CHAPTER 2

Demand, Supply, and Market Equilibrium

As we emphasized in Chapter 1, successful managers understand how market forces create both opportunities and constraints for profitable decision making. Such managers understand the way markets work, and they are able to predict the prices and production levels of the goods, resources, and services that are relevant to their businesses. The production manager of a soft-drink bottler could use new information about sugar production, such as government approval of a potent new fertilizer for growing sugar cane, to predict the future price of sugar and then make changes in syrup inventories. The owner–manager of a home-appliance manufacturing firm would want to use information about new home construction to make future production plans. This chapter presents one of the most powerful tools of economics for analyzing the way market forces determine prices and production in competitive markets—supply and demand analysis.

Even though supply and demand analysis is deceptively simple to learn and apply, it is widely used by highly experienced—and well-paid—market analysts and forecasters. You will see that such analysis provides a useful framework for processing market and other economic information to make decisions that affect the profitability of the business. And you will come across the concepts set forth in this chapter again and again throughout the rest of the text.

This chapter focuses primarily on the way markets for consumer goods and services function, although the basic concepts apply also to markets for resources, such as labor, land, raw materials, energy, and capital equipment. Supply and demand analysis applies principally to markets characterized by many buyers and

sellers in which a homogeneous or relatively nondifferentiated good or service is sold. As we stated in the previous chapter, such markets are called competitive markets. In competitive markets, individual firms are price-takers because prices are determined by the impersonal forces of the marketplace—demand and supply.

We begin the analysis of competitive markets by describing the buyer side of the market—called the *demand side* of the market. Next we describe the seller side—called the *supply side.* We then combine the demand side with the supply side to show how prices and quantities sold are determined in a market. Finally, we show how forces on the demand side or the supply side of the market can change and thereby affect the price and quantity sold in a market.

2.1 DEMAND

需求量 在某一给定的时间段内（一周、一个月等）消费者愿意并且能够购买产品或服务的数量。

The amount of a good or service that consumers in a market are willing and able to purchase during a given period of time (e.g., a week, a month) is called **quantity demanded.** Although economists emphasize the importance of price in purchasing decisions, as we will do, they also recognize that a multitude of factors other than price affect the amount of a good or service people will purchase. However, in order to simplify market analysis and make it manageable, economists ignore the many factors that have an insignificant effect on purchases and concentrate only on the most important factors. Indeed, only six factors are considered sufficiently important to be included in most studies of market demand.

This section develops three types of demand relations: (1) *general demand functions,* which show how quantity demanded is related to product price and five other factors that affect demand, (2) *direct demand functions,* which show the relation between quantity demanded and the price of the product when all other variables affecting demand are held constant at specific values, and (3) *inverse demand functions,* which give the maximum prices buyers are willing to pay to obtain various amounts of product. As you will see in this chapter, direct demand functions are derived from general demand functions, and inverse demand curves are derived from direct demand curves. Traditionally, economists have referred to direct demand functions simply as *demand functions* or *demand.* We shall follow this tradition.

The General Demand Function: $Q_d = f(P, M, P_R, \mathcal{T}, P_e, N)$

广义需求函数 体现需求量和影响需求量的六个因素之间关系的函数 $Q_d = f(P, M, P_R, \mathcal{T}, P_e, N)$。

The six principal variables that influence the quantity demanded of a good or service are (1) the price of the good or service, (2) the incomes of consumers, (3) the prices of related goods and services, (4) the tastes or preference patterns of consumers, (5) the expected price of the product in future periods, and (6) the number of consumers in the market. The relation between quantity demanded and these six factors is referred to as the **general demand function** and is expressed as follows:

$$Q_d = f(P, M, P_R, \mathcal{T}, P_e, N)$$

where *f* means "is a function of" or "depends on," and

Q_d = quantity demanded of the good or service

P = price of the good or service

M = consumers' income (generally per capita)

P_R = price of related goods or services

$\mathcal{T}$ = taste patterns of consumers

P_e = expected price of the good in some future period

N = number of consumers in the market

The general demand function shows how all six variables *jointly* determine the quantity demanded. In order to discuss the *individual* effect that any one of these six variables has on Q_d, we must explain how changing just that one variable *by itself* influences Q_d. Isolating the individual effect of a single variable requires that all other variables that affect Q_d be held constant. Thus whenever we speak of the effect that a particular variable has on quantity demanded, we mean the individual effect *holding all other variables constant.*

We now discuss each of the six variables to show how they are related to the amount of a good or service consumers buy. We begin by discussing the effect of changing the *price* of a good while holding the other five variables constant. As you would expect, consumers are willing and able to buy more of a good the lower the price of the good and will buy less of a good the higher the price of the good. Price and quantity demanded are negatively (inversely) related because when the price of a good rises, consumers tend to shift from that good to other goods that are now relatively cheaper. Conversely, when the price of a good falls, consumers tend to purchase more of that good and less of other goods that are now relatively more expensive. Price and quantity demanded are inversely related when all other factors are held constant. This relation between price and quantity demanded is so important that we discuss it in more detail later in this chapter and again in Chapter 5.

Next, we consider changes in *income,* again holding constant the rest of the variables that influence consumers. An increase in income can cause the amount of a commodity consumers purchase either to increase or to decrease. If an increase in income causes consumers to demand more of a good, when all other variables in the general demand function are held constant, we refer to such a commodity as a **normal good.** A good is also a normal good if a decrease in income causes consumers to demand less of the good, all other things held constant. There are some goods and services for which an increase in income would reduce consumer demand, other variables held constant. This type of commodity is referred to as an **inferior good.** In the case of inferior goods, rising income causes consumers to demand *less* of the good, and falling income causes consumers to demand *more* of the good. Some examples of goods and services that might be inferior include mobile homes, shoe repair services, generic food products, and used cars.

正常品 如果仅收入增加，会增大消费者对某种产品的需求量，我们称此类产品或服务为正常品。

低档品 保持市场上有些产品或服务，当消费者的收入上升时，对它的市场需求量反而会下降，此类产品或服务被称为低档品。

Commodities may be *related in consumption* in either of two ways: as substitutes or as complements. In general, goods are *substitutes* if one good can be used in the place of the other; an example might be Toyotas and Chryslers. If two goods are substitutes, an increase in the price of one good will increase the demand for the other good. If the price of Toyotas rises while the price of Chryslers remains constant, we would expect consumers to purchase more Chryslers—holding all other factors constant. If an increase in the price of a related good causes consumers to demand more of a good, then the two goods are **substitutes.** Similarly, two goods are substitutes if a decrease in the price of one of the goods causes consumers to demand less of the other good, all other things constant.

替代品 保持其他条件不变，如果一种产品价格的上升（下降）会增加（减少）消费者对另一种产品的需求，那么这两种产品是替代品。

Goods are said to be *complements* if they are used in conjunction with each other. Examples might be cameras and film, lettuce and salad dressing, or baseball games and hot dogs. A decrease in the price of tickets to the baseball game will increase the quantity of tickets demanded, and thus increase the demand for hot dogs at the game, all else constant. If the demand for one good increases when the price of a related good decreases, the two goods are **complements.** Similarly, two goods are complements if an increase in the price of one of the goods causes consumers to demand less of the other good, all other things constant.[1]

互补品 其他条件不变，如果一种商品的价格升高（降低）时，另一种商品的需求会下降（升高），那么这些商品就是互补品。

A change in consumer tastes can change demand for a good or service. Obviously, taste changes could either increase or decrease consumer demand. While consumer tastes are not directly measurable (as are the other variables in the general demand function), you may wish to view the variable $\mathcal{T}$ as an index of consumer tastes; $\mathcal{T}$ takes on larger values as consumers perceive a good becoming higher in quality, more fashionable, more healthful, or more desirable in any way. A decrease in $\mathcal{T}$ corresponds to a change in consumer tastes away from a good or service as consumers perceive falling quality, or displeasing appearance, or diminished healthfulness. Consequently, when all other variables in the general demand function are held constant, a movement in consumer tastes toward a good or service will increase demand and a movement in consumer tastes away from a good will decrease demand for the good. A change in consumer tastes or preferences occurs when, for example, the *New England Journal of Medicine* publishes research findings that show a higher incidence of cancer among people who regularly eat bacon. This causes the demand for bacon to decrease (the taste index $\mathcal{T}$ declines), all other factors remaining constant.

Expectations of consumers also influence consumers' decisions to purchase goods and services. More specifically, consumers' expectations about the future price of a commodity can change their current purchasing decisions. If consumers expect the price to be higher in a future period, demand will probably rise in the current period. On the other hand, expectations of a price decline in the future will cause some purchases to be postponed—thus demand in the current period

[1]Not all commodities are either substitutes or complements in consumption. Many commodities are essentially independent. For example, we would not expect the price of lettuce to significantly influence the demand for automobiles. Thus we can treat these commodities as independent and ignore the price of lettuce when evaluating the demand for automobiles.

will fall. An example of this can be seen in the automobile industry. Automakers often announce price increases for the next year's models several months before the cars are available in showrooms in order to stimulate demand for the current year's cars.

Finally, an increase in the number of consumers in the market will increase the demand for a good, and a decrease in the number of consumers will decrease the demand for a good, all other factors held constant. In markets that experience a growth in the number of buyers—such as the health care industry as the population matures or Florida during the tourist season—we would expect demand to increase.

The general demand function just set forth is expressed in the most general mathematical form. Economists and market researchers often express the general demand function in a more specific mathematical form in order to show more precisely the relation between quantity demanded and some of the more important variables that affect demand. They frequently express the general demand function in a linear functional form. The following equation is an example of a linear form of the general demand function:

$$Q_d = a + bP + cM + dP_R + e\mathcal{T} + fP_e + gN$$

where Q_d, P, M, P_R, $\mathcal{T}$, P_e, and N are as defined above, and a, b, c, d, e, f, and g are parameters.

The intercept parameter a shows the value of Q_d when the variables P, M, P_R, $\mathcal{T}$, P_e, and N are all simultaneously equal to zero. The other parameters, b, c, d, e, f, and g, are called **slope parameters:** They measure the effect on quantity demanded of changing one of the variables P, M, P_R, $\mathcal{T}$, P_e, or N while holding the rest of these variables constant. The slope parameter b, for example, measures the change in quantity demanded per unit change in price; that is, $b = \Delta Q_d/\Delta P$.[2] As stressed earlier, Q_d and P are inversely related, and b is negative because ΔQ_d and ΔP have opposite algebraic signs.

斜率参数 线性方程中的参数表示，当一个自变量（M, P_R, $\mathcal{T}$, P_e, N）变化，其他变量不变时，对因变量（Q_d）产生的影响。

The slope parameter c measures the effect on the amount purchased of a one-unit change in income ($c = \Delta Q_d/\Delta M$). For normal goods, sales increase when income rises, so c is positive. If the good is inferior, sales decrease when income rises, so c is negative. The parameter d measures the change in the amount consumers want to buy per unit change in P_R ($d = \Delta Q_d/\Delta P_R$). If an increase in P_R causes sales to rise, the goods are substitutes and d is positive. If an increase in P_R causes sales to fall, the two goods are complements and d is negative. Since $\mathcal{T}$, P_e, and N are each directly related to the amount purchased, the parameters e, f, and g are all positive.[3]

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[2]The symbol "Δ" means "change in." Thus if quantity demanded rises (falls), then ΔQ_d is positive (negative). Similarly, if price rises (falls), ΔP is positive (negative). In general, the ratio of the change in Y divided by the change in X ($\Delta Y/\Delta X$) measures the change in Y per unit change in X.

[3]Since consumer tastes are not directly measurable as are the other variables, you may wish to view $\mathcal{T}$ as an index of consumer tastes that ranges in value from 0, if consumers think a product is worthless, to 10 if they think the product is extremely desirable. In this case, the parameter e shows the effect on quantity of a one-unit change in the taste index ($\mathcal{T}$), and e is positive.

Relation When the general demand function is expressed in linear form:

$$Q_d = a + bP + cM + dP_R + e\mathcal{T} + fP_e + gN$$

the slope parameters (b, c, d, e, f, and g) measure the effect on the amount of the good purchased of changing one of the variables (P, M, P_R, $\mathcal{T}$, P_e, and N) while holding the rest of the variables constant. For example, b ($= \Delta Q_d/\Delta P$) measures the change in quantity demanded per unit change in price holding M, P_R, $\mathcal{T}$, P_e, and N constant. When the slope parameter of a specific variable is positive (negative) in sign, quantity demanded is directly (inversely) related to that variable.

Table 2.1 summarizes this discussion of the general demand function. Each of the six factors that affect quantity demanded is listed, and the table shows whether the quantity demanded varies directly or inversely with each variable and gives the sign of the slope parameters. Again let us stress that these relations are in the context of all other things being equal. An increase in the price of the commodity will lead to a decrease in quantity demanded as long as the other variables—income, the price of related commodities, consumer tastes, price expectations, and the number of customers—remain constant.

A general demand function always includes price as a variable but may not always include every one of the other five variables shown in Table 2.1. Market analysts sometimes omit consumer tastes and price expectations, since these variables may not be important in every situation. The number of customers may also be disregarded in formulating a general demand equation when the number of consumers in a particular market does not change. For example, the demand for city water is not likely to depend on consumer tastes, since fashion generally plays no role in determining water usage, and city water should be tasteless! Price expectations are also unlikely to affect municipal water demand. In January, people don't drink more or less water—or bathe more or less frequently—because they expect the price of city water to be lower or higher in February. Furthermore, in a small town that experiences only an inconsequential change in the number of residents, N does not play an important role in determining the variation in Q_d and need not be included in the general demand function. For these reasons, the

TABLE 2.1
Summary of the General (Linear) Demand Function $Q_d = a + bP + cM + dP_R + e\mathcal{T} + fP_e + gN$

Variable	Relation to quantity demanded	Sign of slope parameter
P	Inverse	$b = \Delta Q_d/\Delta P$ is negative
M	Direct for normal goods	$c = \Delta Q_d/\Delta M$ is positive
	Inverse for inferior goods	$c = \Delta Q_d/\Delta M$ is negative
P_R	Direct for substitute goods	$d = \Delta Q_d/\Delta P_R$ is positive
	Inverse for complement goods	$d = \Delta Q_d/\Delta P_R$ is negative
$\mathcal{T}$	Direct	$e = \Delta Q_d/\Delta \mathcal{T}$ is positive
P_e	Direct	$f = \Delta Q_d/\Delta P_e$ is positive
N	Direct	$g = \Delta Q_d/\Delta N$ is positive

general linear demand function can sometimes be simplified to include just three variables from Table 2.1:

$$Q_d = a + bP + cM + dP_R$$

Although it is not always appropriate to use this simplified version of the general demand function, the three-variable demand function does provide a reasonable model of consumer demand in many applications.

T 1

Direct Demand Functions: $Q_d = f(P)$

直接需求函数 在其他因素保持不变时，表示产品需求量与产品价格之间关系的表格、曲线或方程。

The relation between price and quantity demanded per period of time, when all other factors that affect consumer demand are held constant, is called a **direct demand function** or simply **demand.** Demand gives, for various prices of a good, the corresponding quantities that consumers are willing and able to purchase at each of those prices, all other things held constant. The "other things" that are held constant for a specific demand function are the five variables other than price that can affect demand. A demand function can be expressed as an equation, a schedule or table, or a graph. We begin with a demand equation.

A direct demand function can be expressed in the most general form as the equation

$$Q_d = f(P)$$

which means that the quantity demanded is a function of (i.e., depends on) the price of the good, holding all other variables constant. A direct demand function is obtained by holding all the variables in the general demand function constant except price. For example, using a three-variable demand function,

$$Q_d = f(P, \overline{M}, \overline{P}_R) = f(P)$$

where the bar over the variables M and P_R means that those variables are held constant at some specified amount no matter what value the product price takes.

Relation A direct demand function (also called "demand") expresses quantity demanded as a function of product price only: $Q_d = f(P)$. Demand functions—whether expressed as equations, tables, or graphs—give the quantity demanded at various prices, holding constant the effects of income, price of related goods, consumer tastes, expected price, and the number of consumers. Demand functions are derived from general demand functions by holding all the variables in the general demand function constant except price.

To illustrate the derivation of a direct demand function from the general demand function, suppose the general demand function is

$$Q_d = 3{,}200 - 10P + 0.05M - 24P_R$$

To derive a demand function, $Q_d = f(P)$, the variables M and P_R must be assigned specific (fixed) values. Suppose consumer income is \$60,000 and the price of a

related good is $200. To find the demand function, the fixed values of M and P_R are substituted into the general demand function:

$$\begin{aligned} Q_d &= 3{,}200 - 10P + 0.05(60{,}000) - 24(200) \\ &= 3{,}200 - 10P + 3{,}000 - 4{,}800 \\ &= 1{,}400 - 10P \end{aligned}$$

Thus the direct demand function is expressed in the form of a linear demand equation, $Q_d = 1{,}400 - 10P$. The intercept parameter, 1,400, is the amount of the good consumers would demand if price is zero. The slope of this demand function ($= \Delta Q_d/\Delta P$) is -10 and indicates that a $1 increase in price causes quantity demanded to decrease by 10 units. Although not all demand functions are linear, you will see later in the text that the linear form is a frequently used specification for estimating and forecasting demand functions.

