Like the weather, markets are dynamic, subject to periods of storm and calm, and constantly evolving. Yet, as with weather forecasting, a careful study of markets will reveal certain forces underlying the apparently random movements. To forecast prices and outputs in individual markets, you must first master the analysis of supply and demand.

Take the example of gasoline prices, illustrated in Figure 3-1 on page 47. (This graph shows the "real gasoline price," or the price corrected for movements in the general price level.) Demand for gasoline and other oil products rose sharply after World War II as people fell in love with the automobile and moved increasingly to the suburbs. Next, in the 1970s, supply restrictions, wars among producers, and political revolutions reduced production, with the consequent price spikes seen after 1973 and 1979. In the years that followed, a combination of energy conservation, smaller cars, the growth of the information economy, and expanded production around the world led to falling oil prices. The real price of gasoline fell from over \$2.50 per gallon in 1980 to around \$1.00 per gallon in 1999. The most recent turn came when production cutbacks by the oil cartel and booming demand led to a sharp spike in oil prices in early 2000, angering truckers and motorists and putting upward pressure on inflation.

> What lay behind these dramatic shifts? Economics has a very powerful tool for explaining such changes in the economic environment. It is called the theory of supply and demand. This theory shows how consumer preferences determine consumer demand for commodities, while business costs are the foundation of the supply of commodities. The increases in the price of gasoline occurred either because the demand for gasoline had increased or because the supply of oil had decreased. The same is true for every market, from Internet stocks to diamonds to land: changes in supply and demand drive changes in output and prices. If you understand how supply and demand work, you have gone a long way toward understanding a market economy.

This chapter introduces the notions of supply and demand and shows how they operate in competitive markets for *individual commodities*. We begin with demand curves and then discuss supply curves. Using these basic tools, we will see how the market price is determined where these two curves intersect—where the forces of demand and supply are just in balance. It is the movement of prices—the price mechanism—which brings supply and demand into balance or equilibrium. This chapter closes with some examples of how supplyand-demand analysis can be applied.

CHAPTER 3

Basic Elements of Supply and Demand

What is a cynic? A man who knows the price of everything and the value of nothing.

Oscar Wilde

THE DEMAND SCHEDULE



FIGURE 3-1. Gasoline Prices Move with Demand and Supply Changes

Gasoline prices have fluctuated wildly over the last four decades. Supply reductions in the 1970s produced two dramatic "oil shocks," which provoked social unrest and calls for increased regulation. Reductions in demand from new energy-saving technologies led to the long decline in price after 1980. When the oil cartel reduced supply in late 1999, oil prices once again shot up sharply. The tools of supply and demand are crucial for understanding these trends. (Source: U.S. Departments of Energy and Labor. The price of gasoline has been converted into 2000 prices using the consumer price index.)

# A. THE DEMAND SCHEDULE

Both common sense and careful scientific observation show that the amount of a commodity people buy depends on its price. The higher the price of an article, other things held constant,<sup>1</sup> the fewer units consumers are willing to buy. The lower its market price, the more units of it are bought. There exists a definite relationship between the market price of a good and the quantity demanded of that good, other things held constant. This relationship between price and quantity bought is called the **demand schedule**, or the **demand curve**.

Let's look at a simple example. Table 3-1 presents a hypothetical demand schedule for cornflakes. At each price, we can determine the quantity of cornflakes that consumers purchase. For example, at \$5 per box, consumers will buy 9 million boxes per year.

At a lower price, more cornflakes are bought. Thus, at a price of \$4, the quantity bought is 10 million boxes. At yet a lower price (P) equal to \$3, the quantity demanded (Q) is still greater, at 12 million. And so forth. We can determine the quantity demanded at each listed price in Table 3-1.

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<sup>&</sup>lt;sup>1</sup> Later in this chapter we discuss the other factors that influence demand, including income and tastes. The term "other things held constant" simply means we are varying the price without changing any of these other determinants of demand.

#### CHAPTER 3 🚸 BASIC ELEMENTS OF SUPPLY AND DEMAND

| Demand Schedule for Cornflakes |  |    |  |
|--------------------------------|--|----|--|
|                                | (1) (2)                                  |    |  |
|                                | Price Quantity demanded                  |    |  |
|                                | (\$ per box) (millions of boxes per year |    |  |
|                                | Р  | Q  |  |
| А                              | 5  | 9  |  |
| В                              | 4  | 10 |  |
| С                              | 3  | 12 |  |
| D                              | 2  | 15 |  |
| Е                              | 1  | 20 |  |

**TABLE 3-1.** The Demand Schedule Relates Quantity Demanded to Price

At each market price, consumers will want to buy a certain quantity of cornflakes. As the price of cornflakes falls, the quantity of cornflakes demanded will rise.

## THE DEMAND CURVE

The graphical representation of the demand schedule is the *demand curve*. We show the demand curve in Figure 3-2, which graphs the quantity of cornflakes demanded on the horizontal axis and the price of cornflakes on the vertical axis. Note that quantity and price are inversely related; that is, *Q* goes up when *P* goes down. The curve slopes downward, going from northwest to southeast. This important property is called the *law of downward-sloping demand*. It is based on common sense as well as economic theory and has been empirically tested and verified for practically all commodities—cornflakes, gasoline, college education, and illegal drugs being a few examples.

Law of downward-sloping demand: When the price of a commodity is raised (and other things are held constant), buyers tend to buy less of the commodity. Similarly, when the price is lowered, other things being constant, quantity demanded increases.

