Father Guido Sarducci, a character on the early Saturday Night Live shows, once observed that the average person remembers only about five minutes worth of material from college. He therefore proposed the “Five Minute University,” where you’d learn only the five minutes of material you’d actually remember and dispense with the rest. The economics course would last only 10 seconds, just enough time for students to learn to recite three words: “supply and demand.”

Of course, there is much more to economics than these three words. But many people do regard the phrase “supply and demand” as synonymous with economics and the concept is often misused. But surprisingly few people actually understand what the phrase means. In a debate about health care, poverty, recent events in the stock market, or the high price of housing, you might hear someone say, “Well, it’s just a matter of supply and demand,” as a way of dismissing the issue entirely. Others use the phrase with an exaggerated reverence, as if supply and demand were an inviolable physical law, like gravity, about which nothing can be done. So what does this oft-repeated phrase really mean?

First, supply and demand is just an economic model—nothing more and nothing less. It’s a model designed to explain how prices are determined in certain types of markets.

Why has this model taken on such an exalted role in the field of economics? Because prices themselves play such an exalted role in the economy. In a market system, once the price of something has been determined, only those willing to pay that price will get it. Thus, prices determine which households will get which goods and services and which firms will get which resources. If you want to know why the cell phone industry is expanding while the video rental industry is shrinking, or why homelessness is a more pervasive problem in the United States than hunger, you need to understand how prices are determined. In this chapter, you will learn how the model of supply and demand works and how to use it. You will also learn about the strengths and limitations of the model. It will take more time than Guido Sarducci’s 10-second economics course, but in the end you will know much more than just those three words.

MARKETS

Put any compound in front of a chemist, ask him what it is and what it can be used for, and he will immediately think of the basic elements—carbon, hydrogen, oxygen, and so on. Ask an economist almost any question about the economy, and he will immediately think about markets.
Chapter 3: Supply and Demand

In ordinary language, a market is a specific location where buying and selling take place: a supermarket, a flea market, and so on. In economics, a market is not a place, but rather a collection of traders. More specifically,

*a market is a group of buyers and sellers with the potential to trade with each other.*

Economists think of the economy as a collection of markets. In each of these markets, the collection of buyers and sellers will be different, depending on what is being traded. There is a market for oranges, another for automobiles, another for real estate, and still others for corporate stocks, labor services, land, euros, and anything else that is bought and sold.

However, unlike chemistry—in which the set of basic elements is always the same—in economics, we can define a market in *different* ways, depending on our purpose. In fact, in almost any economic analysis, the first step is to define and characterize the market or collection of markets to analyze.

**HOW BROADLY SHOULD WE DEFINE THE MARKET?**

Suppose we want to study the personal computer industry in the United States. Should we define the market very broadly (“the market for computers”), or very narrowly (“the market for ultra-light laptops”), or something in between (“the market for laptops”)? The right choice depends on the problem we’re trying to analyze.

For example, if we’re interested in why computers *in general* have come down in price over the past decade, there would be no reason to divide computers into desktops and laptops. Such a distinction would only get in the way. Thus, we’d treat all types of computers as if they were the same good. Economists call this process *aggregation*—combining a group of distinct things into a single whole.

But suppose we’re asking a different question: Why do laptops always cost more than desktops with similar computing power? Then we’d aggregate all laptops together as one good, and all desktops as another, and look at each of these more narrowly defined markets.

The same general principle applies to the geographic breadth of the market. If we want to predict how instability in the Persian Gulf will affect gasoline prices around the world, we’d use the “global market for oil,” in which the major oil producers in about 20 countries sell to buyers around the globe. But if we want to explain why gasoline is cheaper in the United States than in most of the rest of the world, we’d want to look at the “U.S. market for oil.” In this market, global sellers choose how much oil to sell to U.S. buyers.

*In economics, markets can be defined broadly or narrowly, depending on our purpose.*

How broadly or narrowly markets are defined is one of the most important differences between *macroeconomics* and *microeconomics*. In macroeconomics, goods and services are aggregated to the highest levels. Macro models even lump all consumer goods—breakfast cereals, cell phones, blue jeans, and so forth—into the single category “consumption goods” and view them as if they are traded in a single, broadly defined market, “the market for consumption goods.” Similarly, instead of recognizing different markets for shovels, bulldozers, computers, and factory
buildings, macro models analyze the market for “capital goods.” Defining markets this broadly allows macroeconomists to take an overall view of the economy without getting bogged down in the details.

In microeconomics, by contrast, markets are defined more narrowly. Instead of asking how much we’ll spend on consumer goods, a microeconomist might ask how much we’ll spend on health care or video games. Although microeconomics always involves some aggregation, the process stops before it reaches the highest level of generality.

**PRODUCT AND RESOURCE MARKETS**

Figure 1 displays the **circular flow** model of the economy, which helps us organize our thinking about markets. It shows how we can divide markets into two major categories, and how each category fits into the big picture.

The upper half of the diagram shows **product markets**, where goods and services such as soft drinks, word-processing software, gasoline, DVDs, college educational services, medical services, and more are bought and sold. The outer arrows represent the flow of goods and services from business firms (the sellers) to households (the buyers). The inner arrows show the associated flow of funds, where household payments for goods and services ($ Expenditures) become the receipts of businesses ($ Revenue).

The lower half of the diagram depicts another type of market: **resource markets**, where labor, land, capital, and entrepreneurship are bought and sold. In these markets, as shown by the outer arrows, households (the ultimate owners of resources) act as sellers. Business firms, which use resources to make goods and services, are the buyers. The inner arrows in the lower half of the diagram show us that when businesses pay for the resources they use ($ Resource Payments), the funds flow to households ($ Income).

There is, of course, much more to the economy than this simple model captures. For example, we’ve left out the government, which buys many goods and services, and also produces some for the general public. And we’ve left out some markets entirely, such as markets where borrowing and lending takes place, or markets where foreign currencies are traded.

But for many problems, the simple circular flow model can help us understand and identify the participants and the type of market we are discussing. In this chapter, for example, our focus is on **product markets**, so we’ll view households as buyers and business firms as sellers. Later in this book (in both microeconomics and macroeconomics), you’ll encounter resource markets where these roles are reversed.

**COMPETITION IN MARKETS**

A final issue in defining a market is how individual buyers and sellers view the price of the product. In many cases, individual buyers or sellers have an important influence over the price. For example, in the national market for cornflakes, Kellogg’s—an individual seller—simply sets its price every few months. It can raise the price and sell fewer boxes of cereal or lower the price and sell more. In a small-town, a major buyer of antiques may be able to negotiate special discount prices with the local antique shops. These are examples of **imperfectly competitive** markets.
In imperfectly competitive markets, individual buyers or sellers can influence the price of the product.

But now think about the national market for wheat. Can an individual seller have any impact on the market price? Not really. On any given day there is a going price for wheat—say, $5.80 per bushel. If a farmer tries to charge more than that—say, $5.85 per bushel—he won’t sell any wheat at all! His customers will instead go to one of his many competitors and buy the identical product from them for less. Each wheat farmer must take the price of wheat as a “given.”

The same is true of a single wheat buyer: If he tries to negotiate a lower price from a seller, he’d be laughed off the farm. “Why should I sell my wheat to you for $5.75 per bushel, when there are others who will pay me $5.80?” Accordingly, each buyer must take the market price as a given.

In perfectly competitive markets (or just competitive markets), each buyer and seller takes the market price as a given.

What makes some markets imperfectly competitive and others perfectly competitive? You’ll learn the complete answer, along with more formal definitions, when you are further into your study of microeconomics. But here’s a hint: In perfectly competitive markets, each buyer and seller takes the market price as a given.
competitive markets, there are many small buyers and sellers, each is a small part of the market, and the product is standardized, like wheat. Imperfectly competitive markets, by contrast, have just a few large buyers or sellers, or else the product of each seller is unique in some way.

**Using Supply and Demand**

Why is it important to know about perfectly competitive markets when using the supply and demand model? For one simple reason:

> The supply and demand model is designed to explain how prices are determined in perfectly competitive markets.

But wait. In the real world, perfectly competitive markets—in which an individual buyer or seller has no influence on market price—are rare. Does that mean the supply and demand model can’t be used when analyzing most markets? Not at all. Many markets, while not strictly perfectly competitive, come rather close. Choosing to view these markets as if they were perfectly competitive is often a useful approximation.

Think of the market for fast-food hot dogs in a big city. On the one hand, every hot dog stand is somewhat different from every other one in terms of location, quality of service, and so on. This means an individual vendor has some influence over the price of his hot dogs. For example, if his competitors are all charging $1.50 for a hot dog, but he sells in a more convenient location, he might be able to charge $1.60 or $1.70 without losing too many customers. In this sense, the market for sidewalk hot dogs does not seem perfectly competitive.

On the other hand, there are rather narrow limits to an individual seller’s freedom to change his price. With so many vendors in a big city, who are not that different from one another, one who charged $2.00 or $2.25 might soon find that he’s lost all of his customers to the other vendors who are charging the market price of $1.50. Since no single seller can deviate too much from the market price, we could—if we wanted to—view the market as more or less perfectly competitive.

How, then, do we decide whether to consider a market, such as the market for big-city hot dogs, as perfectly or imperfectly competitive? You won’t be surprised to hear that it depends on the question we want to answer. If we want to explain why there are occasional price wars among hot dog vendors, or why some of them routinely charge higher prices than others, viewing the market as perfectly competitive would not work well—it would hide, rather than reveal, the answer. For these questions, we’d choose a different model—one designed for a type of imperfectly competitive market. (If your current course is microeconomics, you will soon learn about these models and how to use them.)