This linear demand equation satisfies all the conditions set forth in the definition of demand. All variables other than product price are held constant—income at $60,000 and the price of a related good at $200. At each price, the equation gives the amount that consumers would purchase at that price. For example, if price is $60,

$$Q_d = 1{,}400 - (10 \times \$60) = 800$$

or if price is $40,

$$Q_d = 1{,}400 - (10 \times \$40) = 1{,}000$$

需求表 给出一系列的商品价格，以及与之相对应的商品需求量的表格。

A **demand schedule** (or table) shows a list of several prices and the quantity demanded per period of time at each of the prices, again holding all variables other than price constant. Seven prices and their corresponding quantities demanded are shown in Table 2.2. Each of the seven combinations of price and quantity demanded is derived from the demand function exactly as shown above.

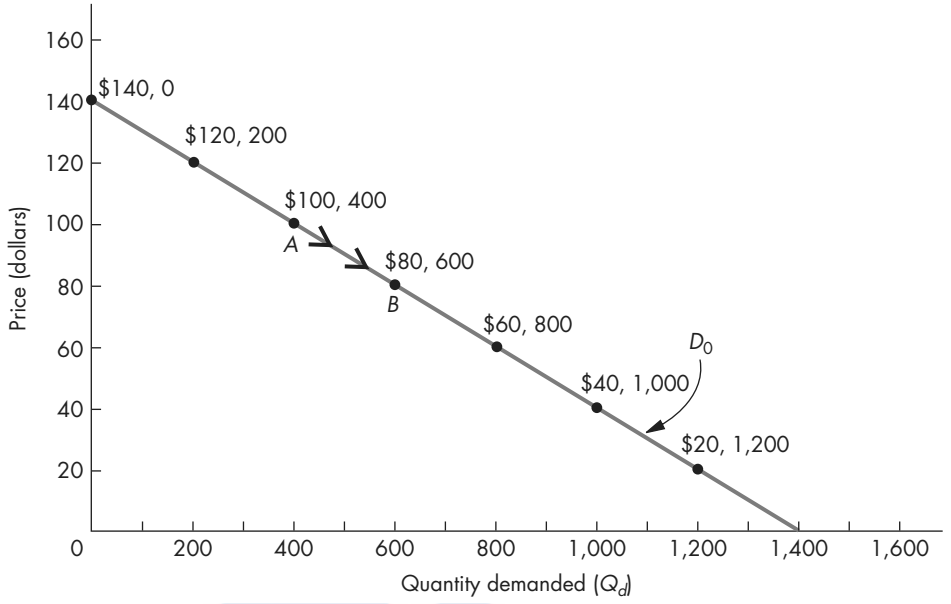
需求曲线 当除价格以外，所有影响需求量的因素都保持不变时，所得到的体现商品需求量与商品价格关系的曲线。

As noted, the final method of showing a demand function is a graph. A graphical demand function is called a **demand curve.** The seven price and quantity demanded combinations in Table 2.2 are plotted in Figure 2.1, and these points are connected with the straight line D_0, which is the demand curve associated with the demand equation $Q_d = 1{,}400 - 10P$. This demand curve meets the specifications of the definition of demand. All variables other than price are held constant. The

TABLE 2.2
The Demand Schedule for the Demand Function D_0: $Q_d = 1{,}400 - 10P$

Price	Quantity demanded
$140	0
120	200
100	400
80	600
60	800
40	1,000
20	1,200

FIGURE 2.1
A Demand Curve: $Q_d = 1{,}400 - 10P$



demand curve D_0 gives the value of quantity demanded (on the horizontal axis) for every value of price (on the vertical axis).

You may recall from high school algebra that mathematical convention calls for plotting the dependent variable (Q_d) on the vertical axis and the independent variable (P) on the horizontal axis. More than a century ago, however, Alfred Marshall, a famous economist and author of an influential economics textbook, decided to counter this mathematical tradition by plotting all monetary variables—such as prices, revenues, and costs—on the vertical axis. This switch is now an established tradition among economists. We mention here the matter of reversing axes only to make sure that you do not let this minor quirk distract you; it is the only meaningless matter we address in this textbook!

Inverse Demand Functions: $P = f(Q_d)$

逆需求函数（需求反函数） 用需求量表示价格的需求函数：$P = f(Q_d)$

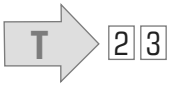
In some situations, it is quite useful to express price as a function of quantity demanded. This form of demand is called the **inverse demand function,** because it is the mathematical inverse of the direct demand function. For example, consider the direct demand equation for D_0 in Figure 2.1: $Q_d = 1{,}400 - 10P$. Solving this direct demand equation for P gives the inverse demand equation: $P = 140 - 1/10Q_d$.[4]

[4]Recall from high school algebra that the "inverse" of a direct function $Y = f(X)$ is the function $X = f(Y)$, which gives X as a function of Y, and the same pairs of Y and X values that satisfy the direct function $Y = f(X)$ also satisfy the inverse function $X = f(Y)$. For example, if the direct equation is $Y = 10 - 2X$, then the inverse function, $X = 5 - (1/2)Y$, is found by solving algebraically for X in terms of Y.

By switching the Q_d and P axes as mentioned above, the graph of demand in Figure 2.1 is, mathematically speaking, a graph of the *inverse* demand function. As you can see in the figure, the vertical intercept is 140, indicating that at a price of \$140—frequently called the "choke" price—consumers will demand zero units of the good. The horizontal intercept is 1,400, which is the maximum amount of the good buyers will take when the good is given away ($P = 0$). The slope of the graphed inverse demand is $-1/10$, indicating that if quantity demanded rises by one unit, price must fall 1/10 of a dollar (or 10 cents). This inverse demand, as you can see in the figure, yields price-quantity combinations identical to those given by the direct demand equation, $Q_d = 1{,}400 - 10P$. In other words, the demand relation shown in Table 2.2 is identically depicted by either a direct or inverse form of the demand equation.

Although demand is generally interpreted as indicating the amount that consumers will buy at each price, sometimes managers and market researchers wish to know the highest price that can be charged for any given amount of the product. As it turns out, every point on a demand curve can be interpreted in either of two ways: (1) the maximum amount of a good that will be purchased if a given price is charged or (2) the maximum price that consumers will pay for a specific amount of a good. Consider, for example, point A (\$100, 400) on the demand curve in Figure 2.1. If the price of the good is \$100, the maximum amount consumers will purchase is 400 units. Equivalently, \$100 is the highest price that consumers can be charged in order to sell a total of 400 units. This price, \$100, is called the "demand price" for 400 units, and every price along a demand curve is called the **demand price** for the corresponding quantity on the horizontal axis. Thus the inverse demand function gives the demand price for any specific quantity of the product or service. Later, in section 2.4, we will explain why demand price can also be interpreted as the *economic value* of any specific unit of a product, because, as you now understand from this discussion, demand price is the maximum amount consumers are willing to pay for the good.

需求价格 在某一特定的交易量下，消费者所愿意承担的商品最高价格。



Movements along Demand

Before moving on to an analysis of changes in the variables that are held constant when deriving a demand function, we want to reemphasize the relation between price and quantity demanded, which was discussed earlier in this chapter. In the demand equation, the parameter on price is negative; in the demand schedule, price and quantity demanded are inversely related; and in the graph, the demand curve is negatively sloped. This inverse relation between price and quantity demanded is not simply a characteristic of the specific demand function discussed here. This inverse relation is so pervasive that economists refer to it as the **law of demand.** The law of demand states that quantity demanded increases when price falls and quantity demanded decreases when price rises, other things held constant.

需求法则 在影响需求的其他因素不变时，商品价格的下降，将会引起商品需求量的上升；而商品价格的上升，则会引起商品需求量的下降。

Economists refer to the inverse relation between price and quantity demanded as a law, not because this relation has been proved mathematically but because examples to the contrary have never been observed. If you have doubts about the

validity of the law of demand, try to think of any goods or services that you would buy more of if the price were higher, other things being equal. Or can you imagine someone going to the grocery store expecting to buy one six-pack of Pepsi for $2.50, then noticing that the price is $5, and deciding to buy two or three six-packs? You don't see stores advertising higher prices when they want to increase sales or get rid of unwanted inventory.

需求量变化 当其他变量保持不变，只有价格发生变化时沿需求曲线的运动。

Once a direct demand function, $Q_d = f(P)$, is derived from a general demand function, a **change in quantity demanded** can be caused only by a change in price. The other five variables that influence demand in the general demand function (M, P_R, $\mathcal{T}$, P_e, and N) are fixed in value for any particular demand equation. A change in price is represented on a graph by a movement along a fixed demand curve. In Figure 2.1, if price falls from $100 to $80 (and the other variables remain constant), a change in quantity demanded from 400 to 600 units occurs and is illustrated by a movement along D_0 from point A to point B.

Relation For a demand function $Q_d = f(P)$, a change in price causes a change in quantity demanded. The other five variables that influence demand in the general demand function (M, P_R, $\mathcal{T}$, P_e, and N) are fixed at specific values for any particular demand equation. On a graph, a change in price causes a movement along a demand curve from one price to another price.

Shifts in Demand

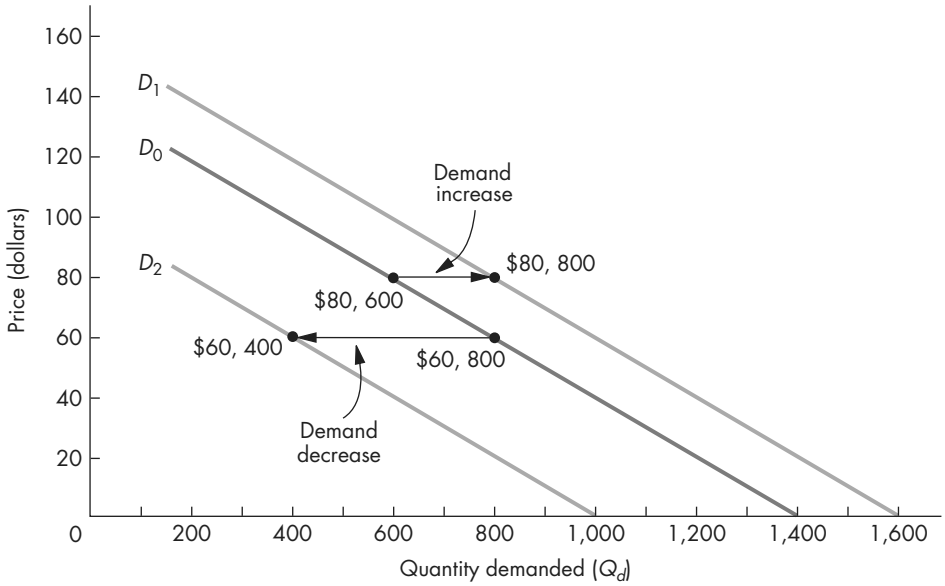
When any one of the five variables held constant when deriving a direct demand function from the general demand relation changes value, a new demand function results, causing the entire demand curve to *shift* to a new location. To illustrate this extremely important concept, we will show how a change in one of these five variables, such as income, affects a demand schedule.

We begin with the demand schedule from Table 2.2, which is reproduced in columns 1 and 2 of Table 2.3. Recall that the quantities demanded for various product prices were obtained by holding all variables except price constant in the general demand function. If income increases from $60,000 to $64,000, quantity demanded increases *at each and every price*, as shown in column 3. When the price is $60, for

TABLE 2.3
Three Demand Schedules

(1) Price	(2) D_0: $Q_d = 1{,}400 - 10P$ Quantity demanded (M = $60,000)	(3) D_1: $Q_d = 1{,}600 - 10P$ Quantity demanded (M = $64,000)	(4) D_2: $Q_d = 1{,}000 - 10P$ Quantity demanded (M = $52,000)
$140	0	200	0
120	200	400	0
100	400	600	0
80	600	800	200
60	800	1,000	400
40	1,000	1,200	600
20	1,200	1,400	800

FIGURE 2.2
Shifts in Demand



example, consumers will buy 800 units if their income is $60,000 but will buy 1,000 units if their income is $64,000. In Figure 2.2, D_0 is the demand curve associated with an income level of $60,000, and D_1 is the demand curve after income rises to $64,000. Since the increase in income caused quantity demanded to increase *at every price,* the demand curve shifts to the right from D_0 to D_1 in Figure 2.2. Everywhere along D_1 quantity demanded is greater than along D_0 for equal prices. This change in the demand function is called an **increase in demand.**

需求上升 需求函数的变化导致每一价格下的数量都增加，通过需求曲线的右移反映。

A **decrease in demand** occurs when a change in one or more of the variables M, P_R, $\mathcal{T}$, P_e, or N causes the quantity demanded to decrease at every price and the demand curve shifts to the left. Column 4 in Table 2.3 illustrates a decrease in demand caused by income falling to $52,000. At every price, quantity demanded in column 4 is less than quantity demanded when income is either $60,000 or $64,000 (columns 2 and 3, respectively, in Table 2.3). The demand curve in Figure 2.2 when income is $52,000 is D_2, which lies to the left of D_0 and D_1.

需求下降 需求函数的变化导致每一价格下的数量都减少，通过需求曲线的左移反映。

While we have illustrated shifts in demand caused by changes in income, a change in any one of the five variables that are held constant when deriving a demand function will cause a shift in demand. These five variables—M, P_R, $\mathcal{T}$, P_e, and N—are called the **determinants of demand** because they determine where the demand curve is located. A **change in demand** occurs when one or more of the determinants of demand change. Think of M, P_R, $\mathcal{T}$, P_e, and N as the five "demand-shifting" variables. The demand curve shifts to a new location only when one or more of these demand-shifting variables changes.

需求函数的决定因素 能够影响在每一价位下产品需求量，即需求曲线位置变化的因素，如 M、P_R、$\mathcal{T}$、P_e、N。

需求变化 当决定需求的五个因素发生变化时，需求曲线便会发生移动，需求改变。

Relation An increase in demand means that, at each price, more is demanded; a decrease in demand means that, at each price, less is demanded. Demand changes, or shifts, when one of the determinants of demand changes. These determinants of demand are income, prices of related goods, consumer tastes, expected future price, and the number of consumers.

The shifts in demand illustrated in Figure 2.2 were derived mathematically from the general demand function. Recall that the demand function D_0 ($Q_d = 1{,}400 - 10P$) was derived from the general demand function

$$Q_d = 3{,}200 - 10P + 0.05M - 24P_R$$

where income and the price of a related good were held constant at values of $M = \$60{,}000$ and $P_R = \$200$. When income increases from \$60,000 to \$64,000, the new demand equation at this higher income is found by substituting $M = \$64{,}000$ into the general demand function and solving for the new demand function:

$$\begin{aligned} D_1: Q_d &= 3{,}200 - 10P + (0.05 \times 64{,}000) - 4{,}800 \\ &= 1{,}600 - 10P \end{aligned}$$

In Figure 2.2, this demand function is shown by the demand curve D_1. At every price, quantity demanded increases by 200 units (1,600 = 1,400 + 200). Each of the quantities in column 3 of Table 2.2 was calculated from the new demand equation $Q_d = 1{,}600 - 10P$. As you can see, every quantity in column 3 is 200 units larger than the corresponding quantity in column 2. Thus the increase in income has caused an increase in demand.

When income falls from \$60,000 to \$52,000, demand shifts from D_0 to D_2. We leave the derivation of the demand function for D_2 as an exercise. The procedure, however, is identical to the process set forth above.

From the preceding discussion, you may have noticed that the direction in which demand shifts when one of the five demand determinants changes depends on the sign of the slope parameter on that variable in the general demand function. The increase in income caused quantity demanded to rise for all prices because $\Delta Q_d/\Delta M$ (= +0.05) is positive, which indicates that a \$1 increase in income causes a 0.05-unit increase in quantity demanded at every price level. Since income increased by \$4,000 in this example, quantity demanded increases by 200 units (= 4,000 × 0.05). Thus when the slope parameter on M is positive in the general demand function, an increase in income causes an increase in demand. As explained earlier, when income and quantity demanded are positively related *in the general demand function,* the good is a normal good. If the parameter on M is negative, an increase in income causes a decrease in demand, and the good is an inferior good.[5] Table 2.4 summarizes for all five determinants of demand the relations between the signs of the slope parameters and the directions in which demand curves shift when each one of the determinants changes.

[5]It is only correct to speak of a change in income affecting *quantity demanded* when referring to the general demand function. Once income has been held constant to derive a direct demand function, a change in income causes a change in demand (a shift in the demand curve), not a change in quantity demanded. The same distinction holds for the other determinants of demand P_R, $\mathcal{T}$, P_e, and N.

TABLE 2.4
Summary of Demand Shifts

Determinants of demand	Demand increases[a]	Demand decreases[b]	Sign of slope parameter[c]
1. Income (M)			
Normal good	M rises	M falls	$c > 0$
Inferior good	M falls	M rises	$c < 0$
2. Price of related good (P_R)			
Substitute good	P_R rises	P_R falls	$d > 0$
Complement good	P_R falls	P_R rises	$d < 0$
3. Consumer tastes ($\mathcal{T}$)	$\mathcal{T}$ rises	$\mathcal{T}$ falls	$e > 0$
4. Expected price (P_e)	P_e rises	P_e falls	$f > 0$
5. Number of consumers (N)	N rises	N falls	$g > 0$

[a]Demand increases when the demand curve shifts rightward.
[b]Demand decreases when the demand curve shifts leftward.
[c]This column gives the sign of the corresponding slope parameter in the general demand function.

