CHAPTER TWO

Market Forces: Demand and Supply

HEADLINE

Samsung and Hynix Semiconductor to Cut Chip Production

Sam Robbins, owner and CEO of PC Solutions, arrived at the office and glanced at the front page of *The Wall Street Journal* waiting on his desk. One of the articles contained statements from executives of two of South Korea's largest semiconductor manufacturers—Samsung Electronic Company and Hynix Semiconductor—indicating that they would suspend all their memory chip production for one week. The article went on to say that another large semiconductor manufacturer was likely to follow suit. Collectively, these three chip manufacturers produce about 30 percent of the world's basic semiconductor chips.

PC Solutions is a small but growing company that assembles PCs and sells them in the highly competitive market for "clones." PC Solutions experienced 100 percent growth last year and is in the process of interviewing recent graduates in an attempt to double its workforce.

After reading the article, Sam picked up the phone and called a few of his business contacts to verify for himself the information contained in the *Journal.* Satisfied that the information was correct, he called the director of personnel, Jane Remak.

What do you think Sam and Jane discussed?

Learning Objectives

After completing this chapter, you will be able to:

LO1 Explain the laws of demand and supply, and identify factors that cause demand and supply to shift.

LO2 Calculate consumer surplus and producer surplus, and describe what they mean.

LO3 Explain price determination in a competitive market, and show how equilibrium changes in response to changes in determinants of demand and supply.

LO4 Explain and illustrate how excise taxes, *ad valorem* taxes, price floors, and price ceilings impact the functioning of a market.

LO5 Apply supply and demand analysis as a qualitative forecasting tool to see the "big picture" in competitive markets.

INTRODUCTION

This chapter describes *supply* and *demand*, which are the driving forces behind the market economies that exist in the United States and around the globe. As suggested in this chapter's opening headline, supply and demand analysis is a tool that managers can use to visualize the "big picture." Many companies fail because their managers get bogged down in the day-to-day decisions of the business without having a clear picture of market trends and changes that are on the horizon.

To illustrate, imagine that you manage a small retail outlet that sells PCs. A magic genie appears and says, "Over the next month, the market price of PCs will decline and consumers will purchase fewer PCs." The genie revealed the big picture: PC prices and sales will decline. If you worry about the *details* of your business without knowledge of these future trends in prices and sales, you will be at a significant competitive disadvantage. Absent a view of the big picture, you are likely to negotiate the wrong prices with suppliers and customers, carry too much inventory, hire too many employees, and—if your business spends money on informative advertising—purchase ads in which your prices are no longer competitive by the time they reach print.

Supply and demand analysis is a qualitative tool which, like the above genie, empowers managers by enabling them to see the "big picture." It is a qualitative forecasting tool you can use to predict trends in competitive markets, including changes in the prices of your firm's products, related products (both substitutes and complements), and the prices of inputs (such as labor services) that are necessary for your operations. As we will see in subsequent chapters, after you use supply and demand analysis to see the big picture, additional tools are available to assist with details—determining *how much* the price will change, *how much* sales and revenues will change, and so on.

For those of you who have taken a principles-level course in economics, some parts of this chapter will be a review. However, make sure you have complete mastery of the tools of supply and demand. The rest of this book will assume you have a thorough working knowledge of the material in this chapter.

DEMAND

Suppose a clothing manufacturer desires information about the impact of its pricing decisions on the demand for its jeans in a small foreign market. To obtain this information, it might engage in market research to determine how many pairs of jeans consumers would purchase each year at alternative prices per unit. The numbers from such a market survey would look something like those in Table 2–1. The market research reveals that if jeans were priced at $10 per pair, 60,000 pairs of jeans would be sold per year; at $30 per pair, 20,000 pairs of jeans would be sold annually.

When there is no ambiguity, it is sometimes convenient to say simply "price" rather than "price per pair" or "price per unit." For instance, if one of your classmates says gasoline is priced at $3.99 in Indianapolis, you understand that she means $3.99 per gallon. Looking at the rows in Table 2-1, notice that the only difference in the entries is the price of jeans and the quantity of jeans sold. Everything else that might influence buyer decisions, such as consumer income, advertising, and

TABLE 2–1 The Demand Schedule for Jeans in a Small Foreign Market

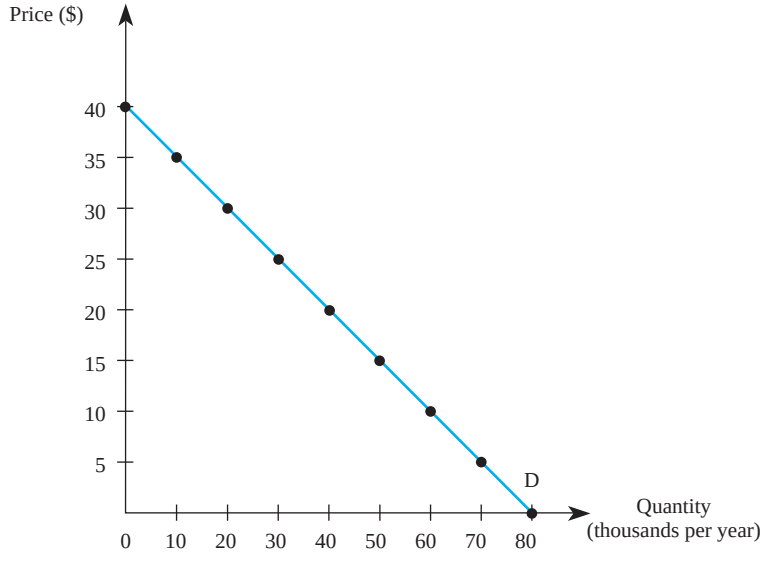
Price of Jeans	Quantity of Jeans Sold	Average Consumer Income	Advertising Expenditure	Average Price of Shirts
$ 0	80,000	$25,000	$50,000	$20
5	70,000	25,000	50,000	20
10	60,000	25,000	50,000	20
15	50,000	25,000	50,000	20
20	40,000	25,000	50,000	20
25	30,000	25,000	50,000	20
30	20,000	25,000	50,000	20
35	10,000	25,000	50,000	20
40	0	25,000	50,000	20

the prices of other goods such as shirts, is held constant. In effect, the market survey does not ask consumers how much they would buy at alternative levels of income or advertising; it simply seeks to determine how much would be purchased at alternative prices. The market research reveals that, holding all other things constant, the quantity of jeans consumers are willing and able to purchase goes down as the price rises. This fundamental economic principle is known as the *law of demand:* Price and quantity demanded are inversely related. That is, as the price of a good rises (falls) and all other things remain constant, the quantity demanded of the good falls (rises).

market demand curve
A curve indicating the total quantity of a good all consumers are willing and able to purchase at each possible price, holding the prices of related goods, income, advertising, and other variables constant.

Figure 2–1 plots the data in Table 2–1. The straight line connecting those points, called the *market demand curve*, interpolates the quantities consumers would be willing and able to purchase at prices not explicitly dealt with in the market

FIGURE 2–1 The Demand Curve



research. For example, using this market demand curve, we conclude that consumers would be willing and able to purchase 35,000 pairs of jeans when the price is $22.50 (and all other variables stay the same). Notice that the line is downward sloping, which reflects the law of demand, and that all other factors that influence demand are held constant at each point on the line.

Demand Shifters

Economists recognize that variables other than the price of a good influence demand. For example, the number of pairs of jeans individuals are willing and financially able to buy also depends on the price of shirts, consumer income, advertising expenditures, and so on. Variables other than the price of a good that influence demand are known as *demand shifters.*

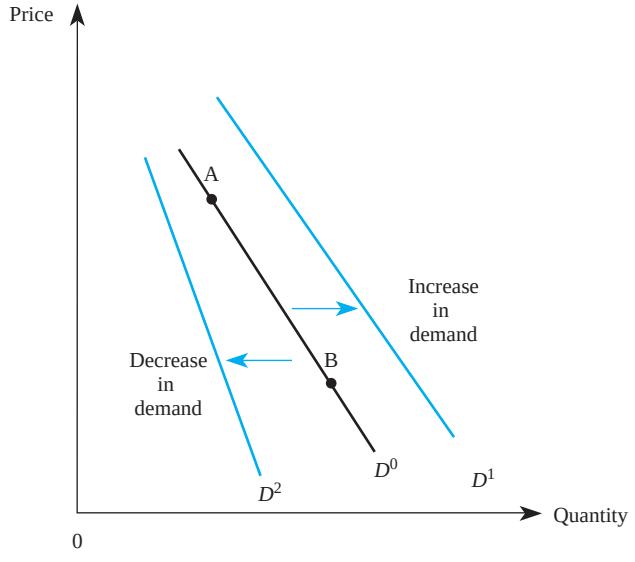
change in quantity demanded Changes in the price of a good lead to a change in the quantity demanded of that good. This corresponds to a movement along a given demand curve.

When we graph the demand curve for good *X*, we hold everything but the price of *X* constant. A representative demand curve is given by D^0 in Figure 2–2. The movement along a demand curve, such as the movement from *A* to *B*, is called a *change in quantity demanded.* Whenever advertising, income, or the price of related goods changes, it leads to a *change in demand;* the position of the entire demand curve shifts. A rightward shift in the demand curve is called an *increase in demand,* since more of the good is demanded at each price. A leftward shift in the demand curve is called a *decrease in demand.*

change in demand Changes in variables other than the price of a good, such as income or the price of another good, lead to a change in demand. This corresponds to a shift of the entire demand curve.

Now that we understand the general distinction between a shift in a demand curve and a movement along a demand curve, it is useful to explain how five demand shifters—consumer income, prices of related goods, advertising and consumer tastes, population, and consumer expectations—affect demand.

FIGURE 2–2 Changes in Demand



INSIDE BUSINESS 2–1

Asahi Breweries Ltd. and the Asian Recession

During a recent recession, Japan saw many business failures. Even businesses that traditionally do well during economic downturns, such as the beer brewing industry, were hit hard. Analysts blame the downturn in the beer market on two factors: (1) Japanese incomes (GDP) declined significantly as a result of the recession, and (2) Japan's government imposed a beer tax in an effort to raise revenue.

As a result of these events, top Japanese breweries such as Kirin Brewery Company, Ltd., and Sapporo Breweries Ltd. experienced a sharp decline in domestic beer sales. Meanwhile, their competitor—Asahi Breweries—touted double-digit growth and increased its market share. Asahi attributes its growth in sales to its superior sales network and strong marketing campaign for its best-selling beer, *Asahi Super Dry.*

While part of Asahi's growth and success is attributable to the company's sales force and marketing activities—both create greater consumer awareness—this does not fully explain why Asahi has done especially well during the recent Asian recession. One possibility is that Asahi beer is an inferior good. This does not mean that Asahi beer is "skunky" or of low quality; indeed, its *Super Dry* is the beer of choice for many Japanese beer drinkers. The term *inferior good* simply means that when Japanese incomes decline due to a recession, the demand for Asahi beer increases.

Sources: Annual Reports for Asahi Breweries Ltd., Sapporo Breweries Ltd., and Kirin Brewery Company, Ltd.

Income

Because income affects the ability of consumers to purchase a good, changes in income affect how much consumers will buy at any price. In graphical terms, a change in income shifts the entire demand curve. Whether an increase in income shifts the demand curve to the right or to the left depends on the nature of consumer consumption patterns. Accordingly, economists distinguish between two types of goods: normal and inferior goods.

A good whose demand increases (shifts to the right) when consumer incomes rise is called a *normal good.* Normal goods may include goods such as steak, airline travel, and designer jeans: As income goes up, consumers typically buy more of these goods at any given price. Conversely, when consumers suffer a decline in income, the demand for a normal good will decrease (shift to the left).

normal good
A good for which an increase (decrease) in income leads to an increase (decrease) in the demand for that good.

Changes in income tend to have profound effects on the demand for durable goods, and these effects are typically amplified in developing countries and rural areas. In 2004, for instance, farmers in India enjoyed higher incomes thanks to the impact on crops of beneficial monsoons. As a result, the demand in rural areas of India for tractors and motorcycles surged, almost tripling the level of demand in the previous year. By 2009, this surge in demand reversed due to significant reductions in consumer incomes stemming from a global economic recession. The demand for durables in developed countries also declined dramatically, and automakers were especially hard hit.

