4 Supply and Demand

After reading this chapter, you should be able to:

1. Explain the law of demand and what it implies.
   a. Distinguish a change in demand from a change in quantity demanded.
   b. Draw a demand curve from a demand table.
   c. Derive the market demand curve.
2. Explain the law of supply and what it implies.
   a. Distinguish a change in supply from a change in quantity supplied.
   b. Draw a supply curve from a supply table.
   c. Derive the market supply curve.
3. Explain how prices adjust to achieve an equilibrium between demand and supply.
   a. Explain the concept of equilibrium.
4. Show the effects of a shift in demand or supply on the equilibrium price and quantity using real-world events.
   a. Be able to determine if an observed change in price and quantity is due to a change in demand or supply.

Teach a parrot the terms supply and demand and you've got an economist.

Thomas Carlyle

Supply and demand. Supply and demand. Roll the phrase around in your mouth, savour it like a good wine. Supply and demand are the most-used words in economics. And for good reason. They provide a good off-the-cuff answer for any economic question. Try it.

Why are bacon and oranges so expensive this winter? *Supply and demand.*

Why are interest rates falling? *Supply and demand.*

Why can't I find decent wool socks anymore? *Supply and demand.*

The importance of the interplay of supply and demand makes it only natural that, early in any economics course, you must learn about supply and demand. Let's start with demand.

4.1 DEMAND

People want lots of things; they "demand" much less than they want because demand means a willingness and capacity to pay. Unless you are willing and able to pay for it, you may *want* it, but you don't *demand* it. For example, we want to own fancy cars. But, we must admit, we're not willing to do what's necessary to own one. If we really wanted one, we'd mortgage everything we own, increase our income by doubling the number of hours we work, not buy anything else, and get that car. But we don't do any of those things, so at the going price, $360,000, we do not demand a Maserati. Sure, we'd buy one if it cost $10,000, but from our actions it's clear that, at $360,000, we don't demand it. This points to an important aspect of demand: The quantity you demand at a low price differs from the quantity you demand at a high price. Specifically, the quantity you demand varies inversely—in the opposite direction—with price.

Prices are the tool by which the market coordinates individuals' desires and limits how much people are willing to buy—what quantity they demand. When goods become scarce, the market reduces the quantity of those scarce goods people demand; as their prices go up, people buy fewer goods. As goods become abundant,

their prices go down, and people want more of them. The invisible hand—the price mechanism—sees to it that what quantity people demand (do what's necessary to get) matches what's available. In doing so, the invisible hand coordinates individuals' demands.

Prices are the tool by which the market coordinates individual desires.

The Law of Demand

The ideas expressed above are the foundation of the **law of demand:**

Quantity demanded rises as price falls, other things constant.

Or alternatively:

Quantity demanded falls as price rises, other things constant.

The law of demand states that the quantity of a good demanded is inversely related to the good's price. When price goes up, quantity demanded goes down. When price goes down, quantity demanded goes up.

This law is fundamental to the invisible hand's ability to coordinate individuals' desires: as prices change, people change how much of a particular good they're willing to buy.

What accounts for the law of demand? Individuals' tendency to substitute other goods for goods whose price has gone up. If the price of CDs rises from $15 to $20 but the price of cassette tapes stays at $9.99, you're more likely to buy that new Avril Lavigne recording on cassette than on CD.

To see that the law of demand makes intuitive sense, just think of something you'd really like but can't afford. If the price is cut in half, you—and other consumers—will become more likely to buy it. Quantity demanded goes up as price goes down.

Just to be sure you've got it, let's consider a real world example: scalpers and the demand for hockey tickets. Standing outside a sold-out game between Montreal and Pittsburgh in Montreal, we saw scalpers trying to sell tickets for $100 a seat. There were few takers—that is, there was little demand at that price. The sellers saw that they had set too high a price and they started calling out lower prices. As the price dropped to $60, then $50, quantity demanded increased; when the price dropped to $35, quantity demanded soared. That's the law of demand in action.

The Demand Curve

A **demand curve** *provides the maximum price consumers will pay for an additional unit of a good or service*. The demand curve is the upper limit of the price consumers will pay for an additional unit. Each point on the demand curve can be thought of as a person, or persons, and their maximum price. Obviously consumers would like to pay something less than their maximum price, and when we consider supply we'll see that they do pay less.

Q-1 Why does the demand curve slope downward?

Figure 4-1 shows a demand curve. As you can see, in graphical terms, the law of demand states that as the price goes up, the quantity demanded goes down, other things constant. An alternative way of saying the same thing is that price and quantity demanded are inversely related, so the demand curve slopes downward to the right.

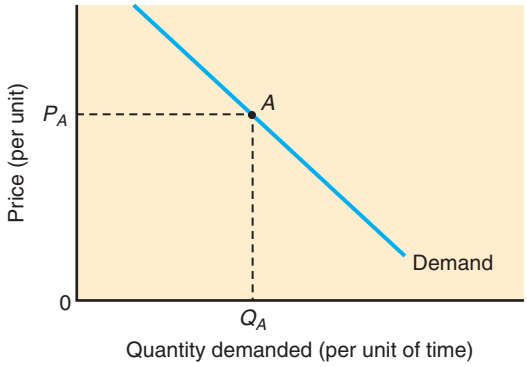
Notice that in stating the law of demand, we put in the qualification "other things constant." That's three extra words, and unless they were important we wouldn't have put them in. But what does "other things constant" mean? Say that over a period of two years, the price of cars rises as the number of cars purchased likewise rises. That seems to violate the law of demand, since the number of cars purchased should have fallen in response to the rise in price. Looking at the data more closely, however, we see that a third factor has also changed: individuals' income has increased. As income increases, people buy more cars, increasing the demand for cars.

"Other things constant" places a limitation on the application of the law of demand.

The increase in price works as the law of demand states—it decreases the number of cars bought. But in this case, income doesn't remain constant; it increases. That rise in income increases the demand for cars. That increase in demand outweighs the decrease in quantity demanded that results from a rise in price, so ultimately more cars are sold. If you want to study the effect of price alone—which is what the law of demand refers to—you

FIGURE 4-1 A Sample Demand Curve

The law of demand states that the quantity demanded of a good is inversely related to the price of that good, other things constant. As the price of a good goes up, the quantity demanded goes down, so the demand curve is downward sloping.



must make adjustments to hold income constant when you make your study. That's why the qualifying phrase "other things constant" is an important part of the law of demand.

The other things that are held constant include individuals' tastes, prices of other goods, and even the weather. Those other factors must remain constant if you're to make a valid study of the effect of an increase in the price of a good on the quantity demanded. In practice, it's impossible to keep all other things constant, so you have to be careful when you say that when price goes up, quantity demanded goes down. Quantity demanded is likely to go down, but it's always possible that something besides price has changed.

Shifts in Demand Versus Movements Along a Demand Curve

To distinguish between the effects of changes in a good's price and the effects of other factors on how much of a good is demanded, economists have developed the following precise terminology—terminology that inevitably shows up on exams. The first distinction to make is between demand and quantity demanded.

- **Demand** refers to *a schedule of quantities of a good that will be bought per unit of time at various prices, other things constant.*
- **Quantity demanded** refers to *a specific amount that will be demanded per unit of time at a specific price, other things constant.*

Q-2 In the 1980s and early 1990s, as animal rights activists made wearing fur coats déclassé, the _____ decreased. Should the missing words be "demand for furs" or "quantity of furs demanded"?

In graphical terms, the term *demand* refers to the entire demand curve. Demand tells how much of a good will be bought *at various prices*. *Quantity demanded* refers to a point on a demand curve, such as point A in Figure 4-1. This terminology allows us to distinguish between *changes in quantity demanded* and *shifts in demand*. A change in the quantity demanded refers to the effect of a price change on the quantity demanded. It refers to a **movement along a demand curve**—*the graphical representation of the effect of a change in price on the quantity demanded*. A **shift in demand** refers to *the effect of anything other than price on demand*.

Shift Factors of Demand

Shift factors of demand are factors that cause shifts in the demand curve. A change in anything besides a good's price causes a shift of the entire demand curve.

Important shift factors of demand include:

1. Society's income.
2. The prices of other goods.

3. Tastes.
4. Expectations.
5. Population.

Income From our example above of "the other things constant" qualification, we saw that a rise in income increases the demand for goods. For most goods this is true. We classify **normal goods** as *goods whose demand increases with an increase in income*. If the *demand for a good decreases as income increases*, we call this good an **inferior good**.

Price of Other Goods Because people make their buying decisions based on the price of related goods, demand will be affected by the prices of other goods. Suppose the price of jeans rose from $25 to $35, but the price of khakis remained at $25. Next time you need pants, you're apt to try khakis instead of jeans. They are substitutes. When two goods are substitutes, if the price of one of the goods falls while the other price remains unchanged, there will be an increase in the quantity demanded of the good whose price fell, and a reduction in the demand for the good whose price remained fixed.

Some goods tend to be purchased together, that is they complement each other when they are consumed. Suppose the price of gasoline increases from $0.75 per litre to $1 per litre, while the price of a luxury car remains constant. Since luxury cars tend to consume more gasoline, an increase in the price of gasoline will likely reduce the quantity demanded of the luxury car. The two goods are **complementary goods**. When two goods are complements, *an increase in the price of one good will reduce the quantity demanded of it and the good whose price remained fixed.*

Q-3 Explain the effect of each of the following on the demand for new computers:
1. The price of computers falls by 30 percent.
2. Total income in the economy rises.

Tastes An old saying goes: "There's no accounting for taste." Of course, many advertisers believe otherwise. Changes in taste can affect the demand for a good without a change in price. As you become older, you may find that your taste for rock concerts has changed to a taste for an evening at the opera or local philharmonic.

Expectations Expectations will also affect demand. Expectations can cover a lot. If you expect your income to rise in the future, you're bound to start spending some of it today. If you expect the price of computers to fall soon, you may put off buying one until later.

These aren't the only shift factors. In fact anything—except the price of the good itself—that affects demand (and many things do) is a shift factor. While economists agree these shift factors are important, they believe that no shift factor influences how much is demanded as consistently as does price of the specific item. That's what makes economists focus first on price as they try to understand the world. That's why economists make the law of demand central to their analysis.

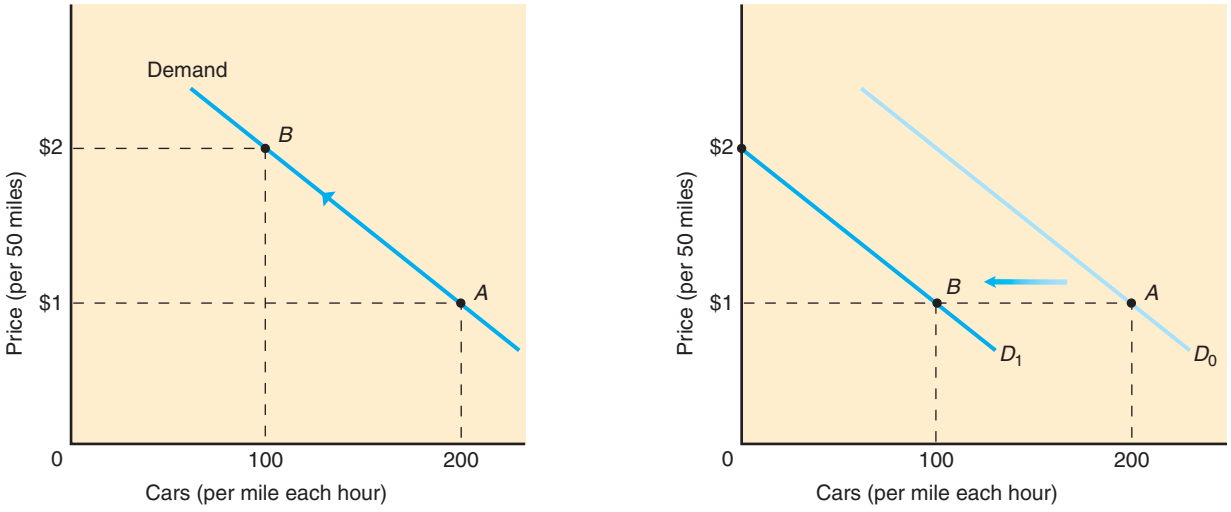
Population Finally, population will also affect demand. If there is an increase in population, there will be a higher quantity demanded at every price. If population falls, as it did in Newfoundland's outports in the mid-1900s, demand falls. It's that simple.