As you may also have noticed from the previous discussion, and as shown in Figure 2.2, our demand curves shift parallel to one another. These parallel shifts in demand are strictly the result of our decision to illustrate demand curves using *linear* general demand functions. In the next section, you will also see *linear* supply curves, which result in parallel shifts in supply. In the real-world, demand and supply curves are seldom perfectly linear and shifts are seldom parallel. Nonetheless, linear curves and parallel shifts provide the easiest way to learn the basics of demand and supply analysis. And, in many cases, real-world curves can be closely approximated by linear functions. We must warn you, however, that if you draw demand shifts (or supply shifts) that are not parallel, the new demand curve (or supply curve) must *not* cross the original demand curve (or supply curve). To see why, suppose in Figure 2.2 we had mistakenly constructed D_1 to cross D_0 from above at \$100—this is *not* shown in the figure—then at prices above \$100 demand would have increased and at prices below \$100 demand would have decreased. Obviously, this would not represent either an increase in demand or a decrease in demand since quantity demanded must either be larger at every price or smaller at every price, respectively.

2.2 SUPPLY

供给量 在一定时间内（一周、一个月等），投入市场用于销售的产品或服务的总量叫做供给量。我们常用符号 Q_s 表示它。

The amount of a good or service offered for sale in a market during a given period of time (e.g., a week, a month) is called **quantity supplied,** which we will denote as Q_s. The amount of a good or service offered for sale depends on an extremely large number of variables. As in the case of demand, economists ignore all the relatively unimportant variables in order to concentrate on those variables that have the greatest effect on quantity supplied. In general, economists assume that the quantity of a good offered for sale depends on six major variables:

1. The price of the good itself.
2. The prices of the inputs used to produce the good.
3. The prices of goods related in production.

ILLUSTRATION 2.1

Effects of Changes in Determinants of Demand

Much of the discussion of demand in this chapter concerns the effects of changes in the determinants of demand, or demand-shifting variables, on demand functions, and the consequent effects of these shifts on prices and sales. Some actual examples of these effects should illustrate and reinforce this theoretical analysis.

Changes in Income (M)

As China's economy booms, personal incomes are rising sharply as well. U.S. and European corporations selling normal goods (e.g., earthmovers, cellular phones, soft drinks, and cognac) are taking advantage of increased demand by Chinese consumers. Income growth in China has been so spectacular that even demand for luxury goods (e.g., French-style manors, in-home movie theaters, Bentley automobiles, Louis Vuitton handbags, and jewelry by Cartier) is booming. With 12 percent of total world demand for all luxury goods, China could soon pass the U.S. and Japan to become the world's largest market for luxury goods—if personal income in China continues to grow at its current annual pace of 9 percent.

Changes in the Price of Related Goods (P_R)

Falling prices of *new* cars worldwide is knocking down demand for *used* cars. In South Africa, for example, the used-car industry has experienced a sharp decrease in demand. Bruno Banco, a manager of an independent car dealership in South Africa, blames low-priced imported cars, such as Kia and Daihatsu. In fact, prices for new cars of all makes and models have been falling worldwide for the past two years, as dealers have been offering various kinds of incentives to new-car buyers that effectively lower new-car prices. As we showed in this chapter, a decrease in the price of a substitute good, all other things constant, causes a decrease in the demand for a good. Since used cars are a substitute good for new cars, it is no surprise that falling new-car prices have cut the demand for used cars, as car buyers are attracted away from used cars into lower-priced new cars.

Changes in Taste ($\mathcal{T}$)

As we stressed, consumer taste is an important determinant of demand. In 2005, *The Wall Street Journal* (*WSJ*) reported that the exploding demand for condominiums in the U.S. housing market had driven up condo prices in some geographic markets by as much as 57 percent between 2001 and 2004. As noted in the *WSJ*, economists and housing experts attribute much of this growth in condo demand and prices to changing housing preferences (or tastes) of middle-class Americans. According to Jason Schenker, an economist at Wachovia Corporation, "Today's middle class looks more like the cast of 'Friends' than 'Ozzie and Harriet.' They're younger, they're urban and they live in high-cost areas of real estate—these sorts of [taste changes] are all conducive to the growth in [demand for] condominiums." The changing characteristics of home buyers in the U.S., especially the emergence of large numbers of single-parent families, caused many of these families during the 2001–2005 period to choose an urban condo rather than a suburban single-family home because

4. The level of available technology.
5. The expectations of the producers concerning the future price of the good.
6. The number of firms or the amount of productive capacity in the industry.

The General Supply Function: $Q_s = f(P, P_I, P_r, T, P_e, F)$

广义供给函数 体现供给量和影响供给量的六个因素之间的关系的函数 $Q_s = g(P, P_I, P_r, T, P_e, F)$。

The **general supply function** shows how all six of these variables *jointly* determine the quantity supplied. The general supply function is expressed mathematically as

$$Q_s = f(P, P_I, P_r, T, P_e, F)$$

they felt a condo in the city was "both more luxurious and convenient than a house with a yard."

Changes in Price Expectations (P_e)

In addition to the changing consumer tastes discussed above, another important factor contributed to the surge in demand for urban condominiums during the years 2001–2005: an increase in the expected future price of condos. According to the *WSJ* article mentioned previously, "housing experts are increasingly concerned that too many people, trying to cash in on the phenomenon [of rising condo prices], are buying speculatively, causing prices to rise faster than economic fundamentals can support." In other words, some buyers were purchasing condos and driving up demand for condos primarily for the purpose of reselling them later at a higher price, rather than buying them because they desired the lifestyle and amenities associated with condo living. Thus, both an increase in consumer preferences and an increase in expected future condo prices created a strong demand for condos during the 2001–2005 period. Managers of firms in the condominium construction industry and investors worried, however, that the high demand was only a speculative "bubble" that would burst when price increases inevitably slowed down and failed to meet buyers' expectations.

The anticipated slowdown in the appreciation of condominium prices has only just begun as we write this Illustration in August 2006. Investors and condo owners are now hoping demand will cool slowly, somehow managing to pull off a "soft landing." In Florida, one of the strongest markets for condo sales during the frenzied period of buying, is now beginning to feel demand slacken: the number of condos sold along the Treasure Coast fell by 50 percent in June. The prospect for a soft landing now depends heavily on the increase in consumer tastes to cushion the decrease in demand caused by speculators dumping their unwanted condos to minimize their speculative losses.

Changes in the Number of Buyers (N)

Population in the state of Utah is growing. When population grows, the number of buyers generally grows as well, and demand increases for most goods and services. As theory predicts, demand in Utah for houses, office buildings, and hospitals is rising as a result of the increase in population.

These illustrations should give you some idea of the way that changes in the determinants of demand actually shift the demand for goods and services and how such shifts affect the price and sales of the products. They should also give an insight into how managers can forecast and react to such changes in a manner that furthers the goals of the organization.

Sources: Dave Anderton, "Medical Construction Boom in Utah," *Desert Morning News,* Nov. 27, 2005; Kemba J. Dunham and Ray A. Smith, "Behind Zooming Condo Prices: New Demographics or a Bubble?" *The Wall Street Journal,* Aug. 18, 2005, p. A1; Linda Rawls, "Treasure Coast Home Sales Bust the Boom," *The Palm Beach Post,* July 26, 2006; Don Robertson, "Used-Car Salesmen Choking on the Fumes," *Sunday Times* (South Africa edition), Oct. 16, 2005, p. 21; Craig Simons, "As China's Economy Booms, Demand for Luxury Goods Grows," Cox News Service, May 25, 2006.

The quantity of a good or service offered for sale (Q_s) is determined not only by the price of the good or service (P) but also by the prices of the inputs used in production (P_I), the prices of goods that are related in production (P_r), the level of available technology (T), the expectations of producers concerning the future price of the good (P_e), and the number of firms or amount of productive capacity in the industry (F).

Now we consider how each of the six variables is related to the quantity of a good or service firms produce. We begin by discussing the effect of a change in the price of a good while holding the other five variables constant. Typically, the higher the price of the product, the greater the quantity firms wish to produce

and sell, all other things being equal. Conversely, the lower the price, the smaller the quantity firms will wish to produce and sell. Producers are motivated by higher prices to produce and sell more, while lower prices tend to discourage production. Thus price and quantity supplied are, in general, directly related.

An increase in the price of one or more of the inputs used to produce the product will obviously increase the cost of production. If the cost rises, the good becomes less profitable and producers will want to supply a smaller quantity at each price. Conversely, a decrease in the price of one or more of the inputs used to produce the product will decrease the cost of production. When cost falls, the good becomes more profitable and producers will want to supply a larger amount at each price. Therefore, an increase in the price of an input causes a decrease in production, while a decrease in the price of an input causes an increase in production.

生产中的替代产品 生产者生产的两种产品中，当一种产品价格相对于另一种产品的价格上升，都会使厂商将增加较高产品的生产，而减少另一种产品的生产，则称此两种产品为生产中的替代产品。

Changes in the prices of goods that are related in production may affect producers in either one of two ways, depending on whether the goods are substitutes or complements in production. Two goods, *X* and *Y*, are **substitutes in production** if an increase in the price of good *X* relative to good *Y* causes producers to increase production of good *X* and decrease production of good *Y*. For example, if the price of corn increases while the price of wheat remains the same, some farmers may change from growing wheat to growing corn, and less wheat will be supplied. In the case of manufactured goods, firms can switch resources from the production of one good to the production of a substitute (in production) commodity when the price of the substitute rises. Alternatively, two goods, *X* and *Y*, are **complements in production** if an increase in the price of good *X* causes producers to supply more of good *Y*. For example, crude oil and natural gas often occur in the same oil field, making natural gas a by-product of producing crude oil, or vice versa. If the price of crude oil rises, petroleum firms produce more oil, so the output of natural gas also increases. Other examples of complements in production include nickel and copper (which occur in the same deposit), beef and leather hides, and bacon and pork chops.

生产中的互补产品 如果一种产品相对于另一种产品的价格上升，会引起生产者对这两种产品的产量都增加，则此两种产品为互补性产品。

技术 有关组织资源生产产品或服务的知识状况。

Next, we consider changes in the level of available technology. **Technology** is the state of knowledge concerning how to combine resources to produce goods and services. An improvement in technology generally results in one or more of the inputs used in making the good to be more productive. As we will show you in Chapters 8 and 9, increased productivity allows firms to make more of a good or service with the same amount of inputs or the same output with fewer inputs. In either case, the cost of producing a given level of output falls when firms use better technology, which would lower the costs of production, increase profit, and increase the supply of the good to the market, all other things remaining the same.

A firm's decision about its level of production depends not only on the current price of the good but also upon the firm's *expectation* about the future price of the good. If firms expect the price of a good they produce to rise in the future, they

may withhold some of the good, thereby reducing supply of the good in the current period.

Finally, if the number of firms in the industry increases or if the *productive capacity* of existing firms increases, more of the good or service will be supplied at each price. For example, the supply of air travel between New York and Hong Kong increases when either more airlines begin servicing this route or when the firms currently servicing the route increase their capacities to fly passengers by adding more jets to service their New York–Hong Kong route. Conversely, a decrease in the number of firms in the industry or a decrease in the productive capacity of existing firms decreases the supply of the good, all other things remaining constant. As another example, suppose a freeze in Florida decreases the number of firms by destroying entirely some citrus growers. Alternatively, it might leave the number of growers unchanged but decrease productive capacity by killing a portion of each grower's trees. In either situation, the supply of fruit decreases. Thus changes in the number of firms in the industry or changes in the amount of productive capacity in the industry are represented in the supply function by changes in F.

As in the case of demand, economists often find it useful to express the general supply function in linear functional form:

$$Q_s = h + kP + lP_I + mP_r + nT + rP_e + sF$$

where Q_s, P, P_I, P_r, T, P_e, and F are as defined earlier, h is an intercept parameter, and k, l, m, n, r, and s are slope parameters. Table 2.5 summarizes this discussion of the general supply function. Each of the six factors that affect production is listed along with the relation to quantity supplied (direct or inverse). Let us again stress that, just as in the case of demand, these relations are in the context of all other things being equal.

直接供给函数 在保持其他五个影响供给的因素不变的情况下，某种商品的供给量与此种商品价格之间的函数关系：$Q_s = f(P)$。

Direct Supply Functions: $Q_s = f(P)$

Just as demand functions are derived from the general demand function, *direct supply functions* are derived from the general supply function. A **direct supply function**

TABLE 2.5
Summary of the General (Linear) Supply Function $Q_s = h + kP + lP_I + mP_r + nT + rP_e + sF$

Variable	Relation to quantity supplied	Sign of slope parameter
P	Direct	$k = \Delta Q_s/\Delta P$ is positive
P_I	Inverse	$l = Q_s/\Delta P_I$ is negative
P_r	Inverse for substitutes in production (wheat and corn)	$m = \Delta Q_s/\Delta P_r$ is negative
	Direct for complements in production (oil and gas)	$m = \Delta Q_s/\Delta P_r$ is positive
T	Direct	$n = \Delta Q_s/\Delta T$ is positive
P_e	Inverse	$r = \Delta Q_s/\Delta P_e$ is negative
F	Direct	$s = \Delta Q_s/\Delta F$ is positive

(also called simply "supply") shows the relation between Q_s and P holding the **determinants of supply** (P_I, P_r, T, P_e, and F) constant:

供给决定因素 能够使供给曲线发生移动的因素。

$$Q_s = f(P, \overline{P}_I, \overline{P}_r, \overline{T}, \overline{P}_e, \overline{F}) = f(P)$$

where the bar means the determinants of supply are held constant at some specified value. Once a direct supply function $Q_s = f(P)$ is derived from a general supply function, a **change in quantity supplied** can be caused only by a change in price.

供给量变化 由于商品价格的变化所造成的、沿着供给曲线的移动。

Relation A direct supply function expresses quantity supplied as a function of product price only: $Q_s = f(P)$. Supply functions give the quantity supplied for various prices, holding constant the effects of input prices, prices of goods related in production, the state of technology, expected price, and the number of firms in the industry. Supply functions are derived from general supply functions by holding all the variables in the general supply function constant except price.

To illustrate the derivation of a supply function from the general supply function, suppose the general supply function is

$$Q_s = 100 + 20P - 10P_I + 20F$$

Technology, the prices of goods related in production, and the expected price of the product in the future have been omitted to simplify this illustration. Suppose the price of an important input is \$100, and there are currently 25 firms in the industry producing the product. To find the supply function, the fixed values of P_I and F are substituted into the general supply function:

$$\begin{aligned} Q_s &= 100 + 20P - 10(\$100) + 20(25) \\ &= -400 + 20P \end{aligned}$$

The linear supply function gives the quantity supplied for various product prices, holding constant the other variables that affect supply. For example, if the price of the product is \$40,

$$Q_s = -400 + 20(\$40) = 400$$

or if the price is \$100,

$$Q_s = -400 + 20(\$100) = 1{,}600$$

供给表 以表格的形式给出一系列可能的价格和与之相对应的供给量。

A **supply schedule** (or table) shows a list of several prices and the quantity supplied at each of the prices, again holding all variables other than price constant. Table 2.6 shows seven prices and their corresponding quantities supplied. Each of the seven price–quantity-supplied combinations is derived, as shown earlier, from the supply equation $Q_s = -400 + 20P$, which was derived from the general supply function by setting $P_I = \$100$ and $F = 25$. Figure 2.3 graphs the **supply curve** associated with this supply equation and supply schedule.

