

macroeconomic fluctuations and to the effects of government interventions. We will try to convey this understanding through simple examples and by urging you to work through some exercises at the end of the chapter.

## 2.1 Supply and Demand

The basic model of supply and demand is the workhorse of microeconomics. It helps us understand why and how prices change, and what happens when the government intervenes in a market. The supply-demand model combines two important concepts: a *supply curve* and a *demand curve*. It is important to understand precisely what these curves represent.

### The Supply Curve

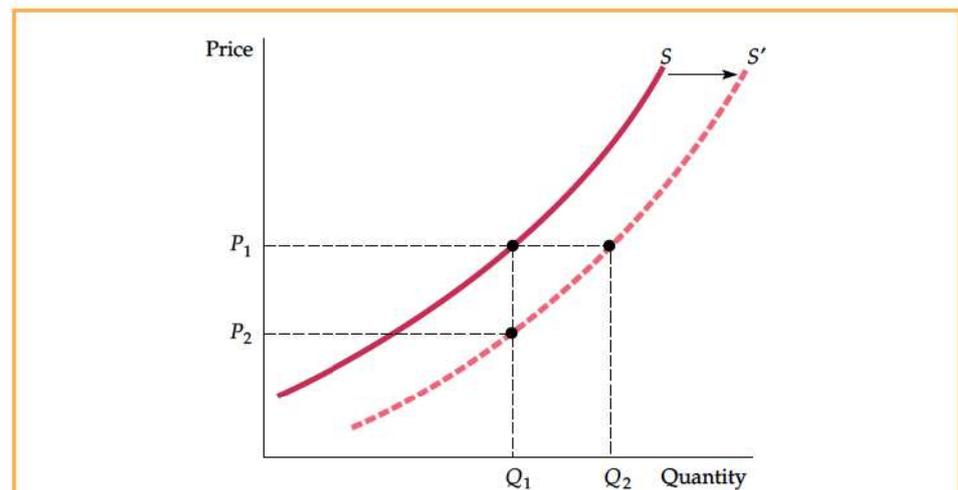
**supply curve** Relationship between the quantity of a good that producers are willing to sell and the price of the good.

The **supply curve** shows the quantity of a good that producers are willing to sell at a given price, holding constant any other factors that might affect the quantity supplied. The curve labeled  $S$  in Figure 2.1 illustrates this. The vertical axis of the graph shows the price of a good,  $P$ , measured in dollars per unit. This is the price that sellers receive for a given quantity supplied. The horizontal axis shows the total quantity supplied,  $Q$ , measured in the number of units per period.

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

$$Q_S = Q_S(P)$$

Or we can draw it graphically, as we have done in Figure 2.1.



**FIGURE 2.1 The Supply Curve**

The supply curve, labeled  $S$  in the figure, shows how the quantity of a good offered for sale changes as the price of the good changes. The supply curve is upward sloping: The higher the price, the more firms are able and willing to produce and sell. If production costs fall, firms can produce the same quantity at a lower price or a larger quantity at the same price. The supply curve then shifts to the right (from  $S$  to  $S'$ ).

Note that the supply curve in Figure 2.1 slopes upward. In other words, the higher the price, *the more that firms are able and willing to produce and sell*. For example, a higher price may enable current firms to expand production by hiring extra workers or by having existing workers work overtime (at greater cost to the firm). Likewise, they may expand production over a longer period of time by increasing the size of their plants. A higher price may also attract new firms to the market. These newcomers face higher costs because of their inexperience in the market and would therefore have found entry uneconomical at a lower price.

**Other Variables That Affect Supply** The quantity supplied can depend on other variables besides price. For example, the quantity that producers are willing to sell depends not only on the price they receive but also on their production costs, including wages, interest charges, and the costs of raw materials. The supply curve labeled  $S$  in Figure 2.1 was drawn for particular values of these other variables. A change in the values of one or more of these variables translates into a shift in the supply curve. Let's see how this might happen.

The supply curve  $S$  in Figure 2.1 says that at a price  $P_1$ , the quantity produced and sold would be  $Q_1$ . Now suppose that the cost of raw materials *falls*. How does this affect the supply curve?

