

>> Supply and Demand

WAKE UP AND DON'T SMELL THE COFFEE

FOR THOSE WHO NEED A CAPPUCCINO, MOCHA latte, or frappuccino to get through the day, coffee drinking can become an expensive habit. And on August 20, 2009, the habit got a little more expensive. On that day Starbucks raised its drink prices by 10–15 cents per cup for most drinks.

Starbucks does not often raise its prices. What changed? Mainly the fact that the cost of a major ingredient—coffee beans—had gone up significantly. In fact, coffee bean prices nearly tripled between 2002 and 2009.

Who decided to raise the prices of coffee beans? Nobody: prices went up because of events outside anyone's control. Specifically, the main cause of rising bean prices was a significant decline in the supply of coffee beans from the world's two leading coffee exporters: Brazil and Vietnam. (Yes, Vietnam: since the 1990s, a country best known to Americans as a place we fought a war has become a coffee-growing giant.) In

Brazil, the decline in supply was a delayed reaction to low prices earlier in the decade, which led coffee growers to cut back on planting. In Vietnam, the problem was weather: a prolonged drought sharply reduced coffee harvests.

And a lower supply of coffee beans from Vietnam or Brazil inevitably translates into a higher price of coffee on Main Street. It's just a matter of supply and demand.

What do we mean by that? Many people use “supply and demand” as a sort of catchphrase to mean “the laws of the marketplace at work.” To economists, however, the concept of supply and demand has a precise meaning: it is a *model of how a market behaves* that is extremely useful for understanding many—but not all—markets.

In this chapter, we lay out the pieces that make up the *supply and demand model*, put them together, and show how this model can be used to understand how many—but not all—markets behave.



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Reduced coffee bean production in Vietnam inevitably translates into higher coffee prices at your local Starbucks.

WHAT YOU WILL LEARN IN THIS CHAPTER:

- ▶ What a **competitive market** is and how it is described by the **supply and demand model**
- ▶ The difference between **movements along a curve** and **shifts of a curve**
- ▶ What the **demand curve** and **supply curve** are
- ▶ How the supply and demand curves determine a market's **equilibrium price** and **equilibrium quantity**
- ▶ In the case of a **shortage** or **surplus**, how price moves the market back to equilibrium

Supply and Demand: A Model of a Competitive Market

Coffee bean sellers and coffee bean buyers constitute a market—a group of producers and consumers who exchange a good or service for payment. In this chapter, we'll focus on a particular type of market known as a *competitive market*. Roughly, a **competitive market** is a market in which there are many buyers and sellers of the same good or service. More precisely, the key feature of a competitive market is that no individual's actions have a noticeable effect on the price at which the good or service is sold. It's important to understand, however, that this is not an accurate description of every market. For example, it's not an accurate description of the market for cola beverages. That's because in the market for cola beverages, Coca-Cola and Pepsi account for such a large proportion of total sales that they are able to influence the price at which cola beverages are bought and sold. But it is an accurate description of the market for coffee beans. The global marketplace for coffee beans is so huge that even a coffee retailer as large as Starbucks accounts for only a tiny fraction of transactions, making it unable to influence the price at which coffee beans are bought and sold.

It's a little hard to explain why competitive markets are different from other markets until we've seen how a competitive market works. So let's take a rain check—we'll return to that issue at the end of this chapter. For now, let's just say that it's easier to model competitive markets than other markets. When taking an exam, it's always a good strategy to begin by answering the easier questions. In this book, we're going to do the same thing. So we will start with competitive markets.

When a market is competitive, its behavior is well described by the **supply and demand model**. Because many markets *are* competitive, the supply and demand model is a very useful one indeed.

There are five key elements in this model:

- The *demand curve*
- The *supply curve*
- The set of factors that cause the demand curve to shift and the set of factors that cause the supply curve to shift
- The *market equilibrium*, which includes the *equilibrium price* and *equilibrium quantity*
- The way the market equilibrium changes when the supply curve or demand curve shifts

To understand the supply and demand model, we will examine each of these elements.

A **competitive market** is a market in which there are many buyers and sellers of the same good or service, none of whom can influence the price at which the good or service is sold.

The **supply and demand model** is a model of how a competitive market works.

The Demand Curve

How many pounds of coffee beans do consumers around the world want to buy in a given year? You might at first think that we can answer this question by looking at the total number of cups of coffee drunk around the world each day and the amount of coffee beans it takes to brew a cup, then multiplying by 365. But that's not enough to answer the question, because how many pounds of coffee beans consumers want

to buy—and therefore how much coffee people want to drink—depends on the price of coffee beans. When the price of coffee rises, as it did in 2006, some people drink less of it, perhaps switching completely to other caffeinated beverages, such as tea or Coca-Cola. (Yes, there are people who drink Coke in the morning.) In general, the quantity of coffee beans, or of any good or service that people want to buy, depends on the price. The higher the price, the less of the good or service people want to purchase; alternatively, the lower the price, the more they want to purchase.

So the answer to the question “How many pounds of coffee beans do consumers want to buy?” depends on the price of coffee beans. If you don’t yet know what the price will be, you can start by making a table of how many pounds of coffee beans people would want to buy at a number of different prices. Such a table is known as a *demand schedule*. This, in turn, can be used to draw a *demand curve*, which is one of the key elements of the supply and demand model.

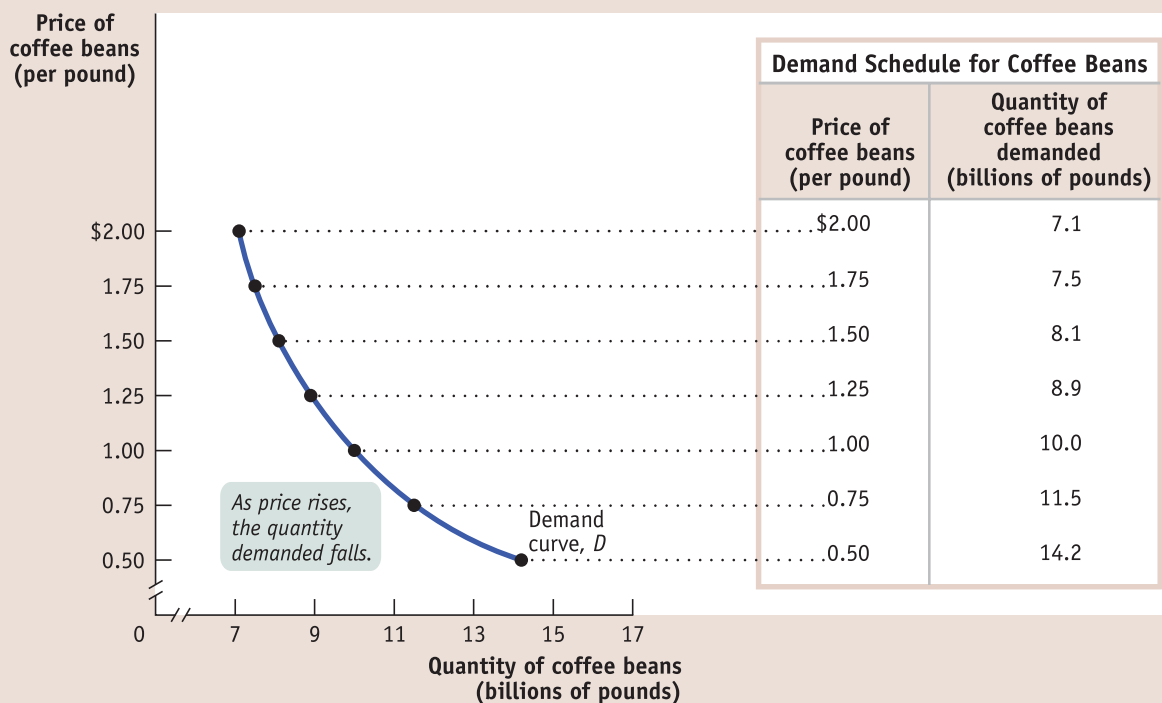
The Demand Schedule and the Demand Curve

A **demand schedule** is a table showing how much of a good or service consumers will want to buy at different prices. At the right of Figure 3-1, we show a hypothetical demand schedule for coffee beans. It’s hypothetical in that it doesn’t use actual data on the world demand for coffee beans and it assumes that all coffee beans are of equal quality (with our apologies to coffee connoisseurs).

According to the table, if coffee beans cost \$1 a pound, consumers around the world will want to purchase 10 billion pounds of coffee beans over the course of a year. If the price is \$1.25 a pound, they will want to buy only 8.9 billion pounds; if

A **demand schedule** shows how much of a good or service consumers will want to buy at different prices.

FIGURE 3-1 The Demand Schedule and the Demand Curve



The demand schedule for coffee beans yields the corresponding demand curve, which shows how much of a good or service consumers want to buy at any given price. The demand curve and the demand

schedule reflect the law of demand: As price rises, the quantity demanded falls. Similarly, a decrease in price raises the quantity demanded. As a result, the demand curve is downward sloping.

The **quantity demanded** is the actual amount of a good or service consumers are willing to buy at some specific price.

A **demand curve** is a graphical representation of the demand schedule. It shows the relationship between quantity demanded and price.

The **law of demand** says that a higher price for a good or service, other things equal, leads people to demand a smaller quantity of that good or service.

the price is only \$0.75 a pound, they will want to buy 11.5 billion pounds; and so on. So the higher the price, the fewer pounds of coffee beans consumers will want to purchase. In other words, as the price rises, the **quantity demanded** of coffee beans—the actual amount consumers are willing to buy at some specific price—falls.

The graph in Figure 3-1 is a visual representation of the information in the table. (You might want to review the discussion of graphs in economics in the appendix to Chapter 2.) The vertical axis shows the price of a pound of coffee beans and the horizontal axis shows the quantity of coffee beans. Each point on the graph corresponds to one of the entries in the table. The curve that connects these points is a **demand curve**. A demand curve is a graphical representation of the demand schedule, another way of showing the relationship between the quantity demanded and price.

Note that the demand curve shown in Figure 3-1 slopes downward. This reflects the general proposition that a higher price reduces the quantity demanded. For example, some people who drink two cups of coffee a day when beans are \$1 per pound will cut down to one cup when beans are \$2 per pound. Similarly, some who drink one cup when beans are \$1 a pound will drink tea instead if the price doubles to \$2 per pound and so on. In the real world, demand curves almost always *do* slope downward. (The exceptions are so rare that for practical purposes we can ignore them.) Generally, the proposition that a higher price for a good, *other things equal*, leads people to demand a smaller quantity of that good is so reliable that economists are willing to call it a “law”—the **law of demand**.

Shifts of the Demand Curve

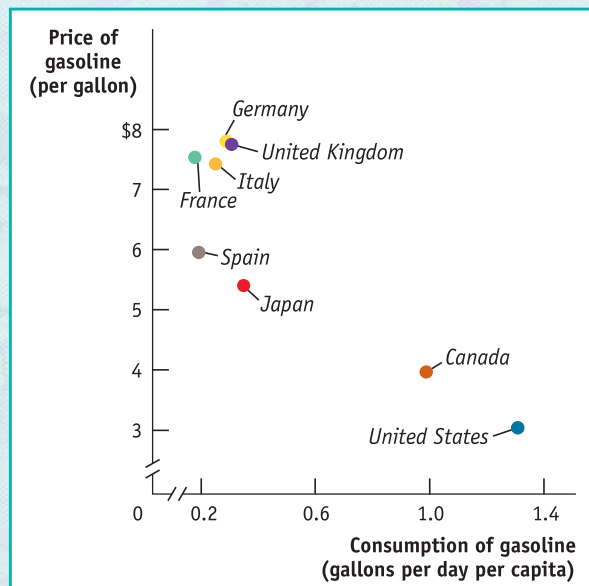
Even though coffee prices were a lot higher in 2009 than they had been in 2002, total world consumption of coffee was higher in 2009. How can we reconcile this fact with the law of demand, which says that a higher price reduces the quantity demanded, other things equal?



PAY MORE, PUMP LESS

For a real-world illustration of the law of demand, consider how gasoline consumption varies according to the prices consumers pay at the pump. Because of high taxes, gasoline and diesel fuel are more than twice as expensive in most European countries as in the United States. According to the law of demand, this should lead Europeans to buy less gasoline than Americans—and they do. As you can see from the figure, per person, Europeans consume less than half as much fuel as Americans, mainly because they drive smaller cars with better mileage.

Prices aren't the only factor affecting fuel consumption, but they're probably the main cause of the difference between European and American fuel consumption per person.



Source: U.S. Energy Information Administration, 2007.

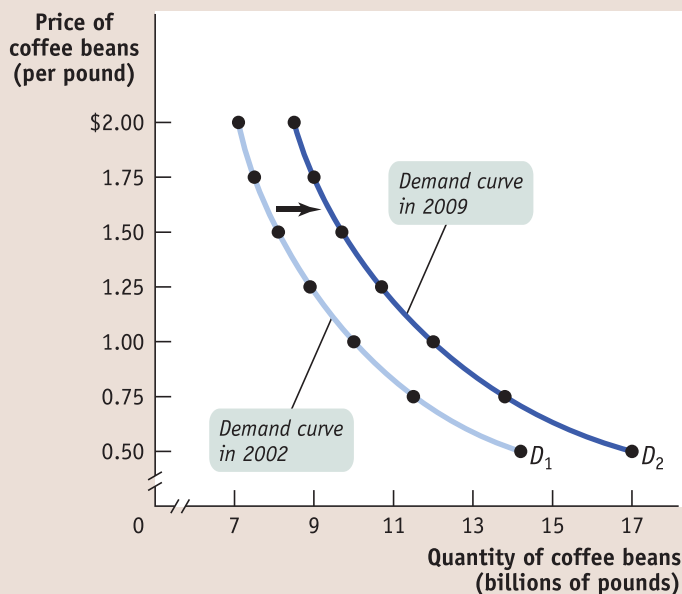
The answer lies in the crucial phrase *other things equal*. In this case, other things weren't equal: the world had changed between 2002 and 2009, in ways that increased the quantity of coffee demanded at any given price. For one thing, the world's population, and therefore the number of potential coffee drinkers, increased. In addition, the growing popularity of different types of coffee beverages, like lattes and cappuccinos, led to an increase in the quantity demanded at any given price. Figure 3-2 illustrates this phenomenon using the demand schedule and demand curve for coffee beans. (As before, the numbers in Figure 3-2 are hypothetical.)

The table in Figure 3-2 shows two demand schedules. The first is a demand schedule for 2002, the same one shown in Figure 3-1. The second is a demand schedule for 2009. It differs from the 2002 demand schedule due to factors such as a larger population and the greater popularity of lattes, factors that led to an increase in the quantity of coffee beans demanded at any given price. So at each price the 2009 schedule shows a larger quantity demanded than the 2002 schedule. For example, the quantity of coffee beans consumers wanted to buy at a price of \$1 per pound increased from 10 billion to 12 billion pounds per year, the quantity demanded at \$1.25 per pound went from 8.9 billion to 10.7 billion pounds, and so on.

