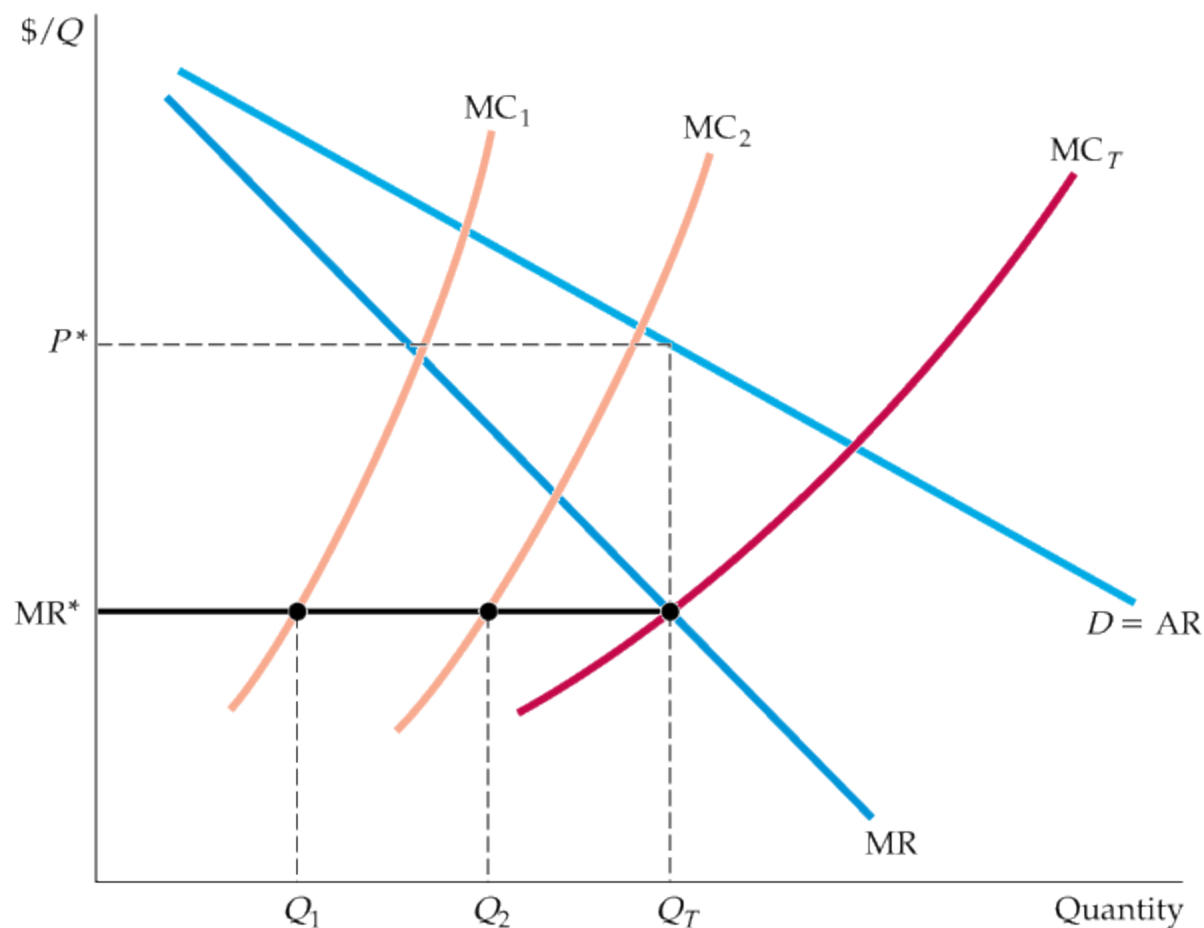
$$MR=MC_1=MC_2$$

# 10.1 MONOPOLY

## The Multiplant Firm

### Production with Two Plants

A firm with two plants maximizes profits by choosing output levels  $Q_1$  and  $Q_2$  such that marginal revenue  $MR$  (which depends on *total* output) equals marginal costs for each plant,  $MC_1$  and  $MC_2$ .



## 10.2 MONOPOLY POWER

- Pure monopoly is rare
- However, a market with several firms, each facing a **downward sloping demand curve**, will produce so that price exceeds marginal cost
- Firms often product similar goods that have some differences, thereby differentiating themselves from other firms
- **Example: Toothbrush manufacturers**

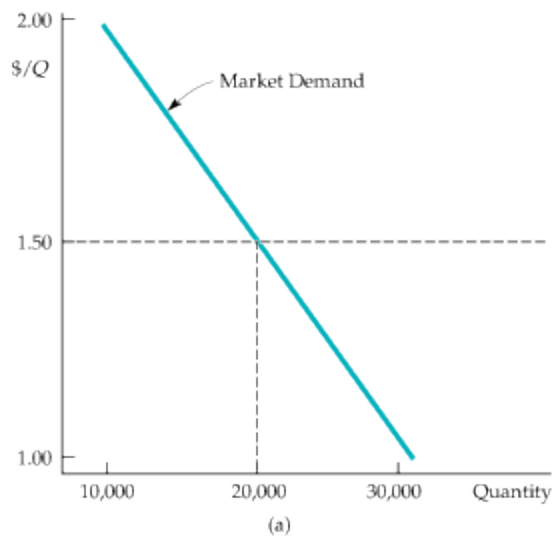
## 10.2 MONOPOLY POWER

### Example: The Demand for Toothbrushes

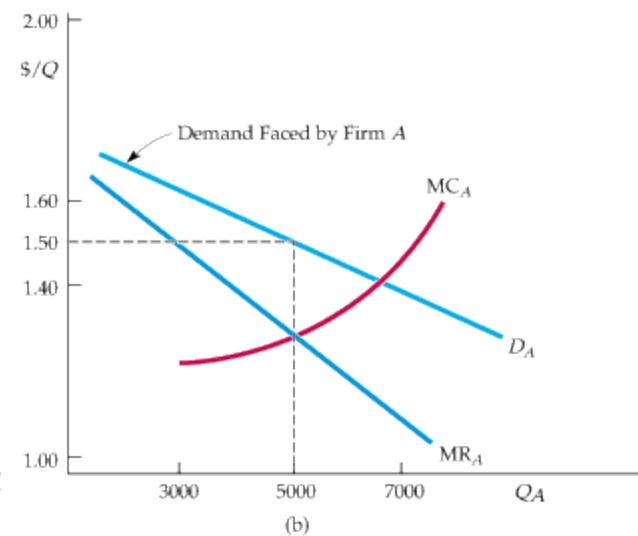
Part (a) shows the market demand for toothbrushes.

- At a market price of \$1.50, elasticity of market demand is  $-1.5$ .
- At a price of \$1.50, Firm A's demand elasticity is  $-6$ .

Although Firm A is not a pure monopolist, they have monopoly power: Its profit-maximizing price is \$1.50, which exceeds marginal cost.



Part (b) shows the demand for toothbrushes as seen by Firm A.



At a market price of \$1.50, elasticity of demand is  $-1.5$ .

Firm A has some monopoly power and charges a price which exceeds  $MC$  :  $P > MC$  where  $MR = MC$

## 10.2 MONOPOLY POWER

### • Measuring Monopoly Power

- *How can we measure monopoly power to compare firms?*
- *What are the sources of monopoly power?*
- *Why do some firms have more than others?*

Is important to remember the distinction between a perfectly competitive firm and a firm with monopoly power:

- *For the competitive firm,  $P=MC$ ;*
- *for the firm with monopoly power,  $P>MC$ .*

Monopoly power can be measured by the extent to which price is greater than MC for each firm:

#### **Lerner Index of Monopoly Power:**

Measure of monopoly power calculated as excess of price over marginal cost as a fraction of price.

$$L = (P - MC) / P$$

This index can also be expressed in terms of the elasticity of demand facing the firm.

$$L = (P - MC) / P = -1 / E_d$$

$E_d$  is elasticity of demand for a firm, not the market



## 10.3 SOURCES OF MONOPOLY POWER

### 1) The Elasticity of Market Demand

- If there is only one firm—a pure monopolist—its demand curve is the market demand curve.
- Because the demand for oil is **fairly inelastic** (at least in the short run), OPEC could raise oil prices far above marginal production cost (during the 1970s and early 1980s).
- Because the demands for such commodities as coffee, cocoa, tin, and copper **are much more elastic**, attempts by producers to cartelize these markets and raise prices have largely failed.
- In each case, the elasticity of market demand limits the potential monopoly power of individual producers.**

## 10.3 SOURCES OF MONOPOLY POWER

### 2) The Number of Firms

When only a few firms account for most of the sales in a market, we say that the market is highly *concentrated*.

- **barrier to entry** Condition that impedes entry by new competitors.

## 10.3 SOURCES OF MONOPOLY POWER

### 3) The Interaction Among Firms

- Firms might compete aggressively, undercutting one another's prices to capture more market share.
- This could drive prices down to nearly competitive levels.
- Firms might even collude (in violation of the antitrust laws), agreeing to limit output and raise prices.
- Because raising prices in concert rather than individually is more likely to be profitable, collusion can generate substantial monopoly power.

## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

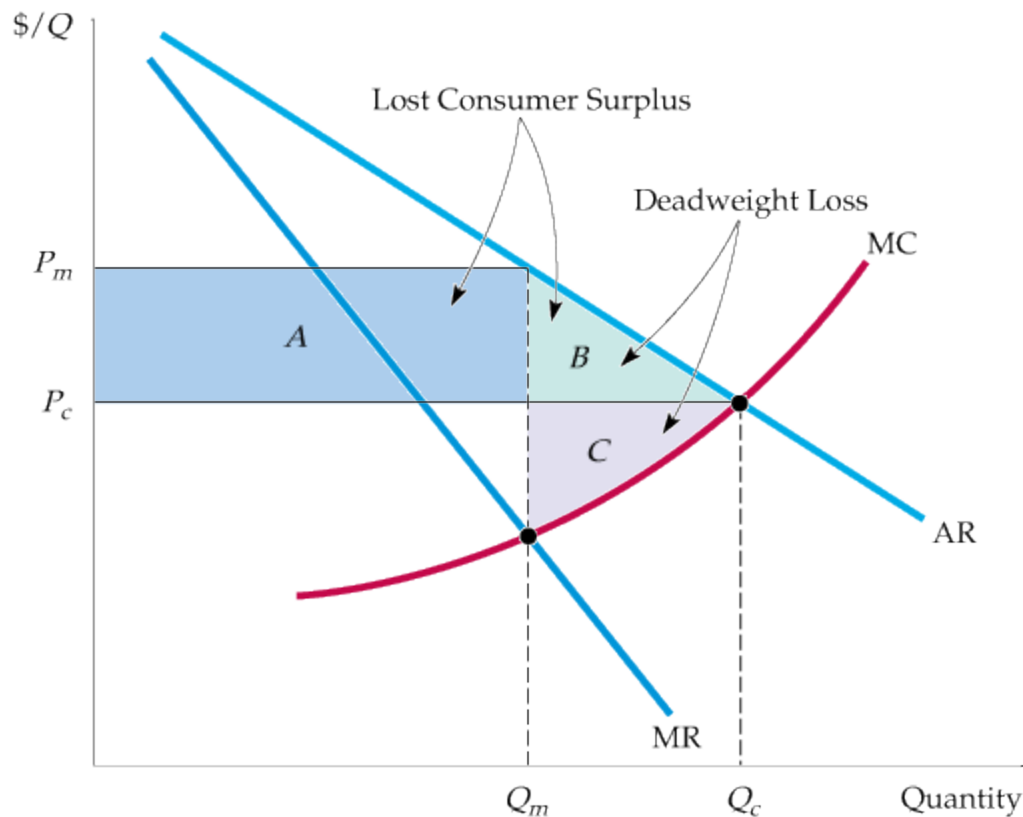
### Deadweight Loss from Monopoly Power

The shaded rectangle and triangles show changes in consumer and producer surplus when moving

- from competitive price and quantity,  $P_c$  and  $Q_c$ ,
- to a monopolist's price and quantity,  $P_m$  and  $Q_m$ .

