



# Demand and Supply Elasticity

# Price Elasticity

- Price Elasticity of Demand ( $E_p$ )

- The responsiveness of quantity demanded of a commodity to changes in its price

$$E_p = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

- Example

- Price of oil increases 10 percent
- Quantity demanded decreases 1 percent

$$E_p = \frac{-1\%}{+10\%} = -.1$$

# Calculating Elasticity

- Elasticity formula:

$$E_p = \frac{\text{change in } Q}{\text{sum of quantities}/2} \bigg/ \frac{\text{change in } P}{\text{sum of quantities}/2}$$

or

$$E_p = \frac{\text{change in } Q}{(Q_1 + Q_2)/2} \bigg/ \frac{\text{change in } P}{(P_1 + P_2)/2}$$

## Example: The Price Elasticity of Demand for Beer

- Lowenbrau, a beer imported from Germany, recently increased in price from \$4.67 to \$7.00 per six-pack.
- In response, annual sales of six-packs fell from 25 million to 16.67 million.
- What is the elasticity of demand?

## Example: The Price Elasticity of Demand for Beer

- Use the elasticity formula:
- $$\frac{25-16.67}{(25 + 16.67)/2} \div \frac{\$7.00 - 4.67}{(\$7.00 + \$4.67)/2}$$
- Solve the formula, and you will find that elasticity equals 1.

# Price Elasticity Ranges

- Elastic demand

$$\% \text{ change in } Q > \% \text{ change in } P; E_p > 1$$

- Unit elastic

$$\% \text{ change in } Q = \% \text{ change in } P; E_p = 1$$

- Inelastic demand

$$\% \text{ change in } Q < \% \text{ change in } P; E_p < 1$$

# Extreme Price Elasticities

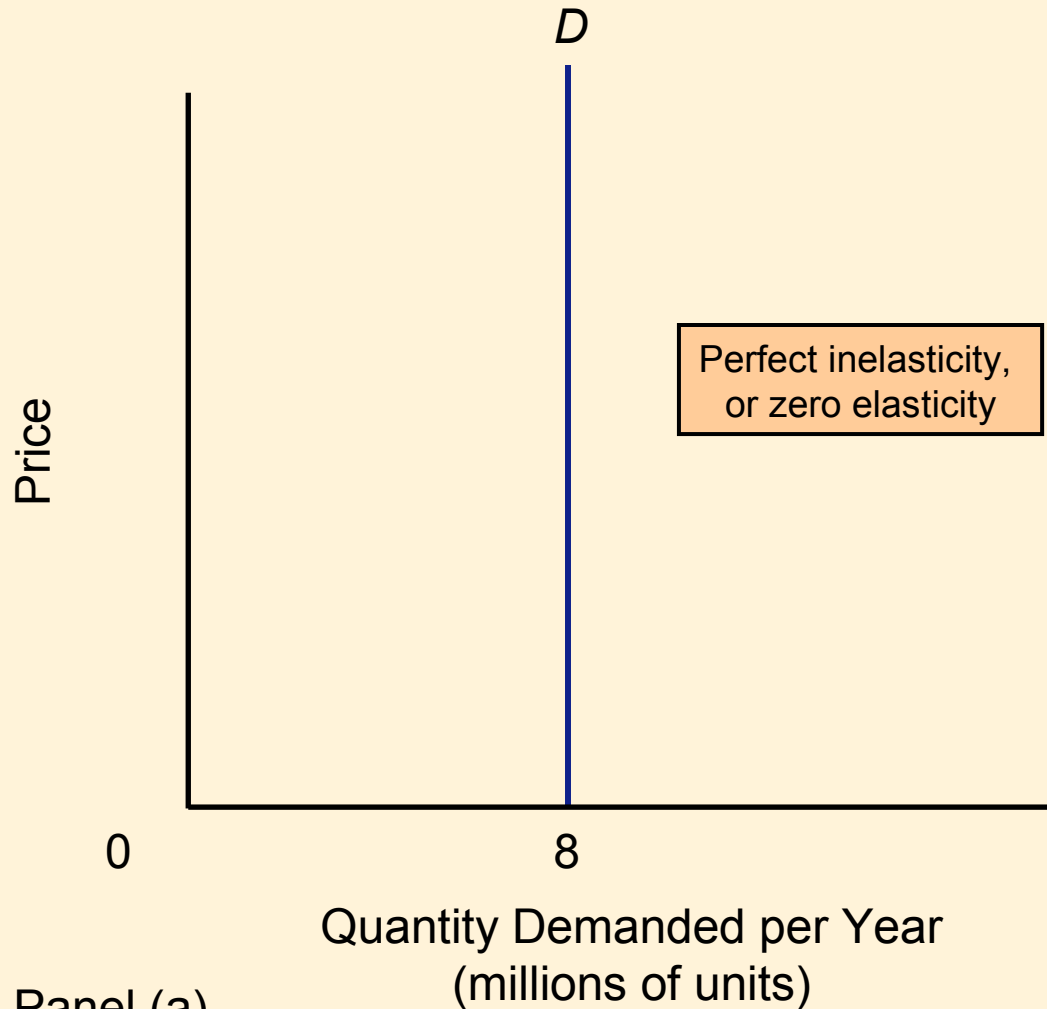


Figure 21-1, Panel (a)

# Extreme Price Elasticities

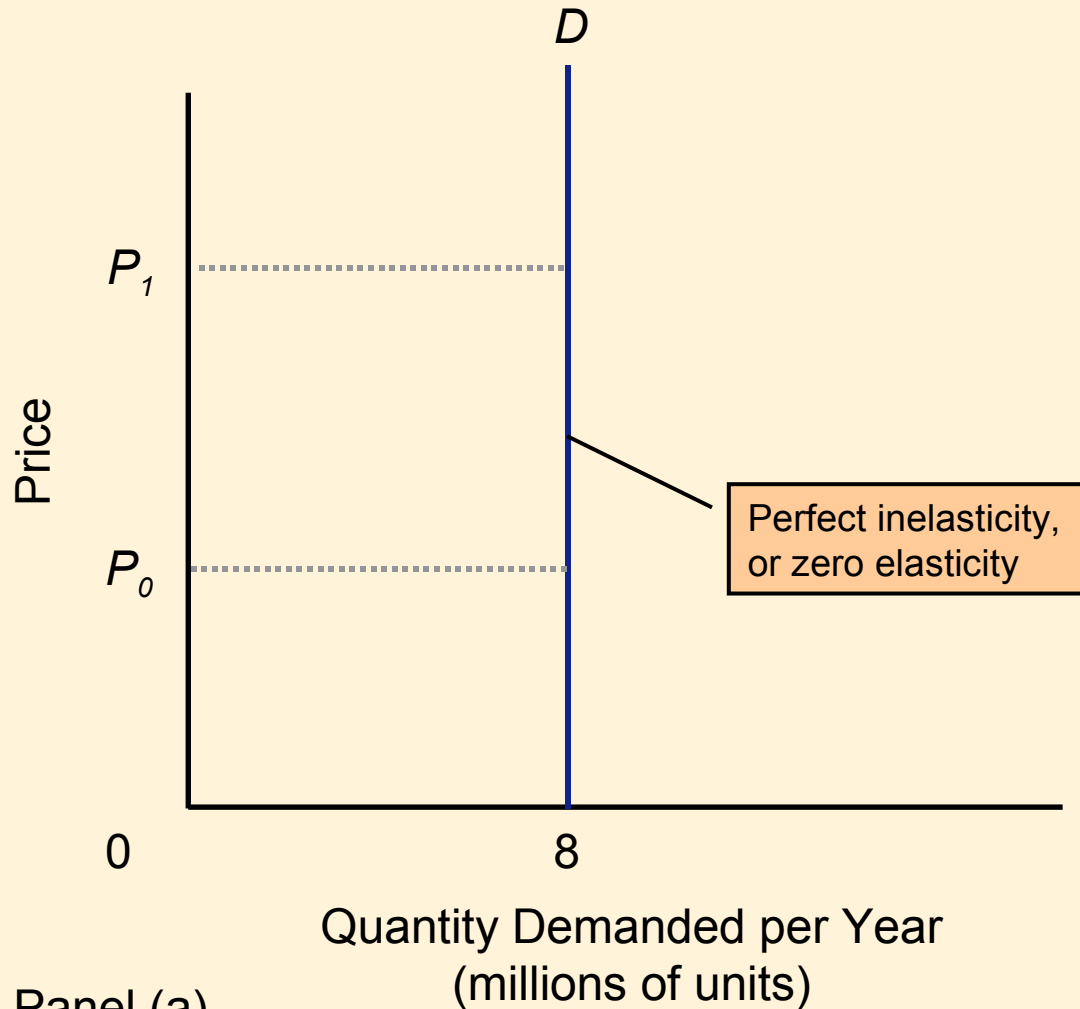


Figure 21-1, Panel (a)



# Extreme Price Elasticities

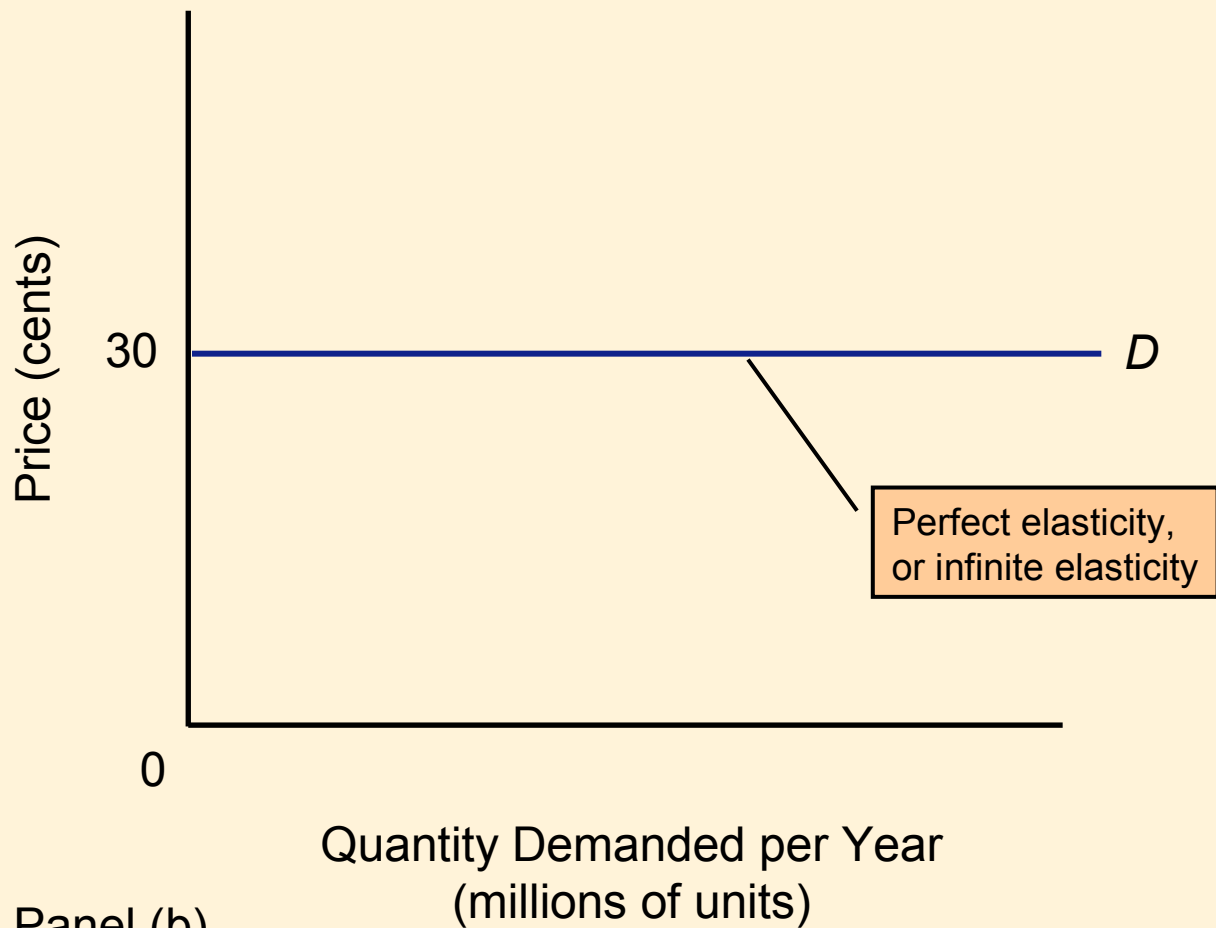


Figure 21-1, Panel (b)