供给曲线 在保持其他影响供给曲线的因素不变的情况下，表示供给量与产品价格的曲线。

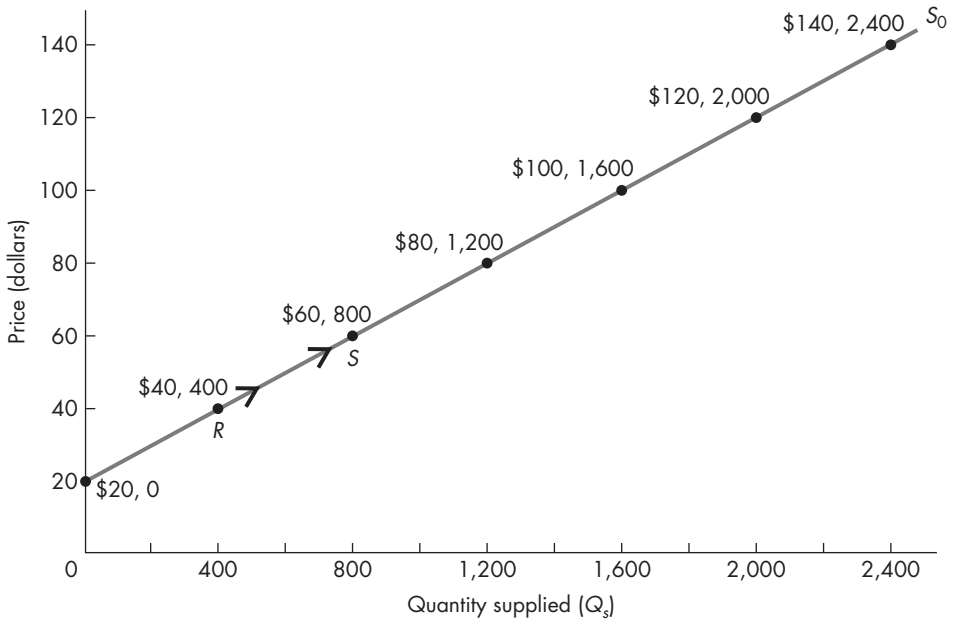
Inverse Supply Functions: $P = f(Q_s)$

Notice in Figure 2.3 that price is shown on the vertical axis and quantity on the horizontal axis as with demand curves. Thus the equation plotted in the figure is the

TABLE 2.6
The Supply Schedule for the Supply Function S_0: $Q_s = -400 + 20P$

Price	Quantity supplied
$140	2,400
120	2,000
100	1,600
80	1,200
60	800
40	400
20	0

FIGURE 2.3
A Supply Curve: $Q_s = -400 + 20P$



逆供给函数（供给反函数） 价格用供给数量表示的供给方程：$P = f(Q_s)$。

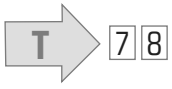
inverse of the supply equation and is called the **inverse supply function:** $P = 20 + 1/20Q$. The slope of this inverse supply equation graphed in Figure 2.3 is $\Delta P/\Delta Q_s$, which equals 1/20 and is the reciprocal of the slope parameter k ($= \Delta Q_s/\Delta P = 20$).

As your intuition tells you, producers usually quit producing if price falls below some minimum level. You can think of $20 in Figure 2.3 as the lowest price for which production will occur. Mathematically speaking, we might say the supply equation describes supply only over the range of prices $20 or greater ($P \geq \$20$). We will show in later chapters how to find the price level below which production ceases.

Any particular combination of price and quantity supplied on a supply curve can be interpreted in either of two equivalent ways. A point on the supply schedule indicates either (1) the maximum amount of a good or service that will be offered for sale at a specific price or (2) the minimum price necessary to induce producers to offer a given quantity for sale. This minimum price is sometimes referred to as the **supply price** for that level of output.

供给价格 厂商愿意生产一定数量产品所需的最低价格。

As in the case of a demand function, once a direct supply equation, $Q_s = f(P)$, is derived from a general supply function, a **change in quantity supplied** can be caused only by a change in price. A change in quantity supplied represents a movement along a given supply curve. Consider the supply curve S_0 in Figure 2.3. If product price rises from \$40 to \$60, the quantity supplied increases from 400 to 800 units, a movement from point R to point S along the supply curve S_0.



Relation For a supply function $Q_s = f(P)$, a change in price causes a change in quantity supplied. The other five variables that affect supply in the general supply function (P_I, P_r, T, P_e, F) are fixed in value for any particular supply function. On a graph, a change in price causes a movement along a supply curve from one price to another price.

Shifts in Supply

As we differentiate between a change in quantity demanded because of a change in price and a shift in demand because of a change in one of the determinants of demand, we must make the same distinction with supply. A shift in supply occurs only when one of the five determinants of supply (P_I, P_r, T, P_e, F) changes value. An increase in the number of firms in the industry, for example, causes the quantity supplied to increase at every price so that the supply curve shifts to the right, and this circumstance is called an **increase in supply.** A decrease in the number of firms in the industry causes a **decrease in supply,** and the supply curve shifts to the left. We can illustrate shifts in supply by examining the effect on the supply function of changes in the values of the determinants of supply.

供给增加 由于供给函数的变化，在任意价格下供给量都上升，供给曲线向右移动。

供给减少 由于供给函数的变化，在任意价格下供给量都下降，供给曲线向左移动。

Table 2.6 is reproduced in columns 1 and 2 of Table 2.7. If the price of the input falls to \$60, the new supply function is $Q_s = 20P$, and the quantity supplied increases *at each and every price* as shown in column 3. This new supply curve when

TABLE 2.7
Three Supply Schedules

(1) Price	(2) S_0: $Q_s = -400 + 20P$ Quantity supplied (P_I = \$100, F = 25)	(3) S_1: $Q_s = 20P$ Quantity supplied (P_I = \$60, F = 25)	(4) S_2: $Q_s = -700 + 20P$ Quantity supplied (P_I = \$100, F = 10)
\$140	2,400	2,800	2,100
120	2,000	2,400	1,700
100	1,600	2,000	1,300
80	1,200	1,600	900
60	800	1,200	500
40	400	800	100
20	0	400	0

FIGURE 2.4
Shifts in Supply

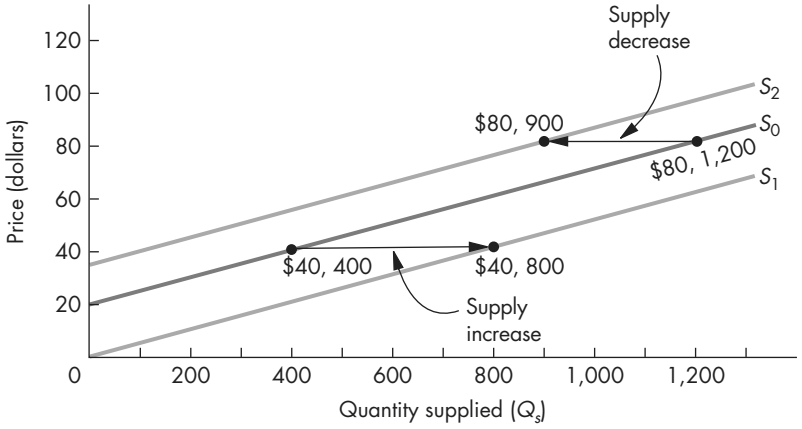


TABLE 2.8
Summary of Supply Shifts

Determinants of supply	Supply increases[a]	Supply decreases[b]	Sign of slope parameter[c]
1. Price of inputs (P_I)	P_I falls	P_I rises	$l < 0$
2. Price of goods related in production (P_r)			
Substitute good	P_r falls	P_r rises	$m < 0$
Complement good	P_r rises	P_r falls	$m > 0$
3. State of technology (T)	T rises	T falls	$n > 0$
4. Expected price (P_e)	P_e falls	P_e rises	$r < 0$
5. Number of firms or productive capacity in industry (F)	F rises	F falls	$s > 0$

[a]Supply increases when the supply curve shifts rightward.
[b]Supply decreases when the supply curve shifts leftward.
[c]This column gives the sign of the corresponding slope parameter in the general supply function.

the price of the input falls to $60 is shown as S_1 in Figure 2.4 and lies to the right of S_0 at every price. Thus the decrease in P_I causes the supply curve to shift rightward, illustrating an increase in supply. To illustrate a decrease in supply, suppose the price of the input remains at $100 but the number of firms in the industry decreases to 10 firms. The supply function is now $Q_s = -700 + 20P$, and quantity supplied decreases *at every price* as shown in column 4. The new supply curve in Figure 2.4, S_2, lies to the left of S_0 at every price. Thus the decrease in the number of firms causes a decrease in supply, which is represented by a leftward shift in the supply curve. You can think of P_I, P_r, T, P_e, and F as the five "supply-shifting" variables. Table 2.8 summarizes this discussion of shifts in supply.

T 9 10 11

Relation An increase in supply means that, at each price, more of the good is supplied; a decrease in supply means that, at each price, less is supplied. Supply changes (or shifts) when one of the determinants of supply changes. These determinants of supply are the price of inputs, the price of goods related in production, the state of technology, the expected price in the future, and the number of firms or the amount of productive capacity in the industry.

2.3 MARKET EQUILIBRIUM

市场均衡 在市场处于某种状态时，消费者愿意以市场价购买厂商所愿意生产的所有产品。在此价格下，$Q_s = Q_d$。

均衡价格 当 $Q_s = Q_d$ 时的市场成交价格。

均衡产量 在均衡状态下的产品交易量。

供过于求（剩余） 当产品供给量超过产品需求量时，称为供过于求。

供不应求（短缺） 当产品需求量超过产品供应量时，称为供不应求。

市场出清价格 消费者愿意以市场价格购买厂商所愿意生产的所有产品。即市场均衡价格。

Demand and supply provide an analytical framework for the analysis of the behavior of buyers and sellers in markets. Demand shows how buyers respond to changes in price and other variables that determine quantities buyers are willing and able to purchase. Supply shows how sellers respond to changes in price and other variables that determine quantities offered for sale. The interaction of buyers and sellers in the marketplace leads to **market equilibrium.** Market equilibrium is a situation in which, *at the prevailing price*, consumers can buy all of a good they wish and producers can sell all of the good they wish. In other words, equilibrium occurs when price is at a level for which quantity demanded equals quantity supplied. In equilibrium, the price is called **equilibrium price** and the quantity sold is called **equilibrium quantity.**

To illustrate how market equilibrium is achieved, we can use the demand and supply schedules set forth in the preceding sections. Table 2.9 shows both the demand schedule for D_0 (given in Table 2.2) and the supply schedule for S_0 (given in Table 2.6). As the table shows, equilibrium in the market occurs when price is \$60 and both quantity demanded and quantity supplied are equal to 800 units. At every price above \$60, quantity supplied is greater than quantity demanded. **Excess supply** or a **surplus** exists when the quantity supplied exceeds the quantity demanded. The first four entries in column 4 of Table 2.9 show the excess supply or surplus at each price above \$60. At every price below \$60, quantity supplied is less than quantity demanded. A situation in which quantity demanded exceeds quantity supplied is called **excess demand** or a **shortage.** The last two entries in column 4 of the table show the excess demand or shortage at each price below the \$60 equilibrium price. Excess demand and excess supply equal zero only in equilibrium. In equilibrium the market "clears" in the sense that buyers can purchase all they want and sellers can sell all they want at the equilibrium price. Because of this clearing of the market, equilibrium price is sometimes called the **market clearing price.**

Before moving on to a graphical analysis of equilibrium, we want to reinforce the concepts illustrated in Table 2.9 by using the demand and supply functions from which the table was derived. To this end, recall that the demand equation is

TABLE 2.9
Market Equilibrium

(1) Price	(2) S_0 Quantity supplied $Q_s = -400 + 20P$	(3) D_0 Quantity demanded $Q_d = 1{,}400 - 10P$	(4) Excess supply (+) or excess demand (−) $Q_s - Q_d$
\$140	2,400	0	+2,400
120	2,000	200	+1,800
100	1,600	400	+1,200
80	1,200	600	+600
60	800	800	0
40	400	1,000	−600
20	0	1,200	−1,200

$Q_d = 1{,}400 - 10P$ and the supply equation is $Q_s = -400 + 20P$. Since equilibrium requires that $Q_d = Q_s$, in equilibrium,

$$1{,}400 - 10P = -400 + 20P$$

Solving this equation for equilibrium price,

$$1{,}800 = 30P$$
$$P = \$60$$

At the market clearing price of $60,

$$Q_d = 1{,}400 - 10(60) = 800$$
$$Q_s = -400 + 20(60) = 800$$

As expected, these mathematically derived results are identical to those presented in Table 2.9.

According to Table 2.9, when price is $80, there is a surplus of 600 units. Using the demand and supply equations, when $P = 80$,

$$Q_d = 1{,}400 - 10(80) = 600$$
$$Q_s = -400 + 20(80) = 1{,}200$$

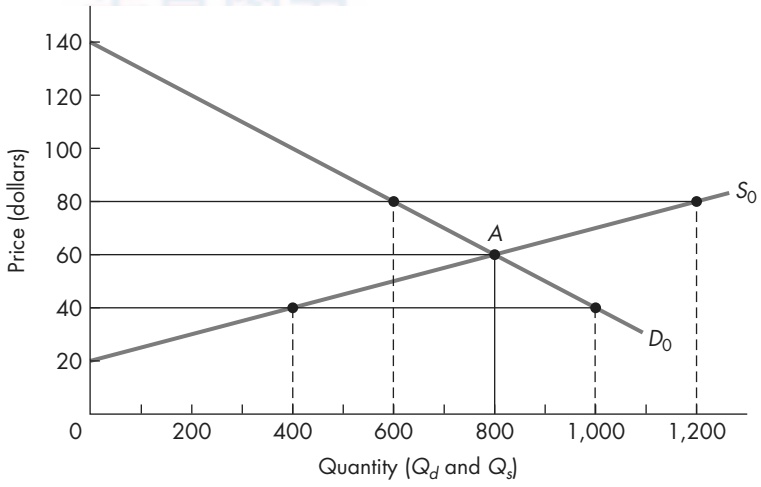
Therefore, when price is $80,

$$Q_s - Q_d = 1{,}200 - 600 = 600$$

which is the result shown in column 4.

To express the equilibrium solution graphically, Figure 2.5 shows the demand curve D_0 and the supply curve S_0 associated with the schedules in Table 2.9. These

FIGURE 2.5
Market Equilibrium



are also the demand and supply curves previously shown in Figures 2.1 and 2.3. Clearly, $60 and 800 units are the equilibrium price and quantity at point *A* in Figure 2.5. Only at a price of $60 does quantity demanded equal quantity supplied.

Market forces will drive price toward $60. If price is $80, producers want to supply 1,200 units while consumers only demand 600 units. An excess supply of 600 units develops. Producers must lower price in order to keep from accumulating unwanted inventories. At any price above $60, excess supply results, and producers will lower price.

If price is $40, consumers are willing and able to purchase 1,000 units, while producers offer only 400 units for sale. An excess demand of 600 units results. Since their demands are not satisfied, consumers bid the price up. Any price below $60 leads to an excess demand, and the shortage induces consumers to bid up the price.

Given no outside influences that prevent price from being bid up or down, an equilibrium price and quantity are attained. This equilibrium price is the price that clears the market; both excess demand and excess supply are zero in equilibrium. Equilibrium is attained in the market because of the following:

Principle The equilibrium price is that price at which quantity demanded is equal to quantity supplied. When the current price is above the equilibrium price, quantity supplied exceeds quantity demanded. The resulting excess supply induces sellers to reduce price in order to sell the surplus. If the current price is below equilibrium, quantity demanded exceeds quantity supplied. The resulting excess demand causes the unsatisfied consumers to bid up price. Since prices below equilibrium are bid up by consumers and prices above equilibrium are lowered by producers, the market will converge to the equilibrium price–quantity combination.

It is crucial for you to understand that in the analysis of demand and supply there will never be either a permanent shortage or a permanent surplus as long as price is allowed to adjust freely to the equilibrium level. In other words, assuming that market price adjusts *quickly* to the equilibrium level, surpluses or shortages do not occur in free markets. In the absence of impediments to the adjustment of prices (such as government-imposed price ceilings or floors), the market is always assumed to clear. This assumption greatly simplifies demand and supply analysis. Indeed, how many instances of surpluses or shortages have you seen in markets where prices can adjust freely? The duration of any surplus or shortage is generally short enough that we can reasonably ignore the adjustment period for purposes of demand and supply analysis.

T 12 13

2.4 MEASURING THE VALUE OF MARKET EXCHANGE

Now that we have explained why market equilibrium occurs at the intersection of demand and supply curves, we can use demand and supply curves to measure the net gain created by voluntary exchange between the buyers and sellers in markets. Markets arise because buyers and sellers find it mutually beneficial to meet for the purpose of voluntary exchange: buyers bring money to market to exchange for the commodities that sellers bring to market to trade for money. In free-market exchange between buyers and sellers, no government agency or labor union forces consumers to pay for the goods they want or coerces producers to sell their goods.

Throughout time, in societies everywhere, markets have formed for the mutual benefit of consumers and producers. Indeed, history has recorded that even "primitive" warring tribes regularly scheduled days of peace for the sole purpose of allowing voluntary exchange between combatants. In a more contemporary example of the value of markets, you may have read in the newspaper that your local NFL football team has raised the price of season tickets to $1,200, causing many fans to complain about "high" ticket prices. Then, with their next breath, many of these same fans rushed to the box office and purchased season tickets. These fans voluntarily traded $1,200 for a season ticket, and the team owner voluntarily sold them a seat for the season. In spite of the complaining, both the ticket-buying fans and the ticket-selling team owner mutually benefited from the exchange, otherwise these tickets would not have been bought or sold! Clearly, the market for NFL football tickets creates value for those individuals in society—both fans and owners—who voluntarily choose to participate in this market.[6] Indeed, every market where there is voluntary exchange creates value for all the buyers and sellers trading in that market.

