section 2

Supply and Demand

For those who need a cappuccino, mocha latte, or Frappuccino to get through the day, coffee drinking can become an expensive habit. And on October 6, 2006, the habit got a little more expensive. On that day, Starbucks raised its drink prices for the first time in six years. The average price of coffee beverages at the world's leading chain of coffeehouses rose about 11 cents per cup.

Starbucks had kept its prices unchanged for six years. So what compelled them to finally raise their prices in the fall of 2006? Mainly the fact that the cost of a major ingredient—coffee beans—had gone up significantly. In fact, coffee bean prices doubled between 2002 and 2006.

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 decrease in the supply of coffee beans from the world's two leading coffee exporters: Brazil and Vietnam. In Brazil, the decrease 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.

In this section, 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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What you will learn in this **Module:**

- What a competitive market is and how it is described by the supply and demand model
- What the demand curve is
- The difference between movements along the demand curve and changes in demand
- The factors that shift the demand curve

Module 5 Supply and Demand: Introduction and Demand

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 section, 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. 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.

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.

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 explain the supply and demand model, we will examine each of these elements in turn. In this module we begin with demand.

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 multiplying the number of cups of coffee drunk around the world each day by the weight of the coffee beans it takes to brew a cup, and 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, 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 (taking "want" to mean they are willing and able to buy it, 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. On the right side of Figure 5.1 on the next page, 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 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 5.1 is a visual representation of the information in the table. 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 the price.

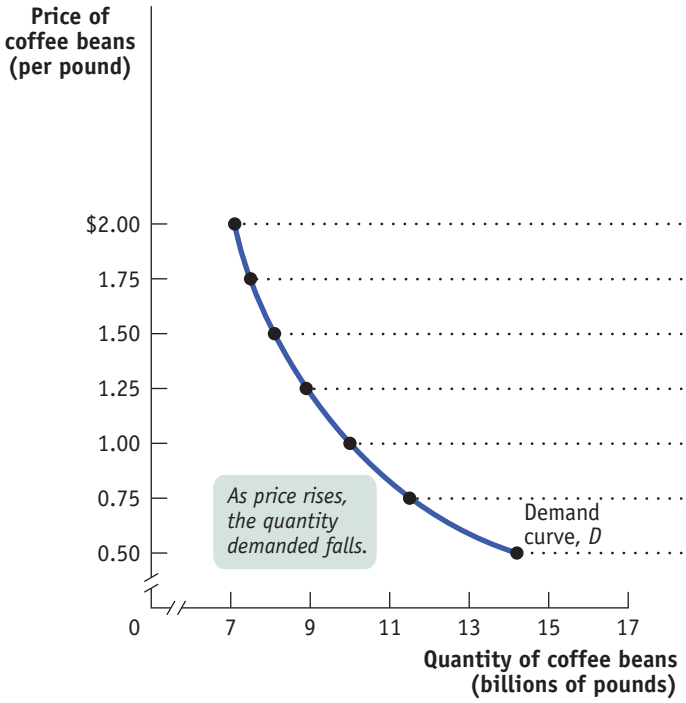
Note that the demand curve shown in Figure 5.1 slopes downward. This reflects the general proposition that a higher price reduces the quantity demanded. For example, some people who drink two cups of coffee a day when beans are $1 per pound will cut down to

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

The **quantity demanded** is the actual amount of a good or service consumers are willing and able 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.

figure 5.1 The Demand Schedule and the Demand Curve



Demand Schedule for Coffee Beans

Price of coffee beans (per pound)	Quantity of coffee beans demanded (billions of pounds)
$2.00	7.1
1.75	7.5
1.50	8.1
1.25	8.9
1.00	10.0
0.75	11.5
0.50	14.2

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

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 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, all other things being 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.**

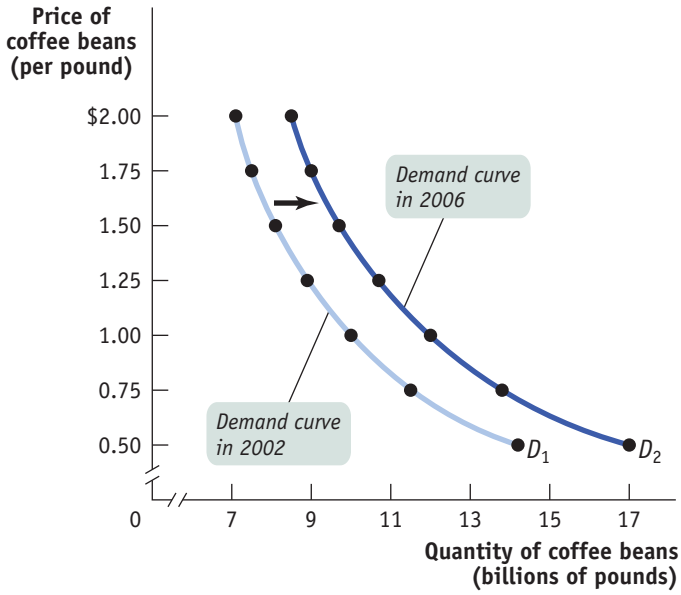
Shifts of the Demand Curve

Even though coffee prices were a lot higher in 2006 than they had been in 2002, total world consumption of coffee was higher in 2006. How can we reconcile this fact with the law of demand, which says that a higher price reduces the quantity demanded, all other things being equal?

The answer lies in the crucial phrase *all other things being equal*. In this case, all other things weren't equal: the world had changed between 2002 and 2006, 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 5.2 illustrates this phenomenon using the demand schedule and demand curve for coffee beans. (As before, the numbers in Figure 5.2 are hypothetical.)

The table in Figure 5.2 shows two demand schedules. The first is a demand schedule for 2002, the same one shown in Figure 5.1. The second is a demand schedule for 2006.

figure 5.2 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 2006
$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 2006, after the rise in population—and their corresponding demand curves. The increase in demand shifts the demand curve to the right.

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 2006 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 2006 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 5.2 show the same information graphically. As you can see, the demand schedule for 2006 corresponds to a new demand curve, D_2, that is to the right of the demand curve for 2002, D_1. This **change in demand** shows the increase in the quantity demanded at any given price, represented by the shift in position of the original demand curve, D_1, to its new location at D_2.

It's crucial to make the distinction between such changes in demand 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 5.3 on the next page 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 5.3 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.

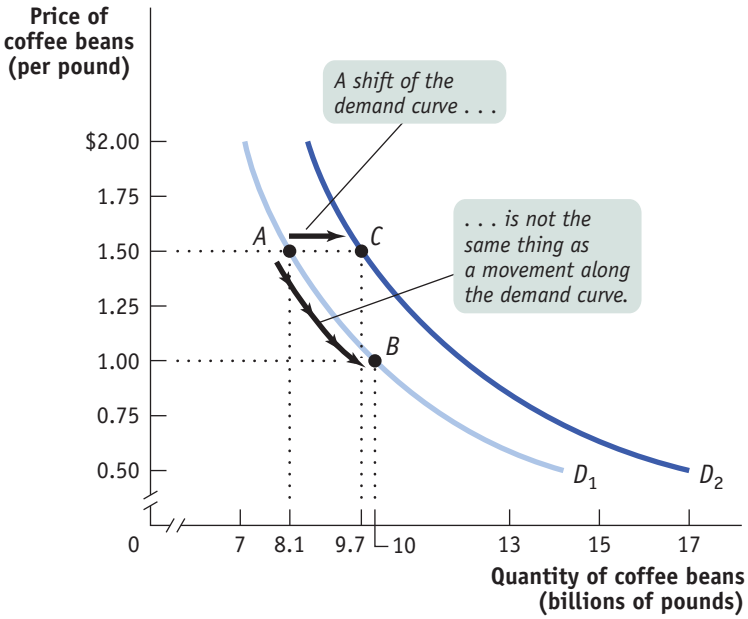
A **change in demand** is a shift of the demand curve, which changes the quantity demanded at any given price.

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 5.3

A Movement Along the Demand Curve Versus a Shift of the Demand Curve

The rise in the 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 the quantity demanded when going from point *A* to point *C* reflects a change in demand: this shift to the right is the result of a rise in the quantity demanded at any given price.



When economists talk about a "change in demand," saying "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.

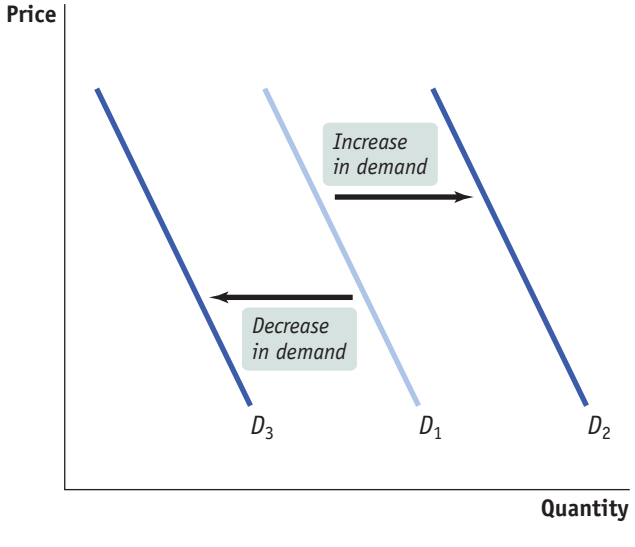
Understanding Shifts of the Demand Curve

Figure 5.4 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

figure 5.4

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.



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.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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, all other things being 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, the demand for its complement decreases, shifting the demand curve for the complement to the left. So the October 2006 rise in Starbucks's cappuccino prices is likely to have precipitated a leftward shift of the demand curve for croissants, as people consumed fewer cappuccinos and croissants. 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

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

Two goods are **complements** if a rise in the price of one of the goods 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.**

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 and Olive Garden and fast-food chains such as McDonald's and KFC. When their incomes rise, Americans 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 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 2006: 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. (Marketers and advertisers, however, 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.


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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 on October 6, 2006, would stock up on Starbucks coffee beans before that date.

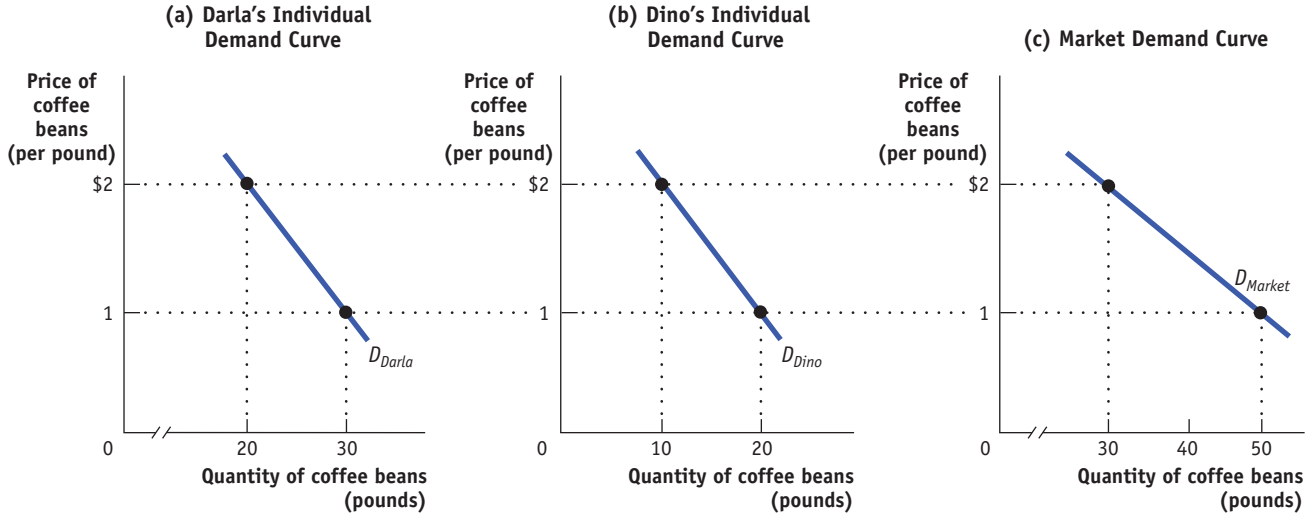
Expected changes in future income can also lead to changes in demand: if you expect your income to rise in the future, you will typically borrow today and increase your demand for certain goods; and if you expect your income to fall in the future, you are likely to save today and reduce your demand for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

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

Changes in the Number of Consumers As we've already noted, one of the reasons for rising coffee demand between 2002 and 2006 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 5.5 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.

figure 5.5 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.

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 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 were 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 5.1.

table **5.1**

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 (shifts to the right).
	. . . and the price of *B* falls, . . .	. . . demand for *A* decreases (shifts to the left).
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.

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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 $192) 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.

NICOLAS ASFOURI/AFP/Getty Images

London's bold policy to charge cars a fee to enter the city center proved effective in reducing traffic congestion.

Module 5 AP Review

Solutions appear at the back of the book.

Check Your Understanding

1. Explain whether each of the following events represents (i) a *change in demand* (a *shift of* the demand curve) or (ii) a *movement along* the demand curve (a *change in the quantity demanded*).
   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. A sharp rise in the price of gasoline leads many commuters to join carpools in order to reduce their gasoline purchases.

Tackle the Test: Multiple-Choice Questions

1. Which of the following would increase demand for a normal good? A decrease in
   a. price.
   b. income.
   c. the price of a substitute.
   d. consumer taste for a good.
   e. the price of a complement.

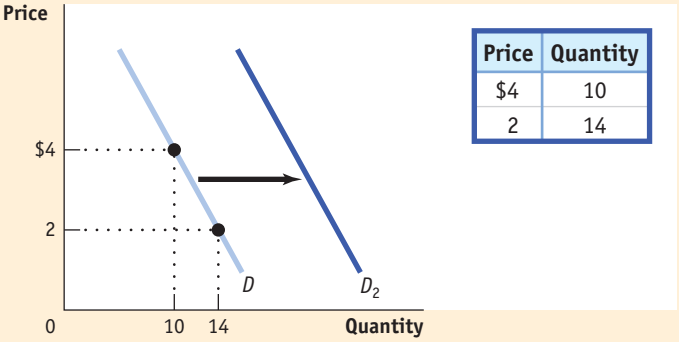
2. A decrease in the price of butter would most likely decrease the demand for
   a. margarine.
   b. bagels.
   c. jelly.
   d. milk.
   e. syrup.

3. If an increase in income leads to a decrease in demand, the good is
   a. a complement.
   b. a substitute.
   c. inferior.
   d. abnormal.
   e. normal.
4. Which of the following will occur if consumers expect the price of a good to fall in the coming months?
   a. The quantity demanded will rise today.
   b. The quantity demanded will remain the same today.
   c. Demand will increase today.
   d. Demand will decrease today.
   e. No change will occur today.
5. Which of the following will increase the demand for disposable diapers?
   a. a new "baby boom"
   b. concern over the environmental effect of landfills
   c. a decrease in the price of cloth diapers
   d. a move toward earlier potty training of children
   e. a decrease in the price of disposable diapers

Tackle the Test: Free-Response Questions

1. Create a table with two hypothetical prices for a good and two corresponding quantities demanded. Choose the prices and quantities so that they illustrate the law of demand. Using your data, draw a correctly labeled graph showing the demand curve for the good. Using the same graph, illustrate an increase in demand for the good.
2. Draw a correctly labeled graph showing the demand for apples. On your graph, illustrate what happens to the demand for apples if a new report from the Surgeon General finds that an apple a day really *does* keep the doctor away.

