

CHAPTER 2

The Basics of Supply and Demand

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Chapter 2 Supply and Demand

CHAPTER 2 OUTLINE

- 2.1 Supply and Demand
- 2.2 The Market Mechanism
- 2.3 Changes in Market Equilibrium
- 2.4 Elasticities of Supply and Demand
- 2.5 Short-Run versus Long-Run Elasticities
- 2.6 Understanding and Predicting the Effects of Changing Market Conditions
- 2.7 Effects of Government Intervention—Price Controls

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The Basics of Supply and Demand



Supply-demand analysis is a fundamental and powerful tool that can be applied to a wide variety of interesting and important problems. To name a few:

- Understanding and predicting how changing world economic conditions affect market price and production
- Evaluating the impact of government price controls, minimum wages, price supports, and production incentives
- Determining how taxes, subsidies, tariffs, and import quotas affect consumers and producers

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2.1 SUPPLY AND DEMAND

The Supply Curve

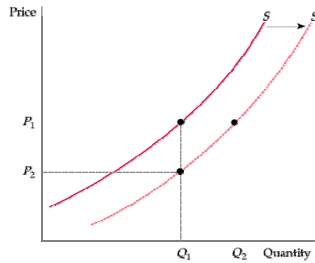
- **supply curve** Relationship between the quantity of a good that producers are willing to sell and the price of the good.

Figure 2.1

The Supply Curve

The supply curve, labeled S in the figure, shows how the quantity of a good offered for sale changes as the price of the good changes. The supply curve is upward sloping; The higher the price, the more firms are able and willing to produce and sell.

If production costs fall, firms can produce the same quantity at a lower price or a larger quantity at the same price. The supply curve then shifts to the right (from S to S').



2.1 SUPPLY AND DEMAND

The Supply Curve

The supply curve is thus a relationship between the quantity supplied and the price. We can write this relationship as an equation:

$$Q_s = Q_s(P)$$

Other Variables That Affect Supply

The quantity that producers are willing to sell depends not only on the price they receive but also on their production costs, including wages, interest charges, and the costs of raw materials.

When production costs *decrease*, output *increases* no matter what the market price happens to be. *The entire supply curve thus shifts to the right.*

Economists often use the phrase *change in supply* to refer to shifts in the supply curve, while reserving the phrase *change in the quantity supplied* to apply to movements along the supply curve.

2.1 SUPPLY AND DEMAND

The Demand Curve

- **demand curve** Relationship between the quantity of a good that consumers are willing to buy and the price of the good.

We can write this relationship between quantity demanded and price as an equation:

$$Q_D = Q_D(P)$$

2.1 SUPPLY AND DEMAND

The Demand Curve

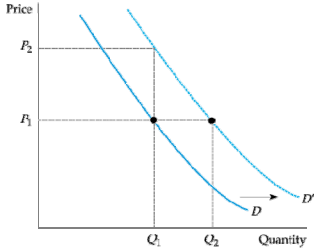
Figure 2.2

The Demand Curve

The demand curve, labeled D , shows how the quantity of a good demanded by consumers depends on its price. The demand curve is downward sloping; holding other things equal, consumers will want to purchase more of a good as its price goes down.

The quantity demanded may also depend on other variables, such as income, the weather, and the prices of other goods. For most products, the quantity demanded increases when income rises.

A higher income level shifts the demand curve to the right (from D to D').

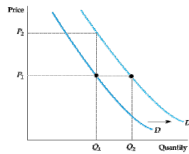


2.1 SUPPLY AND DEMAND

The Demand Curve

Shifting the Demand Curve

If the market price were held constant at P_1 , we would expect to see an increase in the quantity demanded—say from Q_1 to Q_2 , as a result of consumers' higher incomes. Because this increase would occur no matter what the market price, the result would be a *shift to the right of the entire demand curve*.



Shifting the Demand Curve

- **substitutes** Two goods for which an increase in the price of one leads to an increase in the quantity demanded of the other.
- **complements** Two goods for which an increase in the price of one leads to a decrease in the quantity demanded of the other.