# Short-Run and Long-Run Price Elasticity of Demand

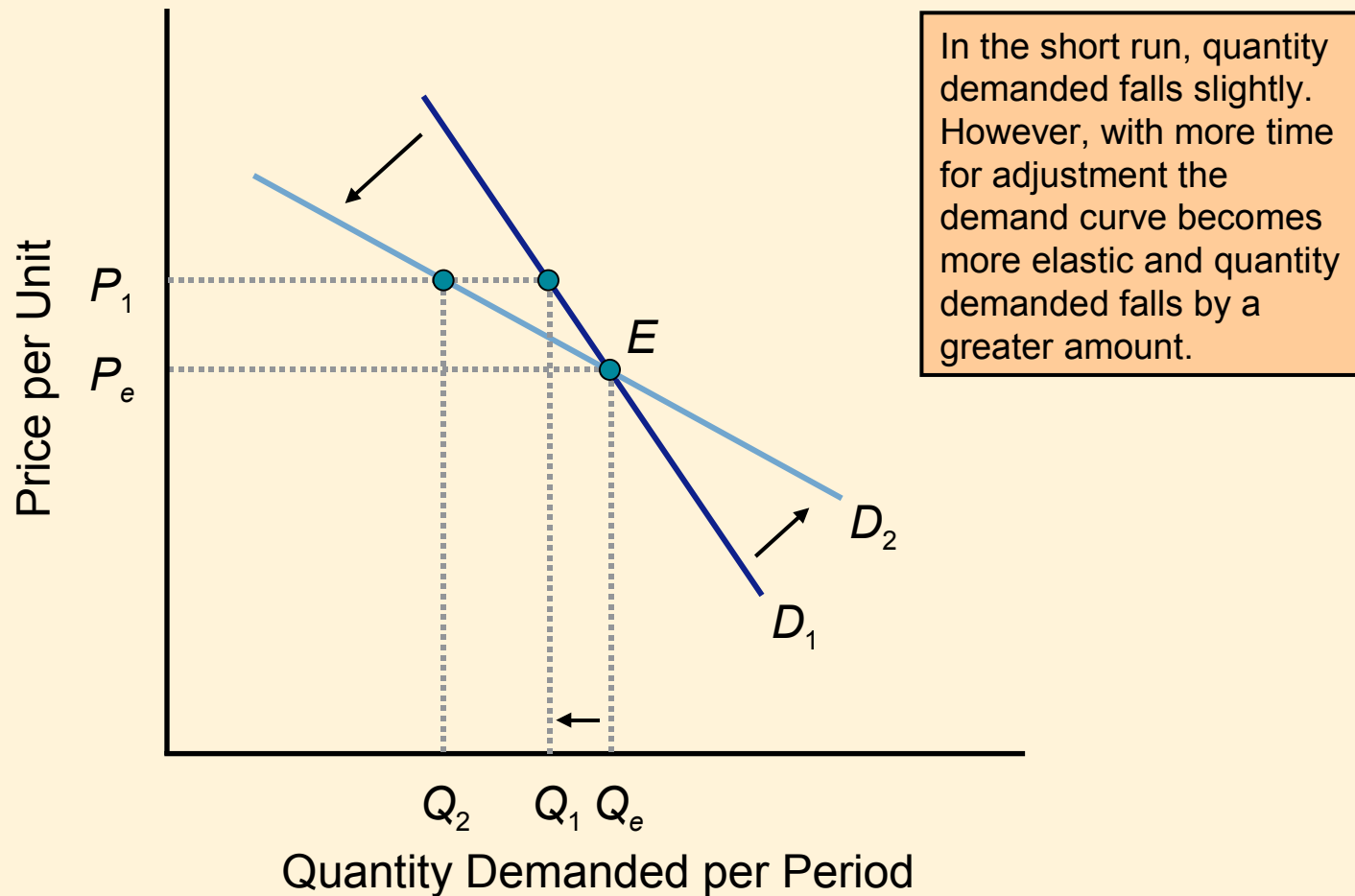


Figure 21-4

# Short-Run and Long-Run Price Elasticity of Demand

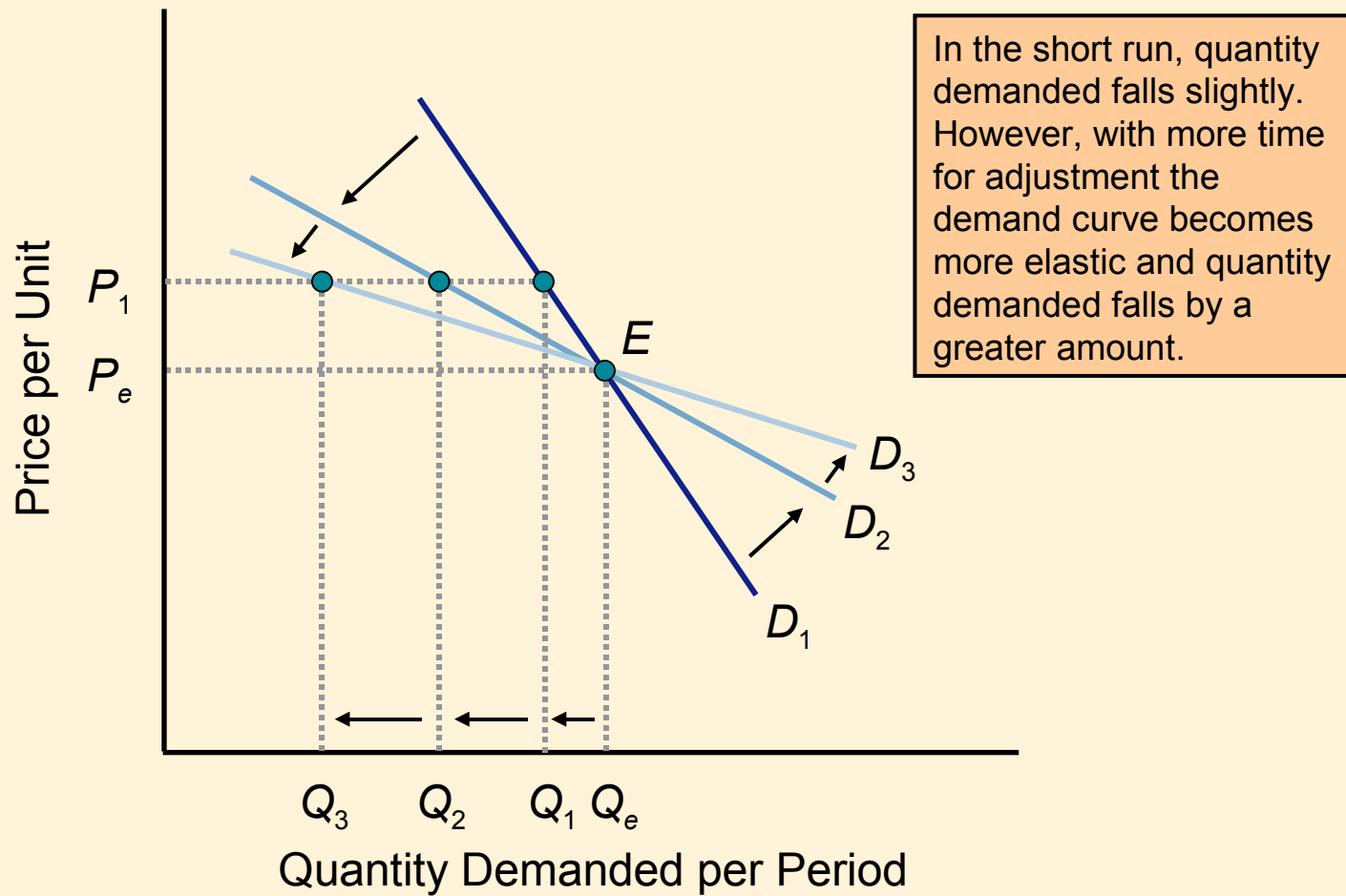
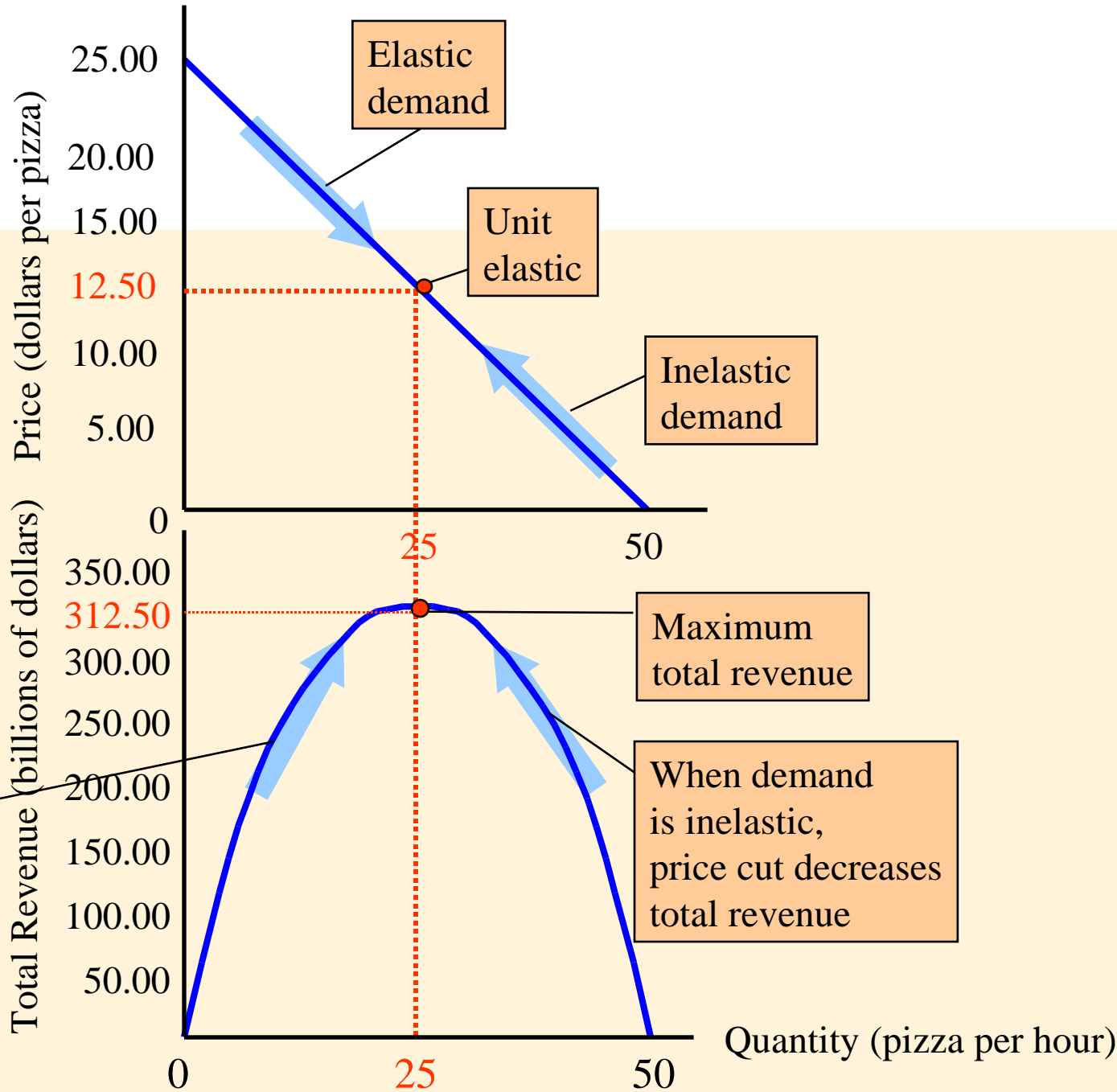