Because of the higher price,

- consumers lose  $A + B$
- and producer gains  $A - C$ .
- The deadweight loss is  $B + C$ .



## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

### a) Rent Seeking

- **rent seeking** Spending money in socially unproductive efforts to acquire, maintain, or exercise monopoly.

In 1996, the Archer Daniels Midland Company (ADM) successfully lobbied the Clinton administration for regulations requiring that the ethanol (ethyl alcohol) used in motor vehicle fuel be produced from corn.

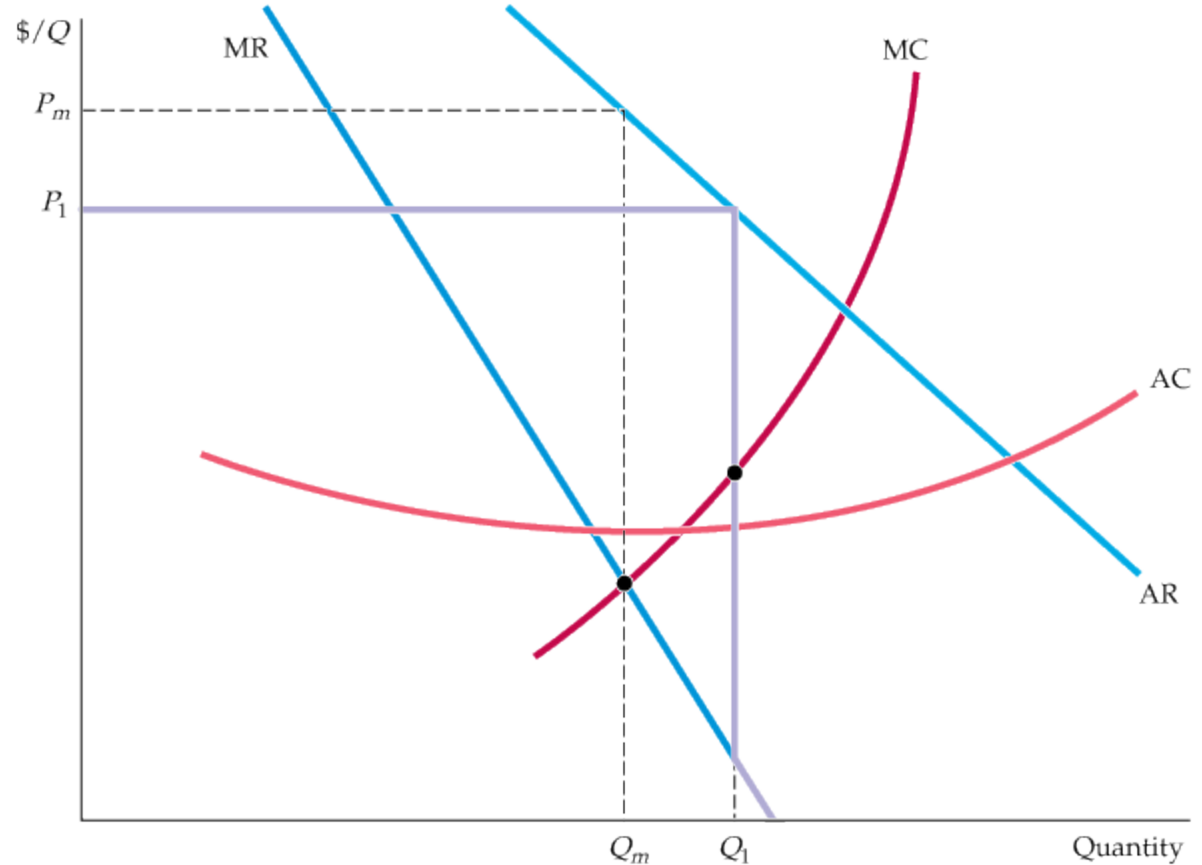
Why? Because ADM had a near monopoly on corn-based ethanol production, so the regulation would increase its gains from monopoly power.

## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

### b) Price Regulation

#### Price Regulation

- If left alone, a monopolist produces  $Q_m$  and charges  $P_m$ .
- When the government imposes a price ceiling of  $P_1$  the firm's average and marginal revenue are constant and equal to  $P_1$  for output levels up to  $Q_1$ .
- For larger output levels, the original average and marginal revenue curves apply.
- The new marginal revenue curve is, therefore, the dark purple line, which intersects the marginal cost curve at  $Q_1$ .



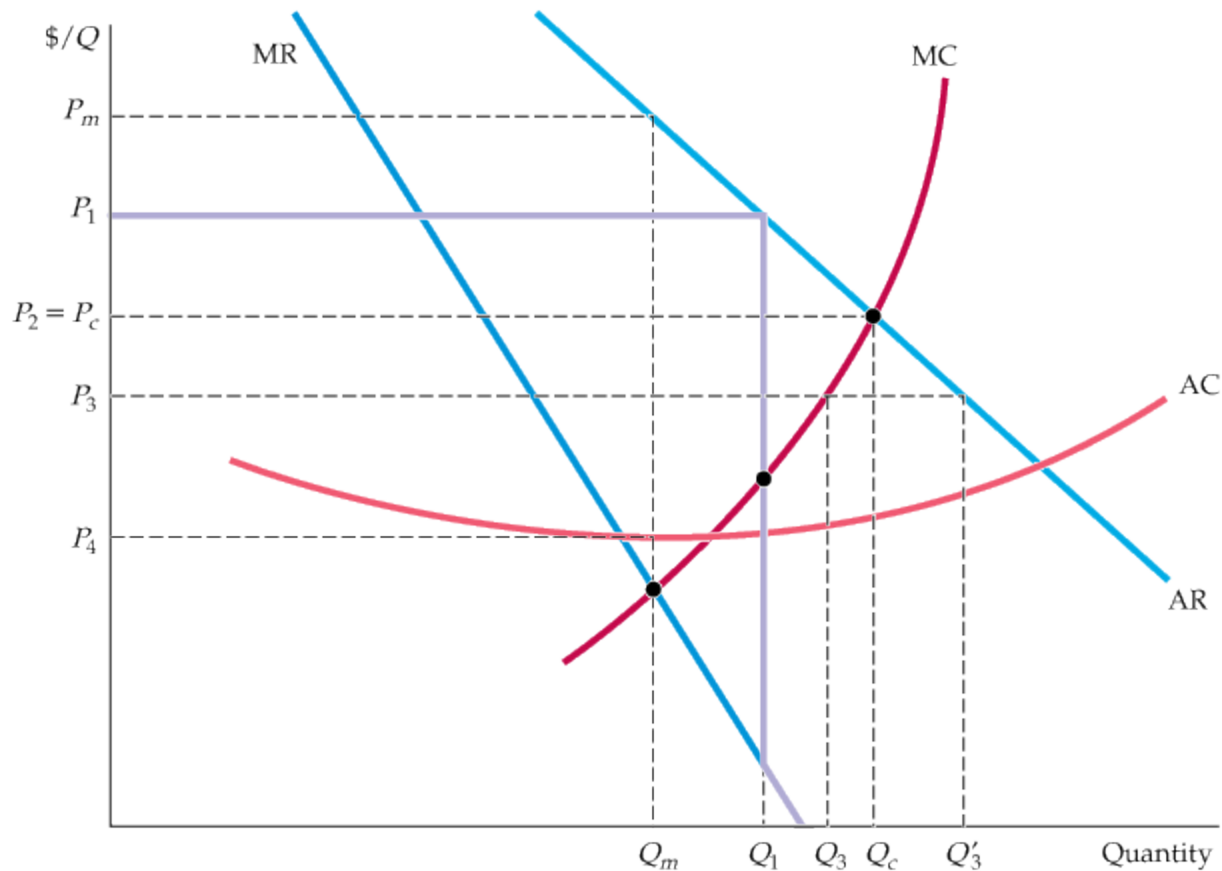
## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

### b) Price Regulation

#### Price Regulation

When price is lowered to  $P_c$ , at the point where marginal cost intersects average revenue, output increases to its maximum  $Q_c$ . This is the output that would be produced by a competitive industry.

Lowering price further, to  $P_3$  reduces output to  $Q_3$  and causes a shortage,  $Q'_3 - Q_3$ .



## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

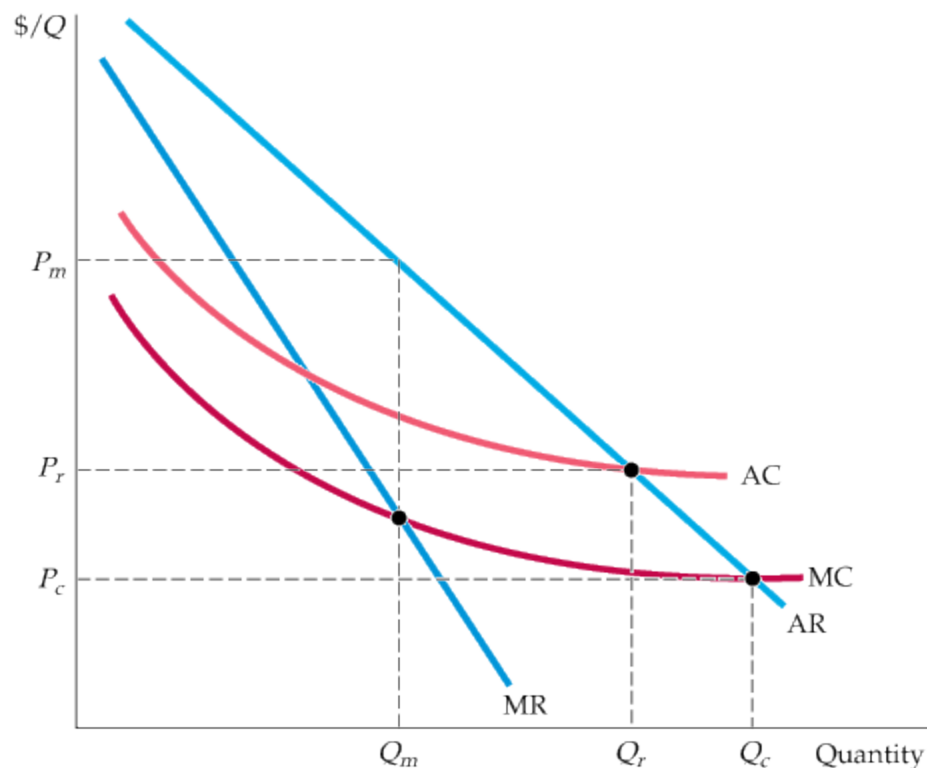
### c) Natural Monopoly

#### • Natural monopoly

*Firm that can produce the entire output of the market at a cost lower than what it would be if there were several firms.*

#### Regulating the Price of a Natural Monopoly

- A firm is a natural monopoly because it has economies of scale (declining average and marginal costs) over its entire output range.
- If price were regulated to be  $P_c$  the firm would lose money and go out of business.
- Setting the price at  $P_r$  yields the largest possible output consistent with the firm's remaining in business; excess profit is zero.