Change in price causes a movement along a demand curve; a change in a shift factor causes a shift in demand.

To make sure you understand the difference between a movement along a demand curve and a shift in demand, let's consider an example. Singapore has one of the highest numbers of cars per mile of road. This means that congestion is considerable. Singapore has adopted two policies to reduce road use: It increased the fee charged to use roads, and it provided an expanded public transportation system. Both policies reduced congestion. Figure 4-2(a) shows that increasing the toll charged to use roads from $1 to $2 per 50 miles of road reduces quantity demanded from 200 to 100 cars per mile every

FIGURE 4-2 (a and b) Shift in Demand Versus a Change in Quantity Demanded

A rise in a good's price results in a reduction in quantity demanded and is shown by a movement up along a demand curve from point *A* to point *B* in (**a**). A change in any other factor besides price that affects demand leads to a shift in the entire demand curve as shown in (**b**).



(a) Movement along a demand curve **(b) Shift in demand**

hour (a movement along the demand curve). Figure 4-2(b) shows that providing alternative methods of transportation such as buses and subways will shift the demand curve for roads. Demand for road use shifts to the left so that at the $1 fee, demand drops from 200 to 100 cars per mile every hour (a shift in the demand curve).

A Review

Let's test your understanding by having you specify what happens to your demand curve for videocassettes in the following examples: First, let's say you buy a DVD player. Next, let's say that the price of videocassettes falls; and finally, say that you won $1 million in a lottery. What happens to the demand for videocassettes in each case? If you answered: It shifts in; it remains unchanged; and it shifts out—you've got it.

The Demand Table

As we emphasized in Chapter 1, introductory economics depends heavily on graphs and graphical analysis—translating ideas into graphs and back into words. So let's graph the demand curve.

Figure 4-3(a), a demand table, describes Marie's demand for renting videocassettes. For example, the maximum price Marie will pay to rent (buy the use of) six cassettes per week is $2 per cassette. The maximum price she will pay to rent nine cassettes is only 50 cents per cassette.

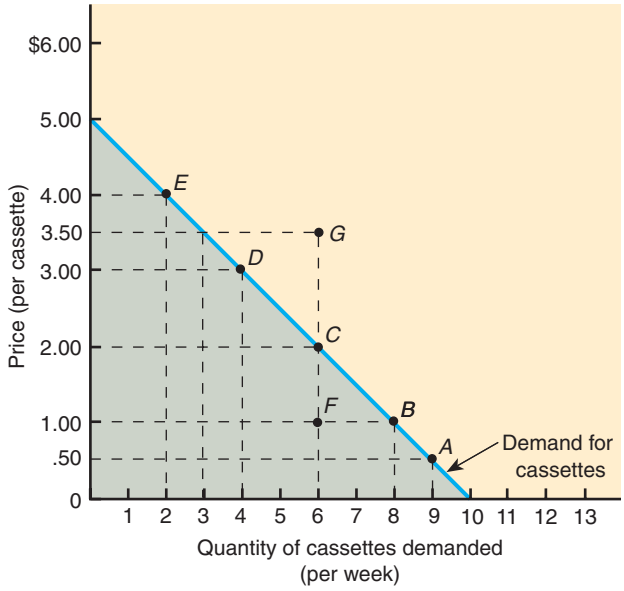
There are four points about the relationship between the number of videos Marie rents and the price of renting them that are worth mentioning. First, the relationship follows the law of demand: as the rental price rises, quantity demanded decreases. Second, quantity demanded has a specific *time dimension* to it. In this example demand

FIGURE 4-3 (a and b) From a Demand Table to a Demand Curve

The demand table in (**a**) is translated into a demand curve in (**b**). Each combination of price and quantity in the table corresponds to a point on the curve. For example, point *A* on the graph represents row *A* in the table: Marie demands nine videocassette rentals at a price of 50 cents. A demand curve is constructed by plotting all points from the demand table and connecting the points by a line.

	Price per cassette	Cassette rentals demanded per week
A	$0.50	9
B	1.00	8
C	2.00	6
D	3.00	4
E	4.00	2

(a) A demand table



(b) A demand curve

refers to the number of cassette rentals per week. Without the time dimension, the table wouldn't provide us with any useful information. Nine cassette rentals per year is quite a different concept from nine cassette rentals per week. Third, Marie's cassette rentals are interchangeable—the ninth cassette rental doesn't significantly differ from the first, third, or any other cassette rental. The fourth point is already familiar to you: The schedule assumes that everything else is held constant.

From a Demand Table to a Demand Curve

Figure 4-3(b) translates the demand table in Figure 4-3(a) into a graph. Point *A* (quantity = 9, price = $0.50) is graphed first at the (9, $0.50) coordinates. Next we plot points *B*, *C*, *D*, and *E* in the same manner and connect the resulting dots with a solid line. The result is the demand curve, which graphically conveys the same information that's in the demand table. Notice that the demand curve is downward sloping (from left to right), indicating that the law of demand holds in the example.

The demand curve represents the maximum price that an individual will pay.

The demand curve represents the *maximum price* that an individual will pay for various quantities of a good; the individual will happily pay less. For example, say someone offers Marie six cassette rentals at a price of $1 each (point *F* of Figure 4-3(b)). Will she accept? Sure; she'll pay any price within the shaded area to the left of the demand curve. But if someone offers her six rentals at $3.50 each (point G), she won't accept. At a rental price of $3.50 apiece, she's willing to buy only three cassette rentals.

Individual and Market Demand Curves

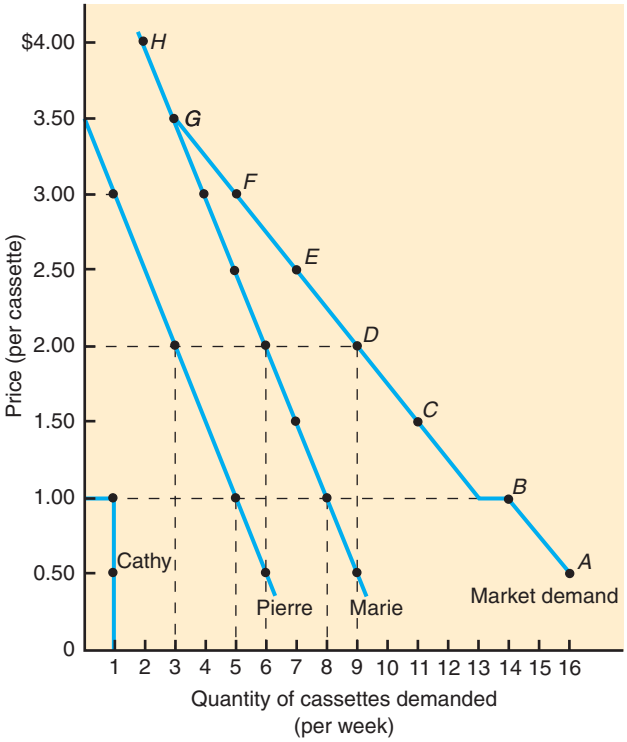
Normally, economists talk about market demand curves rather than individual demand curves. A **market demand curve** is *the horizontal sum of all individual demand curves*. Mar-

FIGURE 4-4 (a and b) From Individual Demands to a Market Demand Curve

The table (**a**) shows the demand schedules for Marie, Pierre, and Cathy. Together they make up the market for videocassette rentals. Their total quantity demanded (market demand) for videocassette rentals at each price is given in column 5. As you can see in (**b**), Marie's, Pierre's, and Cathy's demand curves can be added together to get the total market demand curve. For example, at a price of $2, Cathy demands zero, Pierre demands three, and Marie demands six, for a market demand of nine (point *D*).

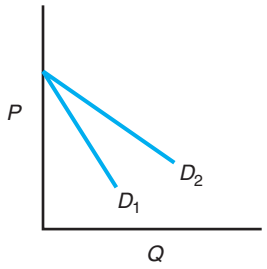
	(1)	(2)	(3)	(4)	(5)
	Price (per cassette)	Marie's demand	Pierre's demand	Cathy's demand	Market demand
A	$0.50	9	6	1	16
B	1.00	8	5	1	14
C	1.50	7	4	0	11
D	2.00	6	3	0	9
E	2.50	5	2	0	7
F	3.00	4	1	0	5
G	3.50	3	0	0	3
H	4.00	2	0	0	2

(a) A demand table



(b) Adding demand curves

Q-4 Derive a market demand curve from the following two individual demand curves:



ket demand curves are what most firms are interested in. Firms don't care whether individual A or individual B buys their goods; they only care that *someone* buys their goods.

It's a good graphical exercise to add individual demand curves together to create a market demand curve. We do that in Figure 4-4. In it we assume that the market consists of three buyers, Marie, Pierre, and Cathy, whose demand tables are given in Figure 4-4(a). Marie and Pierre have demand tables similar to the demand tables discussed previously. At a price of $3 each, Marie rents four cassettes; at a price of $2, she rents six. Cathy is an all-or-nothing individual. She rents one cassette as long as the price is equal to or below $1; otherwise she rents nothing. If you plot Cathy's demand curve, it's a vertical line. However, the law of demand still holds: as price increases, quantity demanded decreases.

The quantity demanded by each consumer is listed in columns 2, 3, and 4 of Figure 4-4(a). Column 5 shows total market demand; each entry is the horizontal sum of the entries in columns 2, 3, and 4. For example, at a price of $3 apiece (row *F*), Marie demands four cassette rentals, Pierre demands one, and Cathy demands zero, for a total market demand of five cassette rentals.

Figure 4-4(b) shows three demand curves: one each for Marie, Pierre, and Cathy. The market, or total, demand curve is the horizontal sum of the individual demand curves. To see that this is the case, notice that if we take the quantity demanded at $1 by Marie (8), Pierre (5), and Cathy (1), they sum to 14, which is point *B* (14, $1) on the market demand curve. We can do that for each price. Alternatively, we can simply add the individual quantities demanded, given in the demand tables, prior to graphing (which we do in column 5 of Figure 4-4(a)), and graph that total in relation to price. Not surprisingly, we get the same total market demand curve.

SEVEN THINGS TO REMEMBER WHEN CONSIDERING A DEMAND CURVE

- A demand curve provides the maximum price a consumer, or consumers, will pay for an additional unit of a good or service.
- A demand curve had better follow the law of demand: When price rises, quantity demanded falls; and vice versa.
- The horizontal axis—quantity—has a time dimension.
- The quantities are of the same quality.
- The vertical axis—price—assumes all other prices remain the same.
- The curve assumes everything else is held constant.
- Effects of price changes are shown by movements along the demand curve. Effects of anything else on demand (shift factors) are shown by shifts of the entire demand curve.