Quantity demanded tends to fall as price rises for two reasons. First is the **substitution effect**. When the price of a good rises, I will substitute other similar goods for it (as the price of beef rises, I eat more chicken). A second reason why a higher price reduces quantity demanded is the **income effect**. This comes into play because when a price goes up, I find myself somewhat poorer than I was before. If gaso-



FIGURE 3-2. A Downward-Sloping Demand Curve Relates Quantity Demanded to Price

In the demand curve for cornflakes, price (P) is measured on the vertical axis while quantity demanded (Q) is measured on the horizontal axis. Each pair of (P, Q) numbers from Table 3-1 is plotted as a point, and then a smooth curve is passed through the points to give us a demand curve, *DD*. The negative slope of the demand curve illustrates the law of downward-sloping demand.

line prices double, I have in effect less real income, so I will naturally curb my consumption of gasoline and other goods.

## Market Demand

Our discussion of demand has so far referred to "the" demand curve. But whose demand is it? Mine? Yours? Everybody's? The fundamental building block for demand is individual preferences. However, in this chapter we will always focus on the *market demand*, which represents the sum total of all individual demands. The market demand is what is observable in the real world.

The market demand curve is found by adding together the quantities demanded by all individuals at each price.

Does the market demand curve obey the law of downward-sloping demand? It certainly does. If prices drop, for example, the lower prices attract new

## THE DEMAND CURVE

customers through the substitution effect. In addition, a price reduction will induce extra purchases of goods by existing consumers through both the income and the substitution effects. Conversely, a rise in the price of a good will cause some of us to buy less.

# The explosive growth in computer demand

We can illustrate the law of downward-sloping demand for the case of personal computers (PCs). The prices of the first PCs were high, and their computing power was relatively modest. They were found in few businesses and even fewer homes. It is hard to believe that just 20 years ago students wrote most of their papers in longhand and did most calculations by hand or with simple calculators.

But the prices of computing power fell sharply over the last two decades. As the prices fell, new buyers were enticed to buy their first computers. PCs came to be widely used for work, for school, and for fun. In the late 1990s, as the value of computers increased with the development of the Internet, yet more people jumped on the computer bandwagon. Worldwide, PC sales totaled about 100 million in 1999.

Figure 3-3 shows the prices and quantities of computers and peripheral equipment in the United States as calculated by government statisticians. The prices reflect the cost of purchasing computers with constant quality that is, they take into account the rapid quality change of the average computer purchased. You can see how falling prices along with improved software, increased utility of the Internet and e-mail, and other factors have led to an explosive growth in computer output.

## Forces behind the Demand Curve

What determines the market demand curve for cornflakes or gasoline or computers? A whole array of factors influences how much will be demanded at a given price: average levels of income, the size of the population, the prices and availability of related goods, individual and social tastes, and special influences.

• The *average income* of consumers is a key determinant of demand. As people's incomes rise, individuals tend to buy more of almost everything, even if prices don't change. Automobile purchases tend to rise sharply with higher levels of income.

- The *size of the market*—measured, say, by the population—clearly affects the market demand curve. California's 32 million people tend to buy 32 times more apples and cars than do Rhode Island's 1 million people.
- The prices and availability of *related goods* influence the demand for a commodity. A particularly important connection exists among substitute goods—ones that tend to perform the same function, such as cornflakes and oatmeal, pens and pencils, small cars and large cars, or oil and natural gas. Demand for good A tends to be low if the price of substitute product B is low. (For example, if the price of computers falls, will that increase or decrease the demand for typewriters?)
- In addition to these objective elements, there is a set of subjective elements called *tastes* or *preferences*. Tastes represent a variety of cultural and historical influences. They may reflect genuine psychological or physiological needs (for liquids, love, or excitement). And they may include artificially contrived cravings (for cigarettes, drugs, or fancy sports cars). They may also contain a large element of tradition or religion (eating beef is popular in America but taboo in India, while curried jellyfish is a delicacy in Japan but would make many Americans gag).
- Finally, *special influences* will affect the demand for particular goods. The demand for umbrellas is high in rainy Seattle but low in sunny Phoenix; the demand for air conditioners will rise in hot weather; the demand for automobiles will be low in New York, where public transportation is plentiful and parking is a nightmare. In addition, expectations about future economic conditions, particularly prices, may have an important impact on demand.

The determinants of demand are summarized in Table 3-2, which uses automobiles as an example.

## Shifts in Demand

As economic life evolves, demand changes incessantly. Demand curves sit still only in textbooks.

## CHAPTER 3 🔅 BASIC ELEMENTS OF SUPPLY AND DEMAND



**FIGURE 3-3.** Declining Computer Prices Have Fueled an Explosive Growth in Computer Power

The prices of computers and peripheral devices such as printers are measured in terms of the cost of purchasing a given bundle of characteristics (such as memory or speed of calculations). The price of computer power has fallen more than a hundred-fold since 1972. Falling prices along with higher incomes and a growing variety of uses has led to a 5000-fold growth in the quantity of computers produced. (Source: Department of Commerce estimates of real output and prices. Note that the data are plotted on ratio scales.)

| Factors affecting the demand curve | Example for automobiles   |
|------------------------------------|---|
| 1. Average income                  | As incomes rise, people increase car purchases.   |
| 2. Population                      | A growth in population increases car purchases.   |
| 3. Prices of related goods         | Lower gasoline prices raise the demand for cars.  |
| 4. Tastes                          | Having a new car becomes a status symbol.   |
| 5. Special influences              | Special influences include availability of alternative forms of transportation, safety of automobiles, expectations of future price increases, etc. |

 TABLE 3-2. Many Factors Affect the Demand Curve

### THE DEMAND CURVE

Why does the demand curve shift? Because influences other than the good's price change. Let's work through an example of how a change in a nonprice variable shifts the demand curve. We know that the average income of Americans rose sharply during the long economic boom of the 1990s. Because there is a powerful income effect on the demand for automobiles, this means that the quantity of automobiles demanded at each price will rise. For example, if average incomes rose by 10 percent, the quantity demanded at a price of \$10,000 might rise from 10 million to 12 million units. This would be a shift in the demand curve because the increase in quantity demanded reflects factors other than the good's own price.

