

Supply and Demand

Introduction (1/1)

- In this chapter, we will explore the two most powerful forces in economics: supply and demand.
- Chapter Outline:
 - 2.1 Markets and Models
 - 2.2 Demand
 - 2.3 Supply
 - 2.4 Market Equilibrium
 - 2.5 Elasticity
 - 2.6 Conclusion

Markets and Models (1/2)

What is the **supply** and **demand** for a good?

- **Supply:** the combined amount of a good that all producers in a market are willing to sell
- **Demand:** the combined amount of a good that all consumers in a market are willing to buy

What is a market?

A market is defined by the specific product being bought and sold (e.g., bananas), a particular location (e.g., a grocery store, a city, etc.), and a point in time (e.g., March 15th).

Markets and Models (2/2)

The supply and demand model makes four assumptions about how markets work:

1. We focus on supply and demand in a single market.
2. All goods sold in the market are identical.
3. All goods sold in the market sell for the same price, and everyone has the same information.
4. There are many producers and consumers in the market.

Demand (1/6)

What factors influence the **demand** for a good or service?

1. Price
2. Number of consumers
3. Consumer income or wealth
4. Consumer tastes
5. Prices of other, related goods
 - Complements and substitutes

Demand (2/6)

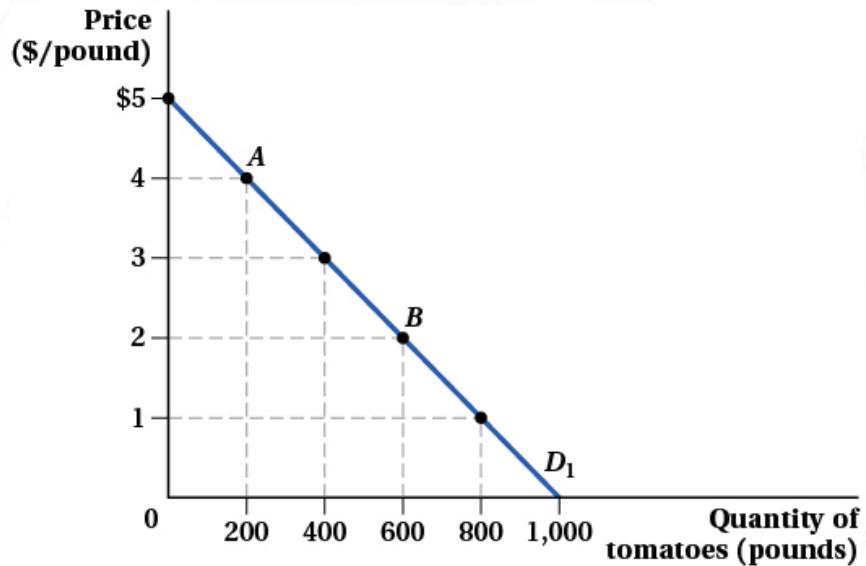
Many factors influence demand for goods and services.
Is there one factor that stands out?

- Think about how the **price** of a good influences the **quantity demanded** by consumers.
- **Demand curve:** describes the relationship between quantity of a good that consumers demand and the good's price, holding all other factors constant

Demand (3/6)

Consider the market for tomatoes. We want to map out the quantity (in pounds) demanded by local consumers at various prices (\$/pound).

Figure 2.1 Demand for Tomatoes



REMEMBER TO ALWAYS LABEL GRAPHS!

At \$5, consumers demand no tomatoes.

- This is known as the **demand choke price**.

As the price drops, consumers demand a greater quantity of tomatoes.

We draw a **demand curve** that connects all the observed price-quantity combinations.

Demand (4/6)

We can also describe the demand curve mathematically:

The **demand curve** on the previous slide is given as

$$Q^D = 1,000 - 200P$$

where Q^D is the quantity of tomatoes demanded (in pounds) and P is the price of tomatoes (\$/pound).

It is common in economics to plot price on the vertical axis.

- Solving for price as a function of quantity demanded yields the **inverse demand curve**

$$P = 5 - 0.005Q^D$$

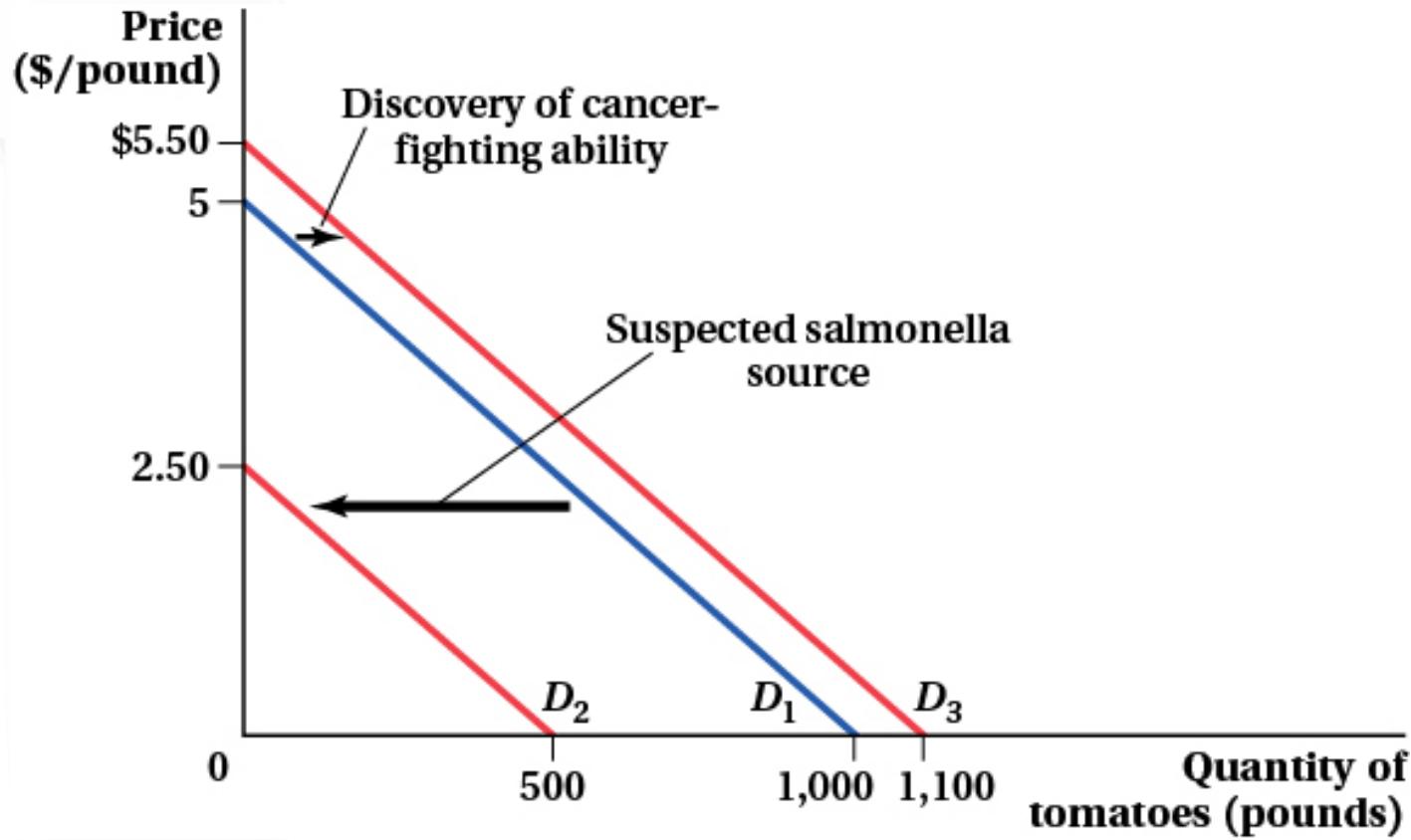
Demand (5/6)

