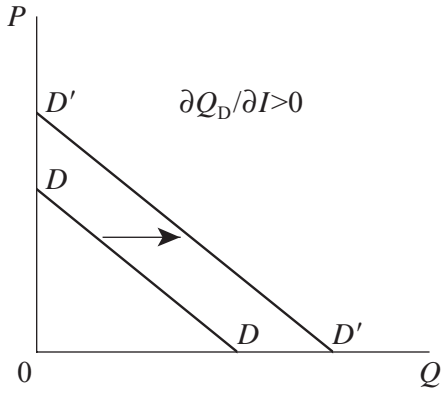

FIGURE 3.6 An increase in demand resulting from an increase in money income.

TASTES OR PREFERENCES (T)

Another determinant of market demand is individuals' tastes, or preferences, for a particular product. After seeing a McDonald's television commercial, for example, one person might be compelled to purchase an increased quantity of hamburgers, even though the price of hamburgers had not fallen or his income had remained the same. This increased demand for hamburgers would be represented as a rightward shift in the demand curve. Similarly, if after reading an article in the *New York Times* about the health dangers associated with diets high in animal fat and salt, the same person might decide to cut down on his intake of hamburgers, which would be shown as a left-shift in his demand curve for hamburgers. The effect of an increase in taste is similar to that depicted for an increase in income in Figure 3.6.

PRICES OF RELATED GOODS: SUBSTITUTES (P_s) AND COMPLEMENTS (P_c)

The prices of related goods can also affect the demand for a particular good or service. Related goods are generally classified as either substitute goods or complementary goods.

Substitutes are goods that consumers consider to be closely related. As the price of good X rises, the quantity demanded of that good will fall according to the law of demand. If good Y is a substitute for good X, the demand for good Y will rise as the consumer substitutes into it. The willingness of the consumer to substitute one good for another varies from good to good and is rarely an either/or proposition. For example, although not perfect substitutes for most consumers, Coca-Cola and Pepsi-Cola might be classified as "close" substitutes. Other examples of goods that may

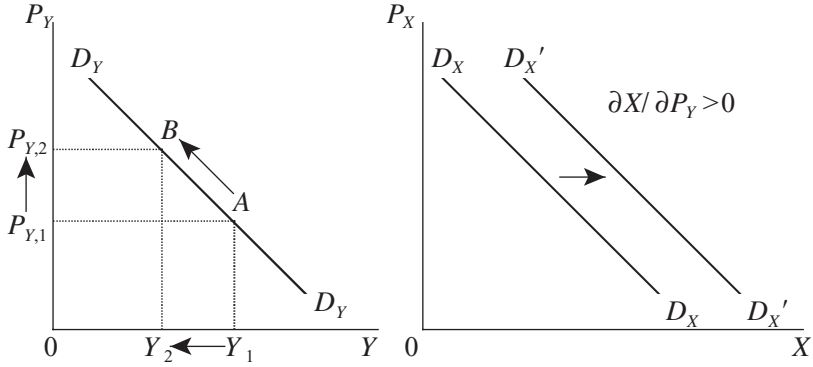

FIGURE 3.7 An increase in demand resulting from a decrease in the price of a substitute good.

be classified as substitutes are oleomargarine and butter, coffee and tea, and beer and ale.

If goods X and Y are substitutes, then we would expect that as the price of Y rises the quantity demanded of Y falls, and the demand for X, other things remaining constant (including the price of X, income, etc.) increase. This interrelationship is illustrated in Figure 3.7.

Note that in Figure 3.7 as the price of good Y rises from $P_{Y,1}$ to $P_{Y,2}$ the quantity demanded of good Y falls from Y_1 to Y_2 (a movement along the D_YD_Y curve from point A to point B), resulting in an increase in the demand for good X. This is illustrated by a right-shift in the demand function for X from D_XD_X to $D_X'D_X'$. Analogously, a fall in the price of product Y, say from $P_{Y,2}$ to $P_{Y,1}$, would result in an increase in the quantity demanded of good Y, or a movement along the demand curve from point B to point A, would result in a left-shift of the demand curve for good X (not shown in Figure 3.7).