In some instances, an increase in income reduces the demand for a good. Economists refer to such a good as an *inferior good.* Bologna, bus travel, and "generic" jeans are possible examples of inferior goods. As income goes up, consumers typically consume less of these goods at each price. It is important to point out that

inferior good
A good for which an increase (decrease) in income leads to a decrease (increase) in the demand for that good.

by calling such goods *inferior*, we do not imply that they are of poor quality; we use this term simply to define products that consumers purchase less of when their incomes rise and purchase more of when their incomes fall.

Prices of Related Goods

Changes in the prices of related goods generally shift the demand curve for a good. For example, if the price of a Coke increases, most consumers will begin to substitute Pepsi, because the relative price of Coke is higher than before. As more and more consumers substitute Pepsi for Coke, the quantity of Pepsi demanded at each price will tend to increase. In effect, an increase in the price of Coke increases the demand for Pepsi. This is illustrated by a shift in the demand for Pepsi to the right. Goods that interact in this way are known as *substitutes*.

substitutes
Goods for which an increase (decrease) in the price of one good leads to an increase (decrease) in the demand for the other good.

Many pairs of goods readily come to mind when we think of substitutes: chicken and beef, cars and trucks, raincoats and umbrellas. Such pairs of goods are substitutes for most consumers. However, substitutes need not serve the same function. For example, televisions and patio furniture could be substitutes; as the price of televisions increases, you may choose to purchase additional patio furniture rather than an additional television. Goods are substitutes when an increase in the price of one good increases the demand for the other good.

Not all goods are substitutes; in fact, an increase in the price of a good such as computer software may lead consumers to purchase fewer computers at each price. Goods that interact in this manner are called *complements*. Beer and pretzels are another example of complementary goods. If the price of beer increased, most beer drinkers would decrease their consumption of pretzels. Notice that when good X is a complement to good Y, a reduction in the price of Y actually increases (shifts to the right) the demand for good X. More of good X is purchased at each price due to the reduction in the price of the complement, good Y.

complements
Goods for which an increase (decrease) in the price of one good leads to a decrease (increase) in the demand for the other good.

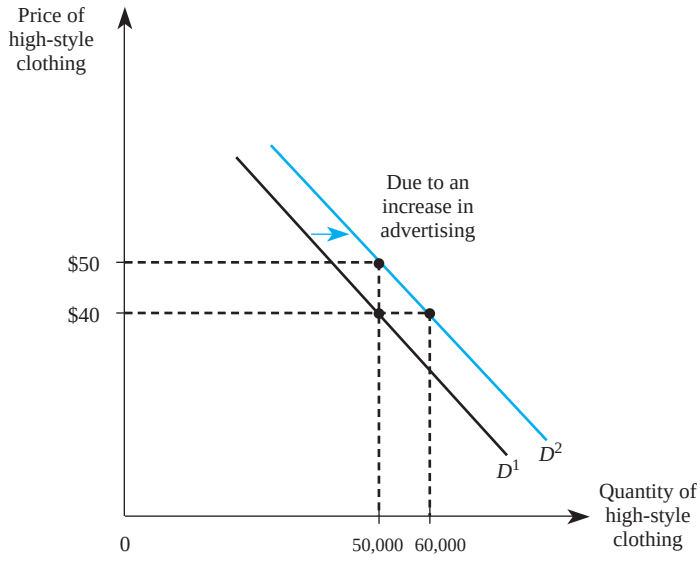
Advertising and Consumer Tastes

Another variable that is held constant when drawing a given demand curve is the level of advertising. An increase in advertising shifts the demand curve to the right, from D^1 to D^2, as in Figure 2–3. Notice that the impact of advertising on demand can be interpreted in two ways. Under the initial demand curve, D^1, consumers would buy 50,000 units of high-style clothing per month when the price is $40. After the advertising, the demand curve shifts to D^2, and consumers will now buy 60,000 units of the good when the price is $40. Alternatively, when demand is D^1, consumers will pay a price of $40 when 50,000 units are available. Advertising shifts the demand curve to D^2, so consumers will pay a higher price—$50—for 50,000 units.

Why does advertising shift demand to the right? Advertising often provides consumers with information about the existence or quality of a product, which in turn induces more consumers to buy the product. These types of advertising messages are known as *informative advertising*.

Advertising can also influence demand by altering the underlying tastes of consumers. For example, advertising that promotes the latest fad in clothing may increase the demand for a specific fashion item by making consumers perceive it as "the" thing to buy. These types of advertising messages are known as *persuasive advertising*.

FIGURE 2–3 Advertising and the Demand for Clothing



Population

The demand for a product is also influenced by changes in the size and composition of the population. Generally, as the population rises, more and more individuals wish to buy a given product, and this has the effect of shifting the demand curve to the right. Over the twentieth century, the demand curve for food products shifted to the right considerably with the increasing population.

It is important to note that changes in the composition of the population can also affect the demand for a product. To the extent that middle-aged consumers desire different types of products than retirees, an increase in the number of consumers in the 30- to 40-year-old age bracket will increase the demand for products like real estate. Similarly, as a greater proportion of the population ages, the demand for medical services will tend to increase.

Consumer Expectations

Changes in *consumer expectations* also can change the position of the demand curve for a product. For example, if consumers suddenly expect the price of automobiles to be significantly higher next year, the demand for automobiles today will increase. In effect, buying a car today is a substitute for buying a car next year. If consumers expect future prices to be higher, they will substitute current purchases for future purchases. This type of consumer behavior often is referred to as *stockpiling* and generally occurs when products are durable in nature. We often see this behavior for less expensive durables, too; consumers may stockpile laundry detergent in response to temporary sales at grocery stores. The current demand for a perishable product such as bananas generally is not affected by expectations of higher future prices.

Other Factors

In concluding our list of demand shifters, we simply note that any variable that affects the willingness or ability of consumers to purchase a particular good is a potential demand shifter. Health scares affect the demand for cigarettes. The birth of a baby affects the demand for diapers.

The Demand Function

By now you should understand the factors that affect demand and how to use graphs to illustrate those influences. The final step in our analysis of the demand side of the market is to show that all the factors that influence demand may be summarized in what economists refer to as a *demand function.*

demand function A function that describes how much of a good will be purchased at alternative prices of that good and related goods, alternative income levels, and alternative values of other variables affecting demand.

The demand function for good X describes how much X will be purchased at alternative prices of X and related goods, alternative levels of income, and alternative values of other variables that affect demand. Formally, let Q_x^d represent the quantity demanded of good X, P_x the price of good X, P_y the price of a related good, M income, and H the value of any other variable that affects demand, such as the level of advertising, the size of the population, or consumer expectations. Then the demand function for good X may be written as

$$Q_x^d = f(P_x, P_y, M, H)$$

Thus, the demand function explicitly recognizes that the quantity of a good consumed depends on its price and on demand shifters. Different products will have demand functions of different forms. One very simple but useful form is the linear representation of the demand function: Demand is *linear* if Q_x^d is a linear function of prices, income, and other variables that influence demand. The following equation is an example of a *linear demand function:*

linear demand function A representation of the demand function in which the demand for a given good is a linear function of prices, income levels, and other variables influencing demand.

$$Q_x^d = \alpha_0 + \alpha_x P_x + \alpha_y P_y + \alpha_M M + \alpha_H H$$

The α_is are fixed numbers that the firm's research department or an economic consultant typically provides to the manager. (Chapter 3 provides an overview of the statistical techniques used to obtain these numbers.)

By the law of demand, an increase in P_x leads to a decrease in the quantity demanded of good X. This means that $\alpha_x < 0$. The sign of α_y will be positive or negative depending on whether goods X and Y are substitutes or complements. If α_y is a positive number, an increase in the price of good Y will lead to an increase in the consumption of good X; therefore, good X is a substitute for good Y. If α_y is a negative number, an increase in the price of good Y will lead to a decrease in the consumption of good X; hence, good X is a complement to good Y. The sign of α_M also can be positive or negative depending on whether X is a normal or an inferior good. If α_M is a positive number, an increase in income (M) will lead to an increase in the consumption of good X, and good X is a normal good. If α_M is a negative number, an increase in income will lead to a decrease in the consumption of good X, and good X is an inferior good.

Demonstration Problem 2–1

An economic consultant for X Corp. recently provided the firm's marketing manager with this estimate of the demand function for the firm's product:

$$Q_x^d = 12{,}000 - 3P_x + 4P_y - 1M + 2A_x$$

where Q_x^d represents the amount consumed of good X, P_x is the price of good X, P_y is the price of good Y, M is income, and A_x represents the amount of advertising spent on good X. Suppose good X sells for \$200 per unit, good Y sells for \$15 per unit, the company utilizes 2,000 units of advertising, and consumer income is \$10,000. How much of good X do consumers purchase? Are goods X and Y substitutes or complements? Is good X a normal or an inferior good?

Answer:

To find out how much of good X consumers will purchase, we substitute the given values of prices, income, and advertising into the linear demand equation to get

$$Q_x^d = 12{,}000 - 3(200) + 4(15) - 1(10{,}000) + 2(2{,}000)$$

Adding up the numbers, we find that the total consumption of X is 5,460 units. Since the coefficient of P_y in the demand equation is $4 > 0$, we know that a \$1 increase in the price of good Y will increase the consumption of good X by 4 units. Thus, goods X and Y are substitutes. Since the coefficient of M in the demand equation is $-1 < 0$, we know that a \$1 increase in income will decrease the consumption of good X by 1 unit. Thus, good X is an inferior good.

The information summarized in a demand function can be used to graph a demand curve. Since a demand curve is the relation between price and quantity, a representative demand curve holds everything but price constant. This means one may obtain the formula for a demand curve by inserting given values of the demand shifters into the demand function, but leaving P_x in the equation to allow for various values. If we do this for the demand function in Demonstration Problem 2–1 (where $P_y = \$15$, $M = \$10{,}000$, and $A_x = 2{,}000$), we get

$$Q_x^d = 12{,}000 - 3P_x + 4(15) - 1(10{,}000) + 2(2{,}000)$$

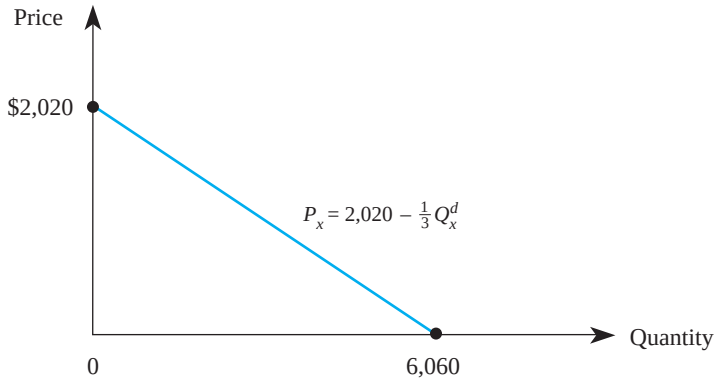
which simplifies to

$$Q_x^d = 6{,}060 - 3P_x \tag{2–1}$$

Because we usually graph this relation with the price of the good on the vertical axis, it is useful to represent Equation 2–1 with price on the left-hand side and everything else on the right-hand side. This relation is called an *inverse demand function.* For this example, the inverse demand function is

$$P_x = 2{,}020 - \frac{1}{3}Q_x^d$$

FIGURE 2–4 Graphing the Inverse Demand Function



It reveals how much consumers are willing and able to pay for each additional unit of good *X*. This demand curve is graphed in Figure 2–4.