What about the other factors that influence demand?

- The demand curve is graphed in two dimensions; all other factors are assumed constant.
 - **Change in quantity demanded**: a movement *along* the demand curve that occurs as a result of a change in the good's price
- If another factor changes, the demand curve will *shift*.
 - **Change in demand**: a shift of the entire demand curve caused by a change in a determinant of demand other than the good's own price

Demand (6/6)

Figure 2.2 Shifts in the Demand Curve



Supply (1/5)

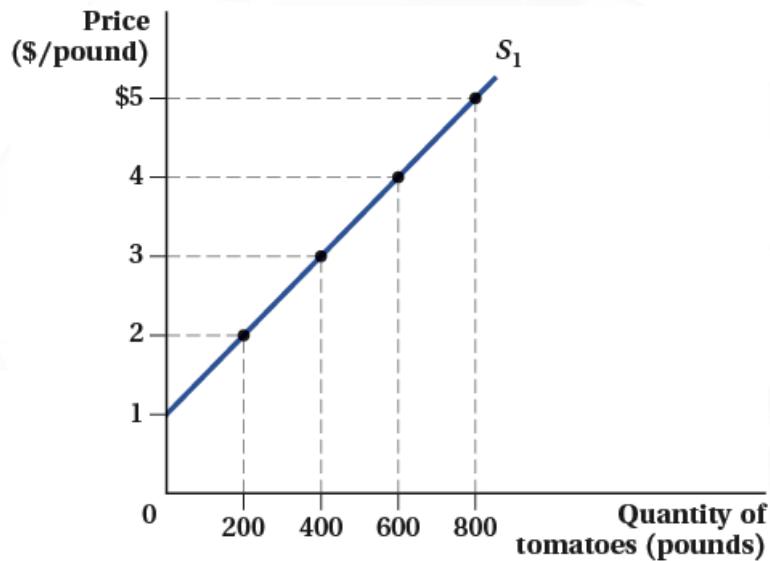
What about the other half of the model? What factors influence the **supply** of a good or service?

1. Price
2. Production costs
 - Includes the processes used to make, distribute, and sell a good (production technology)
3. Number of sellers
4. Sellers' outside options
 - Price of good in other markets and prices of other, related goods

Supply (2/5)

We can describe the relationship between the quantity of tomatoes supplied (in pounds) and the price (\$/pound) with a **supply curve**.

Figure 2.3 Supply of Tomatoes



At the price of \$1 per pound or less, suppliers find it unprofitable to sell any tomatoes so they are unwilling to supply any.

- This is known as the **supply choke price**.

As the price increases beyond \$2, suppliers will provide more and more tomatoes to the market.

Just as with demand, we connect the observed price-quantity combinations using a **supply curve**.

Supply (3/5)

We can also describe the supply curve mathematically:

The **supply curve** on the previous slide is given as

$$Q^s = 200P - 200$$

where Q^s is the quantity of tomatoes supplied (in pounds) and P is the price of tomatoes (\$/pound).

Since we plot price on the vertical axis, the **inverse supply curve** is given as