Complements are products that are normally consumed together. Examples of such product pairs include corned beef and cabbage, tea and lemon, coffee and cream, peanut butter and jelly, tennis rackets and tennis balls, ski boots and skis, and kites and kite string.

If goods X and Y are complements, we would expect that as the price of good Y falls and the quantity demanded of good Y increases, we will also witness an increase in the demand for good X. In Figure 3.8 as the price of Y falls from $P_{Y,1}$ to $P_{Y,2}$ the quantity demanded of good Y increases from Y_1 to Y_2 (a movement along the D_YD_Y curve from point A to point B). The lower price of good Y, say for kites, not only results in an increase in the quantity demanded of kites, but also results in an increase in the demand for good X, kite string. This increase in the demand for good X is shown as a right-shift in the entire demand function for good X. Similarly, an increase

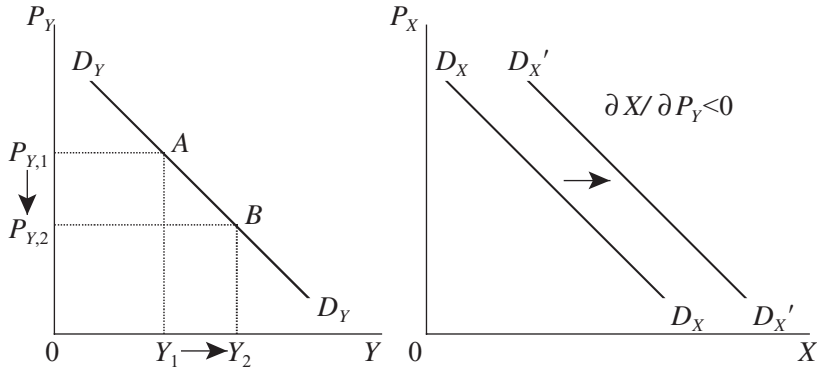

FIGURE 3.8 An increase in demand resulting from a decrease in the price of a complementary good.

in the price of good Y not only would result in a decline in the quantity demanded of good Y, but also would result in a fall in the demand for good X, which is illustrated as left-shift in the demand function for good X.

PRICE EXPECTATIONS (P_e)

If we expect that the price of a good or service will be lower in the future, the demand for that product will be lower today, resulting in a left-shift of today's demand function. Conversely, if we expect the price to be higher tomorrow, the demand will be greater today, resulting in a right-shift in the demand function.

POPULATION (N)

As we discussed earlier, the market demand curve for a good or a service is the horizontal summation of demand curves of individuals that make up the market. Changes in the number of consumers in the market, perhaps because of an increase in the general population, will result in changes in demand. An increase in population, perhaps because of immigration, increased birthrates, or demographic changes, likely will cause an increase in the demand for a product, which will be illustrated diagrammatically as a right-shift in the demand curve. Similarly, a decrease in population will likely cause a decrease in the demand for a product, which will be illustrated diagrammatically as a left-shift in the demand curve.

The relationship between the demand for a good and service and the set of determinants just discussed may be expressed as

$$Q_D = f(P, I, T, P_s, P_c, P_e, N) \tag{3.6}$$

TABLE 3.1 Impacts on Demand Arising from Changes in Demand Determinants

Determinant	Change	Demand shift
Income		
Normal good, I	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Inferior good, I	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Tastes or preferences, T	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Price of substitutes, P_s	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Price of complements, P_c	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Price expectations, P_e	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Population, N	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$

where $\partial Q_D/\partial P < 0, \partial Q_D/\partial I > 0, \partial Q_D/\partial T > 0, \partial Q_D/\partial P_s > 0, \partial Q_D/\partial P_c < 0, \partial Q_D/\partial P_e > 0$, and $\partial Q_D/\partial N > 0$. The diagrammatic effects of changes in determinants on the demand curve are summarized in Table 3.1.