Consumer Surplus

We now show how a manager can use the demand curve to ascertain the value a consumer or group of consumers receives from a product. The concepts developed in this section are particularly useful in marketing and other disciplines that emphasize strategies such as *value pricing* and *price discrimination.*

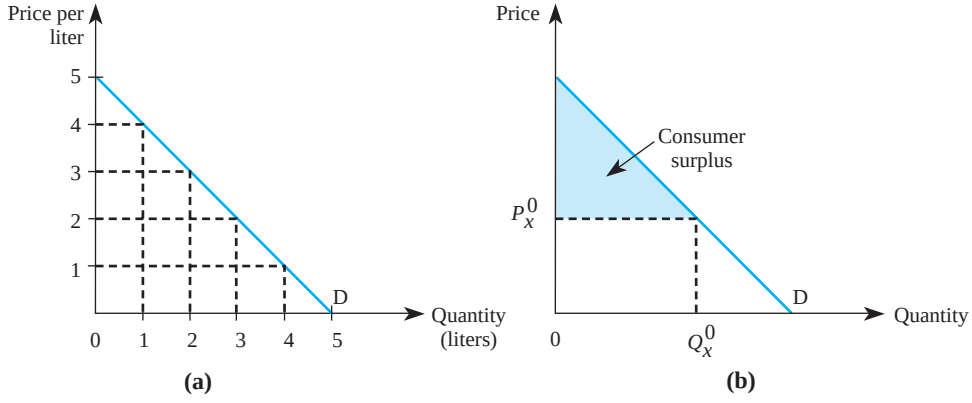
By the law of demand, the amount a consumer is willing to pay for an additional unit of a good falls as more of the good is consumed. For instance, imagine that the demand curve in Figure 2–5(a) represents your demand for water immediately after participating in a 10K run. Initially, you are willing to pay a very high price—in this case, $5 per liter—for the first drop of water. As you consume more water, the amount you are willing to pay for an additional drop declines from $5.00 to $4.99 and so on as you move down the demand curve. Notice that after you have consumed an entire liter of water, you are willing to pay only $4 per liter for another drop. Once you have enjoyed 2 liters of water, you are willing to pay only $3 per liter for another drop.

To find your total value (or benefit) of 2 liters of water, we simply add up the maximum amount you were willing to pay for each of these drops of water between 0 and 2 liters. This amount corresponds to the area underneath the demand curve in Figure 2–5(a) up to the quantity of 2 liters. Since the area of this region is $8, the total value you receive from 2 liters of water is $8.

Fortunately, you don't have to pay different prices for the different drops of water you consume. Instead, you face a per-unit price of, say, $3 per liter and get to buy as many drops (or even liters) as you want at that price. Given the demand curve in Figure 2–5(a), when the price is $3 you will choose to purchase 2 liters of water. In this case, your total out-of-pocket expense for the 2 liters of water is $6. Since you value 2 liters of water at $8 and only have to pay $6 for it, you are getting $2 in value over and above the amount you have to pay for water. This "extra" value is known as *consumer surplus*—the value consumers get from a good but do not have to pay for. This concept

consumer surplus The value consumers get from a good but do not have to pay for.

FIGURE 2–5 Consumer Surplus



is important to managers because it tells how much extra money consumers would be willing to pay for a given amount of a purchased product.

More generally, consumer surplus is the area above the price paid for a good but below the demand curve. For instance, the shaded triangle in Figure 2–5(b) illustrates the consumer surplus of a consumer who buys Q_x^0 units at a price of P_x^0. To see why, recall that each point on the demand curve indicates the value to the consumer of another unit of the good. The difference between each price on the demand curve and the price P_x^0 paid represents surplus (the value the consumer receives but does not have to pay for). When we add up the "surpluses" received for each unit between 0 and Q_x^0 (this sum equals the shaded region), we obtain the consumer surplus associated with purchasing Q_x^0 units at a price of P_x^0 each.

Managers can use the notion of consumer surplus to determine the total amount consumers would be willing to pay for multiunit packages. While this will be discussed in detail in Chapter 11 where we examine pricing strategies, we illustrate the basic idea in the following problem.

Demonstration Problem 2–2

A typical consumer's demand for the Happy Beverage Company's product looks like that in Figure 2–5(a). If the firm charges a price of $2 per liter, how much revenue will the firm earn and how much consumer surplus will the typical consumer enjoy? What is the most a consumer would be willing to pay for a bottle containing exactly 3 liters of the firm's beverage?

Answer:

At a price of $2 per liter, a typical consumer will purchase 3 liters of the beverage. Thus, the firm's revenue is $6 and the consumer surplus is $4.50 [the area of the consumer surplus triangle is one-half the base times the height, or .5(3)($5 − $2) = $4.50]. The total value of 3 liters of the firm's beverage to a typical consumer is thus $6 + $4.50, or $10.50. This is

also the maximum amount a consumer would be willing to pay for a bottle containing exactly 3 liters of the firm's beverage. Expressed differently, if the firm sold the product in 3-liter bottles rather than in smaller units, it could sell each bottle for $10.50 to earn higher revenues and extract all consumer surplus.

SUPPLY

In the previous section we focused on demand, which represents half of the forces that determine the price in a market. The other determinant is market supply. In a competitive market there are many producers, each producing a similar product. The *market supply curve* summarizes the total quantity all producers are willing and able to produce at alternative prices, holding other factors that affect supply constant.

market supply curve A curve indicating the total quantity of a good that all producers in a competitive market would produce at each price, holding input prices, technology, and other variables affecting supply constant.

While the market supply of a good generally depends on many things, when we graph a supply curve, we hold everything but the price of the good constant. The movement along a supply curve, such as the one from A to B in Figure 2–6, is called a *change in quantity supplied*. The fact that the market supply curve slopes upward reflects the inverse *law of supply:* As the price of a good rises (falls) and other things remain constant, the quantity supplied of the good rises (falls). Producers are willing to produce more output when the price is high than when it is low.

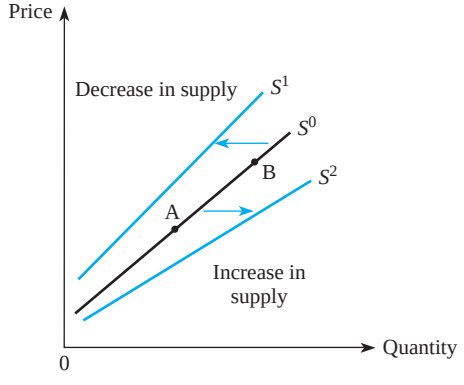
change in quantity supplied Changes in the price of a good lead to a change in the quantity supplied of that good. This corresponds to a movement along a given supply curve.

Supply Shifters

Variables that affect the position of the supply curve are called *supply shifters*, and they include the prices of inputs, the level of technology, the number of firms in the market, taxes, and producer expectations. Whenever one or more of these variables changes, the position of the entire supply curve shifts. Such a shift is known as a *change in supply*. The shift from S^0 to S^2 in Figure 2–6 is called an *increase in supply* since producers sell more output at each given price. The shift from S^0 to S^1 in Figure 2–6 represents a *decrease in supply* since producers sell less of the product at each price.

change in supply Changes in variables other than the price of a good, such as input prices or technological advances, lead to a change in supply. This corresponds to a shift of the entire supply curve.

FIGURE 2–6 Changes in Supply



INSIDE BUSINESS 2–2

The Trade Act of 2002, NAFTA, and the Supply Curve

Over the past two decades, presidents from both political parties have signed trade agreements and laws that include provisions designed to reduce the cost of producing goods at home and abroad. These cost reductions translate into increases in the supply of goods and services available to U.S. consumers.

The North American Free Trade Agreement (NAFTA) between the United States, Canada, and Mexico was signed into law by Bill Clinton and contained provisions to eliminate or phase out tariffs and other barriers in industrial products (such as textiles and apparel) and agricultural products. NAFTA also included provisions designed to reduce barriers to investment in Mexican petrochemicals and financial service sectors.

The Trade Act of 2002 was enacted under George W. Bush and gives the President the ability to negotiate additional international agreements (subject to an up-or-down vote by Congress).

During his campaign and early in his presidency, Barack Obama pledged to renegotiate NAFTA. However, the deep recession during that time caused him to postpone that effort. Only time will tell whether the current and future administrations will continue on the course set by Presidents Clinton and Bush.

Sources: "NAFTA Renegotiation Must Wait, Obama Says," *Washington Post*, February 20, 2009; *Economic Report of the President*, Washington, D.C.: U.S. Government Printing Office, February 2007, p. 60; *Economic Report of the President*, Washington, D.C.: U.S. Government Printing Office, February 2006, p. 153; *Economic Report of the President*, Washington, D.C.: U.S. Government Printing Office, February 1995, pp. 220–21.

Input Prices

The supply curve reveals how much producers are willing to produce at alternative prices. As production costs change, the willingness of producers to produce output at a given price changes. In particular, as the price of an input rises, producers are willing to produce less output at each given price. This decrease in supply is depicted as a leftward shift in the supply curve.

Technology or Government Regulations

Technological changes and changes in government regulations also can affect the position of the supply curve. Changes that make it possible to produce a given output at a lower cost, such as the ones highlighted in Inside Business 2–2, have the effect of increasing supply. Conversely, natural disasters that destroy existing technology and government regulations, such as emissions standards that have an adverse effect on businesses, shift the supply curve to the left.

Number of Firms

The number of firms in an industry affects the position of the supply curve. As additional firms enter an industry, more and more output is available at each given price. This is reflected by a rightward shift in the supply curve. Similarly, as firms leave an industry, fewer units are sold at each price, and the supply decreases (shifts to the left).

Substitutes in Production

Many firms have technologies that are readily adaptable to several different products. For example, automakers can convert a truck assembly plant into a car assembly

plant by altering its production facilities. When the price of cars rises, these firms can convert some of their truck assembly lines to car assembly lines to increase the quantity of cars supplied. This has the effect of shifting the truck supply curve to the left.

Taxes

The position of the supply curve is also affected by taxes. An *excise tax* is a tax on each unit of output sold, where the tax revenue is collected from the supplier. For example, suppose the government levies a tax of $.20 per gallon on gasoline. Since each supplier must now pay the government $.20 per gallon for each gallon of gasoline sold, each must receive an additional $.20 per gallon to be willing to supply the same quantity of gasoline as before the tax. An excise tax shifts the supply curve up by the amount of the tax, as in Figure 2–7. Note that at any given price, producers are willing to sell less gasoline after the tax than before. Thus, an excise tax has the effect of decreasing the supply of a good.

Another form of tax often used by a government agency is an ad valorem tax. *Ad valorem* literally means "according to the value." An *ad valorem tax* is a percentage tax; the sales tax is a well-known example. If the price of a good is $1 and a 10 percent ad valorem tax is attached to that good, the price after the tax is $1.10. Because an ad valorem tax is a percentage tax, it will be higher for high-priced items.

In Figure 2–8, S^0 represents the supply curve for backpacks before the inception of a 20 percent ad valorem tax. Notice that 1,100 backpacks are offered for sale when the price of a backpack is $10 and 2,450 backpacks are offered when the price is $20.

FIGURE 2–7 A Per Unit (Excise) Tax

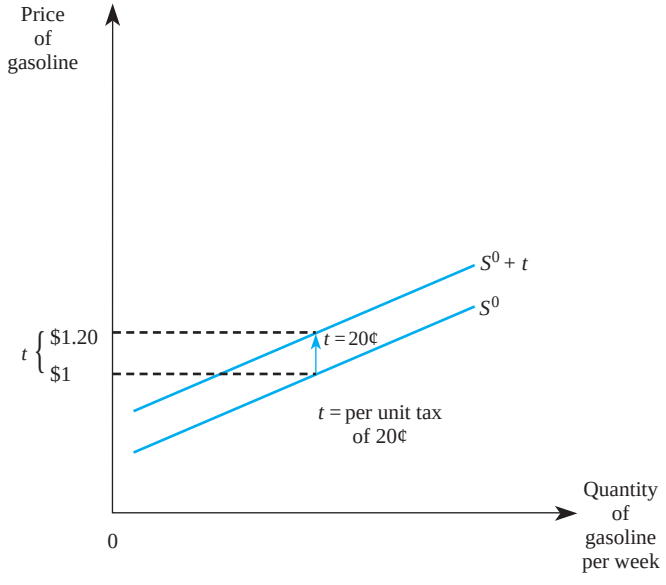
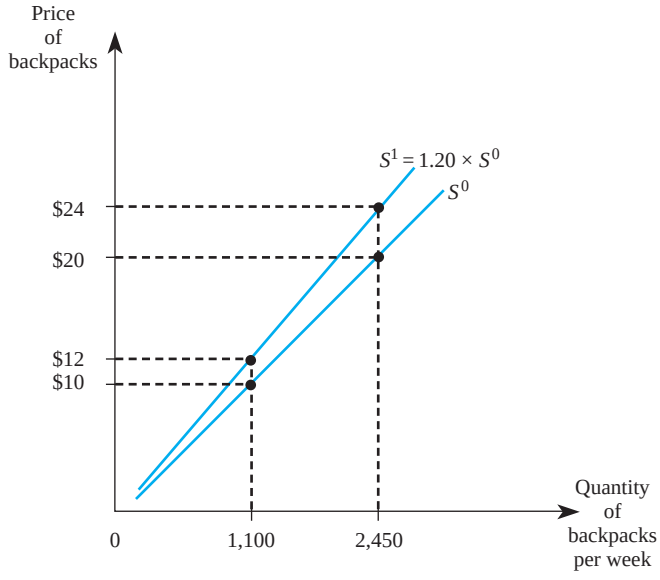


FIGURE 2–8 An Ad Valorem Tax



Once the 20 percent tax is implemented, the price required to produce each unit goes up by 20 percent at any output level. Therefore, price will go up by $2 at a quantity of 1,100 and by $4 at a quantity of 2,450. An ad valorem tax will rotate the supply curve counterclockwise, and the new curve will shift farther away from the original curve as the price increases. This explains why S^1 is steeper than S^0 in Figure 2–8.