Figure 21-4

# Example: Real-World Elasticities of Demand

Category	Estimated Elasticity	
	Short Run	Long Run
Air travel (business)	0.4	1.2
Air travel (vacation)	1.1	2.7
Beef	0.6	N.A.
Cheese	0.3	N.A.
Electricity	0.1	1.7
Fresh tomatoes	4.6	N.A.
Gasoline	0.2	0.5
Hospital services	0.1	0.7
Intercity bus service	0.6	2.2
Physician services	0.1	0.6
Private education	1.1	1.9
Restaurant meals	2.3	N.A.
Tires	0.9	1.2

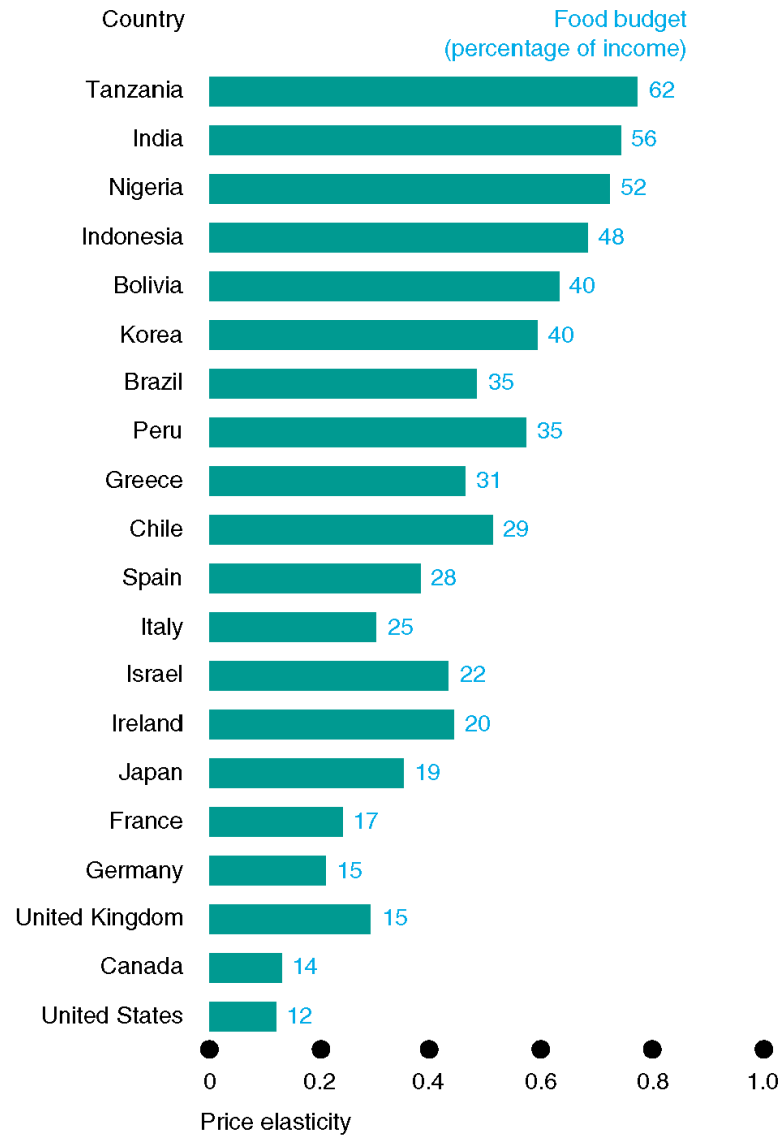
Table 21-2



# Some Real-World Price Elasticities of Demand

<b>Good or Service</b>	<b>Elasticity</b>
<b>Elastic Demand</b>	
Metals	1.52
Electrical engineering products	1.30
Mechanical engineering products	1.30
Furniture	1.26
Motor vehicles	1.14
Instrument engineering products	1.10
Professional services	1.09
Transportation services	1.03
<b>Inelastic Demand</b>	
Gas, electricity, and water	0.92
Oil	0.91
Chemicals	0.89
Beverages (all types)	0.78
Clothing	0.64
Tobacco	0.61
Banking and insurance services	0.56
Housing services	0.55
Agricultural and fish products	0.42
Books, magazines, and newspapers	0.34
Food	0.12

# Price Elasticities in 20 Countries



# Cross Price Elasticity of Demand

- **Cross Price Elasticity of Demand ( $E_{xy}$ )**
  - The percentage change in the demand for one good (holding its price constant) divided by the percentage change in the price of a related good
  - The responsiveness of change in demand of one good to the change in prices of related goods



## Cross Price Elasticity of Demand

- Formula for computing cross elasticity of demand

$$E_{xy} = \frac{\% \text{ change in demand for good } X}{\% \text{ change in price of good } Y}$$

- Substitutes
  - $E_{xy}$  would be positive
    - An increase in the price of  $X$  would increase the quantity of  $Y$  demanded at each price.
- Complements
  - $E_{xy}$  would be negative
    - An increase in the price of  $X$  would decrease the quantity of  $Y$  demanded at each price.

# Income Elasticity of Demand

- **Income Elasticity of Demand ( $E_i$ )**
  - The percentage change in demand for any good, holding its price constant, divided by the percentage change in income
  - The responsiveness of demand to changes in income, holding the good's relative price constant

# Income Elasticity of Demand

$$E_i = \frac{\text{percentage change in demand}}{\text{percentage change in income}}$$

- Income elasticity of demand
  - refers to a *horizontal shift* in the demand curve in response to changes in income
- Price elasticity of demand
  - refers to a movement *along* the curve in response to price changes

# Income Elasticity of Demand

Formula:

$$\frac{\text{Change in Quantity}}{\text{Average Quantity}} \div \frac{\text{Change in Income}}{\text{Average Income}}$$

- The income elasticity of demand can be either negative or positive.
- Remember that, in calculating the income elasticity of demand, the price of the good is assumed to be constant.

# Income Elasticity of Demand

Income elasticity can be:

- 1 ) Greater than 1 (normal good, income elastic)
- 2 ) Between zero and 1 (normal good, income inelastic)
- 3 ) Less than zero (inferior good)

# Some Real-World Income Elasticities of Demand

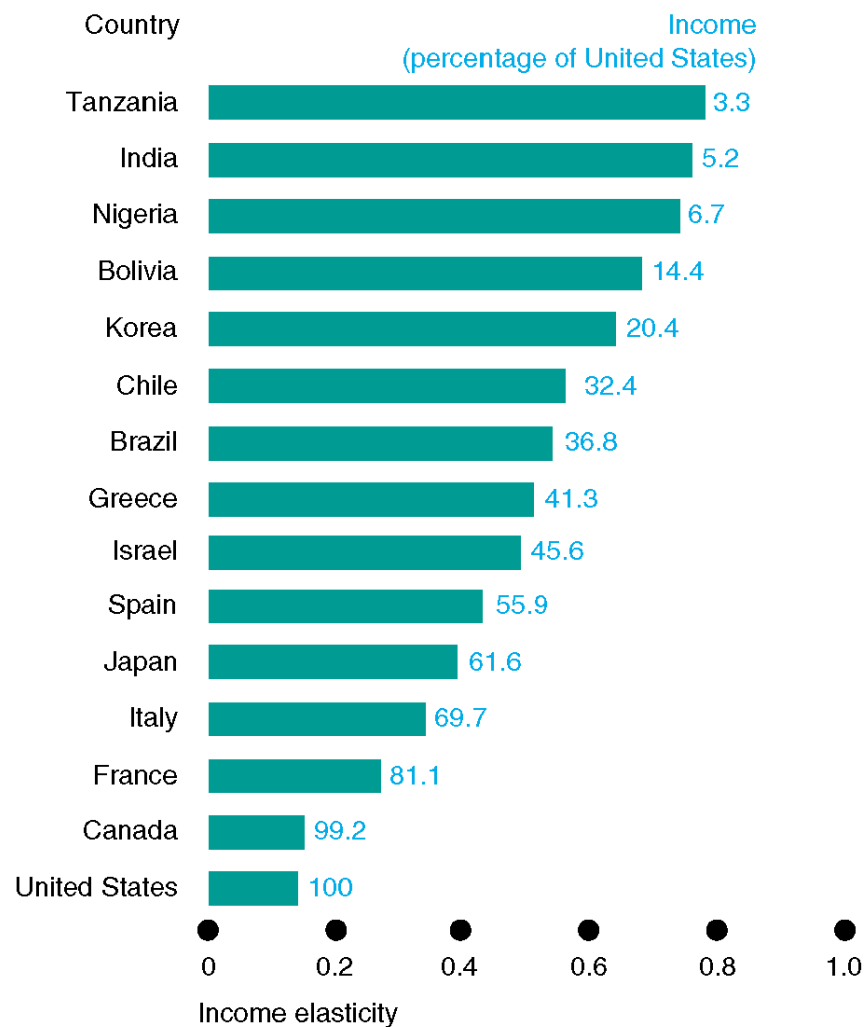
## **Elastic Demand**

Airline Travel	5.82
Movies	3.41
Foreign Travel	3.08
Electricity	1.94
Restaurant meals	1.61
Local buses and trains	1.38
Haircutting	1.36
Cars	1.07

## **Inelastic Demand**

Tobacco	0.86
Alcoholic beverages	0.62
Furniture	0.53
Clothing	0.51
Newspapers and magazines	0.38
Telephone	0.32
Food	0.14

# Income Elasticities in 15 Countries



# Elasticity of Supply

- Price Elasticity of Supply ( $E_s$ )
  - The responsiveness of the quantity supplied of a commodity to a change in its price
  - The percentage change in quantity supplied divided by the percentage change in price