$$P = 0.005Q^s + 1$$

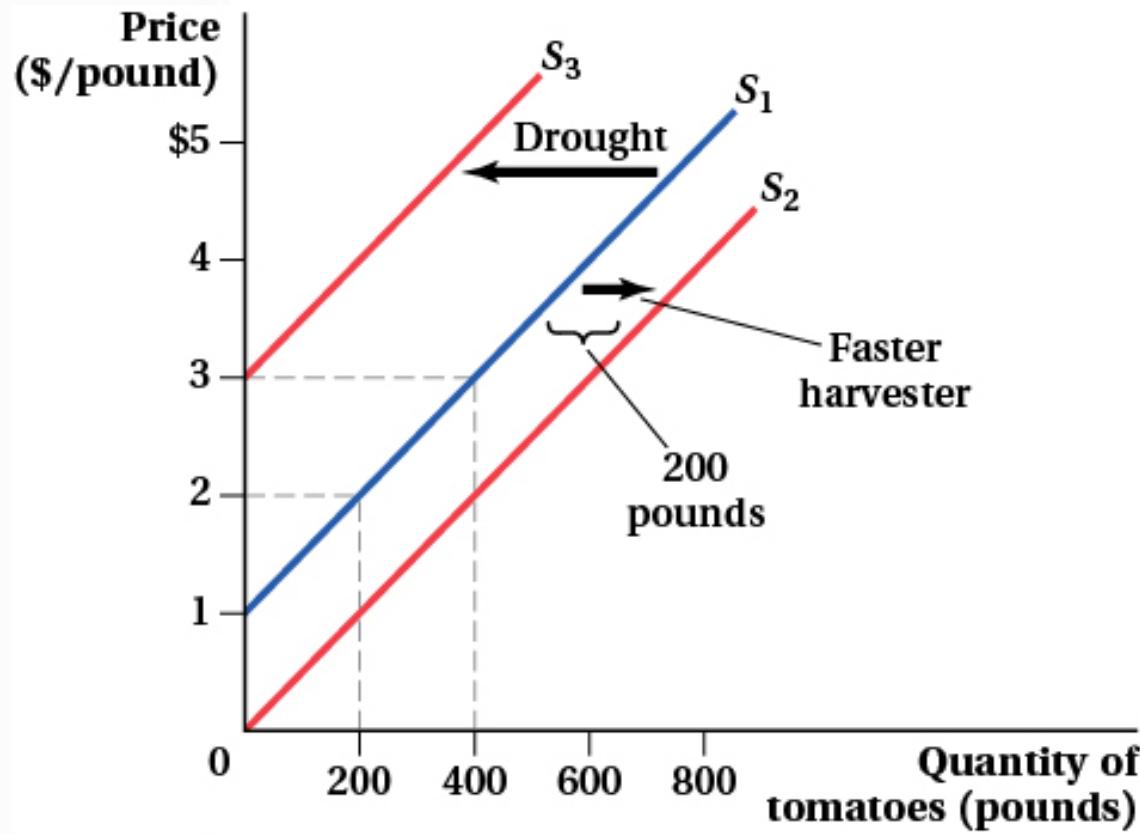
Supply (4/5)

What about the other factors that influence supply?

- The supply curve is also graphed in two dimensions; all other factors are assumed constant.
 - **Change in quantity supplied**: a movement *along* the supply curve that occurs as a result of a change in the good's price
- If another factor changes, the supply curve will *shift*.
 - **Change in supply**: a shift of the entire supply curve caused by a change in a non-price factor that affects supply

Supply (5/5)

Figure 2.4 Shifts in the Supply Curve



Market Equilibrium (1/18)

Combining market supply and market demand completes the model.

- Both relate the **price** of a good to the **quantity** demanded or supplied, so we can draw them on the same graph.

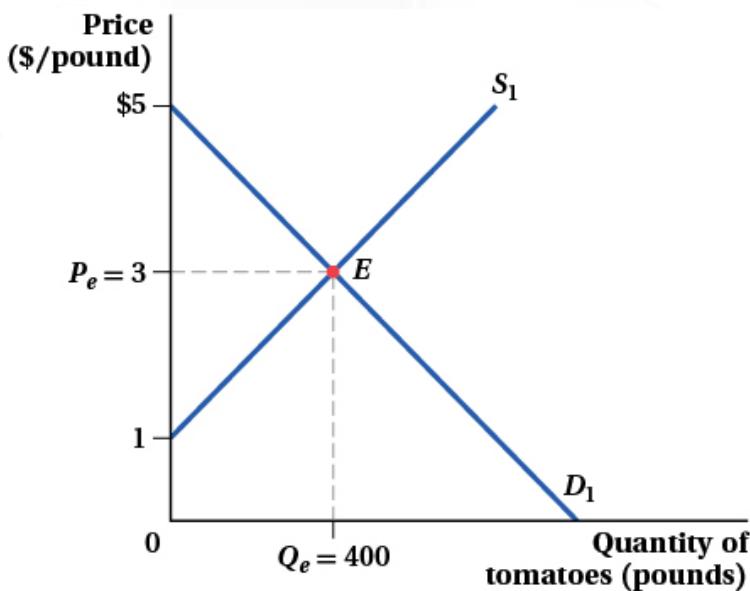
The point at which the supply and demand curves cross is called the **market equilibrium**.

- Equilibrium quantity:** (Q_e) occurs when the price of a good results in the quantity demanded (Q^D) equaling the quantity supplied (Q^S)
- Equilibrium price:** (P_e) the only price at which the quantity demanded equals the quantity supplied

Market Equilibrium (2/18)

Graphically, the equilibrium can be found by plotting the supply and demand curves together.

Figure 2.5 Market Equilibrium



Demand and supply intersect at the price of \$3.00 per pound of tomatoes, resulting in 400 pounds of tomatoes being demanded and supplied in the market.

This is the only price that can “clear” the market.

- Higher prices: Quantity supplied exceeds quantity demanded.
- Lower prices: Quantity demanded exceeds quantity supplied.

Market Equilibrium (3/18)

The market equilibrium can be identified mathematically.

Returning to the tomatoes example:

$$Q^D = 1,000 - 200P \quad \text{and} \quad Q^S = 200P - 200$$

We solve for the **equilibrium price**, P_e , by setting demand equal to supply ($Q^D = Q^S$):

$$1,000 - 200P_e = 200P_e - 200$$

Combining terms containing P_e yields:

$$1,200 = 400P_e, P_e = \$3$$

To find the **equilibrium quantity**, Q_e , substitute $P_e = 3$ into either equation. Both should yield:

$$Q_e = 400$$

Market Equilibrium (4/18)

Why markets move toward equilibrium

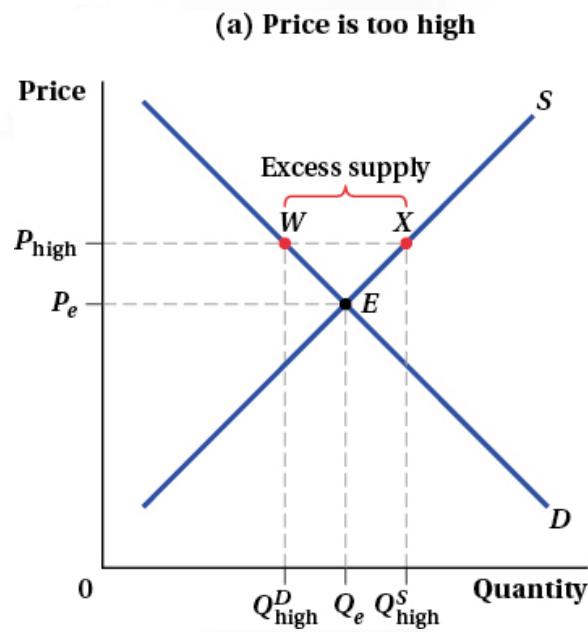
First, if $P > P_e$, quantity supplied will exceed quantity demanded, resulting in **Excess Supply**: $Q^S > Q^D$

- Excess supply is also referred to as a surplus.
- To sell their products, producers must lower prices.
 - As prices fall, quantity demanded increases and quantity supplied decreases until the market reaches an equilibrium at a lower price.