Producer Expectations

Producer expectations about future prices also affect the position of the supply curve. In effect, selling a unit of output today and selling a unit of output tomorrow are substitutes in production. If firms suddenly expect prices to be higher in the future and the product is not perishable, producers can hold back output today and sell it later at a higher price. This has the effect of shifting the current supply curve to the left.

The Supply Function

supply function A function that describes how much of a good will be produced at alternative prices of that good, alternative input prices, and alternative values of other variables affecting supply.

You should now understand the difference between supply and quantity supplied and recognize the factors that influence the position of the supply curve. The final step in our analysis of supply is to show that all the factors that influence the supply of a good can be summarized in a supply function.

The *supply function* of a good describes how much of the good will be produced at alternative prices of the good, alternative prices of inputs, and alternative values of other variables that affect supply. Formally, let Q_x^s represent the quantity supplied of a good, P_x the price of the good, W the price of an input (such as the wage rate on labor), P_r the price of technologically related goods, and H the value

of some other variable that affects supply (such as the existing technology, the number of firms in the market, taxes, or producer expectations). Then the supply function for good X may be written as

$$Q_x^s = f(P_x, P_r, W, H)$$

Thus, the supply function explicitly recognizes that the quantity produced in a market depends not only on the price of the good but also on all the factors that are potential supply shifters. While there are many different functional forms for different types of products, a particularly useful representation of a supply function is the linear relationship. Supply is *linear* if Q_x^s is a linear function of the variables that influence supply. The following equation is representative of a linear supply function:

linear supply function
A representation of the supply function in which the supply of a given good is a linear function of prices and other variables affecting supply.

$$Q_x^s = \beta_0 + \beta_x P_x + \beta_r P_r + \beta_w W + \beta_H H$$

The coefficients (the $\beta_i s$) represent given numbers that have been estimated by the firm's research department or an economic consultant.

Demonstration Problem 2–3

Your research department estimates that the supply function for television sets is given by

$$Q_x^s = 2{,}000 + 3P_x - 4P_r - P_w$$

where P_x is the price of TV sets, P_r represents the price of a computer monitor, and P_w is the price of an input used to make television sets. Suppose TVs are sold for \$400 per unit, computer monitors are sold for \$100 per unit, and the price of an input is \$2,000. How many television sets are produced?

Answer:

To find out how many television sets are produced, we insert the given values of prices into the supply function to get

$$Q_x^s = 2{,}000 + 3(400) - 4(100) - 1(2{,}000)$$

Adding up the numbers, we find that the total quantity of television sets produced is 800.

The information summarized in a supply function can be used to graph a supply curve. Since a supply curve is the relationship between price and quantity, a representative supply curve holds everything but price constant. This means one may obtain the formula for a supply curve by inserting given values of the supply shifters into the supply function, but leaving P_x in the equation to allow for various values. If we do this for the supply function in Demonstration Problem 2–3 (where $P_r = \$100$ and $P_w = 2{,}000$), we get

$$Q_x^s = 2{,}000 + 3P_x - 4(100) - 1(2{,}000)$$

which simplifies to

$$Q_x^s = 3P_x - 400 \tag{2–2}$$

Since we usually graph this relation with the price of the good on the vertical axis, it is useful to represent Equation 2–2 with price on the left-hand side and everything else on the right-hand side. This is known as an *inverse supply function.* For this example, the inverse supply function is

$$P_x = \frac{400}{3} + \frac{1}{3} Q_x^s$$

which is the equation for the supply curve graphed in Figure 2–9. This curve reveals how much producers must receive to be willing to produce each additional unit of good *X*.

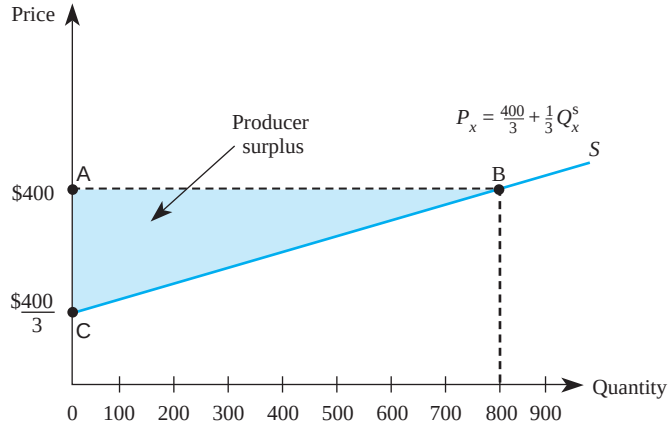
Producer Surplus

Just as consumers want price to be as low as possible, producers want price to be as high as possible. The supply curve reveals the amount producers will be willing to produce at a given price. Alternatively, it indicates the price firms would have to receive to be willing to produce an additional unit of a good. For example, the supply curve in Figure 2–9 indicates that a total of 800 units will be produced when the price is $400. Alternatively, if 800 units are produced, producers will have to receive $400 to be induced to produce another unit of the good.

producer surplus The amount producers receive in excess of the amount necessary to induce them to produce the good.

Producer surplus is the producer analogue to consumer surplus. It is the amount of money producers receive in excess of the amount necessary to induce them to produce the good. More specifically, note that producers are willing to sell each unit of output below 800 units at a price less than $400. But if the price

FIGURE 2–9 Producer Surplus



is $400, producers receive an amount equal to $400 for each unit of output below 800, even though they would be willing to sell those individual units for a lower price.

Geometrically, producer surplus is the area above the supply curve but below the market price of the good. Thus, the shaded area in Figure 2–9 represents the surplus producers receive by selling 800 units at a price of $400—an amount above what would be required to produce each unit of the good. The shaded area, ABC, is the producer surplus when the price is $400. Mathematically, this area is one-half of 800 times $266.67, or $106,668.

Producer surplus can be a powerful tool for managers. For instance, suppose the manager of a major fast-food restaurant currently purchases 10,000 pounds of ground beef each week from a supplier at a price of $1.25 per pound. The producer surplus the meat supplier earns by selling 10,000 pounds at $1.25 per pound tells the restaurant manager the dollar amount that the supplier is receiving over and above what it would be willing to accept for meat. In other words, the meat supplier's producer surplus is the maximum amount the restaurant could save in meat costs by bargaining with the supplier over a package deal for 10,000 pounds of meat. Chapters 6 and 10 will provide details about how managers can negotiate such a bargain.

MARKET EQUILIBRIUM

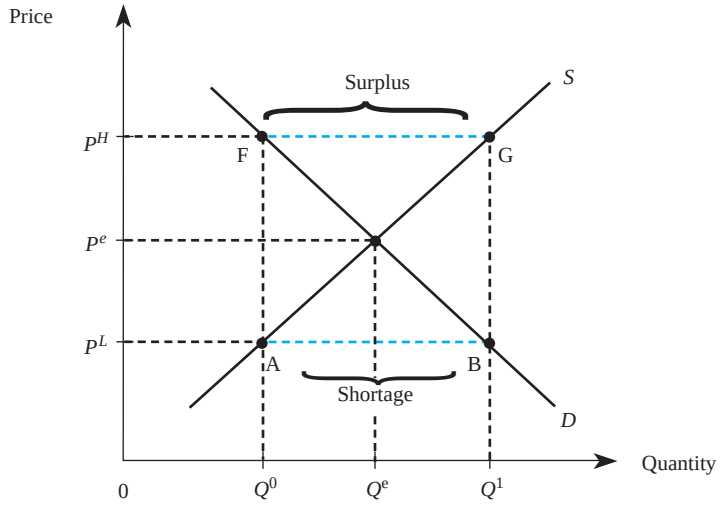
The equilibrium price in a competitive market is determined by the interactions of all buyers and sellers in the market. The concepts of market supply and market demand make this notion of interaction more precise: The price of a good in a competitive market is determined by the interaction of market supply and market demand for the good.

Since we will focus on the market for a single good, it is convenient to drop subscripts at this point and let P denote the price of this good and Q the quantity of the good. Figure 2–10 depicts the market supply and demand curves for such a good. To see how the competitive price is determined, let the price of the good be P^L. This price corresponds to point B on the market demand curve; consumers wish to purchase Q^1 units of the good. Similarly, the price of P^L corresponds to point A on the market supply curve; producers are willing to produce only Q^0 units at this price. Thus, when the price is P^L, there is a *shortage* of the good; that is, there is not enough of the good to satisfy all consumers willing to purchase it at that price.

In situations where a shortage exists, there is a natural tendency for the price to rise; consumers unable to buy the good may offer producers a higher price in an attempt to get the product. As the price rises from P^L to P^e in Figure 2–10, producers have an incentive to expand output from Q^0 to Q^e. Similarly, as the price rises, consumers are willing to purchase less of the good. When the price rises to P^e, the quantity demanded is Q^e. At this price, just enough of the good is produced to satisfy all consumers willing and able to purchase at that price; quantity demanded equals quantity supplied.

Suppose the price is at a higher level—say, P^H. This price corresponds to point F on the market demand curve, indicating that consumers wish to purchase

FIGURE 2–10 Market Equilibrium



Q^0 units of the good. The price P^H corresponds to point G on the market supply curve; producers are willing to produce Q^1 units at this price. Thus, when the price is P^H, there is a *surplus* of the good; firms are producing more than they can sell at a price of P^H.

Whenever a surplus exists, there is a natural tendency for the price to fall to equate quantity supplied with quantity demanded; producers unable to sell their products may ask for a lower price in an attempt to reduce their unsold inventories. As the price falls from P^H to P^e, producers have an incentive to reduce quantity supplied to Q^e. Similarly, as the price falls, consumers are willing to purchase more of the good. When the price falls to P^e, the quantity demanded is Q^e; quantity demanded equals quantity supplied.

Thus, the interaction of supply and demand ultimately determines a competitive price, P^e, such that there is neither a shortage nor a surplus of the good. This price is called the *equilibrium price* and the corresponding quantity, Q^e, is called the *equilibrium quantity* for the competitive market. Once this price and quantity are realized, the market forces of supply and demand are balanced; there is no tendency for prices either to rise or to fall.

Principle

Competitive Market Equilibrium

Equilibrium in a competitive market is determined by the intersection of the market demand and supply curves. The equilibrium price is the price that equates quantity demanded with quantity supplied. Mathematically, if $Q^d(P)$ and $Q^s(P)$ represent the quantity demanded and supplied when the price is P, the equilibrium price, P^e, is the price such that

$$Q^d(P^e) = Q^s(P^e)$$

The equilibrium quantity is simply $Q^d(P^e)$ or, equivalently, $Q^s(P^e)$.

INSIDE BUSINESS 2–3

Unpopular Equilibrium Prices

For a recent college graduation, each graduating student was directed to pick up three free tickets any time between April 9 and April 20. After April 20, remaining tickets were given to those desiring additional tickets, on a first come, first served basis. Once the free tickets were fully distributed, any trades between ticket holders and ticket demanders were left to market forces—which led to a very unpopular equilibrium price.