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



# The Extremes in Supply Curves

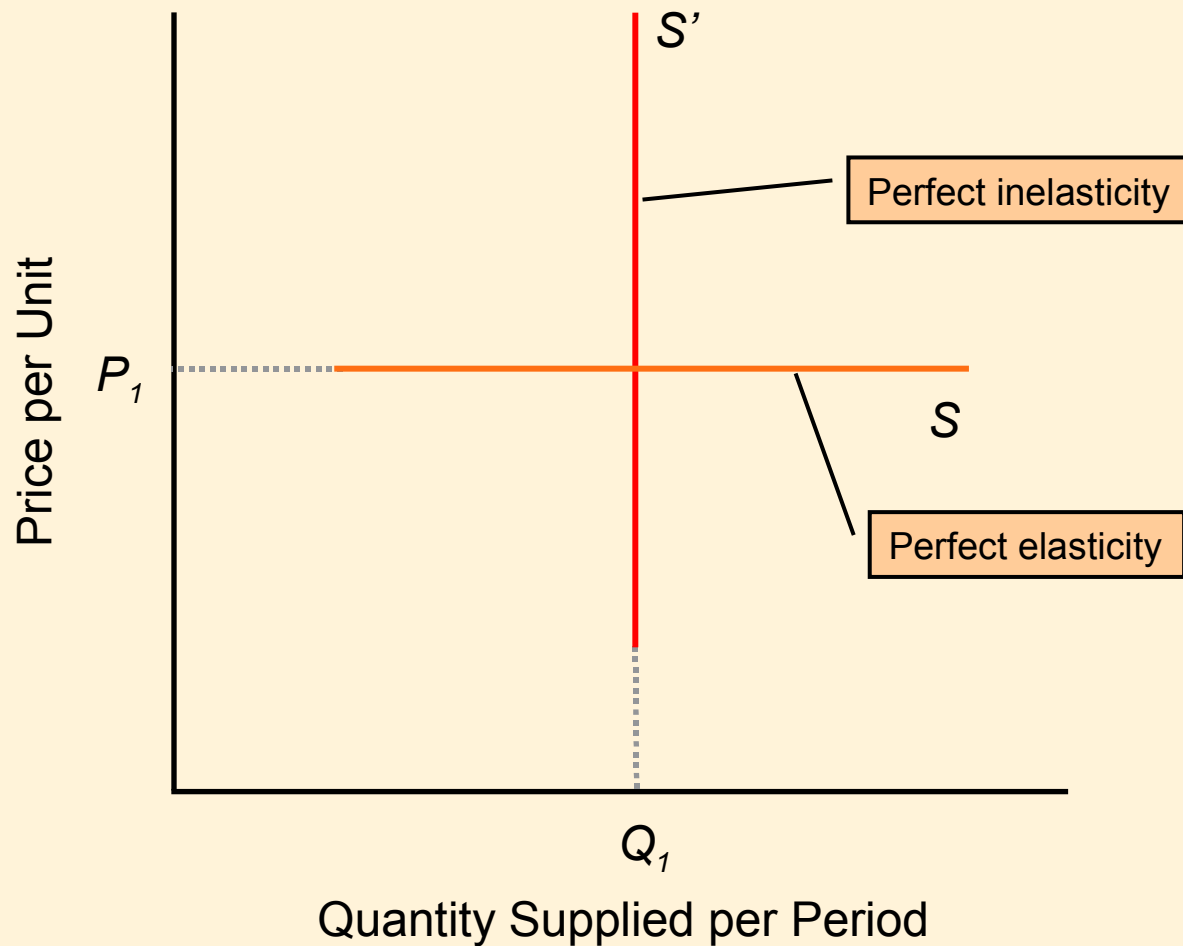
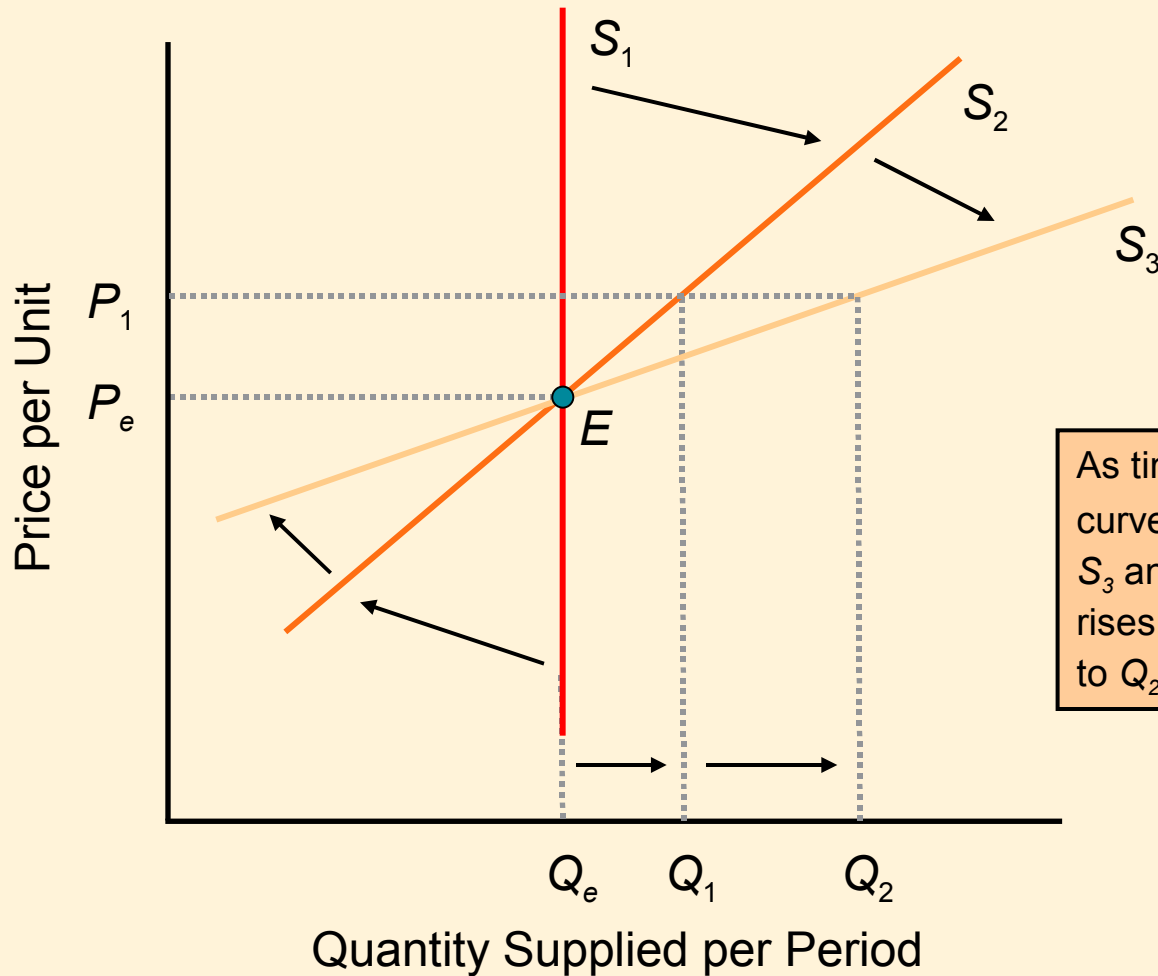


Figure 21-5

# Short-Run and Long-Run Price Elasticity of Supply



As time passes the supply curve rotates to  $S_2$  then to  $S_3$  and quantity supplied rises first to  $Q_1$  and then to  $Q_2$ .

Figure 21-6

# A Compact Glossary of Elasticities

## PRICE ELASTICITIES OF DEMAND

A relationship is described as	When its magnitude is	Which means that
Perfectly elastic or infinitely elastic	Infinity	The smallest possible increase in price causes an infinitely large decrease in quantity demanded
Elastic	Less than infinity but greater than 1	The percent decrease in the quantity demanded exceeds the percent increase in price
Unit elastic	1	The percent decrease in the quantity demanded equals the percent increase in price
In elastic	Greater than zero but less than 1	The percentage decrease in the quantity demanded is less than the percent increase in price.
Perfectly inelastic or completely inelastic	Zero	The quantity demanded is the same at all prices

# A Compact Glossary of Elasticities

## CROSS ELASTICITIES OF DEMAND

A relationship is described as	When its magnitude is	Which means that
Perfect substitutes	Infinity	The smallest possible increase in price of one good causes an infinitely large increase in the demand of the other good.
Substitutes	Positive, less than infinity	If the price of one good increases, the quantity demanded of the other good also increases.
Independent	Zero	The demand for one good remains constant, regardless of the price of the other good.
Complements	Less than zero	The demand for one good decreases when the price of the other good increases.

# A Compact Glossary of Elasticities

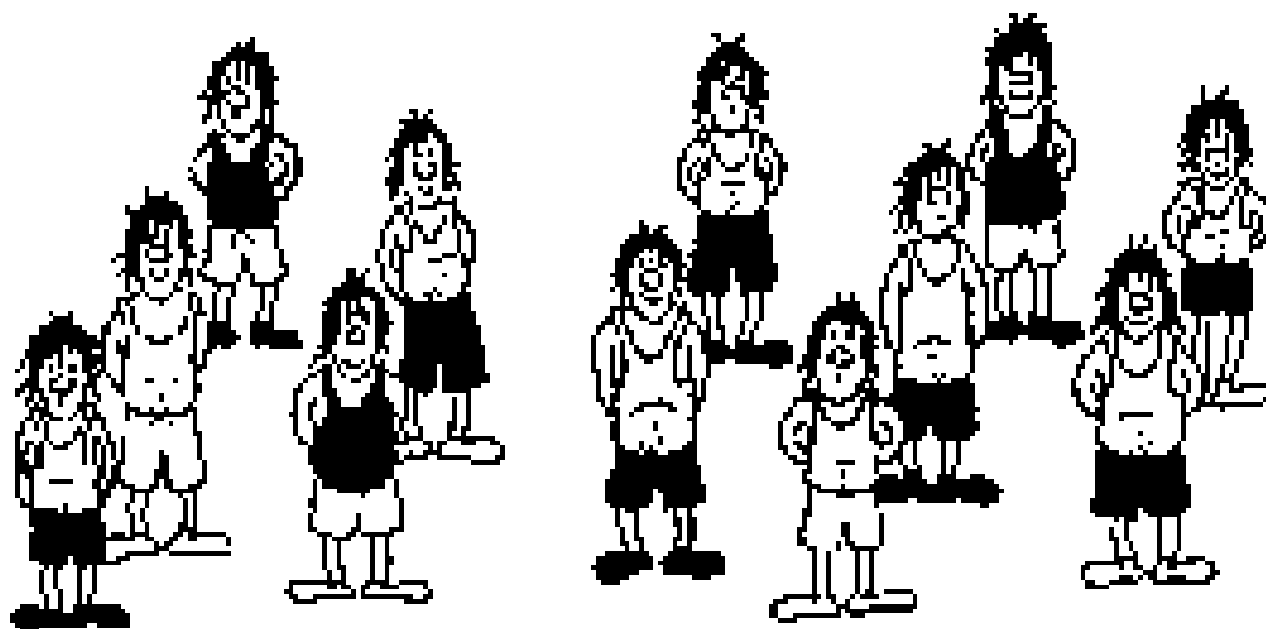
## INCOME ELASTICITIES OF DEMAND

<b>A relationship is described as</b>	<b>When its magnitude is</b>	<b>Which means that</b>
Income elastic (normal good)	Greater than 1	The percent increase in the quantity demanded is greater than the percentage increase in income.
Income inelastic (normal good)	Less than 1 but greater than zero	The percent increase in the quantity demanded is less than the percentage increase in income.
Negative income elastic (inferior good)	Less than zero	When income increases, quantity demanded decreases.