The net effect of the changes in underlying influences is what we call an *increase in demand*. An increase in the demand for automobiles is illustrated in Figure 3-4 as a rightward shift in the demand curve. Note that the shift means that more cars will be bought at every price.





As elements underlying demand change, the demand for automobiles is affected. Here we see the effect of rising average income, increased population, and lower gasoline prices on the demand for automobiles. We call this shift in the demand curve an increase in demand. You can test yourself by answering the following questions: Will a warm winter shift the demand curve for heating oil leftward or rightward? Why? What will happen to the demand for baseball tickets if young people lose interest in baseball and watch basketball instead? What will a sharp fall in the price of personal computers do to the demand for typewriters? What happens to the demand for a college education if wages are falling for bluecollar jobs while salaries for college-educated investment bankers and computer scientists are rising rapidly?

When there are changes in factors other than a good's own price which affect the quantity purchased, we call these changes shifts in demand. Demand increases (or decreases) when the quantity demanded at each price increases (or decreases).

## Movements along curves versus shifts of curves

Do not confuse movement along curves with shift of curves. Great care must be taken not to confuse a change in demand (which denotes a shift of the demand curve) with a change in the quantity demanded (which means moving to a different point on the same demand curve after a price change).

A change in demand occurs when one of the elements underlying the demand curve shifts. Take the case of pizzas. As incomes increase, consumers will want to buy more pizzas even if pizza prices do not change. In other words, higher incomes will increase demand and shift the demand curve for pizzas out and to the right. This is a shift in the demand for pizzas.

Distinguish this from a change in quantity demanded that occurs because consumers tend to buy more pizzas as pizza prices fall, all other things remaining constant. Here, the increased purchases result not from an increase in demand but from the price decrease. This change represents a *movement along* the demand curve, not a *shift of* the demand curve. A movement along the demand curve means that other things were held constant when price changed.

# B. THE SUPPLY SCHEDULE

Let us now turn from demand to supply. The supply side of a market typically involves the terms on which businesses produce and sell their products. The supply of tomatoes tells us the quantity of tomatoes that will be sold at each tomato price. More precisely, the supply schedule relates the quantity supplied of a good to its market price, other things constant. In considering supply, the other things that are held constant include costs of production, prices of related goods, and government policies.

The **supply schedule** (or **supply curve**) for a commodity shows the relationship between its market price and the amount of that commodity that producers are willing to produce and sell other things held constant.

## THE SUPPLY CURVE

Table 3-3 shows a hypothetical supply schedule for cornflakes, and Figure 3-5 plots the data from the table in the form of a supply curve. These data show that at a cornflakes price of \$1 per box, no cornflakes at all will be produced. At such a low price, breakfast cereal manufacturers might want to devote their factories to producing other types of cereal, like bran flakes, that earn them more profit than cornflakes. As the price of cornflakes increases, ever more cornflakes will be produced. At ever-higher cornflakes prices, cereal makers will find it profitable to add more workers and to buy more automated cornflakes-stuffing machines and even more cornflakes factories. All these will increase the output of cornflakes at the higher market prices.

Figure 3-5 shows the typical case of an upwardsloping supply curve for an individual commodity. One important reason for the upward slope is "the law of diminishing returns" (a concept we will learn more about later). Wine will illustrate this important law. If society wants more wine, then additional labor will have to be added to the limited land sites suitable for producing wine grapes. Each new worker will be adding less and less extra product. The price needed to coax out additional wine output is there-

| Supply Schedule for Cornflakes |              |                              |  |  |
|--------------------------------|--------------|------------------------------|--|--|
|                                | (1) (2)      |                              |  |  |
|                                | Price        | Quantity supplied            |  |  |
|                                | (\$ per box) | (millions of boxes per year) |  |  |
|                                | Р            | Q                            |  |  |
| А                              | 5            | 18                           |  |  |
| В                              | 4            | 16                           |  |  |
| С                              | 3            | 12                           |  |  |
| D                              | 2            | 7                            |  |  |
| Ε                              | 1            | 0                            |  |  |
|                                |              |                              |  |  |

## **TABLE 3-3.** Supply Schedule Relates Quantity Supplied to Price

The table shows, for each price, the quantity of cornflakes that cereal makers want to produce and sell. Note the positive relation between price and quantity supplied.



FIGURE 3-5. Supply Curve Relates Quantity Supplied to Price

The supply curve plots the price and quantity pairs from Table 3-3. A smooth curve is passed through these points to give the upward-sloping supply curve, *SS*.

fore higher. By raising the price of wine, society can persuade wine producers to produce and sell more wine; the supply curve for wine is therefore upwardTHE SUPPLY CURVE

sloping. Similar reasoning applies to many other goods as well.

## Forces behind the Supply Curve

In examining the forces determining the supply curve, the fundamental point to grasp is that producers supply commodities for profit and not for fun or charity. One major element underlying the supply curve is the *cost of production*. When production costs for a good are low relative to the market price, it is profitable for producers to supply a great deal. When production costs are high relative to price, firms produce little, switch to the production of other products, or may simply go out of business.

Production costs are primarily determined by the *prices of inputs* and *technological advances*. The prices of inputs such as labor, energy, or machinery obviously have a very important influence on the cost of producing a given level of output. For example, when oil prices rose sharply in the 1970s, the increase raised the price of energy for manufacturers, increased their production costs, and lowered their supply. By contrast, as computer prices fell over the last three decades, businesses increasingly substituted computerized processes for other inputs, as for example in payroll or accounting operations; this increased supply.