## 10.4 THE SOCIAL COSTS OF MONOPOLY POWER

### d) Regulation in Practice

- **Rate-of-return regulation**

*Maximum price allowed by a regulatory agency is based on the (expected) rate of return that a firm will earn.*

- ❑ The difficulty of agreeing on a set of numbers to be used in rate-of-return calculations often leads to delays in the regulatory response to changes in cost and other market conditions.
- ❑ The net result is *regulatory lag*—the delays of a year or more usually entailed in changing regulated prices.

DON'T  
FORGET

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# UNIT 11: PRICING WITH MARKET POWER



# Learning outcome

- a) Explain why and how consumer surplus is captured
- b) Discuss how price discrimination is used to capture consumer surplus
- c) Discuss the use of advertising by firms

# FOCUS AREAS

11.1 Capturing Consumer Surplus

11.2 Price Discrimination

11.5 Advertising

# 11.1 CAPTURING CONSUMER SURPLUS

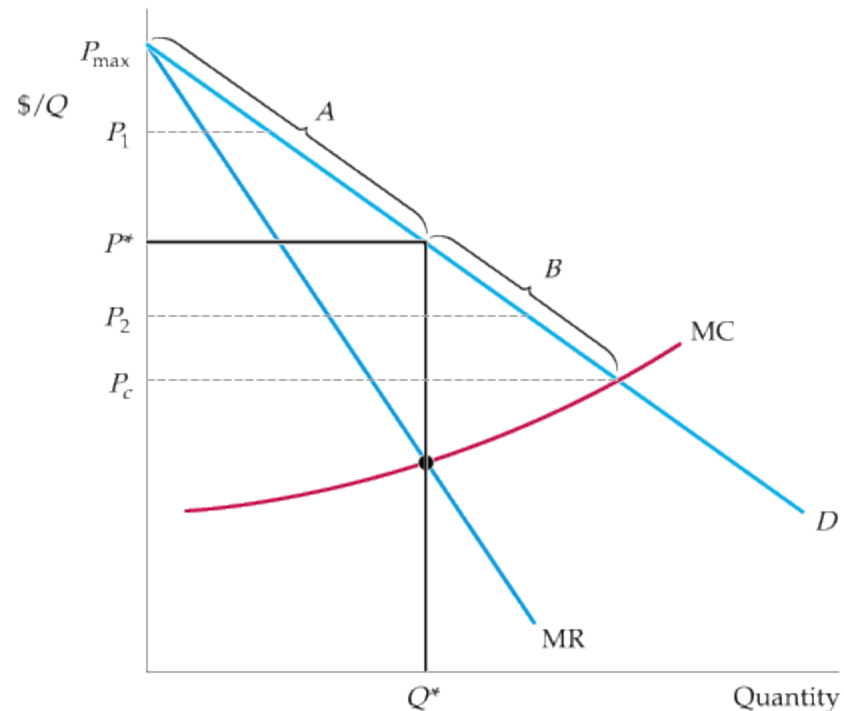
## Capturing Consumer Surplus

If a firm can charge only one price for all its customers, that price will be  $P^*$  and the quantity produced will be  $Q^*$ .

Ideally, the firm would like to charge a higher price to consumers willing to pay more than  $P^*$ , thereby capturing some of the consumer surplus under region *A* of the demand curve.

The firm would also like to sell to consumers willing to pay prices lower than  $P^*$ , but only if doing so does not entail lowering the price to other consumers.

In that way, the firm could also capture some of the surplus under region *B* of the demand curve.



**Price discrimination:** Practice of charging different prices to different consumers for similar goods.

## 11.2 PRICE DISCRIMINATION

### First-Degree Price Discrimination

- Practice of charging each customer her reservation price.
- *Reservation price*: Maximum price that a customer is willing to pay for a good.

### Second-Degree Price Discrimination

- Practice of charging different prices per unit for different quantities of the same good or service
- *block pricing*: Practice of charging different prices for different quantities or “blocks” of a good.

### Third-Degree Price Discrimination

- Practice of dividing consumers into two or more groups with separate demand curves and charging different prices to each group.

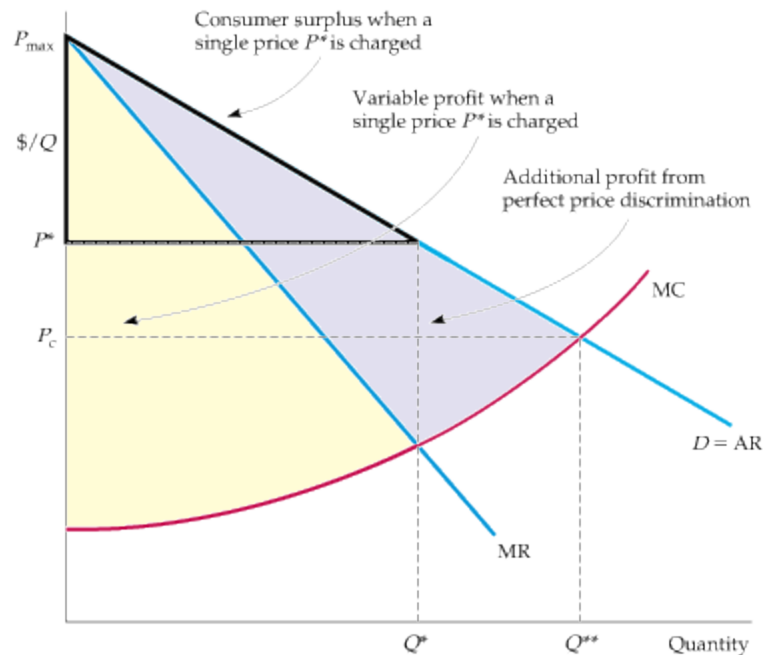
## 11.2 PRICE DISCRIMINATION

### First-Degree Price Discrimination

- **first-degree price discrimination** Practice of charging each customer her reservation price.
- **Reservation price:** Maximum price that a customer is willing to pay for a good.

#### Additional Profit from Perfect First-Degree Price Discrimination

- Because the firm charges each consumer her reservation price, it is profitable to expand output to  $Q^{**}$ .
- When only a single price,  $P^*$ , is charged, the firm's variable profit is the area between the marginal revenue and marginal cost curves.
- With perfect price discrimination, this profit expands to the area between the demand curve and the marginal cost curve.



**Variable profit:** Sum of profits on each incremental unit produced by a firm; i.e., profit ignoring fixed costs.



## 11.2 PRICE DISCRIMINATION

### First-Degree Price Discrimination

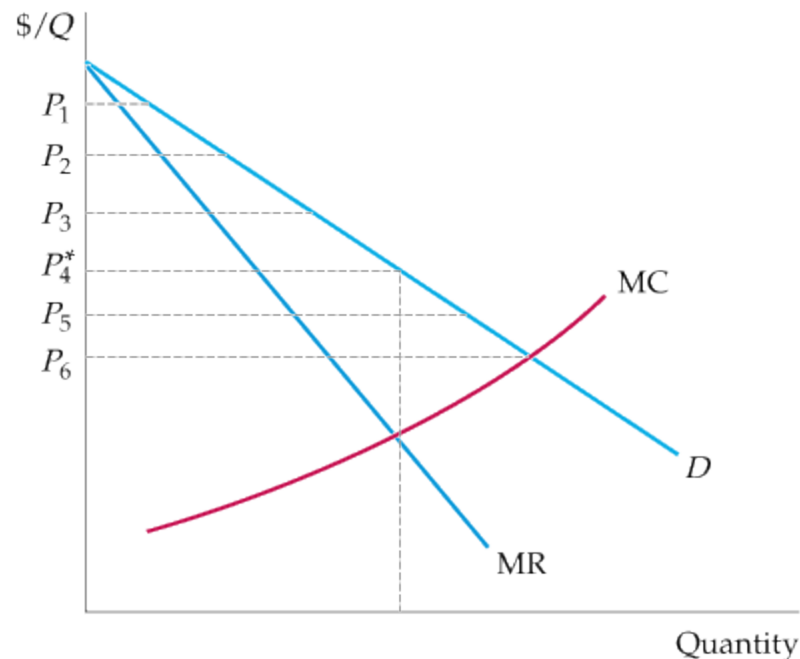
#### Perfect Price Discrimination

*The additional profit from producing and selling an incremental unit is now the difference between demand and marginal cost.*

#### Imperfect Price Discrimination

##### First-Degree Price Discrimination in Practice

- Firms usually don't know the reservation price of every consumer, but sometimes reservation prices can be roughly identified.
- Here, six different prices are charged. The firm earns higher profits, but some consumers may also benefit.
- With a single price  $P_4^*$ , there are fewer consumers.
- The consumers who now pay  $P_5$  or  $P_6$  enjoy a surplus.



## 11.2 PRICE DISCRIMINATION

### Second-Degree Price Discrimination

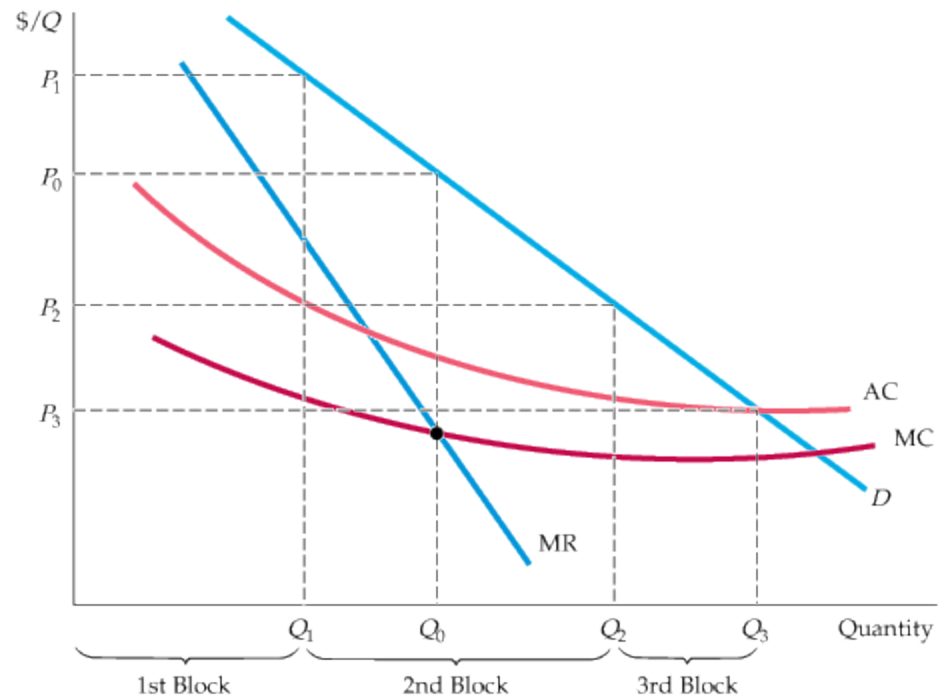
- ❖ **second-degree price discrimination** Practice of charging different prices per unit for different quantities of the same good or service.
- ❖ **block pricing** Practice of charging different prices for different quantities or “blocks” of a good.