What is clear from this example is that the changes that occurred between 2002 and 2009 generated a *new* demand schedule, one in which the quantity demanded was greater at any given price than in the original demand schedule. The two curves in Figure 3-2 show the same information graphically. As you can see, the demand schedule for 2009 corresponds to a new demand curve, D_2 , that is to the right of the demand curve for 2002, D_1 . This **shift of the demand curve** shows the change in the quantity demanded at any given price, represented by the change in position of the original demand curve D_1 to its new location at D_2 .

A **shift of the demand curve** is a change in the quantity demanded at any given price, represented by the change of the original demand curve to a new position, denoted by a new demand curve.

FIGURE 3-2 An Increase in Demand



Demand Schedules for Coffee Beans		
Price of coffee beans (per pound)	Quantity of coffee beans demanded (billions of pounds)	
	in 2002	in 2009
\$2.00	7.1	8.5
1.75	7.5	9.0
1.50	8.1	9.7
1.25	8.9	10.7
1.00	10.0	12.0
0.75	11.5	13.8
0.50	14.2	17.0

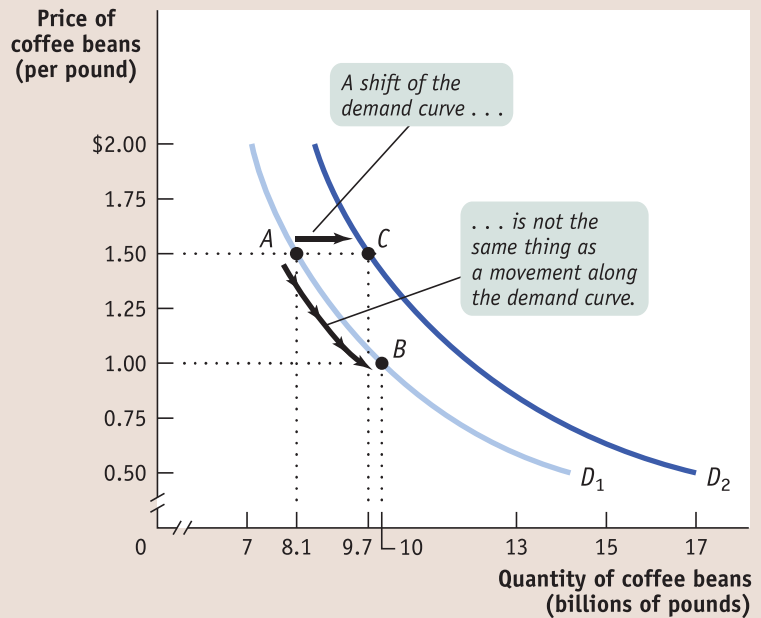
An increase in the population and other factors generate an increase in demand—a rise in the quantity demanded at any given price. This is represented by the two demand schedules—one showing demand in 2002, before the rise

in population, the other showing demand in 2009, after the rise in population—and their corresponding demand curves. The increase in demand shifts the demand curve to the right.

FIGURE 3-3

Movement Along the Demand Curve Versus Shift of the Demand Curve

The rise in quantity demanded when going from point A to point B reflects a movement along the demand curve: it is the result of a fall in the price of the good. The rise in quantity demanded when going from point A to point C reflects a shift of the demand curve: it is the result of a rise in the quantity demanded at any given price.



PITFALLS

DEMAND VERSUS QUANTITY DEMANDED

When economists say “an increase in demand,” they mean a rightward shift of the demand curve, and when they say “a decrease in demand,” they mean a leftward shift of the demand curve—that is, when they’re being careful. In ordinary speech most people, including professional economists, use the word *demand* casually. For example, an economist might say “the demand for air travel has doubled over the past 15 years, partly because of falling air fares” when he or she really means that the *quantity demanded* has doubled.

It’s OK to be a bit sloppy in ordinary conversation. But when you’re doing economic analysis, it’s important to make the distinction between changes in the quantity demanded, which involve movements along a demand curve, and shifts of the demand curve. Sometimes students end up writing something like this: “If demand increases, the price will go up, but that will lead to a fall in demand, which pushes the price down . . .” and then go around in circles. If you make a clear distinction between changes in *demand*, which mean shifts of the demand curve, and changes in *quantity demanded*, you can avoid a lot of confusion.

It’s crucial to make the distinction between such shifts of the demand curve and **movements along the demand curve**, changes in the quantity demanded of a good that result from a change in that good’s price. Figure 3-3 illustrates the difference.

The movement from point A to point B is a movement along the demand curve: the quantity demanded rises due to a fall in price as you move down D_1 . Here, a fall in the price of coffee beans from \$1.50 to \$1 per pound generates a rise in the quantity demanded from 8.1 billion to 10 billion pounds per year. But the quantity demanded can also rise when the price is unchanged if there is an *increase in demand*—a rightward shift of the demand curve. This is illustrated in Figure 3-3 by the shift of the demand curve from D_1 to D_2 . Holding the price constant at \$1.50 a pound, the quantity demanded rises from 8.1 billion pounds at point A on D_1 to 9.7 billion pounds at point C on D_2 .

When economists say “the demand for X increased” or “the demand for Y decreased,” they mean that the demand curve for X or Y shifted—not that the quantity demanded rose or fell because of a change in the price.

Understanding Shifts of the Demand Curve

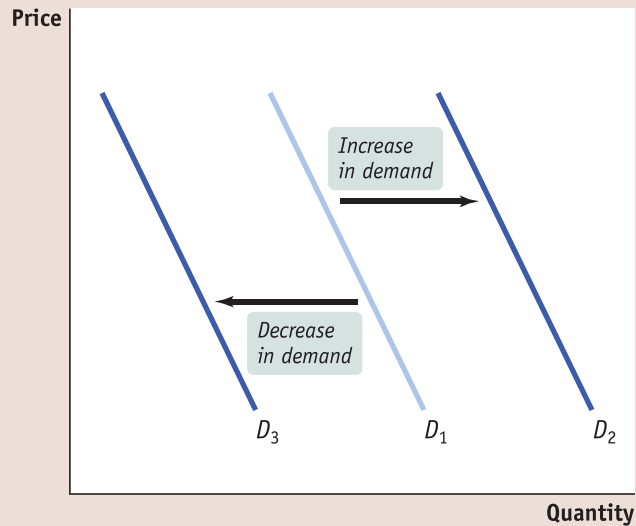
Figure 3-4 illustrates the two basic ways in which demand curves can shift. When economists talk about an “increase in demand,” they mean a *rightward* shift of the demand curve: at any given price, consumers demand a larger quantity of the good or service than before. This is shown by the rightward shift of the original demand curve D_1 to D_2 . And when economists talk about a “decrease in demand,” they mean a *leftward* shift of the demand curve: at any given price, consumers demand a smaller quantity of the good or service than before. This is shown by the leftward shift of the original demand curve D_1 to D_3 .

A **movement along the demand curve** is a change in the quantity demanded of a good that is the result of a change in that good’s price.

FIGURE 3-4

Shifts of the Demand Curve

Any event that increases demand shifts the demand curve to the right, reflecting a rise in the quantity demanded at any given price. Any event that decreases demand shifts the demand curve to the left, reflecting a fall in the quantity demanded at any given price.



What caused the demand curve for coffee beans to shift? We have already mentioned two reasons: changes in population and a change in the popularity of coffee beverages. If you think about it, you can come up with other things that would be likely to shift the demand curve for coffee beans. For example, suppose that the price of tea rises. This will induce some people who previously drank tea to drink coffee instead, increasing the demand for coffee beans.

Economists believe that there are five principal factors that shift the demand curve for a good or service:

- Changes in the prices of related goods or services
- Changes in income
- Changes in tastes
- Changes in expectations
- Changes in the number of consumers

Although this is not an exhaustive list, it contains the five most important factors that can shift demand curves. So when we say that the quantity of a good or service demanded falls as its price rises, *other things equal*, we are in fact stating that the factors that shift demand are remaining unchanged. Let's now explore, in more detail, how those factors shift the demand curve.

Changes in the Prices of Related Goods or Services While there's nothing quite like a good cup of coffee to start your day, a cup or two of strong tea isn't a bad alternative. Tea is what economists call a *substitute* for coffee. A pair of goods are **substitutes** if a rise in the price of one good (coffee) makes consumers more willing to buy the other good (tea). Substitutes are usually goods that in some way serve a similar function: concerts and theater plays, muffins and doughnuts, train rides and air flights. A rise in the price of the alternative good induces some consumers to purchase the original good *instead* of it, shifting demand for the original good to the right.

But sometimes a fall in the price of one good makes consumers *more* willing to buy another good. Such pairs of goods are known as **complements**. Complements are usually goods that in some sense are consumed together: computers and software, cappuccinos and croissants, cars and gasoline. Because consumers like to consume a good and its complement together, a change in the price of one of the goods will affect the demand for its complement. In particular, when the price of one good rises,

Two goods are **substitutes** if a rise in the price of one good leads to an increase in the demand for the other good.

Two goods are **complements** if a rise in the price of one good leads to a decrease in the demand for the other good.

When a rise in income increases the demand for a good—the normal case—it is a **normal good**.

When a rise in income decreases the demand for a good, it is an **inferior good**.

the demand for its complement decreases, shifting the demand curve for the complement to the left. So the rise in Starbucks' cappuccino prices is likely to have precipitated a leftward shift of the demand curve for croissants, as people consumed fewer cappuccinos and croissants. (In fact, after the August 2009 price changes, Starbucks tried to counter this fall in demand by introducing the \$3.95 all-day breakfast combo, which is a breakfast sandwich and a cup of brewed coffee!) Likewise, when the price of one good falls, the quantity demanded of its complement rises, shifting the demand curve for the complement to the right. This means that if, for some reason, the price of cappuccinos falls, we should see a rightward shift of the demand curve for croissants as people consume more cappuccinos and croissants.

Changes in Income When individuals have more income, they are normally more likely to purchase a good at any given price. For example, if a family's income rises, it is more likely to take that summer trip to Disney World—and therefore also more likely to buy plane tickets. So a rise in consumer incomes will cause the demand curves for most goods to shift to the right.

Why do we say “most goods,” not “all goods”? Most goods are **normal goods**—the demand for them increases when consumer income rises. However, the demand for some products falls when income rises. Goods for which demand decreases when income rises are known as **inferior goods**. Usually an inferior good is one that is considered less desirable than more expensive alternatives—such as a bus ride versus a taxi ride. When they can afford to, people stop buying an inferior good and switch their consumption to the preferred, more expensive alternative. So when a good is inferior, a rise in income shifts the demand curve to the left. And, not surprisingly, a fall in income shifts the demand curve to the right.

One example of the distinction between normal and inferior goods that has drawn considerable attention in the business press is the difference between so-called casual-dining restaurants such as Applebee's or Olive Garden and fast-food chains such as McDonald's and KFC. When Americans' income rises, they tend to eat out more at casual-dining restaurants. However, some of this increased dining out comes at the expense of fast-food venues—to some extent, people visit McDonald's less once they can afford to move upscale. So casual dining is a normal good, while fast-food consumption appears to be an inferior good.

Changes in Tastes Why do people want what they want? Fortunately, we don't need to answer that question—we just need to acknowledge that people have certain preferences, or tastes, that determine what they choose to consume and that these tastes can change. Economists usually lump together changes in demand due to fads, beliefs, cultural shifts, and so on under the heading of changes in *tastes* or *preferences*.

For example, once upon a time men wore hats. Up until around World War II, a respectable man wasn't fully dressed unless he wore a dignified hat along with his suit. But the returning GIs adopted a more informal style, perhaps due to the rigors of the war. And President Eisenhower, who had been supreme commander of Allied Forces before becoming president, often went hatless. After World War II, it was clear that the demand curve for hats had shifted leftward, reflecting a decrease in the demand for hats.

We've already mentioned one way in which changing tastes played a role in the increase in the demand for coffee beans from 2002 to 2009: the increase in the popularity of coffee beverages such as lattes and cappuccinos. In addition, there was another route by which changing tastes increased worldwide demand for coffee beans: the switch by consumers in traditionally tea-drinking countries to coffee. “In 1999,” reported *Roast* magazine, “the ratio of Russian tea drinkers to coffee drinkers was five to one. In 2005, the ratio is roughly two to one.”

Economists have little to say about the forces that influence consumers' tastes. (Although marketers and advertisers have plenty to say about them!) However, a *change* in tastes has a predictable impact on demand. When tastes change in favor of a good, more people want to buy it at any given price, so the demand curve shifts to

the right. When tastes change against a good, fewer people want to buy it at any given price, so the demand curve shifts to the left.

Changes in Expectations When consumers have some choice about when to make a purchase, current demand for a good is often affected by expectations about its future price. For example, savvy shoppers often wait for seasonal sales—say, buying next year’s holiday gifts during the post-holiday markdowns. In this case, expectations of a future drop in price lead to a decrease in demand today. Alternatively, expectations of a future rise in price are likely to cause an increase in demand today. For example, savvy shoppers, knowing that Starbucks was going to increase the price of its coffee beans would stock up on Starbucks coffee beans before the price change.

Expected changes in future income can also lead to changes in demand: if you expect your income to rise in the future, you will typically borrow today and increase your demand for certain goods; and if you expect your income to fall in the future, you are likely to save today and reduce your demand for some goods.

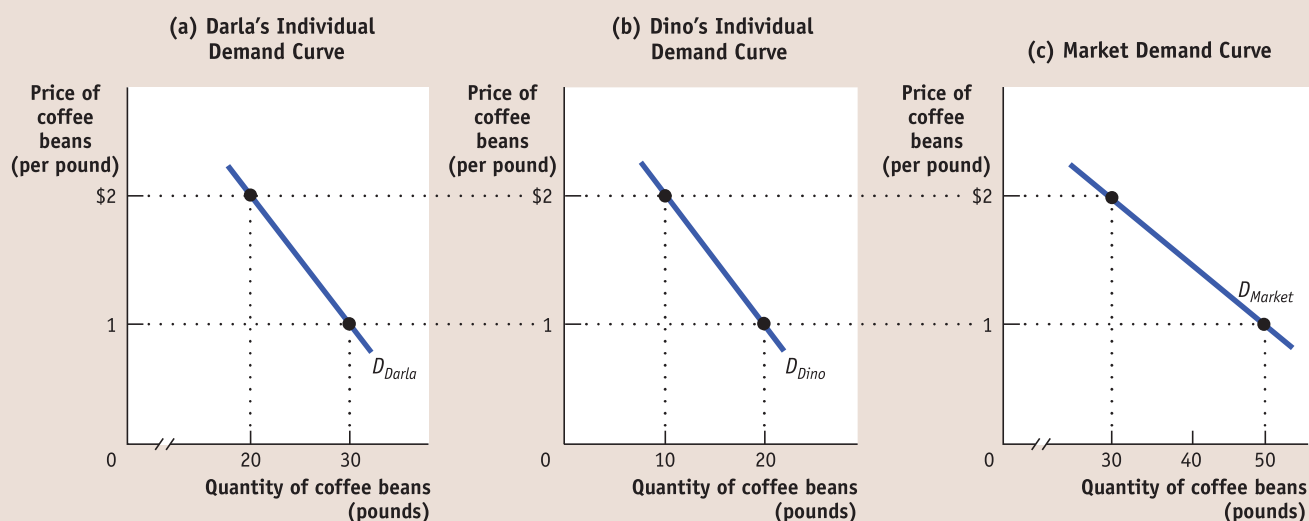
Changes in the Number of Consumers As we’ve already noted, one of the reasons for rising coffee demand between 2002 and 2009 was a growing world population. Because of population growth, overall demand for coffee would have risen even if each individual coffee-drinker’s demand for coffee had remained unchanged.