An equally important determinant of production costs is *technological advances*, which consist of changes that lower the quantity of inputs needed to produce the same quantity of output. Such advances include everything from scientific breakthroughs to better application of existing technology or simply reorganization of the flow of work. For example, manufacturers have become much more efficient over the last decade or so. It takes far fewer hours of labor to produce an automobile today than it did just 10 years ago. This advance enables car makers to produce more automobiles at the same cost. To give another example, if Internet commerce allows purchasers more easily to compare the prices of necessary inputs, that will lower the cost of production.

But production costs are not the only ingredient that goes into the supply curve. Supply is also influenced by the *prices of related goods*, particularly goods that are alternative outputs of the production process. If the price of one production substitute rises, the supply of another substitute will decrease. For example, auto companies typically make several different car models in the same factory. If there's more demand for one model, and its price rises, they will switch more of their assembly lines to making that model, and the supply of the other models will fall. Or if the demand and price for trucks rise, the entire factory can be converted to making trucks, and the supply of cars will fall.

Government policy also has an important impact on the supply curve. Environmental and health considerations determine what technologies can be used, while taxes and minimum-wage laws can significantly raise input prices. In the local electricity market, government regulations influence both the number of firms that can compete and the prices they charge. Government trade policies have a major impact upon

| Factors affecting the supply curve | Example for automobiles   |
|------------------------------------|---|
| 1. Technology                      | Computerized manufacturing lowers production costs and increases supply.  |
| 2. Input prices                    | A reduction in the wage paid to autoworkers lowers production costs and increases supply.   |
| 3. Prices of related goods         | If truck prices fall, the supply of cars rises.   |
| 4. Government policy               | Removing quotas and tariffs on imported automobiles increases total automobile supply.  |
| 5. Special influences              | Internet shopping allows consumers to compare the prices of different dealers more easily and drives high-cost sellers out of business. |

TABLE 3-4. Supply Is Affected by Production Costs and Other Factors

supply. For instance, when a free-trade agreement opens up the U.S. market to Mexican footwear, the total supply of footwear in the United States increases.

Finally, *special influences* affect the supply curve. The weather exerts an important influence on farming and on the ski industry. The computer industry has been marked by a keen spirit of innovation, which has led to a continuous flow of new products. Market structure will affect supply, and expectations about future prices often have an important impact upon supply decisions.

Table 3-4 highlights the important determinants of supply, using automobiles as an example.

### Shifts in Supply

Businesses are constantly changing the mix of products and services they provide. What lies behind these changes in supply behavior?

When changes in factors other than a good's own price affect the quantity supplied, we call these shifts in supply. Supply increases (or decreases) when the





As production costs fall, the supply of automobiles increases. At each price, producers will supply more automobiles, and the supply curve therefore shifts to the right. (What would happen to the supply curve if Congress were to put a restrictive quota on automobile imports?)

## amount supplied increases (or decreases) at each market price.

When automobile prices change, producers change their production and quantity supplied, but the supply and the supply curve do not shift. By contrast, when other influences affecting supply change, supply changes and the supply curve shifts.

We can illustrate a shift in supply for the automobile market. Supply would increase if the introduction of cost-saving computerized design and manufacturing reduced the labor required to produce cars, if autoworkers took a pay cut, if there were lower production costs in Japan, or if the government repealed environmental regulations on the industry. Any of these elements would increase the supply of automobiles in the United States at each price. Figure 3-6 illustrates an increase in the supply of automobiles.

To test your understanding of supply shifts, think about the following: What would happen to the world supply curve for oil if a revolution in Saudi Arabia led to declining oil production? What would happen to the supply curve for clothing if tariffs were slapped on Chinese imports into the United States? What happens to the supply curve for computers if Intel introduces a new computer chip that dramatically increases computing speeds?

## Reminder on shifts of curves versus movements along curves

As you answer the questions above, make sure to keep in mind the difference between moving along a curve and a shift of the curve. Look back at the gasoline-price curve in Figure

3-1 on page 47. When the price of oil rose and the production of oil declined because of political disturbances in the 1970s, these changes resulted from an inward shift in the supply curve. When sales of gasoline declined in response to the higher price, that was a movement along the demand curve.

Does the history of computer prices and quantities shown in Figure 3-3 on page 50 look more like shifting supply or shifting demand? (Question 8 at the end of this chapter explores this issue further.)

How would you describe a rise in chicken production that was induced by a rise in chicken prices? What about the case of a rise in chicken production because of a fall in the price of chicken feed? EQUILIBRIUM OF SUPPLY AND DEMAND



Up to this point we have been considering demand and supply in isolation. We know the amounts that are willingly bought and sold at each price. We have seen that consumers demand different amounts of cornflakes, cars, and computers as a function of these goods' prices. Similarly, producers willingly supply different amounts of these and other goods depending on their prices. But how can we put both sides of the market together?

The answer is that supply and demand interact to produce an equilibrium price and quantity, or a market equilibrium. The **market equilibrium** comes at that price and quantity where the forces of supply and demand are in balance. At the equilibrium price, the amount that buyers want to buy is just equal to the amount that sellers want to sell. The reason we call this an equilibrium is that, when the forces of supply and demand are in balance, there is no reason for price to rise or fall, as long as other things remain unchanged.