Consumer Surplus

经济价值 市场上任意买家愿意为此单位产品支付的最高价，以此产品的需求价格来衡量。

Typically, consumers value the goods they purchase by an amount that exceeds the purchase price of the goods. For any unit of a good or service, the **economic value** of that unit is simply the maximum amount some buyer is willing to pay for the unit. For example, professional real estate agents frequently must remind people who are selling their homes that the value of their property is only as high as some buyer in the market is willing and able to pay, regardless of how much the current owner paid for the home or how much was spent sprucing up the home. Recall that earlier in this chapter we explained that *demand prices*—the prices associated with various quantities along the demand curve—give the maximum price for which each unit can be sold. Thus the economic value of a specific unit of a good or service equals the demand price for the unit, because this price is the maximum amount any buyer is willing and able to pay for the unit:

$$\begin{aligned}\text{Economic value of a particular unit} &= \text{Demand price for the unit}\\ &= \text{Maximum amount buyers are willing to pay}\end{aligned}$$

Fortunately for consumers, they almost never have to pay the maximum amount they are willing to pay. They instead must pay the *market price*, which is lower than the maximum amount consumers are willing to pay (except for the last unit sold in market equilibrium). The difference between the economic value of a good and the price of the good is the net gain to the consumer, and this difference

[6] As you probably know, prices of NFL season tickets are not determined by the market forces of demand and supply. NFL ticket prices are instead set by individual price-setting team owners (i.e., they possess some degree of market power). Even though this chapter focuses on price-taking firms, the concepts of consumer, producer, and social surplus developed in this section can be applied to markets in which firms are either price-takers or price-setters.

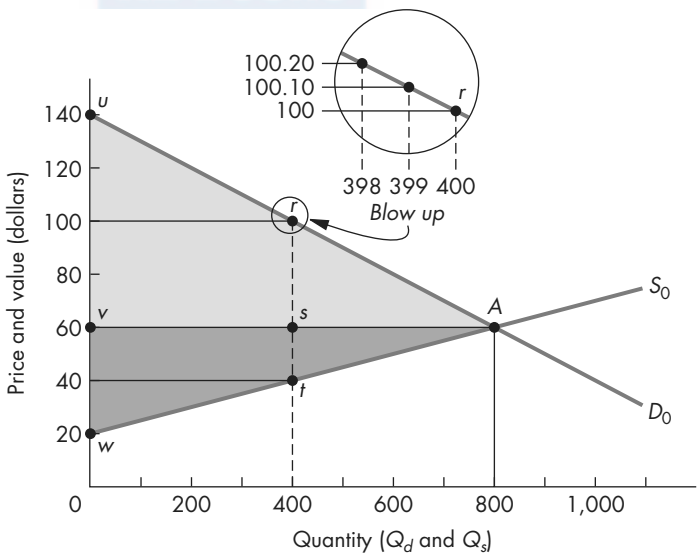
消费者剩余 某种产品的经济价值（它的需求价格）与消费者必须支付的市场价格之间的差值。

is called **consumer surplus.** To illustrate this concept numerically, suppose you would be willing to pay as much as $2,000 for a 40-yard-line NFL season ticket rather than stay at home and watch the game on your high-definition television. By purchasing a season ticket at the price of $1,200, you enjoy a net gain or consumer surplus equal to $800. In this way, consumer surplus for each season ticket sold is measured by the difference between the value of the ticket—measured by the ticket's demand price—and the market price paid for season tickets.

Figure 2.6 illustrates how to measure consumer surplus for the 400th unit of a good using the demand and supply curves developed previously. Recall from our discussion about inverse demand functions that the demand price for 400 units, which is $100 in Figure 2.6, gives the maximum price for which a *total* of 400 units can be sold (see point *r*). But, as we just mentioned, the demand price of $100 also represents the maximum amount for which the 400*th* unit of the good can be sold. Notice in the blow up at point *r* that the consumer who is just willing to buy the 400th unit at $100 would not buy the 400th unit for even a penny more than $100. It follows from this reasoning that the demand price of $100 measures the economic value of the 400th unit, *not* the value of 400 units. You can now see that the consumer surplus for the 400th unit equals $40 (= $100 − $60), which is the difference between the demand price (or economic value) of the 400th unit and the market price (at point *A*). In Figure 2.6, consumer surplus of the 400th unit is the distance between points *r* and *s*.

To measure the *total* consumer surplus for all 400 units—instead of the consumer surplus for the single 400th unit—the vertical distance between demand and market price must be summed for all 400 units. Total consumer surplus for 400 units is equal to the area below demand and above market price over the output

FIGURE 2.6
Measuring the Value of Market Exchange



range 0 to 400 units. In Figure 2.6, total consumer surplus for 400 units is measured by the area bounded by the trapezoid *uvsr.* One way to compute the area of trapezoid *uvsr* is to multiply the length of its base (the distance between *v* and *s*) by the average height of its two sides (*uv* and *rs*): 400 × (($80 + $40)/2) = $24,000. Of course you can also divide the trapezoid into a triangle and a rectangle, and then you can add the two areas to get total consumer surplus. Either way, the total consumer surplus when 400 units are purchased is $24,000.

Now let's measure total consumer surplus in market equilibrium. At point *A* in Figure 2.6, 800 units are bought and sold at the market-clearing price of $60. The area of the red-shaded triangle *uvA* in Figure 2.6 gives the total consumer surplus in market equilibrium. The area of this triangle is $32,000 (= 0.5 × 800 × $80). Thus, $32,000 measures the net gain to all the consumers who voluntarily buy 800 units from producers at $60 per unit. If the government decided for some reason to outlaw completely the consumption of this good, and if all consumers complied with the consumption ban, then the market would disappear, and consumers would be $32,000 worse off by losing the opportunity to buy this good.

Producer Surplus

Next we consider the net gain to producers who supply consumers with the goods and services they demand. Producers typically receive more than the minimum payment necessary to induce them to supply their product. For each unit supplied, the difference between the market price received and the minimum price producers would accept to supply the unit is called **producer surplus.** In Figure 2.6, let's consider the producer surplus for the 400th unit supplied when market price is $60. Recall from our previous discussion about inverse supply functions that the *supply price*, which is $40 for the 400th unit, gives the minimum payment required by the suppliers to produce and sell the 400th unit. The producer surplus generated by the production and sale of the 400th unit is the vertical distance between points *s* and *t*, which is $20 (= $60 − $40). The total producer surplus for 400 units is the sum of the producer surplus of each of the 400 units. Thus, total producer surplus for 400 units is the area below market price and above supply over the output range 0 to 400. In Figure 2.6, total producer surplus for 400 units is measured by the area of the trapezoid *vwts.* By multiplying the base *vs* (= 400) times the average height of the two parallel sides *vw* ($40) and *st* ($20), you can verify that the area of trapezoid *vwts* is $12,000 [= 400 × ($40 + $20)/2].

生产者剩余 对供给的每一单位而言，市场价格与生产者愿意供给的最低价格（它的供给价格）之间的差值。

Now let's measure the total producer surplus in market equilibrium. At point *A*, total producer surplus is equal to the area of the gray-shaded triangle *vwA.* Thus, total producer surplus in equilibrium is $16,000 (= 0.5 × 800 × $40). By doing business in this market, producers experience a net gain of $16,000.

Social Surplus

社会剩余 消费者剩余和生产者剩余之和，即需求曲线以下、供给曲线以上，实现供给和消费的产量之间的区域。

The net gain to society as a whole from any specific level of output can be found by adding total consumer surplus and total producer surplus generated at that specific level of output. This sum is known as **social surplus**.

ILLUSTRATION 2.2

Do Buyers Really Bid Up Prices?

We have emphasized that when a surplus exists, unwanted inventories accumulate and sellers lower prices. And when there is a shortage, consumers, unable to buy all they want at the going price, bid up the price. It's easy to see that a surplus would induce sellers to lower the price. But do consumers actually bid up the price during a shortage?

Over the past two decades, housing markets in the United States have experienced two periods of rapidly increasing demand that created temporary shortages accompanied by episodes of consumers bidding up the prices of homes. The predictable nature of consumer bidding wars is illustrated by two newspaper reports.

In spring 1986, an article in *The Wall Street Journal* described how the bidding process actually took place first in housing markets in Boston and upstate New York, then appeared later in most of the Northeast, suburbs of Chicago, Detroit, Minneapolis, parts of Ohio, and major California cities. Lured by lower mortgage interest rates, a huge influx of home buyers began offering sellers $100 to $45,000 extra for scarce houses in desirable suburbs or prestigious urban neighborhoods. While overbidding wasn't the norm, it occurred in 25 percent of home sales in some booming areas. As the *WSJ* noted, "Its pervasiveness is helping to drive house prices sky high," and "there is too much overbidding to hold down prices."

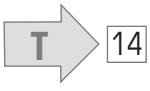
The article reported several specific examples. A New York couple offered $2,000 above the $181,000 asking price for a New Jersey home that needed a new furnace, a new paint job in the garage, and extensive bathroom repairs. They made the offer to win a bidding war with two other buyers. And they said they were happy because they knew people who had paid as much as $10,000 above the asking price. An Alexandria, Virginia, lawyer, after she was outbid for another home, paid $170,000 for a $167,000 house that needed $25,000 in repairs. A real estate agent in Albany, New York, said that one-fourth of the homes in the area priced between $65,000 and $170,000 sold for more than the asking price.

More recently, in August 1997, an article in *The New York Times* reported that relatively low mortgage interest rates and growing stock portfolios were combining to promote the return of bidding wars in affluent areas of northern New Jersey, Los Angeles, the San Francisco Bay area, and Boston: "Competing buyers [are] push[ing] selling prices well beyond the asking price." One 30-something couple chose to pay $17,600 more than the asking price for a Bergen County, New Jersey, home rather than let another couple get the home for just $10,000 over the asking price.

Translated into demand and supply, when interest rates fell and stock market portfolios swelled in value, the demand for homes in many areas of the United States increased substantially. Quantity demanded exceeded quantity supplied at the old equilibrium price. Consumers, not able to get all the houses they wanted at that price bid the price up. Not until the new price reaches the new higher equilibrium will overbidding cease.

Sources: Charles Bagli, "Home Buyers Find the Bidding Wars Are Back," *The New York Times,* Aug. 13, 1997; Joann S. Lublin, "Eager Home Buyers Bid Up Prices in Rising Numbers of Hot Markets," *The Wall Street Journal,* Mar. 7, 1986.

At market equilibrium point *A* in Figure 2.6, social surplus equals $48,000 (= $32,000 + $16,000). As you can now see, the value of social surplus in equilibrium provides a dollar measure of the gain to society from having voluntary exchange between buyers and sellers in this market. In Chapters 12 and 14, we will examine pricing strategies used by firms with market power to transform, as much as possible, consumer surplus into producer surplus. In Chapter 16, we will explain the circumstances under which social surplus is maximized by letting market forces determine the prices at which market exchange takes place.



2.5 CHANGES IN MARKET EQUILIBRIUM

If demand and supply never changed, equilibrium price and quantity would remain the same forever, or at least for a very long time, and market analysis would be extremely uninteresting and totally useless for managers. In reality, the variables held constant when deriving demand and supply curves do change. Consequently, demand and supply curves shift, and equilibrium price and quantity change. Using demand and supply, managers may make either qualitative forecasts or quantitative forecasts. A **qualitative forecast** predicts only the *direction* in which an economic variable, such as price or quantity, will move. A **quantitative forecast** predicts both the *direction* and the *magnitude* of the change in an economic variable.

定性预测 针对经济变量变化方向的预测。

定量预测 预测经济变量变化的方向和大小。

For instance, if you read in *The Wall Street Journal* that Congress is considering a tax cut, demand and supply analysis enables you to forecast whether the price and sales of a particular product will increase or decrease. If you forecast that price will rise and sales will fall, you have made a qualitative forecast about price and quantity. Alternatively, you may have sufficient data on the exact nature of demand and supply to be able to predict that price will rise by $1.10 and sales will fall by 7,000 units. This is a quantitative forecast. Obviously, a manager would get more information from a quantitative forecast than from a qualitative forecast. But managers may not always have sufficient data to make quantitative forecasts. In many instances, just being able to predict correctly whether price will rise or fall can be extremely valuable to a manager.

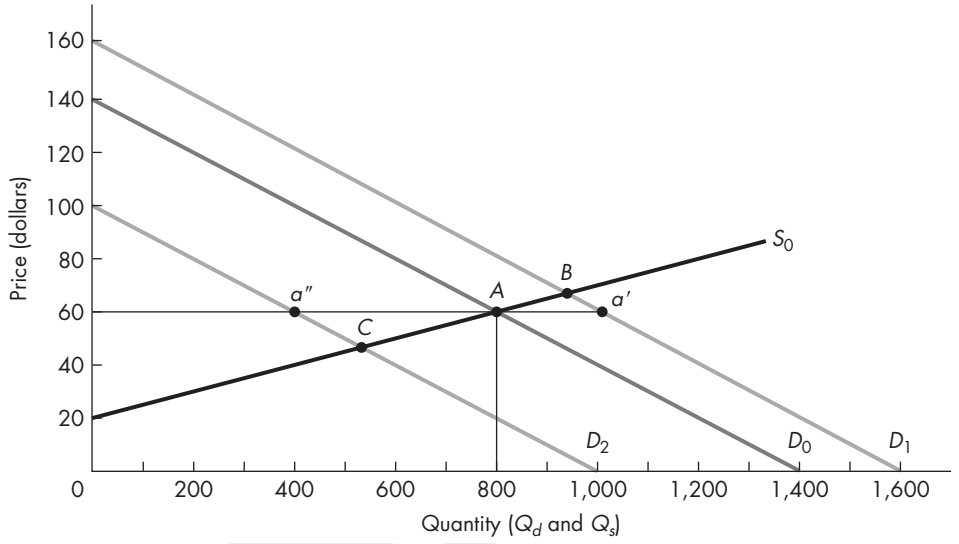
Thus an important function and challenging task for managers is predicting the effect, especially the effect on market price, of specific changes in the variables that determine the position of demand and supply curves. We will first discuss the process of adjustment when something causes demand to change while supply remains constant, then the process when supply changes while demand remains constant.

Changes in Demand (Supply Constant)

To illustrate the effects of changes in demand when supply remains constant, we have reproduced D_0 and S_0 in Figure 2.7. Equilibrium occurs at $60 and 800 units, shown as point A in the figure. The demand curve D_1, showing an increase in demand, and the demand curve D_2, showing a decrease in demand, are reproduced from Figure 2.2. Recall that the shift from D_0 to D_1 was caused by an increase in income. The shift from D_0 to D_2 resulted from the decrease in income.

Begin in equilibrium at point A. Now let demand increase to D_1 as shown. At the original $60 price, consumers now demand a' units with the new demand. Since firms are still willing to supply only 800 units at $60, a shortage of $a' - 800$ units results. As described in Section 2.3, the shortage causes the price to rise to a new equilibrium, point B, where quantity demanded equals quantity supplied. As you can see by comparing old equilibrium point A to new equilibrium point B, the increase in demand increases both equilibrium price and quantity.

FIGURE 2.7
Demand Shifts (Supply Constant)



To illustrate the effect of a decrease in demand, supply held constant, we return to the original equilibrium at point A in the figure. Now we decrease the demand to D_2. At the original equilibrium price of \$60, firms still want to supply 800 units, but now consumers want to purchase only a'' units. Thus there is a surplus of $A - a''$ units. As already explained, a surplus causes price to fall. The market returns to equilibrium only when the price decreases to point C. Therefore the decrease in demand decreases both equilibrium price and quantity (compare points A and C). We have now established the following principle:

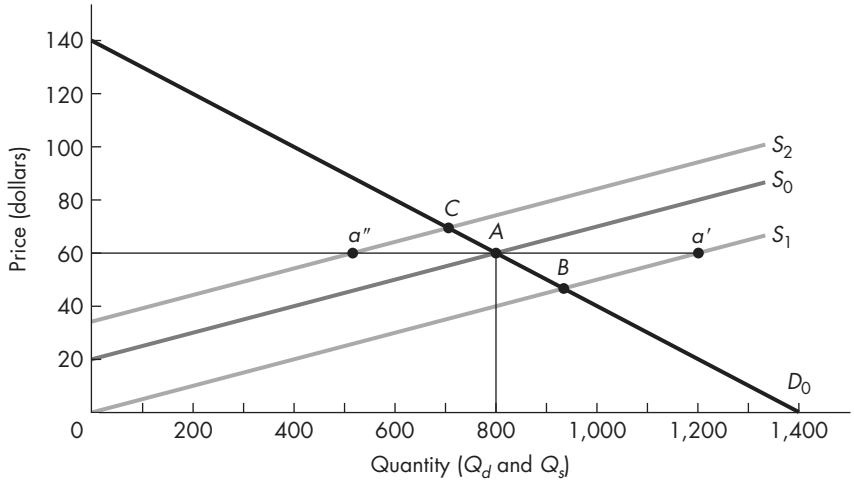
Principle When demand increases and supply is constant, equilibrium price and quantity both rise. When demand decreases and supply is constant, equilibrium price and quantity both fall.

Changes in Supply (Demand Constant)

To illustrate the effects of changes in supply when demand remains constant, we reproduce D_0 and S_0 in Figure 2.8. The supply curve S_1, showing an increase in supply, and the supply curve S_2, showing a decrease in supply, are reproduced from Figure 2.4. Recall that the shift from S_0 to S_1 was caused by a decrease in the price of an input. The shift from S_0 to S_2 resulted from a decrease in the number of firms in the industry.