But if we want to know why hot dogs are cheaper than most other types of fast foods, the simplest approach is to view the market for hot dogs as perfectly competitive. True, each hot dog vendor does have some influence over the price. But that influence is so small, and the prices of different sellers are so similar, that our assumption of perfect competition works pretty well.

Perfect competition then, is a matter of degree, rather than an all-or-nothing characteristic. While there are very few markets in which sellers and buyers take the price as completely given, there are many markets in which a narrow range of prices
is treated as a given (as in the market for hot dogs). In these markets, supply and demand often provides a good approximation to what is going on. This is why it has proven to be the most versatile and widely used model in the economist’s toolkit. Neither laptop computers nor orange juice is traded in a perfectly competitive market. But ask an economist to tell you why the price of laptops decreases every year, or why the price of orange juice rises after a freeze in Florida, and he or she will invariably reach for supply and demand to find the answer.

Supply and demand are like two blades of a scissors: To analyze a market, we need both of them. In this and the next section, we will be sharpening those blades, learning separately about supply and demand. Then, we’ll put them together and put them to use. Let’s start with demand.

**DEMAND**

It’s tempting to think of the “demand” for a product as just a psychological phenomenon, a pure “want” or “desire.” But that notion can lead us astray. For example, you want all kinds of things: a bigger apartment, a better car, nicer clothes, more and better vacations. The list is endless. But you don’t always buy them. Why not?

Because in addition to your wants—which you’d very much like to satisfy—you also face constraints. First, you have to pay. Second, you have limited funds with which to buy things, so every decision to buy one thing is also a decision not to buy something else (or a decision to save less, and have less buying power in the future). As a result, every purchase confronts you with an opportunity cost. Your “wants,” together with the real-world constraints that you face, determine what you will choose to buy in any market. Hence, the following definition:

**The quantity demanded of a good or service is the number of units that all buyers in a market would choose to buy over a given time period, given the constraints that they face.**

Since this definition plays a key role in any supply and demand analysis, it’s worth taking a closer look at it.

**Quantity Demanded Implies a Choice.** Quantity demanded doesn’t tell us the amount of a good that households feel they “need” or “desire” in order to be happy. Instead, it tells us how much households would choose to buy when they take into account the opportunity cost of their decisions. The opportunity cost arises from the constraints households face, such as having to pay a given price for the good, limits on spendable funds, and so on.

**Quantity Demanded Is Hypothetical.** Will households actually be able to purchase the amount they want to purchase? As you’ll soon see, usually yes. But there are special situations—analyzed in microeconomics—in which households are frustrated in buying all that they would like to buy. Quantity demanded makes no assumptions about the availability of the good. Instead, it’s the answer to a hypothetical question: How much would households buy, given the constraints that they face, if the units they wanted to buy were available.
Quantity Demanded Depends on Price. The price of the good is just one variable among many that influences quantity demanded. But because one of our main purposes in building a supply and demand model is to explain how prices are determined, we try to keep that variable front-and-center in our thinking. This is why for the next few pages we’ll assume that all other influences on demand are held constant, so we can explore the relationship between price and quantity demanded.

THE LAW OF DEMAND

How does a change in price affect quantity demanded? You probably know the answer to this already: When something is more expensive, people tend to buy less of it. This common observation applies to air travel, magazines, guitars, and virtually everything else that people buy. For all of these goods and services, price and quantity are negatively related: that is, when price rises, quantity demanded falls; when price falls, quantity demanded rises. This negative relationship is observed so regularly in markets that economists call it the law of demand.

The law of demand states that when the price of a good rises and everything else remains the same, the quantity of the good demanded will fall.

Read that definition again, and notice the very important words, “everything else remains the same.” The law of demand tells us what would happen if all the other influences on buyers’ choices remained unchanged, and only one influence—the price of the good—changed.

This is an example of a common practice in economics. In the real world, many variables change simultaneously. But to understand changes in the economy, we must first understand the effect of each variable separately. So we conduct a series of mental experiments in which we ask: “What would happen if this one influence—and only this one—were to change?” The law of demand is the result of one such mental experiment, in which we imagine that the price of the good changes, but all other influences on quantity demanded remain constant.

Mental experiments like this are used so often in economics that we sometimes use a shorthand Latin expression to remind us that we are holding all but one influence constant: ceteris paribus (formally pronounced KAY-ter-is PAR-ih-bus, although it’s acceptable to pronounce the first word as SEH-ter-is). This is Latin for “all else the same,” or “all else remaining unchanged.” Even when it is not explicitly stated, the ceteris paribus assumption is virtually always implied. The exceptions are cases where we consider two or more influences on a variable that change simultaneously, as we will do toward the end of this chapter.

THE DEMAND SCHEDULE AND THE DEMAND CURVE

To make our discussion more concrete, let’s look at a specific market: the market for real maple syrup in the United States. In this market, we’ll view the buyers as U.S. households, whereas the sellers (to be considered later) are maple syrup producers in the United States or Canada.

Table 1 shows a hypothetical demand schedule for maple syrup in this market. This is a list of different quantities demanded at different prices, with all other variables assumed constant. For example, the demand schedule tells us that when the price of maple syrup is $2.00 per bottle, the quantity demanded will be 60,000 bottles per month. Notice that the demand schedule obeys...
the law of demand: As the price of maple syrup increases, *ceteris paribus*, the quantity demanded falls.

Now look at Figure 2. It shows a diagram that will appear again and again in your study of economics. In the figure, each price-and-quantity combination in Table 1 is represented by a point. For example, point A represents the price $4.00 and quantity 40,000, while point B represents the pair $2.00 and 60,000. When we connect all of these points with a line, we obtain the famous demand curve, labeled with a D in the figure.

The demand curve shows the relationship between the price of a good and the quantity demanded in the market, holding constant all other variables that influence demand. Each point on the curve shows the total quantity that buyers would choose to buy at a specific price.

Notice that the demand curve in Figure 2—like virtually all demand curves—*slopes downward*. This is just a graphical representation of the law of demand.

**Shifts versus Movements Along the Demand Curve**

Markets are affected by a variety of events. Some events will cause us to *move along* the demand curve; others will cause the entire demand curve to *shift*. It is crucial to distinguish between these two very different types of effects.

Let’s go back to Figure 2. There, you can see that when the price of maple syrup rises from $2.00 to $4.00 per bottle, the number of bottles demanded falls from 60,000 to 40,000. This is a movement along the demand curve, from point B to point A. In general,

*a change in the price of a good causes a movement along the demand curve.*

In Figure 2, a *fall* in price would cause us to move *rightward* along the demand curve (from point A to point B), and a *rise* in price would cause us to move *leftward* along the demand curve (from B to A).

Remember, though, that when we draw a demand curve, we assume all other variables that might influence demand are *held constant* at some particular value. For example, the demand curve in Figure 2 might have been drawn to give us quantity demanded at each price when average household income in the United States remains constant at, say, $40,000 per year.

But suppose average income increases to $50,000? With more income, we’d expect households to buy more of *most* things, including maple syrup. This is illus-
Table 2. At the original income level, households would choose to buy 60,000 bottles of maple syrup at $2.00 per bottle. But after income rises, they would choose to buy more at that price—80,000 bottles, according to Table 2. A similar change would occur at any other price for maple syrup: After income rises, households would choose to buy more than before. In other words, the rise in income changes the entire relationship between price and quantity demanded. We now have a new demand curve.

Figure 3 plots the new demand curve from the quantities in the third column of Table 2. The new demand curve lies to the right of the old curve. For example, at a price of $2.00, quantity demanded increases from 60,000 bottles on the old curve (point B) to 80,000 bottles on the new demand curve (point C). As you can see, the rise in household income has shifted the demand curve to the right.

More generally, a change in any variable that affects demand—except for the good’s price—causes the demand curve to shift. When buyers would choose to buy a greater quantity at any price, the demand curve shifts rightward. If they would decide to buy a smaller quantity at any price, the demand curve shifts leftward.

“Change in Quantity Demanded” versus “Change in Demand”

Language is important when discussing demand. The term quantity demanded means a particular amount that buyers would choose to buy at a specific price, represented by a single point on a demand curve. Demand, by contrast, means the entire relationship between price and quantity demanded, represented by the entire demand curve.

For this reason, when a change in the price of a good moves us along a demand curve, we call it a change in quantity demanded. For example, in Figure 2, the movement from point A to point B is an increase in quantity demanded. This is a change from one number (40,000 bottles) to another (60,000 bottles).
When something other than the price changes, causing the entire demand curve to shift, we call it a change in demand. In Figure 3, for example, the shift in the curve would be called an increase in demand.

**Factors That Shift the Demand Curve**

Let’s take a closer look at what might cause a change in demand (a shift of the demand curve). Keep in mind that for now, we’re exploring one factor at a time, always keeping all other determinants of demand constant.

**Income.** In Figure 3, an increase in income shifted the demand for maple syrup to the right. In fact, a rise in income has the same effect on the demand for most goods. We call these normal goods. Housing, automobiles, health club memberships, and real maple syrup are all examples of normal goods.