In practice, of course, firms don't measure individual demand curves, so they don't sum them up in this fashion. Instead, they estimate total demand. Still, summing up individual demand curves is a useful exercise because it shows you how the market demand curve is the sum (the horizontal sum, graphically speaking) of the individual demand curves, and it gives you a good sense of where market demand curves come from. It also shows you that, even if individuals don't respond to small changes in price, the market demand curve can still be smooth and downward sloping. That's because, for the market, the law of demand is based on three phenomena:

1. At lower prices, existing demanders buy more.
2. At lower prices, new demanders (some all-or-nothing demanders like Cathy) enter the market.
3. Finally, the market demand curve is flatter than any of the individual demand curves. This demonstrates that the market is more sensitive to price changes than is any individual.

For the market, the law of demand is based on three phenomena:

1. At lower prices, existing demanders buy more.
2. At lower prices, new demanders enter the market.
3. The market demand curve is flatter than any of the individual demand curves.

4.2 SUPPLY

In one sense, supply is the mirror image of demand. Individuals control the factors of production—inputs, or resources, necessary to produce goods. Individuals' supply of these factors to the market mirrors other individuals' demand for those factors. For example, say you decide you want to rest rather than weed your garden. You hire someone to do the weeding; you demand labour. Someone else decides she would prefer more income instead of more rest; she supplies labour to you. You trade money for labour; she trades labour for money. Her supply is the mirror image of your demand.

For a large number of goods and services, however, the supply process is more complicated than demand. For many goods there's an intermediate step in supply: individuals supply factors of production to firms.

Let's consider a simple example. Say you're a taco technician. You supply your labour to the factor market. The taco company demands your labour (hires you). The taco company combines your labour with other inputs like meat, cheese, beans, and tables, and produces many tacos (production), which it supplies to customers in the goods market. For produced goods, supply depends not only on individuals' decisions to supply factors of production but also on firms' ability to produce—to transform those factors of production into usable goods.

The supply process of produced goods is generally complicated. Often there are many layers of firms—production firms, wholesale firms, distribution firms, and retail-

Supply of produced goods involves a much more complicated process than demand and is divided into analysis of factors of production and the transformation of those factors into goods.

ing firms—each of which passes on in-process goods to the next layer of firms. Real-world production and supply of produced goods is a multistage process.

The supply of nonproduced goods is more direct. Individuals supply their labour in the form of services directly to the goods market. For example, an independent contractor may repair your washing machine. That contractor supplies his labour directly to you.

Thus, the analysis of the supply of produced goods has two parts: an analysis of the supply of factors of production to households and to firms, and an analysis of one process by which firms transform those factors of production into usable goods and services.

The Law of Supply

As crude oil prices rise, the incentive to produce more oil rises.

In talking about supply, the same convention exists that we used for demand. Supply refers to the various quantities offered for sale at various prices. Quantity supplied refers to a specific quantity offered for sale at a specific price.

There's a law of supply that corresponds to the law of demand. The **law of supply** states:

Quantity supplied rises as price rises, other things constant.

Or alternatively:

Quantity supplied falls as price falls, other things constant.

Price regulates quantity supplied just as it regulates quantity demanded. Like the law of demand, the law of supply is fundamental to the invisible hand's (the market's) ability to coordinate individuals' actions.

Our assumption that quantity supplied increases as price increases can be justified with a simple argument. For a firm to increase its output, it must hire more factors of production (labour, capital, materials, etc.) and increase its costs. This will raise the minimum price the firm will require to produce the higher output.

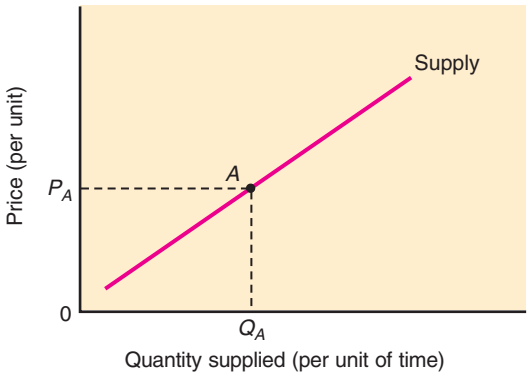
The Supply Curve

A **supply curve** *provides the minimum price the producer requires to produce an additional unit of output*. Of course the producer would like to charge a price higher than the minimum price necessary for each unit of output produced, and they will when we consider demand and supply together.

A supply curve is shown graphically in Figure 4-5. Notice how the supply curve slopes upward to the right. That upward slope captures the law of supply. It tells us that the quantity supplied varies *directly*—in the same direction—with the price.

FIGURE 4-5 A Sample Supply Curve

The supply curve demonstrates graphically the law of supply, which states that the quantity supplied of a good is directly related to that good's price, other things constant. As the price of a good goes up, the quantity supplied also goes up, so the supply curve is upward sloping.



As with the law of demand, the law of supply assumes other things are held constant. Thus, if the price of wheat rises and quantity supplied falls, you'll look for something else that changed—for example, a drought might have caused a drop in supply. Your explanation would go as follows: Had there been no drought, the quantity supplied would have increased in response to the rise in price, but because there was a drought, the supply decreased, which caused prices to rise.

As with the law of demand, the law of supply represents economists' off-the-cuff response to the question "What happens to quantity supplied if price rises?" If the law seems to be violated, economists search for some other variable that has changed. As was the case with demand, these other variables that might change are called shift factors.

Shifts in Supply Versus Movements Along a Supply Curve

The same distinctions in terms made for demand apply to supply.

Supply refers to *a schedule of quantities a seller is willing to sell per unit of time at various prices, other things constant.*

Quantity supplied refers to *a specific amount that will be supplied at a specific price.*

Q-5 In the 1980s and 1990s, as animal activists caused a decrease in the demand for fur coats, the prices of furs fell. This made _____ decline. Should the missing words be "the supply" or "the quantity supplied"?

In graphical terms, supply refers to the entire supply curve because a supply curve tells us how much will be offered for sale at various prices. "Quantity supplied" refers to a point on a supply curve, such as point *A* in Figure 4-5.

The second distinction that is important to make is between the effects of a change in a good's price and the effects of shift factors on how much of a good is supplied. Changes in price cause changes in quantity supplied; such changes are represented by a **movement along a supply curve**—*the graphic representation of the effect of a change in a good's price on the quantity supplied.* If the amount supplied is affected by anything other than that good's price, that is, by a shift factor of supply, there will be a **shift in supply**—*the graphic representation of the effect of a change in a factor other than price on supply.*

Shift Factors of Supply

Other factors besides a good's price that affect how much will be supplied include the price of inputs used in production, technology, expectations, and taxes and subsidies. Let's see how.

Price of Inputs

Firms produce to earn a profit. Since their profit is tied to costs, it's no surprise that costs will affect how much a firm is willing to supply. If costs rise with no change in output, profits will decline, and a firm has less incentive to supply. Supply falls when the price of inputs rises. If costs rise substantially, a firm might even shut down.

Technology

Advances in technology change the production process, reducing the number of inputs needed to produce a given supply of goods. Thus, a technological advance that reduces the number of workers will reduce costs of production. A reduction in the costs of production, at a constant price, increases profits and leads suppliers to increase production. Advances in technology increase supply.

Expectations

Supplier expectations are an important factor in the production decision. If a supplier expects the price of her good to rise at some time in the future, she may store some of today's supply to sell it later and reap higher profits, decreasing supply now and increasing it later.

Q-6 Explain the effect of each of the following on the supply of romance novels:

1. The price of paper rises by 20 percent.
2. Government increases the sales tax on all books by 5 percentage points.

Taxes and Subsidies Taxes on supplies increase the cost of production by requiring a firm to pay the government a portion of the income from products or services sold. Because taxes increase the cost of production, at a constant price, profit declines and suppliers will reduce supply. The opposite is true for subsidies. Subsidies are payments by the government to suppliers to produce goods; thus, they reduce the cost of production. Subsidies increase supply. Taxes on suppliers reduce supply.

These aren't the only shift factors. As was the case with demand, a shift factor of supply is anything that affects supply, other than its price.

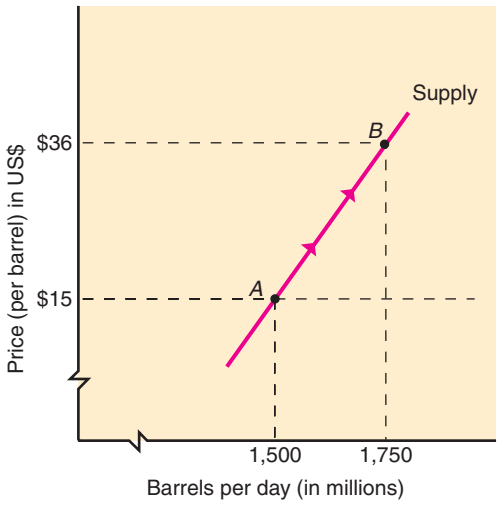
Shift in Supply Versus a Movement Along a Supply Curve, Revisited

The same "movement along" and "shift of" distinction that we developed for demand exists for supply. To make that distinction clear, let's consider an example: the supply of oil. In 1990 and 1991, world oil prices in U.S. dollars rose from $15 to $36 a barrel when oil production in the Persian Gulf was disrupted by the Iraqi invasion of Kuwait. Oil producers, seeing that they could sell their oil at a higher price, increased oil production. As the price of oil rose, domestic producers increased the quantity of oil supplied. The change in domestic quantity supplied in response to the rise in world oil prices is illustrated in Figure 4-6(a) as a movement up along the domestic supply curve from point *A* to point *B*. At $15 a barrel, producers supplied 1,500 million barrels of oil a day, and at $36 a barrel they supplied 1,750 million barrels per day.

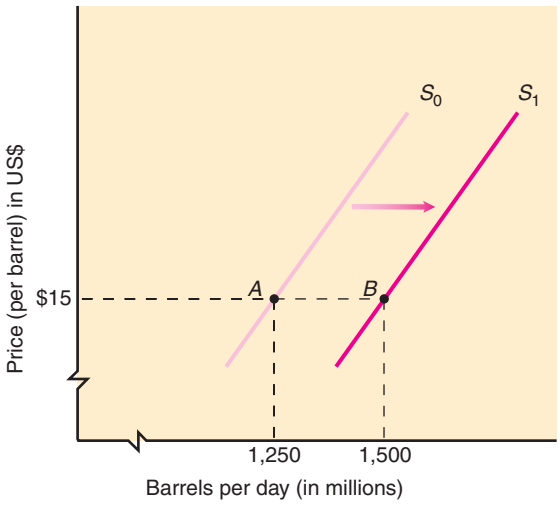
Earlier, in the 1980s, technological advances in horizontal drilling more than doubled the amount of oil that could be extracted from some oil fields. Technological innovations such as this reduced the cost of supplying oil and shifted the supply of oil to

FIGURE 4-6 (a and b) Shift in Supply Versus Change in Quantity Supplied

A change in quantity supplied results from a change in price and is shown by a movement along a supply curve like the movement from point *A* to point *B* in (**a**). A shift in supply—a shift in the entire supply curve—brought about by a change in a nonprice factor is shown in (**b**).