Market Equilibrium (5/18)

Describing **excess supply** graphically

Figure 2.6 Why P_e Is the Equilibrium Price



At a price of P_{high} , $Q_{S\text{ high}}$ pounds are supplied, but only $Q_{D\text{ high}}$ are demanded.

- There is an **excess supply** of:

$$Q_{S\text{ high}} - Q_{D\text{ high}}$$

To reach the equilibrium, prices must fall, leading to a decrease in the quantity supplied and an increase in the quantity demanded.

- The equilibrium is reached where both quantity demanded and quantity supplied equal Q_e at a price of P_e per pound.

Market Equilibrium (6/18)

Why markets move toward equilibrium

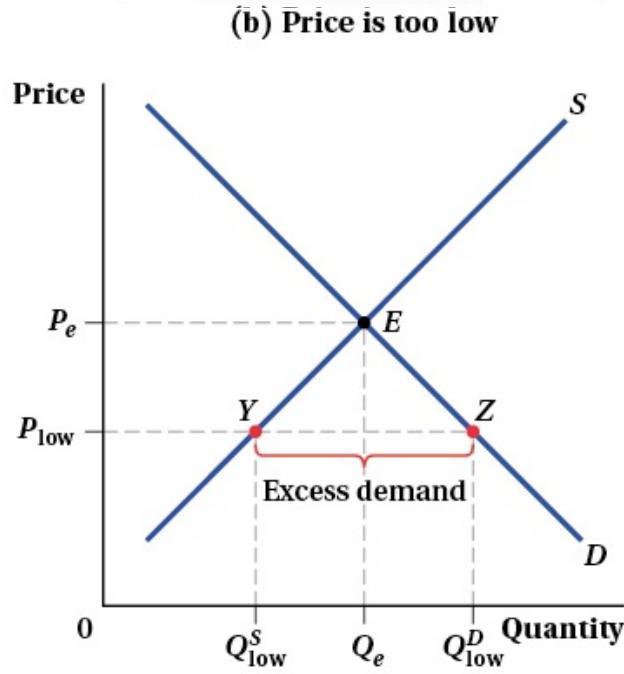
Likewise, if $P < P_e$, quantity demanded will exceed quantity supplied, resulting in **Excess Demand**: $Q^D > Q^S$

- Excess demand is also referred to as a shortage.
- The shortage will induce buyers to bid up the price.
 - As prices rise, quantity demanded will fall and quantity supplied will rise until the market reaches equilibrium at a higher price.

Market Equilibrium (7/18)

Describing excess demand graphically

Figure 2.6 Why P_e Is the Equilibrium Price



At a price of P_{low} , Q_{low}^S pounds are supplied, but Q_{low}^D pounds are demanded.

- There is an **excess demand** of $Q_{low}^D - Q_{low}^S$

To reach the equilibrium, prices must rise, leading to a decrease in the quantity demanded and an increase in the quantity supplied.

- The equilibrium is reached where both quantity demanded and quantity supplied equal Q_e at a price of P_e per pound.

Market Equilibrium (8/18)

What happens to the market equilibrium when there is a *shift* in demand or supply?

Remember the factors that can shift the demand curve:

- Number of consumers
- Wealth or income
- Consumer tastes
- Prices of related goods (complements or substitutes)

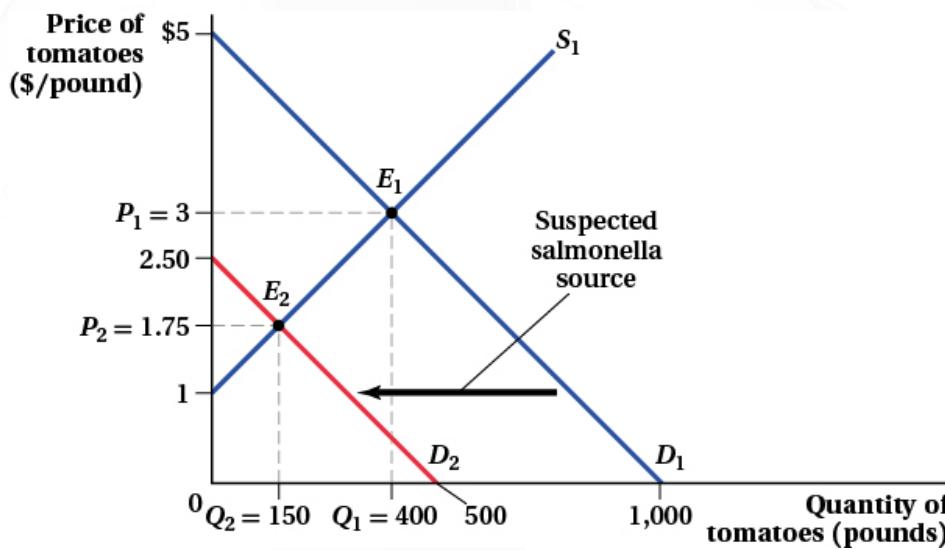
And those that shift the supply curve:

- Number of producers
- Costs of production
- Producer outside options

Market Equilibrium (9/18)

What happens to market equilibrium if there is a salmonella outbreak?

Figure 2.7 Effects of a Fall in the Demand for Tomatoes



After a salmonella outbreak, the demand for tomatoes decreases, causing a leftward shift of the demand curve from D_1 to D_2 .