But not all goods are normal. For some goods—called inferior goods—a rise in income would decrease demand—shifting the demand curve leftward. Regular-grade ground chuck is a good example. It’s a cheap source of protein, but not as high in quality as sirloin. With higher income, households could more easily afford better types of meat—ground sirloin or steak, for example. As a result, higher

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**Table 2**

<table>
<thead>
<tr>
<th>Price per Bottle</th>
<th>Original Quantity Demanded (bottles per month)</th>
<th>New Quantity Demanded After Increase in Income (bottles per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>75,000</td>
<td>95,000</td>
</tr>
<tr>
<td>$2.00</td>
<td>60,000</td>
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</tr>
<tr>
<td>$3.00</td>
<td>50,000</td>
<td>70,000</td>
</tr>
<tr>
<td>$4.00</td>
<td>40,000</td>
<td>60,000</td>
</tr>
<tr>
<td>$5.00</td>
<td>35,000</td>
<td>55,000</td>
</tr>
</tbody>
</table>

**Figure 3**

A Shift of the Demand Curve

*An increase in income shifts the demand curve for maple syrup from D₁ to D₂. At each price, more bottles are demanded after the shift.*

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*Change in demand* A shift of a demand curve in response to a change in some variable other than price.

*Income* The amount that a person or firm earns over a particular period.

*Normal good* A good that people demand more of as their income rises.

*Inferior good* A good that people demand less of as their income rises.
incomes for buyers might cause the demand for ground chuck to decrease. For similar reasons, we might expect that Greyhound bus tickets (in contrast to airline tickets) and single-ply paper towels (in contrast to two-ply) are inferior goods.

A rise in income will increase the demand for a normal good, and decrease the demand for an inferior good.

Wealth. Your wealth at any point in time is the total value of everything you own (cash, bank accounts, stocks, bonds, real estate or any other valuable property) minus the total dollar amount you owe (home mortgage, credit card debt, auto loan, student loan, and so on). Although income and wealth are different, (see the nearby Dangerous Curves box), they have similar effects on demand. Increases in wealth among buyers—because of an increase in the value of their stocks or bonds, for example—gives them more funds with which to purchase goods and services. As you might expect,

an increase in wealth will increase demand (shift the curve rightward) for a normal good, and decrease demand (shift the curve leftward) for an inferior good.

Prices of Related Goods. A substitute is a good that can be used in place of another good and that fulfills more or less the same purpose. For example, many people use real maple syrup to sweeten their pancakes, but they could use a number of other things instead: honey, sugar, jam, or artificial maple syrup. Each of these can be considered a substitute for real maple syrup.

When the price of a substitute rises, people will choose to buy more maple syrup. For example, when the price of jam rises, some jam users will switch to maple syrup, and the demand for maple syrup will increase. In general,

a rise in the price of a substitute increases the demand for a good, shifting the demand curve to the right.

Of course, if the price of a substitute falls, we have the opposite result: Demand for the original good decreases, shifting its demand curve to the left.

There are countless examples in which a change in a substitute’s price affects demand for a good. A drop in the rental price of DVDs, ceteris paribus, would decrease the demand for movies at theaters. A rise in the price of beef, ceteris paribus, would increase the demand for chicken.

A complement is the opposite of a substitute: It’s used together with the good we are interested in. Pancake mix is a complement to maple syrup, since these two goods are used frequently in combination. If the price of pancake mix rises, some consumers will switch to other breakfasts—bacon and eggs, for example—that don’t include maple syrup. The demand for maple syrup will decrease.
A rise in the price of a complement decreases the demand for a good, shifting the demand curve to the left.

For this reason, we’d expect a higher price for automobiles to decrease the demand for gasoline. (To test yourself: How would a lower price for milk affect the demand for breakfast cereal?)

**Population.** As the population increases in an area, the number of buyers will ordinarily increase as well, and the demand for a good will increase. The growth of the U.S. population over the last 50 years has been an important reason (but not the only reason) for rightward shifts in the demand curves for food, housing, automobiles, and many other goods and services.

**Expected Price.** If buyers expect the price of maple syrup to rise next month, they may choose to purchase more *now* to stock up before the price hike. If people expect the price to drop, they may postpone buying, hoping to take advantage of the lower price later.

*In many markets, an expectation that price will rise in the future shifts the current demand curve rightward, while an expectation that price will fall shifts the current demand curve leftward.*

Expected price changes are especially important in the markets for financial assets such as stocks and bonds and in the market for real estate. People want to buy more stocks, bonds, and real estate when they think their prices will rise in the near future. This shifts the demand curves for these items to the right.

**Tastes.** Suppose we know the number of buyers in the United States, their expectations about the future price of maple syrup, the prices of all related goods, and the average levels of income and wealth. Do we have all the information we need to draw the demand curve for maple syrup? Not really. Because we have not yet considered the psychological component—the habits and tastes that determine the basic desire people have for maple syrup. How many Americans eat breakfast every day? Of these, how many eat pancakes or waffles? How often? How many of them like maple syrup, and how much do they like it? And what about all of the other goods and services competing for consumers’ dollars: How do buyers feel about them?

The questions could go on and on, pinpointing various characteristics about buyers that influence their attitudes toward maple syrup. The approach of economics is to lump all of these characteristics of buyers together and call them, simply, *tastes* or *preferences.* Economists are sometimes interested in where these tastes come from or what makes them change. But for the most part, economics deals with the *consequences* of a change in tastes, whatever the reason for its occurrence.

When tastes change *toward* a good (people favor it more), demand increases, and the demand curve shifts to the right. When tastes change *away* from a good, demand decreases, and the demand curve shifts to the left. An example of this is the change in tastes away from cigarettes over the past several decades. The cause may have been an aging population, a greater concern about health among people of all ages, or successful antismoking advertising. But regardless of the cause, the effect has been to decrease the demand for cigarettes, shifting the demand curve to the left.
Figure 4 summarizes the variables we’ve discussed that affect the demand side of the market and how their effects are represented with a demand curve. Notice the important distinction between movements along the demand curve and shifts of the entire curve. Keep in mind that other variables, besides those listed in Figure 4, can influence demand. For example, government subsidies such as Federal Pell Grants for college shift the demand curve for higher education rightward. Expectations other than future price

**Figure 4**

The Demand Curve—A Summary

- **price ↓** ⇒ move rightward along curve
- **price ↑** ⇒ move leftward along curve
- **income or wealth ↑**
- **price of substitute ↑**
- **price of complement ↓**
- **population ↑**
- **expected price ↑**
- **Tastes shift toward good** ⇒ demand curve shifts rightward
- **income or wealth ↓**
- **price of substitute ↓**
- **price of complement ↑**
- **population ↓**
- **expected price ↓**
- **Tastes shift away from good** ⇒ demand curve shifts leftward

**Demand: A Summary**

Figure 4 summarizes the variables we’ve discussed that affect the demand side of the market and how their effects are represented with a demand curve. Notice the important distinction between movements along the demand curve and shifts of the entire curve. Keep in mind that other variables, besides those listed in Figure 4, can influence demand. For example, government subsidies such as Federal Pell Grants for college shift the demand curve for higher education rightward. Expectations other than future price

**Does Supply Affect Demand?** A troubling thought may have occurred to you. Among the variables that shift the demand curve in Figure 3, shouldn’t we include the amount of syrup available? Or to put the question another way, doesn’t supply influence demand?

No—at least not directly. The demand curve by asking people a series of hypothetical questions about how much they would like to buy at each different price. A change in the amount available would not affect the answers to these questions, and so doesn’t affect the curve itself, As you’ll see later, a change in supply will change the price of the good, but this causes a movement along—not a shift of—the demand curve.
matter too. If buyers expect a recession and fear their incomes may fall in the future, their demand for many goods may decrease now, even though current income remains unchanged. Some of these other shift-variables for demand curves will be discussed in future chapters, as they become relevant in each case. But we’ll always use the same logic we used here: If an event makes buyers want to purchase more or less of a good at any price, it causes the demand curve to shift.

SUPPLY

When most people hear the word supply, their first thought is that it’s the amount of something “available,” as if this amount were fixed in stone. For example, someone might say, “We can only drill so much oil from the ground,” or “There are only so many apartments for rent in this town.” And yet, the world’s known oil reserves—as well as yearly production of oil—have increased dramatically over the last half century, as oil companies have found it worth their while to look harder for oil. Similarly, in most towns and cities, short buildings have been replaced with tall ones, and the number of apartments has increased. Supply, like demand, can change, and the amount of a good supplied in a market depends on the choices made by those who produce it.

What governs these choices? We assume that business firms’ managers have a goal: to earn the highest profit possible. But they also face constraints. First, in a competitive market, the price they can charge for their product is a given—the market price. Second, firms have to pay the costs of producing and selling their product. These costs will depend on the production process they use, the prices they must pay for their inputs, and more. Business firms’ desire for profit, together with the real-world constraints that they face, determines how much they will choose to sell in any market. Hence, the following definition:

**Quantity supplied** is the number of units of a good that all sellers in the market would choose to sell over some time period, given the constraints that they face.

Let’s briefly go over the notion of quantity supplied to clarify what it means and doesn’t mean.

**Quantity Supplied Implies a Choice.** We assume that the managers of business firms have a simple goal—to earn the highest possible profit. But they also face constraints: the specific price they can charge for the good, the cost of any inputs used, and so on. Quantity supplied doesn’t tell us the amount of, say, maple syrup that sellers would like to sell if they could charge a thousand dollars for each bottle, and if they could produce it at zero cost. Instead, it’s the quantity that firms choose to sell—the quantity that gives them the highest profit given the constraints they face.

**Quantity Supplied Is Hypothetical.** Will firms actually be able to sell the amount they want to sell at the going price? You’ll soon see that they usually can. But the definition of quantity supplied makes no assumptions about firms’ ability to sell the good. Quantity supplied answers the hypothetical question: How much would firms’ managers sell, given the constraints they face, if they were able to sell all that they wanted.
Quantity Supplied Depends on Price. The price of the good is just one variable among many that influences quantity supplied. But—as with demand—we want to keep that variable foremost in our thinking. This is why for the next couple of pages we’ll assume that all other influences on supply are held constant, so we can explore the relationship between price and quantity supplied.