(a) Movement along a supply curve



(b) Shift in supply

the right as shown in Figure 4-6(b). Before the innovation, suppliers were willing to provide 1,250 million barrels of oil per day at US$15 a barrel. After the innovation, suppliers were willing to supply 1,500 million barrels of oil per day at US$15 a barrel.

A Review

To be sure you understand shifts in supply, explain what is likely to happen to your supply curve for labour in the following cases: (1) You suddenly decide that you absolutely need a new car. (2) You suddenly won a million dollars in the lottery. And finally, (3) the wage you could earn doubled. If you came up with the answers: shift out, shift in, and no change—you've got it down. If not, it's time for a review.

Do we see such shifts in the supply curve often? Yes. A good example is computers. For the past 30 years, technological changes have continually shifted the supply curve for computers out.

The Supply Table

Remember Figure 4-4(a)'s demand table for cassette rentals. In Figure 4-7(a), columns 2 (Ann), 3 (Barry), and 4 (Charlie), we follow the same reasoning to construct a supply table for three hypothetical cassette suppliers. Each supplier follows the law of supply: When price rises, each supplies more, or at least as much as each did at a lower price.

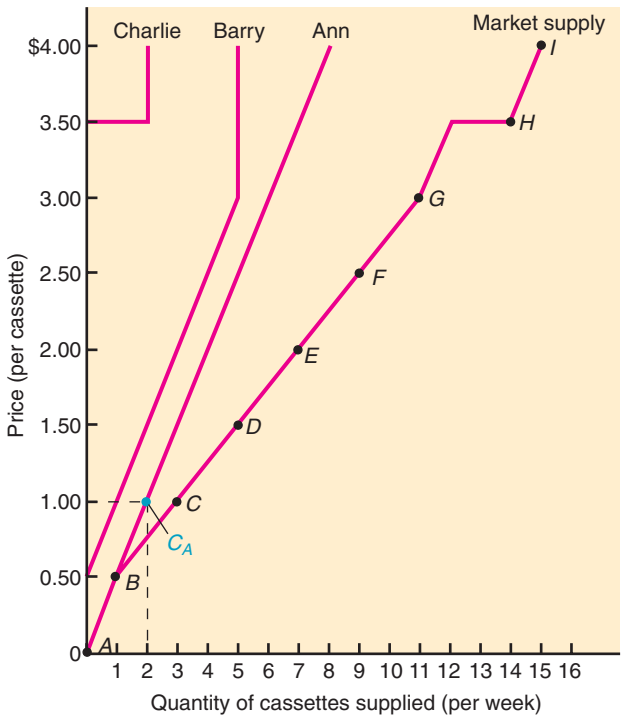
FIGURE 4-7 (a and b) From Individual Supplies to a Market Supply

As with market demand, market supply is determined by adding all quantities supplied at a given price. Three suppliers—Ann, Barry, and Charlie—make up the market of videocassette suppliers. The total market supply is the sum of their individual supplies at each price, shown in column 5 of (**a**).

Each of the individual supply curves and the market supply curve have been plotted in (**b**). Notice how the market supply curve is the horizontal sum of the individual supply curves.

	(1)	(2)	(3)	(4)	(5)
Quantities supplied	Price (per cassette)	Ann's supply	Barry's supply	Charlie's supply	Market supply
A	$0.00	0	0	0	0
B	0.50	1	0	0	1
C	1.00	2	1	0	3
D	1.50	3	2	0	5
E	2.00	4	3	0	7
F	2.50	5	4	0	9
G	3.00	6	5	0	11
H	3.50	7	5	2	14
I	4.00	8	5	2	15

(a) A supply table

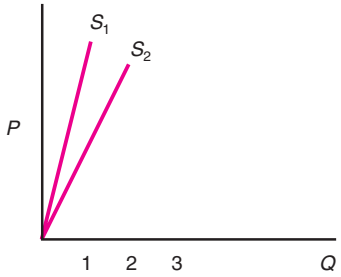


(b) Adding supply curves

SEVEN THINGS TO REMEMBER WHEN CONSIDERING A SUPPLY CURVE

- The supply curve provides the minimum price the firm requires to produce an additional unit of output.
- A supply curve follows the law of supply. When price rises, quantity supplied increases, and vice versa.
- The horizontal axis—quantity—has a time dimension.
- The quantities are of the same quality.
- The vertical axis—price—assumes all other prices remain constant.
- The curve assumes everything else is constant.
- Effects of price changes are shown by movements along the supply curve. Effects of nonprice determinants of supply are shown by shifts of the entire supply curve.

Q-7 Derive the market supply curve from the following two individual supply curves.



From a Supply Table to a Supply Curve

Figure 4-7(b) takes the information in Figure 4-7(a)'s supply table and translates it into a graph of each supplier's supply curve. For instance, point C_A on Ann's supply curve corresponds to the information in columns 1 and 2, row C. Point C_A is at a price of \$1 per cassette and a quantity of two cassettes per week. Notice that Ann's supply curve is upward sloping, meaning that price is positively related to quantity. Charlie's and Barry's supply curves are similarly derived.

The supply curve represents the set of *minimum* prices an individual seller will accept for various quantities of a good. The market's invisible hand stops suppliers from charging more than the market price. If suppliers could escape the market's invisible hand and charge a higher price, they would gladly do so. Unfortunately for them, and fortunately for consumers, a higher price encourages other suppliers to begin selling cassettes. Competing suppliers' entry into the market sets a limit on the price any supplier can charge.

Individual and Market Supply Curves

The market supply curve is derived from individual supply curves in precisely the same way that the market demand curve was. To emphasize the symmetry, we've made the three suppliers quite similar to the three demanders. Ann (column 2) will supply two at \$1; if price goes up to \$2, she increases her supply to four. Barry (column 3) begins supplying at \$1, and at \$3 supplies five, the most he'll supply regardless of how high price rises. Charlie (column 4) has only two units to supply. At a price of \$3.50 he'll supply that quantity, but higher prices won't get him to supply any more.

The **market supply curve** is *the horizontal sum of all individual supply curves*. In Figure 4-7(a) (column 5), we add together Ann's, Barry's, and Charlie's supply to arrive at the market supply curve, which is graphed in Figure 4-7(b). Notice that each point on it corresponds to the information in columns 1 and 5 for each row. For example, point *H* corresponds to a price of \$3.50 and a quantity of 14.

The law of supply is based on two phenomena:

1. At higher prices, existing suppliers supply more.
2. At higher prices, new suppliers enter the market.

The market supply curve's upward slope is determined by two different sources: by existing suppliers supplying more and by new suppliers entering the market. Sometimes existing suppliers may not be willing to increase their quantity supplied in response to an increase in prices, but a rise in price often brings brand-new suppliers into the market. For example, a rise in teachers' salaries will have little effect on the amount of teaching current teachers do, but it will increase the number of people choosing to be teachers.

4.3 THE ANALYSIS OF SUPPLY AND DEMAND

Thomas Carlyle, the English historian who dubbed economics "the dismal science," also wrote this chapter's introductory tidbit. "Teach a parrot the terms *supply* and *demand*

and you've got an economist." In earlier chapters, we tried to convince you that economics is *not* dismal. In the rest of this chapter, we hope to convince you that, while supply and demand are important to economics, parrots don't make good economists. If students think that when they've learned the terms *supply* and *demand* they've learned economics, they're mistaken. Those terms are just labels for the ideas behind supply and demand, and it's the ideas that are important. What matters about supply and demand isn't the labels but how the concepts interact. For instance, what happens if a freeze kills the blossoms on the orange trees? The quantity of oranges supplied isn't expected to equal the quantity demanded. It's in understanding the interaction of supply and demand that economics becomes interesting and relevant.

During the 1990s, an overproduction of wheat led to excess supply and downward pressure on global wheat prices.

Excess Supply

When you have a market in which neither suppliers nor consumers can collude and in which prices are free to adjust, economists have a good answer for the question: What happens if quantity supplied doesn't equal quantity demanded? If there is **excess supply** (a surplus), *quantity supplied is greater than quantity demanded,* and some suppliers won't be able to sell all their goods. This surplus of output will occur if, for some reason, the market price is too high. Inventories will pile up at the current rate of production. This sends a signal to the firm that they should reduce their level of output and sell off their inventories. As they reduce their level of output, their costs per additional unit will fall (they move down their supply curve) and the minimum price they require for each additional unit of output will also fall, so they lower their price. The lower price encourages more consumers to buy the product (it is below the maximum price they are willing to pay) and quantity demanded increases (they move down their demand curve). This process will stop when consumers just purchase all the output the firm is producing.

Excess Demand

The reverse is also true. Say that instead of excess supply, there's **excess demand** (a shortage)—*quantity demanded is greater than quantity supplied.* There are more consumers who want the good than there are suppliers selling the good. In this case, the market price is too low. Lineups outside the store and exhausted inventories will send a signal to the firm to increase its level of output. As it does so, it will incur higher costs, and hence the minimum price the firm requires to produce each additional unit of output will increase, so they raise the price. The higher price discourages some consumers from buying the product (the price is above the maximum price they are willing to pay for an additional unit) and quantity demanded decreases (they move up their demand curve). This process will stop when consumers just purchase all the output the firm is producing.

Q-8 Explain what a sudden popularity of "Economics Professor" brand casual wear would likely do to prices of that brand.

Price Adjusts

This tendency for prices to rise when the quantity demanded exceeds the quantity supplied and for prices to fall when the quantity supplied exceeds the quantity demanded is a central element to understanding supply and demand. So remember:

When quantity demanded is greater than quantity supplied, prices tend to rise.

When quantity supplied is greater than quantity demanded, prices tend to fall.

Two other things to note about supply and demand are (1) the greater the difference between quantity supplied and quantity demanded, the more pressure there is for prices to rise or fall, and (2) when quantity demanded equals quantity supplied, the market is in equilibrium.

4.1
see page 97

People's tendencies to change prices exist as long as there's some difference between quantity supplied and quantity demanded. But the change in price brings the laws of supply and demand into play. As price falls, the quantity supplied decreases due to a combination of firms leaving the industry and those firms that remain reducing their levels of output. And as some people who originally weren't really interested in buying the good think, "Well, at this low price, maybe I do want to buy," quantity demanded increases (the law of demand). Similarly, when price rises, quantity supplied will increase (the law of supply) and quantity demanded will decrease (the law of demand).

Whenever quantity supplied and quantity demanded are unequal, price tends to change. If, however, quantity supplied and quantity demanded are equal, price will stay the same because no one will have an incentive to change.

The Graphical Analysis of Supply and Demand

Figure 4-8 shows supply and demand curves for cassette rentals and demonstrates the force of the invisible hand. Let's consider what will happen to the price of cassettes in three cases:

1. When the price is $3.50 each;
2. When the price is $1.50 each; and
3. When the price is $2.50 each.

Q-9 In a flood, it is ironic that usable water supplies tend to decline because the pumps and water lines are damaged. What will a flood likely do to the prices of bottled water?