# A Compact Glossary of Elasticities

## ELASTICITIES OF SUPPLY

<b>A relationship is described as</b>	<b>When its magnitude is</b>	<b>Which means that</b>
Perfectly elastic	Infinity	The smallest possible increase in price causes an infinitely large increase in the quantity supplied.
Elastic	Less than infinity but greater than 1	The percent increase in the quantity supplied exceeds the percentage increase in the price.
Inelastic	Greater than zero but less than 1	The percentage increase in the quantity supplied is less than the percentage increase in price.
Perfectly inelastic	Zero	The quantity supplied is the same at all prices.



# 3

## SUPPLY AND DEMAND II: MARKETS AND WELFARE





# Welfare Economics

- *Welfare economics* is the study of how the allocation of resources affects economic well-being.
- Buyers and sellers receive benefits from taking part in the market.
- The equilibrium in a market maximizes the total welfare of buyers and sellers.

# CONSUMER SURPLUS

- *Willingness to pay* is the maximum amount that a buyer will pay for a good.
- It measures how much the buyer values the good or service.
- *Consumer surplus* is the buyer's willingness to pay for a good minus the amount the buyer actually pays for it.
- *Consumer surplus* is the buyer's willingness to pay for a good minus the amount the buyer actually pays for it.

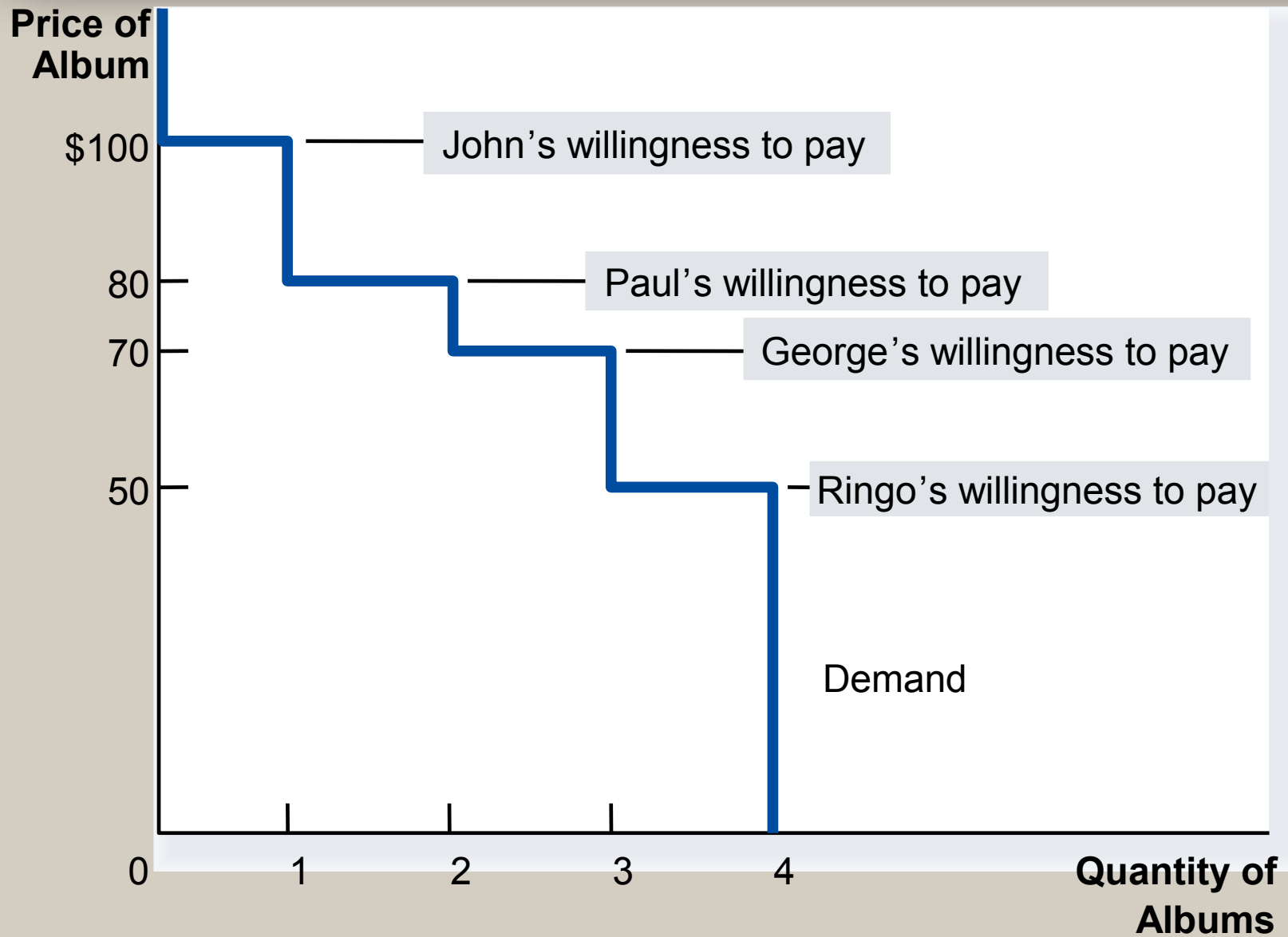
# Table 1 Four Possible Buyers' Willingness to Pay

<b>Buyer</b>	<b>Willingness to Pay</b>
John	\$100
Paul	80
George	70
Ringo	50

# The Demand Schedule and the Demand Curve

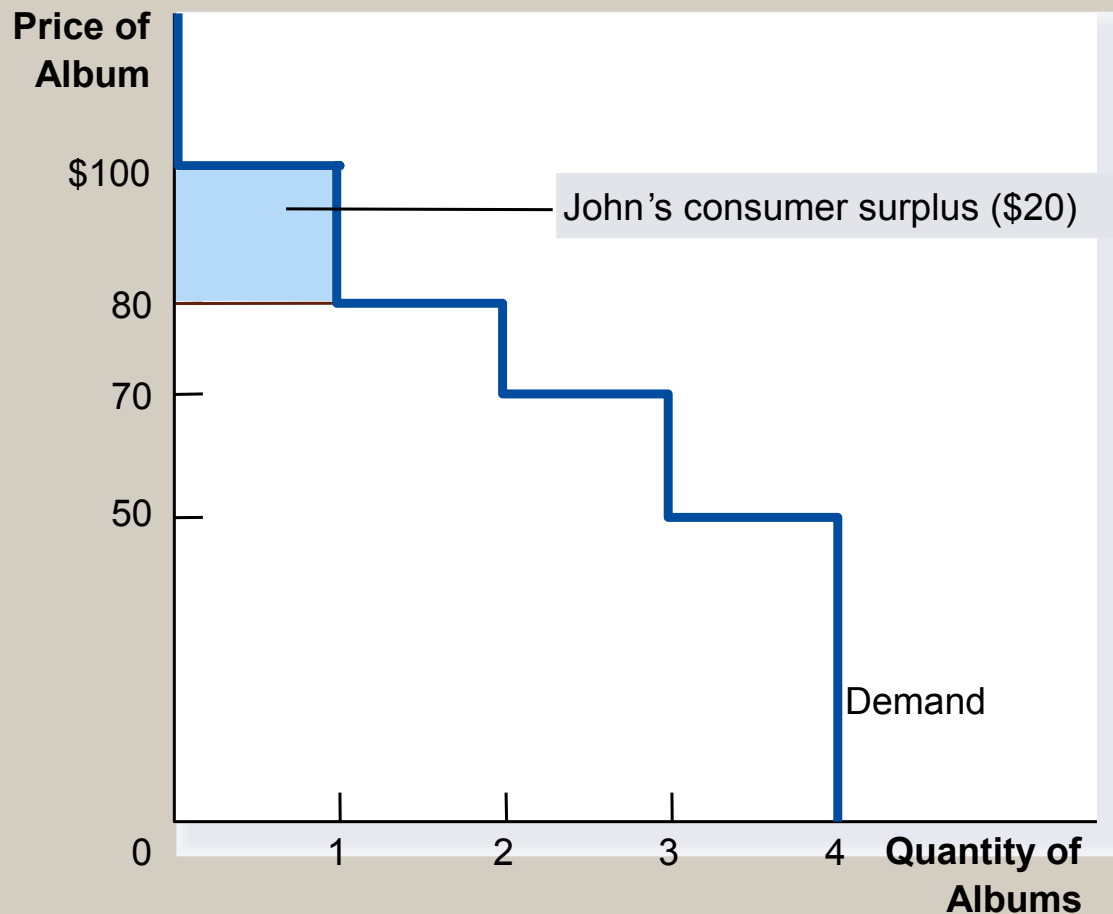
Price	Buyers	Quantity Demanded
More than \$100	None	0
\$80 to \$100	John	1
\$70 to \$80	John, Paul	2
\$50 to \$70	John, Paul, George	3
\$50 or less	John, Paul, George, Ringo	4