Lower raw material costs—indeed, lower costs of any kind—make production more profitable, encouraging existing firms to expand production and enabling new firms to enter the market. If at the same time the market price stayed constant at  $P_1$ , we would expect to observe a greater quantity supplied. Figure 2.1 shows this as an increase from  $Q_1$  to  $Q_2$ . When production costs *decrease*, output *increases* no matter what the market price happens to be. *The entire supply curve thus shifts to the right*, which is shown in the figure as a shift from  $S$  to  $S'$ .

Another way of looking at the effect of lower raw material costs is to imagine that the quantity produced stays fixed at  $Q_1$  and then ask what price firms would require to produce this quantity. Because their costs are lower, they would accept a lower price— $P_2$ . This would be the case no matter what quantity was produced. Again, we see in Figure 2.1 that the supply curve must shift to the right.

We have seen that the response of quantity supplied to changes in price can be represented by movements *along the supply curve*. However, the response of supply to changes in other supply-determining variables is shown graphically as a *shift of the supply curve itself*. To distinguish between these two graphical depictions of supply changes, economists often use the phrase *change in supply* to refer to shifts in the supply curve, while reserving the phrase *change in the quantity supplied* to apply to movements along the supply curve.

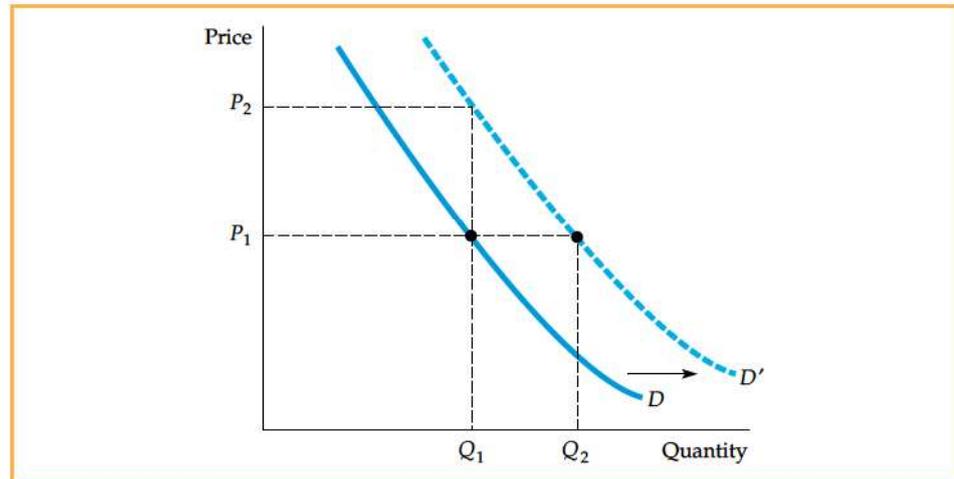
## The Demand Curve

The **demand curve** shows how much of a good consumers are willing to buy as the price per unit changes. We can write this relationship between quantity demanded and price as an equation:

$$Q_D = Q_D(P)$$

or we can draw it graphically, as in Figure 2.2. Note that the demand curve in that figure, labeled  $D$ , slopes *downward*: Consumers are usually ready to buy more if the price is lower. For example, a lower price may encourage consumers who have already been buying the good to consume larger quantities. Likewise, it may allow other consumers who were previously unable to afford the good to begin buying it.

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



**FIGURE 2.2 The Demand Curve**

The demand curve, labeled  $D$ , shows how the quantity of a good demanded by consumers depends on its price. The demand curve is downward sloping; holding other things equal, consumers will want to purchase more of a good as its price goes down. The quantity demanded may also depend on other variables, such as income, the weather, and the prices of other goods. For most products, the quantity demanded increases when income rises. A higher income level shifts the demand curve to the right (from  $D$  to  $D'$ ).

Of course the quantity of a good that consumers are willing to buy can depend on other things besides its price. *Income* is especially important. With greater incomes, consumers can spend more money on any good, and some consumers will do so for most goods.