The Law of Supply

How does a change in price affect quantity supplied? When a seller can get a higher price for a good, producing and selling it become more profitable. Producers will devote more resources toward its production—perhaps even pulling resources from other goods they produce—so they can sell more of the good in question. For example, a rise in the price of laptop computers will encourage computer makers to shift resources out of the production of other things (such as desktop computers) and toward the production of laptops.

In general, price and quantity supplied are positively related: When the price of a good rises, the quantity supplied will rise as well. This relationship between price and quantity supplied is called the law of supply, the counterpart to the law of demand we discussed earlier.

The law of supply states that when the price of a good rises, and everything else remains the same, the quantity of the good supplied will rise.

Once again, notice the very important words “everything else remains the same—ceteris paribus.” Although many other variables influence the quantity of a good supplied, the law of supply tells us what would happen if all of them remained unchanged and only one—the price of the good—changed.

The Supply Schedule and the Supply Curve

Let’s continue with our example of the market for maple syrup in the United States. Who are the suppliers in this market? Maple syrup producers are located mostly in the forests of Vermont, upstate New York, and Canada. The market quantity supplied is the amount of syrup all of these producers together would offer for sale at each price for maple syrup in the United States.

Table 3 shows the supply schedule for maple syrup—a list of different quantities supplied at different prices, with all other variables held constant. As you can see, the supply schedule obeys the law of supply: As the price of maple syrup rises, the quantity supplied rises along with it. But how can this be? After all, maple trees must be about 40 years old before they can be tapped for syrup, so any rise in quantity supplied now or in the near future cannot come from an increase in planting. What, then, causes quantity supplied to rise as price rises?

Many things. First, with higher prices, firms will find it profitable to tap existing trees more intensively. Second, evaporating and bottling can be done more carefully, so that less maple syrup is spilled and more is available for shipping. Finally, the product can be diverted from other areas and shipped to the United States instead. For example, if the price of maple syrup rises in the United States but not in Canada, producers would shift deliveries away from Canada so they could sell more in the United States.
Chapter 3: Supply and Demand

Now look at Figure 5, which shows a very important curve—the counterpart to the demand curve we drew earlier. In Figure 5, each point represents a price-quantity pair taken from Table 3. For example, point F in the figure corresponds to a price of $2.00 per bottle and a quantity of 40,000 bottles per month, while point G represents the price-quantity pair $4.00 and 60,000 bottles. Connecting all of these points with a solid line gives us the supply curve for maple syrup, labeled with an S in the figure.

The supply curve shows the relationship between the price of a good and the quantity supplied in the market, holding constant the values of all other variables that affect supply. Each point on the curve shows the quantity that sellers would choose to sell at a specific price.

Notice that the supply curve in Figure 5—like all supply curves for goods and services—is upward sloping. This is the graphical representation of the law of supply.

**Shifts versus Movements Along the Supply Curve**

As with the demand curve, it’s important to distinguish those events that will cause us to move along a given supply curve for the good, and those that will cause the entire supply curve to shift.

<table>
<thead>
<tr>
<th>Price (per bottle)</th>
<th>Quantity Supplied (bottles per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>25,000</td>
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<tr>
<td>$2.00</td>
<td>40,000</td>
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<tr>
<td>$3.00</td>
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<td>60,000</td>
</tr>
<tr>
<td>$5.00</td>
<td>65,000</td>
</tr>
</tbody>
</table>

**TABLE 3**

Supply Schedule for Maple Syrup in the United States

<table>
<thead>
<tr>
<th>Price per Bottle</th>
<th>Number of Bottles per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4.00</td>
<td>60,000</td>
</tr>
</tbody>
</table>

When the price is $2.00 per bottle, 40,000 bottles are supplied (point F). At $4.00 per bottle, quantity supplied is 60,000 bottles (point G).
If you look once again at Figure 5, you'll see that if the price of maple syrup rises from $2.00 to $4.00 per bottle, the number of bottles supplied rises from 40,000 to 60,000. This is a movement along the supply curve, from point F to point G. In general,

> a change in the price of a good causes a movement along the supply curve.

In the figure, a rise in price would cause us to move rightward along the supply curve (from point F to point G) and a fall in price would move us leftward along the curve (from point G to point F).

But remember that when we draw a supply curve, we assume that all other variables that might influence supply are held constant at some particular values. For example, the supply curve in Figure 5 might tell us the quantity supplied at each price when the cost of an important input—transportation from the farm to the point of sale—remains constant.

But suppose the cost of transportation drops. Then, at any given price for maple syrup, firms would find it more profitable to produce and sell it. This is illustrated in Table 4. With the original transportation cost, and a selling price of $4.00 per bottle, firms would choose to sell 60,000 bottles. But after transportation cost falls, they would choose to produce and sell more—80,000 bottles in our example—assuming they could still charge $4.00 per bottle. A similar change would occur for any other price of maple syrup we might imagine: After transportation costs fall, firms would choose to sell more than before. In other words, the entire relationship between price and quantity supplied has changed, so we have a new supply curve.

Figure 6 plots the new supply curve from the quantities in the third column of Table 4. The new supply curve lies to the right of the old one. For example, at a price of $4.00, quantity supplied increases from 60,000 bottles on the old curve (point G) to 80,000 bottles on the new supply curve (point J). The drop in the transportation costs has shifted the supply curve to the right.

In general,

> a change in any variable that affects supply—except for the good's price—causes the supply curve to shift.

If sellers want to sell a greater quantity at any price, the supply curve shifts rightward. If sellers would prefer to sell a smaller quantity at any price, the supply curve shifts leftward.

**“Change in Quantity Supplied” versus “Change in Supply”**

As we stressed in our discussion of the demand side of the market, be careful about language when thinking about supply. The term *quantity supplied* means a particular amount that sellers would choose to sell at a particular price, represented by a single point on the supply curve. The term *supply*, however, means the entire relationship between price and quantity supplied, as represented by the entire supply curve.

For this reason, when the price of the good changes, and we move along the supply curve, we have a change in quantity supplied. For example, in Figure 5, the movement from point F to point G is an increase in quantity supplied.

When something other than the price changes, causing the entire supply curve to shift, we call it a change in supply. The shift in Figure 6, for example, would be called an increase in supply.
FACTORS THAT SHIFT THE SUPPLY CURVE

Let’s take a closer look at some of the causes of a change in supply (a shift of the supply curve). As always, we’re considering one variable at a time, keeping all other determinants of supply constant.

**Input Prices.** In Figure 6, we saw that a drop in transportation costs shifted the supply curve for maple syrup to the right. But producers of maple syrup use a variety of other inputs besides transportation: land, maple trees, evaporators, sap pans, labor, glass bottles, bottling machinery, and more. A lower price for any of these means a lower cost of producing and selling maple syrup, making it more profitable. As a result, we would expect producers to shift resources into maple syrup production, causing an increase in supply.

In general,

*a fall in the price of an input causes an increase in supply, shifting the supply curve to the right.*

<table>
<thead>
<tr>
<th>Price (per bottle)</th>
<th>Original Quantity Supplied (bottles/month)</th>
<th>Quantity Supplied After Decrease in Transportation Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>25,000</td>
<td>45,000</td>
</tr>
<tr>
<td>$2.00</td>
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<td>60,000</td>
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</tr>
<tr>
<td>$5.00</td>
<td>65,000</td>
<td>90,000</td>
</tr>
</tbody>
</table>

**Figure 6**
A decrease in transportation costs shifts the supply curve for maple syrup from $S_1$ to $S_2$. At each price, more bottles are supplied after the shift.
Similarly, a rise in the price of an input causes a decrease in supply, shifting the supply curve to the left. If, for example, the wages of maple syrup workers rose, the supply curve in Figure 6 would shift to the left.

**Price of Alternatives.** Many firms can switch their production rather easily among several different goods or services, all of which require more or less the same inputs. For example, a dermatology practice can rather easily switch its specialty from acne treatments for the young to wrinkle treatments for the elderly. An automobile producer can—without too much adjustment—switch to producing light trucks. And a maple syrup producer could dry its maple syrup and produce maple *sugar* instead. Or it could even cut down its maple trees and sell maple wood as lumber. These other goods that firms *could* produce are called *alternate goods* and their prices influence the supply curve.

For example, if the price of maple *sugar* rose, then at any given price for maple *syrup*, producers would choose to shift some production from syrup to sugar. This would be a decrease in the supply of maple syrup. If firms already are producing maple sugar, and its price *falls*, the supply of syrup would increase.

Another alternative for the firm is to sell the *same* good in a *different* market, which we’ll call an *alternate market*. For example, since we are considering the market for maple syrup in the United States, the maple syrup market in Canada is an alternate market for producers. For any given price in the United States, a rise in the price of maple syrup in Canada will cause producers to shift some sales from the United States to Canada. In the U.S. market, this will cause the supply curve to shift leftward.

*When the price for an alternative rises—either an alternate good or the same good in an alternate market—the supply curve shifts leftward.*

Similarly, a decrease in the price of an alternate good (or a lower price in an alternate market) will shift the supply curve rightward.

**Technology.** A *technological advance* in production occurs whenever a firm can produce a given level of output in a new and cheaper way than before. For example, the discovery of a surgical procedure called Lasik—in which a laser is used to reshape the interior of the cornea rather than the outer surface—has enabled eye surgeons to correct their patients’ vision with fewer follow-up visits and smaller quantities of medication than were used with previous procedures. This example is a technological advance because it enables firms to produce the same output (eye surgery) more cheaply than before.