With several concurrent events competing for students' attention during this time, many students did not claim their three free tickets by the deadline. As graduation approached, students who did not claim their tickets were willing to pay large sums of money to purchase tickets for visiting family members and friends. Since the demand for tickets was great and only a limited number of tickets were available, some sellers were asking as much as $400 for a ticket!

Several students expressed outrage over the high prices. However, the high prices are merely a symptom of the high value many students placed on graduation tickets coupled with the limited supply. Had graduating seniors without tickets better forecasted this market outcome, they would have picked up their free tickets on time.

Source: "$400? Ticket Scalpers Cash in on IU Kelley's Commencement," *The Herald-Times*, May 3, 2012.

Demonstration Problem 2–4

According to an article in *China Daily*, China recently accelerated its plan to privatize tens of thousands of state-owned firms. Imagine that you are an aide to a senator on the Foreign Relations Committee of the U.S. Senate, and you have been asked to help the committee determine the price and quantity that will prevail when competitive forces are allowed to equilibrate the market. The best estimates of the market demand and supply for the good (in U.S. dollar equivalent prices) are given by $Q^d = 10 - 2P$ and $Q^s = 2 + 2P$, respectively. Determine the competitive equilibrium price and quantity.

Answer:

Competitive equilibrium is determined by the intersection of the market demand and supply curves. Mathematically, this simply means that $Q^d = Q^s$. Equating demand and supply yields

$$10 - 2P = 2 + 2P$$

or

$$8 = 4P$$

Solving this equation for P yields the equilibrium price, $P^e = 2$. To determine the equilibrium quantity, we simply plug this price into either the demand or the supply function (since, in equilibrium, quantity supplied equals quantity demanded). For example, using the supply function, we find that

$$Q^e = 2 + 2(2) = 6$$

PRICE RESTRICTIONS AND MARKET EQUILIBRIUM

The previous section showed how prices and quantities are determined in a free market. In some instances, government places limits on how much prices are allowed to

rise or fall, and these restrictions can affect the market equilibrium. In this section, we examine the impact of price ceilings and price floors on market allocations.

Price Ceilings

One basic implication of the economic doctrine of scarcity is that there are not enough goods to satisfy the desires of all consumers at a price of zero. As a consequence, some method must be used to determine who gets to consume goods and who does not. People who do not get to consume goods are essentially discriminated against. One way to determine who gets a good and who does not is to allocate the goods based on hair color: If you have red hair, you get the good; if you don't have red hair, you don't get the good.

The price system uses price to determine who gets a good and who does not. The price system allocates goods to consumers who are willing and able to pay the most for the goods. If the competitive equilibrium price of a pair of jeans is $40, consumers willing and able to pay $40 will purchase the good; consumers unwilling or unable to pay that much for a pair of jeans will not buy the good.

It is important to keep in mind that it is not the price system that is "unfair" if one cannot afford to pay the market price for a good; rather, it is unfair that we live in a world of scarcity. Any method of allocating goods will seem unfair to someone because there are not enough resources to satisfy everyone's wants. For example, if jeans were allocated to people on the basis of hair color instead of the price system, you would think this allocation rule was unfair unless you were born with the "right" hair color.

Often individuals who are discriminated against by the price system attempt to persuade the government to intervene in the market by requiring producers to sell the good at a lower price. This is only natural, for if we were unable to own a house because we had the wrong hair color, we most certainly would attempt to get the government to pass a law allowing people with our hair color to own a house. But then there would be too few houses to go around, and some other means would have to be used to allocate houses to people.

Suppose that, for whatever reason, the government views the equilibrium price of P^e in Figure 2–11 as "too high" and passes a law prohibiting firms from charging prices above P^c. Such a price is called a *price ceiling.*

price ceiling The maximum legal price that can be charged in a market.

Do not be confused by the fact that the price ceiling is below the initial equilibrium price; the term *ceiling* refers to that price being the highest permissible price in the market. It does not refer to a price set above the equilibrium price. In fact, if a ceiling were imposed above the equilibrium price, it would be ineffective; the equilibrium price would be below the maximum legal price.

Given the regulated price of P^c, quantity demanded exceeds quantity supplied by the distance from A to B in Figure 2–11; there is a shortage of $Q^d - Q^s$ units. The reason for the shortage is twofold. First, producers are willing to produce less at the lower price, so the available quantity is reduced from Q^e to Q^s. Second, consumers wish to purchase more at the lower price; thus, quantity demanded increases from Q^e to Q^d. The result is that there is not enough of the good to satisfy all consumers willing and able to purchase it at the price ceiling.

How, then, are the goods to be allocated now that it is no longer legal to ration them on the basis of price? In most instances, goods are rationed on the basis of

"first come, first served." As a consequence, price ceilings typically result in long lines such as those created in the 1970s due to price ceilings on gasoline. Thus, price ceilings discriminate against people who have a high opportunity cost of time and do not like to wait in lines. If a consumer has to wait in line two hours to buy 10 gallons of gasoline and his or her time is worth \$5 per hour, it costs the consumer $2 \times \$5 = \$10$ to wait in line. Since 10 gallons of gasoline are purchased, this amounts to spending \$1 per gallon waiting in line to purchase the good.

full economic price
The dollar amount paid to a firm under a price ceiling, plus the nonpecuniary price.

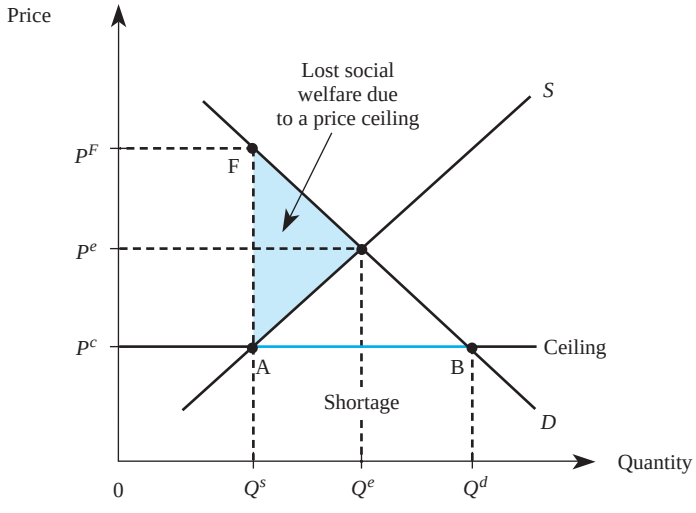
This basic idea can be depicted graphically. Under the price ceiling of P^c, only Q^s units of the good are available. Since this quantity corresponds to point F on the demand curve in Figure 2–11, we see that consumers are willing to pay P^F for another unit of the good. By law, however, they cannot pay the firm more than P^c. The difference, $P^F - P^c$, reflects the price per unit consumers are willing to pay by waiting in line. The *full economic price* paid by a consumer (P^F) is thus the amount paid to the firm (P^c), plus the implicit amount paid by waiting in line ($P^F - P^c$). The latter price is paid not in dollars but through opportunity cost and thus is termed the *nonpecuniary price.*

$$\underset{\text{Full economic price}}{P^F} = \underset{\text{Dollar price}}{P^c} + \underset{\text{Nonpecuniary price}}{(P^F - P^c)}$$

As Figure 2–11 shows, P^F is greater than the initial equilibrium price, P^e. When opportunity costs are taken into account, the full economic price paid for a good is actually higher after the ceiling is imposed.

Since price ceilings reduce the quantity available in the market, such regulations reduce social welfare even if they do not result in long lines. The dollar value of the lost social welfare is given by the shaded triangle in Figure 2–11. Intuitively, each point on the demand curve represents the amount consumers would be willing to pay

FIGURE 2–11 A Price Ceiling



for an additional unit, while each point on the supply curve indicates the amount producers would have to receive to induce them to sell an additional unit. The vertical difference between the demand and supply curves at each quantity therefore represents the change in social welfare (consumer value less relevant production costs) associated with each incremental unit of output. Summing these vertical differences for all units between Q^e and Q^s yields the shaded triangle in Figure 2–11 and thus represents the total dollar value of the lost social welfare due to a price ceiling. The triangle in Figure 2–11 is sometimes called "deadweight loss."

Demonstration Problem 2–5

Based on your answer to the Senate Foreign Relations Committee (Demonstration Problem 2–4), one of the senators raises a concern that the free market price might be too high for the typical Chinese citizen to pay. Accordingly, she asks you to explain what would happen if the Chinese government privatized the market, but then set a price ceiling at the Chinese equivalent of $1.50. How do you answer? Assume that the market demand and supply curves (in U.S. dollar equivalent prices) are still given by

$$Q^d = 10 - 2P \text{ and } Q^s = 2 + 2P$$

Answer:

Since the price ceiling is below the equilibrium price of $2, a shortage will result. More specifically, when the price ceiling is $1.50, quantity demanded is

$$Q^d = 10 - 2(1.50) = 7$$

and quantity supplied is

$$Q^s = 2 + 2(1.50) = 5$$

Thus, there is a shortage of $7 - 5 = 2$ units.

To determine the full economic price, we simply determine the maximum price consumers are willing to pay for the five units produced. To do this, we first set quantity equal to 5 in the demand formula:

$$5 = 10 - 2P^F$$

or

$$2P^F = 5$$

Next, we solve this equation for P^F to obtain the full economic price, $P^F = \$2.50$. Thus, consumers pay a full economic price of $2.50 per unit; $1.50 of this price is in money, and $1 represents the nonpecuniary price of the good.

Based on the preceding analysis, one may wonder why the government would ever impose price ceilings. One answer might be that politicians do not understand the basics of supply and demand. This probably is not the answer, however.

The answer lies in who benefits from and who is harmed by ceilings. When lines develop due to a shortage caused by a price ceiling, people with high opportunity

INSIDE BUSINESS 2–4

Price Ceilings and Price Floors around the Globe

Federal, state, and local authorities around the world are often persuaded to enact laws that restrict the prices that businesses can legally charge their customers. Many states in the United States have usury laws—price ceilings on interest rates—that restrict the rate that banks and other lenders can legally charge their customers. In 2005, Poland passed the Anti-Usury Act, which limited the consumer interest rate to quadruple the security rate of the National Bank of Poland; violators of the Act can face a fine or up to two years of imprisonment. Thailand allowed gasoline prices to be determined by market forces during the 1990s, but its Commerce Ministry imposed a price ceiling in an attempt to hold down the rapidly rising gasoline prices during the early 2000s.

All but five states in the United States have enacted minimum wage legislation—that is, a price floor on the hourly rate a business can legally pay its employees. These restrictions are in addition to the minimum wage set by the federal government, and as of 2012, state minimum wages were higher than the federal minimum wage in 18 states. The effect of these minimum wages is similar to that shown in Figure 2–12. However, since governments do not hire workers who are unable to find employment at the artificially high wage, the "surplus" of labor translates into unemployment. Over a dozen Canadian provinces also have enacted minimum wage laws. In addition, Ontario, British Columbia, and Quebec have established floor prices (called "minimum retail prices") on beer to keep prices artificially high in an attempt to discourage alcohol consumption and to protect Canadian brewers from inexpensive U.S. brands.

Sources: "Oil Sales: Ceiling Set on Retail Margin," *The Nation*, June 15, 2002; "An Oil Shock of Our Own Making," *The Nation*, May 20, 2004; "Italian Usury Laws: Mercy Strain'd" *The Economist*, November 23, 2000; "Democrats Look to Keep Minimum Wage on Table," *The Wall Street Journal*, June 20, 2006; "Beer Price War Punishes Mom-and-Pop Shops," *The Gazette*, November 4, 2005; "EU Lawmakers Pass Credit Directive," *Krakow Post*, May 15, 2012; and United States Department of Labor, www.dol.gov/whd/ minwage/america.htm, accessed May 15, 2012.

costs are hurt, while people with low opportunity costs may actually benefit. For example, if you have nothing better to do than wait in line, you will benefit from the lower dollar price; your nonpecuniary price is close to zero. On the other hand, if you have a high opportunity cost of time because your time is valuable to you, you are made worse off by the ceiling. If a particular politician's constituents tend to have a lower than average opportunity cost, that politician naturally will attempt to invoke a price ceiling.