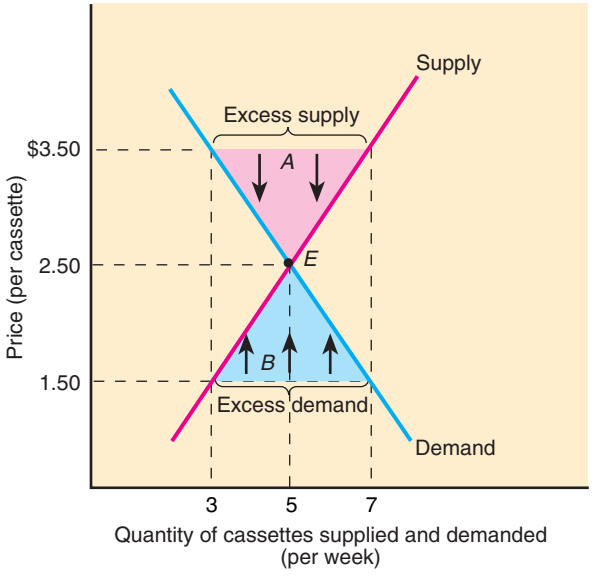
1. When price is $3.50, quantity supplied is seven and quantity demanded is only three. Excess supply is four. Individual consumers can get all they want, but most suppliers can't sell all they wish; they'll be stuck with cassettes that they'd like to rent. Suppliers will tend to offer their goods at a lower price and demanders, who see plenty of suppliers out there, will bargain harder for an even lower price. Both these forces will push the price as indicated by the *A* arrows in Figure 4-8.

Now let's start from the other side.

2. Say price is $1.50. The situation is now reversed. Quantity supplied is three and quantity demanded is seven. Excess demand is four. Now it's consumers who can't

FIGURE 4-8 The Analysis of Supply and Demand

Combining Ann's supply from Figure 4-7 and Marie's demand from Figure 4-4, let's see the force of the invisible hand. When there is excess demand there is upward pressure on price. When there is excess supply there is downward pressure on price. Understanding these pressures is essential to understanding how to apply economics to reality.



get what they want and suppliers who are in the strong bargaining position. The pressures will be on price to rise in the direction of the *B* arrows in Figure 4-8.

3. At $2.50, price is at its equilibrium: quantity supplied equals quantity demanded. Suppliers offer to sell five and consumers want to buy five, so there's no pressure on price to rise or fall. Price will tend to remain where it is (point *E* in Figure 4-8). Notice that the equilibrium price is where the supply and demand curves intersect.

Equilibrium

The concept of equilibrium appears often throughout this text. You need to understand what equilibrium is and what it isn't.

What Equilibrium Is

The concept itself comes from physics—classical mechanics. **Equilibrium** is *a concept in which opposing dynamic forces cancel each other out*. For example, a hot-air balloon is in equilibrium when the upward force exerted by the hot air in the balloon equals the downward pressure exerted on the balloon by gravity. In supply and demand analysis, equilibrium means that the upward pressure on price is exactly offset by the downward pressure on price. **Equilibrium price** is *the price toward which the invisible hand drives the market*. **Equilibrium quantity** is *the amount bought and sold at the equilibrium price*. At the equilibrium price and quantity, the maximum price the last consumer to buy is willing to pay is just equal to the minimum price the firm needs to supply the last unit of output.


4.2
see page 97

So much for what equilibrium is. Now let's consider what it isn't.

What Equilibrium Isn't

First, equilibrium isn't a state of the world. It's a characteristic of the model—the framework you use to look at the world. The same situation could be seen as an equilibrium in one framework and as a disequilibrium in another. Say you're describing a car that's speeding along at 100 kilometres an hour. That car is changing position relative to objects on the ground. Its movement could be, and generally is, described as if it were in disequilibrium. However, if you consider this car relative to another car going 100 kilometres an hour, the cars could be modelled as being in equilibrium because their positions relative to each other aren't changing.

Second, equilibrium isn't inherently good or bad. It's simply a state in which dynamic pressures offset each other. Some equilibria are awful. Say two countries are engaged in a nuclear war against each other and both sides are blown away. An equilibrium will have been reached, but there's nothing good about it.

Equilibrium is not inherently good or bad.

4.4 THE POWER OF SUPPLY AND DEMAND

To ensure that you understand the supply and demand graphs throughout the book, and can apply them, let's go through an example. Figure 4-9(a) deals with an increase in demand. Figure 4-9(b) deals with a decrease in supply.

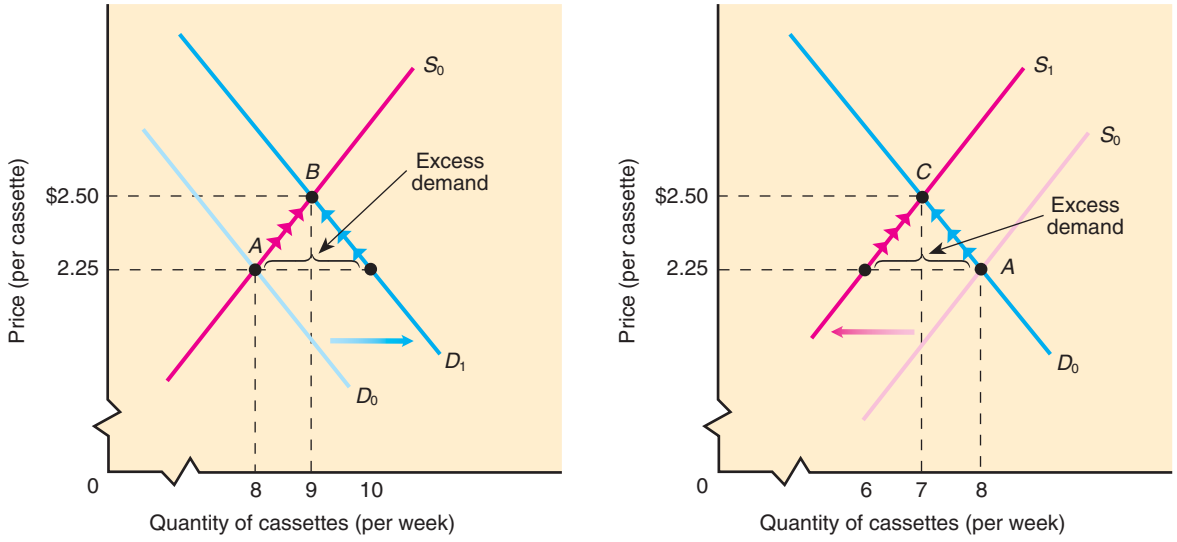
Let's consider again the supply and demand for videocassette rentals. In Figure 4-9(a), the supply is S_0 and initial demand is D_0. They meet at an equilibrium price of $2.25 per cassette and an equilibrium quantity of 8 cassettes per week (point A). Now say that the demand for cassette rentals increases from D_0 to D_1. At a price of $2.25, the quantity of cassette rentals supplied will be 8 and the quantity demanded will be 10; excess demand of 2 exists.

Q-10 Demonstrate graphically the effect of a heavy frost in Nova Scotia on the equilibrium quantity and price of apples.

FIGURE 4-9 (a and b) Shifts in Supply and Demand

When there is an increase in demand (the demand curve shifts outward), there is upward pressure on the price, as shown in (**a**). If demand increases from D_0 to D_1, the quantity of cassette rentals that was demanded at a price of $2.25, 8, increases to 10, but the quantity supplied remains at 8. This excess demand tends to cause prices to rise. Eventually, a new equilibrium is reached at the price of $2.50, where the quantity supplied and the quantity demanded is 9 (point *B*).

If supply of cassette rentals decreases, then the entire supply curve shifts inward to the left, as shown in (**b**), from S_0 to S_1. At the price of $2.25, the quantity supplied has now decreased to six cassettes, but the quantity demanded has remained at eight cassettes. The excess demand tends to force the price upward. Eventually, an equilibrium is reached at the price of $2.50 and quantity seven (point C).



(a) A shift in demand **(b) A shift in supply**

The excess demand pushes prices upward in the direction of the small arrows, decreasing the quantity demanded and increasing the quantity supplied. As it does so, movement takes place along both the supply curve and the demand curve.

The upward push on price decreases the gap between the quantity supplied and the quantity demanded. As the gap decreases, the upward pressure decreases, but as long as that gap exists at all, price will be pushed upward until the new equilibrium price ($2.50) and new quantity (9) are reached (point *B*). At point *B*, quantity supplied equals quantity demanded. So the market is in equilibrium. Notice that the adjustment is twofold: The higher price brings about equilibrium by both increasing the quantity supplied (from 8 to 9) and decreasing the quantity demanded (from 10 to 9).

Figure 4-9(b) begins with the same situation that we started with in Figure 4-9(a); the initial equilibrium quantity and price are eight cassettes per week and $2.25 per cassette (point A). In this example, however, instead of demand increasing, let's assume supply decreases—say because some suppliers change what they like to do, and decide they will no longer supply cassettes. That means that the entire supply curve shifts inward to the left (from S_0 to S_1). At the initial equilibrium price of $2.25, the quantity demanded is greater than the quantity supplied. Two more cassettes are demanded than are supplied. (Excess demand = 2.)

Q_{11} Say a hormone has been discovered that increases cows' milk production by 20 percent. Demonstrate graphically what effect this discovery would have on the price and quantity of milk sold in a market.

This excess demand exerts upward pressure on price. Price is pushed in the direction of the small arrows. As the price rises, the upward pressure on price is reduced but will still exist until the new equilibrium price, $2.50, and new quantity, 7, are reached. At $2.50, the quantity supplied equals the quantity demanded. The adjustment has involved a movement along the demand curve and the new supply curve. As price rises, quantity supplied is adjusted upward and quantity demanded is adjusted downward until quantity supplied equals quantity demanded where the new supply curve intersects the demand curve at point C, an equilibrium of 7 and $2.50.

Here is an exercise for you to try. Demonstrate graphically how the price of computers could have fallen dramatically in the past 10 years, even as demand increased. (Hint: Supply has shifted even more, so even at lower prices, far more computers have been supplied than were being supplied 10 years ago.)

Q-12 Demonstrate graphically the likely effect of an increase in the price of gas on the equilibrium quantity and price of compact cars.

Six Real-World Examples

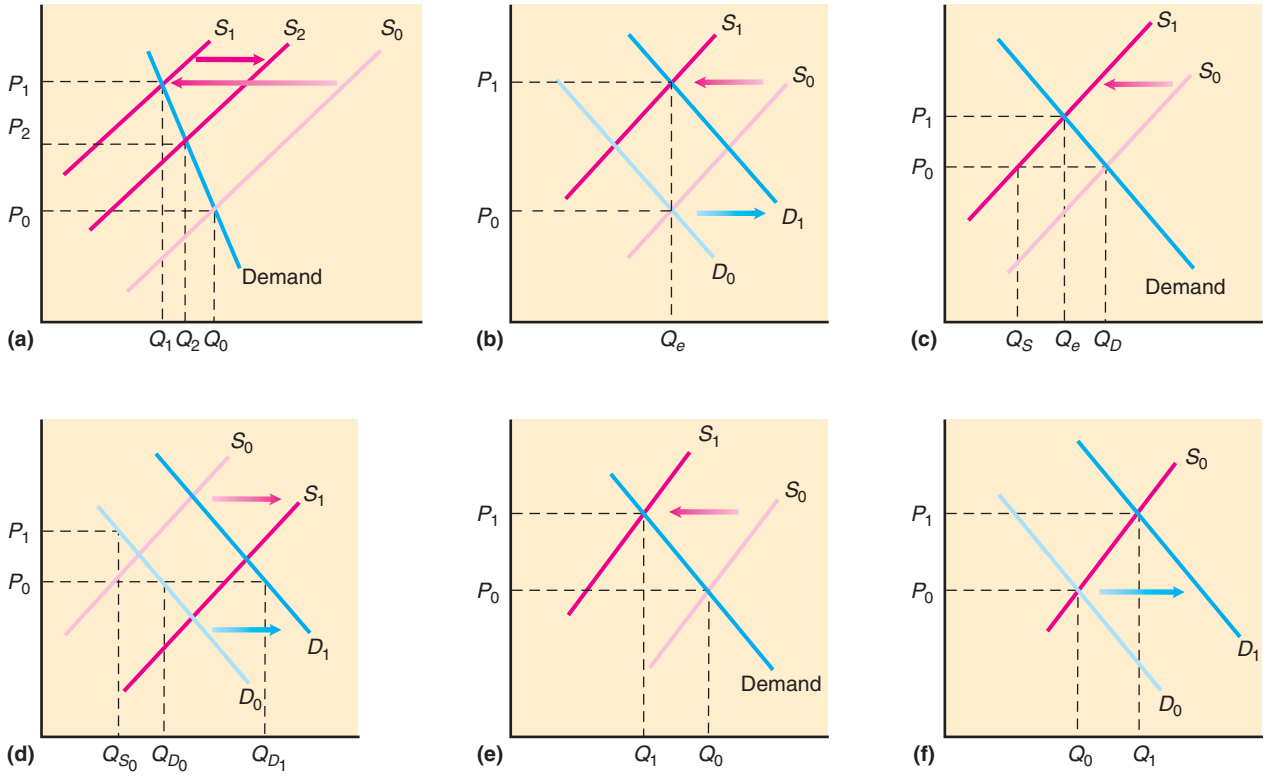
Now that we've been through a generic example of shifts in supply and demand, let's consider some real-world examples. Below are six events. After reading each, try your hand at explaining what happened, using supply and demand curves. To help you in the process, Figure 4-10 provides some diagrams. *Before* reading our explanation, try to match the shifts to the examples. In each, be careful to explain which curve, or curves, shifted and how those shifts affected equilibrium price and quantity.