In maple syrup production, a technological advance might be a new, more efficient tap that draws more maple syrup from each tree, or a new bottling method that reduces spillage. Advances like these would reduce the cost of producing maple syrup, making it more profitable, and producers would want to make and sell more of it at any price.

In general,

*cost-saving technological advances increase the supply of a good, shifting the supply curve to the right.*

**Number of Firms.** A change in the number of firms in a market will change the quantity that all sellers together would want to sell at any given price. For example, if—over
time—more people decided to open up maple syrup farms because it was a profitable business, the supply of maple syrup would increase. And if maple syrup farms began closing down, their number would be reduced and supply would decrease.

An increase in the number of sellers—with no other change—shifts the supply curve rightward.

Expected Price. Imagine you’re the president of Sticky’s Maple Syrup, Inc., and you expect that the market price of maple syrup—over which you, as an individual seller, have no influence—to rise next month. What would you do? You’d certainly want to postpone selling your maple syrup until the price is higher and your profit greater. Therefore, at any given price now, you might slow down production, or just slow down sales by warehousing more of what you produce. If other firms have similar expectations of a price hike, they’ll do the same. Thus, an expectation of a future price hike will decrease supply in the present.

Suppose instead you expect the market price to drop next month. Then—at any given price—you’d want to sell more now, by stepping up production and even selling out of your inventories. So an expected future drop in the price would cause an increase in supply in the present.

In many markets, an expectation of a future price rise shifts the current supply curve leftward. Similarly, an expectation of a future price drop shifts the current supply curve rightward.

Changes in Weather and Other Natural Events. Weather conditions are an especially important determinant of the supply of agricultural goods.

Favorable weather increases crop yields, and causes a rightward shift of the supply curve for that crop. Unfavorable weather destroys crops and shrinks yields, and shifts the supply curve leftward.

In addition to bad weather, natural disasters such as fires, hurricanes, and earthquakes can destroy or disrupt the productive capacity of all firms in a region. If many sellers of a particular good are located in the affected area, the supply curve for that good will shift leftward. For example, after Hurricanes Katrina and Rita struck the U.S. Gulf Coast in August and September of 2005, 20 percent of the nation’s oil refining capacity was taken out for several weeks, causing a sizable leftward shift of the supply curve for gasoline.

Supply—A Summary

Figure 7 summarizes the various factors we’ve discussed that affect the supply side of the market, and how we illustrate them using a supply curve. But the short list
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of *shift-variables* for supply is far from exhaustive. For example, a government tax on a good—or a government subsidy paid to producers—will shift the supply curve. So can other government policies, such as environmental and safety regulations.

Some of the other shift-variables for supply curves will be discussed as they become relevant in future chapters. The basic principle, however, is always the same: Anything that makes sellers want to sell more or less of a good *at any given price* will shift the supply curve.

**PUTTING SUPPLY AND DEMAND TOGETHER**

What happens when buyers and sellers, each having the desire and the ability to trade, come together in a market? The two sides of the market certainly have different agendas. Buyers would like to pay the lowest possible price, while sellers would
like to charge the highest possible price. Is there chaos when they meet, with buyers and sellers endlessly chasing after each other or endlessly bargaining for advantage, so that trade never takes place? A casual look at the real world suggests not. In most markets, most of the time, there is order and stability in the encounters between buyers and sellers. In most cases, prices do not fluctuate wildly from moment to moment but seem to hover around a stable value. Even when this stability is short-lived—lasting only a day, an hour, or even a minute in some markets—for this short-time the market seems to be at rest. Whenever we study a market, therefore, we look for this state of rest—a price and quantity at which the market will settle, at least for a while.

Economists use the word *equilibrium* when referring to a state of rest. When a market is in equilibrium, both the price of the good and the quantity bought and sold have settled into a state of rest. More formally,

*the equilibrium price* and *equilibrium quantity* are values for price and quantity in the market that, once achieved, will remain constant—unless and until the supply curve or the demand curve shifts.

What is the *equilibrium* price of maple syrup in our example, and what is the *equilibrium* quantity that will be bought and sold? These are precisely the questions that the supply and demand model is designed to answer.

Look at Table 5, which combines the supply and demand schedules for maple syrup from Tables 1 and 3. We’ll use Table 5 to find the equilibrium price in this market through the process of elimination.

Let’s first ask what would happen if the price were $1.00 per bottle. At this price, Table 5 tells us that buyers would want to buy 75,000 bottles each month, while sellers would offer to sell only 25,000. There would be an *excess demand* of 50,000 bottles. What would happen? Buyers would compete with each other to get more maple syrup than was available, and would offer to pay a higher price rather than do without. The price would then rise. The same would occur if the price were $2.00, or any other price below $3.00.

We conclude that any price less than $3.00 cannot be an equilibrium price. If the price starts below $3.00, it would start rising—*not* because the supply curve or the demand curve had shifted, but from natural forces within the market itself. This directly contradicts our definition of equilibrium price.

Figure 8 illustrates the same process by putting the supply and demand curves together on the same graph. As you can see, at a price of $1.00, quantity supplied

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<table>
<thead>
<tr>
<th>Price (per bottle)</th>
<th>Quantity Demanded (bottles per month)</th>
<th>Quantity Supplied (bottles per month)</th>
<th>Excess Demand or Supply?</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>75,000</td>
<td>25,000</td>
<td>Excess Demand</td>
<td>Price will Rise</td>
</tr>
<tr>
<td>$2.00</td>
<td>60,000</td>
<td>40,000</td>
<td>Excess Demand</td>
<td>Price will Rise</td>
</tr>
<tr>
<td>$3.00</td>
<td>50,000</td>
<td>50,000</td>
<td>Neither</td>
<td>No Change in price</td>
</tr>
<tr>
<td>$4.00</td>
<td>40,000</td>
<td>60,000</td>
<td>Excess Supply</td>
<td>Price will Fall</td>
</tr>
<tr>
<td>$5.00</td>
<td>35,000</td>
<td>65,000</td>
<td>Excess Supply</td>
<td>Price will Fall</td>
</tr>
</tbody>
</table>

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**Table 5**

Finding the Market Equilibrium

**Equilibrium price** The market price that, once achieved, remains constant until either the demand curve or supply curve shifts.

**Equilibrium quantity** The market quantity bought and sold per period that, once achieved, remains constant until either the demand curve or supply curve shifts.

**Excess demand** At a given price, the amount by which quantity demanded exceeds quantity supplied.
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of 25,000 bottles is found at point $H$ on the supply curve, while quantity demanded is at point $J$ on the demand curve. The horizontal difference between the two curves at $1.00$ is a graphical representation of the excess demand at that price.

At this point, we should ask another question: If the price were initially $1.00$, would it ever stop rising? Yes. Since excess demand is the reason for the price to rise, the process will stop when the excess demand is gone. And as you can see in Figure 8, the rise in price shrinks the excess demand in two ways. First, as price rises, buyers demand a smaller quantity—a leftward movement along the demand curve. Second, sellers increase supply to a larger quantity—a rightward movement along the supply curve. Finally, when the price reaches $3.00$ per bottle, the excess demand is gone and the price stops rising.

This logic tells us that $3.00$ is an equilibrium price in this market—a value that won’t change as long as the supply and demand curves stay put. But is it the only equilibrium price? We’ve shown that any price below $3.00$ is not an equilibrium, but what about a price greater than $3.00$? Let’s see.

Suppose the price of maple syrup was, say, $5.00$ per bottle. Look again at Table 5 and you’ll find that, at this price, quantity supplied would be 65,000 bottles per month, while quantity demanded would be only 35,000 bottles. There is an excess supply of 30,000 bottles. Sellers would compete with each other to sell more maple syrup than buyers wanted to buy, and the price would fall. Thus, $5.00$ cannot be the equilibrium price.

Figure 9 provides a graphical view of the market in this situation. With a price of $5.00$, the excess supply is the horizontal distance between points $K$ (on the demand curve) and $L$ (on the supply curve). In the figure, the resulting drop in price would move us along both the supply curve (leftward) and the demand curve (rightward). As these movements continued, the excess supply of maple syrup would shrink until it disappeared, once again, at a price of $3.00$ per bottle. Our conclusion: If the price happens to be above $3.00$, it will fall to $3.00$ and then stop changing.

You can see that $3.00$ is the equilibrium price—and the only equilibrium price—in this market. Moreover, at this price, sellers would want to sell 50,000 bottles—the
same quantity that households would want to buy. So, when price comes to rest at $3.00, quantity comes to rest at 50,000 per month—the \textit{equilibrium quantity}.

No doubt, you have noticed that $3.00 happens to be the price at which the supply and demand curves cross. This leads us to an easy, graphical technique for locating our equilibrium:

\textit{To find the equilibrium price and quantity in a competitive market, draw the supply and demand curves. The equilibrium price and equilibrium quantity can then be found on the vertical and horizontal axes, respectively, where the two curves cross.}

Notice that in equilibrium, the market is operating on \textit{both} the supply curve \textit{and} the demand curve so that—at a price of $3.00—quantity demanded and quantity supplied are equal. There are no dissatisfied buyers unable to find goods they want to purchase, nor are there any frustrated sellers unable to sell goods they want to sell. Indeed, this is why $3.00 is the equilibrium price. It's the only price that creates consistency between what buyers choose to buy and sellers choose to sell.

But we don't expect a market to stay at any particular equilibrium forever, as you're about to see.