OTHER DEMAND DETERMINANTS

We have mentioned only a very few of the possible factors that will influence the demand for a product. Other demand determinants might include income expectations, changes in interest rates, changes in foreign exchange rates, and the impact of wealth effects. In actual demand analysis, an in-depth familiarity with specific market conditions will usually help one to identify the relevant demand determinants that need to be considered in analyzing market behavior.

THE MARKET DEMAND EQUATION

The functional relationship summarized in Equation (3.6) suggests only that a relationship exists between Q_D and a collection of hypothesized explanatory variables. While such an expression of causality is useful, it says nothing about the specific functional relationship, nor does it say anything about the magnitude of the interrelationships. To quantify the hypothesized relationship in Equation (3.6), it is necessary to specify a functional form. Using the techniques discussed in Green (1997), Gujarati (1995), and

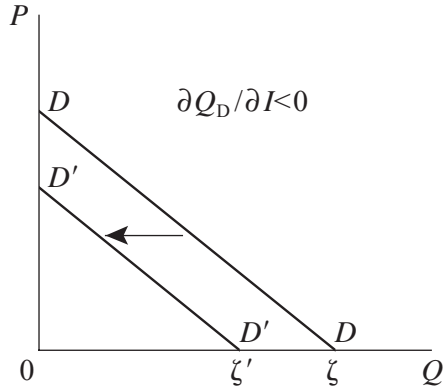

FIGURE 3.9 A decline in consumer income that results in a lower value for the horizontal intercept of a linear demand equation.

Ramanathan (1998), we may proceed to estimate the values of the coefficients. As indicated earlier, the most commonly used functional form is the linear equation. We might, therefore, express Equation (3.6) as

$$Q_D = b_0 + b_1P + b_2I + b_3P_s + b_4P_c + b_5P_e + b_6N \tag{3.7}$$

where

$$b_1 < 0, b_2 > 0, b_3 > 0, b_4 < 0, b_5 > 0, b_6 > 0$$

The coefficients b_i are the first partial derivatives of the demand function. They indicate how Q_D will change from a one unit change in the value of the independent variables. For many purposes, it is useful to concentrate only on the relationship between quantity demanded and the price of the commodity under consideration while holding the other variables constant. Equation (3.7) may be rewritten as

$$Q_D = \zeta + b_1P \tag{3.8}$$

where

$$\zeta = b_0 + b_2I_0 + b_3P_{s,0} + b_4P_{c,0} + b_5P_{e,0} + b_6N_0$$

It should be clear from Equation (3.8) and the discussion thus far that a change in P will result in a change in the quantity demanded and, thus, a movement along the curve labeled DD. On the other hand, a change in any of the demand determinants will result in a change in the value of the horizontal intercept (ζ) resulting in a change in demand and a shift in the entire demand curve. For example, a decline in consumers income will result in a decline in the value of ζ to ζ', resulting in a left-shift of the demand function from DD to $D'D'$. Consider Figure 3.9.

Problem 3.3. The demand equation for a popular brand of fruit drink is given by the equation

$$Q_x = 10 - 5P_x + 0.001I + 10P_y$$

where Q_x = monthly consumption per family in gallons
P_x = price per gallon of the fruit drink = \$2.00
I = median annual family income = \$20,000
P_y = price per gallon of a competing brand of fruit drink = \$2.50

a. Interpret the parameter estimates.
b. At the stated values of the explanatory variables, calculate the monthly consumption (in gallons) of the fruit drink.
c. Rewrite the demand equation in a form similar to Equation (3.8).
d. Suppose that median annual family income increased to \$30,000. How does this change your answer to part b?

Solution

a. According to our demand equation in Q_x, a \$1 increase in the price of the fruit drink will result in a 5-gallon decline in monthly consumption of fruit drink per family. A \$1,000 increase in median annual family income will result in a 1-gallon increase in monthly consumption of fruit drink per family. Finally, a \$1 increase in the price of the competing brand of fruit drink will result in a 10-gallon increase in monthly consumption of the fruit drink per family. In other words, the two brands of fruit drink are substitutes.
b. Substituting the stated values into the demand equation yields

$$Q_x = 10 - 5(2.00) + 0.001(20,000) + 10(2.50) = 45 \text{ gallons}$$

c. $Q_x = 55 - 5P_x$
d. $Q_x = 10 - 5(2.00) + 0.001(30{,}000) + 10(2.50) = 55$ gallons