2.2 THE MARKET MECHANISM

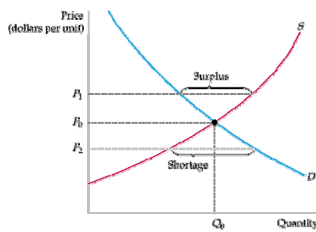
Figure 2.3

Supply and Demand

The market clears at price P_0 and quantity Q_0 .

At the higher price P_1 , a surplus develops, so price falls.

At the lower price P_2 , there is a shortage, so price is bid up.



2.2 THE MARKET MECHANISM



Equilibrium

- **equilibrium** (or **market clearing**) **price** Price that equates the quantity supplied to the quantity demanded.
- **market mechanism** Tendency in a free market for price to change until the market clears.
- **surplus** Situation in which the quantity supplied exceeds the quantity demanded.
- **shortage** Situation in which the quantity demanded exceeds the quantity supplied.

2.2 THE MARKET MECHANISM



When Can We Use the Supply-Demand Model?

We are assuming that at any given price, a given quantity will be produced and sold.

This assumption makes sense only if a market is at least roughly *competitive*.

By this we mean that both sellers and buyers should have little *market power*—i.e., little ability *individually* to affect the market price.

Suppose instead that supply were controlled by a single producer—a monopolist.

If the demand curve shifts in a particular way, it may be in the monopolist's interest to keep the quantity fixed but change the price, or to keep the price fixed and change the quantity.

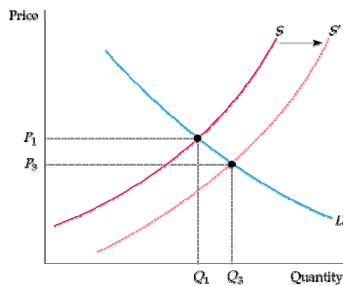
2.3 CHANGES IN MARKET EQUILIBRIUM



Figure 2.4

New Equilibrium Following Shift in Supply

When the supply curve shifts to the right, the market clears at a lower price P_2 and a larger quantity Q_2 .

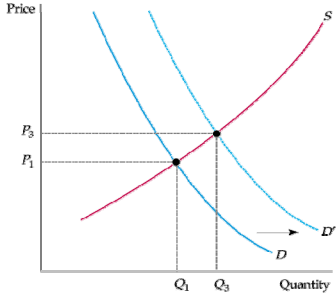


2.3 CHANGES IN MARKET EQUILIBRIUM



Figure 2.5
New Equilibrium Following Shift in Demand

When the demand curve shifts to the right, the market clears at a higher price P_3 and a larger quantity Q_3 .



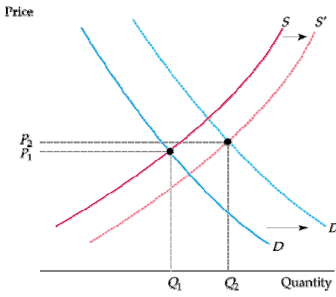
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2.3 CHANGES IN MARKET EQUILIBRIUM



Figure 2.6
New Equilibrium Following Shifts in Supply and Demand

Supply and demand curves shift over time as market conditions change. In this example, rightward shifts of the supply and demand curves lead to a slightly higher price and a much larger quantity. In general, changes in price and quantity depend on the amount by which each curve shifts and the shape of each curve.



Chapter 2 Supply and Demand

2.3 CHANGES IN MARKET EQUILIBRIUM



EXAMPLE 2.1 The Price of Eggs and the Price of a College Education Revisited

From 1970 to 2007, the real (constant-dollar) price of eggs fell by 49 percent, while the real price of a college education rose by 105 percent.

The mechanization of poultry farms sharply reduced the cost of producing eggs, shifting the supply curve downward. The demand curve for eggs shifted to the left as a more health-conscious population tended to avoid eggs.

As for college, increases in the costs of equipping and maintaining modern classrooms, laboratories, and libraries, along with increases in faculty salaries, pushed the supply curve up. The demand curve shifted to the right as a larger percentage of a growing number of high school graduates decided that a college education was essential.

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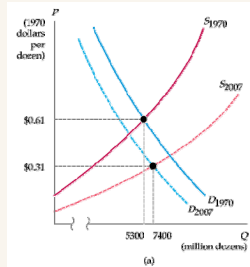
2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.1 The Price of Eggs and the Price of a College Education Revisited (continued)

Figure 2.7

(a) Market for Eggs

The supply curve for eggs shifted downward as production costs fell; the demand curve shifted to the left as consumer preferences changed. As a result, the real price of eggs fell sharply and egg consumption rose.