Begin in equilibrium at point A. Let supply first increase to S_1 as shown. At the original \$60 price consumers still want to purchase 800 units, but sellers now wish to sell a' units, causing a surplus or excess supply of $a' - 800$ units. The surplus

FIGURE 2.8
Supply Shifts (Demand Constant)



causes price to fall, which induces sellers to supply less and buyers to demand more. Price continues to fall until the new equilibrium is attained at point *B*. As you can see by comparing the initial equilibrium point *A* in Figure 2.8 to the new equilibrium point *B*, when supply increases and demand remains constant, equilibrium price will fall and equilibrium quantity will increase.

To demonstrate the effect of a supply decrease, we return to the original input price to obtain the original supply curve S_0 and the original equilibrium at point *A*. Let the number of firms in the industry decrease, causing supply to shift from S_0 to S_2 in Figure 2.8. At the original \$60 price, consumers still want to buy 800 units, but now sellers wish to sell only a'' units, as shown in the figure. This leads to a shortage or excess demand of $a'' - A$ units. Shortages cause price to rise. The increase in price induces sellers to supply more and buyers to demand less, thereby reducing the shortage. Price will continue to increase until it attains the new equilibrium at point *C*. Therefore, when supply decreases while demand remains constant, price will rise and quantity sold will decrease. We have now established the following principle:

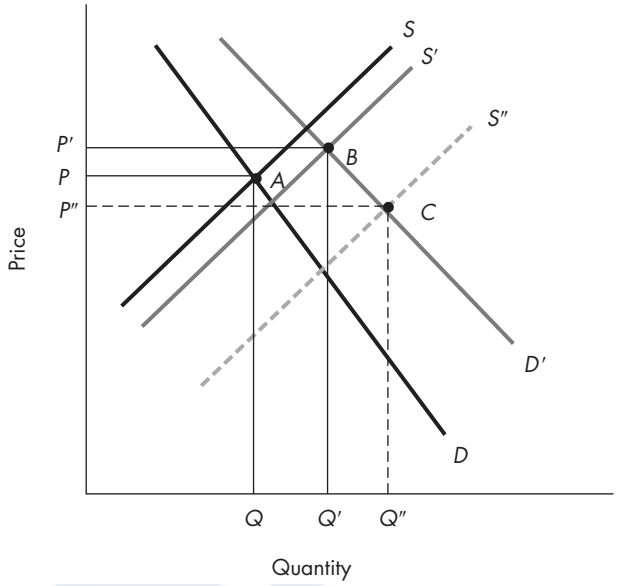
T 15

Principle When supply increases and demand is constant, equilibrium price falls and equilibrium quantity rises. When supply decreases and demand is constant, equilibrium price rises and equilibrium quantity falls.

Simultaneous Shifts in Both Demand and Supply

To this point, we have examined changes in demand or supply holding the other curve constant. In both cases, the effect on equilibrium price and quantity can be predicted. In situations involving *both* a shift in demand *and* a shift in supply, it is

FIGURE 2.9
Shifts in Both Demand and Supply:
Demand and Supply Both Increase



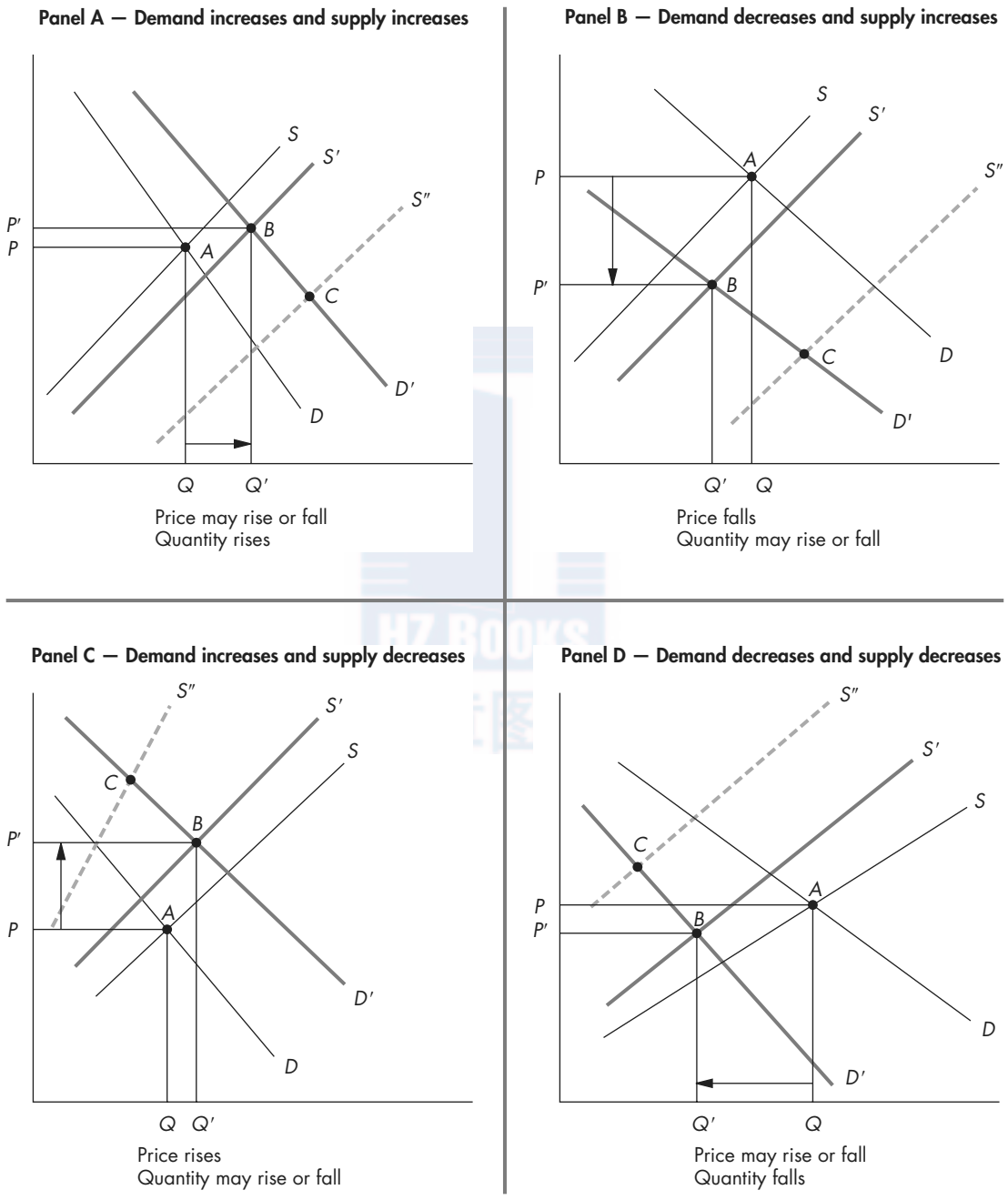
possible to predict either the direction in which price changes or the direction in which quantity changes, *but not both.* When it is not possible to predict the direction of change in a variable, the change in that variable is said to be **indeterminate.** The change in either equilibrium price or quantity will be indeterminate when the direction of change depends upon the relative magnitudes of the shifts in the demand and supply curves.

不确定 无论是均衡价格，还是均衡交易量，变动的方向要依赖于供给曲线与需求曲线相对移动的幅度时，我们称之为不确定。

In Figure 2.9, D and S are, respectively, demand and supply, and equilibrium price and quantity are P and Q (point A). Suppose demand increases to D' and supply increases to S'. Equilibrium quantity increases to Q', and equilibrium price rises from P to P' (point B). Suppose, however, that supply had increased even more to the dashed supply S'' so that the new equilibrium occurs at point C instead of at point B. Comparing point A to point C, equilibrium quantity still increases (Q to Q''), but now equilibrium price *decreases* from P to P''. In the case where both demand and supply increase, a *small* increase in supply relative to demand causes price to rise, while a *large* increase in supply relative to demand causes price to fall. In the case of a simultaneous increase in both demand and supply, equilibrium output always increases, but the change in equilibrium price is indeterminate.

When both demand and supply shift together, either (1) the change in quantity can be predicted and the change in price is indeterminate or (2) the change in quantity is indeterminate and the change in price can be predicted. Figure 2.10 summarizes the four possible outcomes when demand and supply both shift. In each of the four panels in Figure 2.10, point C shows an alternative point of equilibrium that reverses the direction of change in one of the variables, price or

FIGURE 2.10
Summary of Simultaneous Shifts in Demand and Supply:
The Four Possible Cases



quantity. You should use the reasoning process set forth above to verify the conclusions presented for each of the four cases. We have established the following principle:

Principle When demand and supply both shift simultaneously, if the change in quantity (price) can be predicted, the change in price (quantity) is indeterminate. The change in equilibrium quantity or price is indeterminate when the variable can either rise or fall depending upon the relative magnitudes by which demand and supply shift.

Predicting the Direction of Change in Airfares: A Qualitative Analysis

Suppose you manage the travel department for a large U.S. corporation and your sales force makes heavy use of air travel to call on customers. The president of the corporation wants you to reduce travel expenditures for 2010. The extent to which you will need to curb air travel in 2010 will depend on what happens to the price of air travel. If airfares fall in 2010, you can satisfy the wants of both the president, who wants expenditures cut, and the sales personnel, who would be hurt by travel restrictions. Clearly, you need to predict what will happen to airfares in 2010. You have recently read in *The Wall Street Journal* about the following two events that you expect will affect the airline industry in 2010:

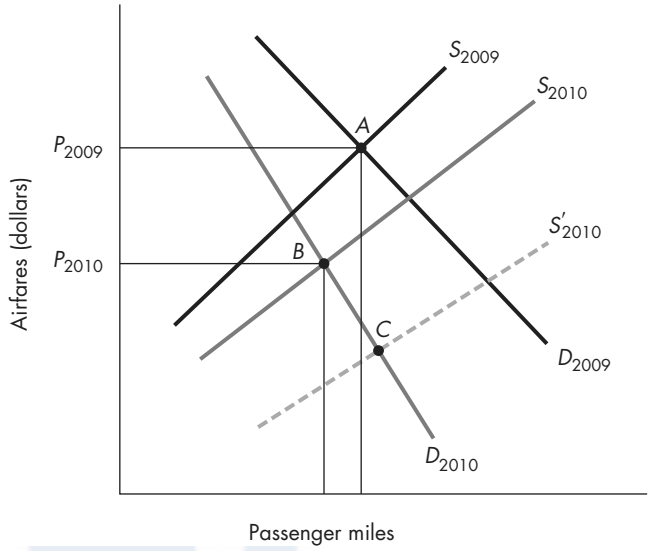
1. A number of new, small airlines have recently entered the industry and others are expected to enter in 2010.
2. Broadband Internet videoconferencing is becoming a popular, cost-effective alternative to business travel for many U.S. corporations. The trend is expected to accelerate in 2010 as telecommunications firms begin cutting prices on teleconferencing rates.

We can use Figure 2.11 to analyze how these events would affect the price of air travel in 2010. The current demand and supply curves in the domestic market are D_{2009} and S_{2009}. Equilibrium airfare in 2009 is denoted P_{2009} at point A in Figure 2.11.

An increase in the number of airlines causes supply to increase. The increase in supply is shown in Figure 2.11 by the shift in supply to S_{2010}. Since videoconferencing and air travel are substitutes, a reduction in the price of videoconferencing causes a decrease in demand. The decrease in demand is shown in Figure 2.11 by the shift in demand to D_{2010}. Thus you must analyze a situation in which demand and supply shift simultaneously. The decrease in demand combined with the increase in supply leads you to predict a fall in airfares in 2010 to P_{2010} (point B in Figure 2.11). While you can predict that airfares will definitely fall when demand decreases and supply increases, you cannot predict whether equilibrium quantity will rise or fall in this situation (supply could instead shift to S'_{2010} in Figure 2.11). The change in quantity is indeterminate. The predicted fall in airfares is good news for you but bad news for the financially troubled airline industry.

This analysis of the air travel market is an example of qualitative analysis. You predicted only the *direction* of the price change, not the magnitude of the change. Managers are certainly interested in whether price will increase or decrease. They are also interested in *how much* price will increase or decrease. Determining how much price will rise involves quantitative analysis. To carry out quantitative analysis,

FIGURE 2.11
Demand and Supply for Air Travel



either you must be given the exact specification of the market demand and supply equations or you must estimate them from market data. In later chapters we will show you how to estimate demand and supply from market data. We will look now at an example of quantitative analysis where the demand and supply equations have already been estimated for you.

T 16

Advertising and the Price of Potatoes: A Quantitative Analysis

The Potato Growers Association of America estimates that next year the demand and supply functions facing U.S. potato growers will be

$$Q_d = 28 - 0.04P$$
$$Q_s = -2 + 0.16P$$

where quantity demanded and quantity supplied are measured in trillions of hundredweight (a measure equal to 100 pounds) per year, and price is measured in cents per hundredweight. First, we predict the price of potatoes next year and how many potatoes will be sold. The market clearing price is easily determined by setting quantity demanded equal to quantity supplied and solving algebraically for equilibrium price:

$$Q_d = Q_s$$
$$28 - 0.04P = -2 + 0.16P$$
$$30 = 0.20P$$
$$150 = P_E$$

ILLUSTRATION 2.3

Did Globalization Kill U.S. Manufacturing?

As we discussed in Chapter 1, globalization of markets brings together buyers and sellers in various countries by weakening, or eliminating entirely, import quotas, tariffs, and other kinds of government restrictions on trade between nations. An article in *BusinessWeek* commented on the recent emergence of global markets: "International trade has mushroomed, becoming a daily part of life for all the world's consumers and workers. Beyond a doubt, there is a consensus among the vast majority of economists, policymakers, and executives that open markets are a boon for growth, and that no country can thrive in the long run unless it is a full part of the global economy." In spite of the largely positive appraisal of globalization by those in government, academics, and business, some Americans believe instead that manufacturing firms in the United States have been harmed by global competition.

Doomsayers began predicting the demise of U.S. manufacturing even before official enactment in 1994 of the North American Free Trade Agreement (NAFTA), the multilateral agreement by the United States, Canada, and Mexico that significantly reduced trade barriers between the three nations. Ross Perot, a candidate in the 1992 presidential election, and labor union officials predicted that passage of NAFTA would cause a substantial relocation of U.S. manufacturing activity to Mexico. "When you've got a seven-to-one wage differential between the United States and Mexico, you will hear the giant sucking sound," Perot said in 1993 in reference to his vision of manufacturing plants being sucked out of the United States into countries with lower labor costs. It seemed "obvious" that low wages in Mexico, China, and India would throw millions of factory workers in America out of work as manufacturers shed productive capacity by shutting down plants and downsizing remaining production facilities.

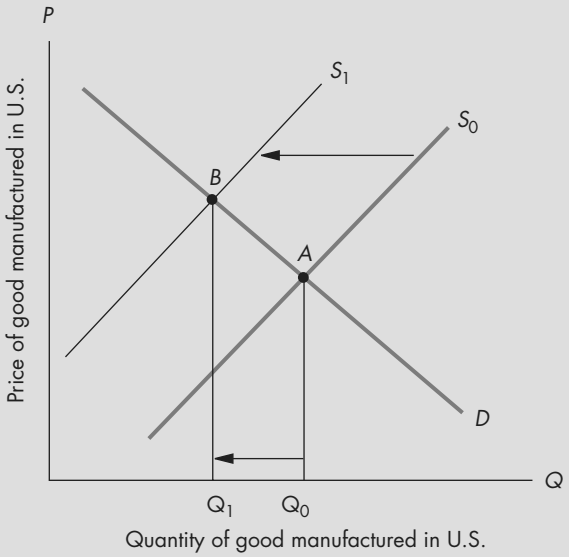
To see how the doomsayers' outlook on globalization leads them to predict a decline in output for U.S. manufacturers, we can apply the tools of demand and supply developed in this chapter. In the figure, Panel A shows the effect of declining productive capacity on equilibrium output for a manufactured good. The decline in productive capacity predicted by Ross Perot and some labor unions causes the supply-shifting variable F (the number of firms or the amount of productive capacity) to decrease and the supply curve for the manufactured good shifts leftward from S_0 to S_1 in Panel A. The decrease in supply causes equilibrium output of the good manufactured in the United States to decrease from Q_0 to Q_1. The doomsayers predicted that the reduced output of manufactured goods in the United States would force the displaced factory workers into jobs paying lower wages. In their view, the United States would become a nation of service-oriented hamburger flippers unable to produce manufactured goods for itself. As it turns out, the predicted demise of U.S. manufacturing industries did not happen.

A recent article in *Fortune* magazine presented statistical evidence debunking the "big myth about U.S. manufacturing" that global competition caused a contraction of output in U.S. manufacturing industries. The following statistics presented in the article show the sustained importance of manufacturing in the U.S. economy:

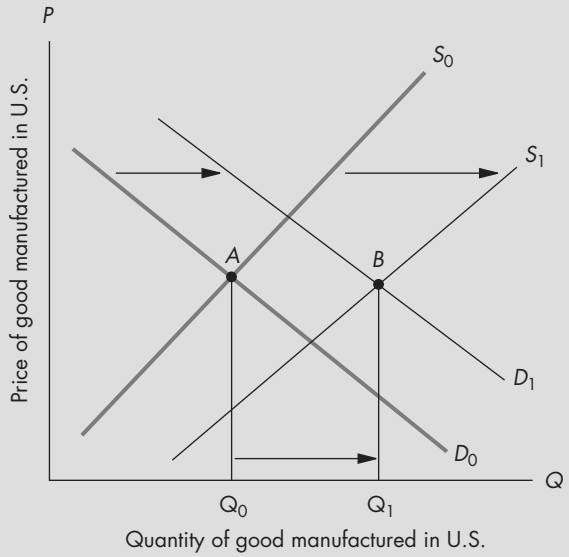
- Manufacturing output in the United States has never been higher.
- Manufacturing accounts for about 17 percent of U.S. gross domestic product (GDP), the same percentage as in 1977.
- In 1998 U.S. manufacturing output was worth $1.43 trillion, 42 percent higher than in 1992.
- U.S. manufacturers produce 50 percent more output than Japan, and 33 percent more than the United Kingdom, France, and Germany combined.