Let us work through the cornflakes example in Table 3-5 to see how supply and demand determine a market equilibrium; the numbers in this table come from Tables 3-1 and 3-3. To find the market price and quantity, we find a price at which the amounts desired to be bought and sold just match. If we try a price of \$5 per box, will it prevail for long? Clearly not. As row A in Table 3-5 shows, at \$5 producers would like to sell 18 million boxes per year while demanders want to buy only 9. The amount supplied at \$5 exceeds the amount demanded, and stocks of cornflakes pile up in supermarkets. Because too few consumers are chasing too many cornflakes, the price of cornflakes will tend to fall, as shown in column (5) of Table 3-5.

Say we try \$2. Does that price clear the market? A quick look at row D shows that at \$2 consumption exceeds production. Cornflakes begin to disappear from the stores at that price. As people scramble around to find their desired cornflakes, they will tend to bid up the price of cornflakes, as shown in column (5) of Table 3-5.

We could try other prices, but we can easily see that the equilibrium price is \$3, or row C in Table 3-5. At \$3, consumers' desired demand exactly equals producers' desired production, each of which is 12 units. Only at \$3 will consumers and suppliers both be making consistent decisions.

A **market equilibrium** comes at the price at which quantity demanded equals quantity supplied. At that equilibrium, there is no tendency for the price to rise or fall. The equilibrium price is also called the **market-clearing price**. This denotes that all supply and demand orders are filled, the books are "cleared" of orders, and demanders and suppliers are satisfied.

| Combining Demand and Supply for Cornflakes |              |                    |                    |             |           |
|--|--------------|--------------------|--------------------|-------------|-----------|
|  | (1)          | (2)                | (3)                | (4)         | (5)       |
|  | Possible     | Quantity demanded  | Quantity supplied  |             |           |
|  | price        | (millions of boxes | (millions of boxes | State of    | Pressure  |
|  | (\$ per box) | per year)          | per year)          | market      | on price  |
| А  | 5            | 9                  | 18                 | Surplus     | ↓Downward |
| В  | 4            | 10                 | 16                 | Surplus     | ↓Downward |
| С  | 3            | 12                 | 12                 | Equilibrium | Neutral   |
| D  | 2            | 15                 | 7                  | Shortage    | ↑Upward   |
| Е  | 1            | 20                 | 0                  | Shortage    | ↑Upward   |
|  |              |                    |                    |             |           |

## **TABLE 3-5.** Equilibrium Price Comes Where Quantity Demanded Equals Quantity Supplied

The table shows the quantities supplied and demanded at different prices. Only at the equilibrium price of \$3 per box does amount supplied equal amount demanded. At too low a price there is a shortage and price tends to rise. Too high a price produces a surplus, which will depress the price.

# EQUILIBRIUM WITH SUPPLY AND DEMAND CURVES

We often show the market equilibrium through a supply-and-demand diagram like the one in Figure 3-7; this figure combines the supply curve from Figure 3-5 with the demand curve from Figure 3-2. Combining the two graphs is possible because they are drawn with exactly the same units on each axis.

We find the market equilibrium by looking for the price at which quantity demanded equals quantity supplied. *The equilibrium price comes at the intersection of the supply and demand curves, at point* C.

How do we know that the intersection of the supply and demand curves is the market equilibrium? Let us repeat our earlier experiment. Start with the initial high price of \$5 per box, shown at the top of the price axis in Figure 3-7. At that price, suppliers



FIGURE 3-7. Market Equilibrium Comes at the Intersection of Supply and Demand Curves

The market equilibrium price and quantity come at the intersection of the supply and demand curves. At a price of \$3, at point *C*, firms willingly supply what consumers willingly demand. When the price is too low (say, at \$2), quantity demanded exceeds quantity supplied, shortages occur, and the price is driven up to equilibrium. What occurs at a price of \$4? want to sell more than demanders want to buy. The result is a *surplus*, or excess of quantity supplied over quantity demanded, shown in the figure by the black line labeled "Surplus." The arrows along the curves show the direction that price tends to move when a market is in surplus.

At a low price of \$2 per box, the market shows a *shortage*, or excess of quantity demanded over quantity supplied, here shown by the black line labeled "Shortage." Under conditions of shortage, the competition among buyers for limited goods causes the price to rise, as shown in the figure by the arrows pointing upward.

We now see that the balance or equilibrium of supply and demand comes at point C, where the supply and demand curves intersect. At point C, where the price is \$3 per box and the quantity is 12 units, the quantities demanded and supplied are equal: there are no shortages or surpluses; there is no tendency for price to rise or fall. At point C and only at point C, the forces of supply and demand are in balance and the price has settled at a sustainable level.

The equilibrium price and quantity come where the amount willingly supplied equals the amount willingly demanded. In a competitive market, this equilibrium is found at the intersection of the supply and demand curves. There are no shortages or surpluses at the equilibrium price.

## Effect of a Shift in Supply or Demand

The analysis of the supply-and-demand apparatus can do much more than tell us about the equilibrium price and quantity. It can also be used to predict the impact of changes in economic conditions on prices and quantities. Let's change our example to the staff of life, bread. Suppose that a spell of bad weather raises the price of wheat, a key ingredient of bread. That shifts the supply curve for bread to the left. This is illustrated in Figure 3-8 (*a*), where the bread supply curve has shifted from SS to S'S'. In contrast, the demand curve has not shifted because people's sandwich demand is largely unaffected by farming weather.

What happens in the bread market? The bad harvest causes bakers to produce less bread at the old price, so quantity demanded exceeds quantity supplied. The price of bread therefore rises, encouraging production and thereby raising quantity

## EQUILIBRIUM WITH SUPPLY AND DEMAND CURVES



quantity move upward to E".

supplied, while simultaneously discouraging consumption and lowering quantity demanded. The price continues to rise until, at the new equilibrium price, the amounts demanded and supplied are once again equal.