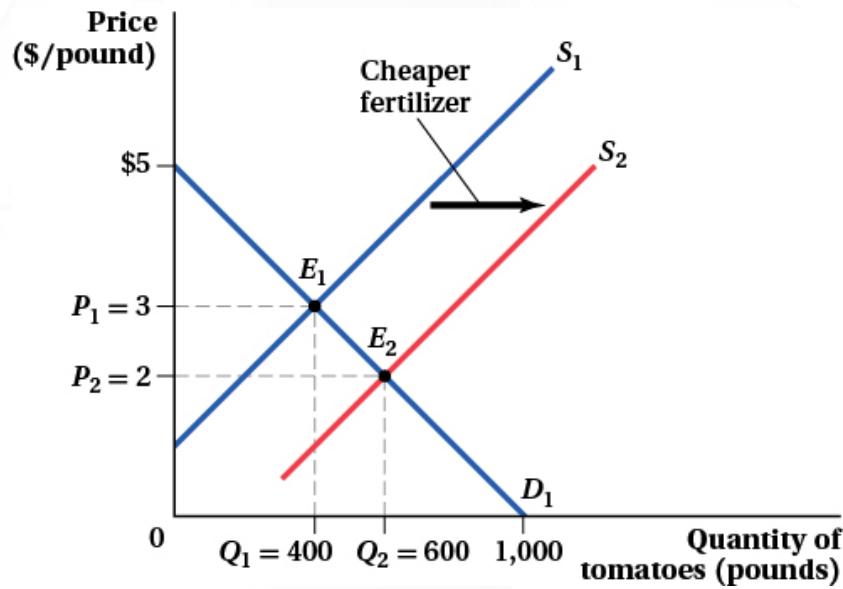
This fall in demand results in a new equilibrium point E_2 , which is lower than the initial equilibrium point E_1 .

The equilibrium quantity falls from Q_1 (400 pounds) to Q_2 (150 pounds), and the equilibrium price falls from P_1 (\$3) to P_2 (\$1.75).

Market Equilibrium (10/18)

What happens to market equilibrium if fertilizer become cheaper?

Figure 2.8 Effects of an Increase in the Supply of Tomatoes



With cheaper fertilizer, farmers supply more tomatoes at every given price and the supply curve shifts outward from S_1 to S_2 .

The equilibrium quantity increases from Q_1 (400 pounds) at E_1 to Q_2 (600 pounds) at E_2 .

The equilibrium price falls from P_1 (\$3/pound) to P_2 (\$2/pound).

Market Equilibrium (11/18)

Summary of the effect of a shift in supply or demand on market equilibrium

Table 2.2 Effect of Shifts in Demand and Supply Curves in Isolation

Curve that Shifts	Direction of Shift	Impact on Equilibrium: Price	Impact on Equilibrium: Quantity
Demand Curve	Out (increase in D)	↑	↑
	In (decrease in D)	↓	↓
Supply Curve	Out (increase in S)	↓	↑
	In (decrease in S)	↑	↓

Market Equilibrium (12/18):

Question 1

Consider the market for burritos. Which of the following will result in an *increase in the equilibrium price and a decrease in the equilibrium quantity* of burritos?

- A. an increase in the price of beans (an input)
- B. new advancements in burrito-making technology
- C. news report on the negative health risks of burritos
- D. an increase in the price of tortilla chips (a complement)

Market Equilibrium (12/18): Question 1 – Correct Answer

Consider the market for burritos. Which of the following will result in an *increase in the equilibrium price and a decrease in the equilibrium quantity of burritos?*

- A. an increase in the price of beans (an input) (correct answer)
- B. new advancements in burrito-making technology
- C. news report on the negative health risks of burritos
- D. an increase in the price of tortilla chips (a complement)

Market Equilibrium (13/18):

Question 2

Consider the market for hot dog buns. Which of the following will result in a *decrease in the equilibrium price and a decrease in the equilibrium quantity* of hot dog buns?

- A. an increase in consumers' preferences for hot dogs
- B. a decrease in the price of hot dogs
- C. an increase in the price of hot dogs
- D. an increase in the price of flour (an input to hot dog buns)

Market Equilibrium (13/18): Question 2 – Correct Answer

Consider the market for hot dog buns. Which of the following will result in a *decrease* in the equilibrium *price and a decrease* in the equilibrium *quantity* of hot dog buns?

- A. an increase in consumers' preferences for hot dogs
- B. a decrease in the price of hot dogs.
- C. **an increase in the price of hot dogs (correct answer)**
- D. an increase in the price of flour (an input to hot dog buns)

Market Equilibrium (14/18)

What determines the *magnitude* of the change in equilibrium price and quantity?

Two important parameters:

- 1. Size of the shift**
- 2. Slope of the curves**

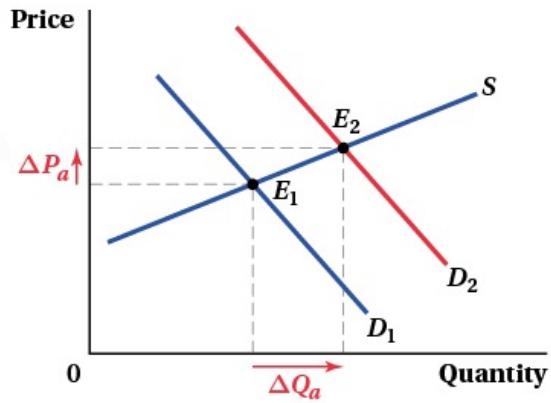
- If demand shifts, the slope of the *supply curve* determines the size of the change in equilibrium price and quantity, and vice versa.
- The size of the change in price is *inversely* related to the size of the change in quantity.

Market Equilibrium (15/18)

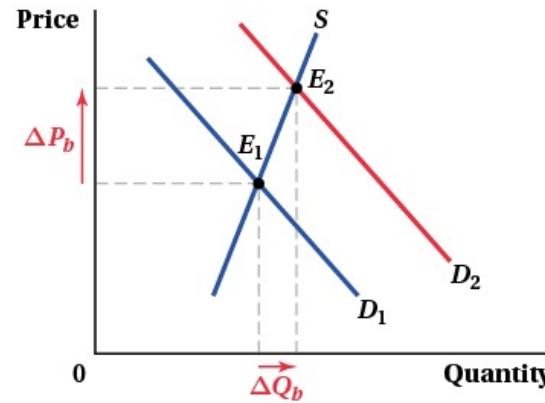
Consider an outward shift in demand (increase)

Figure 2.10 Size of Equilibrium Price and Quantity Changes

(a) Demand curve shift with flatter supply curve



(b) Demand curve shift with steeper supply curve



Panel (a): Supply has relatively shallow slope: The same shift in demand results in *small* change in price and *large* change in quantity exchanged.