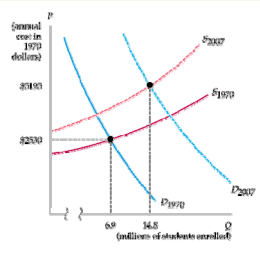
2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.1 The Price of Eggs and the Price of a College Education Revisited (continued)

Figure 2.7

(b) Market for College Education

The supply curve for a college education shifted up as the costs of equipment, maintenance, and staffing rose. The demand curve shifted to the right as a growing number of high school graduates desired a college education. As a result, both price and enrollments rose sharply.



2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.2 Wage Inequality in the United States

Over the past two decades, the wages of skilled high-income workers have grown substantially, while the wages of unskilled low-income workers have fallen slightly.

From 1978 to 2005, people in the top 20 percent of the income distribution experienced an increase in their average real (inflation-adjusted) pretax household income of 50 percent, while those in the bottom 20 percent saw their average real pretax income increase by only 6 percent.

While the supply of unskilled workers—people with limited educations—has grown substantially, the demand for them has risen only slightly.

On the other hand, while the supply of skilled workers—e.g., engineers, scientists, managers, and economists—has grown slowly, the demand has risen dramatically, pushing wages up.

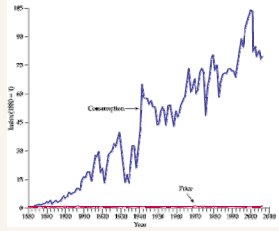
2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.3 The Long-Run Behavior of Natural Resource Prices

Figure 2.8

Consumption and the Price of Copper

Although annual consumption of copper has increased about a hundredfold, the real (inflation-adjusted) price has not changed much.



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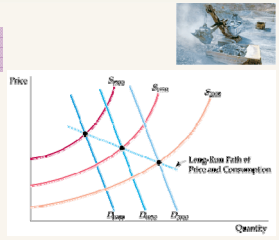
2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.3 The Long-Run Behavior of Natural Resource Prices (continued)

Figure 2.9

Long-Run Movements of Supply and Demand for Mineral Resources

Although demand for most resources has increased dramatically over the past century, prices have fallen or risen only slightly in real (inflation-adjusted) terms because cost reductions have shifted the supply curve to the right just as dramatically.



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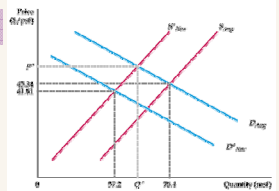
2.3 CHANGES IN MARKET EQUILIBRIUM

EXAMPLE 2.4 The Effects of 9/11 on the Supply and Demand for New York City Office Space

Figure 2.10

Supply and Demand for New York City Office Space

Following 9/11 the supply curve shifted to the left, but the demand curve also shifted to the left, so that the average rental price fell.



Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND



- **elasticity** Percentage change in one variable resulting from a 1-percent increase in another.

Price Elasticity of Demand

- **price elasticity of demand** Percentage change in quantity demanded of a good resulting from a 1-percent increase in its price.

$$E_p = (\% \Delta Q) / (\% \Delta P)$$

$$E_p = \frac{\Delta Q / Q}{\Delta P / P} = \frac{P \Delta Q}{Q \Delta P} \quad (2.1)$$

Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND



Linear Demand Curve

- **linear demand curve** Demand curve that is a straight line.

$$Q = a - bP$$

Figure 2.11

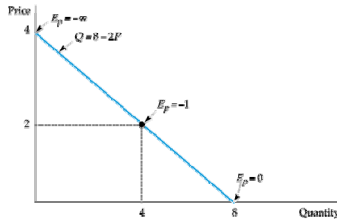
Linear Demand Curve

The price elasticity of demand depends not only on the slope of the demand curve but also on the price and quantity.

The elasticity, therefore, varies along the curve as price and quantity change. Slope is constant for this linear demand curve.

Near the top, because price is high and quantity is small, the elasticity is large in magnitude.

The elasticity becomes smaller as we move down the curve.



Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND

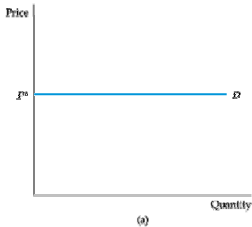


Linear Demand Curve

Figure 2.12

(a) Infinitely Elastic Demand

(a) For a horizontal demand curve, $\Delta Q / \Delta P$ is infinite. Because a tiny change in price leads to an enormous change in demand, the elasticity of demand is infinite.



- **infinitely elastic demand** Principle that consumers will buy as much of a good as they can get at a single price, but for any higher price the quantity demanded drops to zero, while for any lower price the quantity demanded increases without limit.

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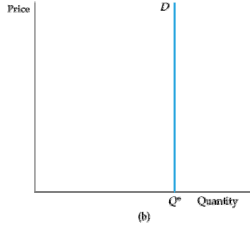
2.4 ELASTICITIES OF SUPPLY AND DEMAND



Linear Demand Curve

Figure 2.12

(b) **Completely Inelastic Demand**
 (b) For a vertical demand curve, $\Delta Q/\Delta P$ is zero. Because the quantity demanded is the same no matter what the price, the elasticity of demand is zero.



- **completely inelastic demand** Principle that consumers will buy a fixed quantity of a good regardless of its price.

Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND



Other Demand Elasticities

- **income elasticity of demand** Percentage change in the quantity demanded resulting from a 1-percent increase in income.

$$E_I = \frac{\Delta Q/Q}{\Delta I/I} = \frac{I \Delta Q}{Q \Delta I} \quad (2.2)$$

- **cross-price elasticity of demand** Percentage change in the quantity demanded of one good resulting from a 1-percent increase in the price of another.

$$E_{Q_1, P_2} = \frac{\Delta Q_1/Q_1}{\Delta P_2/P_2} = \frac{P_2 \Delta Q_1}{Q_1 \Delta P_2} \quad (2.3)$$

Elasticities of Supply

- **price elasticity of supply** Percentage change in quantity supplied resulting from a 1-percent increase in price.

Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND



Point versus Arc Elasticities

- **point elasticity of demand** Price elasticity at a particular point on the demand curve.

Arc Elasticity of Demand

- **arc elasticity of demand** Price elasticity calculated over a range of prices.

Arc elasticity: $E_p = (\Delta Q/\Delta P)(\bar{P}/\bar{Q}) \quad (2.4)$

Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND

EXAMPLE 2.5 The Market for Wheat



During recent decades, changes in the wheat market had major implications for both American farmers and U.S. agricultural policy.

To understand what happened, let's examine the behavior of supply and demand beginning in 1981.

Supply: $Q_S = 1800 + 240P$

Demand: $Q_D = 3550 - 266P$

By setting the quantity supplied equal to the quantity demanded, we can determine the market-clearing price of wheat for 1981:

$$Q_S = Q_D$$

$$1800 + 240P = 3550 - 266P$$

$$506P = 1750$$

$$P = \$3.46 \text{ per bushel}$$

Chapter 2 Supply and Demand

2.4 ELASTICITIES OF SUPPLY AND DEMAND

EXAMPLE 2.5 The Market for Wheat (continued)

Substituting into the supply curve equation, we get

$$Q = 1800 + (240)(3.46) = 2630 \text{ million bushels}$$

We use the demand curve to find the price elasticity of demand:

$$E_P^D = \frac{P}{Q} \frac{\Delta Q}{\Delta P} = \frac{3.46}{2630} (-266) = -0.35$$

Thus demand is inelastic.

We can likewise calculate the price elasticity of supply:

$$E_P^S = \frac{P}{Q} \frac{\Delta Q}{\Delta P} = \frac{3.46}{2630} (240) = 0.32$$

Because these supply and demand curves are linear, the price elasticities will vary as we move along the curves.

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2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

Demand

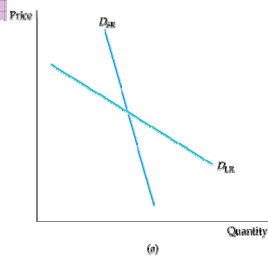
Figure 2.13

(a) Gasoline: Short-Run and Long-Run Demand Curves

(a) In the short run, an increase in price has only a small effect on the quantity of gasoline demanded. Motorists may drive less, but they will not change the kinds of cars they are driving overnight.