Let’s introduce a new concept: the **individual demand curve**, which shows the relationship between quantity demanded and price for an individual consumer. For example, suppose that Darla is a consumer of coffee beans and that panel (a) of Figure 3-5 shows how many pounds of coffee beans she will buy per year at any given price per pound. Then D_{Darla} is Darla’s individual demand curve.

The *market demand curve* shows how the combined quantity demanded by all consumers depends on the market price of that good. (Most of the time, when economists refer to the demand curve, they mean the market demand curve.) The

An **individual demand curve** illustrates the relationship between quantity demanded and price for an individual consumer.

FIGURE 3-5 Individual Demand Curves and the Market Demand Curve



Darla and Dino are the only two consumers of coffee beans in the market. Panel (a) shows Darla’s individual demand curve: the number of pounds of coffee beans she will buy per year at any given price. Panel (b) shows Dino’s individual demand curve. Given that Darla and Dino are the only two consumers, the *market demand curve*, which shows the

quantity of coffee demanded by all consumers at any given price, is shown in panel (c). The market demand curve is the *horizontal sum* of the individual demand curves of all consumers. In this case, at any given price, the quantity demanded by the market is the sum of the quantities demanded by Darla and Dino.

TABLE 3-1

Factors That Shift Demand

Changes in the prices of related goods or services		
If A and B are substitutes . . .	. . . and the price of B rises, . . .	. . . demand for A increases.
	. . . and the price of B falls, . . .	. . . demand for A decreases.
If A and B are complements . . .	. . . and the price of B rises, . . .	. . . demand for A decreases.
	. . . and the price of B falls, . . .	. . . demand for A increases.
Changes in income		
If A is a normal good . . .	. . . and income rises, . . .	. . . demand for A increases.
	. . . and income falls, . . .	. . . demand for A decreases.
If A is an inferior good . . .	. . . and income rises, . . .	. . . demand for A decreases.
	. . . and income falls, . . .	. . . demand for A increases.
Changes in tastes		
	If tastes change in favor of A, . . .	. . . demand for A increases.
	If tastes change against A, . . .	. . . demand for A decreases.
Changes in expectations		
	If the price of A is expected to rise in the future, . . .	. . . demand for A increases today.
	If the price of A is expected to fall in the future, . . .	. . . demand for A decreases today.
If A is a normal good . . .	. . . and income is expected to rise in the future, . . .	. . . demand for A may increase today.
	. . . and income is expected to fall in the future, . . .	. . . demand for A may decrease today.
If A is an inferior good . . .	. . . and income is expected to rise in the future, . . .	. . . demand for A may decrease today.
	. . . and income is expected to fall in the future, . . .	. . . demand for A may increase today.
Changes in the number of consumers		
	If the number of consumers of A rises, . . .	. . . market demand for A increases.
	If the number of consumers of A falls, . . .	. . . market demand for A decreases.

market demand curve is the *horizontal sum* of the individual demand curves of all consumers in that market. To see what we mean by the term *horizontal sum*, assume for a moment that there are only two consumers of coffee, Darla and Dino. Dino's individual demand curve, D_{Dino} , is shown in panel (b). Panel (c) shows the market demand curve. At any given price, the quantity demanded by the market is the sum of the quantities demanded by Darla and Dino. For example, at a price of \$2 per pound, Darla demands 20 pounds of coffee beans per year and Dino demands 10 pounds per year. So the quantity demanded by the market is 30 pounds per year.

Clearly, the quantity demanded by the market at any given price is larger with Dino present than it would be if Darla was the only consumer. The quantity demanded at any given price would be even larger if we added a third consumer, then a fourth, and so on. So an increase in the number of consumers leads to an increase in demand.

For an overview of the factors that shift demand, see Table 3-1.

► **ECONOMICS IN ACTION**



Beating the Traffic

All big cities have traffic problems, and many local authorities try to discourage driving in the crowded city center. If we think of an auto trip to the city center as a good that people consume, we can use the economics of demand to analyze anti-traffic policies.

One common strategy of local governments is to reduce the demand for auto trips by lowering the prices of substitutes. Many metropolitan areas subsidize bus and rail service, hoping to lure commuters out of their cars.

An alternative strategy is to raise the price of complements: several major U.S. cities impose high taxes on commercial parking garages, both to raise revenue and to discourage people from driving into the city. Short time limits on parking meters, combined with vigilant parking enforcement, is a related tactic.

However, few cities have been willing to adopt the politically controversial direct approach: reducing congestion by raising the price of driving. So it was a shock when, in 2003, London imposed a “congestion charge” on all cars entering the city center during business hours—currently £8 (about \$13) for drivers who pay on the same day they travel.

Compliance is monitored with automatic cameras that photograph license plates. People can either pay the charge in advance or pay it by midnight of the day they have driven. If they pay on the day after they have driven, the charge increases to £10 (about \$16). And if they don’t pay and are caught, a fine of £120 (about \$195) is imposed for each transgression. (A full description of the rules can be found at www.cclondon.com.)

Not surprisingly, the result of the new policy confirms the law of demand: three years after the charge was put in place, traffic in central London was about 10 percent lower than before the charge. In February 2007, the British government doubled the area of London covered by the congestion charge, and it suggested that it might institute congestion charging across the country by 2015. Several American and European municipalities, having seen the success of London’s congestion charge, have said that they are seriously considering adopting a congestion charge as well. ▲

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► CHECK YOUR UNDERSTANDING 3-1

1. Explain whether each of the following events represents (i) a *shift of* the demand curve or (ii) a *movement along* the demand curve.
 - a. A store owner finds that customers are willing to pay more for umbrellas on rainy days.
 - b. When XYZ Telecom, a long-distance telephone service provider, offered reduced rates on weekends, its volume of weekend calling increased sharply.
 - c. People buy more long-stem roses the week of Valentine’s Day, even though the prices are higher than at other times during the year.
 - d. The sharp rise in the price of gasoline leads many commuters to join carpools in order to reduce their gasoline purchases.

Solutions appear at back of book.

The Supply Curve

Some parts of the world are especially well suited to growing coffee beans, which is why, as the lyrics of an old song put it, “There’s an awful lot of coffee in Brazil.” But even in Brazil, some land is better suited to growing coffee than other land. Whether Brazilian farmers restrict their coffee-growing to only the most ideal locations or expand it to less suitable land depends on the price they expect to get for their beans. Moreover, there are many other areas in the world where coffee beans could be grown—such as Madagascar and Vietnam. Whether farmers there actually grow coffee depends, again, on the price.

So just as the quantity of coffee beans that consumers want to buy depends on the price they have to pay, the quantity that producers are willing to produce and sell—the **quantity supplied**—depends on the price they are offered.

The Supply Schedule and the Supply Curve

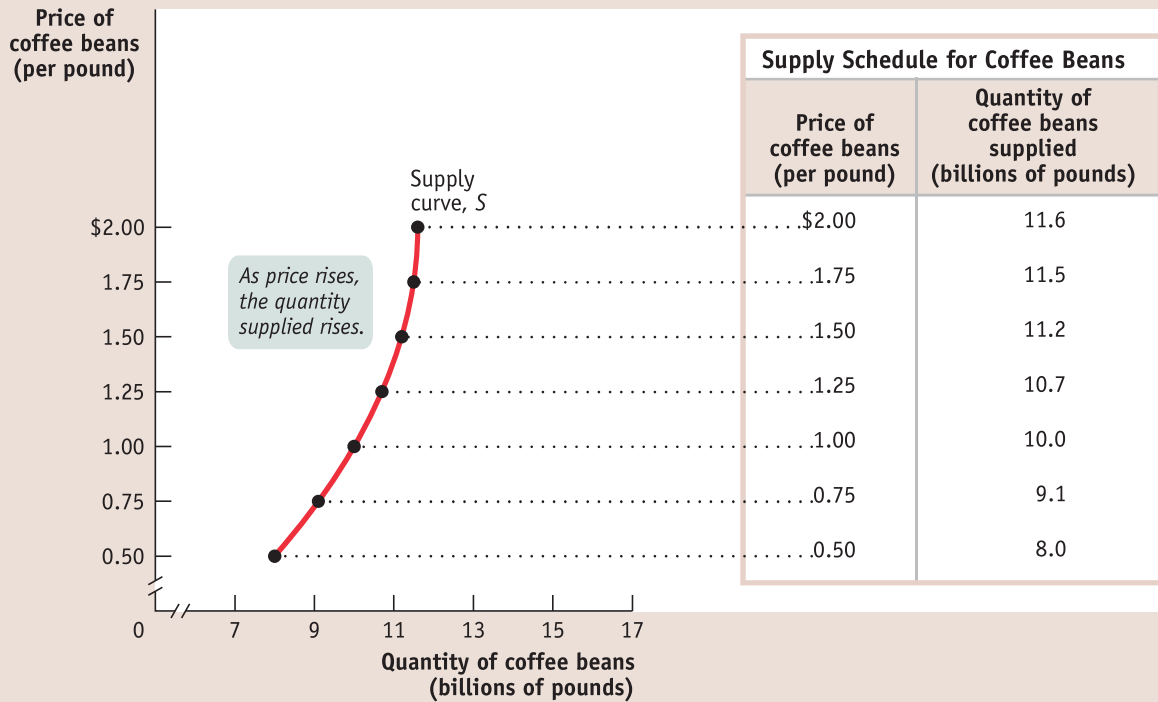
The table in Figure 3-6 on the next page shows how the quantity of coffee beans made available varies with the price—that is, it shows a hypothetical **supply schedule** for coffee beans.

►► QUICK REVIEW

- The **supply and demand model** is a model of a **competitive market**—one in which there are many buyers and sellers of the same good or service.
- The **demand schedule** shows how the **quantity demanded** changes as the price changes. This relationship is illustrated by a **demand curve**.
- The **law of demand** asserts that demand curves normally slope downward—that is, a higher price reduces the quantity demanded.
- Increases or decreases in demand correspond to **shifts of the demand curve**. An increase in demand is a rightward shift: the quantity demanded rises for any given price. A decrease in demand is a leftward shift: the quantity demanded falls for any given price. A change in price results in a **movement along the demand curve**—a change in the quantity demanded.
- The five main factors that can shift the demand curve are changes in (1) the price of a related good, such as a **substitute** or a **complement**, (2) income, (3) tastes, (4) expectations, and (5) the number of consumers.
- The market demand curve is the horizontal sum of the **individual demand curves** of all consumers in the market.

The **quantity supplied** is the actual amount of a good or service producers are willing to sell at some specific price.

A **supply schedule** shows how much of a good or service producers will supply at different prices.

FIGURE 3-6 The Supply Schedule and the Supply Curve


The supply schedule for coffee beans is plotted to yield the corresponding supply curve, which shows how much of a good producers are willing to sell at any given price. The supply curve and the supply

schedule reflect the fact that supply curves are usually upward sloping: the quantity supplied rises when the price rises.

A supply schedule works the same way as the demand schedule shown in Figure 3-1: in this case, the table shows the quantity of coffee beans farmers are willing to sell at different prices. At a price of \$0.50 per pound, farmers are willing to sell only 8 billion pounds of coffee beans per year. At \$0.75 per pound, they're willing to sell 9.1 billion pounds. At \$1, they're willing to sell 10 billion pounds, and so on.

In the same way that a demand schedule can be represented graphically by a demand curve, a supply schedule can be represented by a **supply curve**, as shown in Figure 3-6. Each point on the curve represents an entry from the table.

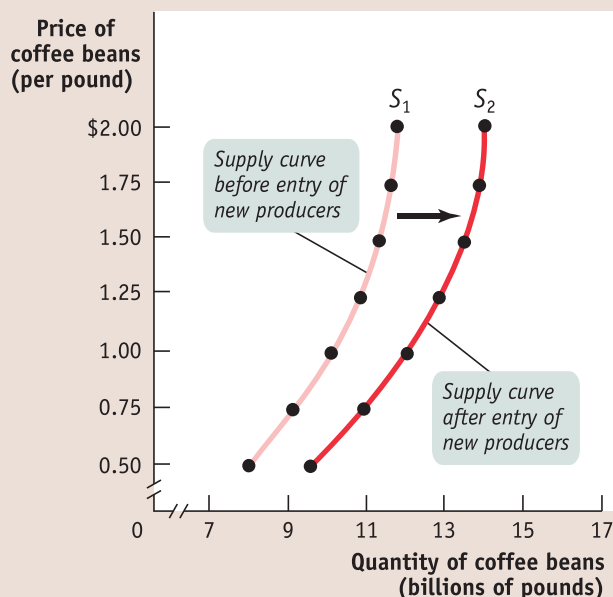
Suppose that the price of coffee beans rises from \$1 to \$1.25; we can see that the quantity of coffee beans farmers are willing to sell rises from 10 billion to 10.7 billion pounds. This is the normal situation for a supply curve, reflecting the general proposition that a higher price leads to a higher quantity supplied. So just as demand curves normally slope downward, supply curves normally slope upward: the higher the price being offered, the more of any good or service producers will be willing to sell.

Shifts of the Supply Curve

Compared to earlier trends, coffee beans were unusually cheap in the early years of the twenty-first century. One reason was the emergence of new coffee bean-producing countries, which began competing with the traditional sources in

A **supply curve** shows the relationship between quantity supplied and price.

FIGURE 3-7 An Increase in Supply



Supply Schedules for Coffee Beans		
Price of coffee beans (per pound)	Quantity of coffee beans supplied (billions of pounds)	
	Before entry	After entry
\$2.00	11.6	13.9
1.75	11.5	13.8
1.50	11.2	13.4
1.25	10.7	12.8
1.00	10.0	12.0
0.75	9.1	10.9
0.50	8.0	9.6

The entry of Vietnam into the coffee bean business generated an increase in supply—a rise in the quantity supplied at any given price. This event is represented by the two supply schedules—one showing supply before Viet-

nam's entry, the other showing supply after Vietnam came in—and their corresponding supply curves. The increase in supply shifts the supply curve to the right.

Latin America. Vietnam, in particular, emerged as a big new source of coffee beans. Figure 3-7 illustrates this event in terms of the supply schedule and the supply curve for coffee beans.

The table in Figure 3-7 shows two supply schedules. The schedule before new producers such as Vietnam arrived on the scene is the same one as in Figure 3-6. The second schedule shows the supply of coffee beans *after* the entry of new producers. Just as a change in demand schedules leads to a shift of the demand curve, a change in supply schedules leads to a **shift of the supply curve**—a change in the quantity supplied at any given price. This is shown in Figure 3-7 by the shift of the supply curve before the entry of the new producers, S_1 , to its new position after the entry of the new producers, S_2 . Notice that S_2 lies to the right of S_1 , a reflection of the fact that quantity supplied increases at any given price.