#### Second-Degree Price Discrimination

Different prices are charged for different quantities, or “blocks,” of the same good. Here, there are three blocks, with corresponding prices  $P_1$ ,  $P_2$ , and  $P_3$ .

There are also economies of scale, and average and marginal costs are declining.

Second-degree price discrimination can then make consumers better off by expanding output and lowering cost.



## 11.2 PRICE DISCRIMINATION

### Third-Degree Price Discrimination

Practice of dividing consumers into two or more groups with separate demand curves and charging different prices to each group.

#### Creating Consumer Groups

If third-degree price discrimination is feasible, how should the firm decide what price to charge each group of consumers?

1. We know that however much is produced, total output should be divided between the groups of customers so that marginal revenues for each group are equal.
2. We know that *total* output must be such that the marginal revenue for each group of consumers is equal to the marginal cost of production.

## 11.2 PRICE DISCRIMINATION

### Third-Degree Price Discrimination

#### Creating Consumer Groups

$$\pi = P_1 Q_1 + P_2 Q_2 - C(Q_T)$$

$$\frac{\Delta \pi}{\Delta Q_1} = \frac{\Delta(P_1 Q_1)}{\Delta Q_1} - \frac{\Delta C}{\Delta Q_1} = 0$$

$$MR_1 = MC$$

$$MR_2 = MC$$

$$MR_1 = MR_2 = MC$$

#### Determining Relative Prices

$$MR = P(1 + 1/E_d)$$

$$\frac{P_1}{P_2} = \frac{(1 + 1/E_2)}{(1 + 1/E_1)}$$

## 11.2 PRICE DISCRIMINATION

### Third-Degree Price Discrimination

#### Third-Degree Price Discrimination

Consumers are divided into two groups, with separate demand curves for each group.

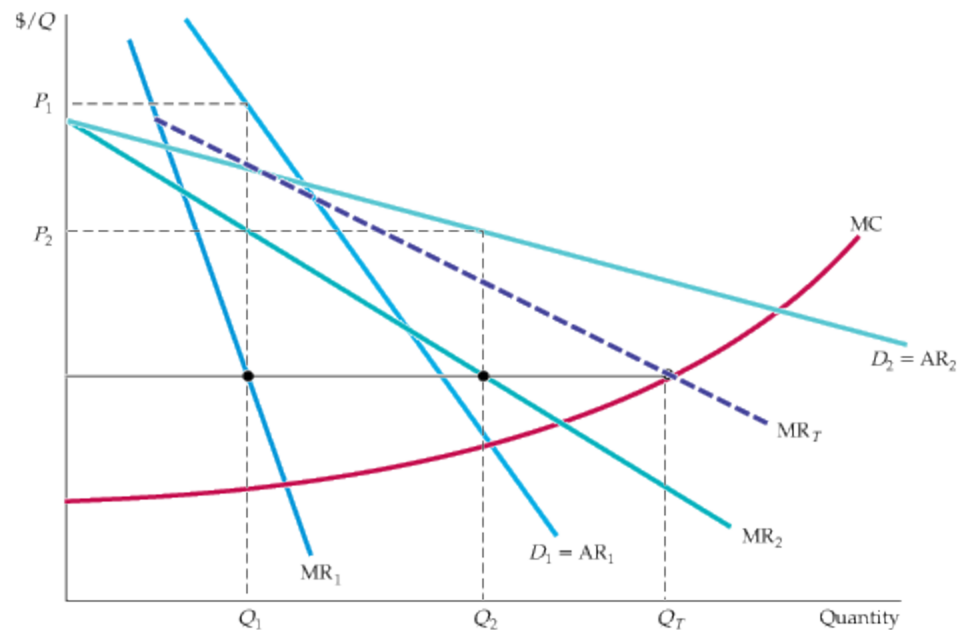
The optimal prices and quantities are such that the marginal revenue from each group is the same and equal to marginal cost.

Here group 1, with demand curve  $D_1$ , is charged  $P_1$ ,

and group 2, with the more elastic demand curve  $D_2$ , is charged the lower price  $P_2$ .

Marginal cost depends on the total quantity produced  $Q_T$ .

Note that  $Q_1$  and  $Q_2$  are chosen so that  $MR_1 = MR_2 = MC$ .



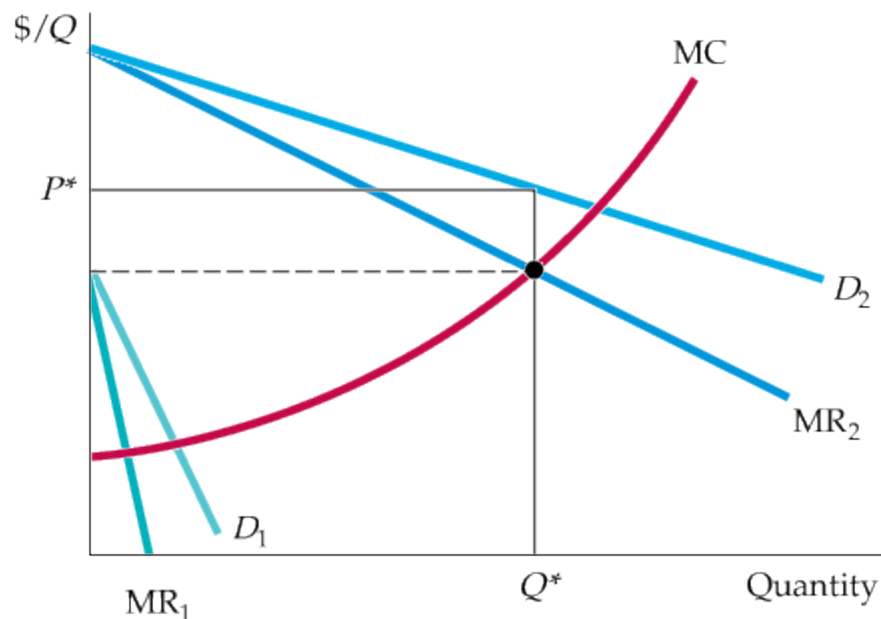
## 11.2 PRICE DISCRIMINATION

### Third-Degree Price Discrimination

#### Determining Relative Prices

##### No Sales to Smaller Market

- Even if third-degree price discrimination is feasible, it may not pay to sell to both groups of consumers if marginal cost is rising.
- Here the first group of consumers, with demand  $D_1$ , are not willing to pay much for the product.
- It is unprofitable to sell to them because the price would have to be too low to compensate for the resulting increase in marginal cost.



# 11.5 ADVERTISING

## Effects of Advertising

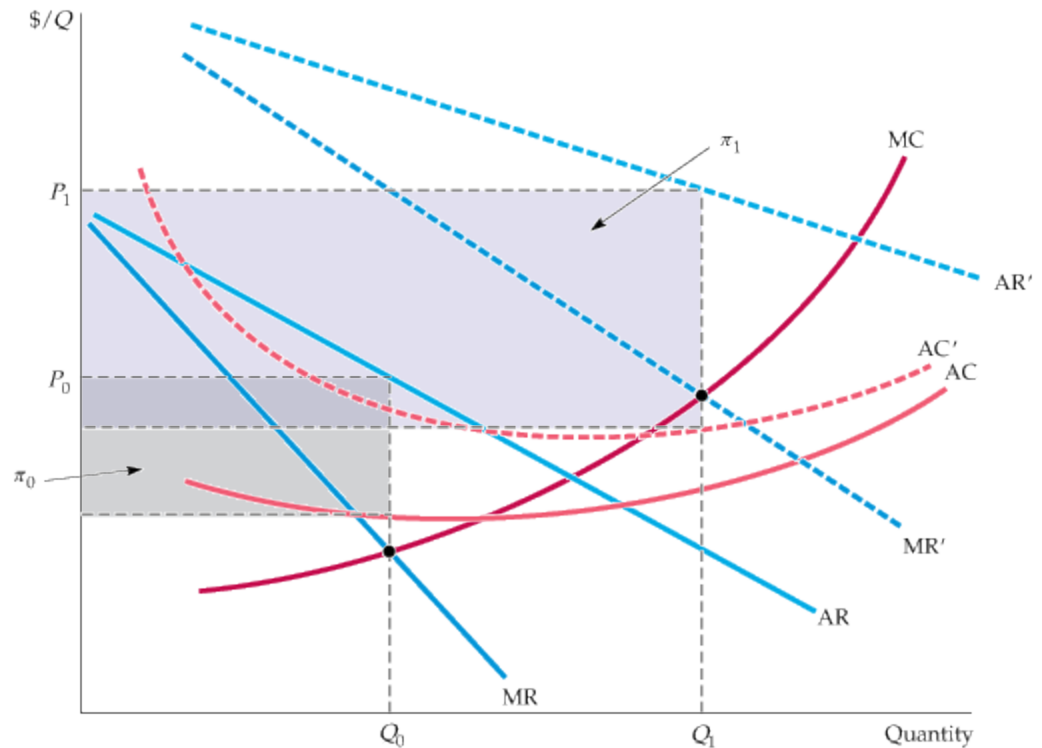
AR and MR are average and marginal revenue when the firm doesn't advertise, and AC and MC are average and marginal cost.

The firm produces  $Q_0$  and receives a price  $P_0$ .

Its total profit  $\pi_0$  is given by the gray-shaded rectangle.

If the firm advertises, its average and marginal revenue curves shift to the right.

- Average cost rises (to  $AC'$ ) but marginal cost remains the same.
- The firm now produces  $Q_1$  (where  $MR' = MC$ ), and receives a price  $P_1$ .
- Its total profit,  $\pi_1$ , is now larger.



$$\pi = PQ(P, A) - C(Q) - A$$

## 11.5

## ADVERTISING

The price  $P$  and advertising expenditure  $A$  to maximize profit, is given by:

$$\pi = PQ(P, A) - CQ - A$$

*Advertising leads to increased output.*

- But increased output in turn **means increased production costs**, and this must be taken into account when comparing the costs and benefits of an extra dollar of advertising.