\textbf{WHAT HAPPENS WHEN THINGS CHANGE?}

Remember that in order to draw the supply and demand curves in the first place, we had to assume particular values for all the other variables—besides price—that affect demand and supply. If one of these variables changes, then either the supply curve or the demand curve will shift, and our equilibrium will change as well. Let's look at some examples.
**Income Rises, Causing an Increase in Demand**

In Figure 10, point $E$ shows an initial equilibrium in the U.S. market for maple syrup, with an equilibrium price of $3.00 per bottle, and equilibrium quantity of 50,000 bottles per month. Suppose that the incomes of buyers rise because the U.S. economy recovers rapidly from a recession. We know that income is one of the shift-variables in the demand curve (but not the supply curve). We also can reason that maple syrup is a *normal good*, so the rise in income will cause the demand curve to shift rightward. What happens then?

The old price—$3.00—is no longer the equilibrium price. How do we know? Because if the price *did* remain at $3.00 after the demand curve shifts, there would be an excess demand that would drive the price upward. The new equilibrium—at point $E'$—is the new intersection point of the curves after the shift in the demand curve. Comparing the original equilibrium at point $E$ with the new one at point $E'$, we find that the shift in demand has caused the equilibrium price to rise (from $3.00 to $4.00) and the equilibrium quantity to rise as well (from 50,000 to 60,000 bottles per month).

So, we can summarize our findings as follows:

> A rightward shift in the demand curve causes a rightward movement along the supply curve. Equilibrium price and equilibrium quantity both rise.

**Bad Weather Causes a Decrease in Supply**

Bad weather can affect supply for most agricultural goods, including maple syrup. An example occurred in January 1998, when New England and Quebec were struck...
by a severe ice storm. Hundreds of thousands of maple trees were downed, and many more were damaged. In Vermont alone, 10 percent of the maple trees were destroyed. How did this affect the market for maple syrup?

As you’ve learned, weather can be shift-variable for the supply curve. Look at Figure 11. Initially, the supply curve for maple syrup is \( S_1 \), with the market in equilibrium at Point \( E \). When had weather hits, the supply curve shifts leftward—say, to \( S_2 \). The result: a rise in the equilibrium price of maple syrup (from $3.00 to $5.00 in the figure) and a fall in the equilibrium quantity (from 50,000 to 35,000 bottles).

In this case, it is bad weather that shifts the supply curve leftward. But suppose, instead, that the wages of maple syrup workers increase, or that evaporators become more expensive, or that some maple syrup producers go out of business and sell their
farms to housing developers. Any of these changes would shift the supply curve for maple syrup leftward, increasing the equilibrium price and decreasing the equilibrium quantity.

More generally,

A leftward shift of the supply curve causes a leftward movement along the demand curve. Equilibrium price rises, but equilibrium quantity falls.

**Higher Income and Bad Weather Together: Both Curves Shift**

So far, we’ve considered examples in which just one curve shifts due to a change in a single variable that influences either demand or supply. But what would happen if two changes affected the market simultaneously? Then both curves would shift.

Figure 12 shows what happens when we take the two factors we’ve just explored separately (a rise in income and bad weather) and combine them together. The rise in income causes the demand curve to shift rightward, from $D_1$ to $D_2$. The bad weather causes the supply curve to shift leftward, from $S_1$ to $S_2$. The result of all this is a change in equilibrium from point $E$ to point $E'$, where the new demand curve $D_2$ intersects the new supply curve $S_2$.

Notice that the equilibrium price rises from $3.00 to $6.00 in our example. This should come as no surprise. A rightward shift in the demand curve, with no other change, causes price to rise. And a leftward shift in the supply curve, with no other change, causes price to rise. So when we combine the two shifts together, the price must rise. In fact, the increase in the price will be greater than would be caused by either shift alone.

But what about equilibrium quantity? Here, the two shifts work in *opposite* directions. The rightward shift in demand works to increase quantity, while the leftward shift in supply works to decrease quantity. We can’t say what will happen to equilibrium quantity until we know which shift is greater and thus has the greater influence. Quantity could rise, fall, or remain unchanged.

In Figure 12, it just so happens that the supply curve shifts more than the demand curve, so equilibrium quantity falls. But you can easily prove to yourself that the other outcomes are possible. First, draw a graph where the demand curves shifts rightward by more than the supply curve shifts leftward. In your graph, you’ll see that equilibrium quantity rises. Then, draw one where both curves shift (in opposite directions) by equal amounts, and you’ll see that equilibrium quantity remains unchanged.

We can also imagine other combinations of shifts. A rightward or leftward shift in either curve can be combined with a rightward or leftward shift in the other.

Table 6 lists all the possible combinations. It also shows what happens to equilibrium price and quantity in each case, and when the result is ambiguous (a ques-
tion mark). For example, the top left entry tells us that when both the supply and demand curves shift rightward, the equilibrium quantity will always rise, but the equilibrium price could rise, fall, or remain unchanged, depending on the relative size of the shifts.

Do not try to memorize the entries in Table 6. Instead, remember the advice in Chapter 1: to study economics actively, rather than passively. This would be a good time to put down the book, pick up a pencil and paper, and see whether you can draw a graph to illustrate each of the nine possible results in the table. When you see a question mark (?) for an ambiguous result, determine which shift would have to be greater for the variable to rise or to fall.

THE THREE-STEP PROCESS

In this chapter, we built a model—a supply and demand model—and then used it to analyze price changes in several markets. You may not have noticed it, but we took

<table>
<thead>
<tr>
<th>Increase in Demand (Rightward Shift)</th>
<th>No Change in Demand</th>
<th>Decrease in Demand (Leftward Shift)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in Supply (Rightward Shift)</td>
<td>$P \uparrow Q\uparrow$</td>
<td>$P\downarrow Q$</td>
</tr>
<tr>
<td>No Change in Supply</td>
<td>$P\uparrow Q\uparrow$</td>
<td>No change in $P$ or $Q$</td>
</tr>
<tr>
<td>Decrease in Supply (Leftward Shift)</td>
<td>$P\uparrow Q\downarrow$</td>
<td>$P\uparrow Q\downarrow$</td>
</tr>
</tbody>
</table>
three distinct steps as the chapter proceeded. Economists take these same three steps to answer many questions about the economy, as you’ll see throughout this book.

Let’s review these steps:

**Step 1—Characterize the Market:** Decide which market or markets best suit the problem being analyzed, and identify the decision makers (buyers and sellers) who interact there.

In economics, we make sense of the very complex, real-world economy by viewing it as a collection of markets. Each of these markets involves a group of decision makers—buyers and sellers—who have the potential to trade with each other. At the very beginning of any economic analysis, we must decide which market or markets to look at and how these markets should be defined.

To define a market, we decide how to view (a) the thing being traded (such as maple syrup); (b) the decision makers in the market (such as maple syrup producers in New England and Canada selling to U.S. households); and (c) the trading environment (in this chapter, we viewed the market for maple syrup as perfectly competitive).

**Step 2—Find the Equilibrium:** Describe the conditions necessary for equilibrium in the market, and a method for determining that equilibrium.

Once we’ve defined a market, and put buyers and sellers together, we look for the point at which the market will come to rest—the equilibrium. In this chapter, we used supply and demand to find the equilibrium price and quantity in a perfectly competitive market, but this is just one example of how economists apply Step 2.

**Step 3—What Happens When Things Change:** Explore how events or government policies change the market equilibrium.

Once you’ve found the equilibrium, the next step is to ask how different events will change it. In this chapter, for example, we explored how rising income or bad weather (or both together) would affect the equilibrium price and quantity for maple syrup.

Economists follow this same three-step procedure to analyze important microeconomic questions. Why does government intervention to lower the price of a good (such as apartment rents) often backfire and sometimes harm the very people it was designed to help? Why do some people earn salaries that are hundreds of times higher than others? What would happen to the price of oil in world markets if supplies from the Persian Gulf were suddenly cut off? If you’re studying microeconomics, you’ll soon see how the three-step process helps us answer all of those questions.

Economists also use the procedure to address important macroeconomic questions. What caused the recession that began in early 2001, and what can we do to help avoid recessions in the future? Why has the United States experienced such low inflation in recent years, and how long can we expect our recent good fortune to continue? Why has the U.S. economy been growing so much more rapidly than the economies of continental Europe? In macroeconomics, the three steps help us answer once again.

In this book, we’ll be taking these three steps again and again, and we’ll often call them to your attention.
In 2005 and early 2006, the avian influenza virus was spreading rapidly among chicken flocks in Asia and Europe. More than a hundred million chickens in the affected countries had either died from the virus or been destroyed in an unsuccessful effort to slow its spread. But in early 2006, the virus had not yet struck flocks in the United States.

The spread of the avian flu virus raised many important questions for economists, health care professionals, medical researchers, and government agencies. But here we focus on a narrower topic: something that was happening in markets for chicken meat.

Here are two relevant facts about these markets toward the end of 2005 and into early 2006.1

• In Europe, people were buying substantially less chicken. (For example, over a period of a few months in early 2006, chicken consumption dropped by 20 percent in France, and a whopping 70 percent in Italy.)

• In the United States, people were buying more chicken.

At first glance (and especially to someone who has not studied supply and demand), the explanation might seem obvious. It would go something like this: “Since chickens were dying or being killed off in Europe, the Europeans had to make do with less chicken. But in the United States, where chicken flocks were unaffected, there was no such problem. And since in most years, the U.S. population rises and income goes up, American chicken consumption probably rose just like it usually does.”

That sounds sensible. But an economist, hearing this explanation, would hesitate. There is an easy way to test this explanation: find out what happened to the price of chicken in Europe and the United States.