Sometimes when shortages are created by a ceiling, goods are not allocated on the basis of lines. Producers may discriminate against consumers on the basis of other factors, including whether or not consumers are regular customers. During the gasoline shortage of the 1970s, many gas stations sold gas only to customers who regularly used the stations. In California during the late 1990s, price ceilings were imposed on the fees that banks charged nondepositors for using their automatic teller machines (ATMs). The banks responded by refusing to let nondepositors use their ATM machines. In other situations, such as ceilings on loan interest rates, banks may allocate money only to consumers who are relatively well-to-do.

The key point is that in the presence of a shortage created by a ceiling, managers must use some method other than price to allocate the goods. Depending on which method is used, some consumers will benefit and others will be worse off.

Price Floors

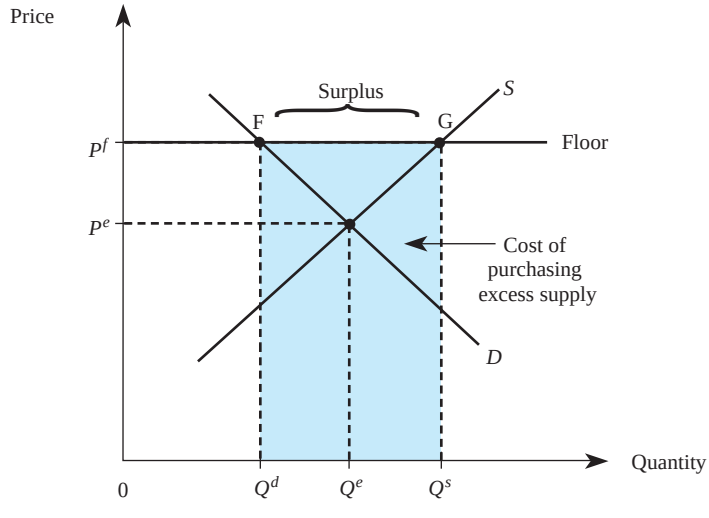
price floor
The minimum legal price that can be charged in a market.

In contrast to the case of a price ceiling, sometimes the equilibrium competitive price may be considered too low for sellers. In these instances, individuals may lobby for the government to legislate a minimum legal price for a good. Such a price is called a *price floor*. Perhaps the best-known price floor is the minimum wage, the lowest legal wage that can be paid to workers.

If the equilibrium price is above the price floor, the price floor has no effect on the market. But if the price floor is set above the competitive equilibrium level, such as P^f in Figure 2–12, there is an effect. Specifically, when the price floor is set at P^f, quantity supplied is Q^s and quantity demanded is Q^d. In this instance, more is produced than consumers are willing to purchase at that price, and a surplus develops. In the context of the labor market, there are more people looking for work than there are jobs to go around at that wage, and unemployment results. In the context of a product market, the surplus translates into unsold inventories. In a free market, price would fall to alleviate the unemployment or excess inventories, but the price floor prevents this mechanism from working. Buyers end up paying a higher price and purchasing fewer units.

What happens to the unsold inventories? Sometimes the government agrees to purchase the surplus. This is the case with price floors on many agricultural products, such as cheese. Under a price floor, the quantity of unsold products is given by the distance from G to F in Figure 2–12, or $Q^s - Q^d$. If the government purchases this surplus at the price floor, the total cost to the government is $P^f(Q^s - Q^d)$. Since the area of a rectangle is its base times its height, the cost to the government of buying the surplus is given by the shaded area FGQ^sQ^d in Figure 2–12.

FIGURE 2–12 A Price Floor



Demonstration Problem 2–6

One of the members of the Senate Foreign Relations Committee has studied your analysis of Chinese privatization (Demonstration Problems 2–4 and 2–5) but is worried that the free-market price might be too low to enable producers to earn a fair rate of return on their investment. He asks you to explain what would happen if the Chinese government privatized the market, but agreed to purchase unsold units of the good at a floor price of $4. What do you tell the senator? Assume that the market demand and supply curves (in U.S. dollar equivalent prices) are still given by

$$Q^d = 10 - 2P \text{ and } Q^s = 2 + 2P$$

Answer:

Since the price floor is above the equilibrium price of $2, the floor results in a surplus. More specifically, when the price is $4, quantity demanded is

$$Q^d = 10 - 2(4) = 2$$

and quantity supplied is

$$Q^s = 2 + 2(4) = 10$$

Thus, there is a surplus of $10 - 2 = 8$ units. Consumers pay a higher price ($4), and producers have unsold inventories of 8 units. However, the Chinese government must purchase the amount consumers are unwilling to purchase at the price of $4. Thus, the cost to the Chinese government of buying the surplus of 8 units is $\$4 \times 8 = \$32$.

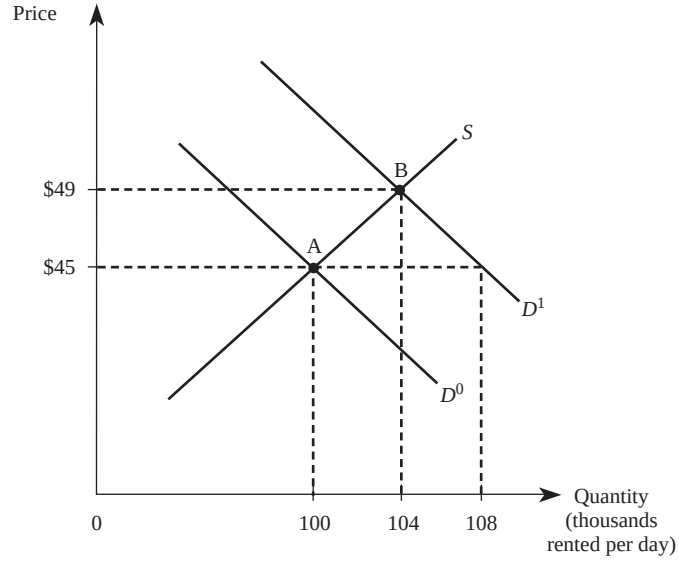
COMPARATIVE STATICS

You now understand how equilibrium is determined in a competitive market and how government policies such as price ceilings and price floors affect the market. Next, we show how managers can use supply and demand to analyze the impact of changes in market conditions on the competitive equilibrium price and quantity. The study of the movement from one equilibrium to another is known as *comparative static analysis.* Throughout this analysis, we assume that no legal restraints, such as price ceilings or floors, are in effect and that the price system is free to work to allocate goods among consumers.

Changes in Demand

Suppose that *The Wall Street Journal* reports that consumer incomes are expected to rise by about 2.5 percent over the next year, and the number of individuals over 25 years of age will reach an all-time high by the end of the year. We can use our supply and demand apparatus to examine how these changes in market conditions will affect car rental agencies like Avis, Hertz, and National. It seems reasonable to presume that rental cars are normal goods: A rise in consumer incomes will most likely increase the demand for rental cars. The increased number of consumers aged 25 and older will also increase demand, since at many locations those who rent cars must be at least 25 years old.

FIGURE 2–13 Effect of a Change in Demand for Rental Cars



We illustrate the ultimate effect of this increase in the demand for rental cars in Figure 2–13. The initial equilibrium in the market for rental cars is at point A, where demand curve D^0 intersects the market supply curve *S*. The changes reported in *The Wall Street Journal* suggest that the demand for rental cars will increase over the next year, from D^0 to some curve like D^1. The equilibrium moves to point B, where car rental companies rent more cars and charge a higher price than before the demand increase.

The reason for the rise in rental car prices is as follows: The growing number of consumers aged 25 or older, coupled with the rise in consumer incomes, increases the demand for rental cars. At the old price of $45 per day, there are only 100,000 cars available. This is less than the 108,000 cars that customers want to rent at that price. Car rental companies thus find it in their interest to raise their prices and to increase their quantity supplied of rental cars until ultimately enough cars are available at the new equilibrium price of $49 to exactly equal the quantity demanded at this higher price.

Demonstration Problem 2–7

The manager of a fleet of cars currently rents them out at the market price of $49 per day, with renters paying for their own gasoline and oil. In a front-page newspaper article, the manager learns that economists expect gasoline prices to rise dramatically over the next year, due to increased tensions in the Middle East. What should she expect to happen to the price of the cars her company rents?

Answer:

Since gasoline and rental cars are complements, the increase in gasoline prices will decrease the demand for rental cars. To see the impact on the market price and quantity of rental cars, let D^1 in Figure 2–13 represent the initial demand for rental cars, so that the initial

INSIDE BUSINESS 2–5

Globalization and the Supply of Automobiles

In today's global economy, the number of firms in the market critically depends on the entry and exit decisions of foreign firms. Recently, several Chinese automakers—including the country's biggest domestic brand, Chery Automobile Co.—announced ambitious plans to expand abroad. Chery already exports to 70 developing countries in Asia, the Middle East, and Latin America, and is eyeing further expansion into more developed markets.

Entry by Chery and other Chinese manufacturers into a developed market such as the U.S. automobile market would shift the supply curve to the right. Other things equal, this will negatively impact the bottom lines of firms that currently sell in these markets: The increase in supply will reduce the equilibrium prices of automobiles and the profits of existing U.S. automakers.

Source: "Chinese Automakers Aim for Global Expansion," Manufacturing.Net, April 23, 2010.

equilibrium is at point B. An increase in the price of gasoline will shift the demand curve for rental cars to the left (to D^0), resulting in a new equilibrium at point A. Thus, she should expect the price of rental cars to fall.

Changes in Supply

We can also use our supply and demand framework to predict how changes in one or more supply shifters will affect the equilibrium price and quantity of goods or services. For instance, consider a bill before Congress that would require all employers, small and large alike, to provide health care to their workers. How would this bill affect the prices charged for goods at retailing outlets?

This health care mandate would increase the cost to retailers and other firms of hiring workers. Many retailers rely on semiskilled workers who earn relatively low wages, and the cost of providing health insurance to these workers is large relative to their annual wage earnings. While firms might lower wages to some extent to offset the mandated health insurance costs paid, the net effect would be to raise the total cost to the firm of hiring workers. These higher labor costs, in turn, would decrease the supply of retail goods. The final result of the legislation would be to increase the prices charged by retailing outlets and to reduce the quantity of goods sold there.

We can see this more clearly in Figure 2–14. The market is initially in equilibrium at point A, where demand curve D intersects the market supply curve, S^0. Higher input prices decrease supply from S^0 to S^1, and the new competitive equilibrium moves to point B. In this instance, the market price rises from P^0 to P^1, and the equilibrium quantity decreases from Q^0 to Q^1.

Simultaneous Shifts in Supply and Demand

Managers in both the private and public sectors sometimes encounter events that lead to simultaneous shifts in both demand and supply. A tragic example occurred at the end of the last century when an earthquake hit Kobe, Japan. The earthquake did considerable damage to Japan's sake wine industry, and the nation's supply of

INSIDE BUSINESS 2–6

Using a Spreadsheet to Calculate Equilibrium in the Supply and Demand Model

The Web site for the eighth edition of *Managerial Economics and Business Strategy*, www.mhhe.com/baye8e, contains a file named SupplyandDemandSolver.xls. With a few clicks of a mouse, you can use this tool to determine equilibrium in the linear supply and demand model under different scenarios by accessing different tabs in the file. You can also use this program to see how equilibrium prices and quantities change through "real-time" comparative static exercises.

Additionally, this tool permits you to calculate both producer and consumer surplus and investigate how their magnitudes change when demand and supply parameters change. You can also use it to examine the quantitative impact of price regulations, such as price ceilings and price floors, and the resulting lost social welfare (or deadweight loss) associated with prices that are regulated at levels above or below the equilibrium price.

It is important to stress that this tool is not a substitute for being able to perform these tasks without the aid of the tool. But the tool will help you visualize how different demand and supply parameters lead to different quantitative effects. Just as important, you can create a never-ending number of practice problems and solve them by hand, and then use this tool to check your answers. For Connect users, the algorithmic versions of the end-of-chapter problems will allow you to solve many versions of these types of equilibrium problems with immediate feedback on your performance.

sake wine decreased as a result. Unfortunately, the stress caused by the earthquake led many to increase their demand for sake and other alcoholic beverages. We can use the tools of this chapter to examine how these simultaneous changes in supply and demand affected the equilibrium price and quantity of sake.