Answer (6 points)



Price	Quantity
$4	10
2	14

1 point: Table with data labeled "Price" (or "P") and "Quantity" (or "Q")

1 point: Values in the table show a negative relationship between P and Q

1 point: Graph with "Price" on the vertical axis and "Quantity" on the horizontal axis

1 point: Negatively sloped curve labeled "Demand" or "D"

1 point: Demand curve correctly plots the data from the table

1 point: A second demand curve (with a label such as D_2) shown to the right of the original demand curve

Module 6
Supply and Demand: Supply and Equilibrium

What you will learn in this Module:

- What the supply curve is
- The difference between movements along the supply curve and changes in supply
- The factors that shift the supply curve
- How 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

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 6.1 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.

A supply schedule works the same way as the demand schedule shown in Figure 5.1: 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 6.1. Each point on the curve represents an entry from the table.

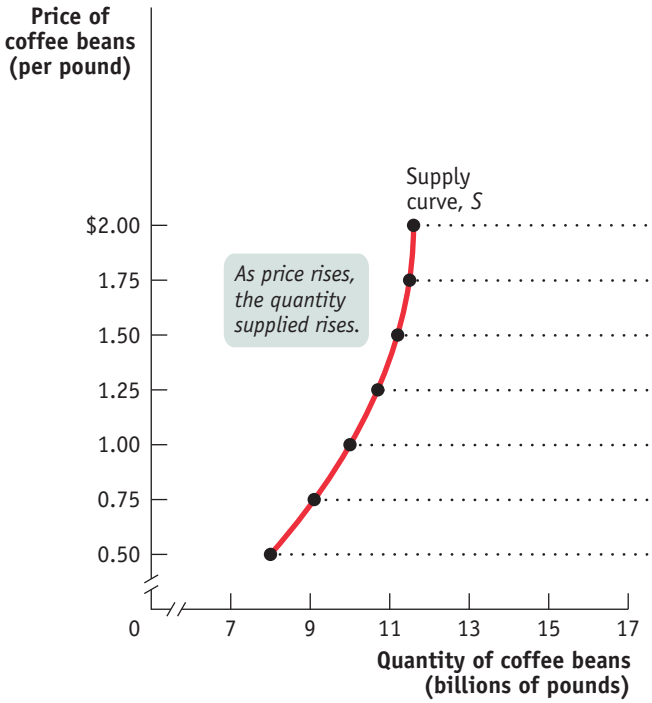
Suppose that the price of coffee beans rises from $1 to $1.25; we can see that the quantity of coffee beans farmers are willing to sell rises from 10 billion to 10.7 billion pounds. This is the normal situation for a supply curve, reflecting the general proposition that a higher price leads to a higher quantity supplied. Some economists refer to

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.

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

figure 6.1 The Supply Schedule and the Supply Curve



Supply Schedule for Coffee Beans

Price of coffee beans (per pound)	Quantity of coffee beans supplied (billions of pounds)
$2.00	11.6
1.75	11.5
1.50	11.2
1.25	10.7
1.00	10.0
0.75	9.1
0.50	8.0

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.

this relationship as the **law of supply.** Generally, the price and quantity supplied are positively related. 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 are 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 Latin America. Vietnam, in particular, emerged as a big new source of coffee beans. Figure 6.2 illustrates this event in terms of the supply schedule and the supply curve for coffee beans.

The table in Figure 6.2 shows two supply schedules. The schedule before new producers such as Vietnam arrived on the scene is the same one as in Figure 6.1. The second schedule shows the supply of coffee beans *after* the entry of new producers. Just as a change in the demand schedule leads to a shift of the demand curve, a change in the supply schedule leads to a shift of the supply curve—a **change in supply.** This is shown in Figure 6.2 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 the quantity supplied increases at any given price.

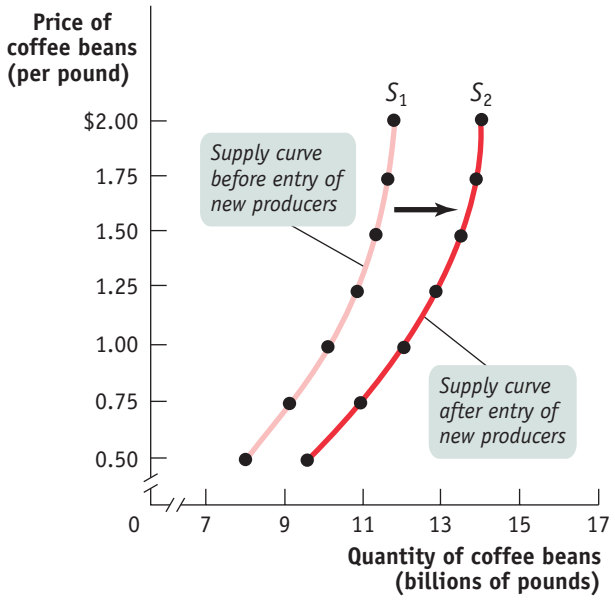
As in the analysis of demand, it's crucial to draw a distinction between such changes in supply and **movements along the supply curve**—changes in the quantity supplied that result from a change in price. We can see this difference in

The **law of supply** says that, other things being equal, the price and quantity supplied of a good are positively related.

A **change in supply** is a shift of the supply curve, which changes the quantity supplied at any given price.

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 6.2 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 Vietnam'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.

Figure 6.3 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.

Understanding Shifts of the Supply Curve

Figure 6.4 on the next page 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 6.4 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.

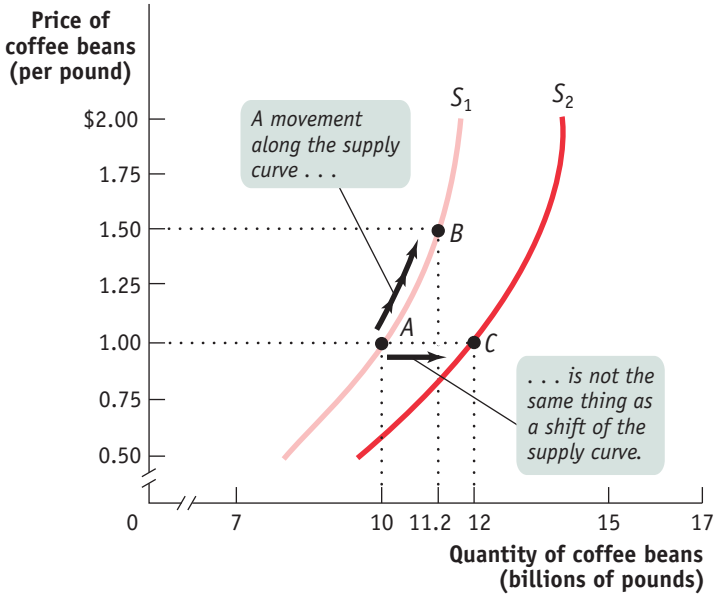
Economists believe that shifts of the supply curve for a good or service are mainly the result of five factors (though, as in the case of demand, there are other possible causes):

- 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

figure 6.3

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 change in supply: this shift to the right is the result of an increase in the quantity supplied at any given price.



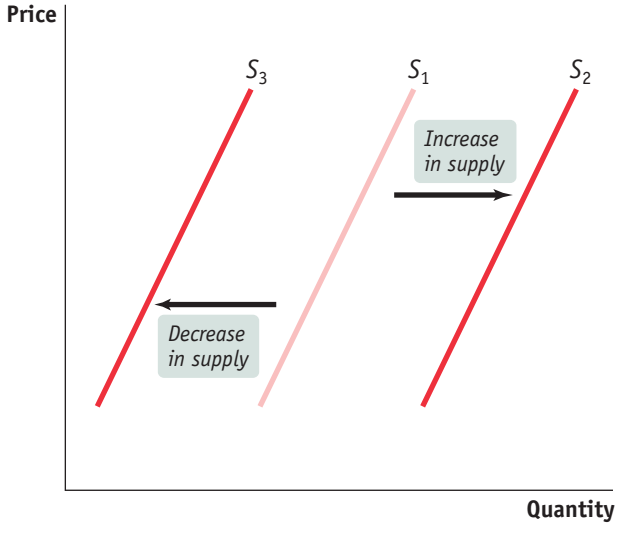
An **input** is anything that is used to produce a good or service.

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 anything used to produce a 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.

figure 6.4

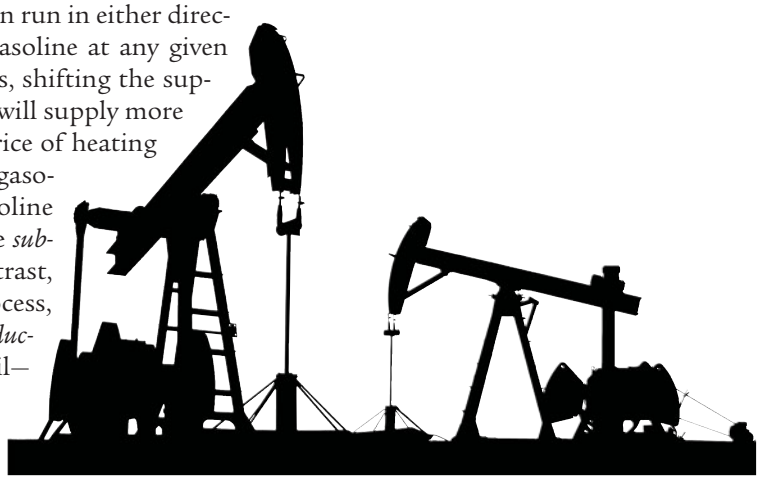
Shifts of the Supply Curve

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.



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 refinery 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 drillers can sell natural gas, the more oil wells they will drill and the more oil they will supply at any given price for oil. As a result, natural gas is a complement in production for crude oil.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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 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 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, among other factors. 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

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

MAURICIO LIMA/AFP/Getty Images

A farmer in Brazil sorts coffee beans by tossing them into the air. With advances in technology, more beans can be sorted in less time, and the supply curve shifts to the right.

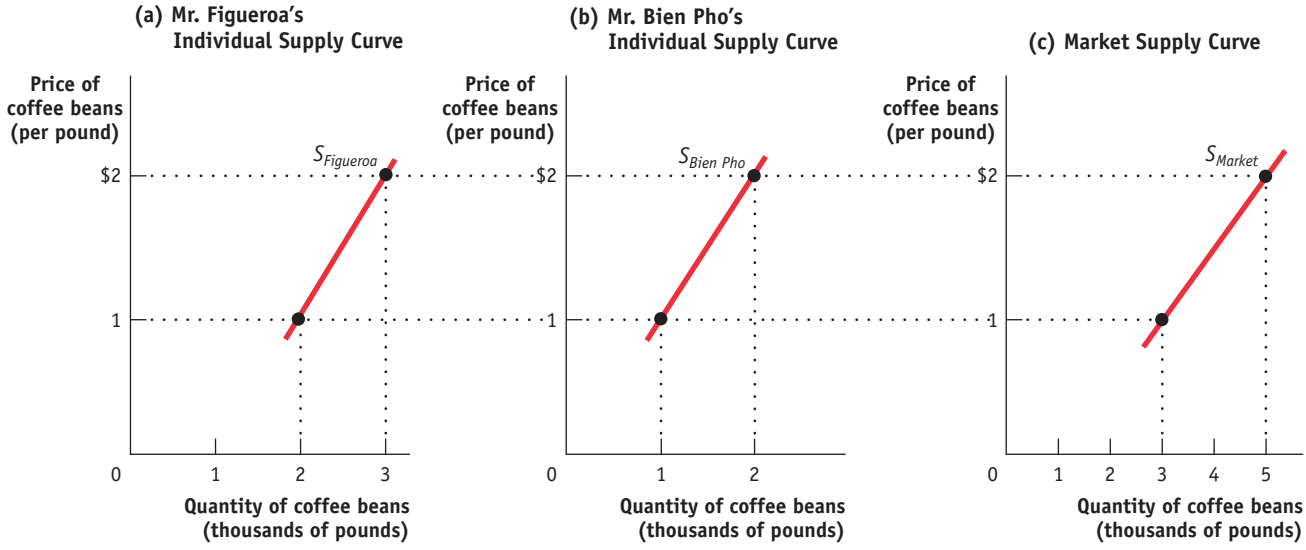
quantity supplied and price for an individual producer. For example, suppose that Mr. Figueroa is a Brazilian coffee farmer and that panel (a) of Figure 6.5 shows how many pounds of beans he will supply per year at any given price. Then $S_{Figueroa}$ is his individual supply curve.

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.

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 were 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 6.1.

figure 6.5 The Individual Supply Curve and the Market Supply Curve



Panel (a) shows the individual supply curve for Mr. Figueroa, $S_{Figueroa}$, which indicates the quantity of coffee beans he will sell at any given price. Panel (b) shows the individual supply curve for Mr. Bien Pho, $S_{Bien\ Pho}$. 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 **6.1**

Factors That Shift Supply

Changes in input prices		
	If the price of an input used to produce *A* rises, . . .	. . . supply of *A* decreases (shifts to the left).
	If the price of an input used to produce *A* falls, . . .	. . . supply of *A* increases (shifts to the right).
Changes in the prices of related goods or services		
If A and *B* are **substitutes in production** . . .	. . . and the price of *B* rises, . . .	. . . supply of *A* decreases.
	. . . and the price of *B* falls, . . .	. . . supply of *A* increases.
If A and *B* are **complements in production** . . .	. . . and the price of *B* rises, . . .	. . . supply of *A* increases.
	. . . and the price of *B* falls, . . .	. . . supply of *A* decreases.
Changes in technology		
	If the technology used to produce *A* improves, . . .	. . . supply of *A* increases.
Changes in expectations		
	If the price of *A* is expected to rise in the future, . . .	. . . supply of *A* decreases today.
	If the price of *A* is expected to fall in the future, . . .	. . . supply of *A* increases today.
Changes in the number of producers		
	If the number of producers of *A* rises, . . .	. . . market supply of *A* increases.
	If the number of producers of *A* falls, . . .	. . . market supply of *A* decreases.

fyi

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. 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.)

An economic situation is in **equilibrium** when no individual would be better off doing something different.

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

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.

In competitive markets this interaction of supply and demand tends to move toward what economists call *equilibrium*. Imagine a busy afternoon at your local supermarket; there are long lines at the checkout counters. Then one of the previously closed registers opens. The first thing that happens is a rush to the newly opened register. But soon enough things settle down and shoppers have rearranged themselves so that the line at the newly opened register is about as long as all the others. This situation—all the checkout lines are now the same length, and none of the shoppers can be better off by doing something different—is what economists call **equilibrium.**

The concept of equilibrium helps us understand the price at which a good or service is bought and sold as well as the quantity transacted of the good or service. 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. Recall the shoppers at the supermarket who cannot make themselves better off (cannot save time) by changing lines. Similarly, at the market equilibrium, the 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?

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 6.6 combines the demand curve from Figure 5.1 and the supply curve from Figure 6.1. 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.