As in the analysis of demand, it's crucial to draw a distinction between such shifts of the supply curve and **movements along the supply curve**—changes in the quantity supplied that result from a change in price. We can see this difference in Figure 3-8 on the next page. The movement from point A to point B is a movement along the supply curve: the quantity supplied rises along S_1 due to a rise in price. Here, a rise in price from \$1 to \$1.50 leads to a rise in the quantity supplied from 10 billion to 11.2 billion pounds of coffee beans. But the quantity supplied can also rise when the price is unchanged if there is an increase in supply—a rightward shift of the supply curve. This is shown by the rightward shift of the supply curve from S_1 to S_2 . Holding price constant at \$1, the quantity supplied rises from 10 billion pounds at point A on S_1 to 12 billion pounds at point C on S_2 .

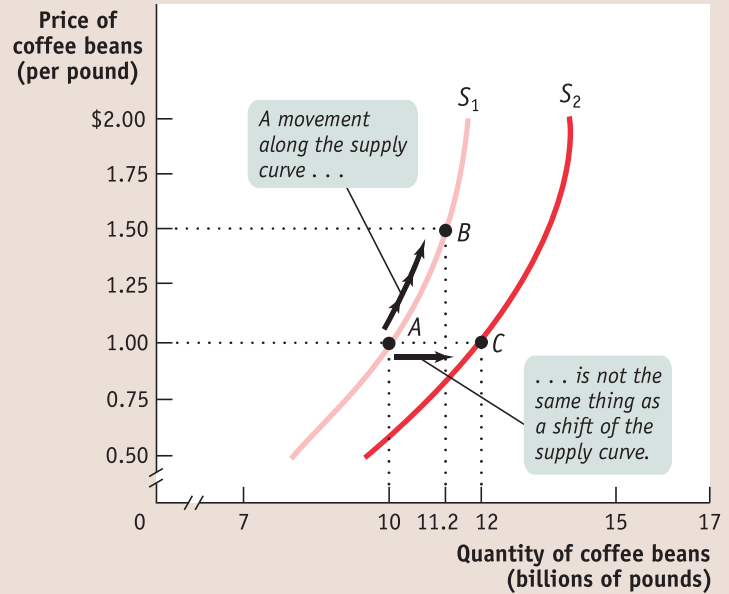
A **shift of the supply curve** is a change in the quantity supplied of a good or service at any given price. It is represented by the change of the original supply curve to a new position, denoted by a new supply curve.

A **movement along the supply curve** is a change in the quantity supplied of a good that is the result of a change in that good's price.

FIGURE 3-8

Movement Along the Supply Curve Versus Shift of the Supply Curve

The increase in quantity supplied when going from point A to point B reflects a movement along the supply curve: it is the result of a rise in the price of the good. The increase in quantity supplied when going from point A to point C reflects a shift of the supply curve: it is the result of an increase in the quantity supplied at any given price.



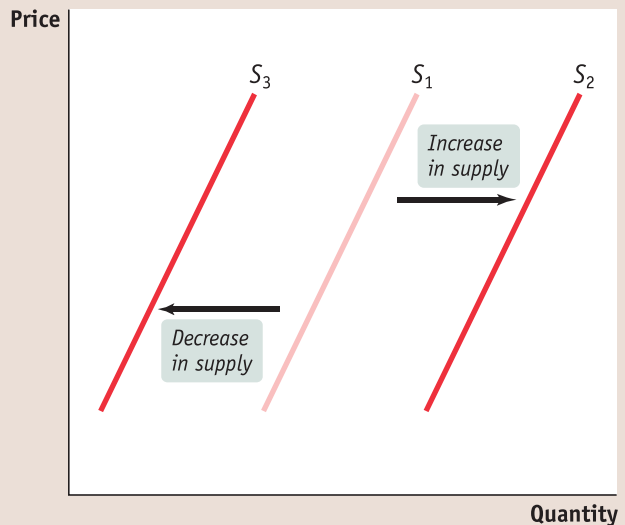
Understanding Shifts of the Supply Curve

Figure 3-9 illustrates the two basic ways in which supply curves can shift. When economists talk about an “increase in supply,” they mean a *rightward* shift of the supply curve: at any given price, producers supply a larger quantity of the good than before. This is shown in Figure 3-9 by the rightward shift of the original supply curve S_1 to S_2 . And when economists talk about a “decrease in supply,” they mean a *leftward* shift of the supply curve: at any given price, producers supply a smaller quantity of the good than before. This is represented by the leftward shift of S_1 to S_3 .

FIGURE 3-9

Shifts of the Supply Curve

Any event that increases supply shifts the supply curve to the right, reflecting a rise in the quantity supplied at any given price. Any event that decreases supply shifts the supply curve to the left, reflecting a fall in the quantity supplied at any given price.



Economists believe that shifts of the supply curve for a good or service are mainly the result of five factors (though, as in the case of demand, there are other possible causes):

- Changes in input prices
- Changes in the prices of related goods or services
- Changes in technology
- Changes in expectations
- Changes in the number of producers

Changes in Input Prices To produce output, you need inputs. For example, to make vanilla ice cream, you need vanilla beans, cream, sugar, and so on. An **input** is any good or service that is used to produce another good or service. Inputs, like output, have prices. And an increase in the price of an input makes the production of the final good more costly for those who produce and sell it. So producers are less willing to supply the final good at any given price, and the supply curve shifts to the left. For example, newspaper publishers buy large quantities of newsprint (the paper on which newspapers are printed). When newsprint prices rose sharply in 1994–1995, the supply of newspapers fell: several newspapers went out of business and a number of new publishing ventures were canceled. Similarly, a fall in the price of an input makes the production of the final good less costly for sellers. They are more willing to supply the good at any given price, and the supply curve shifts to the right.

Changes in the Prices of Related Goods or Services A single producer often produces a mix of goods rather than a single product. For example, an oil refinery produces gasoline from crude oil, but it also produces heating oil and other products from the same raw material. When a producer sells several products, the quantity of any one good it is willing to supply at any given price depends on the prices of its other co-produced goods. This effect can run in either direction. An oil refiner will supply less gasoline at any given price when the price of heating oil rises, shifting the supply curve for gasoline to the left. But it will supply more gasoline at any given price when the price of heating oil falls, shifting the supply curve for gasoline to the right. This means that gasoline and other co-produced oil products are *substitutes in production* for refiners. In contrast, due to the nature of the production process, other goods can be *complements in production*. For example, producers of crude oil—oil-well drillers—often find that oil wells also produce natural gas as a by-product of oil extraction. The higher the price at which a driller can sell its natural gas, the more oil wells it will drill and the more oil it will supply at any given price for oil. As a result, natural gas is a complement in production for crude oil.

Changes in Technology When economists talk about “technology,” they don’t necessarily mean high technology—they mean all the methods people can use to turn inputs into useful goods and services. In that sense, the whole complex sequence of activities that turn corn from an Iowa farm into cornflakes on your breakfast table is technology. And when a better technology becomes available, reducing the cost of production—that is, letting a producer spend less on inputs yet produce the same output—supply increases, and the supply curve shifts to the right. For example, an improved strain of corn that is more resistant to disease makes farmers willing to supply more corn at any given price.

Changes in Expectations Just as changes in expectations can shift the demand curve, they can also shift the supply curve. When suppliers have some choice about when they put their good up for sale, changes in the expected future price of the good can lead a supplier to supply less or more of the good today. For example, consider the fact that gasoline and other oil products are often stored for significant periods of time at oil refineries before being sold to consumers. In fact, storage is normally part of producers’ business strategy. Knowing that the demand for gasoline

An **input** is a good or service that is used to produce another good or service.

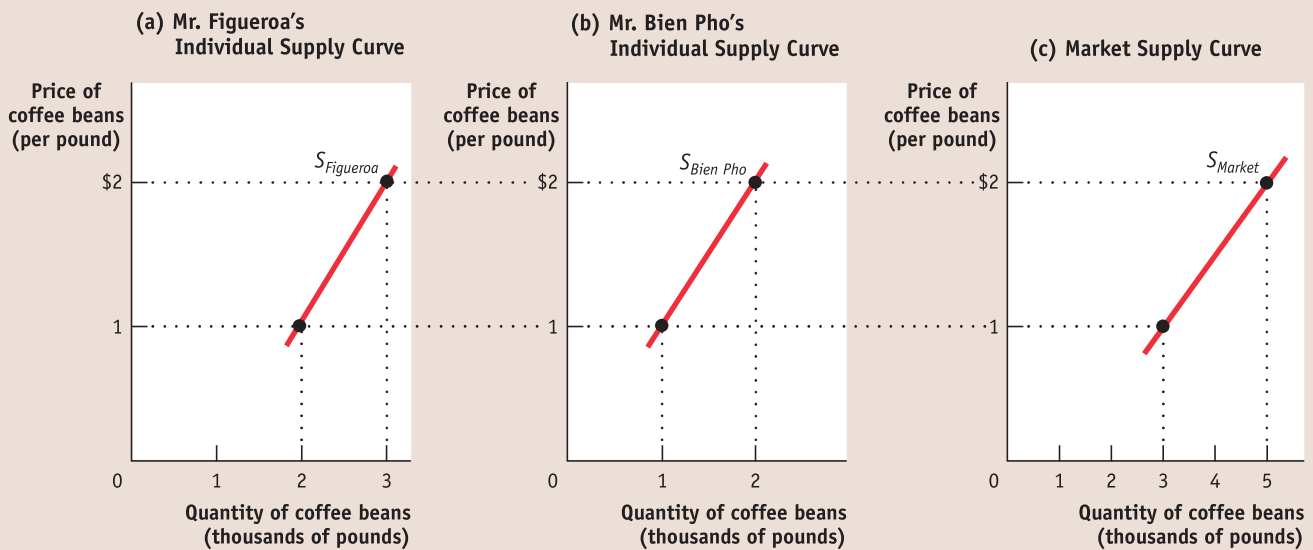
An **individual supply curve** illustrates the relationship between quantity supplied and price for an individual producer.

peaks in the summer, oil refiners normally store some of their gasoline produced during the spring for summer sale. Similarly, knowing that the demand for heating oil peaks in the winter, they normally store some of their heating oil produced during the fall for winter sale. In each case, there's a decision to be made between selling the product now versus storing it for later sale. Which choice a producer makes depends on a comparison of the current price versus the expected future price. This example illustrates how changes in expectations can alter supply: an increase in the anticipated future price of a good or service reduces supply today, a leftward shift of the supply curve. But a fall in the anticipated future price increases supply today, a rightward shift of the supply curve.

Changes in the Number of Producers Just as changes in the number of consumers affect the demand curve, changes in the number of producers affect the supply curve. Let's examine the **individual supply curve**, which shows the relationship between quantity supplied and price for an individual producer. For example, suppose that Mr. Figueroa is a Brazilian coffee farmer and that panel (a) of Figure 3-10 shows how many pounds of beans he will supply per year at any given price. Then S_{Figueroa} is his individual supply curve.

The **market supply curve** shows how the combined total quantity supplied by all individual producers in the market depends on the market price of that good. Just as the market demand curve is the horizontal sum of the individual demand curves of all consumers, the market supply curve is the horizontal sum of the individual supply curves of all producers. Assume for a moment that there are only two producers of coffee beans, Mr. Figueroa and Mr. Bien Pho, a Vietnamese coffee farmer. Mr. Bien Pho's individual supply curve is shown in panel (b). Panel (c) shows the market supply curve. At any given price, the quantity supplied to the market is the sum of the quantities supplied by Mr. Figueroa and Mr. Bien Pho. For example, at a price of \$2 per pound, Mr. Figueroa supplies 3,000 pounds of coffee beans per year and Mr. Bien Pho supplies 2,000 pounds per year, making the quantity supplied to the market 5,000 pounds.

FIGURE 3-10 The Individual Supply Curve and the Market Supply Curve



Panel (a) shows the individual supply curve for Mr. Figueroa, S_{Figueroa} , the quantity of coffee beans he will sell at any given price. Panel (b) shows the individual supply curve for Mr. Bien Pho, $S_{\text{Bien Pho}}$. The market supply curve, which

shows the quantity of coffee beans supplied by all producers at any given price, is shown in panel (c). The market supply curve is the horizontal sum of the individual supply curves of all producers.

TABLE 3-2

Factors That Shift Supply		
Changes in input prices		
	If the price of an input used to produce <i>A</i> rises, . . .	. . . supply of <i>A</i> decreases.
	If the price of an input used to produce <i>A</i> falls, . . .	. . . supply of <i>A</i> increases.
Changes in the prices of related goods or services		
If <i>A</i> and <i>B</i> are substitutes in production . . .	. . . and the price of <i>B</i> rises, . . .	. . . supply of <i>A</i> decreases.
	. . . and the price of <i>B</i> falls, . . .	. . . supply of <i>A</i> increases.
If <i>A</i> and <i>B</i> are complements in production . . .	. . . and the price of <i>B</i> rises, . . .	. . . supply of <i>A</i> increases.
	. . . and the price of <i>B</i> falls, . . .	. . . supply of <i>A</i> decreases.
Changes in technology		
	If the technology used to produce <i>A</i> improves, . . .	. . . supply of <i>A</i> increases.
Changes in expectations		
	If the price of <i>A</i> is expected to rise in the future, . . .	. . . supply of <i>A</i> decreases today.
	If the price of <i>A</i> is expected to fall in the future, . . .	. . . supply of <i>A</i> increases today.
Changes in the number of producers		
	If the number of producers of <i>A</i> rises, . . .	. . . market supply of <i>A</i> increases.
	If the number of producers of <i>A</i> falls, . . .	. . . market supply of <i>A</i> decreases.

Clearly, the quantity supplied to the market at any given price is larger with Mr. Bien Pho present than it would be if Mr. Figueroa was the only supplier. The quantity supplied at a given price would be even larger if we added a third producer, then a fourth, and so on. So an increase in the number of producers leads to an increase in supply and a rightward shift of the supply curve.

For an overview of the factors that shift supply, see Table 3-2.

►ECONOMICS IN ACTION

Only Creatures Small and Pampered

During the 1970s, British television featured a popular show titled *All Creatures Great and Small*. It chronicled the real life of James Herriot, a country veterinarian who tended to cows, pigs, sheep, horses, and the occasional house pet, often under arduous conditions, in rural England during the 1930s. The show made it clear that in those days the local vet was a critical member of farming communities, saving valuable farm animals and helping farmers survive financially. And it was also clear that Mr. Herriot considered his life's work well spent.

But that was then and this is now. According to a 2007 article in the *New York Times*, the United States has experienced a severe decline in the number of farm veterinarians over the past two decades. The source of the problem is competition. As the number of household pets has increased and the incomes of pet owners have grown, the demand for pet veterinarians has increased sharply. As a result, vets are being drawn away from the business of caring for farm animals into the more lucrative business of caring for pets. As one vet stated, she began her career caring for farm animals but changed her mind after "doing a C-section on a cow and it's 50 bucks. Do a C-section on a Chihuahua and you get \$300. It's the money. I hate to say that."