The firm should therefore, advertise up to the point where:

$$\begin{aligned} \text{MR}_{\text{Ads}} &= P \frac{\Delta Q}{\Delta A} = 1 + \text{MC} \frac{\Delta Q}{\Delta A} \\ &= \textit{full marginal cost of advertising} \end{aligned}$$



# UNIT 12: MONOPOLISTIC COMPETITION AND OLIGOPOLY



## **WE SHOULD BE ABLE TO DEFINE AND EXPLAIN/ DESCRIBE**

12.1 Monopolistic Competition

12.2 Oligopoly market structure

12.3 Price Competition

12.4 Competition versus Collusion: “The Prisoners’ Dilemma”

12.5 Implications for Oligopolistic Pricing

12.6 Cartels

## Monopolistic competition v/s Oligopoly

<i>Characteristics</i>	<b>Monopolistic competition</b>	<b>Oligopoly</b>
<i>Number of firms</i>	Many	Few competing
<i>Entry and exist</i>	Free	Barriers exists: natural factors; scale economies; patents; access to technology; name recognition
<i>Nature of demand curve</i>	Fairly elastic	Depend on the nature of makert structure
<i>Profit</i>	Short-run: economic profit Long run: zero profit	Substantial profits
<i>Type of products</i>	Differentiated product but substitutable	May or may not be differentiated
<i>Product example</i>	Toothpaste	Automobiles Steel

*Now you can describe*

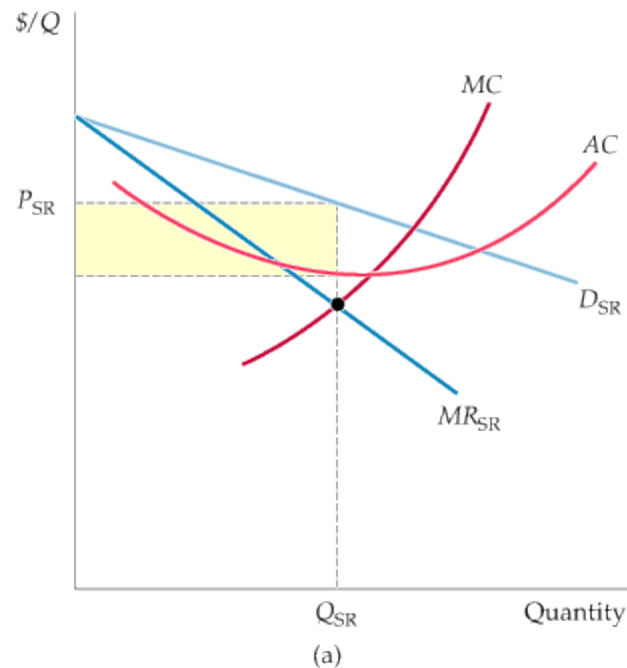
## 2 Key characteristics of a monopolistic competitive market:

1. Firms compete by selling **differentiated products** that are **highly substitutable** for one another but not perfect substitutes.
  - *In other words, the cross-price elasticities of demand are large but not infinite.*
2. There is **free entry and exit**:
  - *it is relatively easy for new firms to enter the market with their own brands and for existing firms to leave if their products become unprofitable.*

## 12.1 MONOPOLISTIC COMPETITION

- Equilibrium in the Short Run and the Long Run

A Monopolistically Competitive Firm in the Short Run

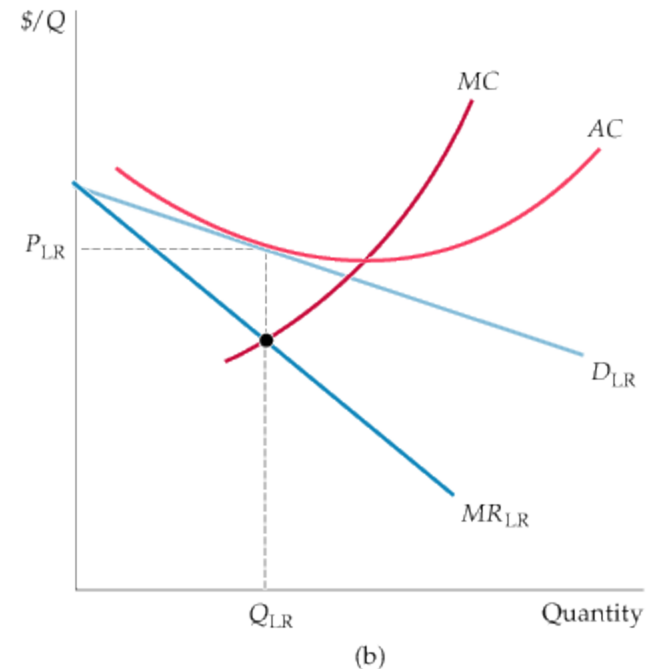
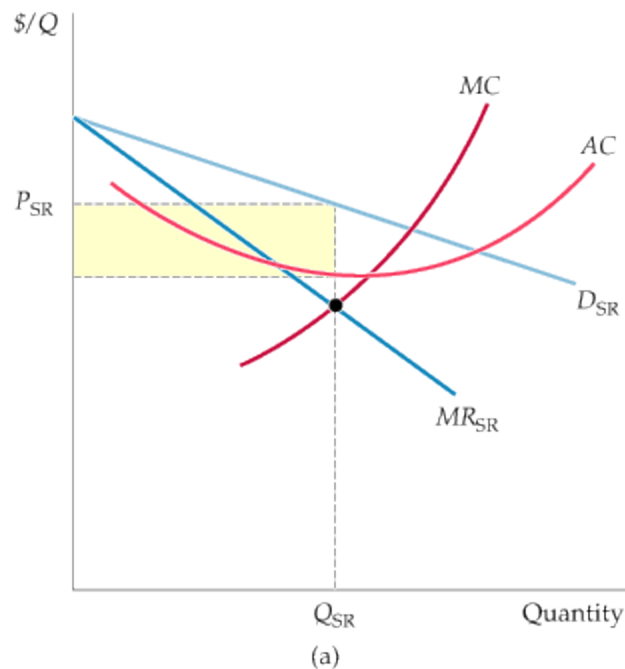


- Because the firm is the only producer of its brand, it faces a downward-sloping demand curve.
- Price exceeds marginal cost and the firm has monopoly power.  $P > MC$
- In the short run, described in part (a), price also exceeds average cost, and the firm earns profits shown by the yellow-shaded rectangle.  $P > AC$  in the short-run

## 12.1 MONOPOLISTIC COMPETITION

- Equilibrium in the Short Run and the Long Run

A Monopolistically Competitive Firm in the Long Run

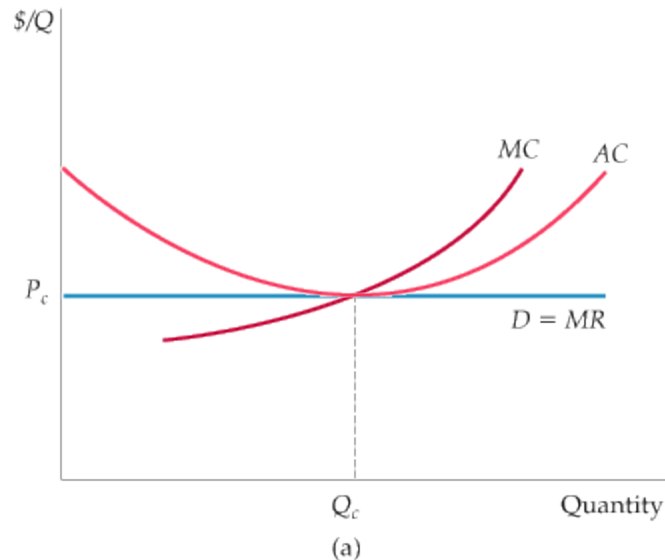


- In the long run, these profits attract new firms with competing brands. The firm's market share falls, and its demand curve shifts downward.
- In long-run equilibrium, described in part (b), **price equals average cost**, so the **firm earns zero profit** even though it has monopoly power.  $P = AC$

## 12.1 MONOPOLISTIC COMPETITION

### Comparison of Monopolistically Competitive Equilibrium and Perfectly Competitive Equilibrium

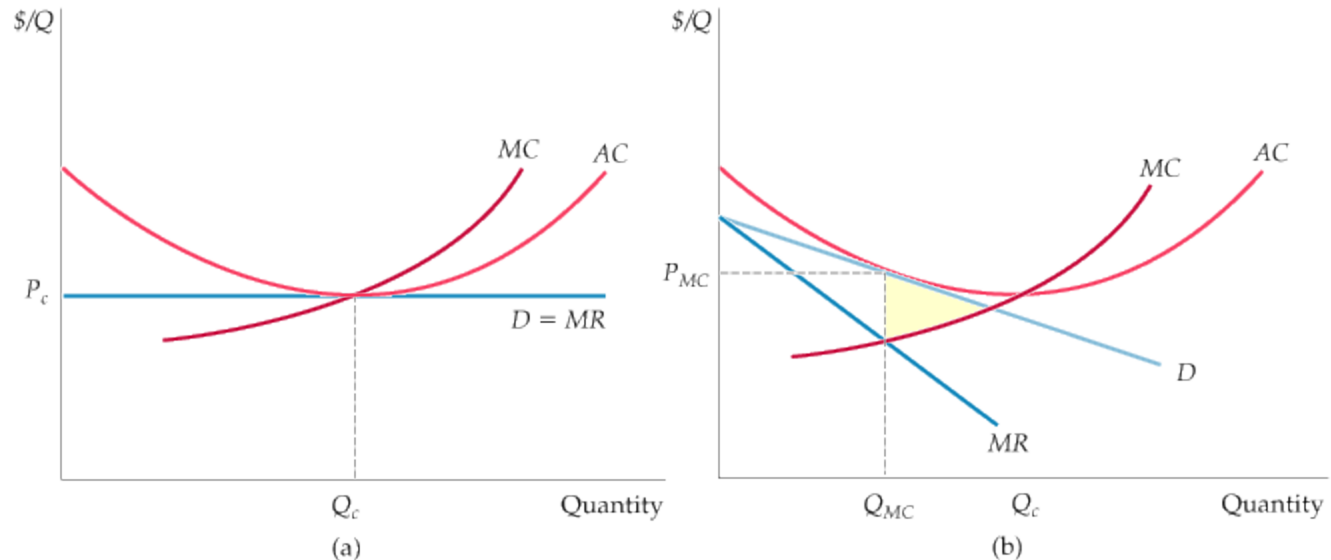
- **Monopolistic Competition and Economic Efficiency**



- **Under perfect competition**, price equals marginal cost.  
$$P = MC$$
- **The demand curve facing the firm is horizontal**, so the zero-profit point occurs at the point of minimum average cost.

## 12.1 MONOPOLISTIC COMPETITION

### Comparison of Monopolistically Competitive Equilibrium and Perfectly Competitive Equilibrium



**Under monopolistic competition**, price exceeds marginal cost.

$$P > MC$$

- Thus there is a deadweight loss, as shown by the yellow-shaded area.
- The demand curve is downward-sloping, so the zero-profit point is to the left of the point of minimum average cost.