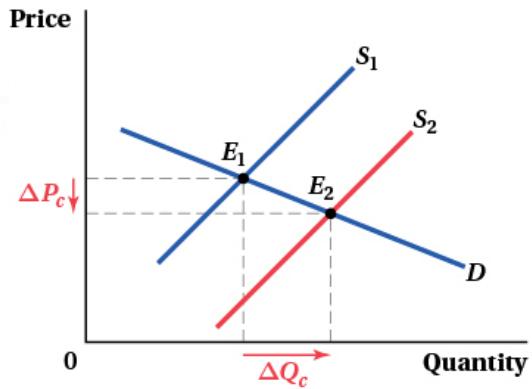
Panel (b): Supply has relatively steep slope: Shift in demand results in *large* change in price and *small* change in quantity exchanged.

Market Equilibrium (16/18)

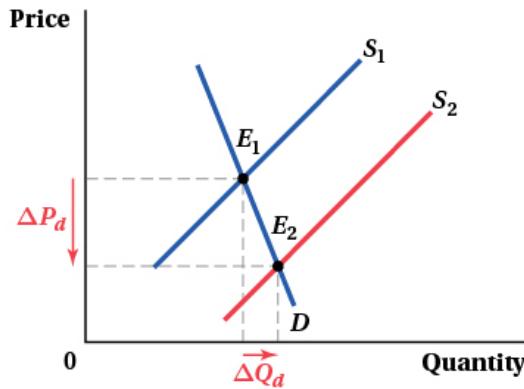
Consider an outward shift in supply (increase)

Figure 2.10 Size of Equilibrium Price and Quantity Changes

(c) Supply curve shift with flatter demand curve



(d) Supply curve shift with steeper demand curve



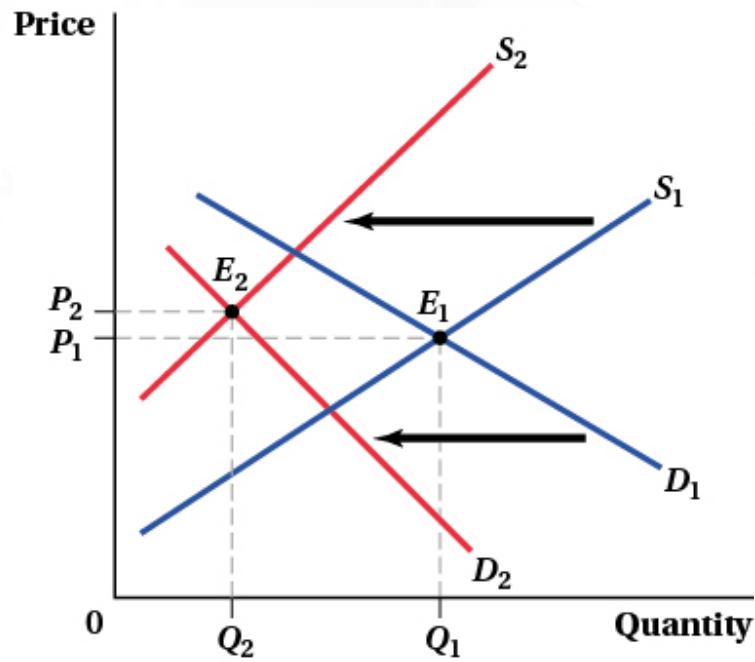
Panel (c): Demand has relatively shallow slope: The same shift in supply results in *small* change in price and *large* change in quantity exchanged.

Panel (d): Demand has relatively steep slope: Shift in supply results in *large* change in price and *small* change in quantity exchanged.

Market Equilibrium (17/18)

Sometimes, demand and supply can shift at the same time!

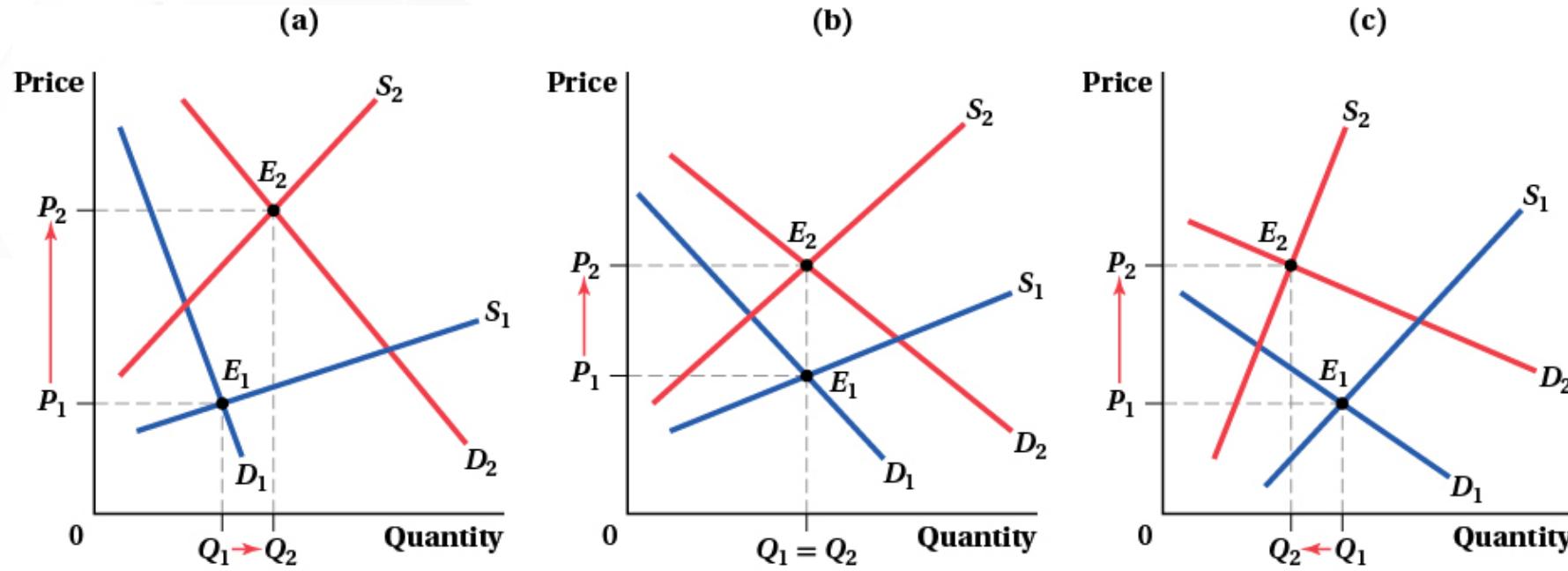
Figure 2.11 Example of a Simultaneous Shift in Demand and Supply