As Figure 3-8 (*a*) shows, the new equilibrium is found at E', the intersection of the new supply curve S'S' and the original demand curve. Thus a bad harvest (or any leftward shift of the supply curve) raises prices and, by the law of downward-sloping demand, lowers quantity demanded.

Suppose that new baking technologies lower costs and therefore increase supply. That means the supply curve shifts down and to the right. Draw in a new S''S'' curve, along with the new equilibrium E'''. Why is the equilibrium price lower? Why is the equilibrium quantity higher?

We can also use our supply-and-demand apparatus to examine how changes in demand affect the market equilibrium. Suppose that there is a sharp increase in family incomes, so everyone wants to eat more bread. This is represented in Figure 3-8 (*b*) as a "demand shift" in which, at every price, consumers demand a higher quantity of bread. The demand curve thus shifts *rightward* from *DD* to D'D'.

The demand shift produces a shortage of bread at the old price. A scramble for bread ensues, with long lines in the bakeries. Prices are bid upward until supply and demand come back into balance at a higher price. Graphically, the increase in demand has changed the market equilibrium from E to E'' in Figure 3-8 (*b*).

For both examples of shifts—a shift in supply and a shift in demand—a variable underlying the demand or supply curve has changed. In the case of supply, there might have been a change in technology or input prices. For the demand shift, one of the influences affecting consumer demand—incomes, population, the prices of related goods, or tastes—changed and thereby shifted the demand schedule (see Table 3-6).

### CHAPTER 3 🔅 BASIC ELEMENTS OF SUPPLY AND DEMAND

|   | Demand and supply shifts                  | Effect on price and quantity                |  |
|---|---|---|--|
| If demand rises   | The demand curve shifts to the right, and | Price ↑<br>Quantity ↑                       |  |
| If demand falls   | The demand curve shifts to the left, and  | Price $\downarrow$<br>Quantity $\downarrow$ |  |
| If supply rises   | The supply curve shifts to the right, and | Price↓<br>Quantity↑                         |  |
| If supply falls   | The supply curve shifts to the left, and  | Price ↑<br>Quantity ↓                       |  |
| TABLE 3-6. The Effect on Price and Quantity of Different Demand and Supply Shifts |   |   |  |

When the elements underlying demand or supply change, this leads to shifts in demand or supply and to changes in the market equilibrium of price and quantity.

## Interpreting Changes in Price and Quantity

Let's go back to our bread example. Suppose that you go to the store and see that the price of bread has doubled. Does the increase in price mean that the demand for bread has risen, or does it mean that bread has become more expensive to produce? The correct answer is that without more information, you don't know—it could be either one, or even both. Let's look at another example. If fewer airline tickets are sold, is the cause that airline fares have gone up or that demand for air travel has gone down? Airlines will be most interested in the answer to this question.

Economists deal with these sorts of questions all the time: When prices or quantities change in a market, does the situation reflect a change on the supply side or the demand side? Sometimes, in simple situations, looking at price and quantity simultaneously gives you a clue about whether it's the supply curve that's shifted or the demand curve. For example, a rise in the price of bread accompanied by a *decrease* in quantity suggests that the supply curve has shifted to the left (a decrease in supply). A rise in price accompanied by an *increase* in quantity indicates that the demand curve for bread has probably shifted to the right (an increase in demand).

This point is illustrated in Figure 3-9. In both panel (a) and panel (b), quantity goes up. But in (a) the price rises, and in (b) the price falls. Figure 3-9

(a) shows the case of an increase in demand, or a shift in the demand curve. As a result of the shift, the equilibrium quantity demanded increases from 10 to 15 units. The case of a movement along the demand curve is shown in Figure 3-9 (b). In this case, a supply shift changes the market equilibrium from point E to point E''. As a result, the quantity demanded changes from 10 to 15 units. But demand does not change in this case; rather, quantity demanded increases as consumers move along their demand curve from E to E'' in response to a price change.

#### The elusive concept of equilibrium

The notion of equilibrium is one of the most elusive concepts of economics. We are familiar with equilibrium in our everyday lives from seeing, for example, an orange sitting at the bottom of a bowl or a pendulum at rest. In

economics, equilibrium means that the different forces operating on a market are in balance, so the resulting price and quantity reconcile the desires of purchasers and suppliers. Too low a price means that the forces are not in balance, that the forces attracting demand are greater than the forces attracting supply, so there is excess demand, or a shortage. We also know that a competitive market is a mechanism for producing equilibrium. If the price is too low, demanders will bid up the price to the equilibrium level.

The notion of equilibrium is tricky, however, as is seen by the statement of a leading pundit: "Don't lecture me about supply and demand equilibrium. The supply of oil is always equal to the demand for oil. You simply can't tell the difference." The pundit is right in an accounting sense.

### EQUILIBRIUM WITH SUPPLY AND DEMAND CURVES

Clearly the oil sales recorded by the oil producers should be exactly equal to the oil purchases recorded by the oil consumers. But this bit of arithmetic cannot repeal the laws of supply and demand. More important, if we fail to understand the nature of economic equilibrium, we cannot hope to understand the way that different forces affect the marketplace.

In economics, we are interested in knowing the quantity of sales that will clear the market, that is, the equilibrium quantity. We also want to know the price at which consumers willingly buy what producers willingly sell. Only at this price will both buyers and sellers be satisfied with their decisions. Only at this price and quantity will there be no tendency for price and quantity to change. Only by looking at the equilibrium of supply and demand can we hope to understand such paradoxes as the fact that immigration may not lower wages in the affected cities, that land taxes do not raise rents, and that bad harvests raise (yes, raise!) the incomes of farmers.