In both types of markets, **entry occurs until profits are driven to zero.**

- In evaluating monopolistic competition, these **inefficiencies** must be balanced against the **gains to consumers** from **product diversity**.



## 12.2

## OLIGOPOLY

- In oligopolistic markets, the products may or may not be differentiated.
- What matters is that only a few firms account for most or all of total production.
- In some oligopolistic markets, some or all **firms earn substantial profits over the long run** because *barriers to entry* make it difficult or impossible for new firms to enter.
- Oligopoly is a prevalent form of market structure.
  - *Examples of oligopolistic industries include automobiles, steel, aluminum, petrochemicals, electrical equipment, and computers.*

# Oligopoly

- A few large firms
- Standardized or differentiated products
- Significant barriers to entry
- Market power (interdependent)
- Examples (Steel, oil, automobiles)



## 12.2 OLIGOPOLY

- **Equilibrium in an Oligopolistic Market**

*When a market is in equilibrium, firms are doing the best they can and have **no reason to change their price or output.***

### **Nash Equilibrium:**

- Is an Equilibrium in oligopoly markets which implies that each firm will want to do the best it can *given what its competitors are doing*, and *these competitors will do the best they can given what that firm is doing.*
- **Nash equilibrium**, is therefore, a set of strategies or actions in which each firm does the best it can given its competitors' actions.

### **Duopoly:**

A market in which two firms compete with each other.

Thus, the behavior of one firm depends on the behavior of the competitor

## 12.2 OLIGOPOLY

### • The Cournot Model

Oligopoly model in which firms produce a **homogeneous good**, each firm treats the **output of its competitors as fixed**, and **all firms decide simultaneously how much to produce**.

#### Firm 1's Output Decision

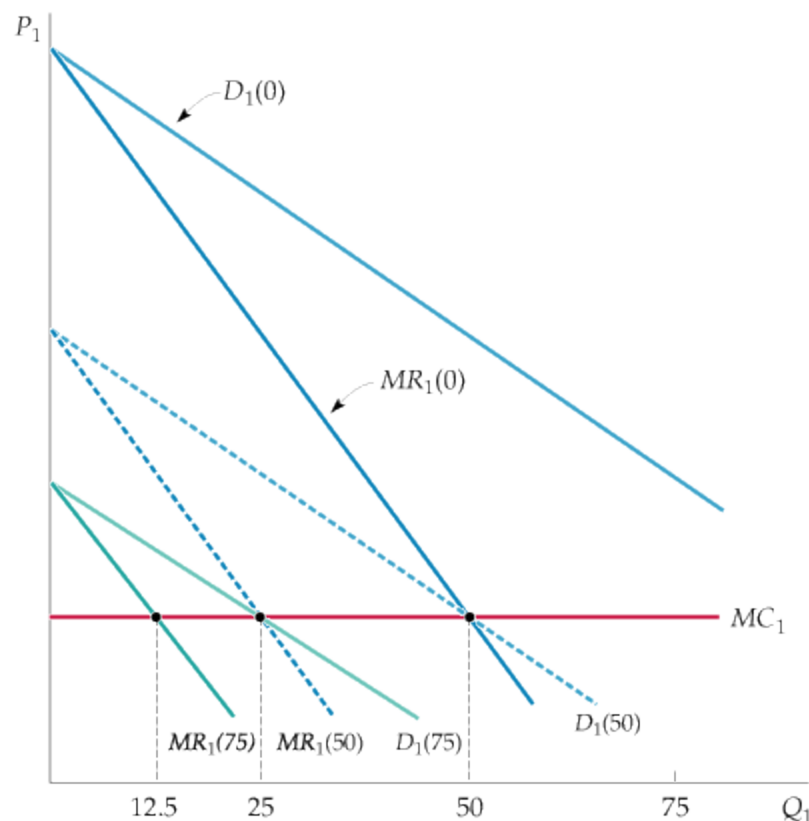
Firm 1's profit-maximizing output depends on how much it thinks that Firm 2 will produce.

If it thinks Firm 2 will produce nothing,

- *its demand curve, labeled  $D_1(0)$ , is the market demand curve.*
- *The corresponding marginal revenue curve, labeled  $MR_1(0)$ , intersects Firm 1's marginal cost curve  $MC_1$  at an output of 50 units.*

If Firm 1 thinks that Firm 2 will produce 50 units, its demand curve,  $D_1(50)$ , is shifted to the left by this amount. Profit maximization now implies an output of 25 units.

Finally, if Firm 1 thinks that Firm 2 will produce 75 units, Firm 1 will produce only 12.5 units.



## 12.2 OLIGOPOLY

### • The Cournot Model

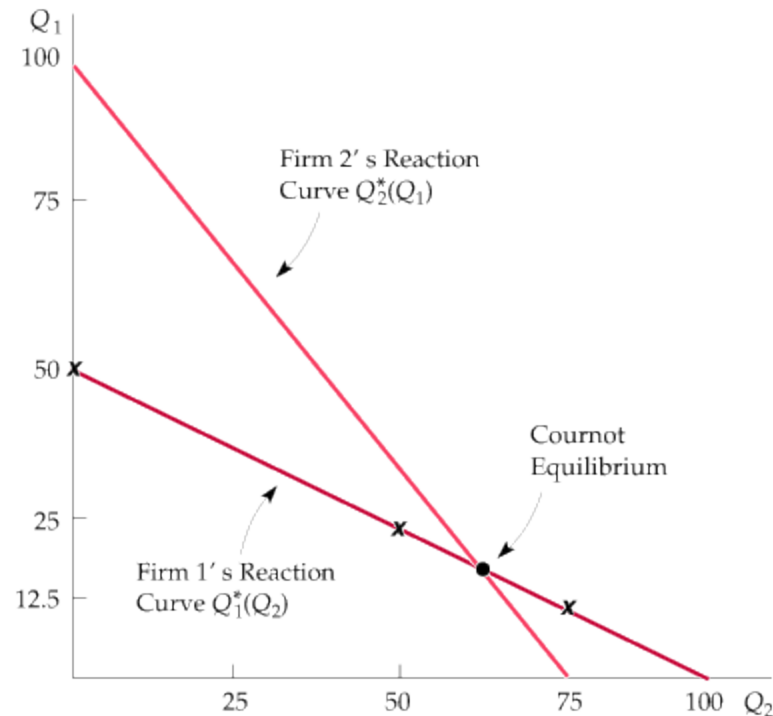
**Reaction curve:** Relationship between a firm's profit-maximizing output and the amount it thinks its competitor will produce.

#### Reaction Curves and Cournot Equilibrium

Firm 1's reaction curve shows how much it will produce as a function of how much it thinks Firm 2 will produce.

Firm 2's reaction curve shows its output as a function of how much it thinks Firm 1 will produce.

In Cournot equilibrium, each firm correctly assumes the amount that its competitor will produce and thereby maximizes its own profits. Therefore, neither firm will move from this equilibrium.



#### Cournot equilibrium:

- An equilibrium in the Cournot model in which each firm correctly assumes how much its competitor will produce and sets its own production level accordingly.
- Is an intersection of the two reaction curves of firm 1 and firm 2.
- This is an example of Nash equilibrium

## 12.2 OLIGOPOLY

- An Example

Assume a duopolists face the following market demand curve

$$P = 30 - Q$$

$$\text{Also, } MC_1 = MC_2 = 0$$

Therefore, Total revenue for firm 1:  $R_1 = PQ_1 = (30 - Q)Q_1$

$$\begin{aligned} \text{then } MR_1 &= \Delta R_1 / \Delta Q_1 \\ &= 30 - 2Q_1 - Q_2 \end{aligned}$$

Setting  $MR_1 = 0$  (the firm's marginal cost) and solving for  $Q_1$ , we find  $Q_1 = Q_2 = 10$

$$\text{Firm 1's reaction curve: } Q_1 = 15 - \frac{1}{2}Q_2$$

$$\text{Similarly, Firm 2's reaction curve: } Q_2 = 15 - \frac{1}{2}Q_1$$

*Cournot equilibrium:*

$$\text{Total quantity produced: } Q = Q_1 + Q_2 = 20$$

## 12.2 OLIGOPOLY

- An Example

Assume the two firms collude, then the total profit-maximizing quantity can be obtained as follows:

$$\text{Total revenue for the two firms: } R = PQ = (30 - Q)Q$$

$$= 30Q - Q^2, \text{ then}$$

$$\text{MR} = \Delta R / \Delta Q$$

$$= 30 - 2Q$$

Setting  $\text{MR} = 0$  (the firms' marginal cost) we find that total profit is maximized at

$$Q = 15.$$

Then,  $Q_1 + Q_2 = 15$  is the ***Collusion curve***.

If the firms agree to share profits equally, each will produce half of the total output:

$$Q_1 = Q_2 = 7.5$$

## 12.2 OLIGOPOLY

### • An Example

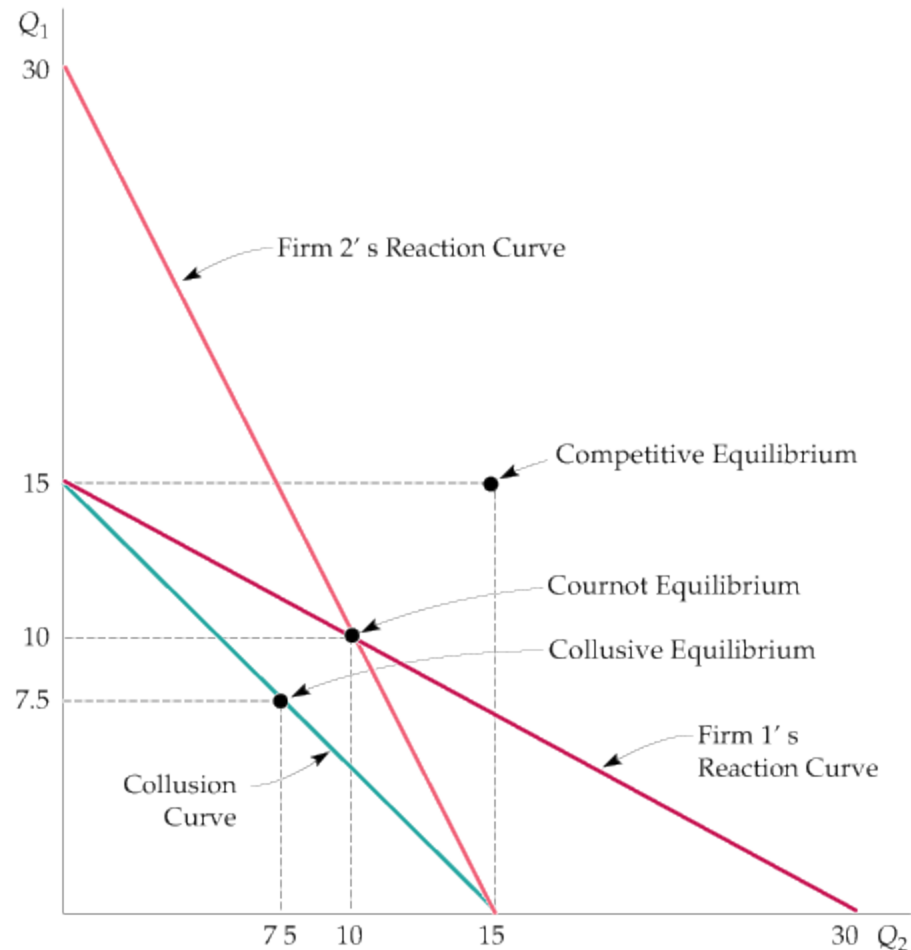
#### Graphic illustration

The demand curve is  $P = 30 - Q$ , and both firms have zero marginal cost. In Cournot equilibrium, each firm produces 10.