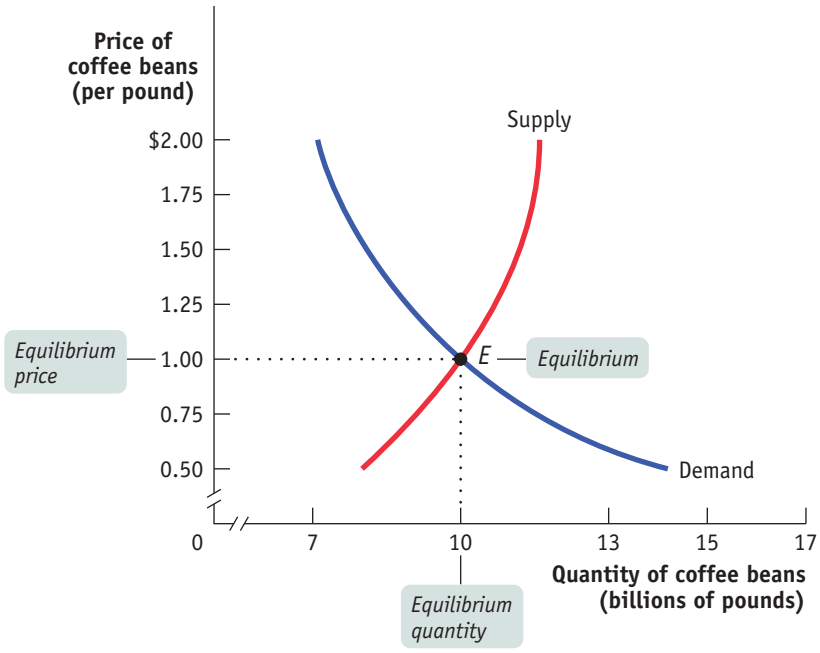
Let's confirm that point *E* fits our definition of equilibrium. At a price of $1 per pound, coffee bean producers are willing to sell 10 billion pounds a year and coffee bean consumers want to buy 10 billion pounds a year. So at the price of $1 a pound, the quantity of coffee beans supplied equals the quantity demanded. Notice that at any other price the market would not clear: some willing buyers 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 curves shown in Figure 6.6, 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:

figure 6.6

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.



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 in which 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.*

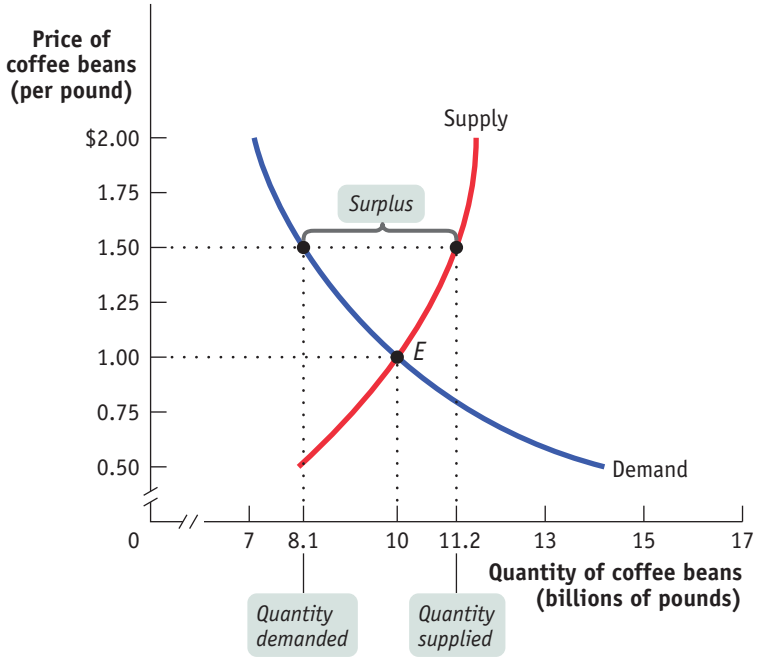
Why Does the Market Price Fall If It Is Above the Equilibrium Price?

Suppose the supply and demand curves are as shown in Figure 6.6 but the market price is above the equilibrium level of $1—say, $1.50. This situation is illustrated in Figure 6.7 on the next page. Why can't the price stay there?

figure 6.7

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.



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

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

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.

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

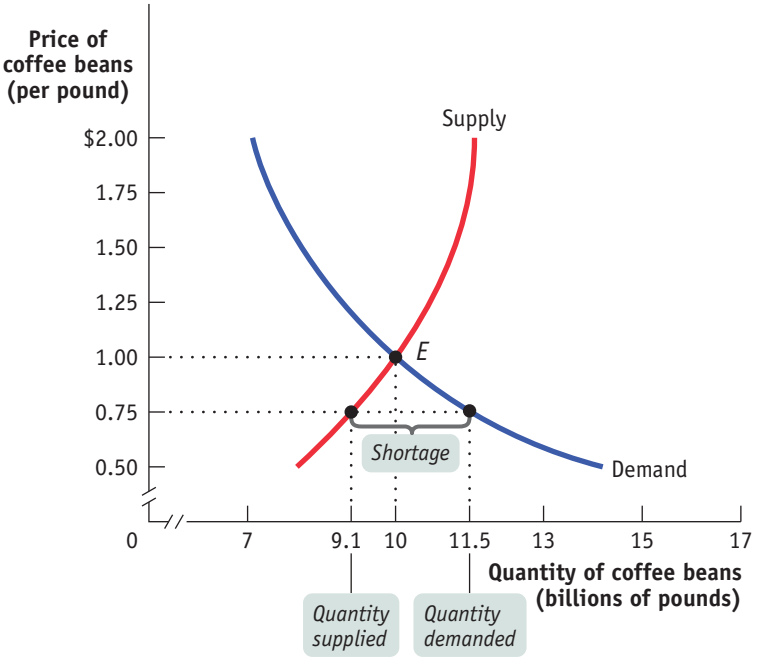
Now suppose the price is below its equilibrium level—say, at $0.75 per pound, as shown in Figure 6.8. In this case, the quantity demanded, 11.5 billion pounds, exceeds the quantity supplied, 9.1 billion pounds, implying that there are would-be buyers who cannot find coffee beans: there is a **shortage**—also 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.

figure 6.8

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.



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.

Module 6 AP Review

Solutions appear at the back of the book.

Check Your Understanding

1. Explain whether each of the following events represents (i) a *change in* supply or (ii) a *movement along* the supply curve.
   a. During a real estate boom that causes house prices to rise, more homeowners put their houses up for sale.
   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, fewer young people are available to work. 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.
2. 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. In 2010 there was a bumper crop of wine grapes.
   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 second-hand snowblowers at the local tool shop.

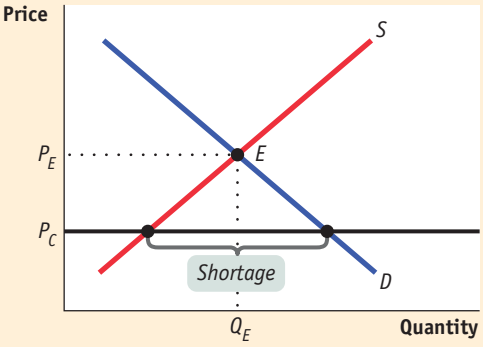
Tackle the Test: Multiple-Choice Questions

1. Which of the following will decrease the supply of good "X"?
   a. There is a technological advance that affects the production of *all* goods.
   b. The price of good "X" falls.
   c. The price of good "Y" (which consumers regard as a substitute for good "X") decreases.
   d. The wages of workers producing good "X" increase.
   e. The demand for good "X" decreases.
2. An increase in the demand for steak will lead to an increase in which of the following?
   a. the supply of steak
   b. the supply of hamburger (a substitute in production)
   c. the supply of chicken (a substitute in consumption)
   d. the supply of leather (a complement in production)
   e. the demand for leather
3. A technological advance in textbook production will lead to which of the following?
   a. a decrease in textbook supply
   b. an increase in textbook demand
   c. an increase in textbook supply
   d. a movement along the supply curve for textbooks
   e. an increase in textbook prices
4. Which of the following is true at equilibrium?
   a. The supply schedule is identical to the demand schedule at every price.
   b. The quantity demanded is the same as the quantity supplied.
   c. The quantity is zero.
   d. Every consumer who enjoys the good can consume it.
   e. Producers could not make any more of the product regardless of the price.
5. The market price of a good will tend to rise if
   a. demand decreases.
   b. supply increases.
   c. it is above the equilibrium price.
   d. it is below the equilibrium price.
   e. demand shifts to the left.

Tackle the Test: Free-Response Questions

1. Draw a correctly labeled graph showing the market for tomatoes in equilibrium. Label the equilibrium price "P_E" and the equilibrium quantity "Q_E." On your graph, draw a horizontal line indicating a price, labeled "P_C", that would lead to a shortage of tomatoes. Label the size of the shortage on your graph.
2. Draw a correctly labeled graph showing the market for oranges in equilibrium. Show on your graph how a hurricane that destroys large numbers of orange groves in Florida will affect supply and demand, if at all.

Answer (6 points)



1 point: Graph with the vertical axis labeled "Price" or "*P*" and the horizontal axis labeled "Quantity" or "*Q*"

1 point: Downward sloping demand curve labeled "Demand" or "*D*"

1 point: Upward sloping supply curve labeled "Supply" or "*S*"

1 point: Equilibrium price "P_E" labeled on the vertical axis and quantity "Q_E" labeled on the horizontal axis at the intersection of the supply and demand curves

1 point: Price line at a price "P_C" below the equilibrium price

1 point: Correct indication of the shortage, which is the horizontal distance between the quantity demanded and the quantity supplied at the height of P_C

What you will learn in this **Module:**

- How equilibrium price and quantity are affected when there is a change in either supply or demand
- How equilibrium price and quantity are affected when there is a simultaneous change in both supply and demand

Module 7 Supply and Demand: Changes in Equilibrium

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, the increase in supply lowered 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 affecting 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?

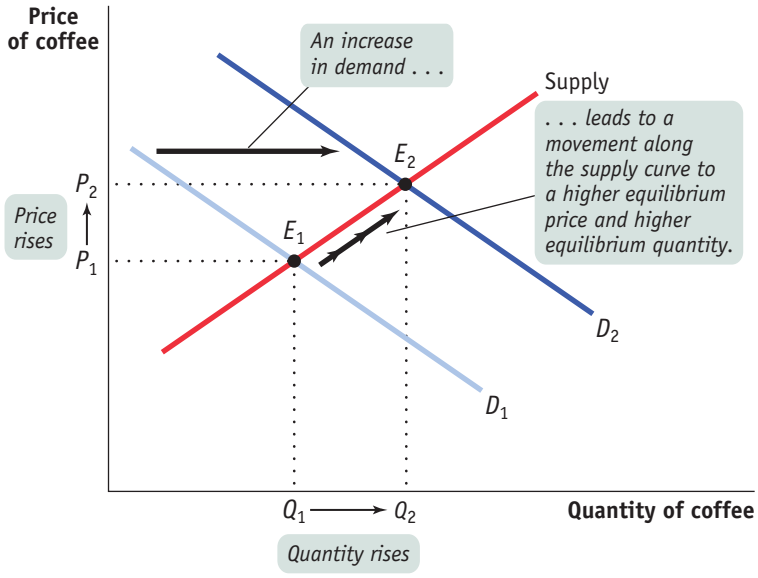
Figure 7.1 on the next page shows the effect of a rise in the price of tea on the market for coffee. The rise in the price of tea increases the demand for coffee. Point E_1 shows the original equilibrium, with P_1 the equilibrium price and Q_1 the equilibrium quantity bought and sold.

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

figure 7.1

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.



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.*


Photodisc

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.*

What Happens When the Supply Curve Shifts

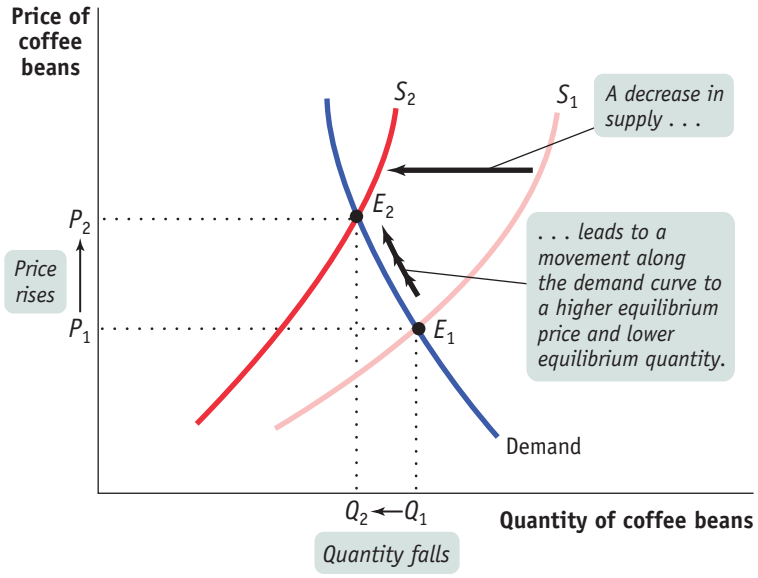
In the real world, it is a bit easier to predict changes in supply than changes in demand. Physical factors that affect supply, like the availability of inputs, are easier to get a handle on than the fickle tastes that affect demand. Still, with supply as with demand, what we can best predict are the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

As we mentioned earlier, a prolonged drought in Vietnam sharply reduced its production of coffee beans. Figure 7.2 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 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

figure 7.2

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.



is higher and the equilibrium quantity is 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.*

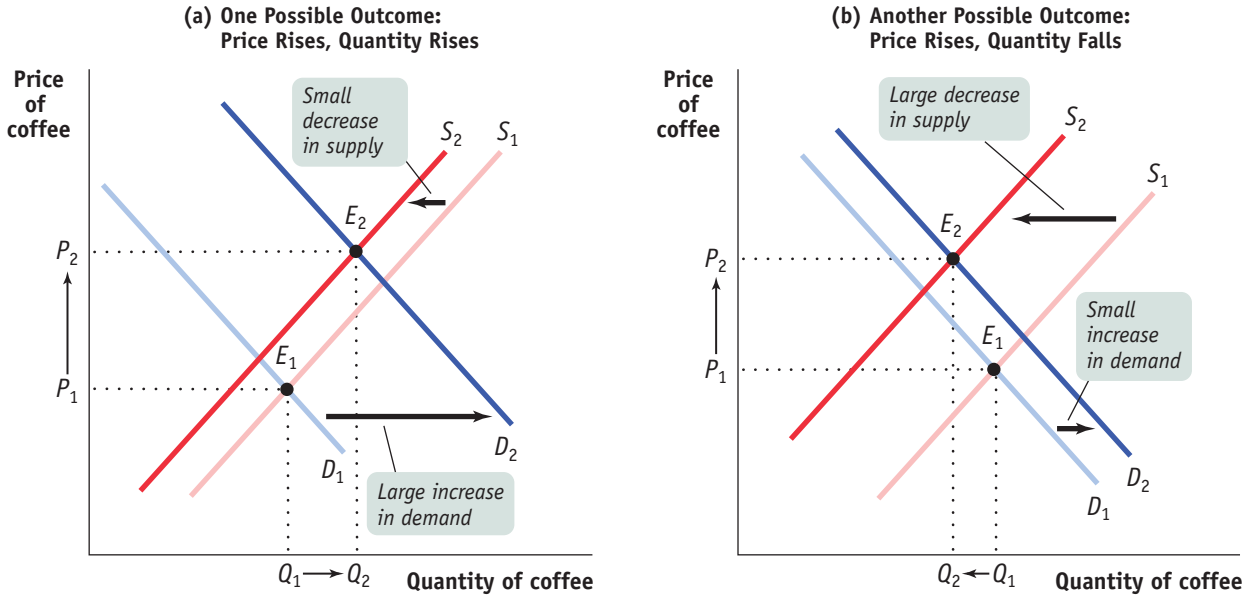
To summarize how a market responds to a change in supply: *An increase in supply leads to a fall in the equilibrium price and a rise in the equilibrium quantity. A decrease in supply leads to a rise in the equilibrium price and a fall in the equilibrium quantity.*

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 7.3 on the next page 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 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 year with only a small increase in coffee demand. 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 large relative to 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,

figure 7.3 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 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 larger than the increase in demand, so the equilibrium price rises and the equilibrium quantity falls.