In the longer run, however, because they will shift to smaller and more fuel-efficient cars, the effect of the price increase will be larger.

Demand, therefore, is more elastic in the long run than in the short run.



Chapter 2 Supply and Demand

2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES



Demand

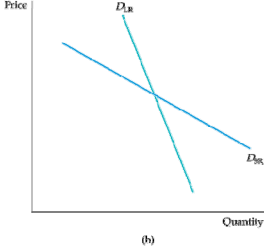
Demand and Durability

Figure 2.13

(b) Automobiles: Short-Run and Long-Run Demand Curves

(b) The opposite is true for automobile demand. If price increases, consumers initially defer buying new cars; thus annual quantity demanded falls sharply.

In the longer run, however, old cars wear out and must be replaced; thus annual quantity demanded picks up. Demand, therefore, is less elastic in the long run than in the short run.



2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES



Demand

Income Elasticities

Income elasticities also differ from the short run to the long run.

For most goods and services—foods, beverages, fuel, entertainment, etc.—the income elasticity of demand is larger in the long run than in the short run.

For a durable good, the opposite is true. The short-run income elasticity of demand will be much larger than the long-run elasticity.

2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES



Demand

Cyclical Industries

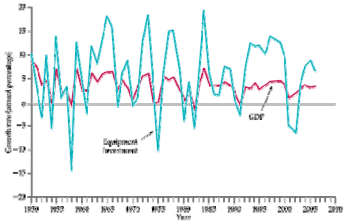
- **cyclical industries** Industries in which sales tend to magnify cyclical changes in gross domestic product and national income.

Figure 2.14

GDP and Investment in Durable Equipment

Annual growth rates are compared for GDP and investment in durable equipment.

Because the short-run GDP elasticity of demand is larger than the long-run elasticity for long-lived capital equipment, changes in investment in equipment magnify changes in GDP. Thus capital goods industries are considered "cyclical."



2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

Demand

Cyclical Industries

Figure 2.15
Consumption of Durables versus Nondurables

Annual growth rates are compared for GDP, consumer expenditures on durable goods (automobiles, appliances, furniture, etc.), and consumer expenditures on nondurable goods (food, clothing, services, etc.).

Because the stock of durables is large compared with annual demand, short-run demand elasticities are larger than long-run elasticities. Like capital equipment, industries that produce consumer durables are "cyclical" (i.e., changes in GDP are magnified). This is not true for producers of nondurables.

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2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

Demand

EXAMPLE 2.6 The Demand for Gasoline and Automobiles

TABLE 2.1 Demand for Gasoline
 Number of Years Allowed to Pass Following a Price or Income Change

Elasticity	1	2	3	5	10
Price	-0.2	-0.3	-0.4	-0.5	-0.8
Income	0.2	0.4	0.5	0.6	1.0

TABLE 2.2 Demand for Automobiles
 Number of Years Allowed to Pass Following a Price or Income Change

Elasticity	1	2	3	5	10
Price	-1.2	-0.9	-0.8	-0.6	-0.4
Income	3.0	2.3	1.9	1.4	1.0

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2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

Supply

Supply and Durability

Figure 2.16
Copper: Short-Run and Long-Run Supply Curves

Like that of most goods, the supply of primary copper, shown in part (a), is more elastic in the long run.

If price increases, firms would like to produce more but are limited by capacity constraints in the short run.

In the longer run, they can add to capacity and produce more.

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2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

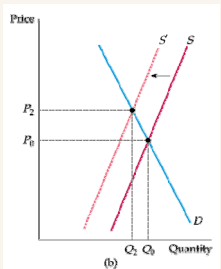


EXAMPLE 2.7 The Weather in Brazil and the Price of Coffee in New York (continued)

Figure 2.18

Supply and Demand for Coffee

(b) In the intermediate run, supply and demand are both more elastic; thus price falls part of the way back, to P_2 .



Chapter 2 Supply and Demand

2.5 SHORT-RUN VERSUS LONG-RUN ELASTICITIES

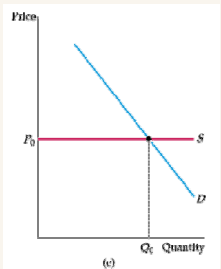


EXAMPLE 2.7 The Weather in Brazil and the Price of Coffee in New York (continued)

Figure 2.18

Supply and Demand for Coffee

(c) In the long run, supply is extremely elastic; because new coffee trees will have had time to mature, the effect of the freeze will have disappeared. Price returns to P_0 .