- The original equilibrium is at point E_1 .
- The decrease in supply and decrease in demand both decrease quantity.
- However, the decrease in supply and demand have opposing effects on equilibrium price.

Market Equilibrium (18/18)

Figure 2.12 When Both Curves Shift, the Direction of Either Price or Quantity Will Be Ambiguous



Elasticity (1/14)

The *slopes* of the supply and demand curves determine how markets respond to shifts in supply and demand.

- **Steep curves:** *large* changes in price and *small* changes in quantity, all else equal
- **Shallow curves:** *small* changes in price and *large* changes in quantity, all else equal

Elasticity (2/14)

Elasticity

- Unit-less measure that describes the sensitivity of quantity demanded or supplied to changes in price, income, or price of related goods.
- Percentage change in one variable (e.g., quantity) divided by the percentage change in another (e.g., price)

Elasticity (3/14)

Price elasticity of demand: percentage change in quantity demanded divided by percent change in price

$$E^D = \frac{\% \Delta Q^D}{\% \Delta P}$$

Price elasticity of supply: percentage change in quantity supplied divided by percent change in price

$$E^S = \frac{\% \Delta Q^S}{\% \Delta P}$$

Elasticity (4/14)

Markets with **large price elasticities of demand**...

- Relatively *small* increases in price result in relatively *large* drops in quantity demanded.

Markets with **less price-responsive elasticities of demand**...

- Relatively *large* increases in price result in relatively *small* drops in quantity demanded.

Markets with **large price elasticities of supply**...

- Relatively *small* increases in price result in relatively *large* increases in quantity supplied.

Markets with **low price elasticities of supply**...

- Relatively *large* increases in price result in relatively *small* increases in quantity supplied.

Elasticity (5/14)

What variables affect the elasticity of demand?

1. Availability of close substitutes
2. Breadth of the market
3. Type of product
 - Necessity or luxury item
4. Percentage of income spent on the good
5. Time horizon of the analysis

What variables affect the elasticity of supply?

1. The ease at which production capacity can be expanded
2. Time horizon of the analysis

Elasticity (6/14)

Terminology

- Inelastic: Demand is inelastic if $0 < |E^D| < 1$
- Unit elastic: Demand is unit elastic if $|E^D| = 1$
- Elastic: Demand is elastic if $|E^D| > 1$
- Perfectly elastic: Demand is perfectly elastic if $|E^D| = \infty$
- Perfectly inelastic: Demand is perfectly inelastic if $|E^D| = 0$

Important: Elasticities do not have units attached.

- Allows for the comparison across different goods and services in different markets
- Above also used to describe supply.

Elasticity (7/14)

Elasticities and Linear Demand and Supply

We often assume demand and supply are linear, so knowing how to calculate the elasticity of a linear curve is important.

The equation for price elasticity (demand or supply):

$$E = \frac{\% \Delta Q}{\% \Delta P} \quad \text{or} \quad E = \frac{\Delta Q / Q}{\Delta P / P}$$

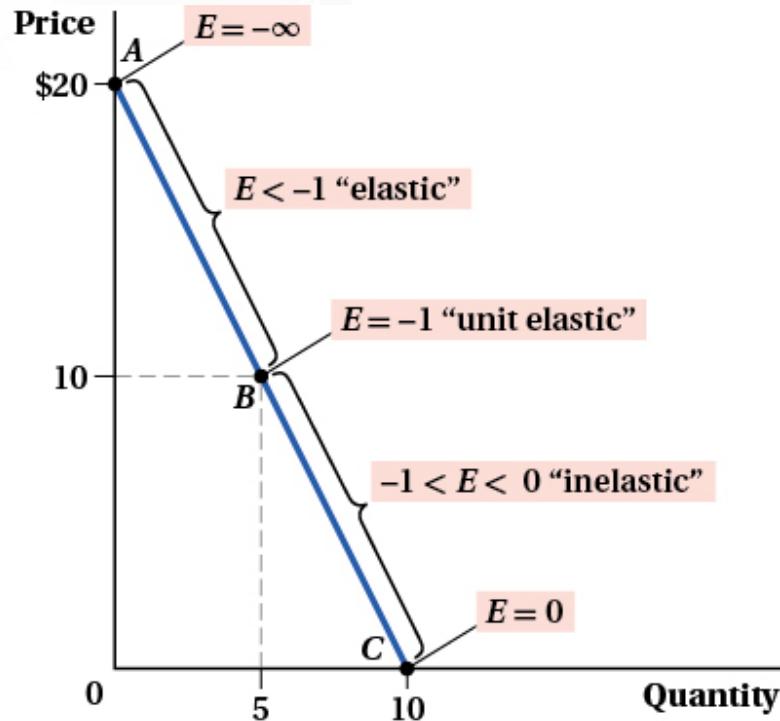
Moving up or down an inverse linear supply or demand curve, the ratio $\Delta Q / \Delta P$ is equal to 1/slope. Rewriting the formula above:

$$E = \frac{\Delta Q / Q}{\Delta P / P} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = \frac{1}{\text{slope}} \cdot \frac{P}{Q}$$

Elasticity (8/14)

Price Elasticity of Demand for a Linear Demand Curve

Figure 2.13 Elasticity of a Linear Demand Curve



As we move down the demand curve, the ratio between price and quantity (P/Q) falls, reducing the magnitude of the price elasticity of demand.