How can we translate this into supply and demand curves? Farm veterinary services and pet veterinary services are like gasoline and fuel oil: they're related goods that are substitutes in production. A veterinarian typically specializes in one type of practice or the other, and that decision often depends on the going price for the service.

>> QUICK REVIEW

- The **supply schedule** shows how the **quantity supplied** depends on the price. The relationship between the two is illustrated by the **supply curve**.
- Supply curves are normally upward sloping: at a higher price, producers are willing to supply more of a good or service.
- A change in price results in a **movement along the supply curve** and a change in the quantity supplied.
- As with demand, increases or decreases in supply correspond to **shifts of the supply curve**. An increase in supply is a rightward shift: the quantity supplied rises for any given price. A decrease in supply is a leftward shift: the quantity supplied falls for any given price.
- The five main factors that can shift the supply curve are changes in (1) input prices, (2) prices of related goods or services, (3) technology, (4) expectations, and (5) number of producers.
- The market supply curve is the horizontal sum of the **individual supply curves** of all producers in the market.

America's growing pet population, combined with the increased willingness of doting owners to spend on their companions' care, has driven up the price of pet veterinary services. As a result, fewer and fewer veterinarians have gone into farm animal practice. So the supply curve of farm veterinarians has shifted leftward—fewer farm veterinarians are offering their services at any given price.

In the end, farmers understand that it is all a matter of dollars and cents—that they get fewer veterinarians because they are unwilling to pay more. As one farmer, who had recently lost an expensive cow due to the unavailability of a veterinarian, stated, “The fact that there’s nothing you can do, you accept it as a business expense now. You didn’t used to. If you have livestock, sooner or later you’re going to have deadstock.” (Although we should note that this farmer *could* have chosen to pay more for a vet who would have then saved his cow.) ▲

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>> CHECK YOUR UNDERSTANDING 3-2

1. Explain whether each of the following events represents (i) a *shift of the supply curve* or (ii) a *movement along the supply curve*.
 - a. More homeowners put their houses up for sale during a real estate boom that causes house prices to rise.
 - b. Many strawberry farmers open temporary roadside stands during harvest season, even though prices are usually low at that time.
 - c. Immediately after the school year begins, fast-food chains must raise wages, which represent the price of labor, to attract workers.
 - d. Many construction workers temporarily move to areas that have suffered hurricane damage, lured by higher wages.
 - e. Since new technologies have made it possible to build larger cruise ships (which are cheaper to run per passenger), Caribbean cruise lines have offered more cabins, at lower prices, than before.

Solutions appear at back of book.

Supply, Demand, and Equilibrium

We have now covered the first three key elements in the supply and demand model: the demand curve, the supply curve, and the set of factors that shift each curve. The next step is to put these elements together to show how they can be used to predict the actual price at which the good is bought and sold, as well as the actual quantity transacted.

What determines the price at which a good or service is bought and sold? What determines the quantity transacted of the good or service? In Chapter 1 we learned the general principle that *markets move toward equilibrium*, a situation in which no individual would be better off taking a different action. In the case of a competitive market, we can be more specific: a competitive market is in equilibrium when the price has moved to a level at which the quantity of a good demanded equals the quantity of that good supplied. At that price, no individual seller could make herself better off by offering to sell either more or less of the good and no individual buyer could make himself better off by offering to buy more or less of the good. In other words, at the market equilibrium, price has moved to a level that exactly matches the quantity demanded by consumers to the quantity supplied by sellers.

The price that matches the quantity supplied and the quantity demanded is the **equilibrium price**; the quantity bought and sold at that price is the **equilibrium quantity**. The equilibrium price is also known as the **market-clearing price**: it is the price that “clears the market” by ensuring that every buyer willing to pay that price finds a seller willing to sell at that price, and vice versa. So how do we find the equilibrium price and quantity?

A competitive market is in equilibrium when price has moved to a level at which the quantity of a good or service demanded equals the quantity of that good or service supplied. The price at which this takes place is the **equilibrium price**, also referred to as the **market-clearing price**. The quantity of the good or service bought and sold at that price is the **equilibrium quantity**.

PITFALLS

BOUGHT AND SOLD?

We have been talking about the price at which a good or service is bought *and* sold, as if the two were the same. But shouldn't we make a distinction between the price received by sellers and the price paid by buyers? In principle, yes; but it is helpful at this point to sacrifice a bit of realism in the interest of simplicity—by assuming away the difference between the prices received by sellers and those paid by buyers. In reality, there is often a middleman—someone who brings buyers and sellers together—who buys from suppliers, then sells to consumers at a markup, for example, coffee

merchants who buy from coffee growers and sell to consumers. The growers generally receive less than those who eventually buy the coffee beans pay. No mystery there: that difference is how coffee merchants or any other middlemen make a living. In many markets, however, the difference between the buying and selling price is quite small. So it's not a bad approximation to think of the price paid by buyers as being the *same* as the price received by sellers. And that is what we assume in this chapter.

Finding the Equilibrium Price and Quantity

The easiest way to determine the equilibrium price and quantity in a market is by putting the supply curve and the demand curve on the same diagram. Since the supply curve shows the quantity supplied at any given price and the demand curve shows the quantity demanded at any given price, the price at which the two curves cross is the equilibrium price: the price at which quantity supplied equals quantity demanded.

Figure 3-11 combines the demand curve from Figure 3-1 and the supply curve from Figure 3-6. They *intersect* at point *E*, which is the equilibrium of this market; that is, \$1 is the equilibrium price and 10 billion pounds is the equilibrium quantity.

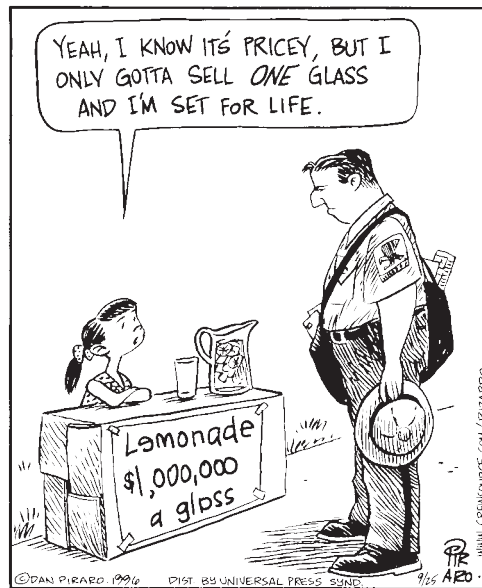
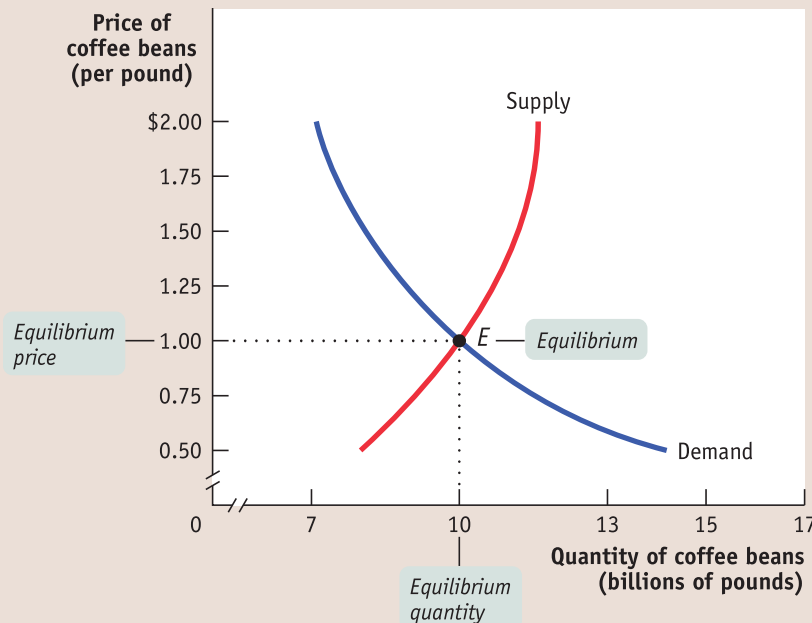


FIGURE 3-11

Market Equilibrium

Market equilibrium occurs at point *E*, where the supply curve and the demand curve intersect. In equilibrium, the quantity demanded is equal to the quantity supplied. In this market, the equilibrium price is \$1 per pound and the equilibrium quantity is 10 billion pounds per year.



There is a **surplus** of a good or service when the quantity supplied exceeds the quantity demanded. Surpluses occur when the price is above its equilibrium level.

Let's confirm that point *E* fits our definition of equilibrium. At a price of \$1 per pound, coffee bean producers are willing to sell 10 billion pounds a year and coffee bean consumers want to buy 10 billion pounds a year. So at the price of \$1 a pound, the quantity of coffee beans supplied equals the quantity demanded. Notice that at any other price the market would not clear: every willing buyer would not be able to find a willing seller, or vice versa. More specifically, if the price were more than \$1, the quantity supplied would exceed the quantity demanded; if the price were less than \$1, the quantity demanded would exceed the quantity supplied.

The model of supply and demand, then, predicts that given the demand and supply curves shown in Figure 3-11, 10 billion pounds of coffee beans would change hands at a price of \$1 per pound. But how can we be sure that the market will arrive at the equilibrium price? We begin by answering three simple questions:

1. Why do all sales and purchases in a market take place at the same price?
2. Why does the market price fall if it is above the equilibrium price?
3. Why does the market price rise if it is below the equilibrium price?

Why Do All Sales and Purchases in a Market Take Place at the Same Price?

There are some markets where the same good can sell for many different prices, depending on who is selling or who is buying. For example, have you ever bought a souvenir in a “tourist trap” and then seen the same item on sale somewhere else (perhaps even in the shop next door) for a lower price? Because tourists don't know which shops offer the best deals and don't have time for comparison shopping, sellers in tourist areas can charge different prices for the same good.

But in any market where the buyers and sellers have both been around for some time, sales and purchases tend to converge at a generally uniform price, so that we can safely talk about *the* market price. It's easy to see why. Suppose a seller offered a potential buyer a price noticeably above what the buyer knew other people to be paying. The buyer would clearly be better off shopping elsewhere—unless the seller was prepared to offer a better deal. Conversely, a seller would not be willing to sell for significantly less than the amount he knew most buyers were paying; he would be better off waiting to get a more reasonable customer. So in any well-established, ongoing market, all sellers receive and all buyers pay approximately the same price. This is what we call the *market price*.

Why Does the Market Price Fall If It Is Above the Equilibrium Price?

Suppose the supply and demand curves are as shown in Figure 3-11 but the market price is above the equilibrium level of \$1—say, \$1.50. This situation is illustrated in Figure 3-12. Why can't the price stay there?

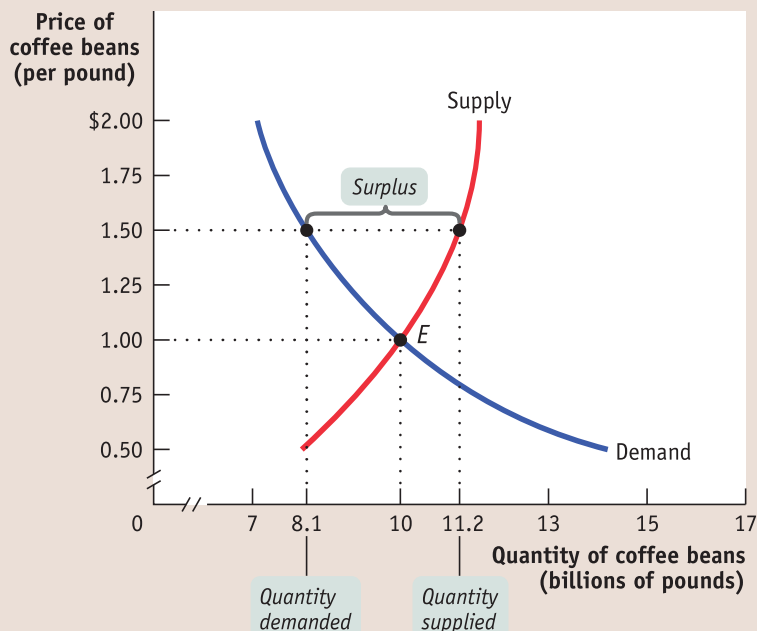
As the figure shows, at a price of \$1.50 there would be more coffee beans available than consumers wanted to buy: 11.2 billion pounds, versus 8.1 billion pounds. The difference of 3.1 billion pounds is the **surplus**—also known as the *excess supply*—of coffee beans at \$1.50.

This surplus means that some coffee producers are frustrated: at the current price, they cannot find consumers who want to buy their coffee beans. The surplus offers an incentive for those frustrated would-be sellers to offer a lower price in order to poach business from other producers and entice more consumers to buy. The result of this price cutting will be to push the prevailing price down until it reaches the equilibrium price. So the price of a good will fall whenever there is a surplus—that is, whenever the market price is above its equilibrium level.

FIGURE 3-12

Price Above Its Equilibrium Level Creates a Surplus

The market price of \$1.50 is above the equilibrium price of \$1. This creates a surplus: at a price of \$1.50, producers would like to sell 11.2 billion pounds but consumers want to buy only 8.1 billion pounds, so there is a surplus of 3.1 billion pounds. This surplus will push the price down until it reaches the equilibrium price of \$1.



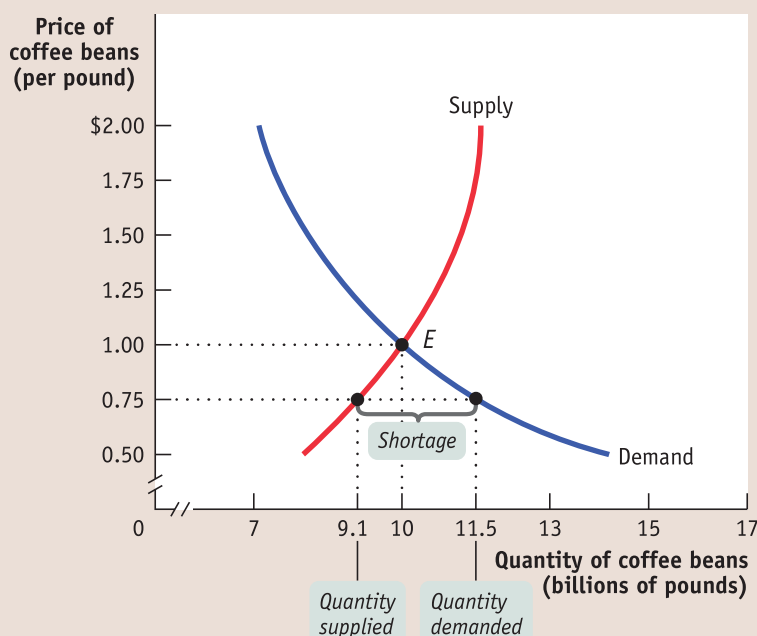
Why Does the Market Price Rise if It Is Below the Equilibrium Price?