In Figure 2–15, the market is initially in equilibrium at point A, where demand curve D^0 intersects market supply curve S^0. Since the earthquake led to a simultaneous

FIGURE 2–14 Effect of a Change in Supply

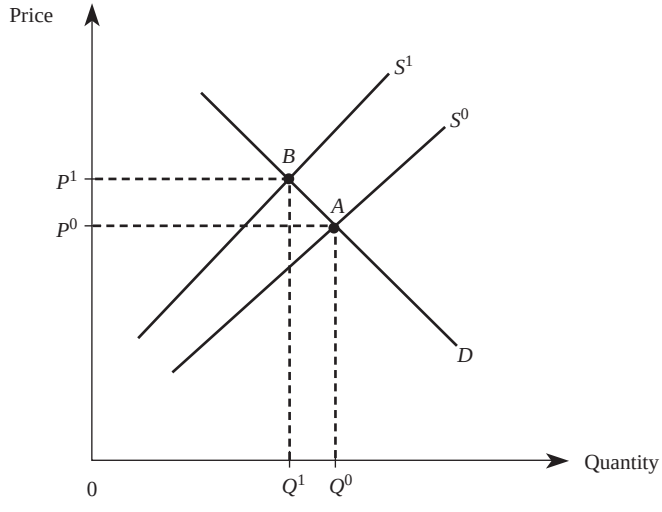
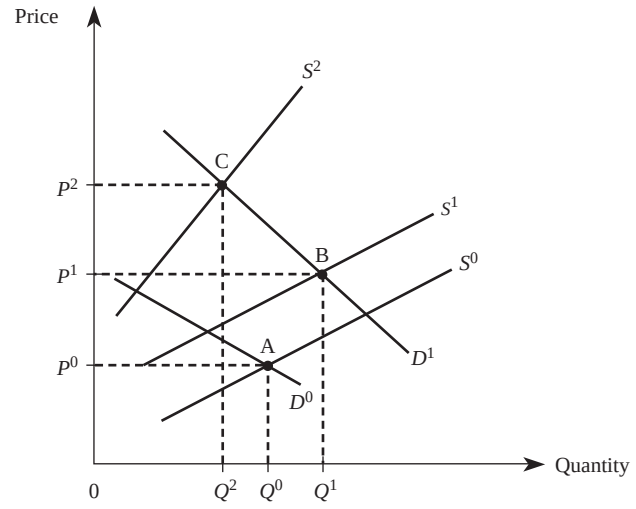


FIGURE 2–15 A Simultaneous Increase in Demand and Decrease in Supply Raises the Equilibrium Price



decrease in supply and increase in demand for sake, suppose supply decreases from S^0 to S^1 and demand increases from D^0 to D^1. In this instance, a new competitive equilibrium occurs at point B; the price of sake increases from P^0 to P^1, and the quantity consumed increases from Q^0 to Q^1.

As the curves are drawn in Figure 2–15, the effect of the decrease in supply and increase in demand was to increase both the price and the quantity. But what if instead of shifting from S^0 to S^1, the supply curve shifted much farther to the left to S^2 so that it intersected the new demand curve at point C instead of B? In this instance, price would still be higher than the initial equilibrium price, P^0. But the resulting quantity would be lower than the initial equilibrium (point C implies a lower quantity than point A). Thus, we have seen that when demand increases and supply decreases, the market price rises, but the market quantity may rise or fall depending on the relative magnitude of the shifts.

When using supply and demand analysis to predict the effects of simultaneous changes in demand and supply, you must be careful that the predictions are not artifacts of how far you have shifted the curves. As shown in Table 2–2, simultaneous changes in demand and supply generally lead to ambiguities regarding whether the equilibrium price or quantity will rise or fall. A valuable exercise is to draw various simultaneous shifts in supply and demand to verify the results summarized in Table 2–2.

Demonstration Problem 2–8

For a video walkthrough of this problem, visit www.mhhe.com/baye8e

Suppose you are the manager of a chain of computer stores. For obvious reasons you have been closely following developments in the computer industry, and you have just learned that Congress has passed a two-pronged program designed to further enhance the U.S. computer industry's position in the global economy. The legislation provides increased funding

TABLE 2–2 Equilibrium Price and Quantity: The Impact of Simultaneous Shifts in Demand and Supply

Nature of the Change	Increase in Demand	Decrease in Demand
Increase in Supply	Price: Ambiguous Quantity: Increases	Price: Decreases Quantity: Ambiguous
Decrease in Supply	Price: Increases Quantity: Ambiguous	Price: Ambiguous Quantity: Decreases

for computer education in primary and secondary schools, as well as tax breaks for firms that develop computer software. As a result of this legislation, what do you predict will happen to the equilibrium price and quantity of software?

Answer:

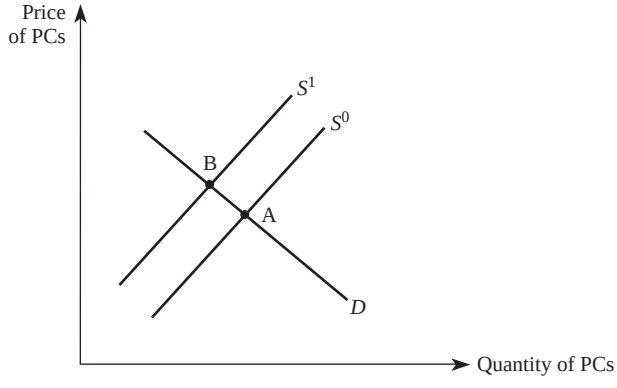
The equilibrium quantity certainly will increase, but the market price may rise, remain the same, or fall, depending on the relative changes in demand and supply. To see this, note that the increased funding for computer education at primary and secondary schools will lead to an increase in the demand for computer software, since it is a normal good. The reduction in taxes on software manufacturers will lead to an increase in the supply of software. You should draw a figure to verify that if the rightward shift in supply is small compared to the rightward shift in demand, both the equilibrium price and quantity will increase. If supply increases by the same amount as demand, there will be no change in the price but the equilibrium quantity will rise. Finally, if supply increases more than the increase in demand, the resulting equilibrium will entail a lower price and a greater quantity. In all cases, the equilibrium quantity increases. But the effect on the market price depends on the relative magnitudes of the increases in demand and supply.

ANSWERING THE HEADLINE

Now that we have developed a formal apparatus for understanding how markets work, we will return to the story that opened this chapter.

Sam recognized that a cut in chip production will ultimately lead to higher chip prices. Since chips are a key input in the production of PCs, an increase in the price

FIGURE 2–16 Rising Chip Prices Decrease the Supply of PCs



of chips would in turn lead to a decrease in the market supply of PCs, as indicated by the change in supply from S^0 to S^1 in Figure 2–16. Notice that total quantity of PCs sold in the market falls as the equilibrium moves from point A to point B. In light of this anticipated decline in PC sales, Sam and Jane discussed the wisdom of going ahead with their plan to double PC Solutions' workforce at this time.

SUMMARY

This chapter provided an overview of supply and demand and the interaction of these forces. We covered applications of demand, supply, price ceilings, price floors, and comparative statics. By reading this chapter and working through the demonstration problems presented, you should have a basic understanding of how to analyze the workings of a competitive market.

The model of supply and demand is just a starting point for this book. Throughout the remainder of the book, we assume you have a thorough understanding of the concepts presented in this chapter. In the next chapter, we will present the concepts of elasticity and show how to use them in making managerial decisions. We will also present some additional quantitative tools to help managers make better decisions.

KEY TERMS AND CONCEPTS

ad valorem tax
change in demand
change in quantity demanded
change in quantity supplied
change in supply
comparative static analysis
complements
consumer expectations
consumer surplus
decrease in demand
decrease in supply
demand
demand function
demand shifters
equilibrium price
equilibrium quantity
excise tax
full economic price
increase in demand
increase in supply
inferior good
informative advertising
inverse demand function
inverse supply function
law of demand
law of supply
linear demand function
linear supply function
market demand curve
market supply curve
nonpecuniary price
normal good
persuasive advertising
price ceiling
price floor
producer expectations
producer surplus
shortage
stockpiling
substitutes
supply
supply function
supply shifters
surplus

END-OF-CHAPTER PROBLEMS BY LEARNING OBJECTIVE

Every end-of-chapter problem addresses at least one learning objective. Below is a nonexhaustive sample of end-of-chapter problems for each learning objective.

LO1 Explain the laws of demand and supply, and identify factors that cause demand and supply to shift.

Try these problems: 1, 3

LO2 Calculate consumer surplus and producer surplus, and describe what they mean.

Try these problems: 5, 9

LO3 Explain price determination in a competitive market, and show how equilibrium changes in response to changes in determinants of demand and supply.

Try these problems: 6, 14

LO4 Explain and illustrate how excise taxes, *ad valorem* taxes, price floors, and price ceilings impact the functioning of a market.

Try these problems: 2, 18

LO5 Apply supply and demand analysis as a qualitative forecasting tool to see the "big picture" in competitive markets.

Try these problems: 11, 19

CONCEPTUAL AND COMPUTATIONAL QUESTIONS

1. The X-Corporation produces a good (called *X*) that is a normal good. Its competitor, Y-Corp., makes a substitute good that it markets under the name *Y*. Good *Y* is an inferior good.
   a. How will the demand for good *X* change if consumer incomes decrease?
   b. How will the demand for good *Y* change if consumer incomes increase?
   c. How will the demand for good *X* change if the price of good *Y* increases?
   d. Is good *Y* a lower-quality product than good *X*? Explain.
2. Good *X* is produced in a competitive market using input *A*. Explain what would happen to the supply of good *X* in each of the following situations:
   a. The price of input *A* decreases.
   b. An excise tax of $3 is imposed on good *X*.
   c. An ad valorem tax of 7 percent is imposed on good *X*.
   d. A technological change reduces the cost of producing additional units of good *X*.
3. Suppose the supply function for product *X* is given by $Q_X^S = -30 + 2P_x - 4P_z$.
   a. How much of product *X* is produced when $P_x = \$600$ and $P_z = \$60$?
   b. How much of product *X* is produced when $P_x = \$80$ and $P_z = \$60$?
   c. Suppose $P_z = \$60$. Determine the supply function and inverse supply function for good *X*. Graph the inverse supply function.

4. The demand for good X is given by

$$Q_x^d = 6{,}000 - \frac{1}{2}P_x - P_y + 9P_z + \frac{1}{10}M$$

Research shows that the prices of related goods are given by $P_y = \$6{,}500$ and $P_z = \$100$, while the average income of individuals consuming this product is $M = \$70{,}000$.

   a. Indicate whether goods Y and Z are substitutes or complements for good X.
   b. Is X an inferior or a normal good?
   c. How many units of good X will be purchased when $P_x = \$5{,}230$?
   d. Determine the demand function and inverse demand function for good X. Graph the demand curve for good X.

5. The demand curve for product X is given by $Q_x^d = 300 - 2P_x$.
   a. Find the inverse demand curve.
   b. How much consumer surplus do consumers receive when $P_x = \$45$?
   c. How much consumer surplus do consumers receive when $P_x = \$30$?
   d. In general, what happens to the level of consumer surplus as the price of a good falls?

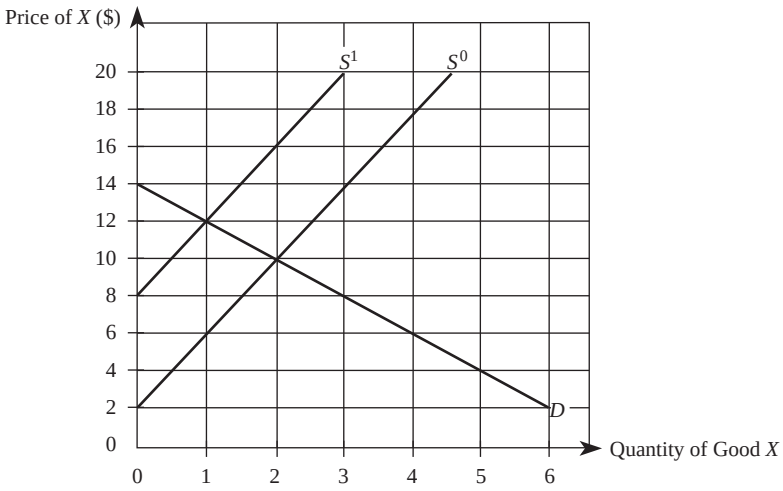
6. Suppose demand and supply are given by $Q^d = 60 - P$ and $Q^s = P - 20$.
   a. What are the equilibrium quantity and price in this market?
   b. Determine the quantity demanded, the quantity supplied, and the magnitude of the surplus if a price floor of \$50 is imposed in this market.
   c. Determine the quantity demanded, the quantity supplied, and the magnitude of the shortage if a price ceiling of \$32 is imposed in this market. Also, determine the full economic price paid by consumers.