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 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, in which both supply and demand 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.

fyi

The Great Tortilla Crisis

"Thousands in Mexico City protest rising food prices." So read a recent headline in the *New York Times*. 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.

OMAR TORRES/AFP/Getty Images

A cook prepares tortillas made with four different types of corn in a restaurant in Mexico City.

Module 7 AP Review

Solutions appear at the back of the book.

Check Your Understanding

1. For each of the following examples, explain how the indicated change affects supply or demand for the good in question and how the shift you describe affects equilibrium price and quantity.
   a. As the price of gasoline fell in the United States during the 1990s, more people bought large cars.
   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?

Tackle the Test: Multiple-Choice Questions

1. Which of the following describes what will happen in the market for tomatoes if a salmonella outbreak is attributed to tainted tomatoes?
   a. Supply will decrease and price will increase.
   b. Supply will decrease and price will decrease.
   c. Demand will decrease and price will increase.
   d. Demand will decrease and price will decrease.
   e. Supply and demand will both decrease.
2. Which of the following will lead to an increase in the equilibrium price of product "X"? A(n)
   a. increase in consumer incomes if product "X" is an inferior good
   b. increase in the price of machinery used to produce product "X"
   c. technological advance in the production of good "X"
   d. decrease in the price of good "Y" (a substitute for good "X")
   e. expectation by consumers that the price of good "X" is going to fall

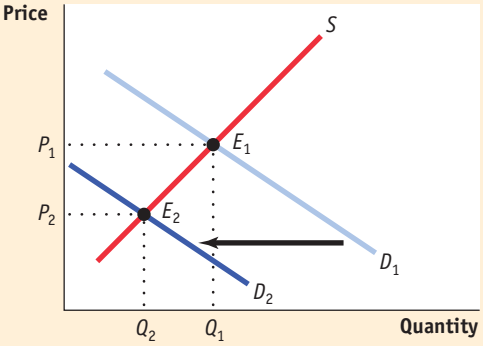
3. The equilibrium price will rise, but equilibrium quantity may increase, decrease, or stay the same if
   a. demand increases and supply decreases.
   b. demand increases and supply increases.
   c. demand decreases and supply increases.
   d. demand decreases and supply decreases.
   e. demand increases and supply does not change.
4. An increase in the number of buyers and a technological advance will cause
   a. demand to increase and supply to increase.
   b. demand to increase and supply to decrease.
   c. demand to decrease and supply to increase.
   d. demand to decrease and supply to decrease.
   e. no change in demand and an increase in supply.
5. Which of the following is certainly true if demand and supply increase at the same time?
   a. The equilibrium price will increase.
   b. The equilibrium price will decrease.
   c. The equilibrium quantity will increase.
   d. The equilibrium quantity will decrease.
   e. The equilibrium quantity may increase, decrease, or stay the same.

Tackle the Test: Free-Response Questions

1. Draw a correctly labeled graph showing the SUV market in equilibrium. On your graph, show the effect on equilibrium price and quantity in the market for SUVs if the price of gasoline increases.

2. Draw a correctly labeled graph showing the market for cups of coffee in equilibrium. On your graph, show the effect of a decrease in the price of coffee beans on equilibrium price and equilibrium quantity in the market for cups of coffee.

Answer (5 points)



1 point: The vertical axis is labeled "Price" (or "*P*") and the horizontal axis is labeled "Quantity" (or "*Q*").

1 point: The graph shows a downward sloping demand curve and an upward sloping supply curve (*with labels*).

1 point: Equilibrium price and quantity are found where supply and demand intersect and are labeled *on the appropriate axes.*

1 point: A new (*and labeled*) demand curve is shown to the left of the original demand curve.

1 point: The new equilibrium price and quantity are found at the intersection of the original supply curve and the new demand curve and are labeled *on the appropriate axes.*

Module 8
Supply and Demand: Price Controls (Ceilings and Floors)

What you will learn in this Module:

- The meaning of price controls, one way government intervenes in markets
- How price controls can create problems and make a market inefficient
- Why economists are often deeply skeptical of attempts to intervene in markets
- Who benefits and who loses from price controls, and why they are used despite their well-known problems

Why Governments Control Prices

You learned in Module 6 that a market moves to equilibrium—that is, the market price moves to the level at which the quantity supplied equals the quantity demanded. But this equilibrium price does not necessarily please either buyers or sellers.

After all, buyers would always like to pay less if they could, and sometimes they can make a strong moral or political case that they should pay lower prices. For example, what if the equilibrium between supply and demand for apartments in a major city leads to rental rates that an average working person can't afford? In that case, a government might well be under pressure to impose limits on the rents landlords can charge.

Sellers, however, would always like to get more money for what they sell, and sometimes they can make a strong moral or political case that they should receive higher prices. For example, consider the labor market: the price for an hour of a worker's time is the wage rate. What if the equilibrium between supply and demand for less skilled workers leads to wage rates that yield an income below the poverty level? In that case, a government might well be pressured to require employers to pay a rate no lower than some specified minimum wage.

In other words, there is often a strong political demand for governments to intervene in markets. And powerful interests can make a compelling case that a market intervention favoring them is "fair." When a government intervenes to regulate prices, we say that it imposes **price controls.** These controls typically take the form of either an upper limit, a **price ceiling,** or a lower limit, a **price floor.**

Unfortunately, it's not that easy to tell a market what to do. As we will now see, when a government tries to legislate prices—whether it legislates them *down* by imposing a price ceiling or *up* by imposing a price floor—there are certain predictable and unpleasant side effects.

Price controls are legal restrictions on how high or low a market price may go. They can take two forms: a **price ceiling,** a maximum price sellers are allowed to charge for a good or service, or a **price floor,** a minimum price buyers are required to pay for a good or service.

We make an important assumption in this module: the markets in question are efficient before price controls are imposed. Markets can sometimes be inefficient—for example, a market dominated by a monopolist, a single seller who has the power to influence the market price. When markets are inefficient, price controls don't necessarily cause problems and can potentially move the market closer to efficiency. In practice, however, price controls often *are* imposed on efficient markets—like the New York City apartment market. And so the analysis in this module applies to many important real-world situations.

Price Ceilings

Aside from rent control, there are not many price ceilings in the United States today. But at times they have been widespread. Price ceilings are typically imposed during crises—wars, harvest failures, natural disasters—because these events often lead to sudden price increases that hurt many people but produce big gains for a lucky few. The U.S. government imposed ceilings on many prices during World War II: the war sharply increased demand for raw materials, such as aluminum and steel, and price controls prevented those with access to these raw materials from earning huge profits. Price controls on oil were imposed in 1973, when an embargo by Arab oil-exporting countries seemed likely to generate huge profits for U.S. oil companies. Price controls were imposed on California's wholesale electricity market in 2001, when a shortage created big profits for a few power-generating companies but led to higher electricity bills for consumers.

Rent control in New York is, believe it or not, a legacy of World War II: it was imposed because wartime production created an economic boom, which increased demand for apartments at a time when the labor and raw materials that might have been used to build them were being used to win the war instead. Although most price controls were removed soon after the war ended, New York's rent limits were retained and gradually extended to buildings not previously covered, leading to some very strange situations.

You can rent a one-bedroom apartment in Manhattan on fairly short notice—if you are able and willing to pay several thousand dollars a month and live in a less-than-desirable area. Yet some people pay only a small fraction of this for comparable apartments, and others pay hardly more for bigger apartments in better locations.

Aside from producing great deals for some renters, however, what are the broader consequences of New York's rent-control system? To answer this question, we turn to the supply and demand model.

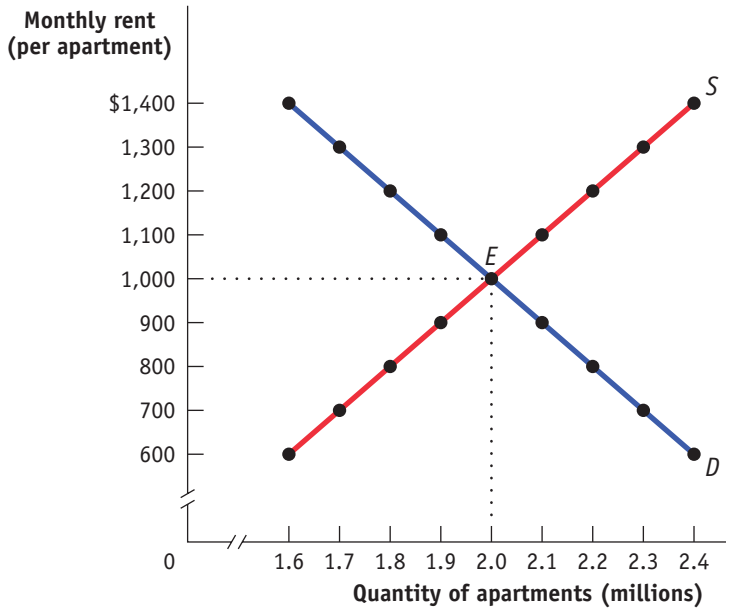
Modeling a Price Ceiling

To see what can go wrong when a government imposes a price ceiling on an efficient market, consider Figure 8.1, which shows a simplified model of the market for apartments in New York. For the sake of simplicity, we imagine that all apartments are exactly the same and so would rent for the same price in an unregulated market. The table in the figure shows the demand and supply schedules; the demand and supply curves are shown on the left. We show the quantity of apartments on the horizontal axis and the monthly rent per apartment on the vertical axis. You can see that in an unregulated market the equilibrium would be at point *E:* 2 million apartments would be rented for $1,000 each per month.

Now suppose that the government imposes a price ceiling, limiting rents to a price below the equilibrium price—say, no more than $800.

Figure 8.2 shows the effect of the price ceiling, represented by the line at $800. At the enforced rental rate of $800, landlords have less incentive to offer apartments, so they won't be willing to supply as many as they would at the equilibrium rate of $1,000. They will choose point *A* on the supply curve, offering only 1.8 million apartments for rent, 200,000 fewer than in the unregulated market. At the same time, more people will want to rent apartments at a price of $800 than at the equilibrium price of $1,000; as shown at point *B* on the demand curve, at a monthly rent of $800 the quantity of apartments

figure 8.1 The Market for Apartments in the Absence of Government Controls



Monthly rent (per apartment)	Quantity of apartments (millions)	
	Quantity demanded	Quantity supplied
$1,400	1.6	2.4
1,300	1.7	2.3
1,200	1.8	2.2
1,100	1.9	2.1
1,000	2.0	2.0
900	2.1	1.9
800	2.2	1.8
700	2.3	1.7
600	2.4	1.6

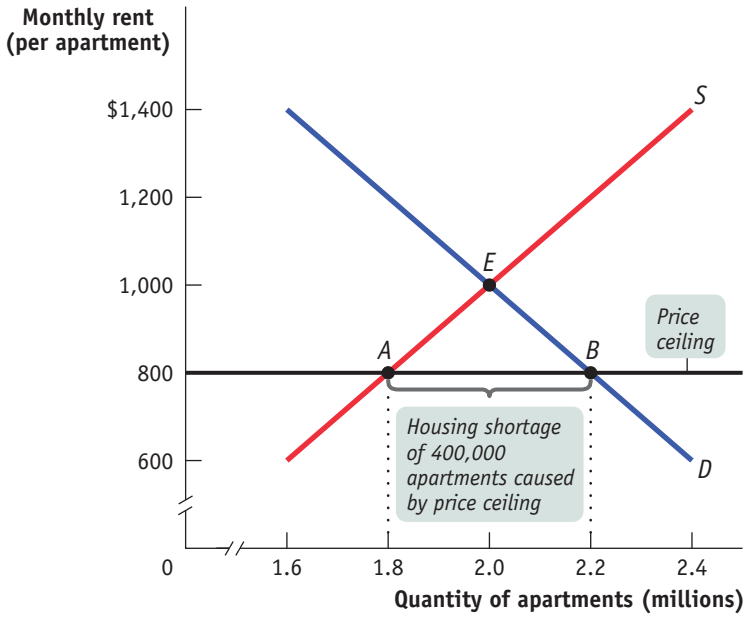
Without government intervention, the market for apartments reaches equilibrium at point *E* with a market rent of $1,000 per month and 2 million apartments rented.

demanded rises to 2.2 million, 200,000 more than in the unregulated market and 400,000 more than are actually available at the price of $800. So there is now a persistent shortage of rental housing: at that price, 400,000 more people want to rent than are able to find apartments.

figure 8.2

The Effects of a Price Ceiling

The black horizontal line represents the government-imposed price ceiling on rents of $800 per month. This price ceiling reduces the quantity of apartments supplied to 1.8 million, point *A*, and increases the quantity demanded to 2.2 million, point *B*. This creates a persistent shortage of 400,000 units: 400,000 people who want apartments at the legal rent of $800 but cannot get them.



Do price ceilings always cause shortages? No. If a price ceiling is set above the equilibrium price, it won't have any effect. Suppose that the equilibrium rental rate on apartments is $1,000 per month and the city government sets a ceiling of $1,200. Who cares? In this case, the price ceiling won't be binding—it won't actually constrain market behavior—and it will have no effect.

Inefficient Allocation to Consumers Rent control doesn't just lead to too few apartments being available. It can also lead to misallocation of the apartments that are available: people who badly need a place to live may not be able to find an apartment, while some apartments may be occupied by people with much less urgent needs.

In the case shown in Figure 8.2, 2.2 million people would like to rent an apartment at $800 per month, but only 1.8 million apartments are available. Of those 2.2 million who are seeking an apartment, some want an apartment badly and are willing to pay a high price to get one. Others have a less urgent need and are only willing to pay a low price, perhaps because they have alternative housing. An efficient allocation of apartments would reflect these differences: people who really want an apartment will get one and people who aren't all that eager to find an apartment won't. In an inefficient distribution of apartments, the opposite will happen: some people who are not especially eager to find an apartment will get one and others who are very eager to find an apartment won't. Because people usually get apartments through luck or personal connections under rent control, it generally results in an **inefficient allocation to consumers** of the few apartments available.

To see the inefficiency involved, consider the plight of the Lees, a family with young children who have no alternative housing and would be willing to pay up to $1,500 for an apartment—but are unable to find one. Also consider George, a retiree who lives most of the year in Florida but still has a lease on the New York apartment he moved into 40 years ago. George pays $800 per month for this apartment, but if the rent were even slightly more—say, $850—he would give it up and stay with his children when he is in New York.