The collusion curve shows combinations of  $Q_1$  and  $Q_2$  that maximize *total* profits.

If the firms collude and share profits equally, each will produce 7.5.

Also shown is the competitive equilibrium, in which price equals marginal cost and profit is zero.





## 12.2 OLIGOPOLY

### • The Stackelberg Model – First Mover Advantage

Is an Oligopoly model in which one firm **sets its output before other firms do.**

*Suppose Firm 1 sets its output first and then Firm 2, after observing Firm 1's output, makes its output decision. In setting output, Firm 1 must therefore consider how Firm 2 will react.*

$$P = 30 - Q \text{ and}$$

$$MC_1 = MC_2 = 0$$

*Firm 2's reaction curve will be:*  $Q_2 = 15 - \frac{1}{2}Q_1$

*Firm 1's revenue:*  $R_1 = PQ_1 = 30Q_1 - Q_1^2 - Q_2Q_1$

$$\begin{aligned} \text{Therefore } MR_1 &= \Delta R_1 / \Delta Q_1 \\ &= 15 - Q_1 \end{aligned}$$

Setting  $MR_1 = 0$  gives  $Q_1 = 15$ , and  $Q_2 = 7.5$

We can therefore, conclude that Firm 1 produces twice as much as Firm 2 and makes twice as much profit. *Going first gives Firm 1 an advantage.*

## 12.3 OLIGOPOLY: PRICE COMPETITION

- **The Bertrand Model**

- **Price competition with Homogeneous products:**

Is An Oligopoly model in which firms produce a **homogeneous good**, **each firm treats the price of its competitors as fixed**, and **all firms decide simultaneously what price to charge**.

$$\text{Given } P = 30 - Q \quad \text{and } MC_1 = MC_2 = \$3$$

$$Q_1 = Q_2 = 9, \text{ and}$$

- ❖ In Cournot equilibrium, the market price is \$12, so that each firm makes a profit of \$81.
- ❖ Nash equilibrium in the Bertrand model results in both firms setting price equal to marginal cost:  $P_1 = P_2 = \$3$ . Then industry output is 27 units, of which each firm produces 13.5 units, and both firms earn zero profit.
- ❖ In the Cournot model, because each firm produces only 9 units, the market price is \$12.
- ❖ Now the market price is \$3. In the Cournot model, each firm made a profit;
- ❖ **in the Bertrand model, the firms price at marginal cost and make no profit.**

## 12.3 OLIGOPOLY: PRICE COMPETITION

- **The Bertrand Model**
  - Price Competition with Differentiated Products

Suppose each of two duopolists has fixed costs of \$20 but zero variable costs, and that they face the same demand curves:

$$\text{Firm 1's demand: } Q_1 = 12 - 2P_1 + P_2$$

$$\text{Firm 2's demand: } Q_2 = 12 - 2P_2 + P_1$$

### Choosing Prices

$$\text{Firm 1's profit: } \pi_1 = P_1 Q_1 - 20 = 12P_1 - 2P_1^2 + P_1 P_2 - 20$$

$$\text{Firm 1's profit maximizing price: } \Delta\pi_1 / \Delta P_1 = 12 - 4P_1 + P_2 = 0$$

$$\text{Firm 1's reaction curve: } P_1 = 3 + \frac{1}{4}P_2$$

$$\text{Firm 2's reaction curve: } P_2 = 3 + \frac{1}{4}P_1$$

## 12.3 OLIGOPOLY: PRICE COMPETITION

- **The Bertrand Model**
  - Price Competition with Differentiated Products

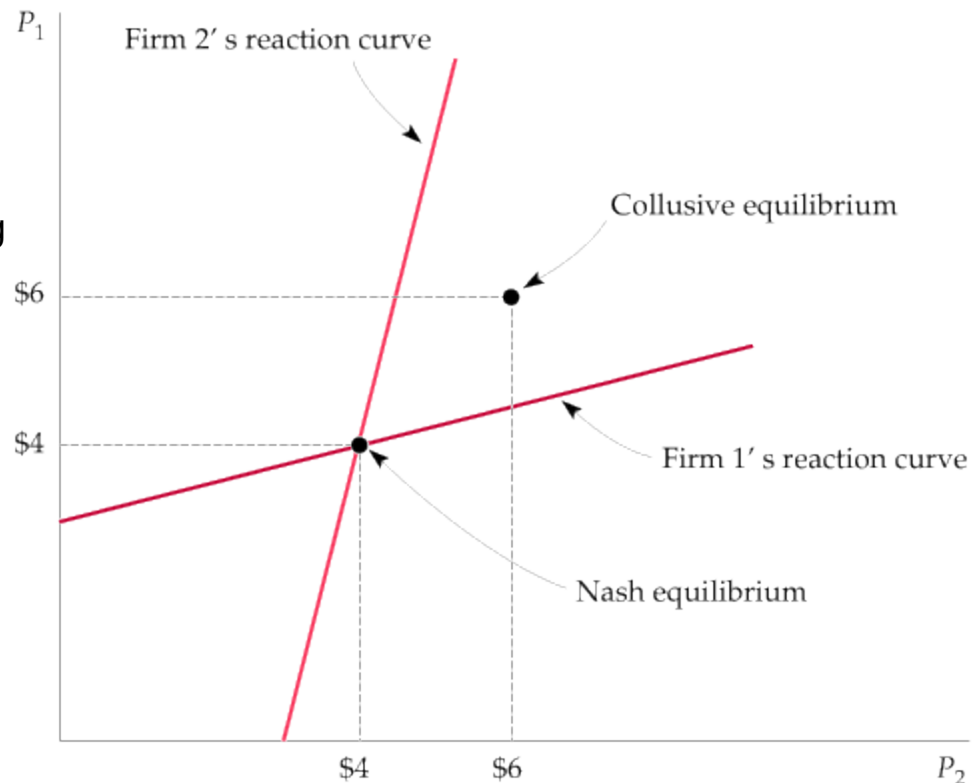
### Nash Equilibrium in Prices

Here two firms sell a differentiated product, and each firm's demand depends both on its own price and on its competitor's price. The two firms choose their prices at the same time, each taking its competitor's price as given.

Firm 1's reaction curve gives its profit-maximizing price as a function of the price that Firm 2 sets, and similarly for Firm 2.

**The Nash equilibrium is at the intersection of the two reaction curves:** When each firm charges a price of \$4, it is doing the best it can given its competitor's price and has no incentive to change price.

Also shown is the collusive equilibrium: If the firms cooperatively set price, they can increase the price (will choose \$6).



**We can conclude that the firm that moves first has a disadvantage because it has to set prices, this means that it can be undercut by the second firm**

## 12.4 COMPETITION V/S COLLUSION: THE PRISONERS' DILEMMA

### Payoff Matrix

**Non-cooperative game:** a Game in which negotiation and enforcement of binding contracts are not possible.

**Payoff matrix:** a Table showing profit (or payoff) to each firm given its decision and the decision of its competitor.

### The Prisoners' Dilemma

**Prisoners' dilemma:** a Game theory example in which two prisoners must decide separately whether to confess to a crime; if a prisoner confesses, he will receive a lighter sentence and his accomplice will receive a heavier one, but if neither confesses, sentences will be lighter than if both confess.

TABLE 12.4 Payoff Matrix for Prisoners' Dilemma

		Prisoner B	
		Confess	Don't confess
Prisoner A	Confess	-5, -5	-1, -10
	Don't confess	-10, -1	-2, -2

## 12.4 COMPETITION V/S COLLUSION: THE PRISONERS' DILEMMA

Lets assume the following:

- there are only two firms,
- each has fixed costs of \$20 and zero variable costs.
- They face the following demand curves:

$$\text{Firm 1's demand: } Q_1 = 12 - 2P_1 + P_2$$

$$\text{Firm 2's demand: } Q_2 = 12 - 2P_2 + P_1$$

We found that in Nash equilibrium each firm will charge a price of \$4 and earn a profit of \$12, whereas if the firms collude, they will charge a price of \$6 and earn a profit of \$16.

But if Firm 1 charges \$6 and Firm 2 charges only \$4, Firm 2's profit will increase to \$20. And it will do so at the expense of Firm 1's profit, which will fall to \$4.

$$\pi_2 = P_2 Q_2 - 20 = (4)[12 - (2)(4) + 6] - 20 = \$20$$

$$\pi_1 = P_1 Q_1 - 20 = (6)[12 - (2)(6) + 4] - 20 = \$4$$

TABLE 12.3 Payoff Matrix for Pricing Game

		Firm 2	
		Charge \$4	Charge \$6
Firm 1	Charge \$4	\$12, \$12	\$20, \$4
	Charge \$6	\$4, \$20	\$16, \$16

## 12.4 COMPETITION V/S COLLUSION: THE PRISONERS' DILEMMA

### EXAMPLE 12.3

### Procter & Gamble in a Prisoners' Dilemma

We argued that P&G should expect its competitors to charge a price of \$1.40 and should do the same. But P&G would be better off if it *and its competitors* all charged a price of \$1.50.

TABLE 12.5 Payoff Matrix for Pricing Problem

		Unilever and KAO	
		Charge \$1.40	Charge \$1.50
P&G	Charge \$1.40	\$12, \$12	\$29, \$11
	Charge \$1.50	\$3, \$21	\$20, \$20

So why don't they charge \$1.50? Because these firms are in a prisoners' dilemma. No matter what Unilever and Kao do, P&G makes more money by charging \$1.40.

## 12.5

# IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

- **Price Rigidity**

### **Price rigidity:**

Characteristic of oligopolistic markets by which firms are **reluctant to change prices** even if costs or demands change.

### **Kinked demand curve model:**

Oligopoly model in which each firm faces a **demand curve kinked at the currently prevailing price**: at higher prices demand is very elastic, whereas at lower prices it is inelastic.