Now suppose the price is below its equilibrium level—say, at \$0.75 per pound, as shown in Figure 3-13. In this case, the quantity demanded, 11.5 billion pounds, exceeds the quantity supplied, 9.1 billion pounds, implying that there are would-be

FIGURE 3-13

Price Below Its Equilibrium Level Creates a Shortage

The market price of \$0.75 is below the equilibrium price of \$1. This creates a shortage: consumers want to buy 11.5 billion pounds, but only 9.1 billion pounds are for sale, so there is a shortage of 2.4 billion pounds. This shortage will push the price up until it reaches the equilibrium price of \$1.



There is a **shortage** of a good or service when the quantity demanded exceeds the quantity supplied. Shortages occur when the price is below its equilibrium level.

buyers who cannot find coffee beans: there is a **shortage**, also known as an *excess demand*, of 2.4 billion pounds.

When there is a shortage, there are frustrated would-be buyers—people who want to purchase coffee beans but cannot find willing sellers at the current price. In this situation, either buyers will offer more than the prevailing price or sellers will realize that they can charge higher prices. Either way, the result is to drive up the prevailing price. This bidding up of prices happens whenever there are shortages—and there will be shortages whenever the price is below its equilibrium level. So the market price will always rise if it is below the equilibrium level.

Using Equilibrium to Describe Markets

We have now seen that a market tends to have a single price, the equilibrium price. If the market price is above the equilibrium level, the ensuing surplus leads buyers and sellers to take actions that lower the price. And if the market price is below the equilibrium level, the ensuing shortage leads buyers and sellers to take actions that raise the price. So the market price always *moves toward* the equilibrium price, the price at which there is neither surplus nor shortage.

► *ECONOMICS IN ACTION*

The Price of Admission

The market equilibrium, so the theory goes, is pretty egalitarian because the equilibrium price applies to everyone. That is, all buyers pay the same price—the equilibrium price—and all sellers receive that same price. But is this realistic?

The market for concert tickets is an example that seems to contradict the theory—there's one price at the box office, and there's another price (typically much higher) for the same event on Internet sites where people who already have tickets resell them, such as StubHub.com or eBay. For example, compare the box office price for a Justin Timberlake concert in Miami, Florida, to the StubHub.com price for seats in the same location: \$88.50 versus \$155.

Puzzling as this may seem, there is no contradiction once we take opportunity costs and tastes into account. For major events, buying tickets from the box office means waiting in very long lines. Ticket buyers who use Internet resellers have decided that the opportunity cost of their time is too high to spend waiting in line. And for those major events with online box offices selling tickets at face value, tickets often sell out within minutes. In this case, some people who want to go to the concert badly but have missed out on the opportunity to buy cheaper tickets from the online box office are willing to pay the higher Internet reseller price.

Not only that, perusing the StubHub.com website you can see that markets really do move to equilibrium. You'll notice that the prices quoted by different sellers for seats close to one another are also very close: \$184.99 versus \$185 for seats on the main floor of the Justin Timberlake concert. As the competitive market model predicts, units of the same good end up selling for the same price. And prices move in response to demand and supply. According to an article in the *New York Times*, tickets on StubHub.com can sell for less than the face value for events with little appeal, while prices can skyrocket for events that are in high demand. (The article quotes a price of \$3,530 for a Madonna concert.) Even StubHub.com's chief executive says his site is "the embodiment of supply-and-demand economics."

So the theory of competitive markets isn't just speculation. If you want to experience it for yourself, try buying tickets to a concert. ▲

► QUICK REVIEW

- Price in a competitive market moves to the **equilibrium price**, or **market-clearing price**, where the quantity supplied is equal to the quantity demanded. This quantity is the **equilibrium quantity**.
- All sales and purchases in a market take place at the same price. If the price is above its equilibrium level, there is a **surplus** that drives the price down. If the price is below its equilibrium level, there is a **shortage** that drives the price up.

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► CHECK YOUR UNDERSTANDING 3-3

1. In the following three situations, the market is initially in equilibrium. After each event described below, does a surplus or shortage exist at the original equilibrium price? What will happen to the equilibrium price as a result?
 - a. 2005 was a very good year for California wine-grape growers, who produced a bumper crop.
 - b. After a hurricane, Florida hoteliers often find that many people cancel their upcoming vacations, leaving them with empty hotel rooms.
 - c. After a heavy snowfall, many people want to buy secondhand snowblowers at the local tool shop.

Solutions appear at back of book.

Changes in Supply and Demand

The emergence of Vietnam as a major coffee-producing country came as a surprise, but the subsequent fall in the price of coffee beans was no surprise at all. Suddenly the quantity of coffee beans available at any given price rose—that is, there was an increase in supply. Predictably, an increase in supply lowers the equilibrium price.

The entry of Vietnamese producers into the coffee bean business was an example of an event that shifted the supply curve for a good without having much effect on the demand curve. There are many such events. There are also events that shift the demand curve without shifting the supply curve. For example, a medical report that chocolate is good for you increases the demand for chocolate but does not affect the supply. That is, events often shift either the supply curve or the demand curve, but not both; it is therefore useful to ask what happens in each case.

We have seen that when a curve shifts, the equilibrium price and quantity change. We will now concentrate on exactly how the shift of a curve alters the equilibrium price and quantity.

What Happens When the Demand Curve Shifts

Coffee and tea are substitutes: if the price of tea rises, the demand for coffee will increase, and if the price of tea falls, the demand for coffee will decrease. But how does the price of tea affect the *market equilibrium* for coffee?

Figure 3-14 on the next page shows the effect of a rise in the price of tea on the market for coffee. The rise in the price of tea increases the demand for coffee. Point E_1 shows the equilibrium corresponding to the original demand curve, with P_1 the equilibrium price and Q_1 the equilibrium quantity bought and sold.

An increase in demand is indicated by a *rightward* shift of the demand curve from D_1 to D_2 . At the original market price P_1 , this market is no longer in equilibrium: a shortage occurs because the quantity demanded exceeds the quantity supplied. So the price of coffee rises and generates an increase in the quantity supplied, an *upward movement along the supply curve*. A new equilibrium is established at point E_2 , with a higher equilibrium price, P_2 , and higher equilibrium quantity, Q_2 . This sequence of events reflects a general principle: *When demand for a good or service increases, the equilibrium price and the equilibrium quantity of the good or service both rise.*

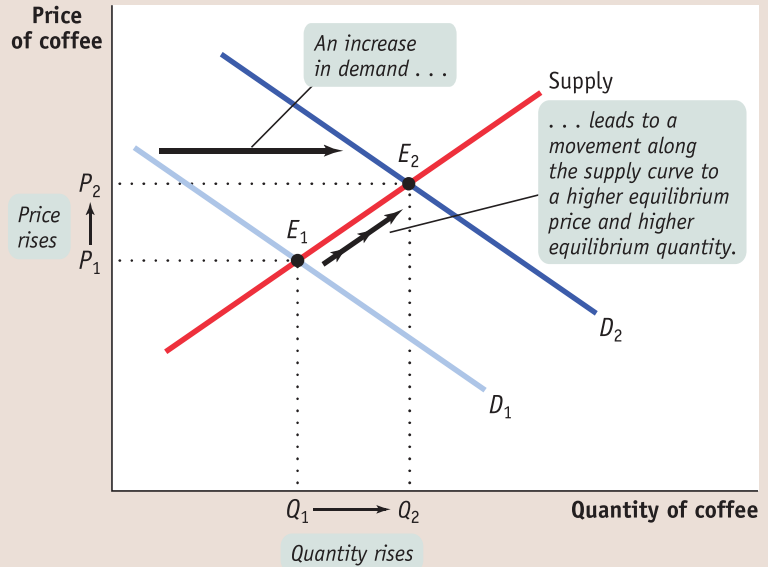
What would happen in the reverse case, a fall in the price of tea? A fall in the price of tea reduces the demand for coffee, shifting the demand curve to the *left*. At the original price, a surplus occurs as quantity supplied exceeds quantity demanded. The price falls and leads to a decrease in the quantity supplied, resulting in a lower equilibrium price and a lower equilibrium quantity. This illustrates another general principle: *When demand for a good or service decreases, the equilibrium price and the equilibrium quantity of the good or service both fall.*

To summarize how a market responds to a change in demand: *An increase in demand leads to a rise in both the equilibrium price and the equilibrium quantity. A decrease in demand leads to a fall in both the equilibrium price and the equilibrium quantity.*

FIGURE 3-14

Equilibrium and Shifts of the Demand Curve

The original equilibrium in the market for coffee is at E_1 , at the intersection of the supply curve and the original demand curve, D_1 . A rise in the price of tea, a substitute, shifts the demand curve rightward to D_2 . A shortage exists at the original price, P_1 , causing both the price and quantity supplied to rise, a movement along the supply curve. A new equilibrium is reached at E_2 , with a higher equilibrium price, P_2 , and a higher equilibrium quantity, Q_2 . When demand for a good or service increases, the equilibrium price and the equilibrium quantity of the good or service both rise.



What Happens When the Supply Curve Shifts

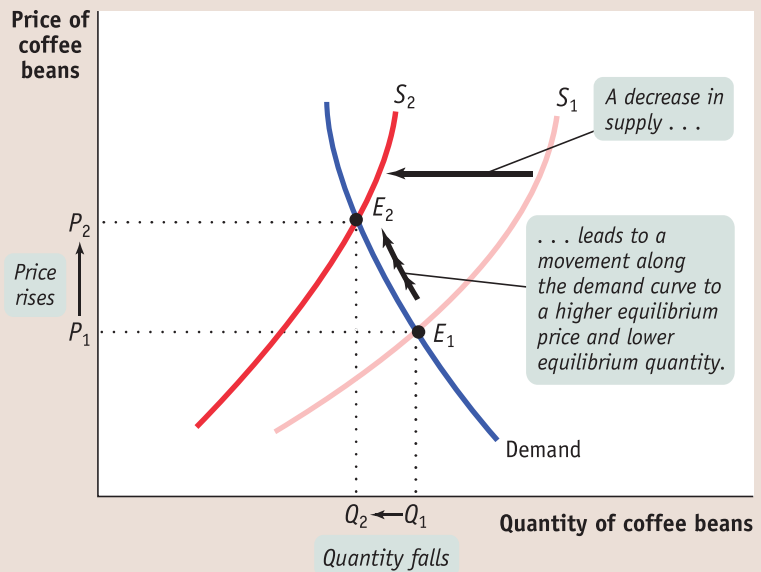
In the real world, it is a bit easier to predict changes in supply than changes in demand. Physical factors that affect supply, like the availability of inputs, are easier to get a handle on than the fickle tastes that affect demand. Still, with supply as with demand, what we can best predict are the *effects* of shifts of the supply curve.

As we mentioned in this chapter's opening story, a prolonged drought in Vietnam sharply reduced its supply of coffee beans. Figure 3-15 shows how this shift affected the market equilibrium. The original equilibrium is at E_1 , the point of intersection of the original supply curve, S_1 , and the demand curve, with an equilibrium price P_1 and

FIGURE 3-15

Equilibrium and Shifts of the Supply Curve

The original equilibrium in the market for coffee beans is at E_1 . A drought causes a fall in the supply of coffee beans and shifts the supply curve leftward from S_1 to S_2 . A new equilibrium is established at E_2 , with a higher equilibrium price, P_2 , and a lower equilibrium quantity, Q_2 .



equilibrium quantity Q_1 . As a result of the drought, supply falls and S_1 shifts leftward to S_2 . At the original price P_1 , a shortage of coffee beans now exists and the market is no longer in equilibrium. The shortage causes a rise in price and a fall in quantity demanded, an upward movement along the demand curve. The new equilibrium is at E_2 , with an equilibrium price P_2 , and an equilibrium quantity Q_2 . In the new equilibrium E_2 , the price is higher and the equilibrium quantity lower than before. This may be stated as a general principle: *When supply of a good or service decreases, the equilibrium price of the good or service rises and the equilibrium quantity of the good or service falls.*

What happens to the market when supply increases? An increase in supply leads to a rightward shift of the supply curve. At the original price, a surplus now exists; as a result, the equilibrium price falls and the quantity demanded rises. This describes what happened to the market for coffee beans when Vietnam entered the field. We can formulate a general principle: *When supply of a good or service increases, the equilibrium price of the good or service falls and the equilibrium quantity of the good or service rises.*

To summarize how a market responds to a change in supply: *An increase in supply leads to a fall in the equilibrium price and a rise in the equilibrium quantity. A decrease in supply leads to a rise in the equilibrium price and a fall in the equilibrium quantity.*

PITFALLS

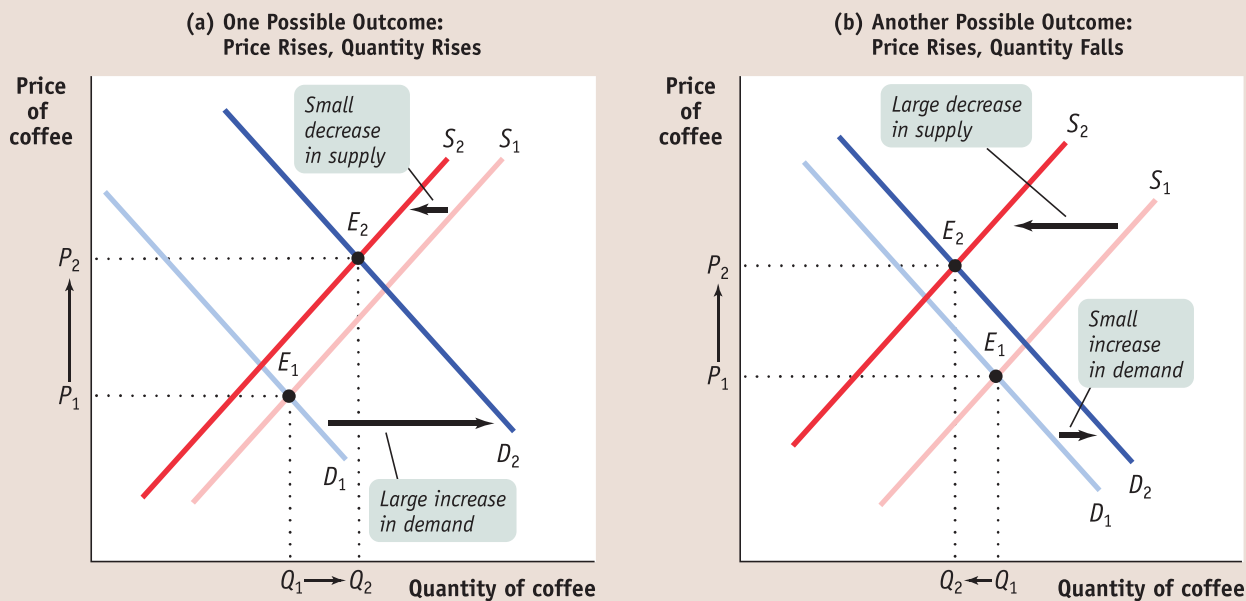
WHICH CURVE IS IT, ANYWAY?