Note: The slope of the linear demand curve does not change as we move down the demand curve, so the falling P/Q ratio decreases the elasticity of demand.

Elasticity (9/14)

As you move down a demand curve, demand becomes *less elastic* (i.e., more inelastic).

- Eventually perfectly inelastic at the horizontal axis

$$E^D = \frac{\Delta Q^D}{\Delta P} \times \frac{P}{Q^D}$$

Slope is constant along the demand curve.

P/Q falls as you move down the demand curve.

Elasticity (10/14)

Perfectly *Inelastic* Demand and Supply

- Implies quantity demanded/supplied does not change in response to a change in price
- Example?
 - Life-saving drugs (near-perfectly inelastic demand)

Perfectly *Elastic* Demand and Supply

- Implies the quantity demanded/supplied is *infinitely* responsive to minuscule changes in price
- Example?
 - Commodity crops (near-perfectly elastic demand)

Elasticity (11/14)

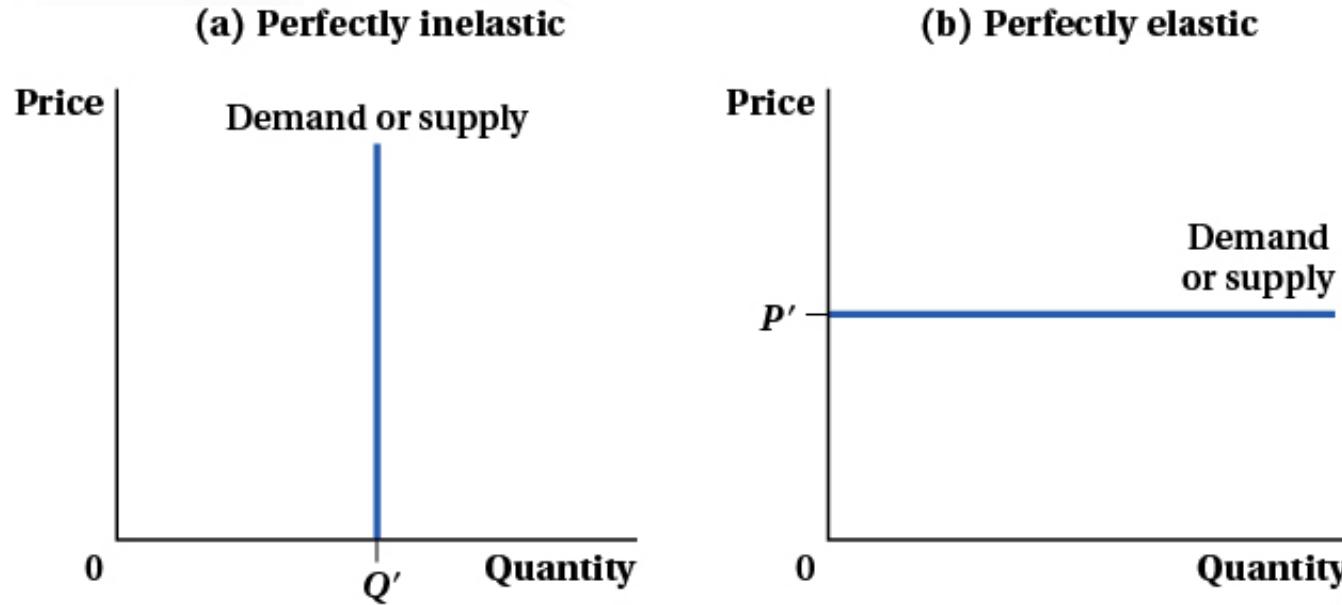
When is demand/supply **perfectly inelastic** ($E = 0$)?

- When the slope of demand/supply is infinite

When is demand/supply **perfectly elastic** ($E = \infty$)?

- When the slope of demand/supply is zero

Figure 2.14 Perfectly Inelastic and Perfectly Elastic Demand or Supply Curves



Elasticity (12/14)

Income elasticity of demand: the ratio of the percentage change in the quantity demanded to the corresponding percentage change in consumer income:

$$E_I^D = \frac{\% \Delta Q^D}{\% \Delta I} = \frac{\Delta Q^D / Q^D}{\Delta I / I}$$

The sign of E_I^D depends on the type of product:

- E_I^D is negative for inferior goods.
 - Consumption *decreases* with increases in income.
- E_I^D is positive for normal goods.
 - Consumption *increases* with increases in income.
 - Luxury Goods: $E_I^D > 1$

Elasticity (13/14)

Cross-price elasticity of demand: The ratio of the percentage change in one good's quantity demanded (e.g., good X) to the percentage change in the price of another good (e.g., good Y):

$$E_{XY}^D = \frac{\% \Delta Q_X^D}{\% \Delta P_Y} = \frac{\Delta Q_X^D / Q_X^D}{\Delta P_Y / P_Y}$$

where X and Y are different products that may be related. The sign of E_{XY}^D depends on the relationship between the products:

- E_{XY}^D is negative for complements
 - Consumption of good X decreases with an increase in the price of a related good Y , and vice versa.
- E_{XY}^D is positive for substitutes
 - Consumption of good X increases with an increase in the price of a related good Y , and vice versa.

Elasticity (14/14): Question 1

A good has an income elasticity of -1.50. If consumers' incomes increase by 10%, the demand for the good:

- A. increases by 10%.
- B. decreases by 10%.
- C. increases by 15%.
- D. decreases by 15%.

Elasticity (14/14):

Question 1 – Correct Answer

A good has an income elasticity of -1.50. If consumers' incomes increase by 10%, the demand for the good:

- A. increases by 10%.
- B. decreases by 10%.
- C. increases by 15%.
- D. **decreases by 15%. (correct answer)**

Conclusion (1/1)

This chapter has introduced one of the most basic models in economics: the **Supply and Demand** model.

Forthcoming chapters:

- Examine the factors of production underlying supply.
- Introduce consumer theory, which underlies market demand.
- Examine situations in which assumptions fail to reflect reality (e.g., the impact of uncertainty).

In **Chapter 3**, we will discover how consumers and producers benefit from markets, and examine the impact of government regulation on market outcomes.