MARKET DEMAND VERSUS FIRM DEMAND

While the discussion thus far has focused on the market demand curve, it is, in fact, the demand curve facing the individual firm that is of most interest to the manager who is formulating price and output decisions. In the case of a monopolist, when firm output constitutes the output of the industry, the market demand curve is identical to the demand curve faced by the firm. Consequently, the firm will bear the entire impact of changes in such demand determinants as incomes, tastes, and the prices of related goods. Similarly, the pricing policies of the monopolist will directly affect the consumer's decisions to purchase the firm's output.

In most cases, however, the firm supplies only a small portion of the total output of the industry. Thus, the firm's demand curve is not identical to that

of the market as a whole. One major difference between firm and market demand may be the existence of additional demand determinants, such as pricing decisions made by the firm's competitors. Another important difference is that the quantitative impact of changes in such determinants as taste, income, and prices of related goods will be smaller because of the firm's smaller share of the total market supply. It is the demand function faced by the individual firm that is of primary concern in managerial economics.

THE LAW OF SUPPLY

While we have discussed some of the conditions under which consumers are willing, and able, to purchase quantities of a particular good or service, we have yet to say anything about the willingness of producers to produce those very same goods and services. Once we have addressed this matter, we will be in a position to give form and substance to the elusive concept of "the market."

Definition: The law of supply asserts that quantity supplied of a good or service is directly (positively) related to the selling price, *ceteris paribus*.

As we will see in later chapters on production and cost, under certain conditions, including short-run production, the hypothesis of a profit maximization, and perfect competition in resource markets, the law of supply is based on the law of diminishing marginal returns (sometimes called the law of diminishing marginal product). In fact, as we will see later, the supply curve of an individual firm is simply a portion of the firm's marginal cost curve, which at some point rises in response to the law of diminishing returns.

The law of diminishing returns is not an economic relationship but a technological relationship that is empirically consistent. In fact, the law of diminishing marginal returns may be the only true law in economics. The law of diminishing marginal returns in fact makes the law of supply a stronger relationship than the "law" of demand. With that, consider the following hypothetical market supply function.

Symbolically, the law of supply may be summarized as follows:

$$Q_S = g(P) \tag{3.9a}$$

and

$$\frac{dQ_S}{dP} > 0 \tag{3.9b}$$

Equation (3.9a) states that the quantity supplied Q_S of a good or service is functionally related to the selling price P. Inequality (3.9b) asserts that

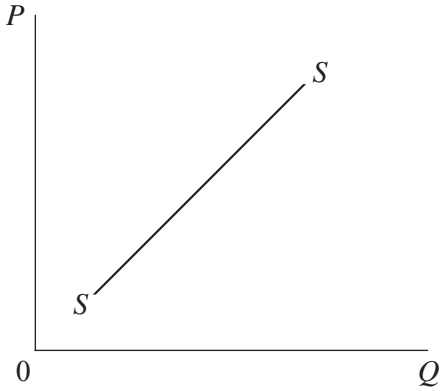

FIGURE 3.10 The supply curve.

quantity supplied of a product and its price are directly related. This relationship is illustrated in Figure 3.10. The upward-sloping *supply curve* illustrates the positive relationship between the quantity demanded of a good or service and its selling price. The market supply curve shows the various amounts of a good or service that profit-maximizing firms are willing to supply at each price. As with the market demand curve, the market supply curve is also the horizontal summation of the individual firms' supply curves. Unlike the earlier discussion of the market demand schedule as the horizontal summation of the individual consumer demand schedules, an investigation of the supply schedule for an individual firm will be deferred.

The market supply curve establishes a relationship between price and quantity supplied. Changes in the price and the quantity supplied of a good or service are represented diagrammatically as a movement along the supply curve. Changes in supply determinants are illustrated as a shift in the entire supply curve.