When the price of some good or service changes, in general, we can say that this reflects a change in either supply or demand. But it is easy to get confused about which one. A helpful clue is the direction of change in the quantity. If the quantity sold changes in the *same* direction as the price—for example, if both the price and the quantity rise—this suggests that the demand curve has shifted. If the price and the quantity move in *opposite* directions, the likely cause is a shift of the supply curve.

Simultaneous Shifts of Supply and Demand Curves

Finally, it sometimes happens that events shift *both* the demand and supply curves at the same time. This is not unusual; in real life, supply curves and demand curves for many goods and services typically shift quite often because the economic environment continually changes. Figure 3-16 illustrates two examples of simultaneous shifts. In both panels there is an increase in demand—that is, a rightward shift of the demand curve, from D_1 to D_2 —say, for example, representing the increase in the demand for

FIGURE 3-16 Simultaneous Shifts of the Demand and Supply Curves



In panel (a) there is a simultaneous rightward shift of the demand curve and leftward shift of the supply curve. Here the increase in demand is relatively larger than the decrease in supply, so the equilibrium price and equilibrium quantity both rise. In panel (b) there is also a

simultaneous rightward shift of the demand curve and leftward shift of the supply curve. Here the decrease in supply is relatively larger than the increase in demand, so the equilibrium price rises and the equilibrium quantity falls.

coffee due to changing tastes. Notice that the rightward shift in panel (a) is larger than the one in panel (b): we can suppose that panel (a) represents a year in which many more people than usual choose to drink double lattes and panel (b) represents a normal year. Both panels also show a decrease in supply—that is, a leftward shift of the supply curve from S_1 to S_2 . Also notice that the leftward shift in panel (b) is relatively larger than the one in panel (a): we can suppose that panel (b) represents the effect of a particularly extreme drought in Vietnam and panel (a) represents the effect of a much less severe weather event.

In both cases, the equilibrium price rises from P_1 to P_2 , as the equilibrium moves from E_1 to E_2 . But what happens to the equilibrium quantity, the quantity of coffee bought and sold? In panel (a) the increase in demand is large relative to the decrease in supply, and the equilibrium quantity rises as a result. In panel (b), the decrease in supply is large relative to the increase in demand, and the equilibrium quantity falls as a result. That is, when demand increases and supply decreases, the actual quantity bought and sold can go either way, depending on *how much* the demand and supply curves have shifted.

In general, when supply and demand shift in opposite directions, we can't predict what the ultimate effect will be on the quantity bought and sold. What we can say is

FOR INQUIRING MINDS

Tribulations on the Runway

You probably don't spend much time worrying about the trials and tribulations of fashion models. Most of them don't lead glamorous lives; in fact, except for a lucky few, life as a fashion model today can be very trying and not very lucrative. And it's all because of supply and demand.

Consider the case of Bianca Gomez, a willowy 18-year-old from Los Angeles, with green eyes, honey-colored hair, and flawless skin, whose experience was detailed in an article in the *Wall Street Journal*. Bianca began modeling while still in high school, earning about \$30,000 in modeling fees during her senior year. Having attracted the interest of some top designers in New York, she moved there after graduation, hoping to land jobs in leading fashion houses and photo-shoots for leading fashion magazines.

But once in New York, Bianca entered the global market for fashion models. And it wasn't very pretty. Due to the ease of transmitting photos over the Internet and the relatively low cost of international travel, top fashion centers such as New York and Milan, Italy, are now deluged with beautiful young women from all over the world, eagerly trying to make it as models.



Carlo Busecemi/WireImage

Bianca Gomez on the runway before intense global competition got her thinking about switching careers.

Although Russians, other Eastern Europeans, and Brazilians are particularly numerous, some hail from places such as Kazakhstan and Mozambique. As one designer said, "There are so many models now. . . . There are just thousands every year."

Returning to our (less glamorous) economic model of supply and demand, the influx of aspiring fashion models from around the world can be represented by a rightward

shift of the supply curve in the market for fashion models, which would by itself tend to lower the price paid to models. And that wasn't the only change in the market. Unfortunately for Bianca and others like her, the tastes of many of those who hire models have changed as well. Over the past few years, fashion magazines have come to prefer using celebrities such as Angelina Jolie on their pages rather than anonymous models, believing that their readers connect better with a familiar face. This amounts to a leftward shift of the demand curve for models—again reducing the equilibrium price paid to models.

This was borne out in Bianca's experiences. After paying her rent, her transportation, all her modeling expenses, and 20% of her earnings to her modeling agency (which markets her to prospective clients and books her jobs), Bianca found that she was barely breaking even. Sometimes she even had to dip into savings from her high school years. To save money, she ate macaroni and hot dogs; she traveled to auditions, often four or five in one day, by subway. As the *Wall Street Journal* reported, Bianca was seriously considering quitting modeling altogether.



that a curve that shifts a disproportionately greater distance than the other curve will have a disproportionately greater effect on the quantity bought and sold. That said, we can make the following prediction about the outcome when the supply and demand curves shift in opposite directions:

- When demand increases and supply decreases, the equilibrium price rises but the change in the equilibrium quantity is ambiguous.
- When demand decreases and supply increases, the equilibrium price falls but the change in the equilibrium quantity is ambiguous.

But suppose that the demand and supply curves shift in the same direction. This was the case in the global market for coffee beans, where both supply and demand have increased over the past decade. Can we safely make any predictions about the changes in price and quantity? In this situation, the change in quantity bought and sold can be predicted but the change in price is ambiguous. The two possible outcomes when the supply and demand curves shift in the same direction (which you should check for yourself) are as follows:

- When both demand and supply increase, the equilibrium quantity increases but the change in equilibrium price is ambiguous.
- When both demand and supply decrease, the equilibrium quantity decreases but the change in equilibrium price is ambiguous.

► **ECONOMICS IN ACTION**



The Great Tortilla Crisis

“Thousands in Mexico City protest rising food prices.” So read the headline in the *New York Times* on February 1, 2007. Specifically, the demonstrators were protesting a sharp rise in the price of tortillas, a staple food of Mexico’s poor, which had gone from 25 cents a pound to between 35 and 45 cents a pound in just a few months.

Why were tortilla prices soaring? It was a classic example of what happens to equilibrium prices when supply falls. Tortillas are made from corn; much of Mexico’s corn is imported from the United States, with the price of corn in both countries basically set in the U.S. corn market. And U.S. corn prices were rising rapidly thanks to surging demand in a new market: the market for ethanol.

Ethanol’s big break came with the Energy Policy Act of 2005, which mandated the use of a large quantity of “renewable” fuels starting in 2006, and rising steadily thereafter. In practice, that meant increased use of ethanol. Ethanol producers rushed to build new production facilities and quickly began buying lots of corn. The result was a rightward shift of the demand curve for corn, leading to a sharp rise in the price of corn. And since corn is an input in the production of tortillas, a sharp rise in the price of corn led to a fall in the supply of tortillas and higher prices for tortilla consumers.

The increase in the price of corn was good news in Iowa, where farmers began planting more corn than ever before. But it was bad news for Mexican consumers, who found themselves paying more for their tortillas. ▲

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► **CHECK YOUR UNDERSTANDING** 3-4

1. In each of the following examples, determine (i) the market in question; (ii) whether a shift in demand or supply occurred, the direction of the shift, and what induced the shift; and (iii) the effect of the shift on the equilibrium price and the equilibrium quantity.
 - a. As the price of gasoline fell in the United States during the 1990s, more people bought large cars.

► **QUICK REVIEW**

- Changes in the equilibrium price and quantity in a market result from shifts of the supply curve, the demand curve, or both.
- An increase in demand increases both the equilibrium price and the equilibrium quantity. A decrease in demand pushes both the equilibrium price and the equilibrium quantity down.
- An increase in supply drives the equilibrium price down but increases the equilibrium quantity. A decrease in supply raises the equilibrium price but reduces the equilibrium quantity.
- Often the fluctuations in markets involve shifts of both the supply and demand curves. When they shift in the same direction, the change in equilibrium quantity is predictable but the change in equilibrium price is not. When they move in opposite directions, the change in equilibrium price is predictable but the change in equilibrium quantity is not. When there are simultaneous shifts of the demand and supply curves, the curve that shifts the greater distance has a greater effect on the change in equilibrium price and quantity.

- b. As technological innovation has lowered the cost of recycling used paper, fresh paper made from recycled stock is used more frequently.
 - c. When a local cable company offers cheaper pay-per-view films, local movie theaters have more unfilled seats.
2. Periodically, a computer chip maker like Intel introduces a new chip that is faster than the previous one. In response, demand for computers using the earlier chip decreases as customers put off purchases in anticipation of machines containing the new chip. Simultaneously, computer makers increase their production of computers containing the earlier chip in order to clear out their stocks of those chips.

Draw two diagrams of the market for computers containing the earlier chip: (a) one in which the equilibrium quantity falls in response to these events and (b) one in which the equilibrium quantity rises. What happens to the equilibrium price in each diagram?

Solutions appear at back of book.

Competitive Markets—And Others

Early in this chapter, we defined a competitive market and explained that the supply and demand framework is a model of competitive markets. But we took a rain check on the question of why it matters whether or not a market is competitive. Now that we've seen how the supply and demand model works, we can offer some explanation.

To understand why competitive markets are different from other markets, compare the problems facing two individuals: a wheat farmer who must decide whether to grow more wheat, and the president of a giant aluminum company—say, Alcoa—who must decide whether to produce more aluminum.

For the wheat farmer, the question is simply whether the extra wheat can be sold at a price high enough to justify the extra production cost. The farmer need not worry about whether producing more wheat will affect the price of the wheat he or she was already planning to grow. That's because the wheat market is competitive. There are thousands of wheat farmers, and no one farmer's decision will have much impact on the market price.

For the Alcoa executive, things are not that simple because the aluminum market is *not* competitive. There are only a few big players, including Alcoa, and each of them is well aware that its actions *do* have a noticeable impact on the market price. This adds a whole new level of complexity to the decisions producers have to make. Alcoa can't decide whether or not to produce more aluminum just by asking whether the additional product will sell for more than it costs to make. The company also has to ask whether producing more aluminum will drive down the market price and reduce its *profit*, its net gain from producing and selling its output.

When a market is competitive, individuals can base decisions on less complicated analyses than those used in a noncompetitive market. This in turn means that it's easier for economists to build a model of a competitive market than of a noncompetitive market.

Don't take this to mean that economic analysis has nothing to say about noncompetitive markets. On the contrary, economists can offer some very important insights into how other kinds of markets work. But those insights require other models, which we will learn about later in this text. In the next chapter, we will focus on how competitive markets benefit producers and consumers. We will also describe the usually unpleasant consequences of attempts to tell competitive markets what to do.

A Butter Mountain

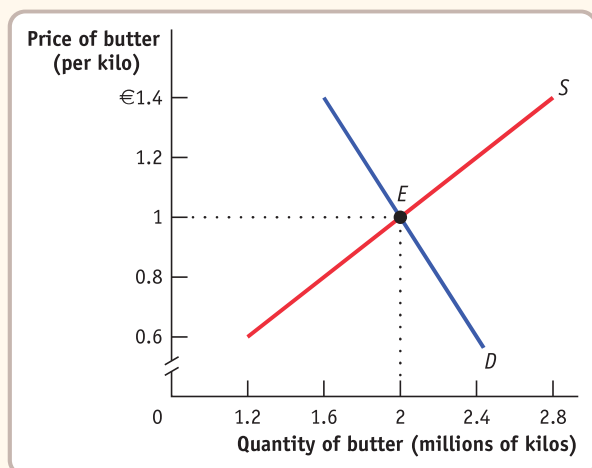
Immediately after World War II, food shortages were common across Europe. To address these shortages, a number of European countries came up with a Common Agricultural Policy (CAP). One of the cornerstones of CAP has been a vigorous price support policy that has created “butter mountains” and “wine lakes.” Suppose that the supply and demand schedule for butter in the European Union is as follows:

Price of Butter (per kilo)	Quantity of Butter (millions of kilos)	
	Quantity Demanded	Quantity Supplied
€1.4	1.6	2.8
1.3	1.7	2.6
1.2	1.8	2.4
1.1	1.9	2.2
1	2	2
0.9	2.1	1.8
0.8	2.2	1.6
0.7	2.3	1.4
0.6	2.4	1.2

Use a demand and supply graph to find the market equilibrium price and quantity. Show how a market price of €1.20 creates a surplus of the good.

STEP 1: Draw and label supply and demand curves. Find the equilibrium quantity demanded.

Review the section “The Demand Schedule and the Demand Curve” (along with Figure 3-1) on page 65, the section “The Supply Schedule and the Supply Curve” on page 73 (including Figure 3-6 on page 74), and the section “Finding the Equilibrium Price and Quantity” (and Figure 3-11) on page 81.

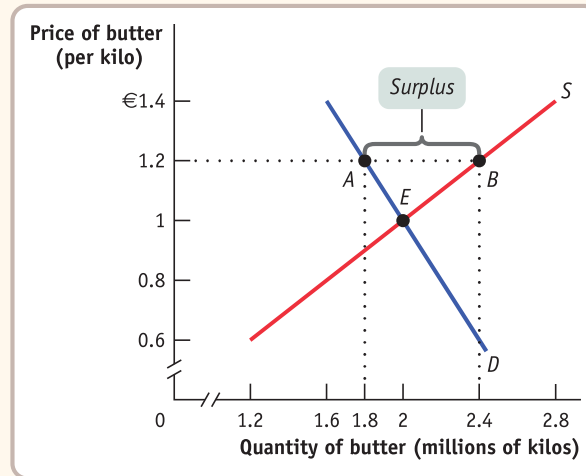


The equilibrium quantity demanded is at point E, the point at which quantity supplied equals quantity demanded. As shown both in the supply and demand schedule and in the figure above, this occurs at an equilibrium quantity of 2.0 kilos and an equilibrium price of €1.00. ■

WORKED PROBLEM

STEP 2: Calculate the surplus of butter that would occur at a market price of €1.20.

Review the section “Why Does the Market Price Fall If It Is Above the Equilibrium Price” on page 82. An example of a price above its equilibrium level that creates a surplus is given in Figure 3-12 on page 83.