If the first-glance explanation is correct, then chicken prices should have risen in both Europe and the United States. The explanation for Europe (fewer chickens available) implies that the supply curve for chicken shifted leftward, raising equilibrium price. (Look back, for example, at Figure 11.) The explanation for the United States (the usual increases in income and population) implies that the demand curve for chicken shifted rightward, once again, raising the price of chicken. (Look back, for example, at Figure 10.)

So what happened to chicken prices in Europe and the United States? They fell in both markets. In fact, they plummeted. From June 2005 to March 2006, the price of chicken in both Europe and the United States dropped by about 70 percent.

So, what really happened? As you’re about to see, the three-step process just discussed will help us find the answer.

First, let’s characterize the market. We are interested in explaining why things were different in Europe and the United States, so it makes sense to look at two geographic markets for chicken: one in Europe, and the other in the United States.

In Figure 13, we first illustrate the market in Europe. Because chicken (especially when frozen) is easily shipped from country to country, the supply side of this market consists of chicken producers around the world. These producers sell some portion of their chicken to buyers in Europe—the demand side of this market.

Now the second step: Find the equilibrium. Our starting point will be the summer of 2005, with demand curve $D_{2005}$ and supply curve $S_{2005}$. The equilibrium occurs at the intersection of the two curves (point A), with quantity $Q_1$ and price equal to the dollar equivalent of about $0.42 per pound. (In this analysis, we’re using the approximate wholesale price of dark-meat chicken. But other chicken-related prices behaved similarly during this period.)

Finally, the third step: What happens when things change? From 2005 to 2006, millions of chickens around the world died or were destroyed, so at any given price, suppliers would choose to sell fewer chickens in any market, including the European market. In Figure 13, the supply curve shifts leftward, to $S_{2006}$. But notice that this shift is depicted as rather small. That’s because the millions of birds eliminated were only a tiny percentage of total world supply. (According to the Food and Agriculture Organization, the total number of chickens in the world is about 16 trillion, a significant fraction of which are brought to market each year.) Still, if this had been the only change in the market (as in the “first glance” explanation), chicken prices in Europe would have risen.

Since chicken prices actually fell, we know something else must have changed in this market. And indeed it did. As the avian influenza virus spread from Asia to Europe, consumers in Europe were gripped by a chicken panic. Even though there
was no danger from eating infected chickens (cooking kills the virus), millions of consumers in Europe decided to take no chances. They simply stopped eating chicken. This is represented by the sizable leftward shift in the demand curve, to \( D_{2006} \) in Figure 13. The equilibrium price of dark meat chicken fell from about $0.42 per pound to about $0.14 per pound.

We know the leftward shift in the demand curve was greater than the leftward shift in the supply curve, because that is the only way to explain the drop in price that actually occurred. So, although a decrease in supply played some role in explaining the drop in European consumption (as in the first-glance explanation), a more important reason for the drop in consumption was a decrease in demand.

Now let’s consider the U.S. market. The demand side of the market is chicken buyers in the United States. And once again, the supply side of the market consists of chicken producers around the world who have the potential to sell their chicken to Americans. However, in practice, the supply side of the market is limited to American chicken farmers. This is because the United States is a chicken exporter: it produces all the chickens demanded in the home market, and then some. This fact will turn out to be important.

Figure 14 depicts the U.S. chicken market. The initial equilibrium in June 2005 was at point \( A \), with the price at about $0.42, the same price as in Europe.

Now let’s look at what changed. In early 2006, there was no “chicken panic” in the United States since the virus had not yet affected U.S. chicken flocks. (Remember: The chicken in U.S. supermarkets was American-produced chicken.) And it is true that the United States was experiencing a healthy rate of income and population growth, so the demand for chicken—a normal good—rose. In Figure 14, we’ve shifted the demand curve rightward a bit, to \( D_{2006} \). If this had been the only change, U.S. chicken prices would have risen somewhat.
But remember that chicken prices actually fell, so something else was going on. Here’s what happened: For U.S. chicken producers, Europe is an alternate market to the United States. As you’ve learned, when the price in an alternate market falls, supply in the original market increases. In this case, with chicken prices in Europe falling, U.S. producers shifted sales back to the home market. In Figure 14, this is represented by a rightward shift in the supply curve to $S_{2006}$—more chicken offered in the United States at any given price.

We know that the rightward shift in the supply curve had to be greater than the rightward shift in the demand curve, because that is the only way the price could have fallen. So, while rising demand played some role in explaining the rise in U.S. consumption (as in the first-glance explanation), a more important reason was the increase in supply.

Why should we worry about the proper explanation for this event, which happened in the past? Because, as you’ll see in later chapters, the tools we’ve just used to analyze this past event can help us make proper predictions about the future as well. And they can be applied to any competitive market.

For example, some observers have predicted there will be rapid growth in solar-power electricity-generation over the next decade. Does this mean the price of solar-generated electricity will be lower or higher than it is now? Or in the market for health care, the price of many services, such as visits to the doctor or hospital stays, is likely to rise over the next decade. Will this be accompanied by an increase in the quantity of these services supplied? Or a decrease?

As you probably suspect, the answer to these questions, and hundreds more like them, depends on which force—demand or supply—is the dominant change in the market. You’ll be asked to look at a few cases similar to these in the end-of-chapter problems.

Summary

In a market economy, prices are determined through the interaction of buyers and sellers in markets. Perfectly competitive markets have many buyers and sellers, and none of them individually can affect the market price. If an individual, buyer, or seller has the power to influence the price of a product, the market is imperfectly competitive.

The model of supply and demand explains how prices are determined in perfectly competitive markets. The quantity demanded of any good is the total amount buyers would choose to purchase given the constraints that they face. The law of demand states that quantity demanded is negatively related to price; it tells us that the demand curve slopes downward. The demand curve is drawn for given levels of income, wealth, tastes, prices of substitute and complementary goods, population, and expected future price. If any of those factors changes, the demand curve will shift.

The quantity supplied of a good is the total amount sellers would choose to produce and sell given the constraints that they face. According to the law of supply, supply curves slope upward. The supply curve will shift if there is a change in the price of an input, the price of an alternate good, the price in an alternate market, the number of firms, expectations of future prices, or (for some goods) a change in weather.

Equilibrium price and quantity in a market are found where the supply and demand curves intersect. If either of these curves shifts, price and quantity will change as the market moves to a new equilibrium.

Economists frequently use a three-step process to answer questions about the economy. The three steps—taken several times in this chapter—are to (1) characterize the market or markets involved in the question; (2) find the equilibrium in the market; and (3) ask what happens when something changes. This three-step process will be used throughout the textbook.

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2 In the figure, you’ll notice that the supply curve shifts just enough to bring the price down to $0.14 per pound—the same as the new price in Europe. The U.S. price has to drop to about the same level as the price in Europe, because if not, U.S. producers would continue shifting sales away from Europe and into the United States, causing further price declines in the United States.
Problem Set  Answers to even-numbered Questions and Problems can be found on the text Web site at www.thomsonedu.com/economics/hall.

1. Consider the following statement: “In 2005 and 2006, as at many other times, new home building in most American cities slowed, and the price of housing came down. Therefore, one way for a city to bring down home prices is to use zoning regulations that slow down new home building.” True or false? Explain.

2. In the late 1990s and through 2000, the British public became increasingly concerned about “Mad Cow Disease,” which could be deadly to humans if they ate beef from these cattle. Fearing the disease, many consumers switched to other meats, like chicken, pork, or lamb. At the same time, the British government ordered the destruction of thousands of head of cattle. Illustrate the effects of these events on the equilibrium price and quantity in the market for British beef. Can we determine with certainty the direction of change for the quantity? For the price? Explain briefly.

3. Discuss, and illustrate with a graph, how each of the following events will affect the market for coffee:
   a. A blight on coffee plants kills off much of the Brazilian crop.
   b. The price of tea declines.
   c. Coffee workers organize themselves into a union and gain higher wages.
   d. Coffee is shown to cause cancer in laboratory rats.
   e. Coffee prices are expected to rise rapidly in the near future.

4. The following table gives hypothetical data for the quantity of two-bedroom rental apartments demanded and supplied in Peoria, Illinois:

<table>
<thead>
<tr>
<th>Monthly Rent</th>
<th>Quantity Demanded (thousands)</th>
<th>Quantity Supplied (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$800</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>$1,000</td>
<td>25</td>
<td>14</td>
</tr>
<tr>
<td>$1,200</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>$1,400</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>$1,600</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>$1,800</td>
<td>15</td>
<td>22</td>
</tr>
</tbody>
</table>

   a. Graph the demand and supply curves.
   b. Find the equilibrium price and quantity.
   c. Explain briefly why a rent of $1,000 cannot be the equilibrium in this market.
   d. Suppose a tornado destroys a significant number of apartment buildings in Peoria, but doesn’t affect people’s desire to live there. Illustrate on your graph the effects on equilibrium price and quantity.

5. The following table gives hypothetical data for the quantity of alarm clocks demanded and supplied per month.

<table>
<thead>
<tr>
<th>Price per Alarm Clock</th>
<th>Quantity Demanded</th>
<th>Quantity Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5</td>
<td>3,500</td>
<td>700</td>
</tr>
<tr>
<td>$10</td>
<td>3,000</td>
<td>900</td>
</tr>
<tr>
<td>$15</td>
<td>2,500</td>
<td>1,100</td>
</tr>
<tr>
<td>$20</td>
<td>2,000</td>
<td>1,300</td>
</tr>
<tr>
<td>$25</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>$30</td>
<td>1,000</td>
<td>1,700</td>
</tr>
<tr>
<td>$35</td>
<td>500</td>
<td>1,900</td>
</tr>
</tbody>
</table>

   a. Graph the demand and supply curves.
   b. Find the equilibrium price and quantity.
   c. Illustrate on your graph how a decrease in the price of telephone wake-up services would affect the market for alarm clocks.
   d. What would happen if there was a decrease in the price of wake-up services at the same time that the price of the plastic used to manufacture alarm clocks rose?