DETERMINANTS OF MARKET SUPPLY

Of course, the market price of a good or service is not the only factor that influences a firm's decision to alter the quantity supplied of a particular good or service. To get a "feel" for whether a firm will increase or decrease the quantity supplied of a particular good or service (assuming the product's price is given) in response to a particular supply-side stimulus, let us assume that the firms that make up the supply side of the market are "profit maximizers." Total profit is defined as

$$\pi(Q) = TR(Q) - TC(Q) \tag{3.10}$$

where π is total profit, TR is total revenue, and TC is the total cost, which are defined as functions of total output Q. Moreover, total revenue may be

expressed as the product of the selling price of the product times the quantity sold.

$$TR = PQ \tag{3.11}$$

Total cost, on the other hand, is assumed to be an increasing function of a firm's output level, which is a function of the productive resources used in its production. Equation (3.12) expresses total cost as a function of labor and capital inputs.

$$TC = h(Q) = h[k(L,K)] = l(L,K) \tag{3.12}$$

If the firm purchases productive resources in a perfectly competitive factors market, the total cost function might be expressed as

$$\begin{aligned} TC &= TFC + TVC \\ &= TFC + P_L L + P_K K \end{aligned} \tag{3.13}$$

where TFC represents total fixed cost (a constant), P_L is the price of labor, which is determined exogenously, L the units of labor employed, P_K is the rental price of capital, also determined exogenously, and K the units of capital employed. Fixed costs represent the cost of factors of production that cannot be easily varied in the short run. Rental payments for office space as specified for the term of a lease represent a fixed cost.

Equation (3.13) indicates that as a firm's output level expands, the costs associated with higher output levels increase. In general, let us say that the change in any factor that causes a firm's profit to increase will result in a decision to increase the quantity the firm supplies to the market, other things remaining the same. Conversely, any change that causes a decline in profits will result in a decline in quantity supplied, other things remaining the same. We have already seen that an increase in product price, which increases total revenue, will result in an increase in the quantity supplied, or a movement to the right and along the supply function. Now let's consider other supply side determinants.

PRICES OF PRODUCTIVE INPUTS (P_L)

By the logic just set forth, a drop in the price of a resource used to produce a product will reduce the total cost of production. If the selling price of the product is parametric, the decrease in the price of resources will result in an increase in the firm's profits, resulting in a right-shift of the supply function. Conversely, a rise in input prices, which increases total cost and reduces profit, at a given price, will result in a left-shift in the supply function. The relationship between supply and a decline in the price of a resource is illustrated in Figure 3.11.

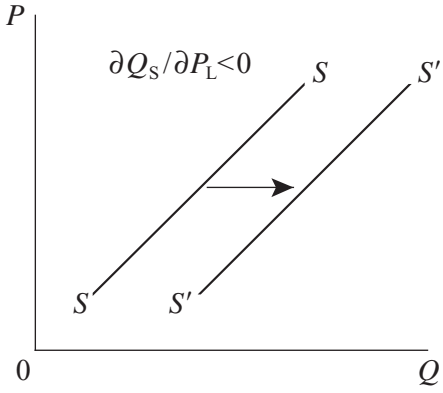

FIGURE 3.11 An increase in supply resulting from a decrease in factor prices.

TECHNOLOGY (*E*)

Advances in methods of management or production imply increases in productive efficiency. Increased efficiency means that either more output can be obtained from some given level of inputs, or some given level of output can be obtained using fewer inputs. In either case, improvements in the managerial or technological arts imply lower total costs of production, other things remaining the same, which implies increased profits, and, therefore, a right-shift in the entire supply schedule.

TAXES AND SUBSIDIES (*R*)

An increase in taxes levied on a firm's operations translates to an increase in the total cost of production, which implies a reduction in profits, other things remaining the same. The result would be a reduction in supply, or a left-shift in the supply curve. Conversely, a reduction in taxes, which is analytically equivalent to, say, a government subsidy, improves the firm's profits, thereby resulting in a right-shift in the supply schedule (an increase in supply).

PRICES OF RELATED GOODS: SUBSTITUTES (P_s) AND COMPLEMENTS (P_c)

The prices of related goods can also affect the supply of a particular good or service. As in the case of demand, these related goods are generally classified as either substitute goods or complementary goods.