As shown in Figure 2 above, a price of €1.20 corresponds to point A on the demand curve. The quantity demanded at a price of €1.20 can be found by starting at point A and following the dotted line down to the horizontal axis and observing that the quantity demanded is 1.8 kilos. Similarly, a price of €1.20 corresponds to point B on the supply curve. The quantity supplied at a price of €1.20 can be found by starting at point B, following the dotted line down to the horizontal axis, and observing that the quantity supplied is 2.4 kilos. The difference between the quantity supplied and the quantity demanded is $2.4 - 1.8 = 0.6$ kilos. This difference can also be found from the supply and demand schedule. As shown in the schedule, at a price of €1.20, the quantity supplied (2.4 kilos) is greater than the quantity demanded (1.8 kilos) by 0.6 kilos. ■

SUMMARY

1. The **supply and demand model** illustrates how a **competitive market**, one with many buyers and sellers, none of whom can influence the market price, works.
2. The **demand schedule** shows the **quantity demanded** at each price and is represented graphically by a **demand curve**. The **law of demand** says that demand curves slope downward; that is, a higher price for a good or service leads people to demand a smaller quantity, other things equal.
3. A **movement along the demand curve** occurs when a price change leads to a change in the quantity demanded. When economists talk of increasing or decreasing demand, they mean **shifts of the demand curve**—a change in the quantity demanded at any given price. An increase in demand causes a rightward shift of the demand curve. A decrease in demand causes a leftward shift.
4. There are five main factors that shift the demand curve:
 - A change in the prices of related goods or services, such as **substitutes** or **complements**

- A change in income: when income rises, the demand for **normal goods** increases and the demand for **inferior goods** decreases.
 - A change in tastes
 - A change in expectations
 - A change in the number of consumers
5. The market demand curve for a good or service is the horizontal sum of the **individual demand curves** of all consumers in the market.
 6. The **supply schedule** shows the **quantity supplied** at each price and is represented graphically by a **supply curve**. Supply curves usually slope upward.
 7. A **movement along the supply curve** occurs when a price change leads to a change in the quantity supplied. When economists talk of increasing or decreasing supply, they mean **shifts of the supply curve**—a change in the quantity supplied at any given price. An increase in supply causes a rightward shift of the supply curve. A decrease in supply causes a leftward shift.
 8. There are five main factors that shift the supply curve:
 - A change in **input** prices
 - A change in the prices of related goods and services
 - A change in technology
 - A change in expectations
 - A change in the number of producers
 9. The market supply curve for a good or service is the horizontal sum of the **individual supply curves** of all producers in the market.
 10. The supply and demand model is based on the principle that the price in a market moves to its **equilibrium price**, or **market-clearing price**, the price at which the quantity demanded is equal to the quantity supplied. This quantity is the **equilibrium quantity**. When the price is above its market-clearing level, there is a **surplus** that pushes the price down. When the price is below its market-clearing level, there is a **shortage** that pushes the price up.
 11. An increase in demand increases both the equilibrium price and the equilibrium quantity; a decrease in demand has the opposite effect. An increase in supply reduces the equilibrium price and increases the equilibrium quantity; a decrease in supply has the opposite effect.
 12. Shifts of the demand curve and the supply curve can happen simultaneously. When they shift in opposite directions, the change in equilibrium price is predictable but the change in equilibrium quantity is not. When they shift in the same direction, the change in equilibrium quantity is predictable but the change in equilibrium price is not. In general, the curve that shifts the greater distance has a greater effect on the changes in equilibrium price and quantity.

KEY TERMS

Competitive market, p. 64	Complements, p. 69	Input, p. 77
Supply and demand model, p. 64	Normal good, p. 70	Individual supply curve, p. 78
Demand schedule, p. 65	Inferior good, p. 70	Equilibrium price, p. 80
Quantity demanded, p. 66	Individual demand curve, p. 71	Equilibrium quantity, p. 80
Demand curve, p. 66	Quantity supplied, p. 73	Market-clearing price, p. 80
Law of demand, p. 66	Supply schedule, p. 73	Surplus, p. 82
Shift of the demand curve, p. 67	Supply curve, p. 74	Shortage, p. 84
Movement along the demand curve, p. 68	Shift of the supply curve, p. 75	
Substitutes, p. 69	Movement along the supply curve, p. 75	

PROBLEMS

1. A survey indicated that chocolate is Americans' favorite ice cream flavor. For each of the following, indicate the possible effects on demand, supply, or both as well as equilibrium price and quantity of chocolate ice cream.
 - a. A severe drought in the Midwest causes dairy farmers to reduce the number of milk-producing cattle in their herds by a third. These dairy farmers supply cream that is used to manufacture chocolate ice cream.
 - b. A new report by the American Medical Association reveals that chocolate does, in fact, have significant health benefits.
 - c. The discovery of cheaper synthetic vanilla flavoring lowers the price of vanilla ice cream.
 - d. New technology for mixing and freezing ice cream lowers manufacturers' costs of producing chocolate ice cream.

2. In a supply and demand diagram, draw the shift of the demand curve for hamburgers in your hometown due to the following events. In each case show the effect on equilibrium price and quantity.
- The price of tacos increases.
 - All hamburger sellers raise the price of their french fries.
 - Income falls in town. Assume that hamburgers are a normal good for most people.
 - Income falls in town. Assume that hamburgers are an inferior good for most people.
 - Hot dog stands cut the price of hot dogs.
3. The market for many goods changes in predictable ways according to the time of year, in response to events such as holidays, vacation times, seasonal changes in production, and so on. Using supply and demand, explain the change in price in each of the following cases. Note that supply and demand may shift simultaneously.
- Lobster prices usually fall during the summer peak lobster harvest season, despite the fact that people like to eat lobster during the summer more than at any other time of year.
 - The price of a Christmas tree is lower after Christmas than before but fewer trees are sold.
 - The price of a round-trip ticket to Paris on Air France falls by more than \$200 after the end of school vacation in September. This happens despite the fact that generally worsening weather increases the cost of operating flights to Paris, and Air France therefore reduces the number of flights to Paris at any given price.
4. Show in a diagram the effect on the demand curve, the supply curve, the equilibrium price, and the equilibrium quantity of each of the following events.
- The market for newspapers in your town
 - Case 1: The salaries of journalists go up.
 - Case 2: There is a big news event in your town, which is reported in the newspapers.
 - The market for St. Louis Rams cotton T-shirts
 - Case 1: The Rams win the Super Bowl.
 - Case 2: The price of cotton increases.
 - The market for bagels
 - Case 1: People realize how fattening bagels are.
 - Case 2: People have less time to make themselves a cooked breakfast.
 - The market for the Krugman and Wells economics textbook
 - Case 1: Your professor makes it required reading for all of his or her students.
 - Case 2: Printing costs for textbooks are lowered by the use of synthetic paper.
5. The U.S. Department of Agriculture reported that in 1997 each person in the United States consumed an average of 41 gallons of soft drinks (nondiet) at an average price of \$2 per gallon. Assume that, at a price of \$1.50 per gallon, each individual consumer would demand 50 gallons of soft drinks. The U.S. population in 1997 was 267 million. From this information

about the individual demand schedule, calculate the market demand schedule for soft drinks for the prices of \$1.50 and \$2 per gallon.

6. Suppose that the supply schedule of Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster supplied (pounds)
\$25	800
20	700
15	600
10	500
5	400

Suppose that Maine lobsters can be sold only in the United States. The U.S. demand schedule for Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster demanded (pounds)
\$25	200
20	400
15	600
10	800
5	1,000

- a. Draw the demand curve and the supply curve for Maine lobsters. What are the equilibrium price and quantity of lobsters?

Now suppose that Maine lobsters can be sold in France. The French demand schedule for Maine lobsters is as follows:

Price of lobster (per pound)	Quantity of lobster demanded (pounds)
\$25	100
20	300
15	500
10	700
5	900

- b. What is the demand schedule for Maine lobsters now that French consumers can also buy them? Draw a supply and demand diagram that illustrates the new equilibrium price and quantity of lobsters. What will happen to the price at which fishermen can sell lobster? What will happen to the price paid by U.S. consumers? What will happen to the quantity consumed by U.S. consumers?
7. Find the flaws in reasoning in the following statements, paying particular attention to the distinction between shifts of and movements along the supply and demand curves. Draw a diagram to illustrate what actually happens in each situation.
- a. "A technological innovation that lowers the cost of producing a good might seem at first to result in a reduction in the price of the good to consumers. But a fall in price will increase demand for the good, and higher

demand will send the price up again. It is not certain, therefore, that an innovation will really reduce price in the end.”

- b. “A study shows that eating a clove of garlic a day can help prevent heart disease, causing many consumers to demand more garlic. This increase in demand results in a rise in the price of garlic. Consumers, seeing that the price of garlic has gone up, reduce their demand for garlic. This causes the demand for garlic to decrease and the price of garlic to fall. Therefore, the ultimate effect of the study on the price of garlic is uncertain.”

8. The following table shows a demand schedule for a normal good.

Price	Quantity demanded
\$23	70
21	90
19	110
17	130

- a. Do you think that the increase in quantity demanded (say, from 90 to 110 in the table) when price decreases (from \$21 to \$19) is due to a rise in consumers’ income? Explain clearly (and briefly) why or why not.
- b. Now suppose that the good is an inferior good. Would the demand schedule still be valid for an inferior good?
- c. Lastly, assume you do not know whether the good is normal or inferior. Devise an experiment that would allow you to determine which one it was. Explain.

9. According to the *New York Times* (November 18, 2006), the number of car producers in China is increasing rapidly. The newspaper reports that “China has more car brands now than the United States. . . . But while car sales have climbed 38 percent in the first three quarters of this year, automakers have increased their output even faster, causing fierce competition and a slow erosion in prices.” At the same time, Chinese consumers’ incomes have risen. Assume that cars are a normal good. Use a diagram of the supply and demand curves for cars in China to explain what has happened in the Chinese car market.

10. Aaron Hank is a star hitter for the Bay City baseball team. He is close to breaking the major league record for home runs hit during one season, and it is widely anticipated that in the next game he will break that record. As a result, tickets for the team’s next game have been a hot commodity. But today it is announced that, due to a knee injury, he will not in fact play in the team’s next game. Assume that season ticket-holders are able to resell their tickets if they wish. Use supply and demand diagrams to explain the following.

- a. Show the case in which this announcement results in a lower equilibrium price and a lower equilibrium quantity than before the announcement.
- b. Show the case in which this announcement results in a lower equilibrium price and a higher equilibrium quantity than before the announcement.

- c. What accounts for whether case a or case b occurs?
- d. Suppose that a scalper had secretly learned before the announcement that Aaron Hank would not play in the next game. What actions do you think he would take?

11. In *Rolling Stone* magazine, several fans and rock stars, including Pearl Jam, were bemoaning the high price of concert tickets. One superstar argued, “It just isn’t worth \$75 to see me play. No one should have to pay that much to go to a concert.” Assume this star sold out arenas around the country at an average ticket price of \$75.

- a. How would you evaluate the arguments that ticket prices are too high?
- b. Suppose that due to this star’s protests, ticket prices were lowered to \$50. In what sense is this price too low? Draw a diagram using supply and demand curves to support your argument.
- c. Suppose Pearl Jam really wanted to bring down ticket prices. Since the band controls the supply of its services, what do you recommend they do? Explain using a supply and demand diagram.
- d. Suppose the band’s next CD was a total dud. Do you think they would still have to worry about ticket prices being too high? Why or why not? Draw a supply and demand diagram to support your argument.
- e. Suppose the group announced their next tour was going to be their last. What effect would this likely have on the demand for and price of tickets? Illustrate with a supply and demand diagram.

12. The accompanying table gives the annual U.S. demand and supply schedules for pickup trucks.

Price of truck	Quantity of trucks demanded (millions)	Quantity of trucks supplied (millions)
\$20,000	20	14
25,000	18	15
30,000	16	16
35,000	14	17
40,000	12	18

- a. Plot the demand and supply curves using these schedules. Indicate the equilibrium price and quantity on your diagram.
- b. Suppose the tires used on pickup trucks are found to be defective. What would you expect to happen in the market for pickup trucks? Show this on your diagram.
- c. Suppose that the U.S. Department of Transportation imposes costly regulations on manufacturers that cause them to reduce supply by one-third at any given price. Calculate and plot the new supply schedule and indicate the new equilibrium price and quantity on your diagram.

13. After several years of decline, the market for handmade acoustic guitars is making a comeback. These guitars are usually made in small workshops employing relatively few highly skilled luthiers. Assess the impact on the equilibrium price

- and quantity of handmade acoustic guitars as a result of each of the following events. In your answers indicate which curve(s) shift(s) and in which direction.
- Environmentalists succeed in having the use of Brazilian rosewood banned in the United States, forcing luthiers to seek out alternative, more costly woods.
 - A foreign producer reengineers the guitar-making process and floods the market with identical guitars.
 - Music featuring handmade acoustic guitars makes a comeback as audiences tire of heavy metal and grunge music.
 - The country goes into a deep recession and the income of the average American falls sharply.
- William Shakespeare is a struggling playwright in sixteenth-century London. As the price he receives for writing a play increases, he is willing to write more plays. For the following situations, use a diagram to illustrate how each event affects the equilibrium price and quantity in the market for Shakespeare's plays.
 - The playwright Christopher Marlowe, Shakespeare's chief rival, is killed in a bar brawl.
 - The bubonic plague, a deadly infectious disease, breaks out in London.
 - To celebrate the defeat of the Spanish Armada, Queen Elizabeth declares several weeks of festivities, which involves commissioning new plays.
 - The small town of Middling experiences a sudden doubling of the birth rate. After three years, the birth rate returns to normal. Use a diagram to illustrate the effect of these events on the following.
 - The market for an hour of babysitting services in Middling today
 - The market for an hour of babysitting services 14 years into the future, after the birth rate has returned to normal, by which time children born today are old enough to work as babysitters
 - The market for an hour of babysitting services 30 years into the future, when children born today are likely to be having children of their own
 - Use a diagram to illustrate how each of the following events affects the equilibrium price and quantity of pizza.
 - The price of mozzarella cheese rises.
 - The health hazards of hamburgers are widely publicized.
 - The price of tomato sauce falls.
 - The incomes of consumers rise and pizza is an inferior good.
 - Consumers expect the price of pizza to fall next week.

EXTEND YOUR UNDERSTANDING

- Demand twisters:* Sketch and explain the demand relationship in each of the following statements.
 - I would never buy a Britney Spears CD! You couldn't even give me one for nothing.
 - I generally buy a bit more coffee as the price falls. But once the price falls to \$2 per pound, I'll buy out the entire stock of the supermarket.
 - I spend more on orange juice even as the price rises. (Does this mean that I must be violating the law of demand?)
 - Due to a tuition rise, most students at a college find themselves with less disposable income. Almost all of them eat more frequently at the school cafeteria and less often at restaurants, even though prices at the cafeteria have risen, too. (This one requires that you draw both the demand and the supply curves for school cafeteria meals.)
- Although he was a prolific artist, Pablo Picasso painted only 1,000 canvases during his "Blue Period." Picasso is now dead, and all of his Blue Period works are currently on display in museums and private galleries throughout Europe and the United States.
 - Draw a supply curve for Picasso Blue Period works. Why is this supply curve different from ones you have seen?
 - Given the supply curve from part a, the price of a Picasso Blue Period work will be entirely dependent on what factor(s)? Draw a diagram showing how the equilibrium price of such a work is determined.
 - Suppose rich art collectors decide that it is essential to acquire Picasso Blue Period art for their collections. Show the impact of this on the market for these paintings.
- Draw the appropriate curve in each of the following cases. Is it like or unlike the curves you have seen so far? Explain.
 - The demand for cardiac bypass surgery, given that the government pays the full cost for any patient
 - The demand for elective cosmetic plastic surgery, given that the patient pays the full cost
 - The supply of reproductions of Rembrandt paintings