This allocation of apartments—George has one and the Lees do not—is a missed opportunity: there is a way to make the Lees and George both better off at no additional cost. The Lees would be happy to pay George, say, $1,200 a month to sublease his apartment, which he would happily accept since the apartment is worth no more than $849 a month to him. George would prefer the money he gets from the Lees to keeping his apartment; the Lees would prefer to have the apartment rather than the money. So both would be made better off by this transaction—and nobody else would be made worse off.

Generally, if people who really want apartments could sublease them from people who are less eager to live there, both those who gain apartments and those who trade their occupancy for money would be better off. However, subletting is illegal under rent control because it would occur at prices above the price ceiling. The fact that subletting is illegal doesn't mean it never happens. In fact, chasing down illegal subletting is a major business for New York private investigators. A 2007 report in the *New York Times* described how private investigators use hidden cameras and other tricks to prove that the legal tenants in rent-controlled apartments actually live in the suburbs, or even in other states, and have sublet their apartments at two or three times the controlled rent. This subletting is a kind of illegal activity, which we will discuss shortly. For now, just notice that the aggressive pursuit of illegal subletting surely discourages the practice, so there isn't enough subletting to eliminate the inefficient allocation of apartments.

Wasted Resources Another reason a price ceiling causes inefficiency is that it leads to **wasted resources:** people expend money, effort, and time to cope with the shortages caused by the price ceiling. Back in 1979, U.S. price controls on gasoline led to shortages that forced millions of Americans to spend hours each week waiting in lines at gas stations. The opportunity cost of the time spent in gas lines—the wages not earned, the leisure time not enjoyed—constituted wasted resources from the point of view of consumers and of the economy as a whole. Because of rent control, the Lees will spend all their spare time for several months searching for an apartment, time they would rather have spent working or engaged in family activities. That is, there is an opportunity cost to the Lees' prolonged search for an apartment—the leisure or income

Price ceilings often lead to inefficiency in the form of **inefficient allocation to consumers:** people who want the good badly and are willing to pay a high price don't get it, and those who care relatively little about the good and are only willing to pay a relatively low price do get it.

Price ceilings typically lead to inefficiency in the form of **wasted resources:** people expend money, effort, and time to cope with the shortages caused by the price ceiling.

they had to forgo. If the market for apartments worked freely, the Lees would quickly find an apartment at the equilibrium rent of $1,000, leaving them time to earn more or to enjoy themselves—an outcome that would make them better off without making anyone else worse off. Again, rent control creates missed opportunities.

Visions of America, LLC/Alamy

Signs advertising apartments to rent or sublet are common in New York City.

Inefficiently Low Quality Yet another way a price ceiling causes inefficiency is by causing goods to be of inefficiently low quality. **Inefficiently low quality** means that sellers offer low-quality goods at a low price even though buyers would rather have higher quality and are willing to pay a higher price for it.

Again, consider rent control. Landlords have no incentive to provide better conditions because they cannot raise rents to cover their repair costs but are able to find tenants easily. In many cases, tenants would be willing to pay much more for improved conditions than it would cost for the landlord to provide them—for example, the upgrade of an antiquated electrical system that cannot safely run air conditioners or computers. But any additional payment for such improvements would be legally considered a rent increase, which is prohibited. Indeed, rent-controlled apartments are notoriously badly maintained, rarely painted, subject to frequent electrical and plumbing problems, sometimes even hazardous to inhabit. As one former manager of Manhattan buildings explained, "At unregulated apartments we'd do most things that the tenants requested. But on the rent-regulated units, we did absolutely only what the law required. . . . We had a perverse incentive to make those tenants unhappy. With regulated apartments, the ultimate objective is to get people out of the building [because rents can be raised for new tenants]."

This whole situation is a missed opportunity—some tenants would be happy to pay for better conditions, and landlords would be happy to provide them for payment. But such an exchange would occur only if the market were allowed to operate freely.

Black Markets And that leads us to a last aspect of price ceilings: the incentive they provide for illegal activities, specifically the emergence of **black markets.** We have already described one kind of black market activity—illegal subletting by tenants. But it does not stop there. Clearly, there is a temptation for a landlord to say to a potential tenant, "Look, you can have the place if you slip me an extra few hundred in cash each month"—and for the tenant to agree, if he or she is one of those people who would be willing to pay much more than the maximum legal rent.

What's wrong with black markets? In general, it's a bad thing if people break *any* law because it encourages disrespect for the law in general. Worse yet, in this case illegal activity worsens the position of those who try to be honest. If the Lees are scrupulous about upholding the rent-control law but other people—who may need an apartment less than the Lees—are willing to bribe landlords, the Lees may *never* find an apartment.

So Why Are There Price Ceilings?

We have seen three common results of price ceilings:

- a persistent shortage of the good
- inefficiency arising from this persistent shortage in the form of inefficiently low quantity, inefficient allocation of the good to consumers, resources wasted in searching for the good, and the inefficiently low quality of the good offered for sale
- the emergence of illegal, black market activity

Given these unpleasant consequences, why do governments still sometimes impose price ceilings? Why does rent control, in particular, persist in New York?

One answer is that although price ceilings may have adverse effects, they do benefit some people. In practice, New York's rent-control rules—which are more complex than our

Price ceilings often lead to inefficiency in that the goods being offered are of **inefficiently low quality:** sellers offer low quality goods at a low price even though buyers would prefer a higher quality at a higher price.

A **black market** is a market in which goods or services are bought and sold illegally—either because it is illegal to sell them at all or because the prices charged are legally prohibited by a price ceiling.

The **minimum wage** is a legal floor on the wage rate, which is the market price of labor.

simple model—hurt most residents but give a small minority of renters much cheaper housing than they would get in an unregulated market. And those who benefit from the controls may be better organized and more vocal than those who are harmed by them.

Also, when price ceilings have been in effect for a long time, buyers may not have a realistic idea of what would happen without them. In our previous example, the rental rate in an unregulated market (Figure 8.1) would be only 25% higher than in the regulated market (Figure 8.2): $1,000 instead of $800. But how would renters know that? Indeed, they might have heard about black market transactions at much higher prices—the Lees or some other family paying George $1,200 or more—and would not realize that these black market prices are much higher than the price that would prevail in a fully unregulated market.

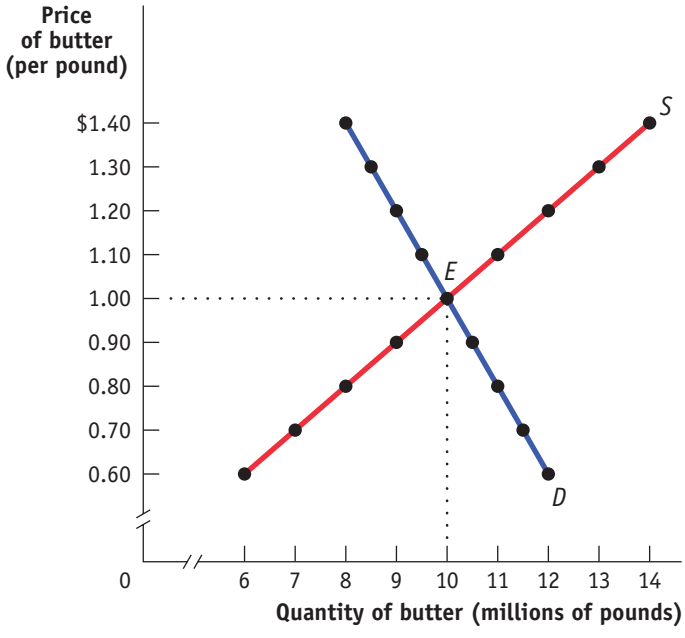
A last answer is that government officials often do not understand supply and demand analysis! It is a great mistake to suppose that economic policies in the real world are always sensible or well informed.

Price Floors

Sometimes governments intervene to push market prices up instead of down. *Price floors* have been widely legislated for agricultural products, such as wheat and milk, as a way to support the incomes of farmers. Historically, there were also price floors on such services as trucking and air travel, although these were phased out by the U.S. government in the 1970s. If you have ever worked in a fast-food restaurant, you are likely to have encountered a price floor: governments in the United States and many other countries maintain a lower limit on the hourly wage rate of a worker's labor—that is, a floor on the price of labor—called the **minimum wage.**

Just like price ceilings, price floors are intended to help some people but generate predictable and undesirable side effects. Figure 8.3 shows hypothetical supply and demand

figure 8.3 The Market for Butter in the Absence of Government Controls



Price of butter (per pound)	Quantity of butter (millions of pounds)	
	Quantity demanded	Quantity supplied
$1.40	8.0	14.0
1.30	8.5	13.0
1.20	9.0	12.0
1.10	9.5	11.0
1.00	10.0	10.0
0.90	10.5	9.0
0.80	11.0	8.0
0.70	11.5	7.0
0.60	12.0	6.0

Without government intervention, the market for butter reaches equilibrium at a price of $1 per pound with 10 million pounds of butter bought and sold.

curves for butter. Left to itself, the market would move to equilibrium at point *E,* with 10 million pounds of butter bought and sold at a price of $1 per pound.

Now suppose that the government, in order to help dairy farmers, imposes a price floor on butter of $1.20 per pound. Its effects are shown in Figure 8.4, where the line at $1.20 represents the price floor. At a price of $1.20 per pound, producers would want to supply 12 million pounds (point *B* on the supply curve) but consumers would want to buy only 9 million pounds (point *A* on the demand curve). So the price floor leads to a persistent surplus of 3 million pounds of butter.

Does a price floor always lead to an unwanted surplus? No. Just as in the case of a price ceiling, the floor may not be binding—that is, it may be irrelevant. If the equilibrium price of butter is $1 per pound but the floor is set at only $0.80, the floor has no effect.

But suppose that a price floor *is* binding: what happens to the unwanted surplus? The answer depends on government policy. In the case of agricultural price floors, governments buy up unwanted surplus. As a result, the U.S. government has at times found itself warehousing thousands of tons of butter, cheese, and other farm products. (The European Commission, which administers price floors for a number of European countries, once found itself the owner of a so-called butter mountain, equal in weight to the entire population of Austria.) The government then has to find a way to dispose of these unwanted goods.

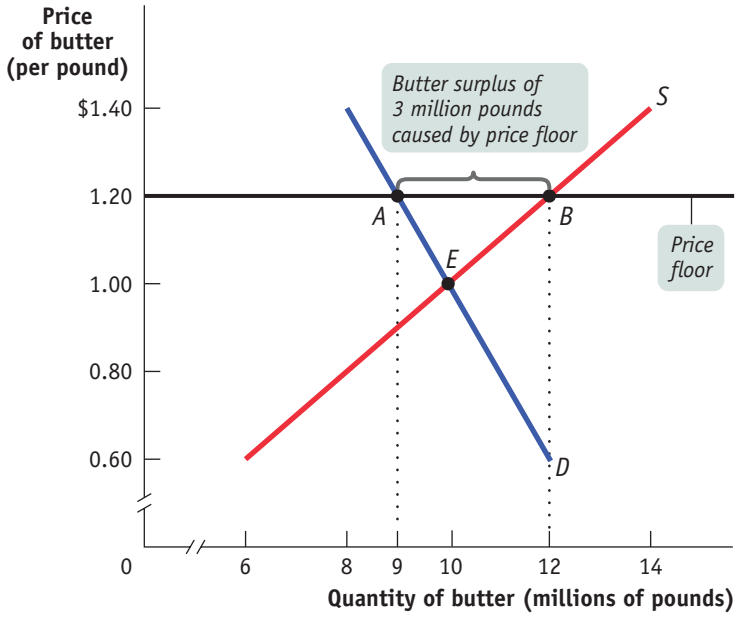
Some countries pay exporters to sell products at a loss overseas; this is standard procedure for the European Union. The United States gives surplus food away to schools, which use the products in school lunches. In some cases, governments have actually destroyed the surplus production. To avoid the problem of dealing with the unwanted surplus, the U.S. government typically pays farmers not to produce the products at all.

When the government is not prepared to purchase the unwanted surplus, a price floor means that would-be sellers cannot find buyers. This is what happens when there is a price floor on the wage rate paid for an hour of labor, the *minimum wage:* when the minimum wage is above the equilibrium wage rate, some people who are willing to work—that is, sell labor—cannot find buyers—that is, employers—willing to give them jobs.

figure 8.4

The Effects of a Price Floor

The dark horizontal line represents the government-imposed price floor of $1.20 per pound of butter. The quantity of butter demanded falls to 9 million pounds, and the quantity supplied rises to 12 million pounds, generating a persistent surplus of 3 million pounds of butter.



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Price Floors and School Lunches

When you were in grade school, did your school offer free or very cheap lunches? If so, you were probably a beneficiary of price floors.

Where did all the cheap food come from? During the 1930s, when the U.S. economy was going through the Great Depression, a prolonged economic slump, prices were low and farmers were suffering severely. In an effort to help rural Americans, the U.S. government imposed price floors on a number of agricultural products. The system of agricultural price floors—officially called price support programs—continues to this day. Among the products subject to price support are sugar and various dairy products; at times grains, beef, and pork have also had a minimum price.

The big problem with any attempt to impose a price floor is that it creates a surplus. To some extent the U.S. Department of Agriculture has tried to head off surpluses by taking steps to reduce supply; for example, by paying farmers *not* to grow crops. As a last resort, however, the U.S. government has been willing to buy up the surplus, taking the excess supply off the market.

But then what? The government has to find a way to get rid of the agricultural products it has bought. It can't just sell them: that would depress market prices, forcing the government to buy the stuff right back. So it has to give it away in ways that don't depress market prices. One of the ways it does this is by giving surplus food, free, to school lunch programs. These gifts are known as "bonus foods." Along with financial aid, bonus foods are what allow many school districts to provide free or very cheap lunches to their students. Is this a story with a happy ending?

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Not really. Nutritionists, concerned about growing child obesity in the United States, place part of the blame on those bonus foods. Schools get whatever the government has too much of—and that has tended to include a lot of dairy products, beef, and corn, and not much in the way of fresh vegetables or fruit. As a result, school lunches that make extensive use of bonus foods tend to be very high in fat and calories. So this is a case in which there is such a thing as a free lunch—but this lunch may be bad for your health.

How a Price Floor Causes Inefficiency

The persistent surplus that results from a price floor creates missed opportunities—inefficiencies—that resemble those created by the shortage that results from a price ceiling.

Inefficiently Low Quantity Because a price floor raises the price of a good to consumers, it reduces the quantity of that good demanded; because sellers can't sell more units of a good than buyers are willing to buy, a price floor reduces the quantity of a good bought and sold below the market equilibrium quantity. Notice that this is the *same* effect as a price ceiling. You might be tempted to think that a price floor and a price ceiling have opposite effects, but both have the effect of reducing the quantity of a good bought and sold.

Inefficient Allocation of Sales Among Sellers Like a price ceiling, a price floor can lead to *inefficient allocation*—but in this case **inefficient allocation of sales among sellers** rather than inefficient allocation to consumers.

An episode from the Belgian movie *Rosetta,* a realistic fictional story, illustrates the problem of inefficient allocation of selling opportunities quite well. Like many European countries, Belgium has a high minimum wage, and jobs for young people are scarce. At one point Rosetta, a young woman who is very eager to work, loses her job at a fast-food stand because the owner of the stand replaces her with his son—a very reluctant worker. Rosetta would be willing to work for less money, and with the money he would save, the owner could give his son an allowance and let him do something else. But to hire Rosetta for less than the minimum wage would be illegal.