7. Suppose demand and supply are given by

$$Q_x^d = 14 - \frac{1}{2}P_x \quad \text{and} \quad Q_x^s = \frac{1}{4}P_x - 1$$

   a. Determine the equilibrium price and quantity. Show the equilibrium graphically.
   b. Suppose a \$12 excise tax is imposed on the good. Determine the new equilibrium price and quantity.
   c. How much tax revenue does the government earn with the \$12 tax?

8. Use the accompanying graph to answer these questions.
   a. Suppose demand is D and supply is S^0. If a price ceiling of \$6 is imposed, what are the resulting shortage and full economic price?
   b. Suppose demand is D and supply is S^0. If a price floor of \$12 is imposed, what is the resulting surplus? What is the cost to the government of purchasing any and all unsold units?
   c. Suppose demand is D and supply is S^0 so that the equilibrium price is \$10. If an excise tax of \$6 is imposed on this product, what happens to the equilibrium price paid by consumers? The price received by producers? The number of units sold?



d. Calculate the level of consumer and producer surplus when demand and supply are given by D and S^0 respectively.

e. Suppose demand is D and supply is S^0. Would a price ceiling of $2 benefit any consumers? Explain.

9. The supply curve for product X is given by $Q_x^s = -520 + 20P_x$.
   a. Find the inverse supply curve.
   b. How much surplus do producers receive when $Q_x = 400$? When $Q_x = 1{,}200$?
10. Consider a market where supply and demand are given by $Q_x^s = -16 + P_x$ and $Q_x^d = 92 - 2P_x$. Suppose the government imposes a price floor of $40, and agrees to purchase any and all units consumers do not buy at the floor price of $40 per unit.
    a. Determine the cost to the government of buying firms' unsold units.
    b. Compute the lost social welfare (deadweight loss) that stems from the $40 price floor.

PROBLEMS AND APPLICATIONS

11. You are the manager of a midsized company that assembles personal computers. You purchase most components—such as random access memory (RAM)—in a competitive market. Based on your marketing research, consumers earning over $80,000 purchase 1.5 times more RAM than consumers with lower incomes. One morning, you pick up a copy of *The Wall Street Journal* and read an article indicating that input components for RAM are expected to rise in price, forcing manufacturers to produce RAM at a higher unit cost. Based on this information, what can you expect to happen to the price you pay for random access memory?

Would your answer change if, in addition to this change in RAM input prices, the article indicated that consumer incomes are expected to fall over the next two years as the economy dips into recession? Explain.

12. You are the manager of a firm that produces and markets a generic type of soft drink in a competitive market. In addition to the large number of generic products in your market, you also compete against major brands such as Coca-Cola and Pepsi. Suppose that, due to the successful lobbying efforts of sugar producers in the United States, Congress is going to levy a $0.50 per pound tariff on all imported raw sugar—the primary input for your product. In addition, Coke and Pepsi plan to launch an aggressive advertising campaign designed to persuade consumers that their branded products are superior to generic soft drinks. How will these events impact the equilibrium price and quantity of generic soft drinks?
13. Some have argued that higher cigarette prices do not deter smoking. While there are many arguments both for and against this view, some find the following argument to be the most persuasive of all: "The laws of supply and demand indicate that higher prices are ineffective in reducing smoking. In particular, higher cigarette prices will reduce the demand for cigarettes. This reduction in demand will push the equilibrium price back down to its original level. Since the equilibrium price will remain unchanged, smokers will consume the same number of cigarettes." Do you agree or disagree with this view? Explain.
14. You are the manager of an organization in America that distributes blood to hospitals in all 50 states and the District of Columbia. A recent report indicates that nearly 50 Americans contract HIV each year through blood transfusions. Although every pint of blood donated in the United States undergoes a battery of nine different tests, existing screening methods can detect only the antibodies produced by the body's immune system—not foreign agents in the blood. Since it takes weeks or even months for these antibodies to build up in the blood, newly infected HIV donors can pass along the virus through blood that has passed existing screening tests. Happily, researchers have developed a series of new tests aimed at detecting and removing infections from donated blood before it is used in transfusions. The obvious benefit of these tests is the reduced incidence of infection through blood transfusions. The report indicates that the current price of decontaminated blood is $60 per pint. However, if the new screening methods are adopted, the demand and supply for decontaminated blood will change to $Q^d = 210 - 1.5P$ and $Q^s = 2.5P - 150$. What price do you expect to prevail if the new screening methods are adopted? How many units of blood will be used in the United States? What is the level of consumer and producer surplus? Illustrate your findings in a graph.
15. As a result of increased tensions in the Middle East, oil production is down by 1.21 million barrels per day—a 5 percent reduction in the world's supply of crude oil. Explain the likely impact of this event on the market for gasoline and the market for small cars.

16. You are an assistant to a senator who chairs an ad hoc committee on reforming taxes on telecommunication services. Based on your research, AT&T has spent over $15 million on related paperwork and compliance costs. Moreover, depending on the locale, telecom taxes can amount to as much as 25 percent of a consumer's phone bill. These high tax rates on telecom services have become quite controversial, due to the fact that the deregulation of the telecom industry has led to a highly competitive market. Your best estimates indicate that, based on current tax rates, the monthly market demand for telecommunication services is given by $Q^d = 300 - 4P$ and the market supply (including taxes) is $Q^s = 3P - 120$ (both in millions), where P is the monthly price of telecommunication services. The senator is considering tax reform that would dramatically cut tax rates, leading to a supply function under the new tax policy of $Q^s = 3.2P - 120$. How much money per unit would a typical consumer save each month as a result of the proposed legislation?
17. G.R. Dry Foods Distributors specializes in the wholesale distribution of dry goods, such as rice and dry beans. The firm's manager is concerned about an article he read in this morning's *Wall Street Journal* indicating that the incomes of individuals in the lowest income bracket are expected to increase by 10 percent over the next year. While the manager is pleased to see this group of individuals doing well, he is concerned about the impact this will have on G.R. Dry Foods. What do you think is likely to happen to the price of the products G.R. Dry Foods sells? Why?
18. From California to New York, legislative bodies across the United States are considering eliminating or reducing the surcharges that banks impose on noncustomers who make $12 million in withdrawals from other banks' ATM machines. On average, noncustomers earn a wage of $24 per hour and pay ATM fees of $3.00 per transaction. It is estimated that banks would be willing to maintain services for 5 million transactions at $1.25 per transaction, while noncustomers would attempt to conduct 19 million transactions at that price. Estimates suggest that, for every 1 million gap between the desired and available transactions, a typical consumer will have to spend an extra minute traveling to another machine to withdraw cash. Based on this information, use a graph to carefully illustrate the impact of legislation that would place a $1.25 cap on the fees banks can charge for noncustomer transactions.
19. Rapel Valley in Chile is renowned for its ability to produce high-quality wine at a fraction of the cost of many other vineyards around the world. Rapel Valley produces over 20 million bottles of wine annually, of which 5 million are exported to the United States. Each bottle entering the United States is subjected to a $0.50 per bottle excise tax, which generates about $2.5 million in tax revenues. Strong La Niña weather patterns have caused unusually cold temperatures, devastating many of the wine producers in that region of Chile. How will La Niña affect the price of Chilean wine? Assuming La Niña does not impact the California wine-producing region, how will La Niña impact the market for Californian wines?

20. Viking InterWorks is one of many manufacturers that supplies memory products to original equipment manufacturers (OEMs) of desktop systems. The CEO recently read an article in a trade publication that reported the projected demand for desktop systems to be $Q^d_{desktop} = 1{,}600 - 2P_{desktop} + .6M$ (in millions of units), where $P_{desktop}$ is the price of a desktop system and M is consumer income. The same article reported that the incomes of the desktop systems' primary consumer demographic would increase 4.2 percent this year to $61,300 and that the selling price of a desktop would decrease to $980, both of which the CEO viewed favorably for Viking. In a related article, the CEO read that the upcoming year's projected demand for 512 MB desktop memory modules is $Q^d_{memory} = 11{,}200 - 100P_{memory} - 2P_{desktop}$ (in thousands of units), where P_{memory} is the market price for a 512 MB memory module and $P_{desktop}$ is the selling price of a desktop system. The report also indicated that five new, small start-ups entered the 512 MB memory module market, bringing the total number of competitors to 100 firms. Furthermore, suppose that Viking's CEO commissioned an industrywide study to examine the industry capacity for 512 MB memory modules. The results indicate that when the industry is operating at maximum efficiency, this competitive industry supplies modules according to the following function: $Q^S_{memory} = 1{,}000 + 25P_{memory} + N$ (in thousands), where P_{memory} is the price of a 512 MB memory module and N is the number of memory module manufacturers in the market. Viking's CEO provides you, the production manager, with the above information and requests a report containing the market price for memory modules and the number of units to manufacture in the upcoming year based on the assumption that all firms producing 512 MB modules supply an equal share to the market. How would your report change if the price of desktops were $1,080? What does this indicate about the relationship between memory modules and desktop systems?
21. Seventy-two percent of the members of the United Food and Commercial Workers Local 655 voted to strike against Stop 'n Shop in the St. Louis area. In fear of similar union responses, two of Stop 'n Shop's larger rivals in the St. Louis market—Dierberg's and Schnuck's—decided to lock out their union employees. The actions of these supermarkets, not surprisingly, caused Local 655 union members to picket and boycott each of the supermarkets' locations. While the manager of Mid Towne IGA—one of many smaller competing grocers—viewed the strike as unfortunate for both sides, he was quick to point out that the strike provided an opportunity for his store to increase market share. To take advantage of the strike, the manager of Mid Towne IGA increased newspaper advertising by pointing out that Mid Towne employed Local 655 union members and that it operated under a different contract than "other" grocers in the area. Use a graph to describe the expected impact of advertising on Mid Towne IGA (how the equilibrium price and quantity change). Identify the type of advertising in which Mid

Towne IGA engaged. Do you believe the impact of advertising will be permanent? Explain.

22. Florida, like several other states, has passed a law that prohibits "price gouging" immediately before, during, or after the declaration of a state of emergency. Price gouging is defined as " . . . selling necessary commodities such as food, gas, ice, oil, and lumber at a price that grossly exceeds the average selling price for the 30 days prior to the emergency." Many consumers attempt to stock up on emergency supplies, such as bottled water, immediately before and after a hurricane or other natural disaster hits an area. Also, many supply shipments to retailers are interrupted during a natural disaster. Assuming that the law is strictly enforced, what are the economic effects of the price gouging statute? Explain carefully.
23. In a recent speech, the governor of your state announced: "One of the biggest causes of juvenile delinquency in this state is the high rate of unemployment among 16 to 19 year olds. The low wages offered by employers in the state have given fewer teenagers the incentive to find summer employment. Instead of working all summer, the way we used to, today's teenagers slack off and cause trouble. To address this problem, I propose to raise the state's minimum wage by $1.50 per hour. This will give teens the proper incentive to go out and find meaningful employment when they are not in school." Evaluate the governor's plan to reduce juvenile delinquency.

CONNECT EXERCISES

If your instructor has adopted Connect for the course and you are an active subscriber, you can practice with the questions presented above, along with many alternative versions of these questions. Your instructor may also assign a subset of these problems and/or their alternative versions as a homework assignment through Connect, allowing for immediate feedback of grades and correct answers.

CASE-BASED EXERCISES

Your instructor may assign additional problem-solving exercises (called *memos*) that require you to apply some of the tools you learned in this chapter to make a recommendation based on an actual business scenario. Some of these memos accompany the Time Warner case (pages 561–597 of your textbook). Additional memos, as well as data that may be useful for your analysis, are available online at www.mhhe.com/baye8e.

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