If this orange orchard was damaged, supply would be reduced, thereby putting upward pressure on orange prices.

1. Brazil is the world's largest sugar producer. Inclement weather reduced production in 2000 by 15 percent. Market: Sugar.
2. In the mid-1990s baby boomers started to put away more and more savings for retirement. This saving was directed toward the purchase of financial assets, driving up the price of stocks. Market: Financial assets.
3. The majority of golfers in Korea prefer to use the newest American-made golf clubs. The Korean government, in an effort to protect domestic golf club producers, imposed a 20 percent luxury tax on imported American clubs. Market: American-made golf clubs in Korea.
4. Rice is crucial to Indonesia's nutritional needs and its rituals. In 1997, drought, pestilence, and a financial crash led to disruptions in the availability of rice. Its price rose so high that in 1998 more than a quarter of all Indonesians could not buy enough market-priced rice to meet their daily needs. Government programs to deliver subsidized rice were insufficient to bring the price of rice back to affordable levels. Market: Rice in Indonesia.
5. In late summer 1998, U.S. farmers were hard pressed to find enough seasonal farmhands. Why? El Niño's weather patterns compressed the harvest season. Grape, apple, and peach growers, who usually harvested at different times, were competing for the same workers. In addition, stronger efforts by authorities had reduced the flow of illegal workers to the United States. Market: Farm labourers.
6. Every Christmas a new toy becomes the craze. In 1997 it was Tickle Me Elmo and in 1998 it was Furby. Before Christmas Day, these toys were hard to find and sold for as much as 10 times their retail price on what is called the black market. Here we use the Furby as the example. Toymaker Tiger, along with retailers, worked up initial interest in Furby in late November, advertising the limited supply. As early as 2:00 A.M., lines formed at the stores carrying Furbies. Some shoppers (including "toy scouts") were able to buy Furbies then resell them the same afternoon for as much as $300 apiece. Even with the shortage, retailers kept the price at its preset advertised price and producers continued to

FIGURE 4-10 (a–f)

In this exhibit, six shifts of supply and demand are shown. Your task is to match them with the events listed in the chapter.



Answers: 1:c; 2:f; 3:e; 4:a; 5:b; 6:d.

limit distribution. Newspapers carried stories about the lines and black market prices, intensifying demand for Furbies, which became even harder to come by. Days before Christmas, the supplier increased shipments of Furbies to meet the increased demand. Customers felt "lucky" when they were able to find Furbies with so few days left before Christmas, and for only $30 instead of $300 on the black market. Market: Furbies in 1998.

Sugar Shock The weather is invariably uncooperative. Nearly every year, some market is hit with a crop-damaging freeze, too little precipitation, or even too much rain. This is a shift factor of supply because it raises the cost of supplying sugar. The bad weather in 2000 shifted the supply curve for Brazilian sugar in, as shown in Figure 4-10(c). At the original price, quantity demanded exceeded quantity supplied and the invisible hand of the market pressured the price to rise until quantity demanded equalled quantity supplied.

Financial Assets and the Baby Boomers The postwar population swell we call the baby boom resulted in increased demand for all sorts of products as the boomers graduated, then bought houses, and now are demanding more health care and financial assets. In this case, demographic changes have led to a shift out in the demand curve for

financial assets, resulting in a rise in stock market prices and an increase in the quantity of stocks and mutual funds supplied. This is depicted in Figure 4-10(f). This figure could also be used to describe the huge rise in housing prices in the 1980s as baby boomers began to purchase houses.

Excise Taxes In our earlier discussion of shift factors, we explained that taxes levied on the supplier will reduce supply. The 20 percent luxury tax will shift the supply curve in. That some golfers use their old clubs and others look elsewhere to buy clubs is substitution at work, and a movement up along the demand curve. Figure 4-10(e) shows this scenario. After the tax, price rises to P_1 and quantity of clubs sold declines to Q_1.

Rice in Indonesia Drought, pestilence, and the financial crash all increased the cost of supplying rice in Indonesia, shifting the supply of rice in from S_0 to S_1 in Figure 4-10(a). Since rice is so important to the well-being of Indonesians, quantity demanded doesn't change much with changes in price. This is shown by the steep demand curve. The price rose to levels unaffordable to many people. In response, the government purchased imported rice and distributed it to the market. This shifted the supply curve out from S_1 to S_2. Since the price was still above its previous level, we know that this second shift in supply is smaller than the first.

Farm Labourers In this case both supply and demand shift, but this time in opposite directions. The previous year's demand is represented in Figure 4-10(b) by D_0 and supply is shown by S_0. Q_e labourers were hired at a wage of P_0. The compressed harvesting season meant that more farmers were looking for labourers, shifting the demand for farm workers out from D_0 to D_1. This put upward pressure on wages and increased quantity of labour supplied. Simultaneously, however, the supply of farm workers shifted in from S_0 to S_1 as the authorities increased border patrols. This put further upward pressure on wages and reduced the quantity of labour demanded. Wages are clearly bid up, in this case to P_1. The effect on the number of labourers hired, however, depends on the relative size of the demand and supply shifts. As we have drawn it, the quantity of labourers hired returns to the quantity of the previous year, Q_e. If the supply shift were greater than the shift in demand, the number of labourers would have declined. If it were smaller, the number of labourers would have risen.

Christmas Toys In this example, both supply and demand shift in the same direction. The initial market is shown by D_0 and S_0 in Figure 4-10(d). The price of $30 (shown by P_0) was below the equilibrium price and a shortage of $Q_{D_0} - Q_{S_0}$ existed. The black market price of $300 (shown by P_1) is shown by the amount that consumers are willing to pay for the quantity supplied, Q_{S_0}. As the craze for the toy intensified following the free newspaper publicity of the lines and black market prices, demand shifted out to D_1. Price was kept at $30 and the shortage became even greater, $Q_{D_1} - Q_{S_0}$. When Tiger made more Furbies available, supply shifted to S_1, eliminating most, but not all, of the shortage. At least one Wal-Mart employee was injured in the mad rush to obtain a Furby.

A Review

As you can see, supply and demand analysis can get quite complicated. That is why you must separate shifts in demand and supply from movements along the supply and demand curves. Remember: Anything that affects demand and supply other than price of the good under consideration will shift the curves. Changes in the price of the good un-

Anything other than price that affects demand or supply will shift the curves.

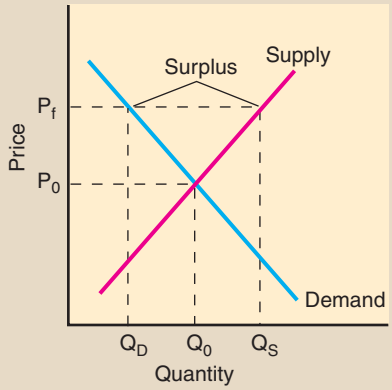
SUPPLY AND DEMAND IN ACTION

KNOWING the Tools

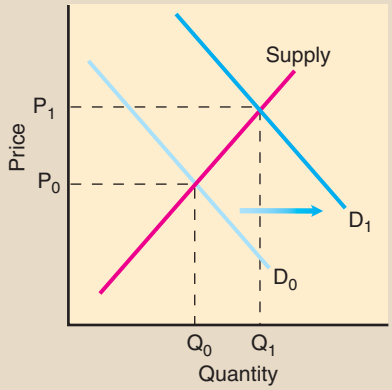
Sorting out the effects of the shifts of supply or demand or both can be confusing. Here are some helpful hints to keep things straight:

- Draw the initial demand and supply curves and label them. The equilibrium price and quantity is where these curves intersect. Label them.
- If only price has changed, no curves will shift and a shortage or surplus will result.
- If a nonprice factor affects demand, determine the direction demand has shifted and add the new demand curve. Do the same for supply.
- Equilibrium price and quantity is where the new demand and supply curves intersect. Label them.
- Compare the initial equilibrium price and quantity to the new equilibrium price and quantity.

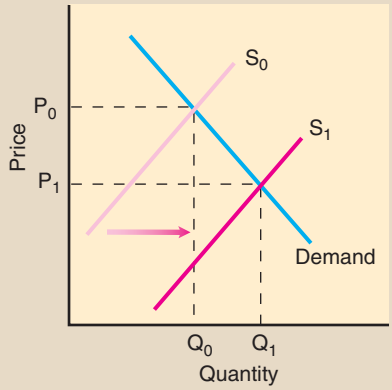
See if you can describe what happened in the three graphs below.



A change in price



A shift in demand



A shift in supply

der consideration result in movements along the curves. Another thing to recognize is that when both curves are shifting you can get a change in price but little change in quantity, or a change in quantity but little change in price.

To test your understanding, we'll now give you six generic results from the interaction of supply and demand. Your job is to decide what shifts produced those results. This exercise is a variation of the previous one. It goes over the same issues, but this time without the graphs. On the left-hand side of the table below, we list combinations of movements of observed prices and quantities, labelling them 1–6. On the right we give six shifts in supply and demand, labelling them *a*–*f*.

If you don't confuse your "shifts of" with your "movements along," supply and demand provide good off-the-cuff answers for many economic questions.

Price and Quantity Changes		
1.	P↑	Q↑
2.	P↑	Q↓
3.	P↑	Q?
4.	P↓	Q?
5.	P?	Q↑
6.	P↓	Q↓

Shifts in Supply and Demand

a. Supply shifts in. No change in demand.
b. Demand shifts out. Supply shifts in.
c. Demand shifts in. No change in supply.
d. Demand shifts out. Supply shifts out.
e. Demand shifts out. No change in supply.
f. Demand shifts in. Supply shifts out.

Q-13 If both demand and supply shift in, what happens to price and quantity?