6. The following table gives hypothetical data for the quantity of electric scooters demanded and supplied per month.

<table>
<thead>
<tr>
<th>Price per Electric Scooter</th>
<th>Quantity Demanded</th>
<th>Quantity Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>$150</td>
<td>500</td>
<td>250</td>
</tr>
<tr>
<td>$175</td>
<td>475</td>
<td>350</td>
</tr>
<tr>
<td>$200</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td>$225</td>
<td>425</td>
<td>550</td>
</tr>
<tr>
<td>$250</td>
<td>400</td>
<td>650</td>
</tr>
<tr>
<td>$275</td>
<td>375</td>
<td>750</td>
</tr>
</tbody>
</table>

   a. Graph the demand and supply curves.
   b. Find the equilibrium price and quantity.
   c. Illustrate on your graph how an increase in the wage rate paid to scooter assemblers would affect the market for electric scooters.
   d. What would happen if there was an increase in the wage rate paid to scooter assemblers at the same time that tastes for electric scooters increased?

7. The following table gives hypothetical data for the quantity of gasoline demanded and supplied in Los Angeles per month.

<table>
<thead>
<tr>
<th>Price per Gallon</th>
<th>Quantity Demanded (millions of gallons)</th>
<th>Quantity Supplied (millions of gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.20</td>
<td>170</td>
<td>80</td>
</tr>
<tr>
<td>$1.30</td>
<td>156</td>
<td>105</td>
</tr>
<tr>
<td>$1.40</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>$1.50</td>
<td>123</td>
<td>175</td>
</tr>
<tr>
<td>$1.60</td>
<td>100</td>
<td>210</td>
</tr>
<tr>
<td>$1.70</td>
<td>95</td>
<td>238</td>
</tr>
</tbody>
</table>
a. Graph the demand and supply curves.
b. Find the equilibrium price and quantity.
c. Illustrate on your graph how a rise in the price of automobiles would affect the gasoline market.

8. How would each of the following affect the market for blue jeans in the United States? Illustrate each answer with a supply and demand diagram.
   a. The price of denim cloth increases.
   b. An economic slowdown in the United States causes household incomes to decrease.

9. Indicate which curve shifted—and in which direction—for each of the following. Assume that only one curve shifts.
   a. The price of furniture rises as the quantity bought and sold falls.
   b. Apartment vacancy rates increase while average monthly rent on apartments declines.
   c. The price of personal computers continues to decline as sales skyrocket.

10. Consider the following forecast: “In 2008, we predict that the demand curve for solar panels will continue its shift rightward, which will tend to raise price and quantity. However, with a higher price, supply will increase as well, shifting the supply curve rightward. A rightward shift of the supply curve will tend to lower price and raise quantity. We conclude that as 2008 proceeds, quantity will increase but the price of solar panels may either rise or fall.” There is a serious mistake of logic in this forecast. Can you find it? Explain.

11. A couple of months after Hurricane Katrina, an article in The New York Times contained the following passage: “Gasoline prices—the national average is now $2.15, according to the Energy Information Administration—have fallen because higher prices held down demand and Gulf Coast supplies have been slowly restored.” The statement about supply is entirely correct and explains why gas prices came down. But the statement about demand confuses two concepts you learned about in this chapter.
   a. What two concepts does the statement about demand seem to confuse? Explain briefly.
   b. On a supply and demand diagram, show what most likely caused gasoline prices to rise when Hurricane Katrina shut down gasoline refineries on the Gulf Coast.
   c. On another supply and demand diagram, show what most likely happened in the market for gasoline as Gulf Coast refineries were repaired—and began operating again—after the Hurricane.
   d. What role did the demand side of the market play in explaining the rise and fall of gas prices?

12. Draw supply and demand diagrams for market A for each of the following. Then use your diagrams to illustrate the impact of the following events. In each case, determine what happens to price and quantity in each market.
   a. A and B are substitutes, and the price of good B rises.
   b. A and B satisfy the same kinds of desires, and there is a shift in tastes away from A and toward B.
   c. A is a normal good, and incomes in the community increase.
   d. There is a technological advance in the production of good A.
   e. B is an input used to produce good A, and the price of B rises.

More Challenging

13. Suppose that demand is given by the equation \( Q_D = 50 - 5P \), where \( Q_D \) is quantity demanded, and \( P \) is the price of the good. Supply is described by the equation \( Q_S = 50 + 25P \), where \( Q_S \) is quantity supplied. What is the equilibrium price and quantity? (See Appendix.)

14. While crime rates have fallen across the country over the past few years, they have fallen especially rapidly in Manhattan. At the same time, there are some neighborhoods in the New York metropolitan area in which the crime rate has remained constant. Using supply and demand diagrams for rental housing, explain how a falling crime rate in Manhattan could make the residents in other neighborhoods worse off. (Hint: As people from around the country move to Manhattan, what happens to rents there? If people cannot afford to pay higher rent in Manhattan, what might they do?)

15. A Wall Street analyst observes the following equilibrium price-quantity combinations in the market for restaurant meals in a city over a four-year period:

<table>
<thead>
<tr>
<th>Year</th>
<th>( P ) (dollars)</th>
<th>( Q ) (thousands of meals per month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

She concludes that the market defies the law of demand. Is she correct? Why or why not?

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In the body of this chapter, notice that the supply and demand curves for maple syrup were not graphed as straight lines. This is because the data they were based on (as shown in the tables) were not consistent with a straight-line graph. You can verify this if you look back at Table 1: When the price rises from $1.00 to $2.00, quantity demanded drops by 15,000 (from 75,000 to 60,000). But when the price rises from $2.00 to $3.00, quantity demanded drops by 10,000 (from 60,000 to 50,000). Since the change in the independent variable (price) is $1.00 in both cases, but the change in the dependent variable (quantity demanded) is different, we know that when the relationship between quantity demanded and price is graphed, it will not be a straight line.

We have no reason to expect demand or supply curves in the real world to be straight lines (to be linear). However, it's often useful to approximate a curve with a straight line that is reasonably close to the original curve. One advantage of doing this is that we can then express both supply and demand as simple equations, and solve for the equilibrium using basic algebra.

For example, suppose the demand for take-out pizzas in a modest-size city is represented by the following equation:

\[ Q_D = 64,000 - 3,000 P \]

where \( Q_D \) stands for the quantity of pizzas demanded per week. This equation tells us that every time the price of pizza rises by $1.00, the number of pizzas demanded each week falls by 3,000. As we'd expect, there is a negative relationship between price and quantity demanded. Moreover, since quantity demanded always falls at the same rate (3,000 fewer pizzas for every $1.00 rise in price), the equation is linear.\(^1\)

Now we'll add an equation for the supply curve:

\[ Q_S = -20,000 + 4,000 P \]

where \( Q_S \) stands for the quantity of pizzas supplied per week. This equation tells us that when the price of pizza rises by $1.00, the number of pizzas supplied per week rises by 4,000—the positive relationship we expect of a supply curve.\(^2\) And like the demand curve, it's linear: Quantity supplied continues to rise at the same rate (4,000 more pizzas for every $1.00 increase in price).

We know that if this market is in equilibrium, quantity demanded (\( Q_D \)) will equal quantity supplied (\( Q_S \)). So let's impose that condition on these curves. That is, let's require \( Q_S = Q_D \). This allows us to use the definitions for \( Q_D \) and \( Q_S \) that have price as a variable, and set those equal to each other in equilibrium:

\[ 64,000 - 3,000 P = -20,000 + 4,000 P \]

This equation is one equation with a single unknown—\( P \)—so we can use the rules of algebra to isolate \( P \) on one side of the equation. We do this by adding 3,000 \( P \) to both sides, which isolates \( P \) on the right, and adding 20,000 to both sides, which moves everything that doesn't involve \( P \) to the left, giving us:

\[ 84,000 = 7,000 P \]

Finally, dividing both sides by 7,000 gives us

\[ 84,000/7,000 = P \]

or

\[ P = 12 \]

\(^1\) If you try to graph the demand curve, don't forget that supply and demand graphs reverse the usual custom of where the independent and dependent variables are plotted. Quantity demanded is the dependent variable (it depends on price), and yet it's graphed on the horizontal axis.

\(^2\) Don't be troubled by the negative sign (-20,000) in this equation. It helps determine a minimum price that suppliers must get in order to supply any pizza at all. Using the entire equation, we find that if price were $5.00, quantity supplied would be zero, and that price has to rise above $5.00 for any pizzas to be supplied in this market. But since a “negative supply” doesn't make sense, this equation is valid only for prices of $5.00 or greater.
We’ve found our equilibrium price: $12.

What about equilibrium quantity? In equilibrium, we know quantity demanded and quantity supplied are equal, so we can either solve for $Q^e$ using the demand equation, or solve for $Q^s$ using the supply equation, and we should get the same answer. For example, using the demand equation, and using the equilibrium price of $12:

$$Q^D = 64,000 - 3,000 \ (12)$$

or

$$Q^D = 28,000$$

To confirm that we didn’t make any errors, we can also use the supply equation.

$$Q^s = -20,000 + 4,000 \ (12)$$

or

$$Q^s = 28,000$$

We’ve now confirmed that the equilibrium quantity is 28,000.