Why, then, did manufacturing expand rather dramatically in the United States even though labor costs are much lower in many foreign countries? How can we explain the absence of the "giant sucking sound" that so worried the doomsayers?

We can identify several events that caused supply and demand for goods manufactured in the United States to increase as illustrated in Panel B of the figure. On the supply side of the market for manufactured goods, U.S. manufacturing has benefited from a sharp and steady increase in productivity for the past 20 years. Over this period, falling interest rates and lower levels of inflation coupled with tax incentives for investment in new plant and equipment—including substantial investments in computers and information management technologies—combined to improve the state of technology in U.S. manufacturing. The improvement in technology



Panel A



Panel B

causes the supply-shifting variable T to increase and the supply of manufactured goods then shifts from S_0 to S_1 in Panel B as both capital and labor in manufacturing become more productive. While manufacturing now employs a declining fraction of the U.S. workforce, the *Fortune* article notes that this is not a problem since "a country's manufacturing prowess isn't measured by the number of people working in factories. If it were, China and India would be the world's leaders." Indeed, increased output from a smaller number of workers indicates strong gains in the productivity of inputs.

On the demand side of the market for goods manufactured in the United States, two factors contributed to the increase in demand. First, when foreign governments lifted trade restrictions, the demand-shifting variable N increased, as more foreign buyers were then able to buy goods made in the United States. Also, during periods of rising income levels around the world (demand-shifting variable M increased), demand for U.S. manufactured goods increased because nearly all goods exported from the United States are normal goods to customers in other countries. The increases in N and M combined to increase demand for goods manufactured in the United States. Panel B shows the combined effects as a rightward shift in demand from D_0 to D_1. The simultaneous increases in both demand and supply for the manufactured good cause the equilibrium output to increase. The effect of globalization on the equilibrium price of the manufactured good is indeterminate because the price of the manufactured good can rise, fall, or stay the same when both demand and supply increase.

Globalization of world markets for manufactured goods has certainly not "killed" manufacturing industries in the United States. While doomsayers are probably correct that some manufactured goods can be produced at lower cost in foreign countries where unskilled labor is much cheaper, advances in U.S. productivity coupled with increased demand for goods made in the United States—particularly high-end manufactured goods that require highly skilled labor—have led to a boom rather than a bust in U.S. manufacturing. We should emphasize, however, that the impact of globalization on U.S. manufacturing might have looked more like the doomsayers' prediction in Panel A had U.S. manufacturing industries not invested heavily to improve the state of technology in manufacturing. We discuss the relation between productivity of inputs and costs of production in much more detail in later chapters.

Sources: Michael J. Mandel and Paul Magnusson, "Global Growing Pains," *BusinessWeek*, Dec. 13, 1999; Philip Siekman, "The Big Myth about U.S. Manufacturing," *Fortune*, Oct. 2, 2000, p. 244 [C, D, E]; for Ross Perot quote, see Charles Zewe, "Three Years Later, NAFTA's Effects Still Debated," CNN Interactive (CNN.com), posted June 30, 1997.

Thus the equilibrium price of potatoes next year will be 150 cents ($1.50) per hundredweight. The equilibrium level of potato production is determined by substituting the market price of 150 cents into either the demand or the supply function to get Q_E:

$$Q_d = Q_s = Q_E$$
$$28 - (0.04 \times 150) = -2 + (0.16 \times 150) = 22$$

Thus the equilibrium output of potatoes will be 22 trillion hundredweight per year.

Even though that's a lot of potatoes, the Potato Growers Association plans to begin a nationwide advertising campaign to promote potatoes by informing consumers of the nutritional benefits of potatoes. The association estimates that the advertising campaign, which will make consumers want to eat more potatoes, will increase demand to

$$Q_d = 40 - 0.05P$$

Assuming that supply is unaffected by the advertising, you would obviously predict that the market price of potatoes will rise as a result of the advertising and the resulting increase in demand. However, to determine the actual market clearing price, you must equate the new quantity demanded with the quantity supplied:

$$40 - 0.05P = -2 + 0.16P$$
$$P_E = 200$$

The price of potatoes will increase to 200 cents ($2.00) with the advertising campaign. Consequently, the prediction is that the national advertising campaign will increase the market price of potatoes by 50 cents per hundredweight. This is an example of a quantitative forecast since the forecast involves both the magnitude and the direction of change in price. To make a quantitative forecast about the impact of the ads on the level of potato sales, you simply substitute the new market price of 200 cents into either the demand or the supply function to obtain the new Q_E:

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$$Q_d = Q_s = Q_E$$
$$40 - (0.05 \times 200) = -2 + (0.16 \times 200) = 30$$

2.6 CEILING AND FLOOR PRICES

Shortages and surpluses *can* occur after a shift in demand or supply, but as we have stressed, these shortages and surpluses are sufficiently short in duration that they can reasonably be ignored in demand and supply analysis. In other words, markets are assumed to adjust fairly rapidly, and we concern ourselves only with the comparison of equilibriums before and after a shift in supply or demand. There are, however, some types of shortages and surpluses that market forces do

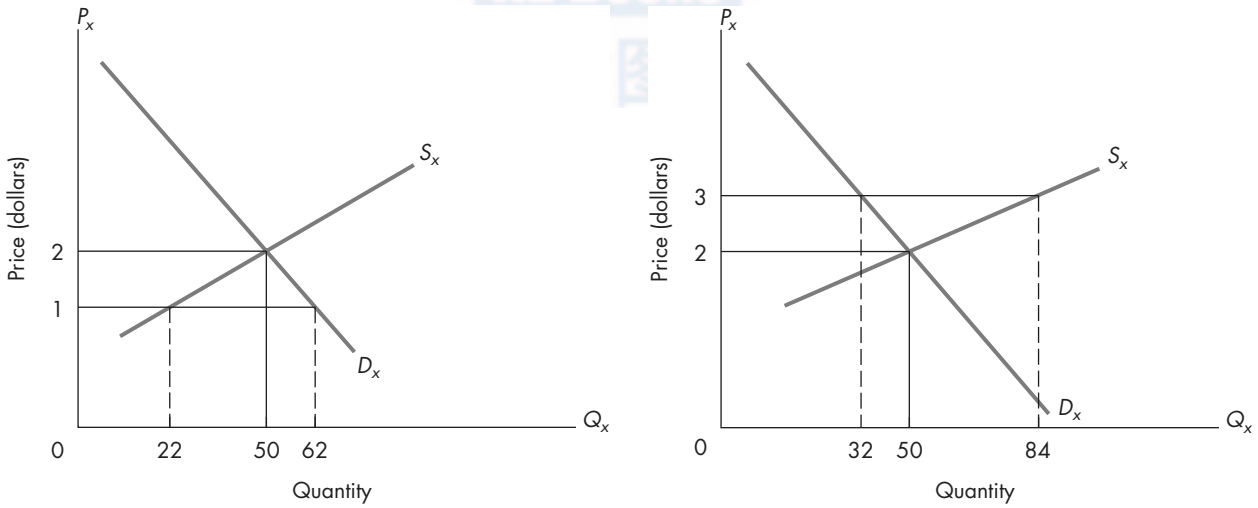
not eliminate. These are more permanent in nature and result from government interferences with the market mechanism, which prevent prices from freely moving up or down to clear the market.

Typically these more permanent shortages and surpluses are caused by government imposing legal restrictions on the movement of prices. Shortages and surpluses can be created simply by legislating a price below or above equilibrium. Governments have decided in the past, and will surely decide in the future, that the price of a particular commodity is "too high" or "too low" and will proceed to set a "fair price." Without evaluating the desirability of such interference, we can use demand and supply curves to analyze the economic effects of these two types of interference: the setting of minimum and maximum prices.

限制价 政府允许销售者对产品所索取的最高价格。当这个价格低于均衡所需价格时，就会出现供不应求。

If the government imposes a maximum price, or **ceiling price,** on a good, the effect is a shortage of that good. In Panel A of Figure 2.12, a ceiling price of $1 is set on some good *X*. No one can legally sell *X* for more than $1, and $1 is less than the equilibrium (market clearing) price of $2. At the ceiling price of $1, the maximum amount that producers are willing to supply is 22 units. At $1, consumers wish to purchase 62 units. A shortage of 40 units results from the imposition of the $1 price ceiling. Market forces will not be permitted to bid up the price to eliminate the shortage because producers cannot sell the good for more than $1. This type of shortage will continue until government eliminates the price ceiling or until shifts in either supply or demand cause the equilibrium price to fall to $1 or lower. It is worth noting that "black" (illegal) markets usually arise in such cases. Some

FIGURE 2.12
Ceiling and Floor Prices



Panel A — Ceiling price **Panel B — Floor price**

consumers are willing to pay more than $1 for good *X* rather than do without it, and some producers are willing to sell good *X* for more than $1 rather than forgo the extra sales. In most cases the law is not a sufficient deterrent to the illegal trade of a good at prices above the ceiling.

支持价 政府允许销售者对商品所索取的最低价格，当这个价格高于市场均衡所需价格时，便会出现供过于求。

Alternatively, the government may believe that the suppliers of the good are not earning as much income as they deserve and, therefore, sets a minimum price or **floor price.** You can see the results of such actions in Panel B of Figure 2.12. Dissatisfied with the equilibrium price of $2 and equilibrium quantity of 50, the government sets a minimum price of $3. Since the government cannot repeal the law of demand, consumers reduce the amount they purchase to 32 units. Producers, of course, are going to increase their production of *X* to 84 units in response to the $3 price. Now a surplus of 52 units exists. Because the government is not allowing the price of *X* to fall, this surplus is going to continue until it is either eliminated by the government or demand or supply shifts cause market price to rise to $3 or higher. In order for the government to ensure that producers do not illegally sell their surpluses for less than $3, the government must either restrict the production of *X* to 32 units or be willing to buy (and store or destroy) the 52 surplus units.

This section can be summarized by the following principle:

Principle When the government sets a ceiling price below the equilibrium price, a shortage or excess demand results because consumers wish to buy more units of the good than producers are willing to sell at the ceiling price. If the government sets a floor price above the equilibrium price, a surplus or excess supply results because producers offer for sale more units of the good than buyers wish to consume at the floor price.

For managers to make successful decisions by watching for changes in economic conditions, they must be able to predict how these changes will affect the market. As we hope you have seen, this is precisely what economic analysis is designed to do. This ability to use economics to make predictions is one of the topics we will emphasize throughout the text.

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2.7 SUMMARY

In this chapter we presented the basic framework of demand and supply analysis. The market was divided into two different groups of participants: consumers and producers. Demand analysis focuses on the behavior of consumers, while supply analysis examines the behavior of producers. The demand and supply curves together determine the price and output that occur in a market. The impact of changing market circumstances on equilibrium price and output is determined by making the appropriate shifts in either demand or supply and comparing equilibriums before and after the change.

The general demand function specifies how the quantity demanded of a good is related to six variables that jointly determine the amount of a good or service consumers are willing and able to buy. By holding constant the five determinants of demand—income, the price of related goods, consumer tastes, expected price, and the number of consumers—and letting only the price of the good vary, a demand function is derived. The law of demand states that quantity demanded and price are inversely related, all other variables influencing demand held constant. Whenever the price of a good changes, a

"change in quantity demanded" occurs, which is represented by a movement along a fixed demand curve. A point on the demand curve shows either the maximum amount of a good that will be purchased if a given price is charged or the maximum price consumers will pay for a specific amount of the good. The five determinants of demand (M, P_R, $\mathcal{T}$, P_e, and N) are also called the demand-shifting variables because their values determine the location of the demand curve. Table 2.4 summarizes how demand curves shift when each of the determinants of demand changes value.

For producers, the general supply function shows how six variables—the price of the product, the price of inputs, the prices of goods related in production, the state of technology, the expected price of the good, and the number of firms or amount of productive capacity—jointly determine the amount of a good or service producers are willing to supply. Quantity supplied and price are directly related, all other variables influencing supply held constant. When the price of a good changes, a change in quantity supplied occurs, which is represented by a movement along a fixed supply curve. A point on the supply curve shows either the maximum amount of a good that will be offered for sale at a given price or the minimum price (the supply price) necessary to induce producers voluntarily to offer a particular quantity for sale. The five determinants of supply (P_I, P_r, T, P_e, and F) are also called the supply-shifting variables because their values determine the location of the supply curve. Table 2.8 summarizes how supply curves shift when each of the determinants of supply changes value.

The equilibrium price and quantity in a market are determined by the intersection of demand and supply curves. At the point of intersection, quantity demanded equals quantity supplied, and the market clears. Since the location of the demand and supply curves is determined by the five determinants of demand and the five determinants of supply, a change in any one of these 10 variables will result in a new equilibrium point. When demand increases and supply remains constant, price and quantity sold both rise. A decrease in demand, supply constant, causes both price and quantity sold to fall. When supply increases and demand remains constant, price falls and quantity sold rises. A decrease in supply, demand constant, causes price to rise and quantity sold to fall.

When buyers and sellers voluntarily engage in market exchange, both consumers and producers enjoy a net gain from the exchange. The net gain to consumers, known as consumer surplus, arises because the equilibrium price consumers pay is less than the value they place on the units they purchase. Total consumer surplus from market exchange is measured by the area under demand above market price up to the equilibrium quantity. The net gain to producers, known as producer surplus, develops because the equilibrium price suppliers receive is greater than the minimum price they would be willing to accept to produce. The total producer surplus is equal to the area below market price and above supply up to the equilibrium quantity. Since consumers and producers are all members of society, the net gain to society arising from market exchange—called social surplus—is the sum of consumer surplus and producer surplus.

When both supply and demand shift simultaneously, it is possible to predict either the direction in which price changes or the direction in which quantity changes, but not both. The change in equilibrium quantity or price is said to be indeterminate when the direction of change depends upon the relative magnitudes by which demand and supply shift. The four possible cases for simultaneous shifts in demand and supply are summarized in Figure 2.10.

Sometimes the government imposes either a ceiling price or a floor price, which interferes with the market mechanism and prevents price from freely moving up or down to clear the market. When government sets a ceiling price below the equilibrium price, a shortage results because consumers wish to buy more of the good than producers are willing to sell at the ceiling price. If government sets a floor price above the equilibrium price, a surplus results because producers offer for sale more of the good than buyers wish to purchase at the higher floor price.

In this chapter we had two purposes. The first was to show you how managers can use economic theory to make predictions about the effect of exogenous events upon prices. We showed what to expect about price and quantity in specific markets when certain variables change or are expected to change. As we will show in later chapters, the ability to make correct forecasts under difficult conditions separates good (successful) managers from those who are not so good (unsuccessful). The second purpose was to prepare you for the material we will present in the following chapters. These chapters will show how demand and supply functions are derived from the behavior of consumers and firms and how these functions can be estimated. A thorough understanding of the material set forth in this chapter is essential to developing the ability to use and interpret demand and supply estimations and make accurate forecasts.

TECHNICAL PROBLEMS

1. The general demand function for good A is

$$Q_d = 600 - 4P_A - 0.03M - 12P_B + 15\mathcal{T} + 6P_e + 1.5N$$

where Q_d = quantity demanded of good A each month, P_A = price of good A, M = average household income, P_B = price of related good B, $\mathcal{T}$ = a consumer taste index ranging in value from 0 to 10 (the highest rating), P_e = price consumers expect to pay next month for good A, and N = number of buyers in the market for good A.

   a. Interpret the intercept parameter in the general demand function.

   b. What is the value of the slope parameter for the price of good A? Does it have the correct algebraic sign? Why?

   c. Interpret the slope parameter for income. Is good A normal or inferior? Explain.

   d. Are goods A and B substitutes or complements? Explain. Interpret the slope parameter for the price of good B.

   e. Are the algebraic signs on the slope parameters for $\mathcal{T}$, P_e, and N correct? Explain.

   f. Calculate the quantity demanded of good A when P_A = \$5, M = \$25,000, P_B = \$40, $\mathcal{T}$ = 6.5, P_e = \$5.25, and N = 2,000.

2. Consider the general demand function:

$$Q_d = 8{,}000 - 16P + 0.75M + 30P_R$$

   a. Derive the equation for the demand function when M = \$30,000 and P_R = \$50.

   b. Interpret the intercept and slope parameters of the demand function derived in part *a.*

   c. Sketch a graph of the demand function in part *a.* Where does the demand function intersect the quantity-demanded axis? Where does it intersect the price axis?

   d. Using the demand function from part *a*, calculate the quantity demanded when the price of the good is \$1,000 and when the price is \$1,500.

   e. Derive the inverse of the demand function in part *a.* Using the inverse demand function, calculate the demand price for 24,000 units of the good. Give an interpretation of this demand price.