You are to match the shifts with the price and quantity movements that best fit each described shift, using each shift and movement only once. Our recommendation to you is to draw the graphs that are described in *a*–*f*, decide what happens to price and quantity, and then find the match in 1–6.

Now that you've worked them, let us give you the answers we came up with. They are: 1:*e*; 2:*a*; 3:*b*; 4:*f*; 5:*d*; 6:*c*. How did we come up with the answers? We did what we suggested you do—took each of the scenarios on the right and predicted what happens to price and quantity. For case *a*, supply shifts in and there is a movement up along the demand curve. Since the demand curve is downward sloping, the price rises and quantity declines. This matches number *2* on the left. For case *b*, demand shifts out. Along the original supply curve, price and quantity would rise. But supply shifts in, leading to even higher prices, but lower quantity. What happens to quantity is unclear, so the match must be number *3*. For case *c*, demand shifts in. There is movement down along the supply curve with lower price and lower quantity. This matches number 6. For case *d*, demand shifts out and supply shifts out. As demand shifts out, we move along the supply curve to the right and price and quantity rise. But supply shifts out too, and we move out along the new demand curve. Price declines, erasing some or all of the previous rise, and the quantity rises even more. This matches number 5.

We'll leave it up to you to confirm our answers to *e* and *f*. Notice that when supply and demand both shift, the change in either price or quantity is uncertain—it depends on the direction and the relative size of the shifts. As a summary, we present a diagrammatic of the combinations in Table 4-1.

TABLE 4-1 Diagram of Effects of Shifts of Demand and Supply on Price and Quantity

This table provides a summary of the effects of shifts in supply and demand on price and quantity. Notice that when both curves shift, the effect on either price or quantity depends on the relative size of the shifts.

	No change in supply.	Supply shifts out.	Supply shifts in.
No change in demand.	No change.	P↓ Q↑ Price declines and quantity rises.	P↑ Q↓ Price rises. Quantity declines.
Demand shifts out.	P↑ Q↑ Price rises. Quantity rises.	P? Q↑ Quantity rises. Price could be higher or lower depending upon relative size of shifts.	P↑ Q? Price rises. Quantity could rise or fall depending upon relative size of shifts.
Demand shifts in.	P↓ Q↓ Price declines. Quantity declines.	P↓ Q? Price declines. Quantity could rise or fall depending upon relative size of shifts.	P? Q↓ Quantity declines. Price rises or falls depending upon relative size of shifts.

CONCLUSION


4.3
see page 97

Throughout the book we'll be presenting examples of supply and demand. So we'll end this chapter here because its intended purposes have been served. What were those intended purposes? First, we exposed you to enough economic terminology and economic thinking to allow you to proceed to our more complicated examples. Second, we have set your mind to work putting the events around you into a supply/demand framework. Doing that will give you new insights into the events that shape all our lives. Once you incorporate the supply/demand framework into your way of looking at the world, you will have made an important step toward thinking like an economist.

Chapter Summary

- The law of demand states that quantity demanded rises as price falls, other things constant.
- The law of supply states that quantity supplied rises as price rises, other things constant.
- Factors that affect supply and demand other than price are called shift factors. Shift factors of demand include income, prices of other goods, tastes, population, and expectations. Shift factors of supply include the price of inputs, technology, expectations, and taxes and subsidies.
- A change in quantity demanded (supplied) is a movement along the demand (supply) curve. A change in demand (supply) is a shift of the entire demand (supply) curve.
- The laws of supply and demand hold true because individuals can substitute.
- A market demand (supply) curve is the horizontal sum of all individual demand (supply) curves.
- When quantity demanded is greater than quantity supplied, prices tend to rise. When quantity supplied is greater than quantity demanded, prices tend to fall.
- When quantity supplied equals quantity demanded, prices have no tendency to change. This is equilibrium.
- When the demand curve shifts to the right (left), equilibrium price rises (declines) and equilibrium quantity rises (falls).
- When the supply curve shifts to the right (left), equilibrium price declines (rises) and equilibrium quantity rises (falls).
- By minding your *P*s and *Q*s—the shifts of and movements along curves—you can describe almost all events in terms of supply and demand.

Key Terms

complementary good *(75)*
demand *(74)*
demand curve *(73)*
equilibrium *(87)*
equilibrium price *(87)*
equilibrium quantity *(87)*
excess demand *(85)*
excess supply *(85)*
inferior good *(75)*
law of demand *(73)*
law of supply *(80)*
market demand curve *(77)*
market supply curve *(84)*
movement along a demand curve *(74)*
movement along a supply curve *(81)*
normal good *(75)*
quantity demanded *(74)*
quantity supplied *(81)*
shift in demand *(74)*
shift in supply *(81)*
supply *(81)*
supply curve *(80)*

Questions for Thought and Review

1. State the law of demand. Why is price inversely related to quantity demanded?
2. State the law of supply. Why is price directly related to quantity supplied?
3. List four shift factors of demand and explain how each affects demand.
4. Distinguish the effect of a shift factor of demand on the demand curve from the effect of a change in price on the demand curve.
5. Draw a market demand curve from the following demand table.

P	*Q*
37	20
47	15
57	10
67	5

6. Draw a demand curve from the following demand table.

P	D_1	D_2	D_3
37	20	4	8
47	15	2	7
57	10	0	6
67	5	0	5

7. Danielle has just stated that normally, as price rises, supply will increase. Her teacher grimaces. Why?
8. List four shift factors of supply and explain how each affects supply.
9. Draw a market supply curve from the following supply table.

P	S_1	S_2	S_3
37	0	4	14
47	0	8	16
57	10	12	18
67	10	16	20

10. It has just been reported that eating meat is bad for your health. Using supply and demand curves, demonstrate the report's likely effect on the price and quantity of steak sold in the market.
11. Say that price and quantity both fell. What would you say was the most likely cause?
12. Say that price fell and quantity remained constant. What would you say was the most likely cause?

Problems and Exercises

1. You're given the following individual demand tables for comic books.

Price	Jean	Liz	Connie
$ 2	4	36	24
4	4	32	20
6	0	28	16
8	0	24	12
10	0	20	8
12	0	16	4
14	0	12	0
16	0	8	0

   a. Determine the market demand table.
   b. Graph the individual and market demand curves.
   c. If the current market price is $4, what's the total market demand? What happens to total market demand if price rises to $8?
   d. Say that an advertising campaign increases demand by 50 percent. Illustrate graphically what will happen to the individual and market demand curves.
2. Draw hypothetical supply and demand curves for tea. Show how the equilibrium price and quantity will be affected by each of the following occurrences:
   a. Bad weather wreaks havoc with the tea crop.
   b. A medical report implying tea is bad for your health is published.
   c. A technological innovation lowers the cost of producing tea.
   d. Consumers' income falls.

3. This is a question concerning what economists call the *identification problem*. Say you go out and find figures on the quantity bought of various products. You will find something like the following:

Product	Year	Quantity	Average Price
VCRs	1998	100,000	$210
	1999	110,000	220
	2000	125,000	225
	2001	140,000	215
	2002	135,000	215
	2003	160,000	220

Plot these figures on a graph.
   a. Have you plotted a supply curve, a demand curve, or what?
   b. If we assume that the market for VCRs is competitive, what information must you know to determine whether these are points on a supply curve or on a demand curve?
   c. Say you know that the market is one in which suppliers set the price and allow the quantity to vary. Could you then say anything more about the curves you have plotted?
   d. What information about shift factors would you expect to find to make these points reflect the law of demand?

4. You're a commodity trader and you've just heard a report that the winter wheat harvest will be 2.09 billion bushels, a 44 percent jump, rather than an expected 35 percent jump to 1.96 billion bushels.
   a. What would you expect would happen to wheat prices?
   b. Demonstrate graphically the effect you suggested in part (a).

5. In Canada, gasoline costs consumers about $0.80 per litre. In Italy it costs consumers about $2 per litre. What effect does this price differential likely have on:
   a. The size of cars in Canada and in Italy?
   b. The use of public transportation in Canada and in Italy?
   c. The fuel efficiency of cars in Canada and in Italy? What would be the effect of raising the price of gasoline in Canada to $2 per litre?

Web Questions

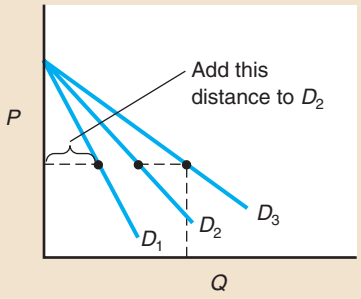
1. Go to the World Bank's Health, Nutrition and Population home page (devdata.worldbank.org/hnpstats/) and find data about Canada's population in 2000 and projections for 2010, 2020, and 2035. What do you expect to happen to the proportion of the population over 65? Report your findings. Other things constant, what do you expect will happen in the next 50 years to the relative demand and supply for each of the following, being careful to distinguish between shifts of and a movement along a curve:
   a. Nursing homes.
   b. Prescription medication.
   c. Baby high chairs.
   d. Postsecondary education.

2. Go to Natural Resources Canada's Energy Policy Branch home page (www.nrcan.gc.ca/es/epb/eng/enghome.htm)and answer the following questions:
   a. List the factors that are expected to affect demand and supply for energy in the near term. How will each factor affect demand? Supply?
   b. What is the Energy Policy Branch's forecast for world oil prices? Show graphically how the factors listed in your answer to (a) are consistent with the Energy Policy Branch's forecast. Label all shifts in demand and supply.
   c. Describe and explain the Energy Policy Branch's forecast for the price of gasoline, heating oil, and natural gas. Be sure to mention the factors that are affecting the forecast.

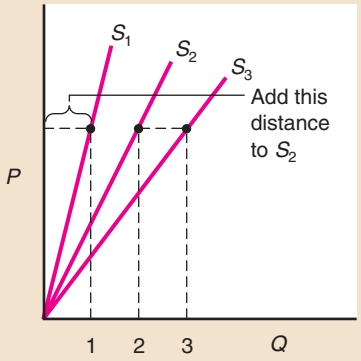
3. Go to the Canadian Taxpayers Federation home page (www.taxpayer.com) and look up sales tax rates for the 10 provinces.
   a. Which province(s) have no sales tax? Which province(s) have the highest sales tax?
   b. Show graphically the effect of sales tax on supply, demand, equilibrium quantity, and equilibrium price.
   c. Name two neighbouring provinces that have significantly different sales tax rates. How does that affect the supply or demand for goods in those provinces?