## Supply, Demand, and Immigration

A fascinating and important example of supply and demand, full of complexities, is the role of immigration in determining wages. If you ask people, they are likely to tell you that immigration into California or Florida surely lowers the wages of people in those regions. It's just supply and demand. They might point to Figure 3-10 (a), which shows a supply-and-demand analysis of immigration. According to this analysis, immigration into a region shifts the supply curve for labor to the right and pushes down wages.





Start out with initial equilibrium at E and a quantity of 10 units. In (a), an increase in demand (i.e., a shift of the demand curve) produces a new equilibrium of 15 units at E'. In (b), a shift in supply results in a movement along the demand curve from E to E''.



FIGURE 3-10. Impact of Immigration on Wages

In (a), new immigrants cause the supply curve for labor to shift from SS to S'S', lowering equilibrium wages. But more often, immigrants go to cities with growing labor markets. Then, as shown in (b), the wage changes are small if the supply increase comes in labor markets with growing demand.

Careful economic studies cast doubt on this simple reasoning. A recent survey of the evidence concludes:

[The] effect of immigration on the labor market outcomes of natives is small. There is no evidence of economically significant reductions in native employment. Most empirical analysis . . . finds that a 10 percent increase in the fraction of immigrants in the population reduces native wages by at most 1 percent.<sup>2</sup>

How can we explain the small impact of immigration on wages? Labor economists emphasize the high geographic mobility of the American population. This means that new immigrants will quickly spread around the entire country. Once they arrive, immigrants may move to cities where they can get jobs—workers tend to move to those cities where the demand for labor is already rising because of a strong local economy. This point is illustrated in Figure 3-10 (b), where a shift in labor supply to S' is associated with a higher demand curve, D'. The new equilibrium wage at E'' is the same as the original wage at E. Another factor is that native-born residents may move out when immigrants move in, so the total supply of labor is unchanged. This would leave the supply curve for labor in its original position and leave the wage unchanged.

Immigration is a good example for demonstrating the power of the simple tools of supply and demand.

## **RATIONING BY PRICES**

Let us now take stock of what the market mechanism accomplishes. By determining the equilibrium prices and quantities, the market allocates or rations out the scarce goods of the society among the possible uses. Who does the rationing? A planning board? Congress? The President? No. The marketplace, through the interaction of supply and demand, does the rationing. This is *rationing by the purse*.

<sup>&</sup>lt;sup>2</sup> Rachel M. Friedberg and Jennifer Hunt, "The Impact of Immigrants on Host Country Wages, Employment, and Growth," *Journal of Economic Perspectives*, Spring 1995, pp. 23–44.

#### SUMMARY

What goods are produced? This is answered by the signals of the market prices. High oil prices stimulate oil production, whereas low food prices drive productive resources out of agriculture. Those who have the most dollar votes have the greatest influence on what goods are produced.

*For whom* are goods produced? The power of the purse dictates the distribution of income and consumption. Those with higher incomes end up with larger houses, more clothing, and longer vacations. When backed up by cash, the most urgently felt needs get fulfilled through the demand curve.

Even the *how* question is decided by supply and demand. When corn prices are low, it is not prof-

itable for farmers to use expensive tractors and irrigation systems. When oil prices are high, oil companies drill in deep offshore waters and employ novel seismic techniques to find oil.

With this introduction to supply and demand, we begin to see how desires for goods, as expressed through demands, interact with costs of goods, as reflected in supplies. Further study will deepen our understanding of these concepts and will show how these tools can be applied to other important areas. But even this first survey will serve as an indispensable tool for interpreting the economic world in which we live.

## SUMMARY

1. The analysis of supply and demand shows how a market mechanism solves the three problems of *what*, *how*, and *for whom*. A market blends together demands and supplies. Demand comes from consumers who are spreading their dollar votes among available goods and services while businesses supply the goods and services with the goal of maximizing their profits.

### A. The Demand Schedule

- 2. A demand schedule shows the relationship between the quantity demanded and the price of a commodity, other things held constant. Such a demand schedule, depicted graphically by a demand curve, holds constant other things like family incomes, tastes, and the prices of other goods. Almost all commodities obey the *law of downward-sloping demand*, which holds that quantity demanded falls as a good's price rises. This law is represented by a downward-sloping demand curve.
- **3.** Many influences lie behind the demand schedule for the market as a whole: average family incomes, population, the prices of related goods, tastes, and special influences. When these influences change, the demand curve will shift.

#### **B.** The Supply Schedule

- 4. The supply schedule (or supply curve) gives the relationship between the quantity of a good that producers desire to sell—other things constant—and that good's price. Quantity supplied generally responds positively to price, so the supply curve is upward-sloping.
- 5. Elements other than the good's price affect its supply. The most important influence is the commodity's production cost, determined by the state of technology and by input prices. Other elements in supply include

the prices of related goods, government policies, and special influences.

#### C. Equilibrium of Supply and Demand

- 6. The equilibrium of supply and demand in a competitive market occurs when the forces of supply and demand are in balance. The equilibrium price is the price at which the quantity demanded just equals the quantity supplied. Graphically, we find the equilibrium at the intersection of the supply and demand curves. At a price above the equilibrium, producers want to supply more than consumers want to buy, which results in a surplus of goods and exerts downward pressure on price. Similarly, too low a price generates a shortage, and buyers will therefore tend to bid price upward to the equilibrium.
- 7. Shifts in the supply and demand curves change the equilibrium price and quantity. An increase in demand, which shifts the demand curve to the right, will increase both equilibrium price and quantity. An increase in supply, which shifts the supply curve to the right, will decrease price and increase quantity demanded.
- 8. To use supply-and-demand analysis correctly, we must (*a*) distinguish a change in demand or supply (which produces a shift in a curve) from a change in the quantity demanded or supplied (which represents a movement along a curve); (*b*) hold other things constant, which requires distinguishing the impact of a change in a commodity's price from the impact of changes in other influences; and (*c*) look always for the supply-and-demand equilibrium, which comes at the point where forces acting on price and quantity are in balance.
- **9.** Competitively determined prices ration the limited supply of goods among those who demand them.