**Shifting the Demand Curve** Let's see what happens to the demand curve if income levels increase. As you can see in Figure 2.2, if the market price were held constant at  $P_1$ , we would expect to see an increase in the quantity demanded—say, from  $Q_1$  to  $Q_2$ , as a result of consumers' higher incomes. Because this increase would occur no matter what the market price, the result would be a *shift to the right of the entire demand curve*. In the figure, this is shown as a shift from  $D$  to  $D'$ . Alternatively, we can ask what price consumers would pay to purchase a given quantity  $Q_1$ . With greater income, they should be willing to pay a higher price—say,  $P_2$  instead of  $P_1$  in Figure 2.2. Again, *the demand curve will shift to the right*. As we did with supply, we will use the phrase *change in demand* to refer to shifts in the demand curve, and reserve the phrase *change in the quantity demanded* to apply to movements along the demand curve.<sup>1</sup>

**Substitute and Complementary Goods** Changes in the prices of related goods also affect demand. Goods are **substitutes** when an increase in the price of one leads to an increase in the quantity demanded of the other. For example,

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

<sup>1</sup>Mathematically, we can write the demand curve as

$$Q_D = D(P, I)$$

where  $I$  is disposable income. When we draw a demand curve, we are keeping  $I$  fixed.

copper and aluminum are substitute goods. Because one can often be substituted for the other in industrial use, *the quantity of copper demanded will increase if the price of aluminum increases*. Likewise, beef and chicken are substitute goods because most consumers are willing to shift their purchases from one to the other when prices change.

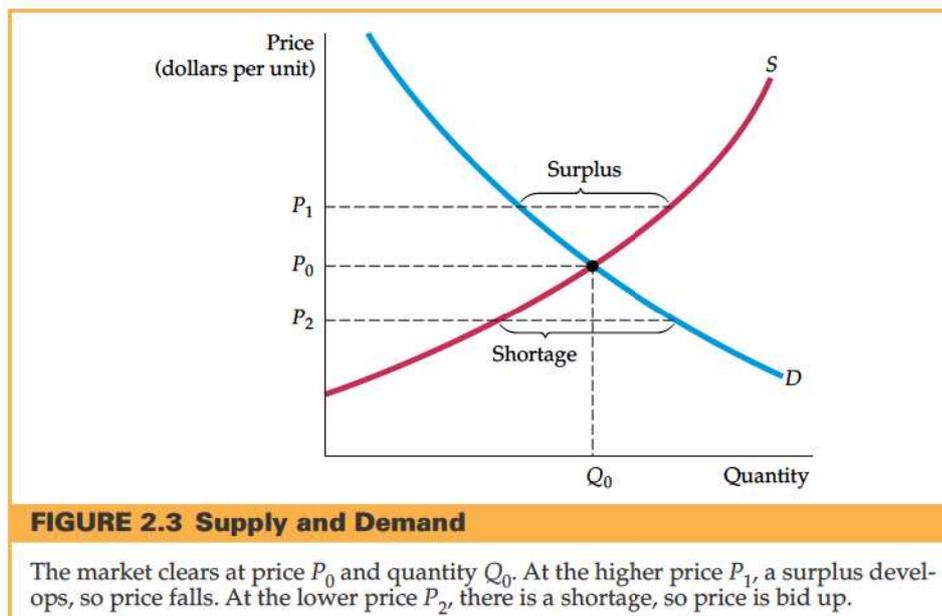
Goods are **complements** when an increase in the price of one leads to a decrease in the quantity demanded of the other. For example, automobiles and gasoline are complementary goods. Because they tend to be used together, a decrease in the price of gasoline increases the quantity demanded for automobiles. Likewise, computers and computer software are complementary goods. The price of computers has dropped dramatically over the past decade, fueling an increase not only in purchases of computers, but also purchases of software packages.

We attributed the shift to the right of the demand curve in Figure 2.2 to an increase in income. However, this shift could also have resulted from either an increase in the price of a substitute good or a decrease in the price of a complementary good. Or it might have resulted from a change in some other variable, such as the weather. For example, demand curves for skis and snowboards will shift to the right when there are heavy snowfalls.