Wasted Resources Also like a price ceiling, a price floor generates inefficiency by *wasting resources.* The most graphic examples involve government purchases of the unwanted surpluses of agricultural products caused by price floors. When the surplus production is simply destroyed, and when the stored produce goes, as officials euphemistically put it, "out of condition" and must be thrown away, it is pure waste.

Price floors lead to **inefficient allocation of sales among sellers:** those who would be willing to sell the good at the lowest price are not always those who manage to sell it.

Price floors also lead to wasted time and effort. Consider the minimum wage. Would-be workers who spend many hours searching for jobs, or waiting in line in the hope of getting jobs, play the same role in the case of price floors as hapless families searching for apartments in the case of price ceilings.

Price floors often lead to inefficiency in that goods of **inefficiently high quality** are offered: sellers offer high-quality goods at a high price, even though buyers would prefer a lower quality at a lower price.

Inefficiently High Quality Again like price ceilings, price floors lead to inefficiency in the quality of goods produced.

We've seen that when there is a price ceiling, suppliers produce goods that are of inefficiently low quality: buyers prefer higher-quality products and are willing to pay for them, but sellers refuse to improve the quality of their products because the price ceiling prevents their being compensated for doing so. This same logic applies to price floors, but in reverse: suppliers offer goods of **inefficiently high quality.**

How can this be? Isn't high quality a good thing? Yes, but only if it is worth the cost. Suppose that suppliers spend a lot to make goods of very high quality but that this quality isn't worth much to consumers, who would rather receive the money spent on that quality in the form of a lower price. This represents a missed opportunity: suppliers and buyers could make a mutually beneficial deal in which buyers got goods of lower quality for a much lower price.

A good example of the inefficiency of excessive quality comes from the days when transatlantic airfares were set artificially high by international treaty. Forbidden to compete for customers by offering lower ticket prices, airlines instead offered expensive services, like lavish in-flight meals that went largely uneaten. At one point the regulators tried to restrict this practice by defining maximum service standards—for example, that snack service should consist of no more than a sandwich. One airline then introduced what it called a "Scandinavian Sandwich," a towering affair that forced the convening of another conference to define *sandwich*. All of this was wasteful, especially considering that what passengers really wanted was less food and lower airfares.


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Since the deregulation of U.S. airlines in the 1970s, American passengers have experienced a large decrease in ticket prices accompanied by a decrease in the quality of in-flight service—smaller seats, lower-quality food, and so on. Everyone complains about the service—but thanks to lower fares, the number of people flying on U.S. carriers has grown several hundred percent since airline deregulation.

Illegal Activity Finally, like price ceilings, price floors provide incentives for illegal activity. For example, in countries where the minimum wage is far above the equilibrium wage rate, workers desperate for jobs sometimes agree to work off the books for employers who conceal their employment from the government—or bribe the government inspectors. This practice, known in Europe as "black labor," is especially common in southern European countries such as Italy and Spain.

So Why Are There Price Floors?

To sum up, a price floor creates various negative side effects:

- a persistent surplus of the good
- inefficiency arising from the persistent surplus in the form of inefficiently low quantity, inefficient allocation of sales among sellers, wasted resources, and an inefficiently high level of quality offered by suppliers
- the temptation to engage in illegal activity, particularly bribery and corruption of government officials

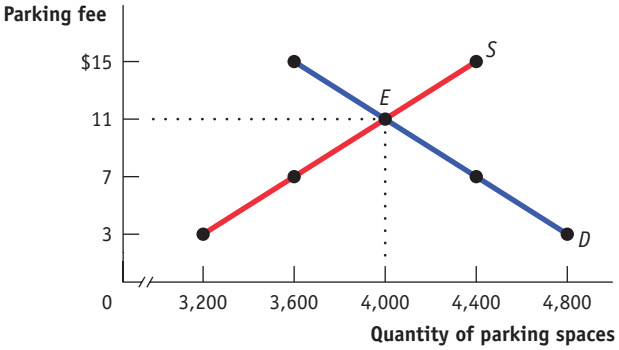
So why do governments impose price floors when they have so many negative side effects? The reasons are similar to those for imposing price ceilings. Government officials often disregard warnings about the consequences of price floors either because they believe that the relevant market is poorly described by the supply and demand model or, more often, because they do not understand the model. Above all, just as price ceilings are often imposed because they benefit some influential buyers of a good, price floors are often imposed because they benefit some influential sellers.

Module 8 AP Review

Solutions appear at the back of the book.

Check Your Understanding

1. On game days, homeowners near Middletown University's stadium used to rent parking spaces in their driveways to fans at a going rate of $11. A new town ordinance now sets a maximum parking fee of $7. Use the accompanying supply and demand diagram to explain how each of the following can result from the price ceiling.

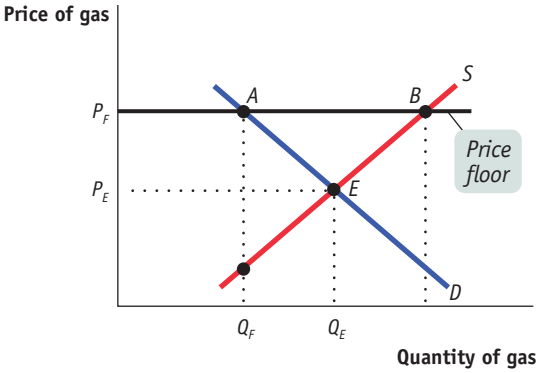


   a. Some homeowners now think it's not worth the hassle to rent out spaces.
   b. Some fans who used to carpool to the game now drive alone.
   c. Some fans can't find parking and leave without seeing the game.

   Explain how each of the following adverse effects arises from the price ceiling.
   d. Some fans now arrive several hours early to find parking.
   e. Friends of homeowners near the stadium regularly attend games, even if they aren't big fans. But some serious fans have given up because of the parking situation.
   f. Some homeowners rent spaces for more than $7 but pretend that the buyers are nonpaying friends or family.

2. True or false? Explain your answer. A price ceiling below the equilibrium price in an otherwise efficient market does the following:
   a. increases quantity supplied
   b. makes some people who want to consume the good worse off
   c. makes all producers worse off

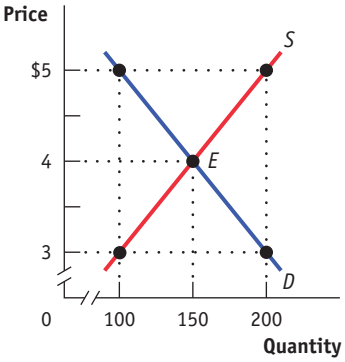
3. The state legislature mandates a price floor for gasoline of P_F per gallon. Assess the following statements and illustrate your answer using the figure provided.



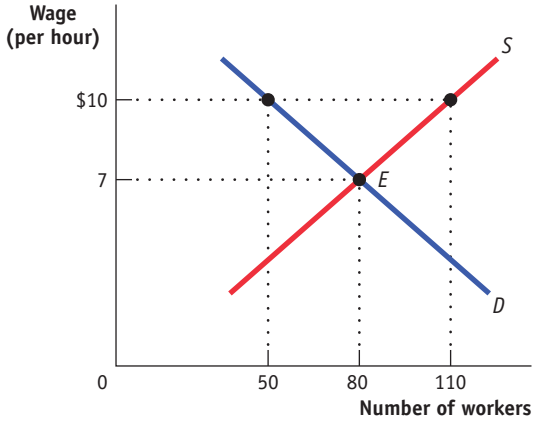
   a. Proponents of the law claim it will increase the income of gas station owners. Opponents claim it will hurt gas station owners because they will lose customers.
   b. Proponents claim consumers will be better off because gas stations will provide better service. Opponents claim consumers will be generally worse off because they prefer to buy gas at cheaper prices.
   c. Proponents claim that they are helping gas station owners without hurting anyone else. Opponents claim that consumers are hurt and will end up doing things like buying gas in a nearby state or on the black market.

Tackle the Test: Multiple-Choice Questions

1. To be effective, a price ceiling must be set
   I. above the equilibrium price.
   II. in the housing market.
   III. to achieve the equilibrium market quantity.
   a. I
   b. II
   c. III
   d. I, II, and III
   e. None of the above



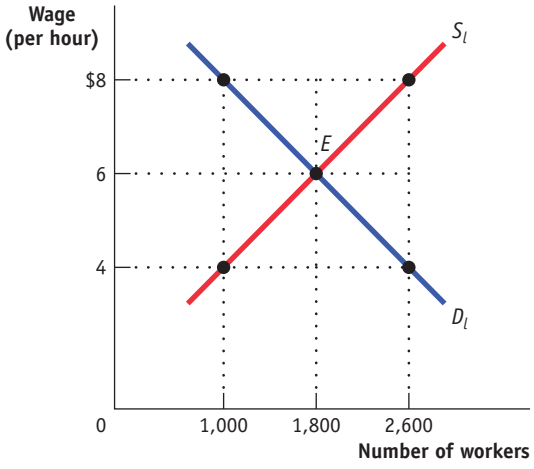
2. Refer to the graph provided. A price floor set at $5 will result in
   a. a shortage of 100 units.
   b. a surplus of 100 units.
   c. a shortage of 200 units.
   d. a surplus of 200 units.
   e. a surplus of 50 units.
3. Effective price ceilings are inefficient because they
   a. create shortages.
   b. lead to wasted resources.
   c. decrease quality.
   d. create black markets.
   e. do all of the above.
4. Refer to the graph provided. If the government establishes a minimum wage at $10, how many workers will benefit from the higher wage?



   a. 30
   b. 50
   c. 60
   d. 80
   e. 110
5. Refer to the graph for question 4. With a minimum wage of $10, how many workers are unemployed (would like to work, but are unable to find a job)?
   a. 30
   b. 50
   c. 60
   d. 80
   e. 110

Tackle the Test: Free-Response Questions

1. Refer to the graph provided to answer the following questions.



   a. What are the equilibrium wage and quantity of workers in this market?
   b. For it to be effective, where would the government have to set a minimum wage?
   c. If the government set a minimum wage at $8,
      i. how many workers would supply their labor?
      ii. how many workers would be hired?
      iii. how many workers would want to work that did *not* want to work for the equilibrium wage?
      iv. how many previously employed workers would no longer have a job?

Answer (6 points)

1 point: wage = $6, quantity of labor = 1,800

1 point: anywhere above $6

1 point: 2,600 workers would supply their labor

1 point: 1,000 workers would be hired

1 point: 800 (the number of workers who would want to work for $8 but did not supply labor for $6)

1 point: 800 (at equilibrium, 1,800 workers were hired, at a wage of $8, 1,000 workers would be hired. 1,800 – 1,000 = 800)

2. Draw a correctly labeled graph of a housing market in equilibrium. On your graph, illustrate an effective legal limit (ceiling) on rent. Identify the quantity of housing demanded, the quantity of housing supplied, and the size of the resulting surplus or shortage.

What you will learn in this **Module:**

- The meaning of quantity controls, another way government intervenes in markets
- How quantity controls create problems and can make a market inefficient
- Who benefits and who loses from quantity controls, and why they are used despite their well-known problems

Module 9
Supply and Demand: Quantity Controls

Controlling Quantities

In the 1930s, New York City instituted a system of licensing for taxicabs: only taxis with a "medallion" were allowed to pick up passengers. Because this system was intended to ensure quality, medallion owners were supposed to maintain certain standards, including safety and cleanliness. A total of 11,787 medallions were issued, with taxi owners paying $10 for each medallion.

In 1995, there were still only 11,787 licensed taxicabs in New York, even though the city had meanwhile become the financial capital of the world, a place where hundreds of thousands of people in a hurry tried to hail a cab every day. (An additional 400 medallions were issued in 1995, and after several rounds of sales of additional medallions, today there are 13,257 medallions.)

The result of this restriction on the number of taxis was that a New York City taxi medallion became very valuable: if you wanted to operate a taxi in New York, you had to lease a medallion from someone else or buy one for a going price of several hundred thousand dollars.

It turns out that this story is not unique; other cities introduced similar medallion systems in the 1930s and, like New York, have issued few new medallions since. In San Francisco and Boston, as in New York, taxi medallions trade for six-figure prices.

A taxi medallion system is a form of **quantity control,** or **quota,** by which the government regulates the quantity of a good that can be bought and sold rather than regulating the price. Typically, the government limits quantity in a market by issuing **licenses;** only people with a license can legally supply the good. A taxi medallion is just such a license. The government of New York City limits the number of taxi rides that can be sold by limiting the number of taxis to only those who hold medallions. There are many other cases of quantity controls, ranging from limits on how much foreign currency (for instance, British pounds or Mexican pesos) people are allowed to buy to the quantity of clams New Jersey fishing boats are allowed to catch.

A **quantity control,** or **quota,** is an upper limit on the quantity of some good that can be bought or sold.

A **license** gives its owner the right to supply a good or service.

Some attempts to control quantities are undertaken for good economic reasons, some for bad ones. In many cases, as we will see, quantity controls introduced to address a temporary problem become politically hard to remove later because the beneficiaries don't want them abolished, even after the original reason for their existence is long gone. But whatever the reasons for such controls, they have certain predictable—and usually undesirable—economic consequences.

The **demand price** of a given quantity is the price at which consumers will demand that quantity.

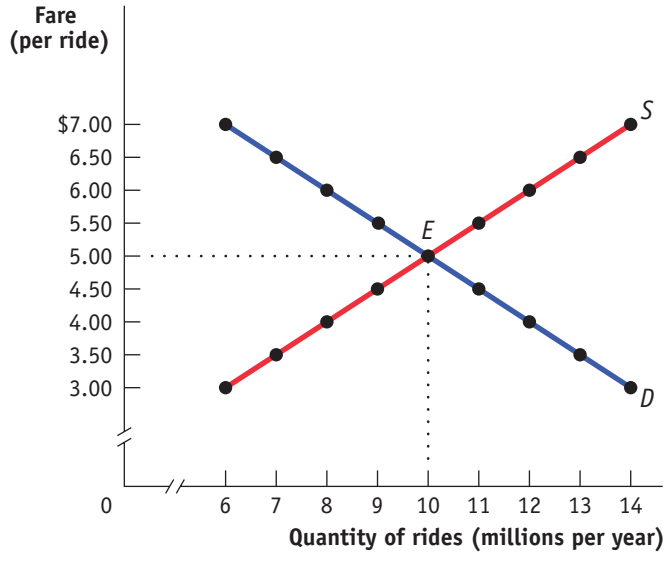
The Anatomy of Quantity Controls

To understand why a New York taxi medallion is worth so much money, we consider a simplified version of the market for taxi rides, shown in Figure 9.1. Just as we assumed in the analysis of rent control that all apartments were the same, we now suppose that all taxi rides are the same—ignoring the real-world complication that some taxi rides are longer, and so more expensive, than others. The table in the figure shows supply and demand schedules. The equilibrium—indicated by point *E* in the figure and by the shaded entries in the table—is a fare of $5 per ride, with 10 million rides taken per year. (You'll see in a minute why we present the equilibrium this way.)