# Figure 1 The Demand Schedule and the Demand Curve

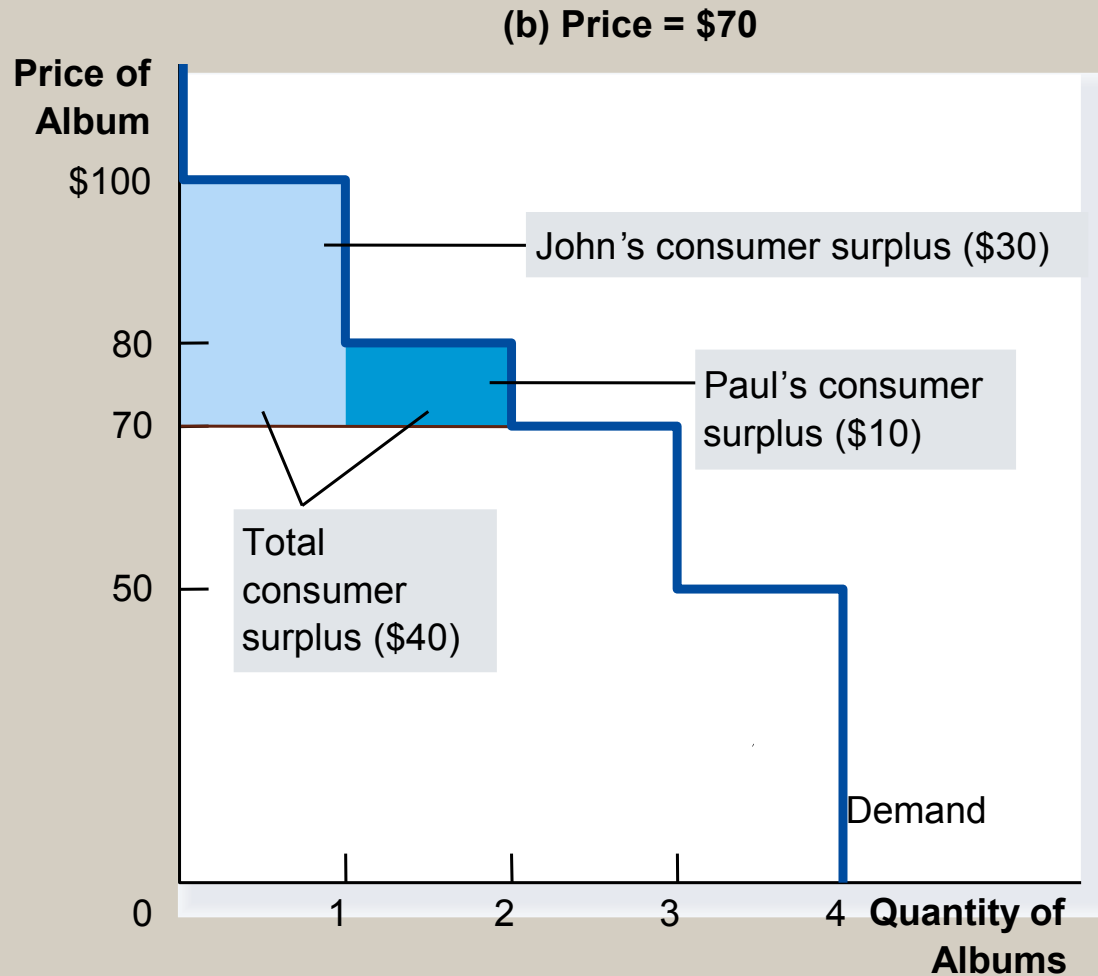


# Figure 2 Measuring Consumer Surplus with the Demand Curve

(a) Price = \$80

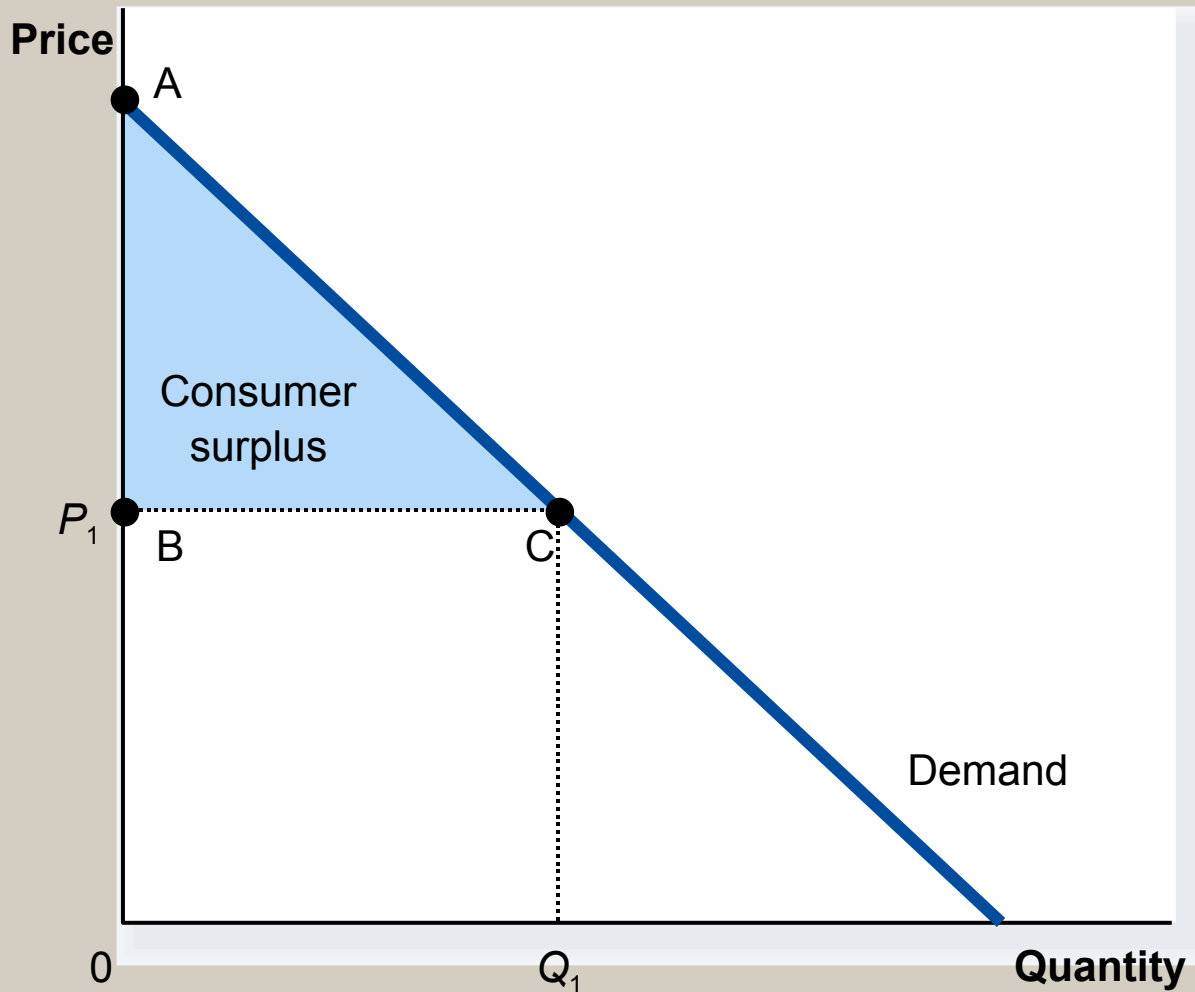


# Figure 2 Measuring Consumer Surplus with the Demand Curve



# Figure 3 How the Price Affects Consumer Surplus

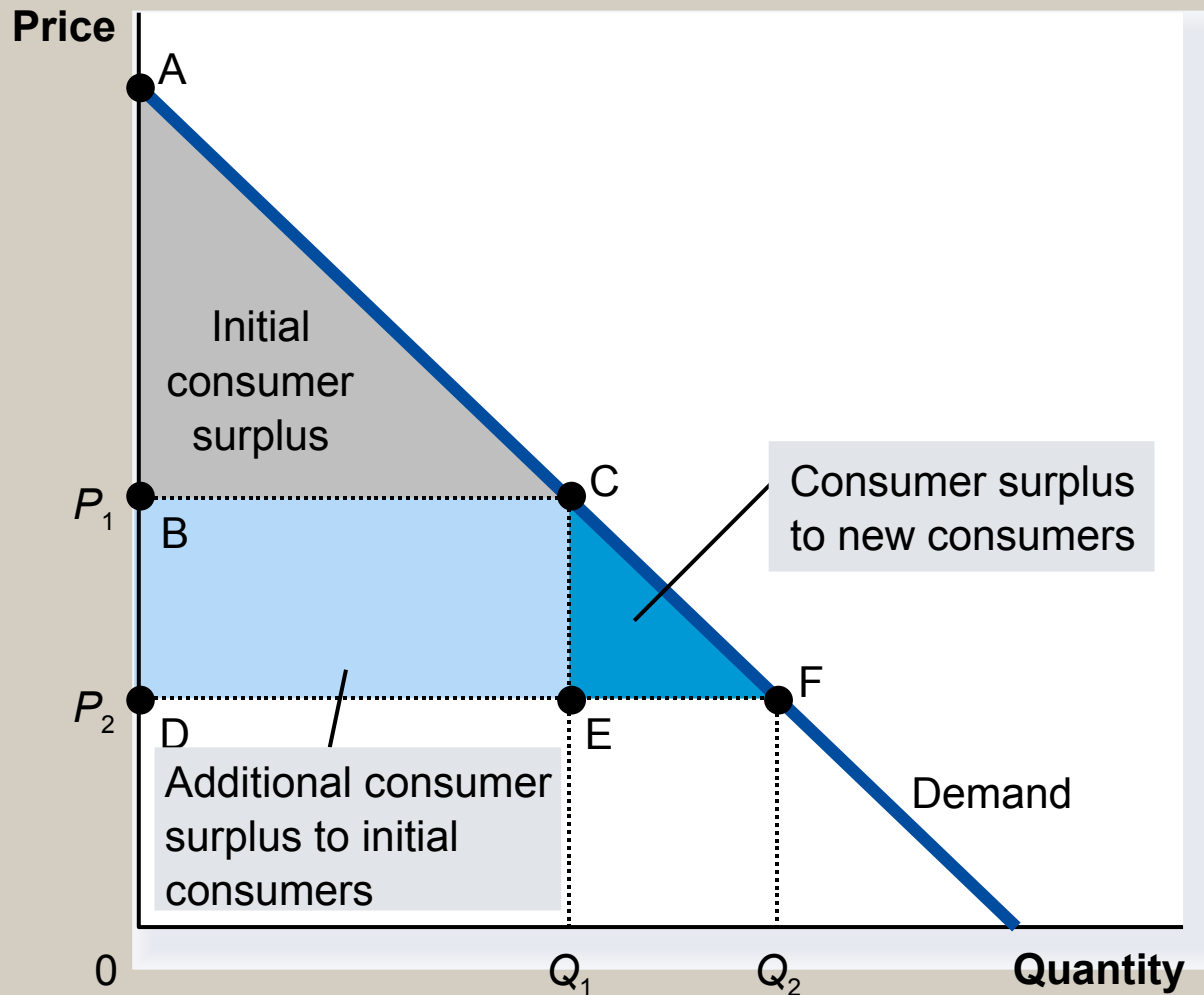
(a) Consumer Surplus at Price  $P_1$





# Figure 3 How the Price Affects Consumer Surplus

(b) Consumer Surplus at Price  $P_2$



# PRODUCER SURPLUS

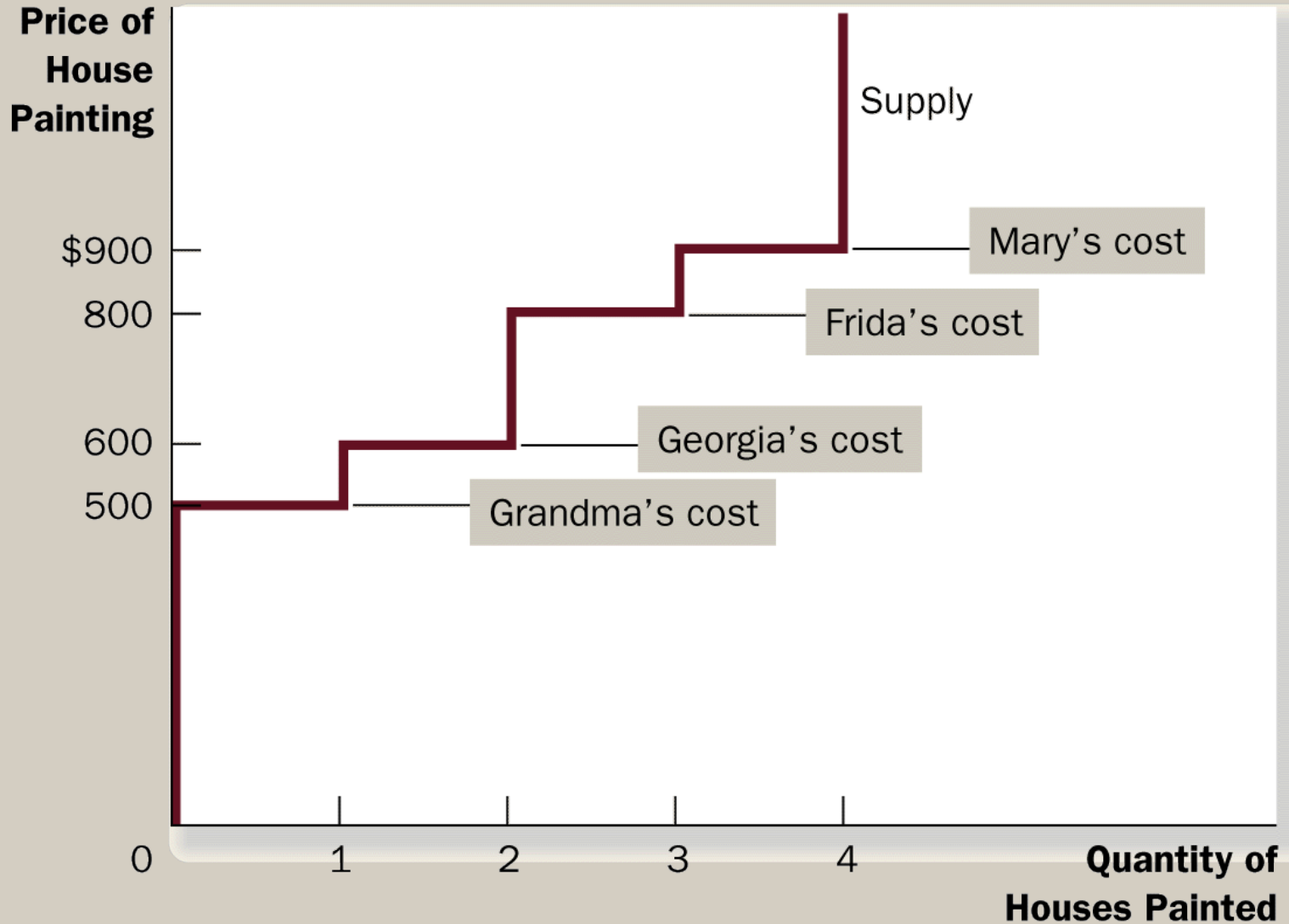
- *Producer surplus* is the amount a seller is paid for a good minus the seller's *cost*.