Substitutes are goods that may be produced using the same (fixed) production facilities. Suppose, for example, that land can be used to grow wheat or corn. An increase in the price of corn would cause farmers to devote

more land to the production of corn and less to the production of wheat. Thus, even though the price of wheat may have initially remained unchanged, the increase in the price of corn causes a reduction in the supply of wheat.

Complements are goods that are produced together. Beef and cowhide leather, for example, are complements in production. An increase in the price of beef will cause an increase in the quantity supplied of beef, which may also result in an increase in the supply of cowhide leather, even though the price of cowhide leather initially remained unchanged.

PRICE EXPECTATIONS (P_e)

If firm owners expect an increase in the product's selling price, they can be expected to withhold some output from the market, thereby building up inventories, for later sale at the anticipated higher price. Notice that this would probably result in a reduction in total revenues, and profits, today in favor of expected higher profits tomorrow. This would result in a reduction in supply, or a left-shift in the supply curve. Conversely, firm owners who anticipate a decline in selling prices can be expected to draw down inventories below what are considered optimal levels for sale today, thereby causing the supply curve to shift to the right.

NUMBER OF FIRMS IN THE INDUSTRY (F)

Other things being equal, including the selling price of a given product, an influx of firms into an industry will result in an increase in total supply. The result would be a right-shift in the supply function. Conversely, if firms exit the industry, the supply curve would be expected to shift to the left.

The relationship between the supply of a good and service and the set of supply determinants discussed thus far may be expressed as

$$Q_S = f(P, P_L, E, R, P_s, P_c, P_e, F) \tag{3.14}$$

where $\partial Q_S/\partial P > 0, \partial Q_S/\partial P_L < 0, \partial Q_S/\partial E > 0, \partial Q_S/\partial R < 0, \partial Q_S/\partial P_s < 0, \partial Q_S/\partial P_c > 0, \partial Q_S/\partial P_e < 0$, and $\partial Q_S/\partial F > 0$. The effects of changes in these supply determinants on the curve are summarized in Table 3.2.

Remember that a change in the quantity supplied of a good or service refers to the relationship between changes in the price of the good or service in question and changes in the quantity supplied. This is illustrated diagrammatically as a movement along the supply curve. A change in supply, on the other hand, refers to the relationship between changes in any other supply determinant, such as factor prices and production technology, which is shown diagrammatically shift in the entire supply curve.

TABLE 3.2 Impacts on Supply Arising from Changes in Supply Determinants

Determinant	Change	Supply shift
Resource prices, P_L	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Technology, E	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Taxes and subsidies, R	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Price of substitutes, P_s	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Price of complements, P_c	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$
Price expectations, P_e	$\Delta\uparrow$	$\leftarrow$
	$\Delta\downarrow$	$\rightarrow$
Number of firms, F	$\Delta\uparrow$	$\rightarrow$
	$\Delta\downarrow$	$\leftarrow$

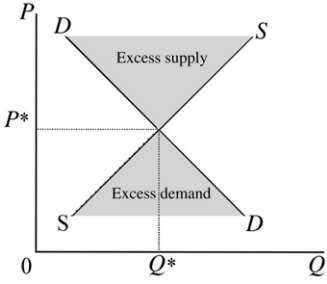

FIGURE 3.12 Market equilibrium.

THE MARKET MECHANISM: THE INTERACTION OF DEMAND AND SUPPLY

We can now use the concepts of demand and supply to explain the functioning of the market mechanism. Consider Figure 3.12, which brings together the market demand and supply curves. In our hypothetical market, the market equilibrium price is P^*. At that price, the quantity of a good or service that buyers are able and willing to buy is precisely equal to Q^*, the amount that firms are willing to supply. At a price below P^*, the quantity demanded exceeds the quantity supplied. In this situation, consumers will bid among themselves for the available supply of Q, which will drive up the selling price. Buyers who are unable or unwilling to pay the higher price will drop out of the bidding process. At the higher price, profit-maximizing producers will increase the quantity supplied. As long as the selling price is