The New York medallion system limits the number of taxis, but each taxi driver can offer as many rides as he or she can manage. (Now you know why New York taxi drivers are so aggressive!) To simplify our analysis, however, we will assume that a medallion system limits the number of taxi rides that can legally be given to 8 million per year.

Until now, we have derived the demand curve by answering questions of the form: "How many taxi rides will passengers want to take if the price is $5 per ride?" But it is possible to reverse the question and ask instead: "At what price will consumers want to buy 10 million rides per year?" The price at which consumers want to buy a given quantity—in this case, 10 million rides at $5 per ride—is the **demand price** of that

figure 9.1 The Market for Taxi Rides in the Absence of Government Controls



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

Without government intervention, the market reaches equilibrium with 10 million rides taken per year at a fare of $5 per ride.

The **supply price** of a given quantity is the price at which producers will supply that quantity.

quantity. You can see from the demand schedule in Figure 9.1 that the demand price of 6 million rides is $7 per ride, the demand price of 7 million rides is $6.50 per ride, and so on.

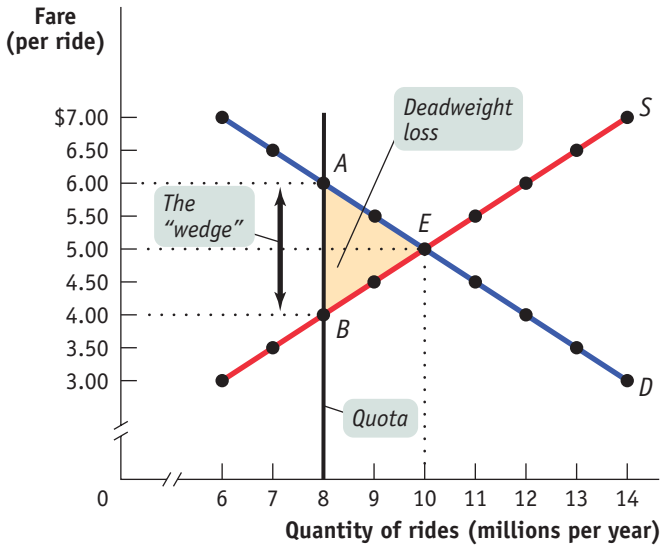
Similarly, the supply curve represents the answer to questions of the form: "How many taxi rides would taxi drivers supply at a price of $5 each?" But we can also reverse this question to ask: "At what price will producers be willing to supply 10 million rides per year?" The price at which producers will supply a given quantity—in this case, 10 million rides at $5 per ride—is the **supply price** of that quantity. We can see from the supply schedule in Figure 9.1 that the supply price of 6 million rides is $3 per ride, the supply price of 7 million rides is $3.50 per ride, and so on.

Now we are ready to analyze a quota. We have assumed that the city government limits the quantity of taxi rides to 8 million per year. Medallions, each of which carries the right to provide a certain number of taxi rides per year, are made available to selected people in such a way that a total of 8 million rides will be provided. Medallion holders may then either drive their own taxis or rent their medallions to others for a fee.

Figure 9.2 shows the resulting market for taxi rides, with the black vertical line at 8 million rides per year representing the quota. Because the quantity of rides is limited to 8 million, consumers must be at point *A* on the demand curve, corresponding to the shaded entry in the demand schedule: the demand price of 8 million rides is $6 per ride. Meanwhile, taxi drivers must be at point *B* on the supply curve, corresponding to the shaded entry in the supply schedule: the supply price of 8 million rides is $4 per ride.

But how can the price received by taxi drivers be $4 when the price paid by taxi riders is $6? The answer is that in addition to the market in taxi rides, there is also a market in medallions. Medallion-holders may not always want to drive their taxis: they

figure 9.2 Effect of a Quota on the Market for Taxi Rides



Fare (per ride)	Quantity of rides (millions per year)	
	Quantity demanded	Quantity supplied
$7.00	6	14
6.50	7	13
6.00	8	12
5.50	9	11
5.00	10	10
4.50	11	9
4.00	12	8
3.50	13	7
3.00	14	6

The table shows the demand price and the supply price corresponding to each quantity: the price at which that quantity would be demanded and supplied, respectively. The city government imposes a quota of 8 million rides by selling enough medallions for only 8 million rides, represented by the black vertical line. The price paid by consumers rises to $6 per ride, the demand price of 8 million rides, shown by point *A*. The supply price of 8 million rides is only $4 per ride, shown by point *B*. The difference between these two prices is the quota rent per ride, the earnings that accrue to the owner of a medallion. The quota rent drives a wedge between the demand price and the supply price. Because the quota discourages mutually beneficial transactions, it creates a deadweight loss equal to the shaded triangle.

may be ill or on vacation. Those who do not want to drive their own taxis will sell the right to use the medallion to someone else. So we need to consider two sets of transactions here, and so two prices: (1) the transactions in taxi rides and the price at which these will occur and (2) the transactions in medallions and the price at which these will occur. It turns out that since we are looking at two markets, the $4 and $6 prices will both be right.

To see how this all works, consider two imaginary New York taxi drivers, Sunil and Harriet. Sunil has a medallion but can't use it because he's recovering from a severely sprained wrist. So he's looking to rent his medallion out to someone else. Harriet doesn't have a medallion but would like to rent one. Furthermore, at any point in time there are many other people like Harriet who would like to rent a medallion. Suppose Sunil agrees to rent his medallion to Harriet. To make things simple, assume that any driver can give only one ride per day and that Sunil is renting his medallion to Harriet for one day. What rental price will they agree on?

To answer this question, we need to look at the transactions from the viewpoints of both drivers. Once she has the medallion, Harriet knows she can make $6 per day—the demand price of a ride under the quota. And she is willing to rent the medallion only if she makes at least $4 per day—the supply price of a ride under the quota. So Sunil cannot demand a rent of more than $2—the difference between $6 and $4. And if Harriet offered Sunil less than $2—say, $1.50—there would be other eager drivers willing to offer him more, up to $2. So, in order to get the medallion, Harriet must offer Sunil at least $2. Since the rent can be no more than $2 and no less than $2, it must be exactly $2.

It is no coincidence that $2 is exactly the difference between $6, the demand price of 8 million rides, and $4, the supply price of 8 million rides. In every case in which the supply of a good is legally restricted, there is a **wedge** between the demand price of the quantity transacted and the supply price of the quantity transacted. This wedge, illustrated by the double-headed arrow in Figure 9.2, has a special name: the **quota rent.** It is the earnings that accrue to the medallion holder from ownership of a valuable commodity, the medallion. In the case of Sunil and Harriet, the quota rent of $2 goes to Sunil because he owns the medallion, and the remaining $4 from the total fare of $6 goes to Harriet.

So Figure 9.2 also illustrates the quota rent in the market for New York taxi rides. The quota limits the quantity of rides to 8 million per year, a quantity at which the demand price of $6 exceeds the supply price of $4. The wedge between these two prices, $2, is the quota rent that results from the restrictions placed on the quantity of taxi rides in this market.

But wait a second. What if Sunil doesn't rent out his medallion? What if he uses it himself? Doesn't this mean that he gets a price of $6? No, not really. Even if Sunil doesn't rent out his medallion, he could have rented it out, which means that the medallion has an *opportunity cost* of $2: if Sunil decides to use his own medallion and drive his own taxi rather than renting his medallion to Harriet, the $2 represents his opportunity cost of not renting out his medallion. That is, the $2 quota rent is now the rental income he forgoes by driving his own taxi. In effect, Sunil is in two businesses—the taxi-driving business and the medallion-renting business. He makes $4 per ride from driving his taxi and $2 per ride from renting out his medallion. It doesn't make any difference that in this particular case he has rented his medallion to himself! So regardless of whether the medallion owner uses the medallion himself or herself, or rents it to others, it is a valuable asset. And this is represented in the going price for a New York City taxi medallion. Notice, by the way, that quotas—like price ceilings and price floors—don't always have a real effect. If the quota were set at 12 million rides—that is, above the equilibrium quantity in an unregulated market—it would have no effect because it would not be binding.

A quantity control, or quota, drives a **wedge** between the demand price and the supply price of a good; that is, the price paid by buyers ends up being higher than that received by sellers. The difference between the demand and supply price at the quota amount is the **quota rent,** the earnings that accrue to the license-holder from ownership of the right to sell the good. It is equal to the market price of the license when the licenses are traded.

PNI Ltd./Picture Quest

New York City: An empty cab is hard to find.

Deadweight loss is the lost gains associated with transactions that do not occur due to market intervention.

The Costs of Quantity Controls

Like price controls, quantity controls can have some predictable and undesirable side effects. The first is the by-now-familiar problem of inefficiency due to missed opportunities: quantity controls prevent mutually beneficial transactions from occurring, transactions that would benefit both buyers and sellers. Looking back at Figure 9.2, you can see that starting at the quota of 8 million rides, New Yorkers would be willing to pay at least $5.50 per ride for an additional 1 million rides and that taxi drivers would be willing to provide those rides as long as they got at least $4.50 per ride. These are rides that would have taken place if there had been no quota. The same is true for the next 1 million rides: New Yorkers would be willing to pay at least $5 per ride when the quantity of rides is increased from 9 to 10 million, and taxi drivers would be willing to provide those rides as long as they got at least $5 per ride. Again, these rides would have occurred without the quota. Only when the market has reached the unregulated market equilibrium quantity of 10 million rides are there no "missed-opportunity rides"—the quota of 8 million rides has caused 2 million "missed-opportunity rides." A buyer would be willing to buy the good at a price that the seller would be willing to accept, but such a transaction does not occur because it is forbidden by the quota. Economists have a special term for the lost gains from missed opportunities such as these: **deadweight loss.** Generally, when the demand price exceeds the supply price, there is a deadweight loss. Figure 9.2 illustrates the deadweight loss with a shaded triangle between the demand and supply curves. This triangle represents the missed gains from taxi rides prevented by the quota, a loss that is experienced by both disappointed would-be riders and frustrated would-be drivers.

Because there are transactions that people would like to make but are not allowed to, quantity controls generate an incentive to evade them or even to break the law. New York's taxi industry again provides clear examples. Taxi regulation applies only to those drivers who are hailed by passengers on the street. A car service that makes prearranged pickups does not need a medallion. As a result, such hired cars provide much of the service that might otherwise be provided by taxis, as in other cities. In addition, there are substantial numbers of unlicensed cabs that simply defy the law by picking up passengers without a medallion. Because these cabs are illegal, their drivers are completely unregulated, and they generate a disproportionately large share of traffic accidents in New York City.

fyi

The Clams of New Jersey

Forget the refineries along the Jersey Turnpike; one industry that New Jersey *really* dominates is clam fishing. In 2005 the Garden State supplied 71% of the country's surf clams, whose tongues are used in fried-clam dinners, and 92% of the quahogs, which are used to make clam chowder.

In the 1980s, however, excessive fishing threatened to wipe out New Jersey's clam beds. To save the resource, the U.S. government introduced a clam quota, which sets an overall limit on the number of bushels of clams that may be caught and allocates licenses to owners of fishing boats based on their historical catches.

istockphoto

A fried clam feast is a favorite on the Jersey shore.

Notice, by the way, that this is an example of a quota that is probably justified by broader economic and environmental considerations—unlike the New York taxicab quota, which has long since lost any economic rationale. Still, whatever its rationale, the New Jersey clam quota works the same way as any other quota.

Once the quota system was established, many boat owners stopped fishing for clams. They realized that rather than operate a boat part time, it was more profitable to sell or rent their licenses to someone else, who could then assemble enough licenses to operate a boat full time. Today, there are about 50 New Jersey boats fishing for clams; the license required to operate one is worth more than the boat itself.

In fact, in 2004 the hardships caused by the limited number of New York taxis led city leaders to authorize an increase in the number of licensed taxis. In a series of sales, the city sold more than 1,000 new medallions, to bring the total number up to the current 13,257 medallions—a move that certainly cheered New York riders. But those who already owned medallions were less happy with the increase; they understood that the nearly 1,000 new taxis would reduce or eliminate the shortage of taxis. As a result, taxi drivers anticipated a decline in their revenues as they would no longer always be assured of finding willing customers. And, in turn, the value of a medallion would fall. So to placate the medallion owners, city officials also raised taxi fares: by 25% in 2004, and again—by a smaller percentage—in 2006. Although taxis are now easier to find, a ride now costs more—and that price increase slightly diminished the newfound cheer of New York taxi riders.

Module 9 AP Review

Solutions appear at the back of the book.

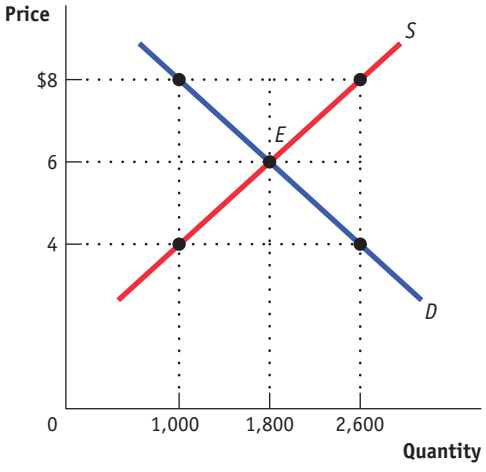
Check Your Understanding

1. Suppose that the supply and demand for taxi rides is given by Figure 9.1 and a quota is set at 6 million rides. Replicate the graph from Figure 9.1, and identify each of the following on your graph:
   a. the price of a ride
   b. the quota rent
   c. the deadweight loss resulting from the quota

   Suppose the quota on taxi rides is increased to 9 million.
   d. What happens to the quota rent and the deadweight loss?
2. Again replicate the graph from Figure 9.1. Suppose that the quota is 8 million rides and that demand decreases due to a decline in tourism. Show on your graph the smallest parallel leftward shift in demand that would result in the quota no longer having an effect on the market.

Tackle the Test: Multiple-Choice Questions

Refer to the graph provided for questions 1–3.



1. If the government established a quota of 1,000 in this market, the demand price would be
   a. less than $4.
   b. $4.
   c. $6.
   d. $8.
   e. more than $8.
2. If the government established a quota of 1,000 in this market, the supply price would be
   a. less than $4.
   b. $4.
   c. $6.
   d. $8.
   e. more than $8.
3. If the government established a quota of 1,000 in this market, the quota rent would be
   a. $2.
   b. $4.
   c. $6.
   d. $8.
   e. more than $8.
4. Quotas lead to which of the following?
   I. inefficiency due to missed opportunities
   II. incentives to evade or break the law
   III. a surplus in the market
   a. I
   b. II
   c. III
   d. I and II
   e. I, II, and III

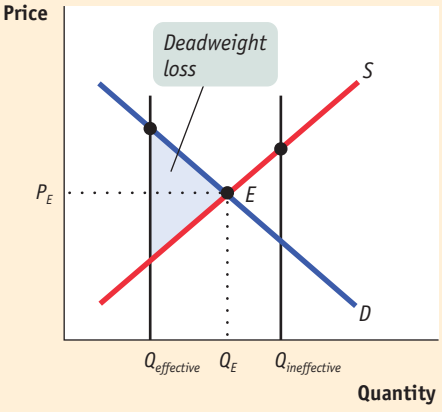
5. Which of the following would decrease the effect of a quota on a market? A(n)
   a. decrease in demand
   b. increase in supply
   c. increase in demand
   d. price ceiling above the equilibrium price
   e. none of the above

Tackle the Test: Free-Response Questions

1. Draw a correctly labeled graph illustrating hypothetical supply and demand curves for the U.S. automobile market. Label the equilibrium price and quantity. Suppose the government institutes a quota to limit automobile production. Draw a vertical line labeled "$Q_{ineffective}$" to show the level of a quota that would have no effect on the market. Draw a vertical line labeled "$Q_{effective}$" to show the level of a quota that would have an effect on the market. Shade in and label the deadweight loss resulting from the effective quota.