- It measures the benefit to sellers participating in a market.

<b>Seller</b>	<b>Cost</b>
Mary	\$900
Frida	800
Georgia	600
Grandma	500

# The Supply Schedule and the Supply Curve

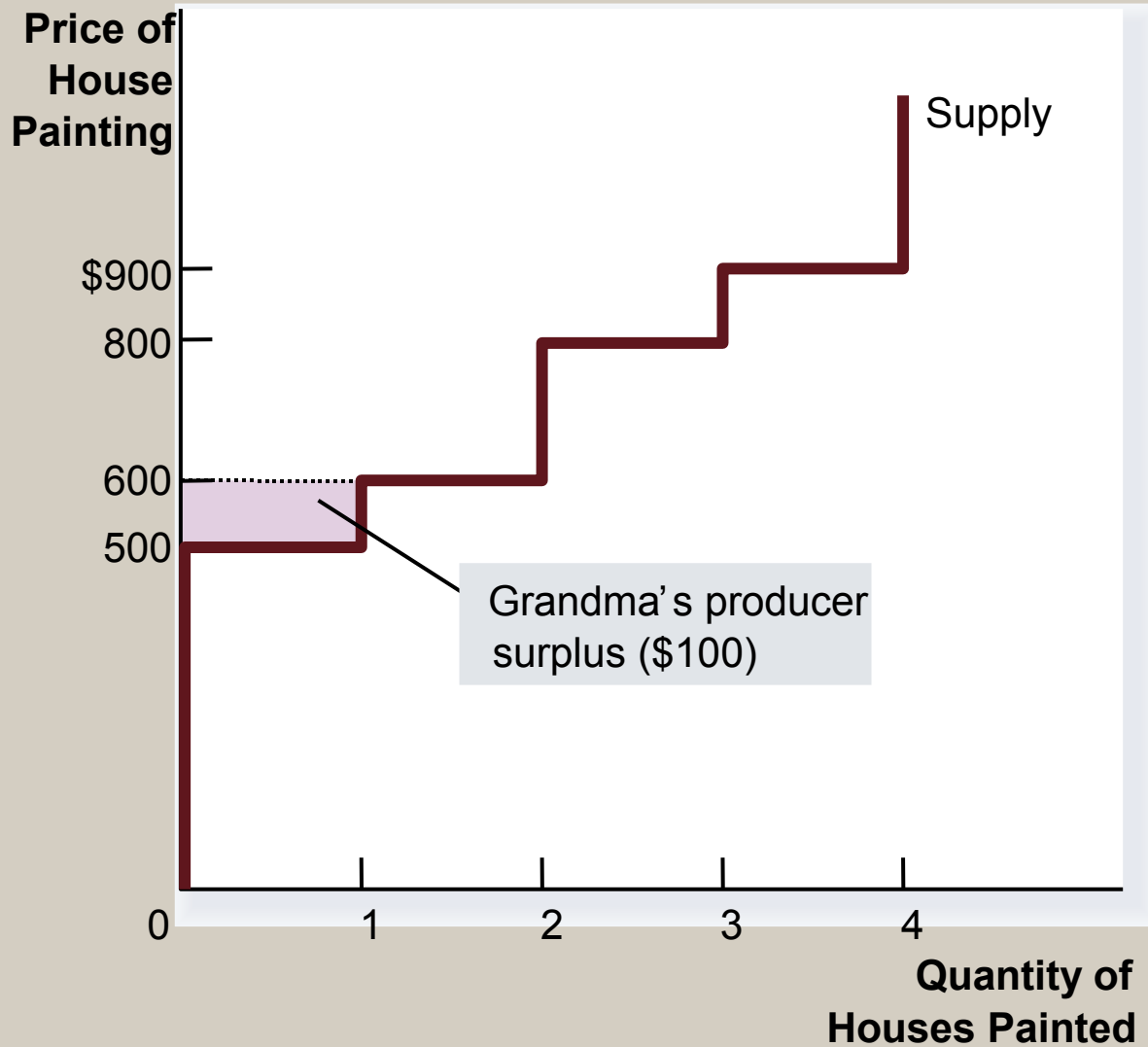
Price	Sellers	Quantity Supplied
\$900 or more	Mary, Frida, Georgia, Grandma	4
\$800 to \$900	Frida, Georgia, Grandma	3
\$600 to \$800	Georgia, Grandma	2
\$500 to \$600	Grandma	1
Less than \$500	None	0

# Figure 4 The Supply Schedule and the Supply Curve



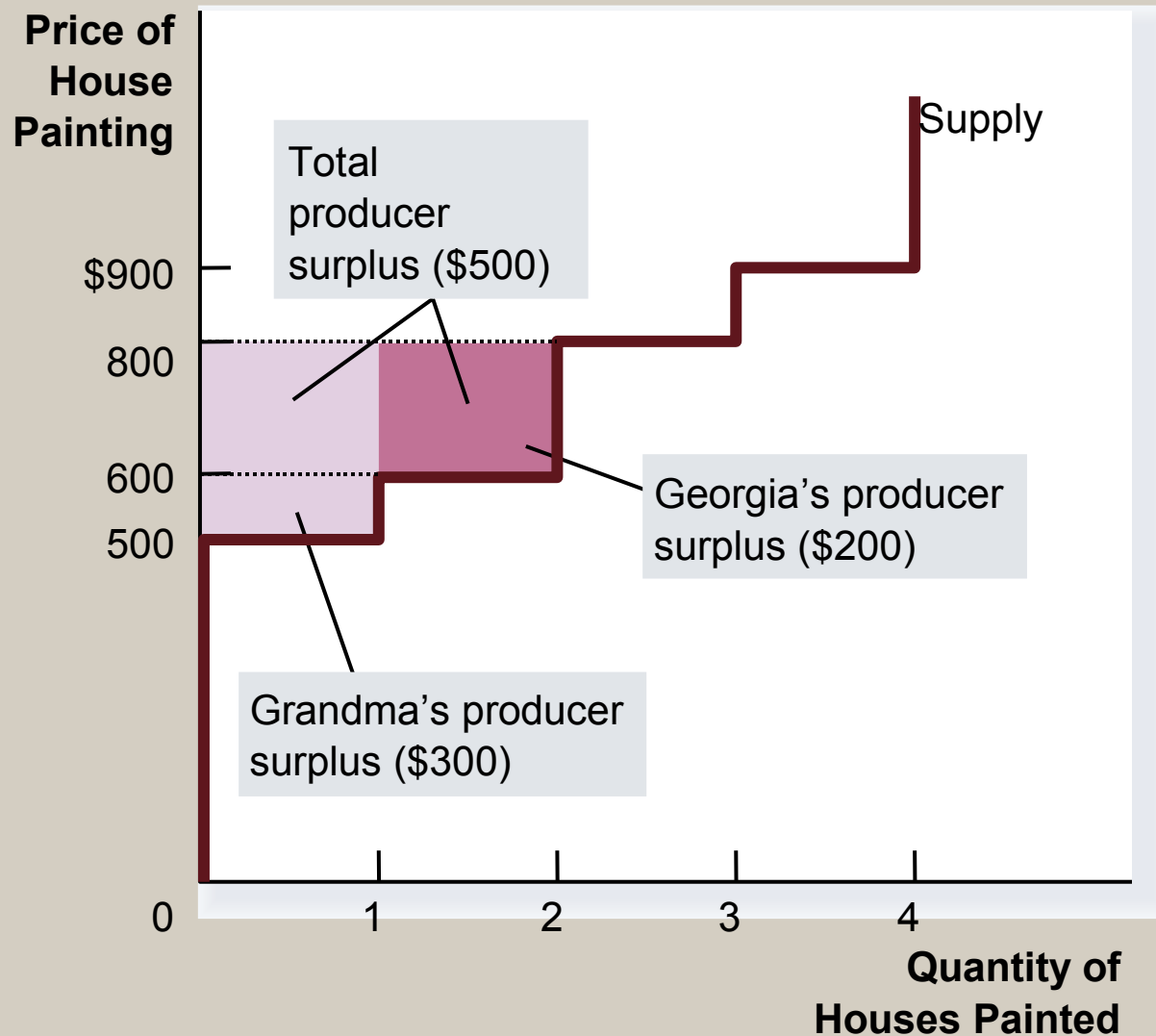
# Figure 5 Measuring Producer Surplus with the Supply Curve