CHAPTER 3 🔅 BASIC ELEMENTS OF SUPPLY AND DEMAND



supply-and-demand analysis demand schedule or curve, *DD* law of downward-sloping demand influences affecting demand curve supply schedule or curve, SS influences affecting supply curve equilibrium price and quantity shifts in supply and demand curves all other things held constant rationing by prices

## FURTHER READING AND INTERNET WEBSITES

#### **Further Reading**

Supply and demand analysis is the single most important and useful tool in microeconomics. Supply and demand analysis was developed by the great British economist, Alfred Marshall, in *Principles of Economics* (9<sup>th</sup> edition, New York, Macmillan, [1890] 1961). To reinforce your understanding, you might look in textbooks on intermediate microeconomics. Two good references are Hal Varian, *Intermediate Microeconomics* (Norton, New York, 5<sup>th</sup> edition, 1999) and Walter Nicholson, *Intermediate Microeconomics* (7<sup>th</sup> edition, 1997, Dryden).

A recent survey of the economic issues in immigration is in George Borjas, *Heaven's Door: Immigration Policy and the American Economy* (Princeton University Press, Princeton, NJ, 1999).

## Websites

You can examine a recent study of the impact of immigration on American society from the National Academy of Sciences, *The New Americans* (1997), at www.nap.edu. This site provides free access to over 1000 studies from economics and the other social and natural sciences.

An entertaining site is called "The Dismal Economist" at www.dismal.com. You can look here to see if there are any recent stories on "supply and demand." Another site with much entertaining and useful information is www.economics.miningco.com/finance/economics/.



- **1. a.** Define carefully what is meant by a demand schedule or curve. State the law of downward-sloping demand. Illustrate the law of downward-sloping demand with two cases from your own experience.
  - **b.** Define the concept of a supply schedule or curve. Show that an increase in supply means a rightward and downward shift of the supply curve. Contrast this with the rightward and upward shift in the demand curve implied by an increase in demand.
- 2. What might increase the demand for hamburgers? What would increase the supply? What would inexpensive frozen pizzas do to the market equilibrium for hamburgers? To the wages of teenagers who work at McDonald's?
- Explain why the price in competitive markets settles down at the equilibrium intersection of supply and demand. Explain what happens if the market price starts out too high or too low.
- 4. Explain why each of the following is *false*:

- **a.** A freeze in Brazil's coffee-growing region will lower the price of coffee.
- **b.** "Protecting" American textile manufacturers from Chinese clothing imports will lower clothing prices in the United States.
- **c.** The rapid increase in college tuitions will lower the demand for college.
- **d.** The war against drugs, with increased interdiction of imported cocaine, will lower the price of domestically produced marijuana.
- 5. The following are four laws of supply and demand. Fill in the blanks. Demonstrate each law with a supply-and-demand diagram.
  - **a.** An increase in demand generally raises price and raises quantity demanded.
  - **b.** A decrease in demand generally \_\_\_\_\_\_ price and \_\_\_\_\_\_ quantity demanded.
  - **c.** An increase in supply generally lowers price and raises quantity demanded.

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### QUESTIONS FOR DISCUSSION

- **d.** A decrease in supply generally \_\_\_\_\_ price and \_\_\_\_\_ quantity demanded.
- **6.** For each of the following, explain whether quantity demanded changes because of a demand shift or a price change, and draw a diagram to illustrate your answer:
  - **a.** As a result of decreased military spending, the price of Army boots falls.
  - **b.** Fish prices fall after the pope allows Catholics to eat meat on Friday.
  - **c.** An increase in gasoline taxes lowers the consumption of gasoline.
  - **d.** After the Black Death struck Europe in the four-teenth century, wages rose.
- **7.** Examine the graph for the price of gasoline in Figure 3-1, page 47. Then, using a supply-and-demand diagram, illustrate the impact of each of the following on price and quantity demanded:
  - Improvements in transportation lower the costs of importing oil into the United States in the 1960s.
  - **b.** After the 1973 war, oil producers cut oil production sharply.
  - **c.** After 1980, smaller automobiles get more miles per gallon.
  - **d.** A record-breaking cold winter in 1995–1996 unexpectedly raises the demand for heating oil.
  - e. A global economic recovery in 1999–2000 led to a sharp upturn in oil prices.
- 8. Examine Figure 3-3 on page 50. Does the price-quantity relationship look more like a supply curve or a de-

mand curve. Assuming that the demand curve was unchanged over this period, trace supply curves for 1972 and 2000 that would have generated the (P, Q) pairs for those years. Explain what forces might have led to the shift in the supply curve.

**9.** From the following data, plot the supply and demand curves and determine the equilibrium price and quantity:

| Supply and Demand for Pizzas |  |  |  |
|------------------------------|--|--|--|
| Price<br>(\$ per pizza)      | Quantity<br>demanded<br>(pizzas per<br>semester) | Quantity<br>supplied<br>(pizzas per<br>semester) |  |
| 10                           | 0  | 40   |  |
| 8                            | 10   | 30   |  |
| 6                            | 20   | 20   |  |
| 4                            | 30   | 10   |  |
| 2                            | 40   | 0  |  |
| 0                            | 125  | 0  |  |

What would happen if the demand for pizzas tripled at each price? What would occur if the price were initially set at \$4 per pizza? -(

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