2. Draw a correctly labeled graph of the market for taxicab rides. On the graph, draw and label a vertical line showing the level of an effective quota. Label the demand price, the supply price, and the quota rent.

Answer (5 points)



1 point: Correctly labeled supply and demand diagram (vertical axis labeled "Price" or "*P*," horizontal axis labeled "Quantity" or "*Q*," upward sloping supply curve with label, downward sloping demand curve with label)

1 point: Equilibrium at the intersection of supply and demand with the equilibrium price labeled on the vertical axis and the equilibrium quantity labeled on the horizontal axis

1 point: Vertical line to the right of equilibrium quantity labeled $Q_{ineffective}$

1 point: Vertical line to the left of equilibrium quantity labeled $Q_{effective}$

1 point: The triangle to the right of the effective quota line and to the left of supply and demand shaded in and labeled as the deadweight loss

Section 2 Review

Summary

1. The **supply and demand model** illustrates how a **competitive market,** one with many buyers and sellers of the same product, 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, meaning that as price decreases, the quantity demanded increases.

3. A **movement along the demand curve** occurs when the price changes and causes a change in the quantity demanded. When economists talk of **changes in 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, 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 **supply schedule** shows the **quantity supplied** at each price and is represented graphically by a **supply curve.** Supply curves usually slope upward.
6. A **movement along the supply curve** occurs when the price changes and causes a change in the quantity supplied. When economists talk of **changes in 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.
7. 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
8. 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.
9. 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.
10. Shifts of the demand curve and the supply curve can happen simultaneously. When they shift in opposite directions, the change in price is predictable but the change in quantity is not. When they shift in the same direction, the change in quantity is predictable but the change in price is not. In general, the curve that shifts the greater distance has a greater effect on the changes in price and quantity.
11. Even when a market is efficient, governments often intervene to pursue greater fairness or to please a powerful interest group. Interventions can take the form of **price controls** or **quantity controls,** both of which generate predictable and undesirable side effects, consisting of various forms of inefficiency and illegal activity.
12. A **price ceiling,** a maximum market price below the equilibrium price, benefits successful buyers but creates persistent shortages. Because the price is maintained below the equilibrium price, the quantity demanded is increased and the quantity supplied is decreased compared to the equilibrium quantity. This leads to predictable problems including **inefficient allocation to consumers, wasted resources,** and **inefficiently low quality.** It also encourages illegal activity as people turn to **black markets** to get the good. Because of these problems, price ceilings have generally lost favor as an economic policy tool. But some governments continue to impose them either because they don't understand the effects or because the price ceilings benefit some influential group.
13. A **price floor,** a minimum market price above the equilibrium price, benefits successful sellers but creates a persistent surplus: because the price is maintained above the equilibrium price, the quantity demanded is decreased and the quantity supplied is increased compared to the equilibrium quantity. This leads to predictable problems: inefficiencies in the form of **inefficient allocation of sales among sellers,** wasted resources, and **inefficiently high quality.** It also encourages illegal activity and black markets. The most well known kind of price floor is the **minimum wage,** but price floors are also commonly applied to agricultural products.
14. Quantity controls, or **quotas,** limit the quantity of a good that can be bought or sold. The government issues **licenses** to individuals, the right to sell a given quantity of the good. The owner of a license earns a **quota rent,** earnings that accrue from ownership of the right to sell the good. It is equal to the difference between the **demand price** at the quota amount, what consumers are willing to pay for that amount, and the **supply price** at the quota amount, what suppliers are willing to accept for that amount. Economists say that a quota drives a **wedge** between the demand price and the supply price; this wedge is equal to the quota rent. By limiting mutually beneficial transactions, quantity controls generate inefficiency. Like price controls, quantity controls lead to **deadweight loss** and encourage illegal activity.

Key Terms

Competitive market, p. 48
Supply and demand model, p. 48
Demand schedule, p. 49
Quantity demanded, p. 49
Demand curve, p. 49
Law of demand, p. 50
Change in demand, p. 51
Movement along the demand curve, p. 51
Substitutes, p. 53
Complements, p. 53
Normal good, p. 53
Inferior good, p. 54
Individual demand curve, p. 55
Quantity supplied, p. 59
Supply schedule, p. 59
Supply curve, p. 59
Law of supply, p. 60
Change in supply, p. 60
Movement along the supply curve, p. 60
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Equilibrium, p. 66
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Wasted resources, p. 80
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Minimum wage, p. 82
Inefficient allocation of sales among sellers, p. 84
Inefficiently high quality, p. 85
Quantity control or quota, p. 88
License, p. 88
Demand price, p. 89
Supply price, p. 90
Wedge, p. 91
Quota rent, p. 91
Deadweight loss, p. 92

Problems

1. A survey indicated that chocolate ice cream is America's favorite ice-cream flavor. For each of the following, indicate the possible effects on the demand and/or supply, equilibrium price, and equilibrium quantity of chocolate ice cream.

a. A severe drought in the Midwest causes dairy farmers to reduce the number of milk-producing cows 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 change in demand for hamburgers in your hometown due to the following events. In each case show the effect on equilibrium price and quantity.

a. The price of tacos increases.

b. All hamburger sellers raise the price of their french fries.

c. Income falls in town. Assume that hamburgers are a normal good for most people.

d. Income falls in town. Assume that hamburgers are an inferior good for most people.

e. 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.

a. Lobster prices usually fall during the summer peak harvest season, despite the fact that people like to eat lobster during the summer months more than during any other time of year.

b. The price of a Christmas tree is lower after Christmas than before and fewer trees are sold.

c. 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 on the designated market.

a. 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, and residents want to learn more about it.

b. the market for St. Louis Rams cotton T-shirts
Case 1: The Rams win the national championship.
Case 2: The price of cotton increases.

c. the market for bagels
Case 1: People realize how fattening bagels are.
Case 2: People have less time to make themselves a cooked breakfast.

5. Find the flaws in reasoning in the following statements, paying particular attention to the distinction between changes in 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."

6. 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.

7. 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.

a. Environmentalists succeed in having the use of Brazilian rosewood banned in the United States, forcing luthiers to seek out alternative, more costly woods.

b. A foreign producer reengineers the guitar-making process and floods the market with identical guitars.

c. Music featuring handmade acoustic guitars makes a comeback as audiences tire of heavy metal and grunge music.

d. The country goes into a deep recession and the income of the average American falls sharply.

8. Will 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.

a. The playwright Christopher Marlowe, Shakespeare's chief rival, is killed in a bar brawl.

b. The bubonic plague, a deadly infectious disease, breaks out in London.

c. To celebrate the defeat of the Spanish Armada, Queen Elizabeth declares several weeks of festivities, which involves commissioning new plays.

9. 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:

a. the market for an hour of babysitting services in Middling today

b. 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

c. 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

10. Use a diagram to illustrate how each of the following events affects the equilibrium price and quantity of pizza.

a. The price of mozzarella cheese rises.

b. The health hazards of hamburgers are widely publicized.

c. The price of tomato sauce falls.

d. The incomes of consumers rise and pizza is an inferior good.

e. Consumers expect the price of pizza to fall next week.

11. 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.

a. Draw a supply curve for Picasso Blue Period works. Why is this supply curve different from ones you have seen?

b. 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.

c. Suppose that 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.

12. Draw the appropriate curve in each of the following cases. Is it like or unlike the curves you have seen so far? Explain.

a. the demand for cardiac bypass surgery, given that the government pays the full cost for any patient

b. the demand for elective cosmetic plastic surgery, given that the patient pays the full cost

c. the supply of Rembrandt paintings

d. the supply of reproductions of Rembrandt paintings

13. Suppose it is decided that rent control in New York City will be abolished and that market rents will now prevail. Assume that all rental units are identical and are therefore offered at the same rent. To address the plight of residents who may be unable to pay the market rent, an income supplement will be paid to all low-income households equal to the difference between the old controlled rent and the new market rent.

a. Use a diagram to show the effect on the rental market of the elimination of rent control. What will happen to the quality and quantity of rental housing supplied?

b. Now use a second diagram to show the additional effect of the income-supplement policy on the market. What effect does it have on the market rent and quantity of rental housing supplied in comparison to your answers to part a?

c. Are tenants better or worse off as a result of these policies? Are landlords better or worse off?

d. From a political standpoint, why do you think cities have been more likely to resort to rent control rather than a policy of income supplements to help low-income people pay for housing?

14. In the late eighteenth century, the price of bread in New York City was controlled, set at a predetermined price above the market price.

a. Draw a diagram showing the effect of the policy. Did the policy act as a price ceiling or a price floor?

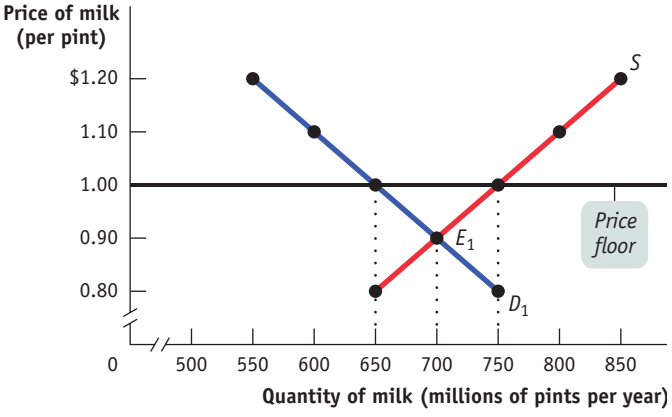
b. What kinds of inefficiencies were likely to have arisen when the controlled price of bread was above the market price? Explain in detail.

One year during this period, a poor wheat harvest caused a leftward shift in the supply of bread and therefore an increase in its market price. New York bakers found that the controlled price of bread in New York was below the market price.

c. Draw a diagram showing the effect of the price control on the market for bread during this one-year period. Did the policy act as a price ceiling or a price floor?

d. What kinds of inefficiencies do you think occurred during this period? Explain in detail.

15. Suppose the U.S. government decides that the incomes of dairy farmers should be maintained at a level that allows the traditional family dairy farm to survive. It therefore implements a price floor of $1 per pint by buying surplus milk until the market price is $1 per pint. Use the accompanying diagram to answer the following questions.



a. How much surplus milk will be produced as a result of this policy?

b. What will be the cost to the government of this policy?

c. Since milk is an important source of protein and calcium, the government decides to provide the surplus milk it purchases to elementary schools at a price of only $0.60 per pint. Assume that schools will buy any amount of milk available at this low price. But parents now reduce their purchases of milk at any price by 50 million pints per year because they know their children are getting milk at school. How much will the dairy program now cost the government?

d. Give two examples of inefficiencies arising from wasted resources that are likely to result from this policy. What is the missed opportunity in each case?

16. As noted in the text, European governments tend to make greater use of price controls than does the U.S. government. For example, the French government sets minimum starting yearly wages for new hires who have completed *le bac,* certification roughly equivalent to a high school diploma. The demand schedule for new hires with *le bac* and the supply schedule for similarly credentialed new job seekers are given in the accompanying table. The price here—given in euros, the currency used in France—is the same as the yearly wage.

Wage (per year)	Quantity demanded (new job offers per year)	Quantity supplied (new job seekers per year)
€45,000	200,000	325,000
40,000	220,000	320,000
35,000	250,000	310,000
30,000	290,000	290,000
25,000	370,000	200,000

a. In the absence of government interference, what is the equilibrium wage and number of graduates hired per year? Illustrate with a diagram. Will there be anyone seeking a job at the equilibrium wage who is unable to find one—that is, will there be anyone who is involuntarily unemployed?

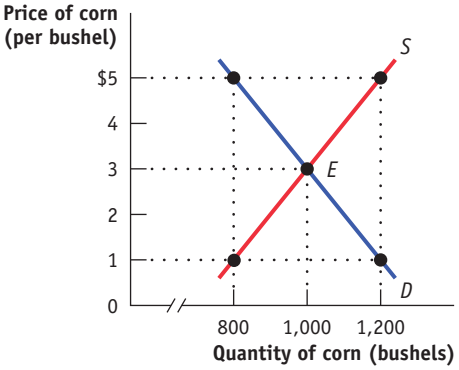
b. Suppose the French government sets a minimum yearly wage of 35,000 euros. Is there any involuntary unemployment at this wage? If so, how much? Illustrate with a diagram. What if the minimum wage is set at 40,000 euros? Also illustrate with a diagram.

c. Given your answer to part b and the information in the table, what do you think is the relationship between the level of involuntary unemployment and the level of the minimum wage? Who benefits from such a policy? Who loses? What is the missed opportunity here?

17. Until recently, the standard number of hours worked per week for a full-time job in France was 39 hours, similar to in the United States. But in response to social unrest over high levels of involuntary unemployment, the French government instituted a 35-hour workweek—a worker could not work more than 35 hours per week even if both the worker and employer wanted it. The motivation behind this policy was that if current employees worked fewer hours, employers would be forced to hire more new workers. Assume that it is costly for employers to train new workers. French employers were greatly opposed to this policy and threatened to move their operations to neighboring countries that did not have such employment restrictions. Can you explain their attitude? Give an example of both an inefficiency and an illegal activity that are likely to arise from this policy.

18. For the last 70 years, the U.S. government has used price supports to provide income assistance to U.S. farmers. At times the government has used price floors, which it maintains by

buying up the surplus farm products. At other times, it has used target prices, giving the farmer an amount equal to the difference between the market price and the target price for each unit sold. Use the accompanying diagram to answer the following questions.



a. If the government sets a price floor of $5 per bushel, how many bushels of corn are produced? How many are purchased by consumers? by the government? How much does the program cost the government? How much revenue do corn farmers receive?

b. Suppose the government sets a target price of $5 per bushel for any quantity supplied up to 1,000 bushels. How many bushels of corn are purchased by consumers and at what price? by the government? How much does the program cost the government? How much revenue do corn farmers receive?

c. Which of these programs (in parts a and b) costs corn consumers more? Which program costs the government more? Explain.

d. What are the inefficiencies that arise in each of these cases (parts a and b)?

19. The waters off the north Atlantic coast were once teeming with fish. Now, due to overfishing by the commercial fishing industry, the stocks of fish are seriously depleted. In 1991, the National Marine Fishery Service of the U.S. government implemented a quota to allow fish stocks to recover. The quota limited the amount of swordfish caught per year by all U.S.-licensed fishing boats to 7 million pounds. As soon as the U.S. fishing fleet had met the quota, the swordfish catch was closed down for the rest of the year. The accompanying table gives the hypothetical demand and supply schedules for swordfish caught in the United States per year.

Price of swordfish (per pound)	Quantity of swordfish (millions of pounds per year)	
	Quantity demanded	Quantity supplied
$20	6	15
18	7	13
16	8	11
14	9	9
12	10	7

a. Use a diagram to show the effect of the quota on the market for swordfish in 1991.

b. How do you think fishermen will change how they fish in response to this policy?