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

## 2.2 The Market Mechanism

The next step is to put the supply curve and the demand curve together. We have done this in Figure 2.3. The vertical axis shows the price of a good,  $P$ , again measured in dollars per unit. This is now the price that sellers receive for a given quantity supplied, and the price that buyers will pay for a given quantity demanded. The horizontal axis shows the total quantity demanded and supplied,  $Q$ , measured in number of units per period.



**FIGURE 2.3 Supply and Demand**

The market clears at price  $P_0$  and quantity  $Q_0$ . At the higher price  $P_1$ , a surplus develops, so price falls. At the lower price  $P_2$ , there is a shortage, so price is bid up.

**equilibrium (or market-clearing) price** Price that equates the quantity supplied to the quantity demanded.

**market mechanism** Tendency in a free market for price to change until the market clears.

**surplus** Situation in which the quantity supplied exceeds the quantity demanded.

**shortage** Situation in which the quantity demanded exceeds the quantity supplied.

**Equilibrium** The two curves intersect at the **equilibrium**, or **market-clearing, price** and quantity. At this price ( $P_0$  in Figure 2.3), the quantity supplied and the quantity demanded are just equal (to  $Q_0$ ). The **market mechanism** is the tendency in a free market for the price to change until the market *clears*—i.e., until the quantity supplied and the quantity demanded are equal. At this point, because there is neither excess demand nor excess supply, there is no pressure for the price to change further. Supply and demand might not always be in equilibrium, and some markets might not clear quickly when conditions change suddenly. The *tendency*, however, is for markets to clear.

To understand why markets tend to clear, suppose the price were initially above the market-clearing level—say,  $P_1$  in Figure 2.3. Producers will try to produce and sell more than consumers are willing to buy. A **surplus**—a situation in which the quantity supplied exceeds the quantity demanded—will result. To sell this surplus—or at least to prevent it from growing—producers would begin to lower prices. Eventually, as price fell, quantity demanded would increase, and quantity supplied would decrease until the equilibrium price  $P_0$  was reached.

The opposite would happen if the price were initially below  $P_0$ —say, at  $P_2$ . A **shortage**—a situation in which the quantity demanded exceeds the quantity supplied—would develop, and consumers would be unable to purchase all they would like. This would put upward pressure on price as consumers tried to outbid one another for existing supplies and producers reacted by increasing price and expanding output. Again, the price would eventually reach  $P_0$ .

**When Can We Use the Supply-Demand Model?** When we draw and use supply and demand curves, we are assuming that at any given price, a given quantity will be produced and sold. This assumption makes sense only if a market is at least roughly *competitive*. By this we mean that both sellers and buyers should have little *market power*—i.e., little ability *individually* to affect the market price.

Suppose instead that supply were controlled by a single producer—a monopolist. In this case, there will no longer be a simple one-to-one relationship between price and the quantity supplied. Why? Because a monopolist's behavior depends on the shape and position of the demand curve. If the demand curve shifts in a particular way, it may be in the monopolist's interest to keep the quantity fixed but change the price, or to keep the price fixed and change the quantity. (How this could occur is explained in Chapter 10.) Thus when we work with supply and demand curves, we implicitly assume that we are referring to a competitive market.

## 2.3 Changes in Market Equilibrium

We have seen how supply and demand curves shift in response to changes in such variables as wage rates, capital costs, and income. We have also seen how the market mechanism results in an equilibrium in which the quantity supplied equals the quantity demanded. Now we will see how that equilibrium changes in response to shifts in the supply and demand curves.

Let's begin with a shift in the supply curve. In Figure 2.4, the supply curve has shifted from  $S$  to  $S'$  (as it did in Figure 2.1), perhaps as a result of a decrease in the price of raw materials. As a result, the market price drops (from  $P_1$  to  $P_3$ ), and the total quantity produced increases (from  $Q_1$  to  $Q_3$ ). This is what we would expect: Lower costs result in lower prices and increased sales. (Indeed, gradual decreases in costs resulting from technological progress and better management are an important driving force behind economic growth.)