## 12.5 IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

### • Price Rigidity

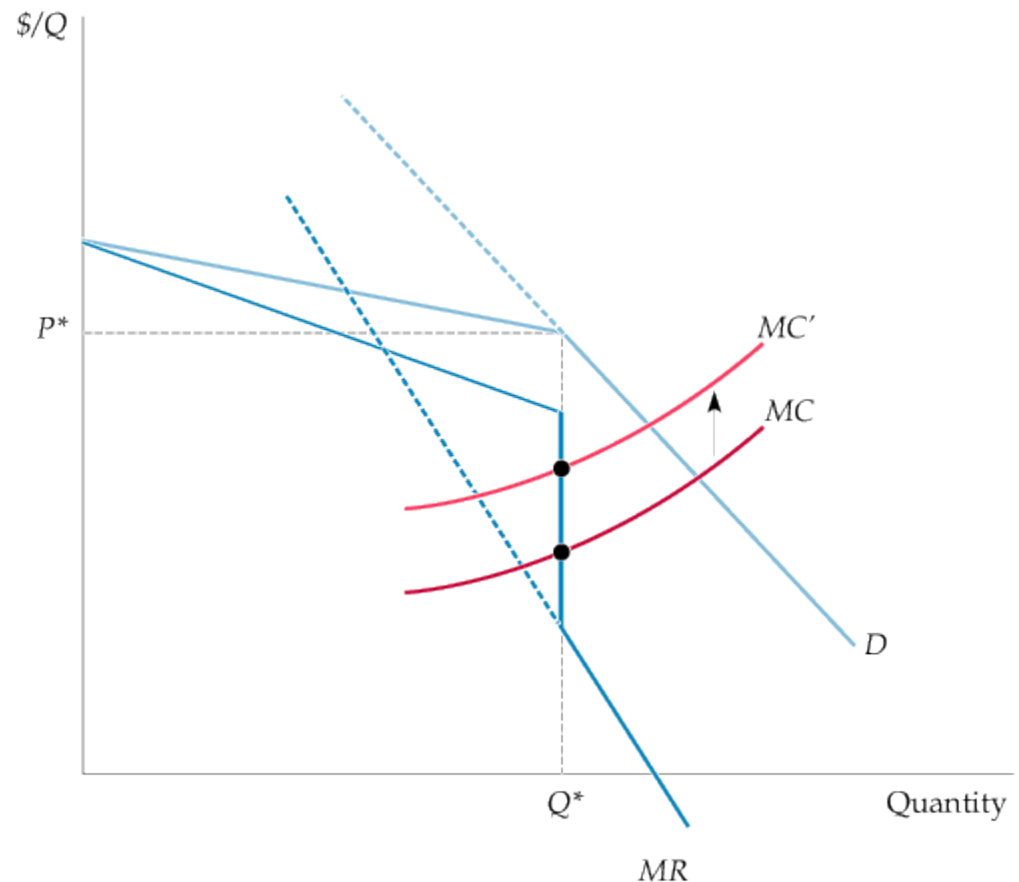
#### The Kinked Demand Curve

Each firm believes that if it raises its price above the current price  $P^*$ , none of its competitors will follow suit, so it will lose most of its sales.

Each firm also believes that if it lowers price, everyone will follow suit, and its sales will increase only to the extent that market demand increases.

As a result, the firm's demand curve  $D$  is kinked at price  $P^*$ , and its marginal revenue curve  $MR$  is discontinuous at that point.

If marginal cost increases from  $MC$  to  $MC'$ , the firm will still produce the same output level  $Q^*$  and charge the same price  $P^*$ .



## 12.5

# IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

- **Price Signaling and Price Leadership**

**Price signaling:**

Form of implicit collusion in which a firm announces a price increase in the hope that other firms will follow suit.

**Price leadership:**

Pattern of pricing in which one firm regularly announces price changes that other firms then match.

## 12.5 IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

### • Price Signaling and Price Leadership

#### EXAMPLE 12.4

#### Price Leadership and Price Rigidity in Commercial Banking

- The interest rate that banks charge large corporate clients is called the *prime rate*.
- Because it is widely known, it is a convenient focal point for price leadership.
- The prime rate changes only when money market conditions cause other interest rates to rise or fall substantially. When that happens, one of the major banks announces a change in its rate and other banks quickly follow suit.
- Different banks act as leader from time to time, but when one bank announces a change, the others follow within two or three days.

## 12.5

# IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

### • The Dominant Firm Model

A **dominant firm** is a firm with a large share of total sales that sets price to maximize profits, taking into account the supply response of smaller firms.

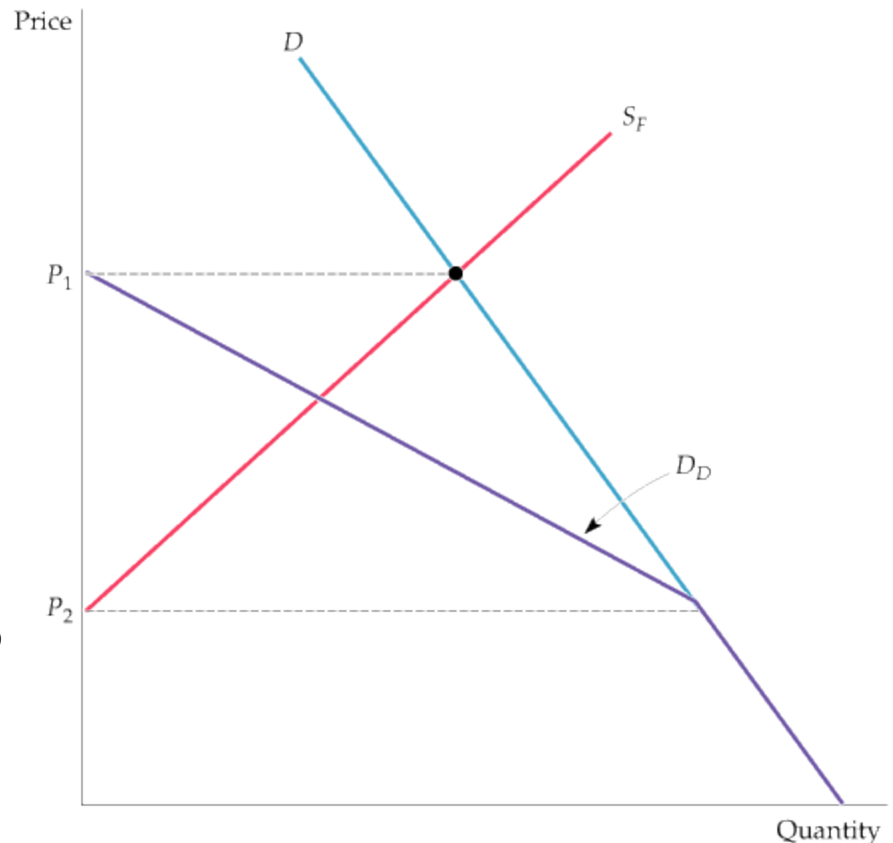
#### Price Setting by a Dominant Firm

$D$  is the market demand curve, and  $S_F$  is the supply curve (i.e., the aggregate marginal cost curve) of the smaller fringe firms.

The dominant firm must determine *its* demand curve  $D_D$ . As the figure shows, this curve is just the difference between market demand and the supply of fringe firms.

At price  $P_1$ , the supply of fringe firms is just equal to market demand; thus the dominant firm can sell nothing. At a price  $P_2$  or less, fringe firms will not supply any of the good, so the dominant firm faces the market demand curve.

At prices between  $P_1$  and  $P_2$ , the dominant firm faces the demand curve  $D_D$ .



# 12.5

## IMPLICATIONS OF THE PRISONERS' DILEMMA FOR OLIGOPOLISTIC PRICING

### • The Dominant Firm Model

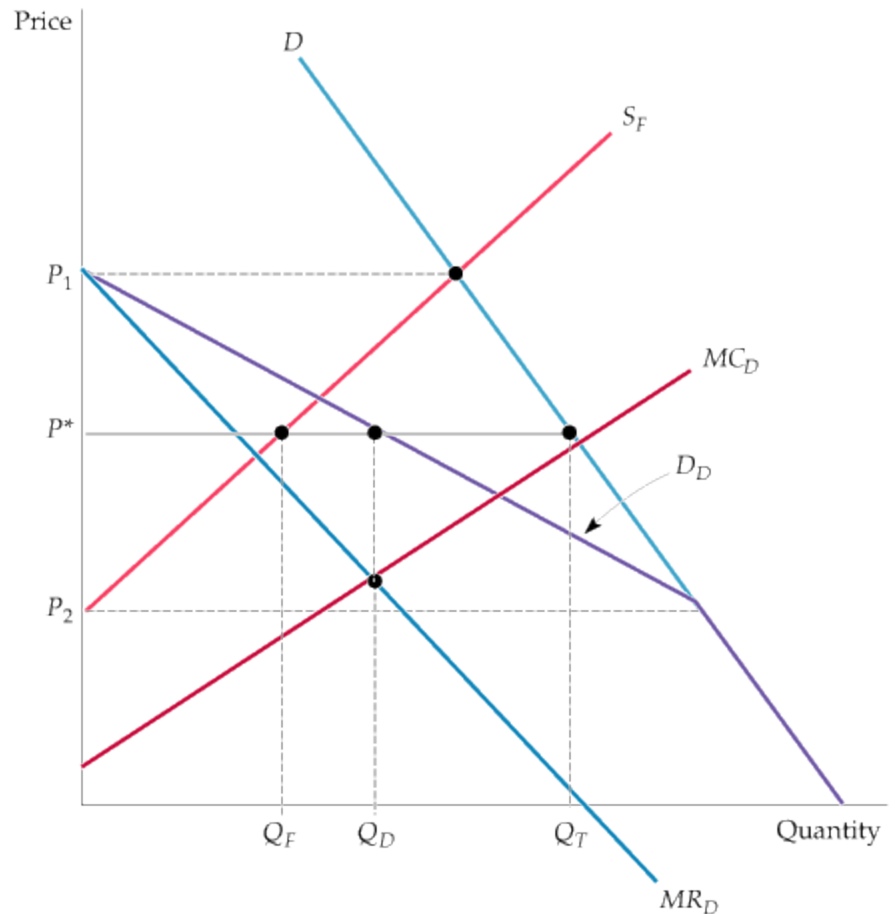
#### Price Setting by a Dominant Firm

The dominant firm produces a quantity  $Q_D$  at the point where its marginal revenue  $MR_D$  is equal to its marginal cost  $MC_D$ .

The corresponding price is  $P^*$ .

At this price, fringe firms sell  $Q_F$

Total sales equal  $Q_T$ .



## 12.6 CARTELS

Producers in a *cartel* **explicitly agree to cooperate in setting prices and output levels.**

### • Analysis of Cartel Pricing

#### The OPEC Oil Cartel

TD is the total world demand curve for oil, and  $S_c$  is the competitive (non-OPEC) supply curve.

OPEC's demand  $D_{OPEC}$  is the difference between the two.

Because both total demand and competitive supply are inelastic, OPEC's demand is inelastic.

OPEC's profit-maximizing quantity  $Q_{OPEC}$  is found at the intersection of its marginal revenue and marginal cost curves; at this quantity, OPEC charges price  $P^*$ .

If OPEC producers had not cartelized, price would be  $P'_c$ , where OPEC's demand and marginal cost curves intersect.