Chapter 2 Supply and Demand

2.6 UNDERSTANDING AND PREDICTING THE EFFECTS OF CHANGING MARKET CONDITIONS

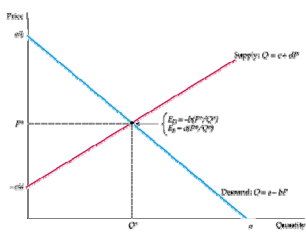


Figure 2.19

Fitting Linear Supply and Demand Curves to Data

Linear supply and demand curves provide a convenient tool for analysis.

Given data for the equilibrium price and quantity P^* and Q^* , as well as estimates of the elasticities of demand and supply E_D and E_S , we can calculate the parameters c and d for the supply curve and a and b for the demand curve. (In the case drawn here, $c < 0$.) The curves can then be used to analyze the behavior of the market quantitatively.



Chapter 2 Supply and Demand

2.6 UNDERSTANDING AND PREDICTING THE EFFECTS OF CHANGING MARKET CONDITIONS



Demand: $Q = a - bP$ (2.5a)

Supply: $Q = c + dP$ (2.5b)

• **Step 1:**

$E = (P/Q)(\Delta Q/\Delta P)$

Demand: $E_D = -b(P^*/Q^*)$ (2.6a)

Supply: $E_S = d(P^*/Q^*)$ (2.6b)

• **Step 2:**

$a = Q^* + bP^*$

$Q = a - bP + fI$ (2.7)

2.6 UNDERSTANDING AND PREDICTING THE EFFECTS OF CHANGING MARKET CONDITIONS



EXAMPLE 2.8 The Behavior of Copper Prices

After reaching a level of about \$1.00 per pound in 1980, the price of copper fell sharply to about 60 cents per pound in 1986.

Worldwide recessions in 1980 and 1982 contributed to the decline of copper prices.

Why did the price increase sharply in 2005–2007? First, the demand for copper from China and other Asian countries began increasing dramatically. Second, because prices had dropped so much from 1996 through 2003, producers closed unprofitable mines and cut production.

What would a decline in demand do to the price of copper? To find out, we can use linear supply and demand curves.

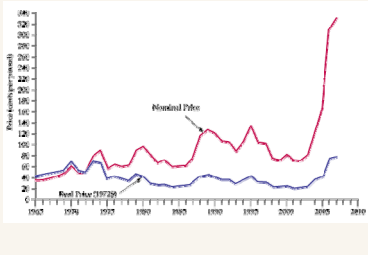
2.6 UNDERSTANDING AND PREDICTING THE EFFECTS OF CHANGING MARKET CONDITIONS



EXAMPLE 2.8 The Behavior of Copper Prices (continued)

Figure 2.20
Copper Prices, 1965–2007

Copper prices are shown in both nominal (no adjustment for inflation) and real (inflation-adjusted) terms. In real terms, copper prices declined steeply from the early 1970s through the mid-1980s as demand fell. In 1988–1990, copper prices rose in response to supply disruptions caused by strikes in Peru and Canada but later fell after the strikes ended. Prices declined during the 1996–2002 period but then increased sharply during 2005–2007.



2.7 EFFECTS OF GOVERNMENT INTERVENTION— PRICE CONTROLS



EXAMPLE 2.10 Price Controls and Natural Gas Shortages (continued)

- The (free-market) wholesale price of natural gas was \$6.40 per mcf (thousand cubic feet);
- Production and consumption of gas were 23 Tcf (trillion cubic feet);
- The average price of crude oil (which affects the supply and demand for natural gas) was about \$50 per barrel.

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

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

Substitute \$3.00 for P_G in both the supply and demand equations (keeping the price of oil, P_O , fixed at \$50).

You should find that the supply equation gives a quantity supplied of 20.6 Tcf and the demand equation a quantity demanded of 29.1 Tcf.

Therefore, these price controls would create an excess demand of $29.1 - 20.6 = 8.5$ Tcf.