3. The demand curve for good X passes through the point P = \$2 and Q_d = 35. Give two interpretations of this point on the demand curve.

4. Recall that the general demand function for the demand curves in Figure 2.2 is

$$Q_d = 3{,}200 - 10P + 0.05M - 24P_R$$

   Derive the demand function for D_2 in Figure 2.2. Recall that for D_2 income is \$52,000 and the price of the related good is \$200.

5. Using a graph, explain carefully the difference between a movement along a demand curve and a shift in the demand curve.

6. What happens to *demand* when the following changes occur?

   a. The price of the commodity falls.

   b. Income increases and the commodity is normal.

   c. Income increases and the commodity is inferior.

   d. The price of a substitute good increases.

   e. The price of a substitute good decreases.

   f. The price of a complement good increases.

   g. The price of a complement good decreases.

7. Consider the general supply function:

$$Q_s = 60 + 5P - 12P_I + 10F$$

where Q_s = quantity supplied, P = price of the commodity, P_I = price of a key input in the production process, and F = number of firms producing the commodity.

   a. Interpret the slope parameters on P, P_I, and F.

   b. Derive the equation for the supply function when P_I = \$90 and F = 20.

   c. Sketch a graph of the supply function in part *b*. At what price does the supply curve intersect the price axis? Give an interpretation of the price intercept of this supply curve.

   d. Using the supply function from part *b*, calculate the quantity supplied when the price of the commodity is \$300 and \$500.

   e. Derive the inverse of the supply function in part *b*. Using the inverse supply function, calculate the supply price for 680 units of the commodity. Give an interpretation of this supply price.

8. Suppose the supply curve for good X passes through the point P = \$25, Q_s = 500. Give two interpretations of this point on the supply curve.

9. The following general supply function shows the quantity of good X that producers offer for sale (Q_s):

$$Q_s = 19 + 20P_x - 10P_I + 6T - 32P_r - 20P_e + 5F$$

where P_x is the price of X, P_I is the price of labor, T is an index measuring the level of technology, P_r is the price of a good R that is related in production, P_e is the expected future price of good X, and F is the number of firms in the industry.

   a. Determine the equation of the supply curve for X when $P_I = 8$, $T = 4$, $P_r = 4$, $P_e = 5$, and $F = 47$. Plot this supply curve on a graph.

   b. Suppose the price of labor increases from 8 to 9. Find the equation of the new supply curve. Plot the new supply curve on a graph.

   c. Is the good related in production a complement or a substitute in production? Explain.

   d. What is the correct way to interpret each of the coefficients in the general supply function given above?

10. Using a graph, explain carefully the difference between a movement along a supply curve and a shift in the supply curve.

11. Other things remaining the same, what would happen to the *supply* of a particular commodity if the following changes occur?

   a. The price of the commodity decreases.

   b. A technological breakthrough enables the good to be produced at a significantly lower cost.

   c. The prices of inputs used to produce the commodity increase.

   d. The price of a commodity that is a substitute in production decreases.

   e. The managers of firms that produce the good expect the price of the good to rise in the near future.

   f. Firms in the industry purchase more plant and equipment, increasing the productive capacity in the industry.

12. The following table presents the demand and supply schedules for apartments in a small U.S. city:

Monthly rental rate (dollars per month)	Quantity demanded (number of units per month)	Quantity supplied (number of units per month)
$300	130,000	35,000
350	115,000	37,000
400	100,000	41,000
450	80,000	45,000
500	72,000	52,000
550	60,000	60,000
600	55,000	70,000
650	48,000	75,000

a. If the monthly rental rate is $600, excess _____ of _____ apartments per month will occur and rental rates can be expected to _____.

b. If the monthly rental rate is $350, excess _____ of _____ apartments per month will occur and rental rates can be expected to _____.

c. The equilibrium or market clearing rental rate is $_____ per month.

d. The equilibrium number of apartments rented is _____ per month.

13. Suppose that the demand and supply functions for good X are

$$Q_d = 50 - 8P$$
$$Q_s = -17.5 + 10P$$

a. What are the equilibrium price and quantity?

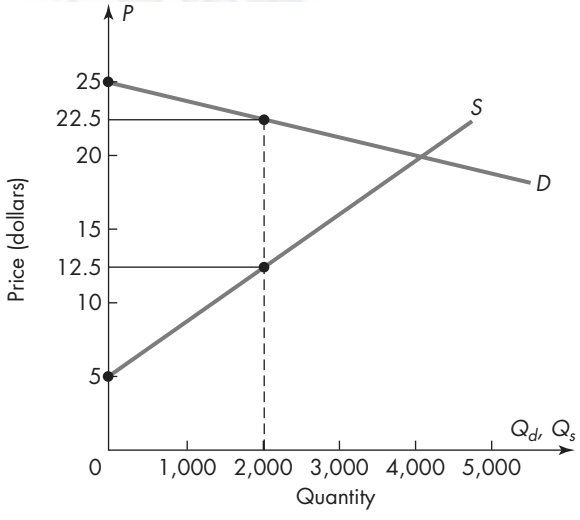
b. What is the market outcome if price is $2.75? What do you expect to happen? Why?

c. What is the market outcome if price is $4.25? What do you expect to happen? Why?

d. What happens to equilibrium price and quantity if the demand function becomes $Q_d = 59 - 8P$?

e. What happens to equilibrium price and quantity if the supply function becomes $Q_s = -40 + 10P$ (demand is $Q_d = 50 - 8P$)?

14. Use the linear demand and supply curves shown below to answer the following questions:



a. The market or equilibrium price is $_____.

b. The economic value of the 2,000th unit is $_____, and the minimum price producers will accept to produce this unit is $_____.

c. When 2,000 units are produced and consumed, total consumer surplus is $_____, and total producer surplus is $_____.

d. At the market price in part *a*, the net gain to consumers when 2,000 units are purchased is $_____.

e. At the market price in part *a*, the net gain to producers when they supply 2,000 units is $_____.

f. The net gain to society when 2,000 units are produced and consumed at the market price is $_____, which is called _____.

g. In market equilibrium, total consumer surplus is $_____, and the total producer surplus is $_____.

h. The net gain to society created by this market is $_____.

15. Determine the effect upon equilibrium price and quantity sold if the following changes occur in a particular market:

a. Consumers' income increases and the good is normal.

b. The price of a substitute good (in consumption) increases.

c. The price of a substitute good (in production) increases.

d. The price of a complement good (in consumption) increases.

e. The price of inputs used to produce the good increases.

f. Consumers expect that the price of the good will increase in the near future.

g. It is widely publicized that consumption of the good is hazardous to health.

h. Cost-reducing technological change takes place in the industry.

16. Suppose that a pair of events from problem 15 occur simultaneously. For each of the pairs of events indicated below, perform a qualitative analysis to predict the direction of change in either the equilibrium price or the equilibrium quantity. Explain why the change in one of these two variables is indeterminate.

a. Both *a* and *h* in problem 15 occur simultaneously.

b. Both *d* and *e* in problem 15 occur simultaneously.

c. Both *d* and *h* in problem 15 occur simultaneously.

d. Both *f* and *c* in problem 15 occur simultaneously.

17. Suppose that the general demand function for good X is

$$Q_d = 60 - 2P_x + 0.01M + 7P_R$$

where

Q_d = quantity of X demanded
P_x = price of X
M = (average) consumer income
P_R = price of a related good R

a. Is good X normal or inferior? Explain.

b. Are goods X and R substitutes or complements? Explain.

Suppose that M = $40,000 and P_R = $20.

c. What is the demand function for good X?

Suppose the supply function is

$$Q_s = -600 + 10P_x$$

d. What are the equilibrium price and quantity?

e. What happens to equilibrium price and quantity if other things remain the same as in part *d* but income increases to $52,000?

f. What happens to equilibrium price and quantity if other things remain the same as in part *d* but the price of good *R* decreases to $14?

g. What happens to equilibrium price and quantity if other things remain the same, income and the price of the related goods are at their original levels, and supply shifts to $Q_s = -360 + 10P_x$?

18. In problem 12, suppose the city council decides rents are too high and imposes a rent ceiling of $400.

a. The ceiling on rent causes a _____ of _____ apartments per month.

b. How many *more* renters would have found an apartment in this city if the ceiling had not been imposed?

Suppose that instead of imposing a ceiling price, the city council places a floor price of $600 on rental rates.

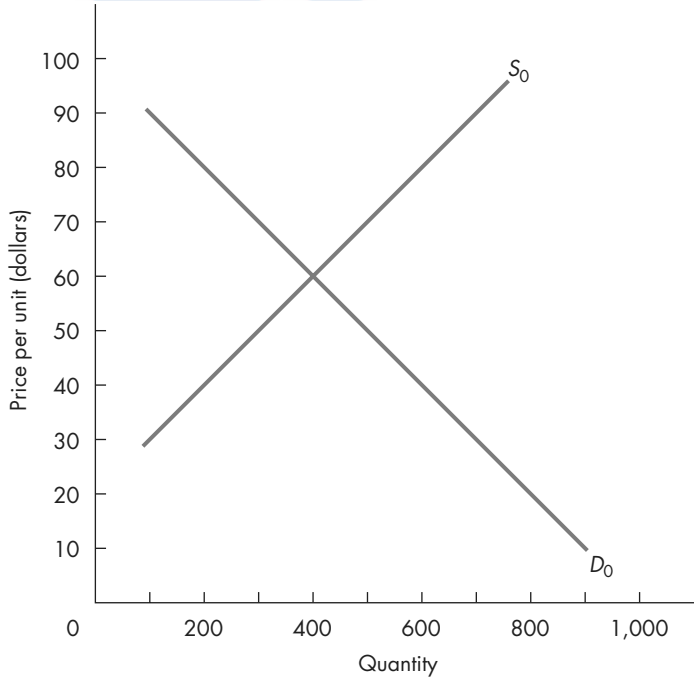
c. The floor price on rent causes a _____ of _____ apartments per month.

19. Use the following graph to answer these questions.

a. What are the equilibrium price and quantity?

b. What is the effect of a ceiling price of $40?

c. What is the effect of a floor price of $50? A floor price of $70?



d. Suppose income increases and consumers are willing and able to buy 100 more units at each price. Construct the new demand curve and label it D_1. What are the new equilibrium price and quantity?

e. Suppose input prices fall and suppliers are willing to offer for sale 200 more units at each price. Construct the new supply curve, and label it S_1. Suppose instead that when input prices fall, supply price falls by $20 for each level of output. Verify that the new supply curve is exactly the same in either case. What are the new equilibrium price and output when the supply and demand curves are D_1 and S_1?

APPLIED PROBLEMS

1. Suppose you are the manager of a California winery. How would you expect the following events to affect the price you receive for a bottle of wine?
   a. The price of comparable French wines decreases.
   b. One hundred new wineries open in California.
   c. The unemployment rate in the United States decreases.
   d. The price of cheese increases.
   e. The price of a glass bottle increases significantly due to new government antishatter regulations.
   f. Researchers discover a new wine-making technology that reduces production costs.
   g. The price of wine vinegar, which is made from the leftover grape mash, increases.
   h. The average age of consumers increases, and older people drink less wine.
2. Florida Citrus Mutual, an agricultural cooperative association for citrus growers in Florida, needs to predict what will happen to the price and output of Florida oranges under the conditions below. What are your predictions? For each part, sketch a graph showing the appropriate demand and supply analysis.
   a. A major freeze destroys a large number of the orange trees in Florida.
   b. The scientists in the agricultural extension service of the University of Florida discover a way to double the number of oranges produced by each orange tree.
   c. The American Medical Association announces that drinking orange juice can reduce the risk of heart attack.
   d. The price of Florida grapefruit falls.
3. Evaluate the following statements using graphical analysis. Provide a brief narrative explanation of your graph to support your evaluation. Make sure the axes and curves in your graphs are properly labeled.
   a. "When demand for home heating oil increases, a shortage of heating oil will occur."
   b. "A decrease in the supply of random access memory (RAM) chips for personal computers causes a shortage of RAM chips."
4. Rising jet fuel prices recently led most major U.S. airlines to raise fares by approximately 15 percent. Explain how this substantial increase in airfares would affect the following:
   a. The demand for air travel.
   b. The demand for hotels.
   c. The demand for rental cars.
   d. The supply of overnight mail.

5. The famous Swedish economist Assar Lindbeck remarked in his book on rent controls, "Rent control appears to be the most efficient technique presently known to destroy a city—except for bombing." Rent controls place price ceilings on rents at levels below equilibrium rental rates for the stated purpose of making housing more affordable for low-income families. Using demand and supply analysis, answer the following questions:
   a. How does imposing rent controls affect the number of housing units available to low-income families?
   b. Under rent controls, can all low-income families get rent-controlled housing?
   c. Who gains from rent controls? Who loses?
   d. Why would Professor Lindbeck think rent controls are destructive?
   e. Can you think of an alternative policy to make plenty of housing available to low-income families that would not be subject to the problems of rent controls?
6. Suppose you are a stock market analyst specializing in the stocks of theme parks, and you are examining Disneyland's stock. *The Wall Street Journal* reports that tourism has slowed down in the United States. At Six Flags Magic Mountain in Valencia, California, a new Viper roller coaster is now operating and another new ride, Psyclone, will be opening this year. Using demand and supply analysis, predict the impact of these events on ticket prices and attendance at Disneyland. As reported in *The Wall Street Journal,* Disneyland slashed ticket prices and admitted that attendance was somewhat lower. Is this consistent with your prediction using demand and supply analysis? In light of the fact that both price and output were falling at Disneyland, is the law of demand being violated in the world of fantasy?
7. California voters, in an attempt to halt the rapid increase in the state's automobile insurance rates, approved Proposition 103. The measure proposes to roll back auto insurance rates by 20 percent and freeze them for at least a year. Using a graph, show the impact of Proposition 103 on the market for automobile insurance in California. As the costs of providing insurance continue to rise, what do you predict will happen over time in the California market for auto insurance? How would your prediction change if Proposition 103 is defeated?
8. Construct a graph showing equilibrium in the market for movie tickets. Label both axes and denote the initial equilibrium price and quantity as P_0 and Q_0. For each of the following events, draw an appropriate new supply or demand curve for movies, and predict the impact of the event on the market price of a movie ticket and the number of tickets sold in the new equilibrium situation:
   a. Movie theaters double the price of soft drinks and popcorn.
   b. A national video rental chain cuts its rental rate by 25 percent.
   c. Cable television begins offering pay-per-view movies.
   d. The screenwriters' guild ends a 10-month strike.
   e. Kodak reduces the price it charges Hollywood producers for motion picture film.
9. An article in *BusinessWeek* reported the discovery of a new processing technology that makes it economically feasible to turn natural gas into a liquid petroleum that yields superclean gasoline, diesel fuel, or any other product derived from crude oil. This discovery represents 770 billion barrels of oil equivalent, "enough to slake the world's thirst for oil for 29 years."
   a. Using demand and supply analysis, explain why this new process will *not* cause a surplus of crude oil. If no surplus is created, then what will be the impact of this process on the market for crude oil?

b. Had this process *not* been discovered, explain why we still would have had "enough" crude oil to meet the growing worldwide demand for crude oil.

10. Firewood prices in places from northern California to Boston and suburban New Jersey have remained steady even though the supply of firewood has been diminished by environmental restrictions on cutting. *The Wall Street Journal* reports that sales of gas fireplaces are outpacing sales of wood-burning hearths and that "people are burning less and less wood." Use supply and demand analysis to show why firewood prices are not rising while the quantity of firewood burned is declining. (*Hint:* Allow for simultaneous shifts in the demand and supply of firewood.)
11. *BusinessWeek* recently declared, "We have entered the Age of the Internet," and observed that when markets for goods or services gain access to the Internet, more consumers and more businesses participate in the market. Use supply and demand analysis to predict the effect of e-commerce on equilibrium output and equilibrium price of products gaining a presence on the Internet.
12. The world market for newly smelted primary aluminum (i.e., excluding scrap or recycled sources) recently experienced a period of rising inventories and falling prices. *The Wall Street Journal* reported that Russian smelter Rusal, the world's largest aluminum producer, expected primary aluminum ingot prices would need to fall even further before worldwide inventory accumulation could stabilize. Suppose the demand for primary aluminum can be represented by the equation $Q_d = 124 - 0.025\,P$ (Q_d is the annual worldwide quantity demanded in millions of metric tons of new aluminum, P is the dollar price of new aluminum per ton). Further suppose the world supply of aluminum is $Q_s = -50 + 0.025\,P$ (Q_s is the annual worldwide quantity supplied in millions of metric tons of new aluminum, P is the dollar price of new aluminum per ton).
    a. At the time of Rusal's concern, primary aluminum prices were relatively high at $3,600 per ton. At this price, calculate the *monthly* rate of inventory growth in the global aluminum market using the given demand and supply equations for the world aluminum market.
    b. Rusal believed the price of aluminum would fall because of the growing accumulation of inventories worldwide. Evaluate Rusal's prediction by using the demand and supply equations provided to make a prediction about the movement of world aluminum price.