Answers to Margin Questions

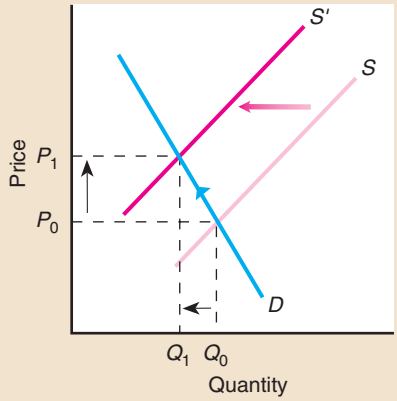
1. The demand curve slopes downward because price and quantity demanded are inversely related. As the price of a good rises, people switch to purchasing other goods whose prices have not risen as much. *(73)*
2. *Demand for furs*. The other possibility, *quantity demanded*, is used to refer to movements along (not shifts of) the demand curve. *(74)*
3. (1) The decline in price will increase the quantity of computers demanded (movement down along the demand curve); (2) With more income, demand for computers will rise (shift of the demand curve to the right). *(75)*
4. When adding two demand curves, you sum them horizontally, as in the accompanying diagram. *(78)*



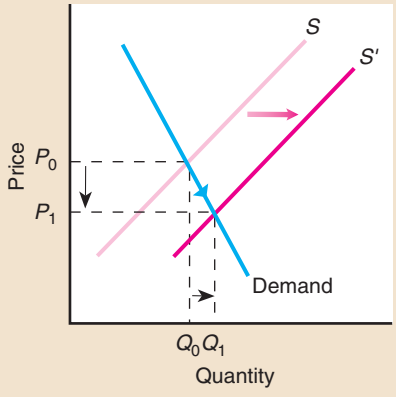
5. "The quantity supplied" declined because there was a movement along the supply curve. The supply curve itself remained unchanged. *(81)*
6. (1) The supply of romance novels declines since paper is an input to production (supply shifts to the left); (2) the supply of romance novels declines since the tax increases the cost to the producer (supply shifts to the left). *(82)*
7. When adding two supply curves, sum horizontally the two individual supply curves, as in the diagram below. *(84)*



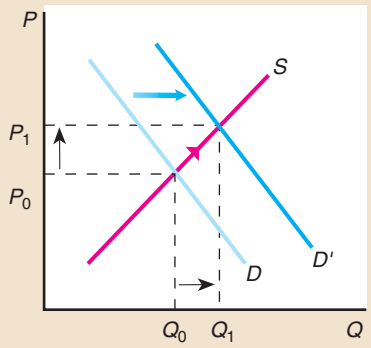
8. Customers will flock to stores demanding that funky "Economics Professor" look, creating excess demand. This excess demand will soon catch the attention of suppliers, and prices will be pushed upward. *(85)*
9. As substitutes—tap water—decrease, demand for bottled water increases enormously, and there will be upward pressure on prices. Social and political forces will, however, likely work in the opposite direction—against "profiteering" from people's misery. *(86)*
10. A heavy frost in Nova Scotia will decrease the supply of apples, increasing the price and decreasing the quantity demanded, as in the accompanying graph. *(87)*



11. A discovery of a hormone that will increase cows' milk production by 20 percent will increase the supply of milk, pushing the price down and increasing the quantity demanded, as in the accompanying graph. *(88)*



12. An increase in the price of gas will likely increase the demand for compact cars, increasing their price and increasing the quantity supplied, as in the accompanying graph. *(89)*



13. Quantity decreases but it is unclear what happens to price. *(92)*

APPENDIX A

Algebraic Representation of Supply, Demand, and Equilibrium

In Chapter 4 we discussed demand, supply, and the determination of equilibrium price and quantity in words and graphs. These concepts can also be presented in equations. In this appendix we do so, using straight-line supply and demand curves.

A4.1 THE LAWS OF SUPPLY AND DEMAND IN EQUATIONS

Since the law of supply states that quantity supplied is positively related to price, the slope of an equation specifying a supply curve is positive. (The quantity intercept term is generally less than zero since suppliers are generally unwilling to supply a good at a price less than zero.) An example of a supply equation is:

$$Q_S = -5 + 2P$$

where Q_S is units supplied and P is the price of each unit in dollars per unit. The law of demand states that as price rises, quantity demanded declines. Price and quantity are negatively related, so a demand curve has a negative slope. An example of a demand equation is:

$$Q_D = 10 - P$$

where Q_D is units demanded and P is the price of each unit in dollars per unit.

Determination of Equilibrium

The equilibrium price and quantity can be determined in three steps using these two equations. To find the equilibrium price and quantity for these particular demand and supply curves, you must find the quantity and price that solve both equations simultaneously.

Step 1: Set the quantity demanded equal to quantity supplied:

$$Q_S = Q_D \rightarrow -5 + 2P = 10 - P$$

Step 2: Solve for the price by rearranging terms. Doing so gives:

$$3P = 15$$
$$P = \$5$$

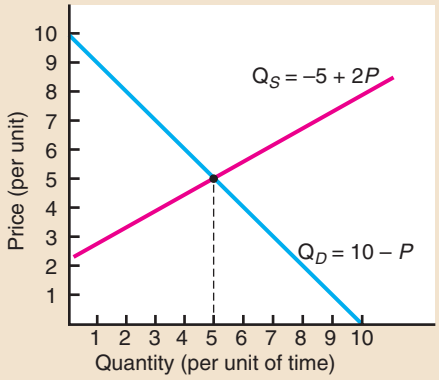
Thus, equilibrium price is $5.

Step 3: To find equilibrium quantity, you can substitute $5 for P in either the demand or supply equation. Let's do it for supply: $Q_S = -5 + (2 \times 5) = 5$ units. we'll leave it to you to confirm that the quantity you obtain by substituting $P = \$5$ in the demand equation is also 5 units.

The answer could also be found graphically. The supply and demand curves specified by these equations are depicted in Figure A4-1. As you can see, demand and supply intersect; quantity demanded equals quantity supplied at a quantity of 5 units and a price of $5.

FIGURE A4-1 Supply and Demand Equilibrium

The algebra in this appendix leads to the same results as the geometry in the chapter. Equilibrium occurs where quantity supplied equals quantity demanded.



Movements Along a Demand and Supply Curve

The demand and supply curves above represent schedules of quantities demanded and supplied at various prices. Movements along each can be represented by selecting various prices and solving for quantity demanded and supplied. Let's create a supply and demand table using the following equations—supply: $Q_S = -5 + 2P$; demand: $Q_D = 10 - P$.

P	$Q_S = -5 + 2P$	$Q_D = 10 - P$
$ 0	−5	10
1	−3	9
2	−1	8
3	1	7
4	3	6
5	5	5
6	7	4
7	9	3
8	11	2
9	13	1
10	15	0

As you move down the rows, you are moving up along the supply schedule, as shown by increasing quantity supplied, and moving down along the demand schedule, as shown by decreasing quantity demanded. Just to confirm your equilibrium quantity and price calculations, notice that at a price of $5, quantity demanded equals quantity supplied.

Shifts of a Demand and Supply Schedule

What would happen if suppliers' expectations changed so that they would be willing to sell more goods at every price? This shift factor of supply would shift the entire supply curve out to the right. Let's say that at every price, quantity supplied increases by three. Mathematically the new equation would be $Q_S = -2 + 2P$. The quantity intercept increases by 3. What would you expect to happen to equilibrium price and quantity? Let's solve the equations mathematically first.

Step 1: To determine equilibrium price, set the new quantity supplied equal to quantity demanded:

$$10 - P = -2 + 2P$$

Step 2: Solve for the equilibrium price:

$$12 = 3P$$

$$P = \$4$$

Step 3: To determine equilibrium quantity, substitute P in either the demand or supply equation:

$$Q_D = 10 - (1 \times 4) = 6 \text{ units}$$

$$Q_S = -2 + (2 \times 4) = 6 \text{ units}$$

Equilibrium price declined to $4 and equilibrium quantity rose to six, just as you would expect with a rightward shift in a supply curve.

Now let's suppose that demand shifts out to the right. Here we would expect both equilibrium price and equilibrium quantity to rise. We begin with our original supply and demand curves—supply: $Q_S = -5 + 2P$; demand: $Q_D = 10 - P$. Let's say at every price, the quantity demanded rises by three. The new equation for demand would be $Q_D = 13 - P$. You may want to solve this equation for various prices to confirm that at every price, quantity demanded rises by three. Let's solve the equations for equilibrium price and quantity.

Step 1: Set the quantities equal to one another:

$13 - P = -5 + 2P$

Step 2: Solve for equilibrium price:

$18 = 3P$

$P = \$6$

Step 3: Substitute P in either the demand or supply equation:

$Q_D = 13 - (1 \times 6) = 7$ units

$Q_S = -5 + (2 \times 6) = 7$ units

Equilibrium price rose to $6 and equilibrium quantity rose to seven units, just as you would expect with a rightward shift in a demand curve.

Just to make sure you've got it, we will do two more examples. First, suppose the demand and supply equations for wheat per year in Canada can be specified as follows (notice that the slope is negative for the demand curve and positive for the supply curve):

$Q_D = 500 - 2P$

$Q_S = -100 + 4P$

P is the price in dollars per thousand bushels and Q is the quantity of wheat in thousands of bushels. Remember that the units must always be stated. What is the equilibrium price and quantity?

Step 1: Set the quantities equal to one another:

$500 - 2P = -100 + 4P$

Step 2: Solve for equilibrium price:

$600 = 6P$

$P = \$100$

Step 3: Substitute P in either the demand or supply equation:

$Q_D = 500 - (2 \times 100) = 300$

$Q_S = -100 + (4 \times 100) = 300$

Equilibrium quantity is 300,000 (300 thousand) bushels.

As our final example, take a look at Marie's demand curve depicted in Figure 4-4(b). Can you write an equation that represents the demand curve in that figure? It is $Q_D = 10 - 2P$. At a price of zero, the quantity of cassette rentals Marie demands is 10, and for every increase in price of $1, the quantity she demands falls by 2. Now look at Ann's supply curve shown in Figure 4-7(b). Ann's supply curve mathematically is $Q_S = 2P$. At a zero price, the quantity Ann supplies is zero, and for every $1 increase in price, the quantity she supplies rises by 2. What is the equilibrium price and quantity?

Step 1: Set the quantities equal to one another:

$10 - 2P = 2P$

Step 2: Solve for equilibrium price:

$4P = 10$

$P = \$2.5$

Step 3: Substitute P in either the demand or supply equation:

$Q_D = 10 - (2 \times 2.5) = 5$, or

$Q_S = 2 \times 2.5 = 5$ cassettes per week

Ann is willing to supply five cassettes per week at $2.50 per rental and Marie demands five cassettes at $2.50 per cassette rental. Remember that in Figure 4-8, we showed you graphically the equilibrium quantity and price of Marie's demand curve and Ann's supply curve. We'll leave it up to you to check that the graphic solution in Figure 4-8 is the same as the mathematical solution we came up with here.

Questions for Thought and Review

1. Suppose the demand and supply for milk is described by the following equations: $Q_D = 600 - 100P$; $Q_S = -150 + 150P$, where P is price in dollars, Q_D is quantity demanded in millions of litres per year, and Q_S is quantity supplied in millions of litres per year.
   a. Create demand and supply tables corresponding to these equations.
   b. Graph supply and demand and determine equilibrium price and quantity.
   c. Confirm your answer to (b) by solving the equations mathematically.
2. Suppose a growth hormone is introduced that allows dairy farmers to offer 125 million more litres of milk per year at each price.
   a. Construct new demand and supply curves reflecting this change. Describe with words what happened to the supply curve and to the demand curve.
   b. Graph the new curves and determine equilibrium price and quantity.
   c. Determine equilibrium price and quantity by solving the equations mathematically.
   d. Suppose the government set the price of milk at $3 a litre. Demonstrate the effect of this regulation on the market for milk. What is quantity demanded? What is quantity supplied?
3. Write demand and supply equations that represent demand, D_0, and supply, S_0, in Figure 4-9(a) in the chapter.
   a. Solve for equilibrium price and quantity mathematically.
   b. Rewrite the demand equation to reflect the shift in demand to D_1. What happens to equilibrium price and quantity as shown in Figure 4-9(a) in the chapter? Confirm by solving the equations for equilibrium price and quantity.
4. a. How is a shift in demand reflected in a demand equation?
   b. How is a shift in supply reflected in a supply equation?
   c. How is a movement along a demand (supply) curve reflected in a demand (supply) equation?