(a) Price = \$600



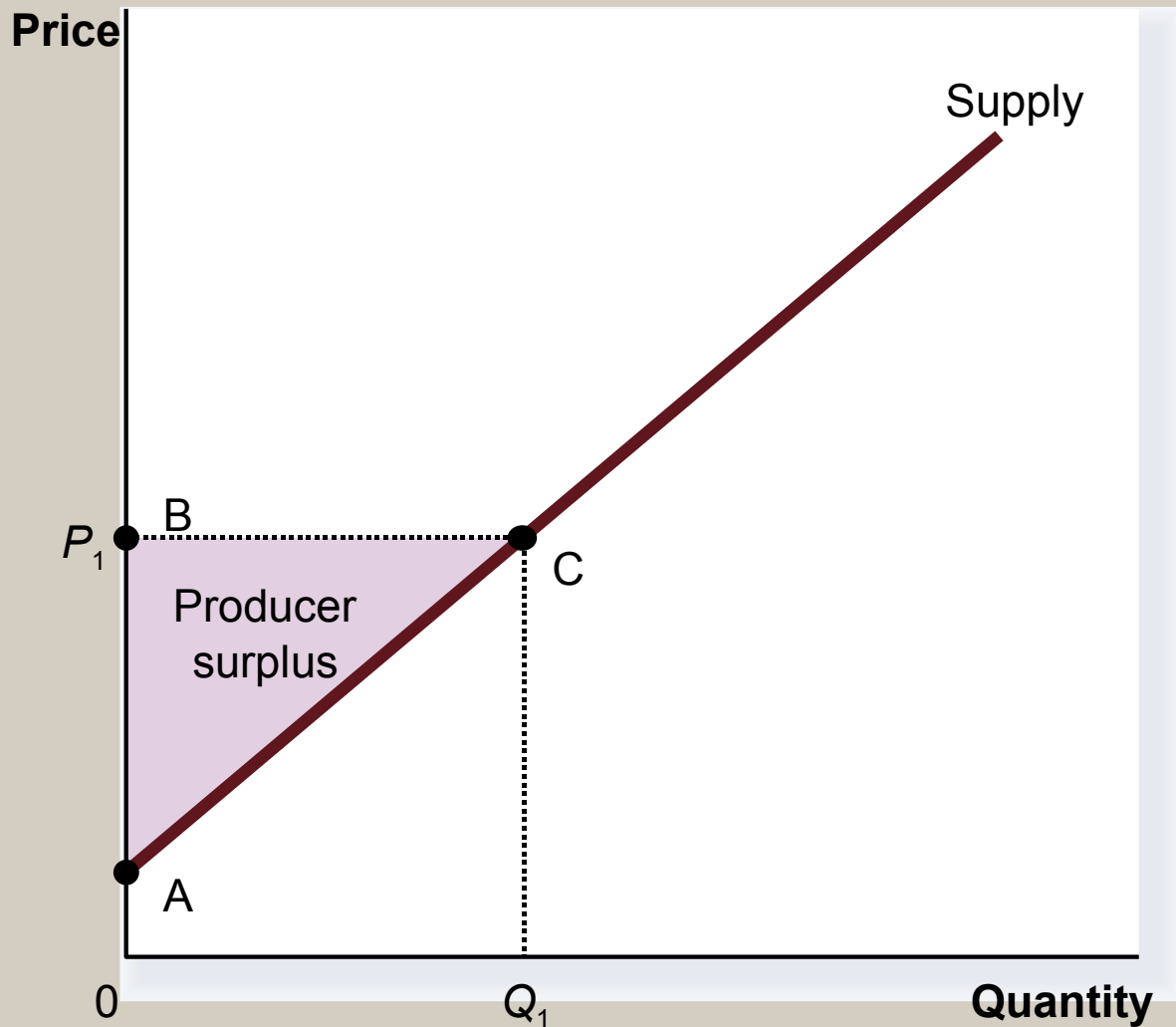
# Figure 5 Measuring Producer Surplus with the Supply Curve

(b) Price = \$800



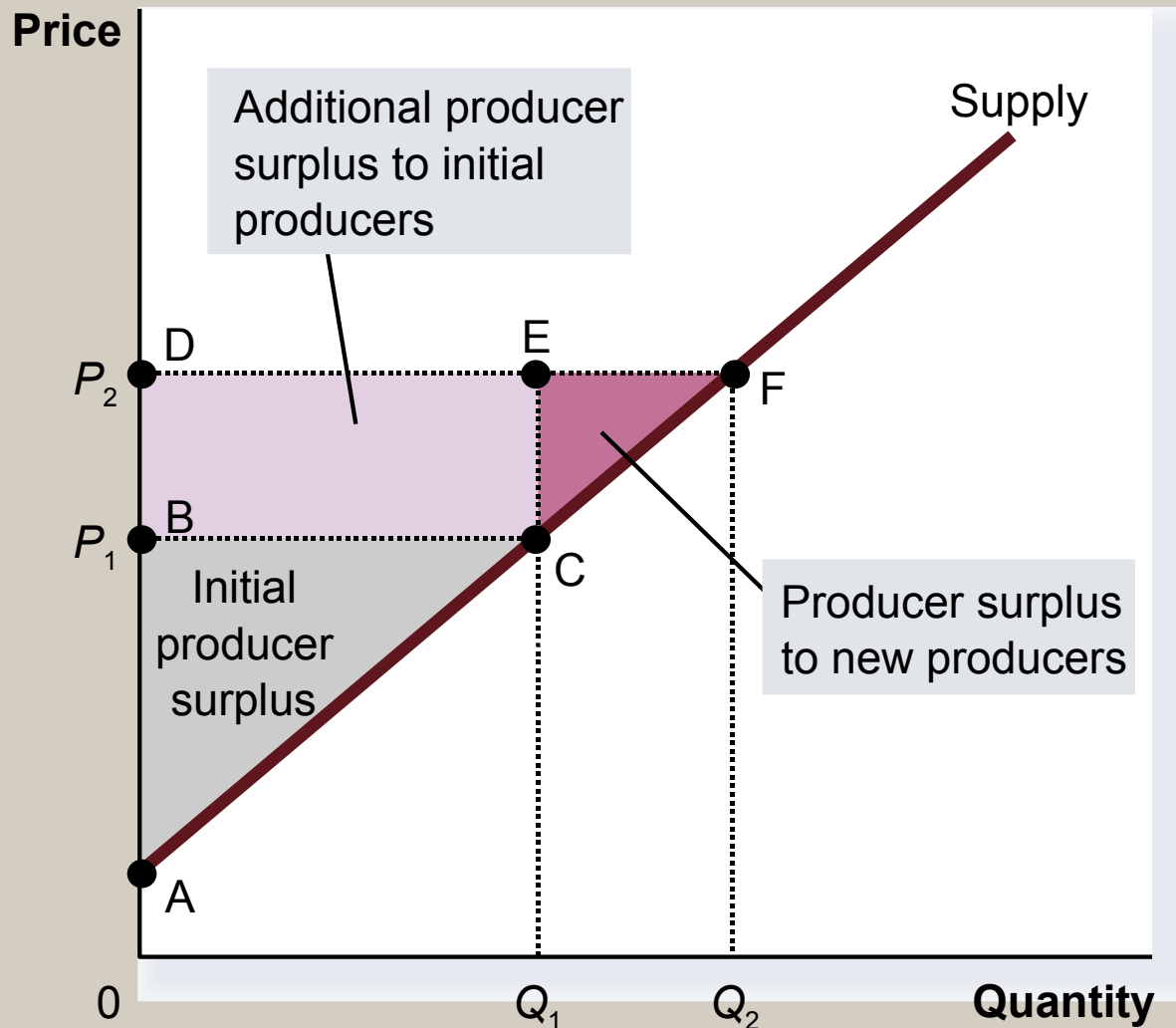
# Figure 6 How the Price Affects Producer Surplus

(a) Producer Surplus at Price  $P_1$



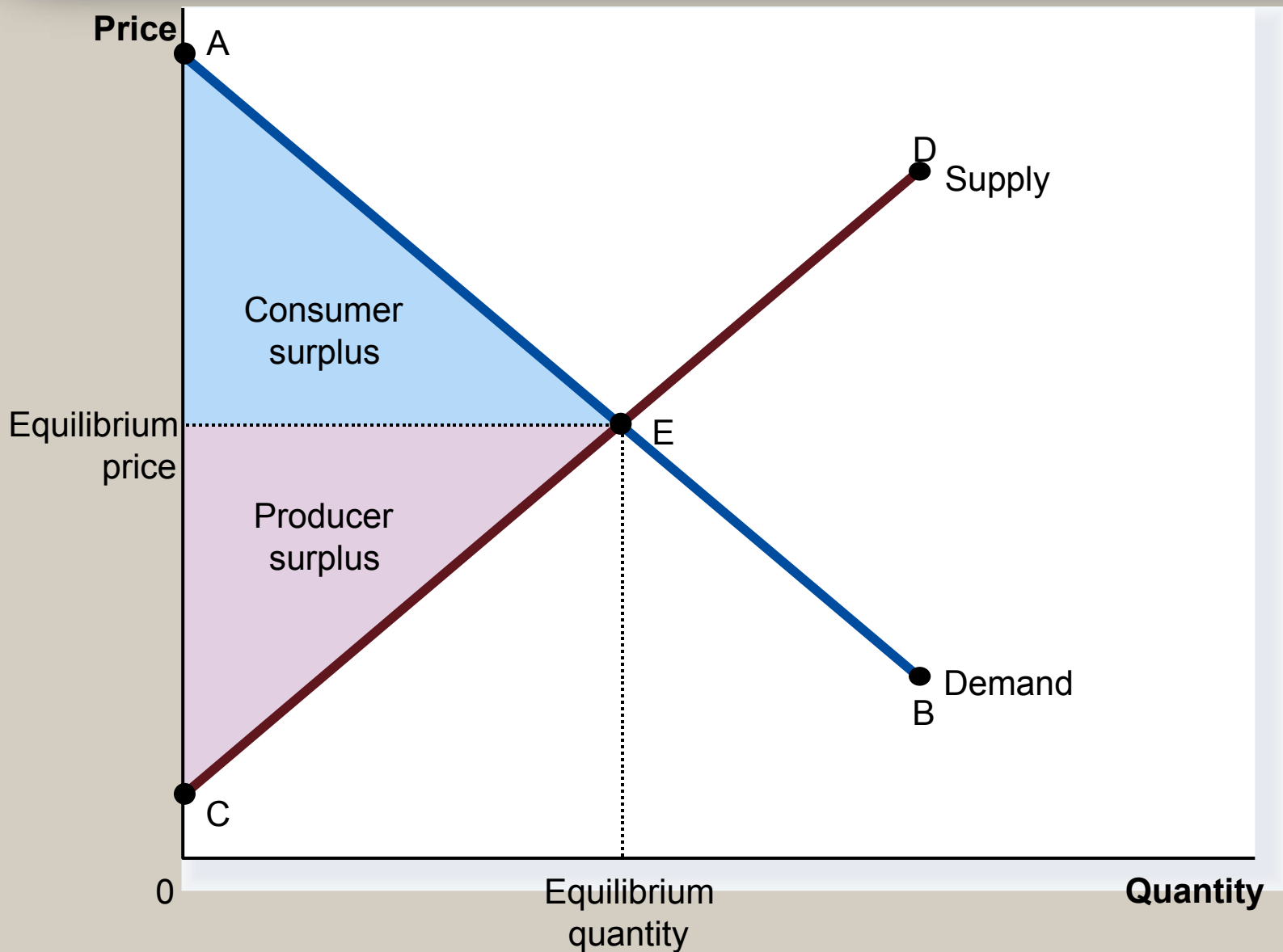
# Figure 6 How the Price Affects Producer Surplus

(b) Producer Surplus at Price  $P_2$





# Figure 7 Consumer and Producer Surplus in the Market Equilibrium



# MARKET EFFICIENCY

- Three Insights Concerning Market Outcomes
  - Free markets allocate the supply of goods to the buyers who value them most highly, as measured by their willingness to pay.
  - Free markets allocate the demand for goods to the sellers who can produce them at least cost.
  - Free markets produce the quantity of goods that maximizes the sum of consumer and producer surplus.

# Figure 8 The Efficiency of the Equilibrium Quantity

